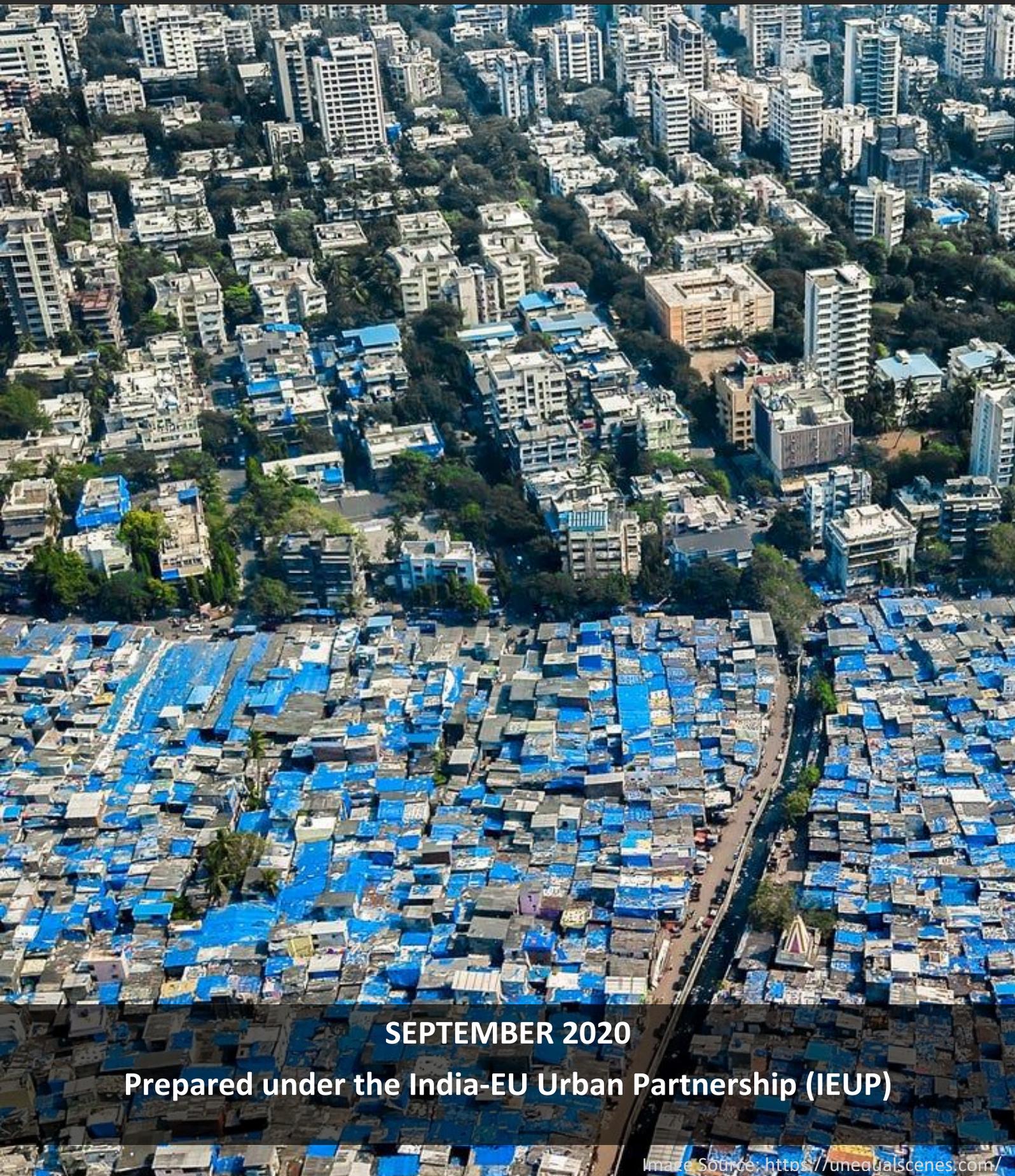


# MAINSTREAMING RESILIENCE IN URBAN PLANNING PRACTICES IN INDIA



SEPTEMBER 2020

Prepared under the India-EU Urban Partnership (IEUP)

---

## Contents

Abstract.....	4
CHAPTER 1: INTRODUCTION.....	5
1.1 Background .....	5
1.2 Rationale .....	5
1.3 Objective .....	6
1.4 Approach.....	6
1.5 Output of the technical study .....	6
CHAPTER 2: WHAT IS RESILIENT PLANNING?.....	8
2.1 Concept of resilience.....	8
2.2 Rationale for resilience in urban planning .....	9
2.3 Parameters that indicate resilience in planning .....	12
2.4 Urban resilience in the Indian planning framework .....	16
2.5 The URDPFI Guidelines in the context of the SDGs .....	20
CHAPTER 3: INDIAN PLANNING FRAMEWORK: IMPROVING RESILIENCE.....	22
3.1 Vulnerable areas .....	23
3.2 Suggested areas to be covered in URDPFI Guidelines and Model Building Bye-Laws.....	28
3.3 Possible improvements in norms for disaster management.....	31
CHAPTER 4: INTERNATIONAL AND INDIAN CASE STUDIES .....	32
4.1 Copenhagen .....	32
4.2 Stockholm .....	35
4.3 Lisbon .....	37
4.4 Barcelona .....	38
4.5 Summary of European Case Studies .....	42
4.6 Case Studies from Asia .....	44
4.7 Examples from India of incorporating resilience .....	48
CHAPTER 5: RECOMMENDATIONS.....	53
5.1 Recommendations for URDPFI Guidelines.....	55
5.2 Recommendations for MBBL .....	65
5.3 Recommendation on Disaster Management.....	66
5.4 Dealing with Pandemics.....	68
5.5 Analysis of Master Plans from Indian cities to understand the mainstreaming of resilience 68	
5.6 Conclusion.....	75
ANNEXURE .....	83
Annexure 1: New inclusions in the URDPFI Guidelines 2014.....	83
BIBLIOGRAPHY .....	90

---

## List of figures

Figure 1: Estimated and projected urban populations of the world, more developed regions and less developed regions, 1950-2050 .....	9
Figure 2: Geo-tagging of COVID 19 suspect patients in Ujjain .....	11
Figure 3: Initiatives for Awareness to citizens for COVID – 19 at Ujjain.....	12
Figure 4: Features of 15-minute city plan.....	16
Figure 5: Provisions to the urban planning process .....	21
Figure 6: Shocks and stresses faced by cities.....	22
Figure 7: GIS-enabled city plans.....	24
Figure 8: Different agencies involved in the planning process.....	26
Figure 9: Milestones achieved by National Urban Missions, 2014–18 .....	27
Figure 10: City resilience framework .....	28
Figure 11: Urban resilience using GI for managing flood risk in Copenhagen .....	34
Figure 12: Green Infrastructure solutions as part of the street design in Copenhagen .....	34
Figure 13: Location of the city: Stockholm .....	35
Figure 14: Stockholm Royal Seaport (SRS).....	36
Figure 15: View of Barcelona city .....	38
Figure 16: Supeblocks of Barcelona .....	38
Figure 17: Current Block (left), Superblock (right).....	39
Figure 18: Strategies of Barcelona Plan .....	40
Figure 19: Benthenheim Water Square in Rotterdam.....	41
Figure 20: Neighbourhood accessibility planning, Community Focus, Ballahalli, Mysore .....	52
Figure 21: Metropolitan Scale. Source: <a href="http://www.pedrobortiz.com">www.pedrobortiz.com</a> .....	55
Figure 22: Compartmentalising the parts to act specifically in parts affected by an incident. ....	58
Figure 23: New approach to city planning.....	59
Figure 24: Four Components of the metropolitan Genoma and five sectors of the Physical Components.....	64
Figure 25: Evolving Street Network from Existing Development .....	70
Figure 26: Categorisation of Parks, gardens based on size, location and use.....	72
Figure 27: Population growth and density in BMA.....	74
Figure 28: Spatial distribution of schools and slums .....	75
Figure 29: Sector-wise weightage for Climate Smart Cities Assessment .....	76
Figure 30: City Resilience Framework. Source: ARUP & The Rockefeller Foundation, 2015 ..	77

---

# Mainstreaming Resilience into Urban Planning Practices in India

## Abstract

The COVID-19 pandemic is generating global debate on the way cities are planned and managed. This Technical Study stems from discussions with the Ministry of Housing and Urban Affairs (MoHUA), Government of India and more specifically the Town and Country Planning Organization that were seeking inputs on improving the resilience at the city level (as a response to the pandemic) as well as at a strategic level through the 'Urban and Regional Development Plan Formulation and Implementation Guidelines' (URDPFI) Guidelines and Model Municipal Bye-Laws. The Technical Study identified the key parameters of structural planning that contribute to resilience namely, land suitability, infrastructure, population density, mixed use development, and governance. These parameters were studied in terms of their implementation and use while preparing Master Plans. Examples of good practices from Europe and India of cities that have designed interventions across these parameters have been included to provide ideas that may be adapted to local conditions. Some case examples of city-level response to COVID have been included – these serve to highlight the role of governance and participation in city functioning as an immediate response. Although the URDPFI Guidelines include Metropolitan Planning, this is an area of weakness. The Technical Study has included a strong reference to metropolitan planning and the need to embed resilience in planning to start from this scale to the city scale. The Government initiative of ranking cities on City Smartness has been included as a tool for cities to monitor their operations. The Study includes a checklist to measure whether the plans being prepared fulfil the resilience criteria that are central to this document. The Study reiterates that urbanization is better managed and urban areas have improved coping mechanisms if there is rigour and structure in planning starting from the metropolitan scale. The Ahmedabad Master Plan and the Bengaluru Revised Master Plan have been assessed through the lens of the resilience criteria and gaps identified. The use of technology for informed decision-making and delivery of the decision as appropriate has been noted with examples however, technology is only a tool for decision making and cannot make any decisions. The absence of an operational and effective platform for strategic metropolitan decision making is one of the areas that need attention. The constitution, role, and capacity building of the Metropolitan Planning Committees need revisiting. The URDPFI Guidelines are robust as are the Model Building Bye-Laws – the importance of operationalizing the aspects of sustainable planning and thus resilience are areas that need greater attention.

---

# CHAPTER 1: INTRODUCTION

## 1.1 Background

The European Union (EU) is supporting the 'India-EU Urban Partnership' (IEUP) project with the aim of strengthening its urban diplomacy and leadership in the context of the implementation of the New Urban Agenda and the Paris Agreement. The specific objective of the EU support is to develop and operationalize the partnership for smart and sustainable urbanization for India and the EU.

## 1.2 Rationale

Urban populations are facing increasing challenges from rapid urbanization that is leading to strained infrastructure in cities, homelessness, unemployment, etc. These are further impacted by climate change, terrorism, health pandemics, and increased risks from natural hazards. Cities must learn to adapt and thrive in the face of these diverse challenges – they must learn how to build resilience in an uncertain world. This knowledge and understanding will be key to developing effective strategies to foster more resilient cities. The information will benefit governments, donors, investors, policymakers, the private sector and most importantly, the citizens to contribute effectively to resilient growth.

The increase in the scale of urban risk is an outcome of unmanaged urbanization. The risks are also more unpredictable due to the complexity of city systems and the uncertainty associated with many hazards. Most cities are 'reactive' in the face of hazards but, there is an increasing requirement to move towards a 'preventative' approach; thus, risk assessments and measures to reduce specific foreseeable risks play an important role in urban planning and urban management. The need to look at urban planning in a holistic manner from the metropolitan scale with greater emphasis on the 'softer aspects' i.e. governance is more critical than the traditional land use and infrastructure focus. The impact of climate change – sea-level rise, droughts, floods – may well require a complete revision of prevalent guidelines and norms. *Thus, urban planning needs to be looked at from the metropolitan scale with greater emphasis on governance and the more immediate local/city scale by way of improvement proposals. The two-pronged approach will help cities ensure that their development strategies and investment decisions enhance, rather than undermine, the city's administration.*

At the city level, the current pandemic has exposed the pressures faced by cities and their emergency response. Trends indicate that in the foreseeable future, cities will need to be flexible to adapt to emerging needs. While some of the needs can be addressed through prudent planning that considers the changing climatic patterns, sea-level rise, and interventions that are site appropriate at the local level, it is more about managing emerging crises with the existing infrastructure that may be inadequate and outdated. The pandemic has brought to the forefront various examples of coping mechanisms but, the common theme is that of people's participation and governance rather than the creation of new infrastructure at the city level.

In the Indian context, there are two guiding documents for planned urban development – the Urban and Regional Development Plan Formulation and Implementation (URDPFI) Guidelines 2014 and the Model Building Bye-Laws 2016. Both these documents focus on physical planning and have perhaps not given adequate consideration to climate issues like the

---

changing monsoon track, sea-level rise, etc. The URDPFI Guidelines provide details of definitions of plans at different scales, their periodicity, and norms/benchmarks for services to be provided as the scale of the maps reduce. These Guidelines assist in planning (physical and social infrastructure) including comments on economic development and governance to implement the plans. The Model Building Bye-Laws guide the construction of buildings for various uses on different plot sizes. Most importantly, it guides building heights and setbacks for specific plot sizes.

The current pandemic has served to increase debate on the above Guidelines and a need to examine them from a resilience perspective to strengthen the ‘sustainability’ aspect of planning that is inherent in these documents. This Technical Study examines urban planning at two levels – the metropolitan scale and the city scale. While the URDPFI Guidelines cover the relevant approaches to planning starting from the metropolitan scale, these are most often not followed. The Technical Study will provide insights at a strategic level on modifications and methodologies for implementation of existing norms for consideration by the MoHUA, Government of India (GoI). Input at the strategic level i.e. planning, management, administration (government), participation (governance) and finance will serve to guide decisions at the operational levels when cities plan their urban development.

### 1.3 Objective

This Technical Study titled **“Mainstreaming Resilience into Urban Planning Practices in India”** under the IEUP project has the following objectives:

- To understand the rationale for resilience and its parameters in urban planning
- To identify resilience gaps in the existing Indian urban planning framework
- To illustrate the application of resilience parameters with case-studies from European cities
- To recommend modifications and reiterate the methodologies for mainstreaming resilience in the URDPFI Guidelines, 2014 and Model Building Bye-Laws, 2016 for enhanced resilience in urban planning
- To examine the Master Plan of 2 Indian cities through the defined resilience lens to identify the gaps.

### 1.4 Approach

The Technical Study is based on secondary literature. Detailed research has been done to understand the concept of resilience from various angles – national and international. European cities that have successfully mainstreamed resilience have been studied to identify concepts that may be adapted to the Indian context. The response of cities to the ongoing pandemic from an urban planning perspective has been an important area of research. The Technical Study has been enriched through discussions and interactions with key government players in India as well as renowned international experts.

### 1.5 Output of the technical study

The Technical Study makes recommendations to mainstream resilience in urban planning in India through the URDPFI Guidelines and the Model Building Bye-Laws. The study explicitly lays importance on revisiting the neighbourhood planning norms, green infrastructure solutions for urban roads, population density, non-motorized transport/urban mobility. The study also focusses on the use of tools and technologies, land suitability analysis and slope analysis to be made mandatory while preparing the master plans, development plans. Although not in

---

great detail, the management procedures for the design and implementation of plans has also been discussed.

---

## CHAPTER 2: WHAT IS RESILIENT PLANNING?

### 2.1 Concept of resilience

The concept of resilience has its roots in disciplines such as Physics and Sociology. Urban resilience is a relatively new concept and it is only since the last two decades that cities around the world are focusing on it. The increased attention to resilience is an outcome of the impacts of a wide range of man-made and natural disasters with their associated risks. Managing risk is a dynamic process that requires constant revision and updating of the city's status and is heavily reliant on access to real-time data.

Resilience of urban systems is their preparedness to identify, resist, adapt, and recover from all shocks and stresses while maintaining essential functions and adapting towards sustainability. There are multiple definitions of the term proposed by Research Agencies and Organizations with all definitions emphasizing 'coping mechanisms' and 'adaptive strategies' to risks. For the purpose of this Technical Study, resilience is defined as *'the ability of an individual, a household, a community, a country or a region to withstand, cope, adapt, and quickly recover from stresses and shocks such as violence, conflict, drought, and other natural and man-made disasters without compromising long-term development'*.

Climate change and disaster risk management have been central to the focus on resilience at metropolitan scale over the past few decades but, recent economic crisis, health crisis, and failure of vital services have underscored the need for revisiting the concept of 'resilience' in urban planning and development. There are several initiatives globally that support and promote resilient urban development. The importance of building urban resilience is also reiterated in the UN Sustainable Development Goals (SDGs):

- **SDG 11:** states that cities should adopt plans to build their resilience in line with the Sendai Framework for Disaster Risk Reduction 2015–2030;
- **SDG 9:** is focused on developing resilient infrastructure to support sustainable development.

The general concept of resilience or resilient planning includes mitigation and adaptation to climate change; disaster planning, management, and recovery; energy and environmental security; urban infrastructure management, and urban design. The planning process should focus on building and enhancing the resilience of the city, communities, people, environment, and infrastructure systems. The process should also identify actions and procedures that can be undertaken to prepare for and recover from hazards or risks.

Resilience planning also stresses on the application of smart methodologies (that may use technology) on cities and urban settlements to administrate and manage urban transformations to cope with climate change and the mitigation of environmental hazards. Additionally, resilience planning also involves all levels of urban interventions such as national, regional, provincial, and municipal authorities, architects, and urban planners, citizens, and communities.

Further, the UN Office for Disaster Risk Reduction (UNDRR) and its partners launched the 'Making Cities Resilient' (MCR) Campaign in 2010. The "Ten Essentials for Making Cities Resilient" were developed to provide the basic building blocks for understanding disaster resilience at the local level, based on the Hyogo Framework for Action. The Sendai Framework which is the successor instrument to the Hyogo Framework for Action was adopted at the 3<sup>rd</sup> United Nations World Conference on Disaster Risk Reduction. The Ten Essentials for Making

Cities Resilient were modified and aligned with the guidance provided by the Sendai Framework and are as follows:

1. Organize for disaster resilience
2. Identify, understand and use current and future risk scenarios
3. Strengthen financial capability for resilience
4. Pursue resilient urban development and design
5. Safeguard natural buffers to enhance the protective functions offered by natural capital
6. Strengthen institutional capacity for resilience
7. Understand and strengthen societal capacity for resilience
8. Increase infrastructure resilience
9. Ensure effective disaster response
10. Expedite recovery and build back better

## 2.2 Rationale for resilience in urban planning

At the beginning of the 20<sup>th</sup> century, only 14 percent of the world's population lived in urban areas. By 2018, this increased to 55 percent of the global population living in cities and it is expected to reach 68 percent by the year 2050<sup>1</sup>. Most of this urbanization is taking place in developing countries that are not prepared to cater for such rapid population growth. Urban growth is happening spontaneously; not following the official planning framework and is characterized by informal and unplanned development. This rapid growth is resulting in the proliferation of informal settlements that are more prone to risks, natural and man-made hazards while coping with limited access to adequate infrastructure.

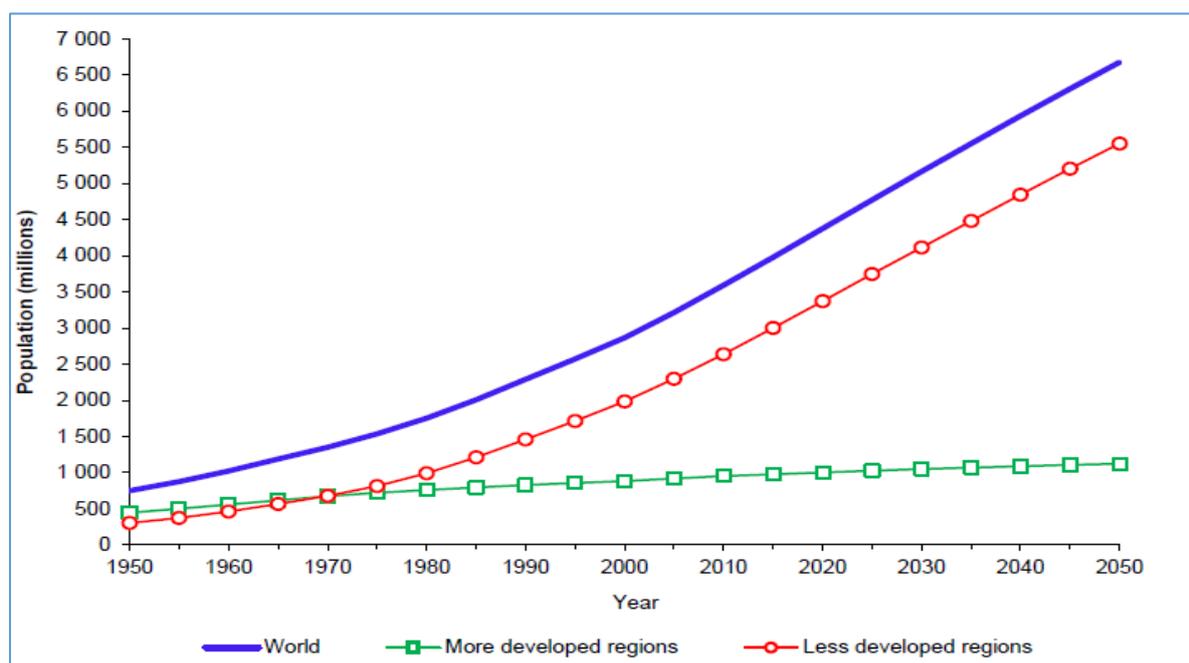


Figure 1: Estimated and projected urban populations of the world, more developed regions and less developed regions, 1950-2050<sup>2</sup>

Unplanned urbanization and climate change are impacting city efficiencies and functioning. There are increasing examples of disasters in places that were previously unheard and unseen – metropolitan floods in Chennai and Kochi in recent years are examples. Additionally,

<sup>1</sup> United Nations, World Urbanization Prospects: The 2018 Revision

<sup>2</sup> United Nations, World Urbanisation Prospects, The 2018 Revision

terrorism, health pandemics, etc. also pose challenges to the urban areas. Considering the pace of urbanization and required investment for the development of sustainable infrastructure, achieving sustainable development has always been a challenge. These challenges will only continue to grow unless urgent action is taken for developing risk reduction and sustainable urban growth.

Improving city planning and management, as well as adapting urban spaces to mitigate the adverse effects of climate change, will certainly be critical in the coming years and decades. The focus is on how to incorporate resilience in planning to achieve a sustainable development pathway and thrive despite the constant global changes. In the recent past, we have seen many cases in India, where the essential services have failed bringing the city to the verge of disaster. In 2015 the metropolitan city of Chennai faced a catastrophic flood and in 2019 all of the city's water reservoirs virtually dried up creating a water crisis. These may well be an outcome of unplanned development upstream of natural drainage lines or wrong siting of infrastructure – the metropolitan approach to planning not receiving adequate attention is perhaps a larger contributing factor than poor and/or inadequate infrastructure at the city level. Situations such as these are increasingly commonplace and pose challenges to city administrations.

At this time, the COVID-19 pandemic is spiraling across the globe, exposing the gaps in the ability to cope in long-established ways of doing business. The cities are the worst affected by this pandemic. For example, in India, the metropolitan capital cities of Mumbai and Delhi are amongst the hardest hit by the pandemic. The pandemic has challenged the practitioners and policymakers across the globe to rethink the urban planning strategy by highlighting the central role of urban planning in the post-COVID-19 recovery and the unique opportunity it presents in rethinking the way we

plan cities i.e. the hardware, manage i.e. implement the plans and behave i.e. the software of our cities. Some of the key questions that this pandemic has raised include the approach to planning; the importance of population density, green public spaces, shorter distances

#### **TUMAKURU SMART CITY**

Tumakuru Smart City has procured and deployed drones as part of smart city mission activities. These were deployed to monitor movement all over the city, especially in the hotspots. Going forward, the city can improve its efficiency by real time tracking, monitoring and even logistical support.

#### **UJJAIN SMART CITY**

Through the Integrated Command Control Centre (ICCC) the following measures are being undertaken:

- i. Broadcasting awareness support messages regarding the preventive measures through **32** functioning Variable Message Sign (VMS) locations across the city.
- ii. Coordinating with the police for Lockdown Management by disseminating information vide public announcement systems installed at 13 junctions of the city.
- iii. Monitoring vehicles at the entry/exit points and major junctions through Automatic Number Plate Recognition (ANPR) System.
- iv. Setting up helpline numbers for lockdown support.
- v. Geo-tagging of properties of COVID 19 suspect cases.
- vi. Launching of an application for COVID 19 support which enables tele-consulting services, reporting COVID 19 suspect cases, and access to essential services and products for certain categories of vulnerable citizens.

*This is an illustrative example and not currently in the planning guidelines*

between work-home and leisure, and urban mobility. On the 'software' aspects i.e. the way we behave has played a larger role in the response to the pandemic. For example, the cities in the USA with far superior infrastructure have fared less adequately than countries like Vietnam. The lessons from COVID-19 present an opportunity to build resilient and sustainable cities.

During the COVID -19 pandemic, many of the Indian cities came up with mitigation strategies that reflect the potential of resilience within the cities. One of the examples includes geofencing the infected zone and planning of resource distribution using updated GIS Base Maps and through the Control and Command Centers set up under the Smart City Mission. These are immediate governance and participation-based solutions and not really planning hardware-based solutions. But, these responses and the number of cases has exposed the inadequacy of infrastructure as well.

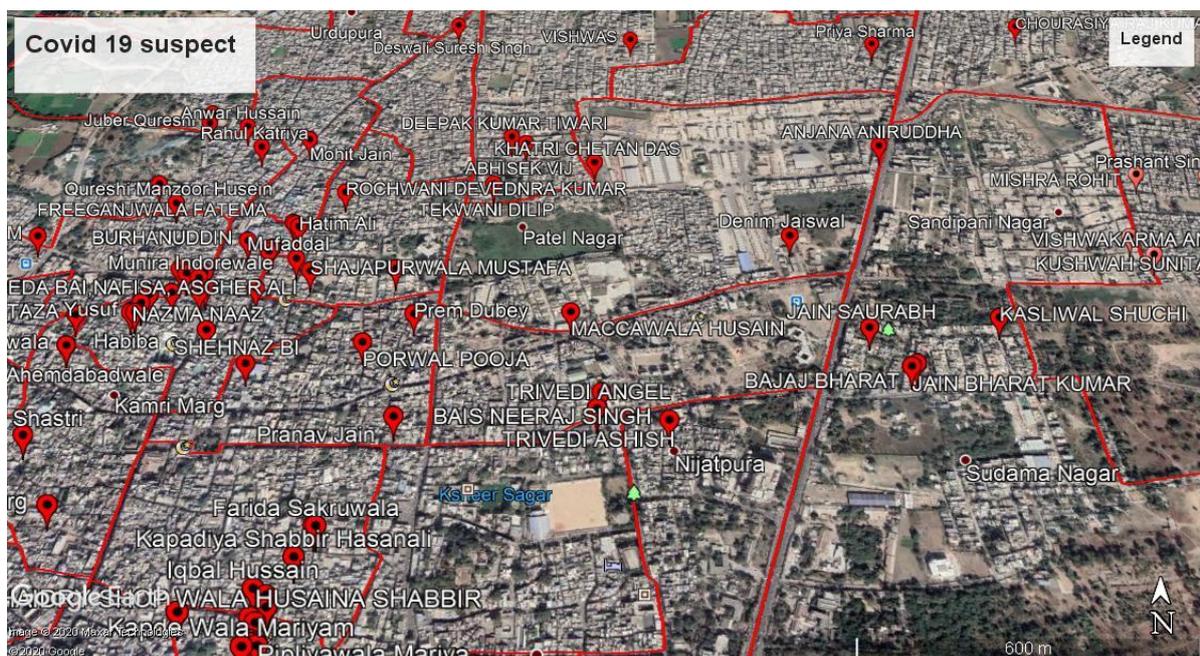


Figure 2: Geo-tagging of COVID 19 suspect patients in Ujjain



Figure 3: Initiatives for Awareness to citizens for COVID – 19 at Ujjain

Urban planning that is resilient is of key importance to the city and urban practitioners for understanding spatial planning impact, prediction of future growth, and mitigation of disaster risk. There is a need to revisit the contemporary planning tools including land use, residential density, the spatial distribution of services and facilities, basic services, etc. through the lens of urban resilience. The continuously changing urban fabric should be understood and managed as a dynamic system. Despite all the planning tools it is not possible to predict the behaviors of the complex urban development. It is, however, possible to make statements about the expected outcomes.

### 2.3 Parameters that indicate resilience in planning

This Technical Study focuses on the parameters of urban planning and its processes that influence the resilience of a city on the one hand and comments/reiterates the merits of a metropolitan planning approach that automatically embeds an element of resilience in urban plans. The determination of resilience capacity of a city demands planners and researchers to identify variables that trigger a disturbance in a city (a community, a region, or landscape), along with the mechanism to mitigate these disturbances. It is possible to mark the parameters (variables) that induce vulnerability or enhance resilience however it is difficult to measure their influence. While we understand the scale of influence of these parameters conceptually and intuitively, it is important to prioritize these factors in a pursuit to achieve resilience (Gonsalves, 2013).

The critical resilience parameters in the urban planning eco-system (starting from the metropolitan scale and cascading to the city scale) are identified as follows:

a) **Land suitability:** Land suitability analysis guides the location, type, density, conservation of natural resources, etc. The suitability analysis is very crucial for resilient planning and allocation of various uses. It uses Geographic Information System (GIS) to identify potential areas for development, using a set of variables with specified criteria and weights. The variables can include various environmental, economic, social, and other physical factors that are required to identify parcels with reduced risk. The exercise is crucial for the preparation of all the metropolitan plans, master plans and zonal plans.

The European Commission undertook a study (2019) of 214 cities around the world as part of “*Making Cities Resilient and Sustainable: Implementing the Sendai Framework for Disaster Risk Reduction 2015-2030 at the Local Level*” concluded that; while 60% of the cities are zoned according to land use that considers hazard and risk mapping, only 16% of cities regularly update the zoning on agreed intervals, whereas, 9% of the cities have no known or clear zoning.

A shared understanding of disaster risk between a city and its various utility providers is a critical aspect of disaster risk reduction. Land suitability analysis contributes to embedding resilience in planning, integration of plans of various agencies and sustainability of investments for infrastructure – overall, this approach contributes to maximum return on investments. ***The suitability analysis promotes informed and rational decision-making. This allows ease of communication of outcomes and higher acceptance and thus lesser resistance to implementation.***

b) **Physical and Social Infrastructure critical for resilience:** Infrastructure both physical and social are the most vulnerable to disasters and risks. Physical infrastructure such as water supply, drainage, sanitation, transport and solid waste management are the ‘hardware’ of the cities while, social infrastructure like schools, parks and open spaces, hospitals, shelters, government buildings have proved critical in the pandemic. Disasters in the recent past like floods in cities (Chennai, Kochi) and the pandemic have underlined the need to have information on exact location of both social infrastructure and physical infrastructure. Cities must ensure that these are maintained such that in times of emergencies, these can be optimally used. Social infrastructure like school buildings, government buildings act as emergency refuge and provide shelter in times of distress. Similarly, critical transport infrastructure like airports, major roads are the first that need

The Public Transport Access Level (PTAL) measure of connectivity in planning as demonstrated in London many years ago was used in the planning of the Ahmedabad Metro Rail in 2014. PTAL takes into account average walk speed and time, distances to public transport stops, and peak-hour route frequencies of different public transport modes to recommend optimal transport routing. Using overlays of GIS maps and the PTAL methodology, the alignment and routes of the metro rail were finalized, thereby achieving the goal of improving the level and quality of service of the public transport system. PTAL maps are an easy and smart representative tool for accessibility. PTAL mapping is used in planning that integrates land use–transport, improving public transport and prioritizing investments, formulating parking policies, and planning transit-oriented development (TOD).

---

protection and restoration to tackle emergencies. Thus, technologies for construction and location of both physical and social infrastructure must incorporate elements of resilience. ‘Green infrastructure’ solutions are one method that cities could consider and adopt. Some examples of successful adoption of this are:

- **Barcelona Climate Plan** (2018-2030) has adopted a comprehensive approach to tackle the challenges of climate change. Various infrastructure strategies aiming at developing the city’s resilience have been incorporated in this plan such as encouraging water saving at a municipal level, **promotion of the use of rain and regenerated water**, facilitate water infiltration into the subsoil, use of greywater, increasing soil permeability by defining a sustainable urban drainage strategy for Barcelona.
- The **Green roofs in Basel**, Switzerland is another example that addresses combining mitigation and adaptation measures. Basel has implemented an incentive programme to promote green roofs. This is both a mitigation measure to save **energy and adaptation measures** to reduce emissions and lower indoor temperatures. Financial incentives and building regulations were used in combination to promote the initiative since the early 1990s through legislation in support of energy-saving measures.

In India, the European Union has been supporting several cities to prepare ‘Climate Action Plans’. Further, municipal legislation in India has an incentive for a rebate on the property tax in case the building has installed a rain-water harvesting system or reuse of greywater. To promote ‘green growth’ and the use of eco-friendly technologies, the Government of India has developed standards and incentives, especially for buildings. These initiatives involve the private sector that certifies green buildings - GRIHA, IGBC, and LEED<sup>3</sup>. These good practices should be enforced more strictly than they are at present. These interventions will contribute to improved infrastructure and resilience in the face of disasters.

- c) Population density<sup>4</sup>:** The COVID pandemic has generated global debate on population density and whether there is a direct link between density and increased vulnerability – the density that is of relevance in this context is the number of persons per square kilometer i.e. a measure of overcrowding and congestion. While the high population densities and proximate living conditions in informal settlements certainly increase the risk of exposure to COVID 19 (UN, 2020), planning at metropolitan scale demonstrates the advantages of population concentrations along high-density corridors. The Transport Oriented Development (TOD) approach promotes higher density at transport nodes with corresponding quality infrastructure as the backbone. As the scales of planning decrease to the operational levels, population density becomes an important balancing feature to enhancing resilience. The COVID pandemic has shown examples of adaptation through appropriate densities and the location of services.

---

<sup>3</sup> GRIHA: Green Rating for Integrated Habitat Assessment

IGBC: The Indian Green Building Council

LEED: Leadership in Energy and Environmental Design

<sup>4</sup> There are two types of population density – (i) the number of persons per square kilometer (ii) the square meter of facilities and built space per inhabitant. If one lives in a 50 sq.m. per person built space then the relation with the urban density as a whole is not very relevant.

---

**d) Mixed-use development and norms for distribution of services (commercial and social infrastructure) and design norms for public spaces:** The mixed-use development stemming from the metropolitan to city level plan scale provides for a range of residential, commercial, and others use which complement the mixed-use of the neighbourhood/area. Resilient cities and neighbourhoods will need to not only embrace diversity and mix of uses, with convenient access to public transport, public spaces, compatible uses, and distribution of commercial and social infrastructure but also and perhaps more importantly, people’s behavioral patterns and the ethics of social awareness and responsible behaviour. SDG, Goal 11 of the UN aims to provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport.

Existing urban planning norms segregate the different hierarchies of services for the local level, neighbourhood level, district level, city level, and regional-level plans. This includes norms for the planning and management of public spaces. The Global Framework for 2030 New Urban Agenda emphasizes universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons, and persons with disabilities.

The C40 Cities have pitched for a *‘15-minute city’* as part of the COVID recovery plan. Also known as ‘complete neighbourhoods’, the concept recommends that all residents will live in a 15-minute walking or cycling distance to most of their service needs. This type of city requires creating mixed-use development, flexible buildings and spaces. Examples are seen in parts of Delhi, Bengaluru, Kolkata, Jaipur and Chennai in India.

Paris and Milan have adopted the concept as an integral part of their framework for recovery from COVID.



Figure 4: Features of 15-minute city plan

Source: <https://www.planning.vic.gov.au>

- e) **Urban Governance:** At the core of planned development is governance and capacities. Government structure and management not as a reaction to an emergency rather, as a preventative measure and private sector behaviour both from private institutions and citizens behaviour as a whole are important considerations. Without the appropriate legislative framework and behaviours, it will not be possible to initiate structured interventions. Disasters and the COVID 19 have demonstrated the need for integration and a matrix structure of governance for an efficient and appropriate response. Integrating resilience into the planning framework may require a relook at the nature of governance and decision making at certain scales and there needs to be a willingness to adopt this for long term benefits.

## 2.4 Urban resilience in the Indian planning framework

The Ministry of Housing and Urban Affairs, India (MoHUA) has issued two documents, URDPFI Guidelines, and Model Building Bye-Laws. These are the base documents that guide planning and building construction in the country. The states have the autonomy to make adjustments to these legislations as per local conditions but, all adjustments must be within the broad framework defined by the URDPFI Guidelines and the Model Building Bye-Laws.

The first national-level planning guidelines 'Urban Development Plans Formulation and Implementation' (UDPFI) were framed in 1996 by the Institute of Town Planners, India. These guidelines provide an integrated framework for urban and regional plan preparation and implementation. The Guidelines were revised in the wake of emerging issues linked to rapid

---

urbanization and published as 'Urban and Regional Development Plan Formulation and Implementation Guidelines' (URDPFI) by the MoUD (now MoHUA) in 2014. The need for revision was felt because of the following emerging issues:

- Integration of Landuse and Transport at planning stage
- Comprehensive Mobility Plans (CMP) for Urban Transport
- Mixed Landuse concept
- Service Level Benchmarks
- Disaster Management
- Inclusive Planning
- Sustainable Habitat
- Environmentally Sustainable Transport
- Resource Mobilization
- Streamlining the preparation of Master Plans
- Urban Reforms
- Regulatory Framework for Town Planning profession

The revised version incorporated features of sustainable habitat, integration of land use and transport planning, disaster management concepts, inclusive planning and governance aspects. The *objective of the guidelines* remains the same *'to promote and facilitate balanced and integrated urban and regional development'*. Since the conditions may vary from city to city and region to region, these guidelines may need to be modified and adopted as per the local conditions.

The URDPFI Guidelines, 2014 is in two volumes - Volume 1 elaborates the planning process, classification of urban settlements, contents of the plans as per the planning system, resource mobilization for plan implementation including land and finance as the primary resources for sustainable development, institutional reforms particularly at the state level, and approaches and strategies for regional and urban planning. Volume 2 comprises the provisions under 74<sup>th</sup> Constitutional Amendment Act (CAA) and its implication on urban development, other legislative frameworks including Land Acquisition Rehabilitation and Resettlement Act, Model Regional and Town Planning and Development Law, Model Municipal Law, Existing legal framework at state-level planning, Legal requirement for industrial development and other acts/laws

Throughout history, pandemics such as the Black Death, Cholera, and SARS have reshaped the management and response of cities.

- In London, the sanitation system was developed as a response to the Cholera outbreak in Soho in 1854.
- The Spanish Flu of 1918 is responsible for Manhattan, New York modifying some of its by-laws.
- Surat's transformation into one of the cleanest cities in India was after the outbreak of Plague in the mid-1990s through a mix of urban management followed by urban design.

COVID-19 presents a possible opportunity to influence key aspects at the intersection of urbanism and disease.

---

regulating the urban and regional development across the country. The new inclusions in the URDPFI Guidelines 2014 are included in **Annexure 1**.

To address sustainability, various sections in the Guidelines mention land suitability, impact of climate change, a brief on existing environmental policies, and environmental guidelines for development in eco-sensitive areas. URDPFI also includes guidelines for disaster management and mitigation techniques. To speed up the process of plan formulation, simplified planning techniques, and norms and standards for social and physical infrastructure planning are detailed along with simplified development promotion regulations. The overall recommendations for future actions have also been included.

The URDPFI Guidelines are very detailed in their coverage of most of the variables in urban planning. The Guidelines exclusively cover the subject of Sustainable Habitat and Environmentally Sustainable Transport. Indian cities are finding it difficult to adopt a sustainable development approach on account of the rapid pace of urbanization and limitation of resources. As India is undergoing rapid urbanization the focus of the urban development Missions<sup>5</sup> in India has been on the provision of basic infrastructure, without adequate attention to achieving sustainability (Desai, et al., 2019).

Like the URDPFI Guidelines for urban planning, the Model Building Bye-Laws (MBBL) regulate coverage, height, building bulk, and architectural design and construction aspects to achieve planned development of an area. The MBBL was published in 2004 in the wake of the devastating earthquake in Bhuj, Gujarat in 2001. The focus of the legislation was on the structural safety of buildings by incorporating provisions of disaster management, cyclone, landslide, etc. These Bye-Laws are relevant at the city planning scale and are their recommendations on protecting buildings against fire, earthquake, noise, structural failures, and other hazards are mandatory. The MBBL is for the guidance of the State Governments, Urban Local Bodies, Urban Development Authorities, etc. and the states/UTs are directed to revise their respective building bye-laws within this framework.

These bye-laws were upgraded and revised in 2016 in the wake of growing environmental concerns, technological development, and thus the need for increased safety and security measures. The MBBL-2016 also addresses norms for solar installation, building regulations for natural hazard-prone areas, conservation of heritage sites and natural feature areas, bye-laws for safe use of glass, barrier-free environment for disabled, children and old persons, and mitigation of the effects of electromagnetic radiation in built spaces. The MBBL 2016 exclusively covers the sustainable development approach by addressing the following environmental concerns:

- Green buildings and sustainability provisions: Water Re-use and Recycling, Solar Roof Top, Sustainable Waste Management and Sustainability of Building Materials
- Rainwater harvesting including enforcement and monitoring, technology options
- Climate-resilient construction, integration of environmental clearances with the building plan sanction and approval.
- Peripheral open spaces including setbacks for high rise buildings.

---

<sup>5</sup> The Smart City Mission, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Swachh Bharat Mission

- Electric Vehicle Charging Infrastructure, as an initiative towards SDG 13: Climate Change

The key elements of the URDPFI Guidelines and Model Building Bye-Laws that provide scope for mainstreaming resilience are summarized below.

ASPECT	MODEL BUILDING BYE-LAWS	URDPFI
<b>PURPOSE</b>	Legislative framework used to regulate coverage, height, building bulk, and architectural design and construction of buildings to achieve orderly development of an area.	Legislative framework for preparation of Master and Regional Plans for balanced and integrated urban and regional development.
<b>BROAD AREAS</b>	Building design as per bye-laws: <ul style="list-style-type: none"> <li>▪ Building plan sanction and approval</li> <li>▪ Development Control Regulations</li> <li>▪ Fire safety</li> <li>▪ Structural safety and earthquake resistance</li> <li>▪ Heritage conservation</li> <li>▪ Additional provisions for high-rise buildings</li> <li>▪ Green Buildings and sustainability</li> </ul>	<ul style="list-style-type: none"> <li>▪ Land use classification</li> <li>▪ Zoning regulations</li> <li>▪ Population density</li> <li>▪ Growth directions</li> <li>▪ Future infrastructure needs</li> <li>▪ Development norms: FAR/FSI, height, setbacks, ground coverage</li> <li>▪ Parking</li> </ul>

### Disaster Management

The Indian Government planned their COVID 19 response strategy around the Disaster Management Act, 2005 that gives the Central government powers to take quick policy decisions and impose restrictions as required to manage a disaster. Under the purview of the powers described under this Act, the central government outlined the strategies, guidelines, and enforced restrictions to combat the pandemic – the key role of the central government was critical in the immediate response to tackle the situation. Subsequently, the states were given increasing autonomy in customizing their response however, the central government retains the right to intervene as needed. The State governments, in addition to the Disaster Management Act, used the Epidemic Diseases Act, 1897, and the various state-specific Public Health Acts (eg: Tamil Nadu Public Health Act, 1939) to deal with the COVID crisis.

The Kerala government’s prompt response to COVID-19 can be attributed to its experience and investment made in emergency preparedness and outbreak response in the past during Kerala floods in 2018 and especially, the NIPAH outbreak in 2019.

The state used innovative approached and its experience in disaster management planning to quickly deploy resources and put up a timely and comprehensive response in collaboration with stakeholders.

Active surveillance, setting up of district control rooms for monitoring, capacity building of frontline health workers, rish communication and strong community engagement and addressing the psychosocial needs of the vulnerable population are some of the key strategic interventions implemented that helped manage the disease.

---

Within the disaster management framework, the National Policy on Disaster Management (NPDM)-2009 is an important achievement. The NPDM emphasizes on mainstreaming resilience in planning at various levels. It advocates the following resilient planning components:

- Check unplanned urbanization and ensure safer human habitat against all forms of disasters.
- Land-use planning to be done based on the environmental and hazard data analysis for the formulation of alternative land-use plans for different geographical and administrative areas with a holistic approach.
- Urban mapping of the infrastructure of spatial resolution for the development of a Decision Support System (DSS) for managing urban risks.
- Development control regulations, building bye-laws, and structural safety features to be reviewed periodically to identify the safety gaps from disasters and hazards.
- Improve urban drainage systems with a special focus on the non-obstruction of natural drainage systems.
- Building mitigation measures in all development projects.

The National Disaster Management Plan (NDMP)-2016 is another important legislation in India. This is aligned to the Sendai Framework for Disaster Risk Reduction, to which India is a signatory. The Plan represents an important step towards India's response and preparedness for disaster and climate-event risks. The Plan

includes measures that will be implemented over the short (5 years), medium (10 years), and long-term (15 years) over the time horizon of the Sendai Framework ending in 2030.

It is envisaged that these will help India in mainstreaming disaster resilience and more capable of achieving the goals of sustainable development.

#### Features of NDMP-2016

- Hazard Risk and Vulnerability Profile of India
- Planning framework for reducing risk and enhancing resilience
- Planning needs for preparedness and response
- Strengthening disaster risk governance
- Maintaining and Updating the Plan

## 2.5 The URDPFI Guidelines in the context of the SDGs

Urban adaptation and resilience have been embedded in the SDGs 2030. Goal 11 refers to urban ecosystems and emphasizes on making cities inclusive, safe, resilient, and sustainable by implementing integrated policies and plans for resource use efficiency and adaptation to climate change. Goal 9 refers to developing quality, reliable, and resilient infrastructure ensuring equal access to all, promoting sustainable industries, innovative technologies, mass transport, and renewable energy.



### Sustainable Development Goal 11

**Make Cities and Human Settlements Inclusive, Safe Resilient and Sustainable**



## Sustainable Development Goal 9

**Build Resilient Infrastructure, Promote Inclusive and Sustainable Industrialization and Foster Innovation**

Whereas the URDPFI guidelines have a separate chapter on sustainability guidelines, this Technical Study will identify various urban planning norms and standards that impact the resilience of a city from the perspective of SDG 9 and SDG 11. URDPFI Guidelines have been analyzed on the following factors:

- A. Process of urban planning
- B. Development promotion regulations
- C. Resilient infrastructure

The norms and standards under each outlook have been identified based upon the broad resilience parameters identified in section 2.2 are as shown below.

<b>APPROACH</b>	Carrying land suitability analysis, using digital base maps and GIS tools for plan preparation at various levels.	
	Encourage intensive and mixed-use development as part of the redevelopment and re-densification strategy along with the concept of ToD. Design for footpaths, cycling tracks and focus on barrier free and universal accessibility.	
<b>RESILIENCE MEASURES</b>	Planning approach guided by the concepts of green, compact and smart city. The importance for resilient infrastructure to be developed as backbone for the cities.	
	Climate Change Mitigation and Adaptation comprising of green buildings, environment policies and statutory obligation, environmental guidelines, and disaster management guidelines have also been introduced.	
	Development regulations for various land uses, norms for green and public spaces, social and physical infrastructure, population density etc. based on population and planning unit.	
	As part of the Green Infrastructure initiatives, the emphasis is only on Zero Waste and Waste Recycling, GHG mitigation measures for wastewater, Decentralized Wastewater Management, Low Water use and Ecological Sanitation, Recovery of Energy and Reducing need for pumping.	

Figure 5: Provisions to the urban planning process

The planning process, policies, and discourses are increasingly framed using the lens of resilience. To help cities build their resilience, it is essential to mainstream the concepts and approaches into all levels of planning.

## CHAPTER 3: INDIAN PLANNING FRAMEWORK: IMPROVING RESILIENCE

Cities rely on a complex web of institutions, infrastructure, and information for their functioning. However, this is now under threat by both acute shocks and chronic stresses<sup>6</sup>. While there are elaborate frameworks and Guidelines available globally and cities are expected to adhere to them while planning, the reality is different. In the Indian context, Master Plans and consecutive Zonal Plans, Layout Plans and Town Planning Schemes make provisions to accommodate urban expansion for its horizon year but, cities cannot cope with the influx of people who come in search of livelihoods and, in the absence of affordable housing, live in slums. The COVID 19 has underlined the higher risk that these settlements face.

A resilience thinking approach tries to investigate how the different interacting systems of people and nature or social-ecological systems can be best managed to ensure a sustainable and resilient supply of essential infrastructure and services on which humanity depends (SRC, 2015).

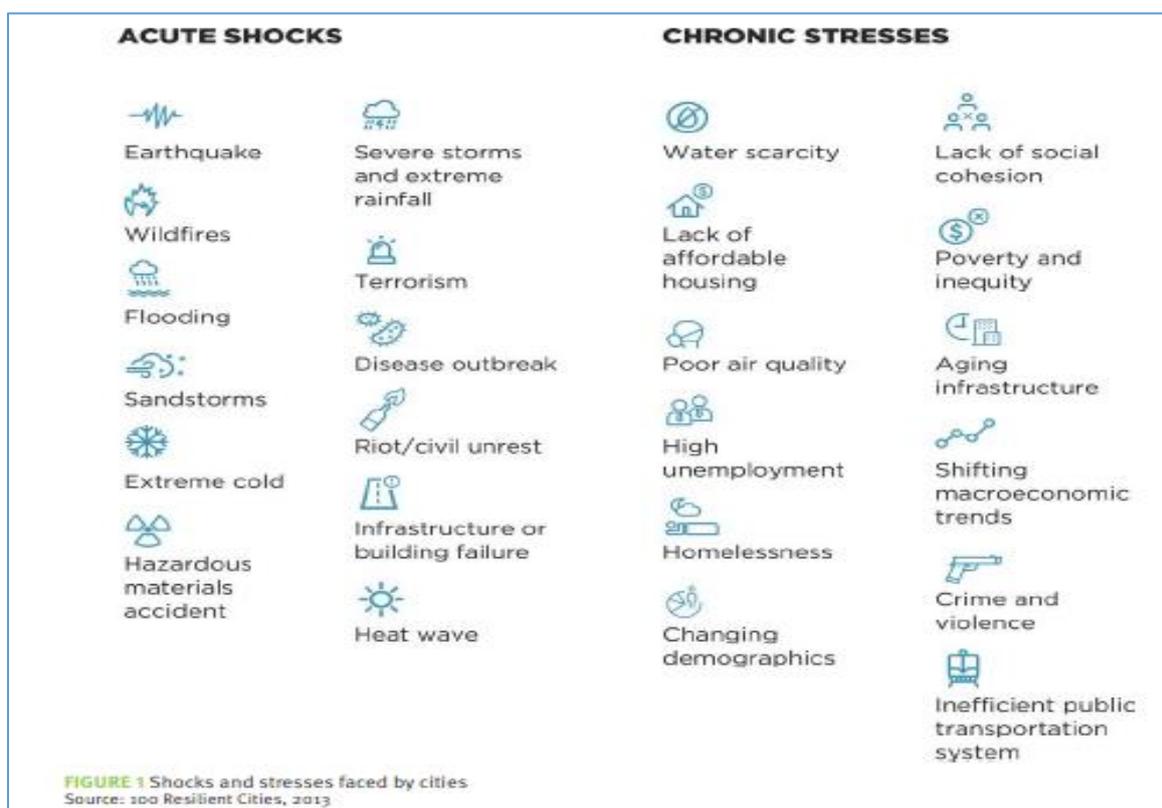


Figure 6: Shocks and stresses faced by cities

The problems of unregulated growth, lack of basic services, accessible other social factors increase vulnerability. From a planning perspective, settlements in low lying, overcrowded, dilapidated, and hazardous built areas are at higher risk. But these settlements have grown as a result of the inability to incorporate these zones within the planned development or plan without accurate estimates of population pressures. The underlying reasons for such

<sup>6</sup> 100 Resilient Cities, 2013, The Rockefeller Foundation

---

unplanned development may be due to the gaps in land suitability analysis provision of infrastructure, inability to allocate compatible land use, density allocation, decision making in the governance and allocation of public spaces. Thus, as cities continue to grow, it is imperative to manage and guide their growth.

Another reason for growing vulnerability is the isolated approach to planning and infrastructure development. In India, planning lays greater emphasis on Master Plans that are revised every 20 years, while infrastructure development is barely able to match the pace of urbanization. It is self-evident that if plans are not executed swiftly, they are rendered largely redundant by the interim growth that takes place in the city. While the URDPFI Guidelines include metropolitan planning as a concept, these are not strictly enforced. Metropolitan Planning again, is of two types – (i) structural i.e. environment, transport, housing, social facilities and productive activities and (ii) strategic i.e. governance, finance, etc. Metropolitan planning focusing on the structural demonstrates the inter-relationship between the five components and how their appropriate placement automatically embeds a level of resilience. Metropolitan planning focusing on the strategic is on decision making, funding and guidance to the planning approach in a region.

Among the most important planning deficits in India is the fact that low-income and rental housing is largely ignored in city plans. One of the reasons could be the reluctance to acknowledge the issue of urban poverty or of finding adequate space for the urban poor to live in and the other is the preference of most Indians to be homeowners. Government schemes for affordable housing are primarily a corrective approach since the demand from this segment of the economy is not catered to by private developers.

500 cities have been identified for improvement under Central Mission of AMRUT with a focus on the following: improving water supply, sewerage and septage management, stormwater drains, pedestrian and non-motorized transport facilities and green spaces by reforms management and capacity building. Changing climate and correspondingly increasing disaster risk, has not been recognized in the mission statement and guidelines for action.

The Government of India Flagship Urban Missions – the Smart City Mission and AMRUT both focus on infrastructure creation, however, one of the elements of ‘smartness’, as defined under the Smart City Mission, is ‘slum-free city’. The Smart City Plans have opted for the relocation of slums most often to areas that conflict with the livelihood requirements of the poor. What therefore are the focus areas that define vulnerability in cities and what are the gaps in the existing urban planning framework at various scales that contribute to these gaps?

### 3.1 Vulnerable areas

The ‘urban experience’ in Indian cities is one of imbalance between the scale and sustainability of development. With the increasing size and density of a metropolitan city, the pressure on infrastructure and carrying capacity of the land multiply and reduces the availability of green and open spaces and access to public areas. City infrastructure has a strong bias towards ‘grey infrastructure’ and this is a big contributor to city level vulnerability in the face of disasters. The impact of unplanned development and preponderance of grey

infrastructure is seen in increasing air pollution, heat island effects, increasing urban flooding, and deteriorating the health of city dwellers. These are outcomes of wrong planning or planning that has not considered metropolitan scale or broader sectors.

Vulnerability is an outcome of the following overlapping areas: 'vulnerable zones' that are an outcome of poor planning, 'vulnerable infrastructure' that is an outcome of construction quality and age, and 'vulnerable built environment' that is an outcome of nonconformity of building norms.

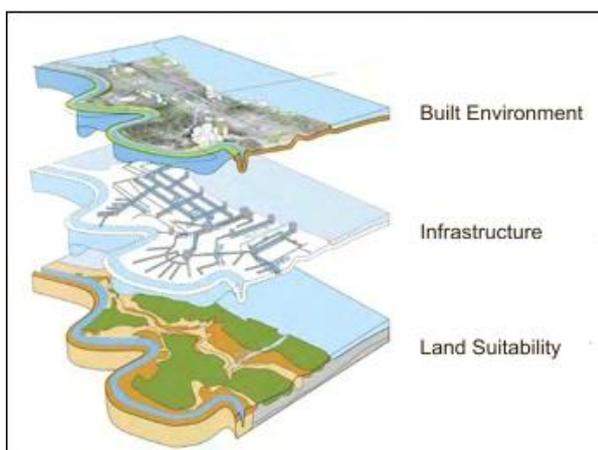


Figure 7: GIS-enabled city plans

**Vulnerable Zones:** Master Plan implementation in India has been poor, generally not crossing the one-third mark <sup>7</sup>. In the current urban planning approach, vulnerable areas such as low-lying areas and undevelopable land areas are identified through the resilience parameter of land suitability analysis and are earmarked as no-development zones. Further, as per the URDPFI guidelines, the Master Plan shall also define the planned residential density of each zone but, ULBs do not have any tools to regulate the density in a zone and, in some cases, the proposed FAR in a zone is in conflict with the planned residential density.

Similarly, building regulations (building bye-laws) that are to regulate the built environment are rendered useless in case of unauthorized development or development before the commencement of building regulation.

Despite the robustness of provisions in planning and regulatory tools in India, poor or rather delayed plan development and implementation has increased the vulnerability of certain parts of the city. These zones are most vulnerable to natural disasters like earthquakes, floods, fire, or even a pandemic. As the population density of these zones is often high, the impact of the disaster is maximum in these zones. In the case of slums and unauthorized development, low affordability and lack of social infrastructure also add to the factor of high vulnerability.

High population densities and overcrowding contribute to higher vulnerabilities – how then has Dharavi, the largest slum in Asia, managed to keep the COVID 19 curve in control? When COVID-19 struck the state of Maharashtra and importantly Mumbai city, the worst affected areas were Dharavi, Dadar and Mahim<sup>8</sup>. The world waited and watched the COVID story unfolding in Dharavi but, the residents and the city administration proved that miracles are possible. The lessons that emerge from Dharavi's handling of the pandemic offer solutions to looking at city governance i.e. the interface between people and administration and behaviours – these are discussed later in the document.

<sup>7</sup> India's Urban Challenges: Recommendations for the New Government (2019-2024)

<sup>8</sup> <https://mumbaimirror.indiatimes.com/coronavirus/news/mumbai-covid-19-tracker-dharavi-dadar-and-mahim-among-mumbais-worst-covid-19-affected-areas/articleshow/76093203.cms?>

---

For Dharavi to turn a corner in the midst of crisis is a noteworthy story of customized solutions, community involvement and perseverance. Dharavi offers both lessons and promise for other dense neighbourhoods, particularly in the developing world battling the pandemic. The odds were stacked against Dharavi as Mumbai emerged as India's coronavirus epicentre and in mid-June 99% of the city's intensive care beds were occupied. About 1 million people are packed into Dharavi's one-square-mile area with most residents depending on community toilets used by thousands every day. This situation made conventional solutions such as social distancing and contact tracing impossible to enforce. The city government took matters in hand and charted their own course.

- Five areas reporting the most cases were identified and focused for 100% screening
- Local doctors were enlisted to instil confidence and in 10 days, 47,000 people had been screened and 20% were found to be positive.
- Health camps were set up in prominent locations in the slum for free walk-in testing and private clinics were urged to remain open so more cases could be detected. In turn the government provided protective gear and daily sanitization.
- Building health infrastructure from scratch was another critical challenge – the government run facilities inside the slum had no beds or intensive care equipment. Local government officials took over a sports complex, a park, a marriage hall and private hospitals to house quarantine and treatment facilities. They also built a 200-bed hospital with oxygen beds on a vacant plot.
- Hundreds of community toilets were sanitized three times a day and soap and water supply regularized.

The efforts paid off – the number of new cases in July was a fifth that of May. The recovery rate is over 80% and the number of active cases manageable. This has proved the importance of management as an immediate response.

*Source: The Washington Post July 31, 2020*

**Vulnerable Infrastructure (physical infrastructure):** With the infrastructure already trying to function beyond its designed capacity, any disaster, even of a smaller scale, poses a great threat to the infrastructure. Failure of any civic infrastructure can be catastrophic and the cascading effect of it on other city infrastructure and services. Producing infrastructure is very expensive and difficult for states to afford. Thus, the protocol for cost-benefit analysis and opportunity costs for siting of infrastructure are critical. Urban planning is in the State List of the Constitution of India which means that the state governments have full responsibility for this function. The MoHUA formulates policies and centrally sponsored schemes for urban infrastructure development; The Town and Country Planning Organization (TCPO) and the National Institute of Urban Affairs (NIUA), amongst others, function as autonomous bodies under the MoHUA and provide technical support for urban planning and related activities. Given the multiple agencies responsible for various activities in urban planning, financing, implementation, and management at various levels of governance in the country, overlapping jurisdictions, and fragmented roles and responsibilities have been a major factor in the poor delivery of urban services (HPEC, MoUD, 2011).

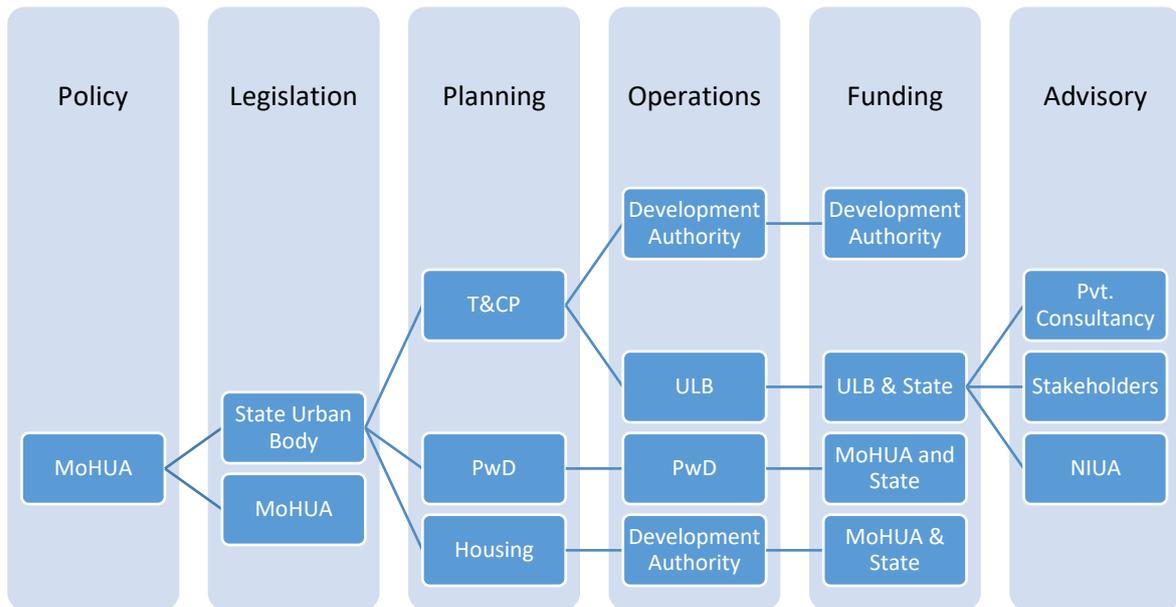


Figure 8: Different agencies involved in the planning process

The Ministry of Housing and Urban Affairs (MoHUA), Government of India, has launched several missions and schemes over the last few decades to facilitate structured urban development. Most recently, in 2014, MoHUA launched the ‘AMRUT Mission’ to address infrastructure gaps, ‘Housing for All’ to provide affordable housing, ‘Swachh Bharat Mission’ to improve sanitation, and ‘Smart City Mission’ to improve livability. The Ministry also launched the ‘Ease of Living Index’ in 2018 with the aim of facilitating a shift towards ‘outcome-based’ urban planning. These urban Missions have been designed to manage the fast-paced urbanization in cities and contribute towards the achievement of the UN Sustainable Development Goals. All the Missions have a greater emphasis on the provision of basic infrastructure although, AMRUT also has a ‘reform’ component. The Smart City Mission encourages cities to develop and implement innovative and sustainable infrastructure and, pilots have been successful in most cities – how they will be scaled up is still unknown.

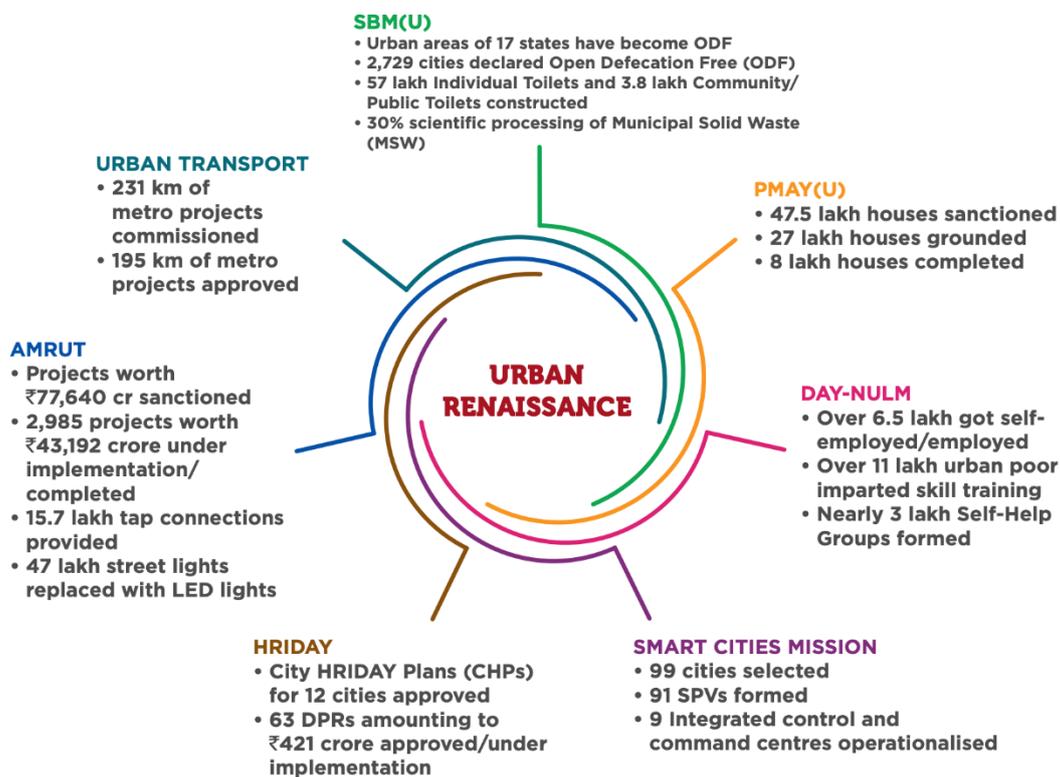


Figure 9: Milestones achieved by National Urban Missions, 2014–18

**Vulnerable Built Environment:** India suffers from recurring harmful consequences of disasters such as flooding, landslides, and earthquakes, affecting the lives of millions exposed to risk. Vulnerable populations, particularly the urban poor, suffer a high degree of human and economic which is further exacerbated by an unsafe built environment. Experience shows that building collapse, fires, and other recurrent, small-scale events also have destructive impacts, which augment in the absence of effective resilient measures.

Enforcing robust building regulations is a priority across the country. Historically, building regulation has focused on the health and safety of occupants and on helping to reduce economic losses associated with a wide range and magnitude of hazards and disaster events. As disasters are becoming more frequent and intense, particularly as a result of climate change, building regulation must take into account additional measures to protect the increasing number of people at risk and address emerging societal objectives such as accessibility for all, affordability, and resource efficiency.

Within the existing Indian planning framework, structural safety and basic accessibility of the buildings are regulated by zoning regulations of the Master Plan and minimum construction standards defined in the building bye-laws. The zoning regulation defines the maximum ground coverage, FAR, height, residential density, minimum setbacks, access road width, and parking requirements. While the building bye-laws define the standards for structural safety, provision of services, fire safety norms, habitable room sizes, etc. However, unplanned development or unauthorized development does not come under the jurisdiction of either of the above. Similarly, the core area of the city is also excluded from the jurisdiction of provisions under the building regulations. Considering that almost 60% of the population in Indian cities is residing in or near the city core, the vulnerability quotient they face is significantly higher. As has been discussed not enough attention is given to the metropolitan planning approach that the URDPFI Guidelines also discuss.

A city can become resilient if its people are healthy and have access to basic services; if its people are safe, socially cohesive with reliable employment supporting a vulnerable economy; if the city's ecosystem, infrastructure and services are well balanced and if city leadership and local communities work together in driving integrated planning (WEF, 2015) – several of these traits were the drivers behind Dharavi's COVID-19 response. In the resilience literature, these are termed as the four dimensions of the City Resilience Framework (CRF) as seen in the figure (ARUP and Rockefeller Foundation, 2015):

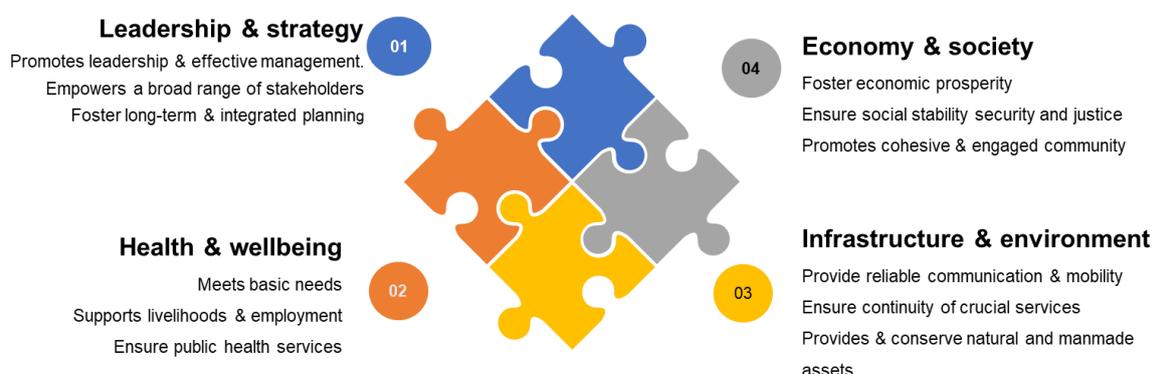


Figure 10: City resilience framework<sup>9</sup>

### 3.2 Suggested areas to be covered in URDPFI Guidelines and Model Building Bye-Laws

The URDPFI Guidelines and the Model Building Bye-Laws provide extensive guidance on planned urban development but, there are some gaps that impact resilient planning. These gaps are at the theoretical level and at the level of design standards.

#### a) Gaps at the Process Level

- i. **Need for mainstreaming resilience in urban planning framework:** MoHUA through its various Urban Missions and extensive guidelines provide clear mandates. However, the current policy framework and approach to urban planning does not adequately address the concept of sustainability and resilience. For instance, the *URDPFI guidelines on sustainable development give an overview of concepts of sustainable development and introduce various regulations for sustainable and resilient development. However, there is no guidance on how they are to be incorporated and mainstreamed for sustainable planning* – this is impacting the use of the recommendations and results on the ground.
- ii. **Need for a comprehensive approach to planning:** Urban planning in India is piecemeal, project-based, sectoral/infrastructure driven as against following a comprehensive structure. Further, the multiplicity of departments and agencies involved worsens impacts on the ground. *Ground-level impacts of planning show various shortcomings* because of the absence of a strategic approach to planning especially on natural resources and topography.
- iii. **Need for a dynamic planning and management approach:** Master Plans are made with a 20-year horizon and focus on land use compared to the Metropolitan Plan that has a 40-year horizon. The rapid urbanization has placed the need for

<sup>9</sup> Source: ARUP & Rockefeller Foundation, 2015

---

metropolitan planning at the centre of the debate. While cities are ever-evolving with changing requirements of physical and social infrastructure that the Master Plan is unable to keep up with, a structured metropolitan plan can contribute significantly to managing the spread of the urbanization and its associated chaos if done well. Updating plans rarely happens because of the difficulties in data collection and the time involved. Technology offers real-time solutions that should be used more often at the local level to address impending problems and resolve identified ones.

- iv. **Weaknesses in Institutional capacity:** Lack of technical expertise and institutional capacities of ULBs is a key constraint. ULB laws are outdated and focus on the provision of basic services with limited manpower and inadequate skills. The constant firefighting approach to city governance leaves little scope for strategic thinking and preparedness to face challenges. The Government of India has invested extensively in capacity building, but these have not had the desired impact.
  - v. **Need to decongest by regulating the working population:** The current approach of Master Plans to avoid overcrowding is to regulate the living density by regulating permissible built-up area in a neighborhood. However, over the past many decades it has been observed that regulating living density is not feasible. Economic opportunities induce residents more than the planned residential density thus leading to overcrowding and unauthorized development. In the current planning framework, there is no mechanism to relate economic opportunities and residential density while preparing the Master Plan. However, the URDPFI guidelines suggest the provision of mixed land uses, which are at a very conceptual level and do not provide enough clarity for cities to utilize this tool for a more balanced approach.
- b) Gap in planning and implementation of Sustainable Infrastructure:**
- i. **Gap in Approach towards planning and designing of Urban Infrastructure:** In an ideal scenario the Master Plan of a city shall identify the requirement of city infrastructure based on land suitability analysis and population projection. However, there is often a mismatch from what is required. Due to limited time, data and technical capacity, land suitability is often a futile exercise. This is one of the reasons that every government-funded infrastructure programme, be it JnNURM or AMRUT conduct a separate analysis of infrastructure requirement which does not match the provisions under the Master Plan. Another reason for unrealistic planning is the use of conventional tools, often resulting in inefficient distribution and optimization of resources. Technology plays a vital role in identifying solutions that can help solve these problems. Technologies including simulations, 3D modeling, UAV and drone mapping, remote sensing data, and GIS are useful in planning and efficient management of infrastructure. The Smart City Mission cities have demonstrated examples of using their Integrated Command and Control centres for real-time data generation and monitoring in these pandemic times. Similar examples are seen in European cities that have used simulation maps to predict the spread of COVID and emergent hot spots (London).

- 
- ii. **Need to emphasize the metropolitan structural planning approach in URDPFI and MBBL:** This approach emphasizes the importance and the interplay between environment (as the key driver) on which transport, housing, social facilities and productive activities are overlaid. Each of the thematic areas has sub-sectors that are discussed later in the report. If the metropolitan plan is at the core of all urban planning in a region, resilience and sustainability are automatically embedded. However, in the current governance framework in India, these plans are not effective because of the many governments and institutions involved. Planning Departments, therefore, take the relatively easier route of focusing on the Master Plan scale downwards. The metropolitan plan emphasizes Green Infrastructure (GI) that is defined as infrastructure that ‘protecting and enhancing nature and natural processes which are consciously integrated into spatial planning and territorial development’. The URDPFI and MBBL do mention about sustainable development but hardly cover the features of GI. For example, a typical road cross section suggested in URDPFI defines the pedestrian pathway, cycle track, car lane, etc. but it does not suggest the scale and type of plantation required along these cross-sections. Similarly, there is a need to relook the design guidelines, material specifications, and water conservation policies while considering the provision of GI to a maximum extent at the operational scale. The emphasis on the metropolitan plan should be at the core.
- iii. **Gap in infrastructure financing:** Urban Local Bodies (ULBs) in India are weak in terms of capacity to raise resources and financial autonomy. Hence, they are heavily dependent on the central, state government, or bilateral funding for infrastructure. Raising funds by ULBs is a focus in the Government of India that has developed guidelines for ‘Value Capture Funding’ however, given the overall weak status of ULBs, it is highly unlikely that the majority of cities will be able to capitalize on this tool. Similarly, PPP for infrastructure development has long been discussed as a likely approach but, there are very few examples of successful municipal PPPs in India that are at scale. The Government of India has encouraged ULBs to float bonds to raise funds from the market but, except for Ahmedabad and Bangalore in the past and more recently, Pune, others are very low down the scale of being considered creditworthy. Considering the capital cost of resilient infrastructure is higher than conventional infrastructure, it is likely that there needs to be some more guidance and innovative financial tools to raise revenues for this.
- c) **Gap in the regulation of the built environment:** The built environment within a city depends on three critical components, legal and administrative framework, development and management, and Implementation. While the MBBL provides sufficient guidance for developing the legal framework to regulate built environment; in some cases, the appropriate legal and legislative foundations may be lacking or may not be working in sync with the zoning, building, and fire regulations needed to provide the necessary baseline for public safety and disaster resilience. In some cases, the one size fits all strategy of building regulations are not viable for cities with different characteristics falling under the same legislation. For example, the core area of any city cannot be covered under

---

the normal building regulations applicable for development after the commencement of the legislation.

The model building bye-laws are limited to earthquakes, but not to other hazards such as cyclones, drought, and floods, which in many cities are bigger risks – a multi-hazard approach is lacking.

To achieve a resilient built environment and to ensure occupant safety, revision of the minimum design, construction, and maintenance standards is needed with a focus on:

- Building safety regulations while considering disasters other than earthquake, including urban flooding, drought, cyclone, and even a pandemic.
- Incomplete sharing of liabilities across design professionals, contractors, operators.
- Assessment of adverse environmental impacts from activities like wastage of water, unsustainable disposal of wastewater, heat island effect etc.

Lastly, the option of property insurance shall be explored as a requirement to ensure the safety of the building. The initiative can make the market self-responsive towards a resilient built environment.

### **3.3 Possible improvements in norms for disaster management**

Although disaster management is governed by other legislation, it has a link with the overall urban planning process. The problems of unregulated growth, illegal construction, and poor building stock make the urban areas increasingly vulnerable to natural hazards. The five-year plans of the GoI also emphasize that development cannot be sustainable without mitigation being built into the planning process.

The disaster management plan and policy have many strengths, but some of the gaps that have been identified are as follows.

- a) Both the National Disaster Management Act 2005 and the National Disaster Management Policy 2009 focus on the comprehensive risk reduction approach. The legal frameworks and funding are limited to rescue and response and not risk reduction and preparedness. The Act does not take into consideration measures for pre-disaster mitigation and preparedness which are essential for achieving resilient development.
- b) The responsibility of the local authorities is a bit unclear. The local authorities do not generally perceive disaster mitigation as their responsibility. This is mainly because of the incapacity of the local authorities to undertake these tasks.

The State Disaster Management Plans (SDMPs) prepared by few states in India do not cover the use of hazard mapping for land use plans, alternative land use plans, urban mapping of infrastructure in core areas, or using digital analysis or tools. The reason may be attributed to the lack of data available with the states/cities on hazards, risks, and unclear strategies to mainstream disaster risk reduction into development planning.

## CHAPTER 4: INTERNATIONAL AND INDIAN CASE STUDIES

Cities are considered the engines of growth and development (Keivani, 2010). As the world continues to urbanize, the successful management of the cities and urban areas is strongly intertwined with resilience and sustainable development. With the urban population projected to reach 9.7 billion in 2050 i.e. about two-thirds of the population living in urban areas<sup>10</sup>, it is important to ensure that the cities and urban areas focus on resilient interventions. The New Urban Agenda 2030 is an important step forward and recognizes the importance of resilient development through its goals and related targets. Thus, the resilience parameters identified in this study *to create mixed-use development, land suitability analysis, integration of green infrastructure solutions, properly designed density, high-quality streets and public spaces, better connectivity are critical for building the city's resilience* are core to the study of the URDPFI Guidelines and the Model Municipal Bye-Laws.

Cities around the globe present examples that India can learn from and, Europe which is one of the most urbanized regions in the world, with 73% of its population living in cities and towns, offers many examples worth studying and adapting. The case studies provide an insight into the implementation of the resilience parameters that this Technical Study is examining; describe briefly the achievement of such integration. For example, the potential of green infrastructure solutions to flood-proof cities, mitigate the heat island effect, create green spaces, stormwater run-off, energy-efficient buildings, etc. are critical to achieving resilience. The land suitability analysis and the use of the latest tools and technology support informed decision-making in planning and design. The intent here is to showcase some tangible examples from the cities of Copenhagen, Stockholm, Lisbon, and Barcelona that have demonstrated mainstreaming resilience in their planning.

### 4.1 Copenhagen

#### COPENHAGEN

is the capital and largest city of Denmark with a city population of 794,128 and a metropolitan population of 2,057,142. The city aims to become carbon neutral by 2025 and has initiated multiple interventions for the incorporation of resilience in its planning and growth. *As an Urban Planning feature, the 'Finger Plan' has been adopted as the national planning directive in 2007 to avoid urban sprawl and overcrowding.* Urbanization is directed away from the inner city and along the fingers separated by green wedges. The strict enforcement of conservation and zoning laws provided legal support for the Finger Plan. The aim for “dense mixed development with transit nodes” and a “well-distributed network of urban parks” rested on two rigid principles - **the station proximity principle that** allowed for new housing, businesses, and public services to be erected only close to train stations and **the green wedge principle that** worked to preserve the green spaces between these urban settlements. The Finger Plan has emphasized mixed-use development backed with quality infrastructure and a strong public transport system. The plan explicitly focused on the



Integrated Urban  
Planning

<sup>10</sup> United Nations, World Urbanization Prospects: The 2018 Revision

---

integration of land use planning and transport systems thereby promoting high-quality urban spaces through good transport links and proximity to recreational green spaces. It focusses on decentralization, framework control, and public participation. The emphasis on creating parks and recreational spaces at the neighbourhood level is being implemented with residents living within 15 minutes walking distance of a public park and green spaces established throughout the city.

The Danish capital also promotes the use of Green Infrastructure (GI) solutions over the conventional ones. The solutions of rainwater re-use, green roof, permeable pavements, green roads and the parks acting as retention areas emphasize the use of GI solutions. The city council adopted the management plan in 2012 for preparing 300 projects over the next 20 years that would increase the city's blue and green infrastructure<sup>11</sup>. GI helps in mitigating the effects of flooding risks and provides opportunities for recreational spaces which contributes to a high quality of life for residents. Copenhagen has also proved that large-scale grey infrastructure renovations are not always the best response to climate change. Instead, faced with increasing rates of flooding, the Danish capital created the world's first climate-resilient district - Østerbro Climate Quarter - by implementing green infrastructure<sup>12</sup>. It is estimated that 30% of rainwater will be managed through GI, instead of ending up in the sewer system and the cityscape will become climate-resilient with natural urban infrastructure.



Copenhagen has demonstrated coping strategies for the infrastructure systems that were not originally designed to deal with these issues. In an attempt to avoid floods caused by cloudbursts, one of Copenhagen's streets, Helenevej, has been transformed into a climate street with infiltration of rainwater. Asphalt has been replaced with tiles to allow rainwater to seep through the surface to groundwater aquifers. The tiles and the joints are designed to infiltrate the maximum amount of water. There is a reservoir consisting of 40cm of gravel beneath the tiles that retain the water in extreme rainfall instances and the road has proved its abilities without problems during a cloudburst.

The capital city has also demonstrated smart initiatives for water savings in the apartments through several initiatives like the installation of individual water meters, price mechanisms, awareness campaigns, etc. It has been found that after switching from a collective water bill shared by apartment buildings to individual water meters, water consumption fell by about 26%.

---

<sup>11</sup> <https://issuu.com/sustainia/docs/cities100>

<sup>12</sup> [https://www.c40.org/case\\_studies](https://www.c40.org/case_studies)



Figure 11: Urban resilience using GI for managing flood risk in Copenhagen<sup>13</sup>  
 Blue-green infrastructure: in fine weather a lawn, in heavy rain a stormwater course.



Figure 12: Green Infrastructure solutions as part of the street design in Copenhagen

<sup>13</sup> <https://www.researchgate.net>; [www.ramboll.com](http://www.ramboll.com)

## 4.2 Stockholm

**STOCKHOLM**, the capital of Scandinavia is Europe’s most attractive city region.

The city has registered a high population growth over the last decade and it is estimated that by 2040, the population will be 1.3 million<sup>14</sup>. To accommodate this growth and demand for infrastructure and service delivery Stockholm adopted Vision 2040 “a world-class Stockholm”, in January 2017. The city has been working on sustainable urban development and in 2010, was awarded the European Green Capital Award for maintaining its sustainable urban development.



Figure 13: Location of the city: Stockholm

The long-term vision for the city’s resilient development and sustainable growth is oriented towards four main goals: (i) A cohesive city (ii) A climate-smart and resilient city (iii) Good public spaces (iv) A growing city. To meet the goals of the Vision 2040, the city launched the ‘Stockholm City Plan’ which focusses on the resilience parameters and sets out main directions for urban planning.

Key resilience parameters	How the city has incorporated in the Vision
Mixed-use functions	Vibrant, mixed-use city with multi-functional spaces
Flourishing green infrastructure	Let nature do the work: Green rooftops, energy generating facilities in buildings, urban parks as retention areas, streets as permeable surfaces. (Treatment of wastewater and integration with green strips to create recreational zones)
Regeneration of inner areas	Redevelopment of abandoned inner-city areas with a focus on accessibility and walkability
Unique digital infrastructure	Smart ICT initiatives for providing online services for citizens and publicly accessible data on spatial planning
Urban Governance: participation and consultation	Engagement of various stakeholders in planning and implementation as a major contributor to resilient planning

Stockholm’s City Plan sets forth the strategies for infill development and revitalization to better utilize the existing urban landscape and preserve the natural elements of the city. The strategies to create mixed-use urban development with homes as well as workplaces with people living close to the locations, they need to use day to day such as schools, leisure activities, and facilities. This densification strategy also recognized the importance of green spaces within the city, and no resident lives farther than a 5-10-minute walk from a 12-acre

<sup>14</sup> City Planning Administration, Stockholm City Plan- 2018

---

park. An example of this new infill strategy can be seen in the redevelopment of Hammarby Sjostad (Sea City). This is the first redevelopment area in inner Stockholm. The site was originally industrial but had become vacant and run down.

Another remarkable example of brownfield to resilient development is the Stockholm Royal Seaport (SRS), an abandoned industrial area in the inner city. In this area, 17 hectares of contaminated land was redeveloped and reused. A total of over 12,000 homes and 35,000 new jobs are planned in SRS by the end of 2030<sup>15</sup> making it one of the largest urban developments in Europe. The SRS project involves multiple aspects of resilience including mixed-functions, energy-efficient housing, flourishing green infrastructure, green roofs, proximity to and availability of recreational spaces, walking, and pedestrian-oriented infrastructure, restrictions on private cars, and parking per household with more than 70% of work-related trips using public transport.



Figure 14: Stockholm Royal Seaport (SRS)

Stockholm has adopted an innovative tool known as 'Green Area Factor' (GAF) to increase the quantity and quality of the urban landscape by maintaining the current land use. The GAF expresses the ratio of ecologically effective surface area to the total land area. In this calculation, the particular parts of the land (a plot or block) are weighted according to their "ecological value". It is a scoring system to promote attractive and ecologically functional landscapes, including ecosystem elements such as green roofs and walls, permeable paving, tree preservation, etc.

In an initiative by the European Union (EU) INSPIRE Directive to create a new EU-wide spatial data infrastructure, the city is working actively to provide open data through the portal 'Open Stockholm'. It provides about 100 open data sources<sup>16</sup> for spatial planning including land use, environment, transport, buildings, lakes, and streams, etc. This enables the sharing of information among the public, and organizations. The city offers a unique digital infrastructure, data storage information exchange, analysis in areas such as education, health care services, etc. to lead towards the smart and connected city. The city also delivers many municipal online services that residents and companies can use. Some of the online services include building permit approval, route planning through mobile phones, planning bike trips to find the safest and shortest bike route, applying for elementary school. The use of digitalization and new technology to simplify and improve life for its residents helps in

---

<sup>15</sup> City Planning Administration, Stockholm City Plan- 2018

<sup>16</sup> <https://international.stockholm.se/governance/smart-and-connected-city/open-data>

---

achieving the city's vision to reach the goal of becoming the world's smart and resilient city by 2040.

#### Online Services provided by the city

- **Building permit approval:** The City Planning Administration deals with around 9,000 planning issues a year. The e-service informs people on how to apply for a building permit and track the application through the process.
- **Route planning:** 6,000 visually impaired people will have personal freedom and security with this mobile route-planning tool.
- **Planning bike trip:** About 70,000 people cross Stockholm travel by bike every day. This e-service allows the users to find the safest and shortest bike route from one location to another, in and outside the city.
- **Applying for elderly care:** Approximately 6,000 people apply for elderly care each year. This service makes the application process convenient.
- **Applying for elementary school:** The processing time with this online service is expected to be cut by half, from nine months to four.

*“No matter where you live in Stockholm, you’re no more than a half-mile from a park of at least 12 acres, designed with safe and convenient access.”*

### 4.3 Lisbon

**LISBON**, the capital city of Portugal has a population of 506,892 and the metropolitan area is much larger with a total population of 2,821,697 (data from 2011). Lisbon plays a crucial role not only in Portugal but also in Europe by virtue of it being the gateway to the markets in the southern hemisphere. Due to the process of suburbanization, uncontrolled urban development, and urban sprawl that began in the 1960s, the core city lost its population to suburban areas. This led the city to emphasize urban regeneration as a central future development objective with the **Master Plan as a strategic tool**. Lisbon's Master Plan approved in 2012, has been guiding the city's development with the focus on redevelopment, refurbishment, regeneration and distribution of green spaces. The rehabilitation and upgrading of the most central areas have been quite successful in its early stages. In this process, green infrastructure has been the priority for enhancing resilience through urban regeneration. The city parks show how planting street trees and making green areas can create synergies and improve existing grey infrastructure. These solutions helped the city in mitigating the effects of 'urban heat island', absorb stormwater runoff and integrate nature into the urban fabric and reconnect urban dwellers to nature both visually and physically.

Additionally, with the help of GIS-based overlay mapping and the use of digital technology, the Master Plan was elaborated to ascertain the suitability or unsuitability of regulated land use and effective land use. This analysis helped the city in deciding the ecological and agricultural corridors and connecting areas that are protected or to be protected. The suitability analysis as a resilience parameter played an important role in the city Master Plan.

As part of the smart ICT initiatives and to measure the city's resilience performance, the city implemented a web dashboard with a GIS approach, complementing the Resilience Action Plan. This platform allows Lisbon to make a diagnosis of the city: identification of its

partnerships and public involvement in daily activities, understanding of the society in terms of disaster risks, the messages communicated, the channels used, and the territories involved. It also identifies the strong and weak points of the strategy adopted and allows the municipality to centralize data, promote the reuse of these data, and reduce dependence. Further, the city has adopted smart ICT initiatives, especially in the water sector. The city adopted various measures and awareness programs, and smart initiatives like the online water management system called 'Aquamatrix'. With the result, the water losses caused by leaks, thefts, or metering inaccuracies in Lisbon are very low at only 7%, which makes it one of the leaders in the water sector.

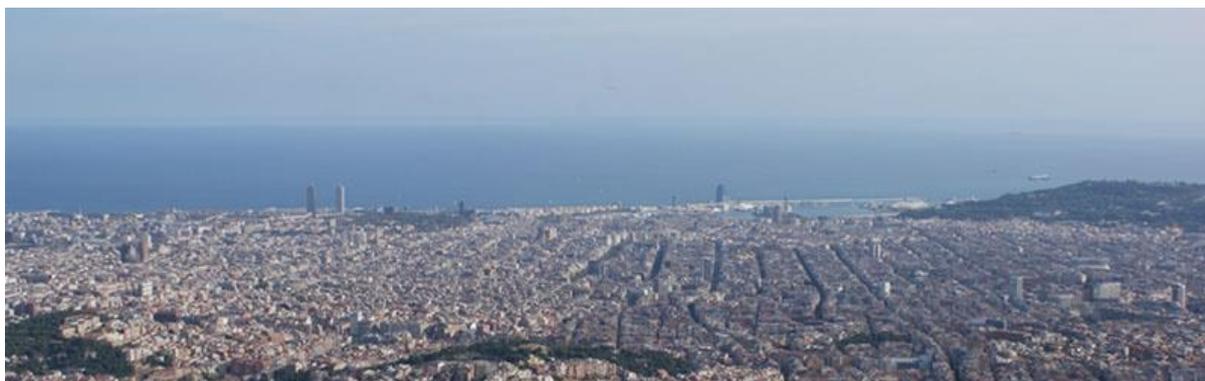


Figure 15: View of Barcelona city<sup>17</sup>

#### 4.4 Barcelona

**BARCELONA**, the capital of the Catalonia region and is the second-largest metropolis in Spain, Barcelona has a population of 5 million (as of 2017). With a highly dense population, Barcelona is the fifth most populous urban area in the European Union. The city has a dense and compact pattern resulting in challenges such as accommodating society's

increasing demand for green space. Congestion, pollution, and a lack of community spaces have become major impediments to people's aspirations and experiences of urban living. To address these challenges, the City Council of Barcelona implemented an innovative urban approach of "Superblocks"- new urban organizational units, with a size of around 400m x 400m. In these superblocks, planning interventions adopted included the regeneration of public spaces through the preparation of



Figure 16: Superblocks of Barcelona

micro-urban development plans, maintain the mixed-compact city development, and integrating planning with mobility. Superblocks are urban units based on objectives of sustainable mobility, enhanced urban green space, social cohesion and citizen participation. **The objective is to "reclaim more than half the streets that are now devoted to cars for mixed-use public spaces, or "superblocks."**

<sup>17</sup> Source: <https://oppla.eu/casestudy>;

Through the Superblocks program, Barcelona is redesigning the city's streets to limit traffic and increase the amount of green and recreational spaces available to citizens. The new programme changes traditional city blocks into clusters of "superblocks," where perimeter streets allow through traffic, but inner streets are reserved for pedestrians and cyclists.<sup>18</sup>

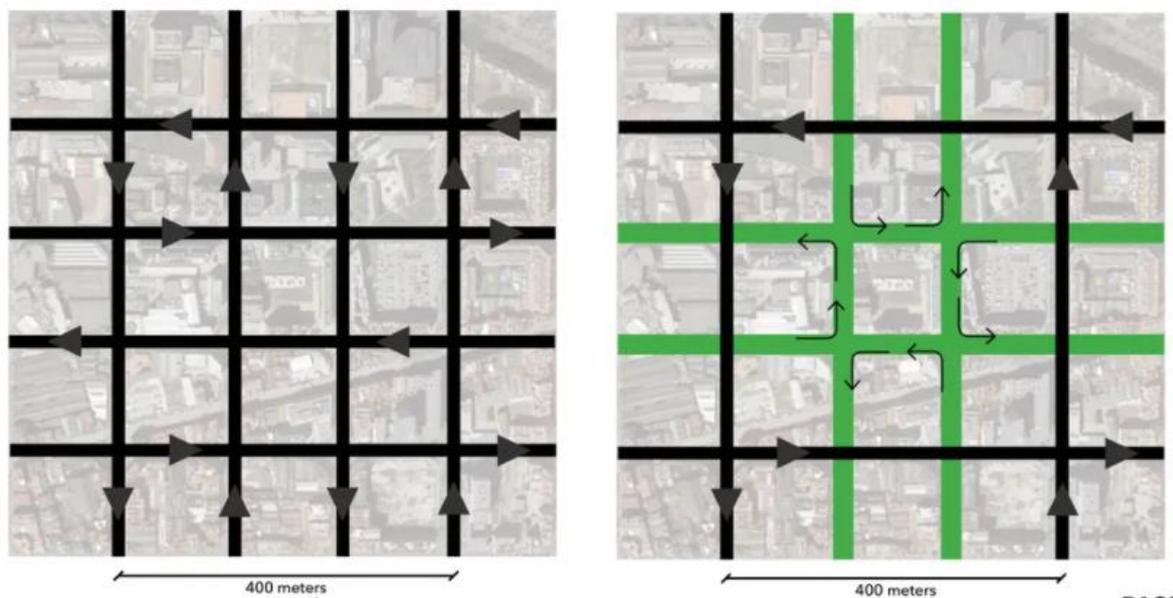


Figure 17: Current Block (left), Superblock (right)

Black routes allow public transport and cars at 50km/h, while green routes only allow private vehicles at 10km/h to prioritise pedestrians and cycling.

Due to its geographic location, the city is vulnerable to urban flooding, heavy stormwater events, and droughts. As this could have a considerable impact on the correct functioning of the city's urban services, the city council partnered with various institutions to implement the RESCCUE project. The focus of this project is developing innovative tools for building urban resilience to help informed decision making through resilience parameters of urban governance, use of tools, and technology (including GIS). The tools indicate the permeability of buildings to help determine the vulnerability of elements at risk and identify the most vulnerable areas through GIS maps. This also helps the city to estimate the economic impact of floods, as well as resilience assessment, planning and management. The tools and the results provided the necessary information to the City Council to update and enhance the Barcelona Climate Plan. Finally, the tool also helped in decision making by the city council through a set of prioritized adaptive resilience measures for the city. These datasets and GIS maps will be made publicly available on the resilience platform of the City Council.

<sup>18</sup> [https://www.c40cities.org/case\\_studies](https://www.c40cities.org/case_studies)

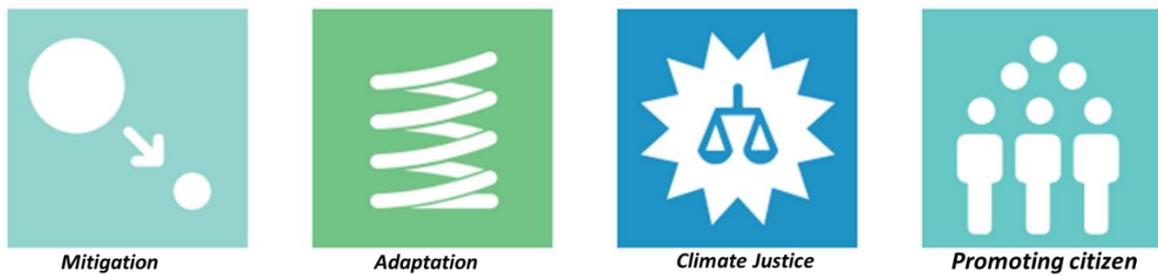


Figure 18: Strategies of Barcelona Plan

The city is also a pioneer in providing smart technology solutions to its citizens. The city is committed to gaining a reputation as a leader in sustainable urban development innovations. Barcelona was awarded the first ‘European Capital of Innovation Award’ by the European Commission for bringing the use of new technologies closer to the citizens. The City Council has implemented e-administration to make processes accessible, efficient, and transparent. Integrating the city’s fibre optic networks, implementing energy-efficient LED street lighting, bus transit system, smart infrastructure such as the hybrid bus network, smart water management, boosting the use of electric vehicles, parking sensor projects, etc. are some of the innovative solutions in the urban sector.

Another critical resilient parameter that the city is working towards is the promotion of green growth as part of the green infrastructure solutions. The city council promotes the conversion of roofs, decks, and courtyards in existing and newly-constructed buildings into living and green roofs. They increase the green and biodiversity, contribute to reducing energy demand and promoting energy production systems with natural resources to contribute to the adaptation of buildings and cities to climate change, thus increasing the resilience of the city. The city council provides financial assistance and technical support for rehabilitation, revision of current regulations, materials on roofs and terraces. This also helps in mitigating the issues of urban heat effects of the city.

Barcelona has also proposed urban drainage management as a strategy to increase soil permeability. To find the present impermeability, the city’s subsoil base map can be developed through which reserve spaces for infiltration will be created. Recharging pools can be developed at high points of the city which generate flow retention and lamination effect. Rainwater capture systems can be utilized for restoration, saline intrusion can be prevented by using regenerated water and surplus groundwater.

Barcelona is also committed to guaranteeing the efficient use of energy and promoting the use of renewable energies. Since 2000, the Solar Bye-law has been applicable in the city, making the installation of solar heating panels compulsory in new and renovated buildings.

In the **Netherlands**, it is mandatory to provide decentralized retention and collection of rainwater, through green roofs or collected from buildings and traffic areas. Only surplus water, which can neither be retained, infiltrated nor stored, may be discharged from polders to rivers or canals. All new urban developments in the Dutch lowlands require the compulsory construction and integration of open surface water bodies, which should be 5-10% of the land area of new development.

In 2007 the government launched a “Room for the River” programme. The programme was designed so that rivers could accommodate higher water levels that would contribute to the

restoration of natural flood plains in places where it is least harmful to protect those areas that need to be defended. The programme covers the restoration of marshy riverine landscapes as natural water storage sponges, to safeguard biodiversity, and to be used for recreation. The city of **Rotterdam** has transformed existing open/vacant spaces such as city parks, playgrounds, and post-industrial zones into water-prudent landscapes using green interventions. These spaces integrate nature into the urban fabric increasing biodiversity and reconnect urban dwellers to nature both visually and physically. Benthenheim Water Square as shown in the figure below is an example of an integrated multi-use blue-green-grey solution, a conventional play and sports areas with a permeable surface that doubles as an unconventional stormwater catch basin <sup>19</sup>



Figure 19: Benthenheim Water Square in Rotterdam

<sup>19</sup> <https://wricitiesindia.org/content/living-water-integrating-blue-green-and-grey-infrastructure-manage-urban-floods>

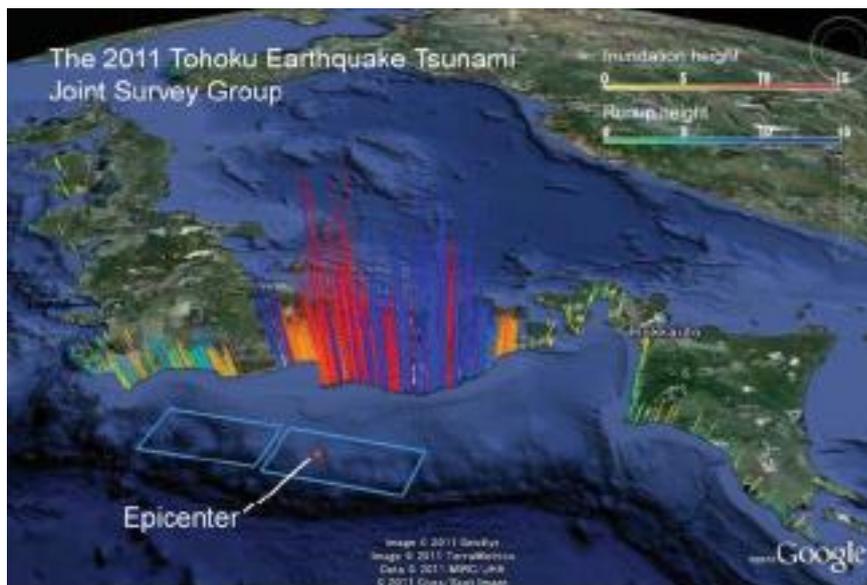
## 4.5 Summary of European Case Studies

CITY AND ITS KEY FEATURES	PLANNING INTERVENTIONS	REPLICABILITY IN THE INDIAN CONTEXT
<p><b>COPENHAGEN</b></p> <ul style="list-style-type: none"> <li>• Strong urban and cultural development, facilitated by investment in its institutions and infrastructure.</li> <li>• Retrofitting of buildings.</li> <li>• The 'Finger Plan' has been adopted as the national planning directive for urban planning to avoid urban sprawl and overcrowding.</li> <li>• Created the world's first climate-resilient district by implementing green infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>• Emphasis for Pocket parks and green roofs, within 15 minutes walking distance.</li> <li>• Promotion of GI solutions over the conventional ones: retrofitting of buildings, water savings, green streets, rainwater reuse system and green rooftops, integration of green and blue.</li> <li>• Focus on dense mixed development with transit nodes and a well-distributed network of urban parks.</li> </ul>	<ul style="list-style-type: none"> <li>• Compact cities with adequate public spaces, infrastructure provisioning and public transport options can be replicated for city development.</li> <li>• Emphasis on creating parks and recreational spaces at the neighbourhood level.</li> <li>• Legal support and strict enforcement of the master plan and development/zoning regulations in the cities.</li> <li>• Disaster and climate-resilient adaptation techniques to be incorporated into the planning framework.</li> <li>• GI solutions to be considered in new and retrofitted development. The use of these solutions can be incentivized by the ULBs.</li> </ul>
<p><b>STOCKHOLM</b></p> <ul style="list-style-type: none"> <li>• 'Stockholm City Plan' which provides clear guidance regarding the city's intentions and sets out main directions for urban development with a time horizon of 2040.</li> <li>• Unique digital infrastructure, GIS and mapping tools.</li> <li>• Green Infrastructure principles integrated with city planning.</li> <li>• Emphasizes connecting the green spaces for recreation and to promote biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>• The resilient strategies (climate-smart and resilient city, good public spaces, growing city) are incorporated in the plan for effective enforcement. Key elements include mixed-use city, GI facilities and solutions, participation, and consultation.</li> <li>• Scientific approach and the latest technology, layout plan to highlight the accessibility of essential services.</li> <li>• Parks designed with safe and convenient access.</li> <li>• Transport and mobility city planning to be strengthened through increasing accessibility by creating high density and good transport options.</li> </ul>	<ul style="list-style-type: none"> <li>• Creating high-density urban neighbourhoods to prevent urban sprawl and promote infill development in inner-city and suburban areas. Expansion strategy of the Stockholm City Plan can be adapted to focus on core city areas and develop mixed land use with efficient modes of transport.</li> <li>• The core and dense areas can be given a special focus in the planning process in terms of development regulations and plan approval.</li> <li>• Use of GIS and mapping technologies for preparing urban development maps.</li> <li>• For improving the city's resilience smart green solutions (urban ecosystem</li> </ul>

CITY AND ITS KEY FEATURES	PLANNING INTERVENTIONS	REPLICABILITY IN THE INDIAN CONTEXT
		<p>services) can be built into new and regenerated urban environments.</p> <ul style="list-style-type: none"> <li>City's planning goals by setting out targets, investments, and available planning resources.</li> </ul>
<p><b>LISBON</b></p> <ul style="list-style-type: none"> <li>Master Plan as a strategic tool.</li> <li>Sendai Framework approach to evaluate risk and measure resilience.</li> <li>Climate adaptation strategy by making use of urban green infrastructure.</li> <li>Smart Technology-driven planning approach and management.</li> </ul>	<ul style="list-style-type: none"> <li>Successful implementation of the Master Plan as a strategic tool for development</li> <li>Use of ICT and GIS in mapping, planning activities maintenance of web dashboard and database of the city. Smart technology and GI solutions as a tool for adaptation strategy.</li> <li>Revival of the old core areas and redevelopment to control urban sprawl.</li> </ul>	<ul style="list-style-type: none"> <li>Strict implementation of the Master Plan; redevelopment, refurbishment, and regeneration options can be suggested for the revival of core areas and potential areas of the city.</li> <li>Cities to undergo self-assessment which is similar to India's Liveability Index to identify the gaps and focus on priority areas.</li> <li>ICT and GIS technology for land suitability analysis (mapping flood-prone areas) and designing infrastructure.</li> </ul>
<p><b>BARCELONA</b></p> <ul style="list-style-type: none"> <li>Smart technology</li> <li>Superblock programme: 400mx400m urban blocks by keeping car traffic on the outskirts of each block and giving streets to the residents.</li> <li>Creation of urban green networks</li> <li>Comprehensive coastline management plan to manage water bodies</li> <li>Drainage system and establishing conservation measures</li> </ul>	<ul style="list-style-type: none"> <li>Use of Smart technology: Street light: LED-based lighting system, Waste disposal: use of smart bins, Public Bicycle Sharing, Bus Transit System, Noise Sensors and Fab Lab.</li> <li>Strengthening of Transport and mobility planning through increasing accessibility by creating high density and good transport options.</li> <li>Green city principles can be integrated with city planning</li> <li>Developing the city's resilience through climate adaptation strategies to cope up with future climate change</li> <li>Superblocks: This urban development creates a peaceful, more spacious inner area, ideal for cycling and walking, and encourages social cohesion and economic development.</li> </ul>	<ul style="list-style-type: none"> <li>Focus on e-governance and smart technology.</li> <li>Technological innovation can help local governments address the challenges of urban governance, improve the urban environment, increase their competitive edge, and cope with environmental risks.</li> <li>Pedestrians and cycling lanes, public spaces to be prioritized in resilient city planning to an environmentally healthy and social city.</li> <li>Promotion by the city councils/ULBs in implementing the energy-efficient measures through bye-laws in new and retrofitted buildings.</li> <li>Local governments as the first line of response in a crisis.</li> </ul>

## 4.6 Case Studies from Asia

**Japan:** In March 2011, an earthquake of magnitude 9.0 occurred in the Pacific Ocean off the coast of Japan's Tohoku region lasting for several minutes. This was followed by a tsunami of *unprecedented* force over the 650km coastline toppling sea walls and other defenses, flooding more than 500 sq.km. of land and washing away entire towns and villages.



The Great East Japan Earthquake (GEJE) was the first disaster ever recorded that included an earthquake, a tsunami, a nuclear power plant accident (Fukushima), a power supply failure, and a large-scale disruption of supply chains. This event was unprecedented and never seen before by Japan:

Source: The 2011 Tohoku Earthquake Tsunami Joint Survey Group <https://www.coastal.jp/tsunami2011/index.php>

1. It was a high impact event with a low-probability of occurrence
2. It was a highly complex phenomenon, the effects of which cascaded to sensitive facilities
3. Direct damage to major Japanese industries rocketed through supply chains around the world

In coping with the GEJE, Japan's advanced DRM system, built up during nearly 2000 years of coping with natural risks and hazards, proved its worth. The losses could have been much greater if the country's policies and practices had been less effective. The main elements of the DRM system are:

1. Investments in structural measures (such as reinforced buildings and seawalls), cutting edge risk assessments, early-warning systems, and hazard mapping – all supported by sophisticated technology for data collection, simulation, information and communication, and by scenario building to assess risks and to plan responses (such as evacuations) to hazards.
2. A culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and on schools and workplaces.
3. Stakeholder involvement, where the national and local government, communities, NGOs, and the private sector all know their role.
4. Effective legislation, regulation, and enforcement – for example, of building codes that have been kept current.

- 
5. The use of sophisticated instrumentation to underpin planning and assessment operations.

Other countries can protect themselves from major disasters by adopting and adapting some of the measures taken by Japan, and by understanding the strengths and weaknesses of Japan's response to the GEJE. The successes of Japan's DRM system, as well as the ways in which the system could be improved, are reflected in the lessons drawn from the GEJE. The response may be grouped as follows:

1. Structural measures – include construction standards and stability performance. There is need for continuous revision of building codes and structural standards for infrastructure. Critical facilities should be built in safe locations and secured by the most sophisticated disaster management plans. A multilayered approach to DRM is needed, employing both structural and nonstructural measures. Defensive infrastructure alone is not enough to cope with infrequent disasters of high impact. Nonstructural measures also need to be established, including early warning systems, rigorous planning and regulation, prompt evacuation of residents and a variety of institutional and financial measures – among them insurance, rehabilitation funds, and emergency teams.
2. Nonstructural measures – Japan's long history of coping with disasters has meant that there has been incremental improvements. Over the years the country's investments in disaster preparedness have been wide ranging, covering seismic and tsunami detection, early warning systems, multichannel systems for disseminating warnings, hazard mapping, evacuation planning (routes and shelters), regular disaster training and drills in schools and workplaces, and improved signage. Municipal governments have the main responsibility for disaster management, including formulating and implementing local disaster management plans based on the national plan, establishing community based organizations, distributing hazard maps to the public, raising public awareness, and developing evacuation procedures.
3. Emergency responses – specific interventions included prompt rehabilitation of infrastructure, governance in time of emergency i.e. the presence of dedicated agencies and highly skilled and experience staff; partnerships to facilitate emergency operations; evacuation centres and temporary housing (schools, community centres, hotels, temples). One of the problems identified in the operation of the emergency shelters was the lack of privacy and services for women and children – these were addressed but later; dealing with trauma through counselling; crowd-sourced information and the use of social media and FM radio for searches, rescues and fundraising
4. Reconstruction Planning – enactment of appropriate legislation; hastening recovery and reconstruction through cooperation between communities and local and national governments; debris and waste management; livelihood and job creation.
5. Hazard and risk information and decision making
6. Recovery and relocation – relocation and new regulations for land use in at risk areas in the wake of mega disasters but managing relocation projects and consulting with affected communities is challenging. A cross-sectoral approach is required to

rehabilitate people's daily lives. Organizations should harmonize recovery plans among all sectors concerned, such as roads, DRM, and urban planning.

## Singapore

The Blue-Green Infrastructure (BGI) is the network of green spaces that provides multiple water-related ecosystem services. Natural systems in the city used to be seen as either troublesome or merely decorative. The recent recognition of their importance to urbanism has brought increasing attention to the concept of green infrastructure. Singapore is among the most crowded cities of the world. In 2006, Singapore's national water agency, the Public Utilities Board (PUB), launched the Active, Beautiful, Clean (ABC) Waters Programme with an ambition to simultaneously improve the recreational value, physical appearance, and water quality of all waters in Singapore through 2030. It



*A typical channelized river in Singapore*



*A bio-retention swale near the Kallang River at Potong Pasir*

is a holistic water management programme, addressing both waterbodies and stormwater runoff in the catchment. The ABC Waters Programme exemplifies a shift from gray infrastructure to BGI in urban water management, showcasing a BGI building programme for a high density city.

In the past few decades, Singapore's surface water management – a responsibility of PUB – focused solely on efficient drainage for flood control and water collection for water supply. Except for the very few nature preserves, all rivers and streams in Singapore have been heavily channelized with several rivers dammed at the mouths to create reservoirs. Stormwater runoff is managed by a dense network of open and subsurface storm drains. The ABC programme emerged out of this backdrop of a highly utilitarian, tightly controlled, and aesthetically unappealing water network. Although Singapore's water network is part of the urban landscape, it is largely external to the everyday life of people. The ABC Waters Programme is to harness the full potential of the existing water network to enhance urban livability. It aspires to bring people closer to the water by seamlessly integrating the water

---

into the surrounding environment to create new community spaces and encourage lifestyle activities to flourish in and around the waters.

The two targets – water quality and urban livability – of the programme are addressed mainly by sustainable stormwater management and waterway enhancement.

**Stormwater runoff** is a major pollution in Singapore’s water network. Following the sustainable stormwater management practices in the West, e.g. low-impact development and sustainable urban drainage systems, and drawing particularly from Water Sensitive Urban Design in Australia, the ABC Programme deploys nature based solutions to enhance the



*A sedimentation basin in Clementi*

purification (sedimentation, filtration, and biological uptake), detention, retention and infiltration functions of terrestrial green spaces to manage stormwater runoff at source. Some of the specific interventions under the ABC Programme are vegetated swales, bio-retention swales, bio-retention basins (rain gardens), sedimentation basins, constructed wetlands, and cleansing biotopes. Floating wetlands and architectural elements (e.g. green roof and green walls) are also used in the ABC Waters Programme. To a lesser degree, the ABC Water Programme also addresses flood mitigation to cope with the increasing stormwater runoff at source, expanding the capacity of the rivers/canals and drains that convey stormwater (pathway), and strengthening flood protection where stormwater is collected and where it poses flood risk (receptor).

**Waterway enhancement** focuses on improving the aesthetics of and public access to Singapore’s rivers and canals. The most common measures include greening of the embankment and waterfront, adding amenities such as benches and look-out decks, building weirs to form a permanent pool and using gabions or other soil bio-engineering techniques to naturalize the embankment. One of the best interventions is the Bishan-Ang Mo Kio Park that now resembles a natural river corridor. The original straight channel has been transformed into a naturalized meandering river, integrated with surrounding terrestrial green space. This intervention allows the channel to spill onto the adjacent terrestrial green space that significantly enlarges the flood carrying capacity of the Kallang River.

As an urban water management programme, the ABC Waters Programme is unusual because it involves a master planning approach. This approach was to ensure that the projects are not ad hoc, and that each project would integrate with the surrounding landscape to be multifunctional and readily accessible. The selection of project sites was a process



*The Bishan-Ang Mo Kio Park, where the naturalized Kallang River is integrated with its surrounding terrestrial green space*

of suitability assessment based on multiple criteria. While land availability may be a constraint in other high density cities, Singapore has demonstrated that high density cities can still build BGI by optimizing existing green spaces and leveraging ecosystem services to gain public support.

#### 4.7 Examples from India of incorporating resilience

Experience from initiatives across the globe has shown that local innovation in planning and designing people-centric spaces, implementation mechanisms, promotion of social entrepreneurship and partnerships with the non-government sector; and use of technology for resilience planning and management at city level can go a long way in building cities and communities.<sup>20</sup>

In India, CITIIS (City Investments to Innovate, Integrate and Sustain) is an example of a challenge-driven infrastructure development programme being implemented by MoHUA with an aim to foster sustainable, innovative and participatory approaches to projects within the Smart Cities Mission. Supported by the French Development Agency (AFD) and the EU, 15 projects are part of a unique experimentation laboratory helping to highlight and address specific issues faced by cities across India in developing innovative and resilient approaches for urban renewal projects. The table below provides a list of other successful case examples of cities formulating and implementing resilient urban solutions in India<sup>21</sup>.

City - Initiative	Key Features
-------------------	--------------

<sup>20</sup> 100 RC, 2019

<sup>21</sup> Mainstreaming Urban Resilience – Lessons from Indian Cities; NIUA, TERI, 2020

<p><b>Pune – City Resilience Strategy</b></p> 	<ul style="list-style-type: none"> <li>• Office of Resilience headed by Chief Resilience Officer (CRO) and supported by Strategy and Platform partners for financial and technical inputs</li> <li>• The CRO oversaw developing a City Resilience Strategy</li> <li>• The Strategy illustrates 40 resilience building actions that can be implemented over 50 projects each of which has a resilience value that can help in prioritization</li> </ul>
<p><b>Chennai – Urban Horticulture</b></p> 	<ul style="list-style-type: none"> <li>• The Chennai CRO collaboration with the Tamil Nadu Horticulture Department and local NGOs are driving a horticulture project in Chennai to address food access and security for the urban poor, better waste management and urban heat</li> <li>• Through trainings by local NGOs on rooftop gardening techniques, communities across the city are able to grow nutritious food to increase health outcomes. Trainings also encourage communities to harvest rainwater and use drip irrigation to maximize water efficiency</li> <li>• Rooftop horticulture is also linked to waste management through segregation of waste and demand for compost, which benefits the city’s waste management agency</li> <li>• Rooftops with gardens have been shown to reduce roof surface temperatures and the city aims to scale this initiative to address heat stress in the city</li> </ul>
<p><b>Indore – Integrated Disease Surveillance Project</b></p> 	<ul style="list-style-type: none"> <li>• Intends to reduce human vulnerability by detectin early warning signals of disease outbreaks to ensure appropriate response</li> <li>• The real-time surveillance is meant to support public health workers in monitoring and responding effectively</li> <li>• Project required the analysis of the existing SOPs of public health surveillance organizations, developing a new and improved system, training medical practitioners and public health workers and integrating the system with other relevant services</li> </ul>
<p><b>Surat – End to End Early Warning System for Ukai and Local Floods</b></p> 	<ul style="list-style-type: none"> <li>• With the objective to reduce the damage caused by floods by reducing their intensity, the project reduces human vulnerability especially of the economically weaker sections by: <ul style="list-style-type: none"> <li>○ Installing weather systems and data transfer mechanisms from catchment to reservoir to city</li> <li>○ Developing weather and flow prediction models, and</li> <li>○ Improving existing flood preparedness</li> </ul> </li> <li>• The project is implemented by Surat Climate Change Trust</li> </ul>

**Gorakhpur – Urban community-based micro resilience model of ward exposed to climate and hydrometeorological risks**



- Impacts of climate change were experienced by certain wards where basic services like drinking water, sanitation, and solid waste were limited
- This was dealt with through decentralized planning and improvements in accountability
- Ward-level community institutions organized monthly meetings, prepared action plans on a monthly basis and monitored their implementation by municipal bodies

The World Summit on Sustainable Development in Johannesburg, 2002, highlighted the concept of integration of climate policy in planning. In 2008 Asian Cities Climate Change Resilience Network (ACCCRN) was launched by the Rockefeller Foundation. This was the first conscious step of mainstreaming resilient planning in Indian cities. The National Action Plan on Climate Change (NAPCC) and National Mission report on Sustainable Habitat are important guides for resilient urban development in India.

The Asian Cities Climate Change Resilience Network (ACCCRN) launched by the Rockefeller Foundation in 2008 aimed at developing resilience strategies, provide funding and action models in seven cities of India. ACCCRN has been working in Gorakhpur, Shimla, Guwahati, Bhubaneswar, Surat, Mysore and Indore. The objective was to develop and demonstrate effective processes and practices for addressing urban vulnerabilities using participatory approaches as well as implementing projects. The methodologies and processes for building resilience involved shared learning dialogues, vulnerability assessments, sector studies and pilot engagement projects and resilience planning and strategy. The study highlighted the following:

- Need for a strong policy and mandate at national and state level on resilience planning.
- Need and efficacy of integrating resilience planning with the urban planning process of the cities.
- Governance systems and institutional mechanisms to be designed, updated and channelled towards the goal of resilient cities.
- Capacity building and financial support at different stages.
- Facilitation of climate projection results and data management systems to be developed to inform decision making and subsequently develop resilience strategies.
- Awareness generation on a larger scale to harness support and engagement of the city level stakeholders and community in the process.

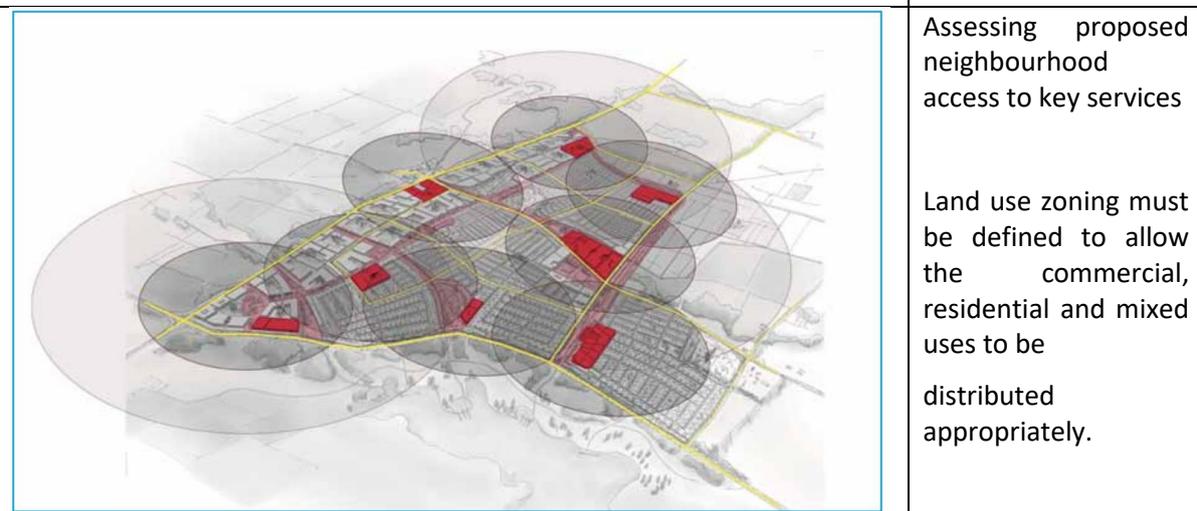
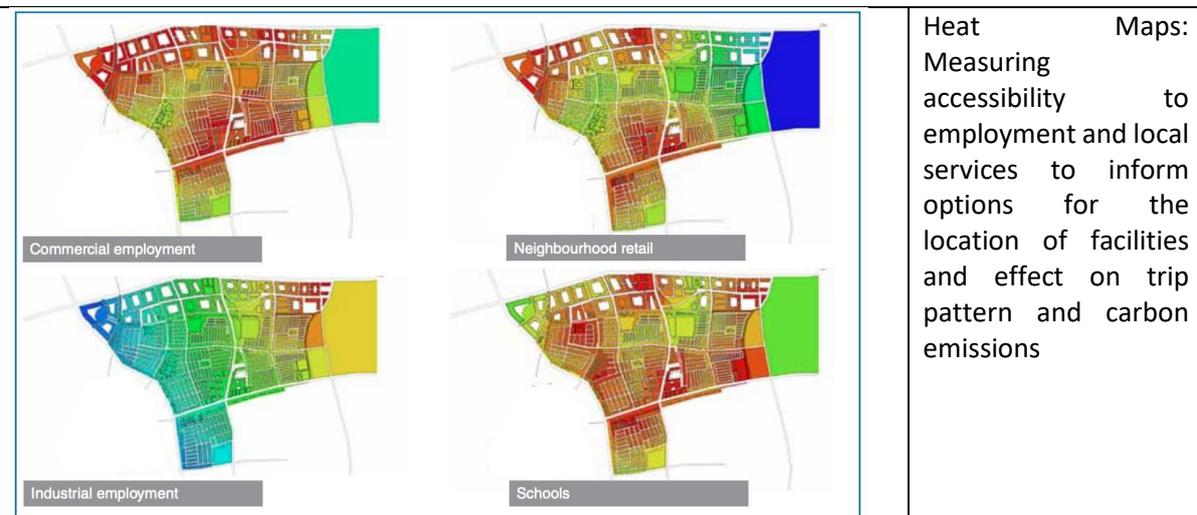
*Source: IIED, December 2013, Urban Climate Resilience: A review of the methodologies adopted under the ACCCRN initiative in Indian cities*

**Pune** was selected in 2016 to join the 100 Resilient Cities (100 RC) Network of the Rockefeller Foundation. Pune has investigated shocks/stresses and diagnosed the city on 12 resilience parameters based on which a resilience strategy with 3 pillars, 10 inter-related goals, and 28 actions to be implemented through more 40 projects was developed. One of the goals is to promote integrated development planning in Pune urban region. Under this goal, the various project envisaged are as follows:

Project	Success Indicators	Resilience Value
<ul style="list-style-type: none"> <li>Launch a multi-stakeholder Forum of Sustainability Planning to foster innovations</li> </ul>	<ul style="list-style-type: none"> <li>Participation of the key institutional stakeholders in the Forum</li> <li>Interaction of the Forum with diverse input providers on innovations in planning, and social, environmental and economic aspects</li> <li>Incubation of innovations</li> </ul>	<ul style="list-style-type: none"> <li>Promotes leadership and effective management for resilience planning</li> </ul>
<ul style="list-style-type: none"> <li>Prepare a strategic structure plan for the metropolitan region, integrating various Development Plans identifying resilience indicators at a strategic level</li> </ul>	<ul style="list-style-type: none"> <li>An integrated strategic plan is created</li> <li>Resilience enhancing elements are added to the strategic plan</li> <li>Resilience in the metropolitan region increases over time, captured against the identified resilience indicators</li> </ul>	<ul style="list-style-type: none"> <li>Avoids uncontrolled urban development</li> <li>Avoids infrastructure failure</li> <li>Fosters long-term &amp; integrated planning</li> </ul>
<ul style="list-style-type: none"> <li>Develop guidelines for implementation, enforcement and monitoring of Development Plans and their adoption in Pune</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of the Development Plan implementation guidelines</li> <li>% implementation of the Development Plan</li> <li>Enhanced transparency in processes of implementation and review</li> </ul>	<ul style="list-style-type: none"> <li>Avoids uncontrolled urban development</li> <li>Avoids infrastructure failure</li> <li>Increases transparency and accountability in development planning</li> </ul>
<ul style="list-style-type: none"> <li>Conduct pilots of LAPs and TOD in a range of typologies of density and land-use, with a participatory approach, including for rejuvenation and conservation of core city precincts</li> </ul>	<ul style="list-style-type: none"> <li>Improvement in access to public services as compared to the baseline created through the socio-economic survey by Gokhale Institute</li> </ul>	<ul style="list-style-type: none"> <li>Local Area Plans can promote integrated growth, with potential for locale-specific detail and effective and inclusive public participation</li> <li>Fosters long-term &amp; integrated planning</li> <li>Guards against infrastructure failure</li> </ul>

**Mysuru and Madurai** cities jointly prepared a Sourcebook, *'Integrated City Development Plan – A holistic approach to low carbon and resource-efficient future'*, with support from the British High Commission's Prosperity Fund. The cities considered six strands which include, Responsive, Green Infrastructure, Accessible and Healthy, Community Focus, Resource Efficient, and Delivery. Within these strands, the city has proposed restructuring of neighborhood plans to incorporate green corridors, established a hierarchy of local community facilities to improve access to employment and local service, and has considered factors to improve the built environment, such as the orientation of streets to maximize wind flow and minimize strong sun on either side of the buildings. This approach will result in improved quality of life of residents.

Figure 20: Neighbourhood accessibility planning, Community Focus, Ballahalli, Mysore



Source: *Planning and Design Handbook for Integrated City Development - A holistic approach to low carbon and resource-efficient future*, March 2013, British High Commission, New Delhi

Resilience is a priority in urban planning – the European and Indian examples described highlight how cities have incorporated/are experimenting with this in their planning. The New Urban Agenda 2030 and the Paris Declaration recognize the need for mainstreaming resilience and signatory countries are to report on the achievement of their commitments under these. In the face of rapid urbanization, unplanned development, disaster risks, climate

---

change, recurring and frequent urban floods across Indian cities it is important to assimilate and mainstream the resilience parameters in the Indian planning system. What is possible? What should be the focus in India with the current constraints of capacities and finances? These are discussed in the next chapter.

## CHAPTER 5: RECOMMENDATIONS

Cities have always faced risks, and many cities that have existed for centuries have demonstrated resilience in the face of a variety of hazards. In the 21<sup>st</sup> Century, global pressures that act at a city-scale – climate change, disease, pandemics, economic fluctuations and terrorism – pose new challenges. The scale of urban risk (at metropolitan and city level) is directly proportional to the number of people. Risk assessments and measures to reduce

---

specific foreseeable risks will continue to play an important role in urban planning. In addition, metropolises (first) and cities need to ensure that their development strategies and investment decisions enhance resilience.

Evidence from secondary literature has shown the different approaches to framing or assessing resilience. They focus either on urban assets or systems, and at varying degrees consider man-made infrastructure, the natural environment, urban management and human behaviour. Asset-based approaches focus on the physical assets and overlook the interactivensness with users and the environment. System-based approaches are better aligned with the concept of resilience and the fact that cities present a complex interplay of systems. There is empirical evidence that urban systems that exhibit particular qualities/characteristics are more likely to be resilient.

According to the City Resilience Framework (CRF)<sup>22</sup>, there are seven characteristics of resilience:

- **Reflective** – systems that are accepting of the inherent and increasing uncertainty and change in today’s world. They have mechanisms to continuously evolve and modify in the face of emerging evidence rather than seeking permanent solutions to maintain the status quo.
- **Robust** – systems that are well-conceived, constructed and managed i.e. physical assets that can withstand the impacts of hazard events without significant damage or loss of function.
- **Redundant** – refers to the creation of spare capacity in systems so that they can accommodate disruption, extreme pressures or surges in demand.
- **Flexible** – systems that can change, evolve, adapt in response to changing circumstances. This may favour decentralized and modular approaches to infrastructure or ecosystem management.
- **Resourceful** – people and institutions are able to rapidly find different ways to achieve their goals or meet their demands during a shock or under stress.
- **Inclusive** – emphasizes the need for broad consultation and engagement of communities, including the most vulnerable groups.
- **Integrated** – promotes consistency in decision making and ensures that all investments are mutually supportive to a common outcome. Integration is evident within and between resilient systems, and across different scales of their operation.

The URDPFI Guidelines and the Model Building Bye-Laws have been analyzed through this lens and some areas for consideration are being suggested. Perhaps one of the biggest issues facing the use of these very robust guidelines is the limited capacities of implementing agencies down the scale. Competing priorities in cities, limited fund availability and tortuous systems and processes dominate well-meaning governance. There are however some tools and techniques that allow a quicker turnaround time in acting of the various recommendations of these documents.

---

<sup>22</sup> ARUP and Rockefeller Foundation

## 5.1 Recommendations for URDPFI Guidelines

1. **Process of preparation of development plans:** The approach to Master Planning needs to be re-invented. While the Guidelines talk about the hierarchies of plans, the details of how they are to be approached is missing. To ensure that resilience is mainstreamed in planning, the start needs to be from the metropolitan scale. The understanding of this scale is fuzzy at best at operational and implementation levels and needs reiteration.

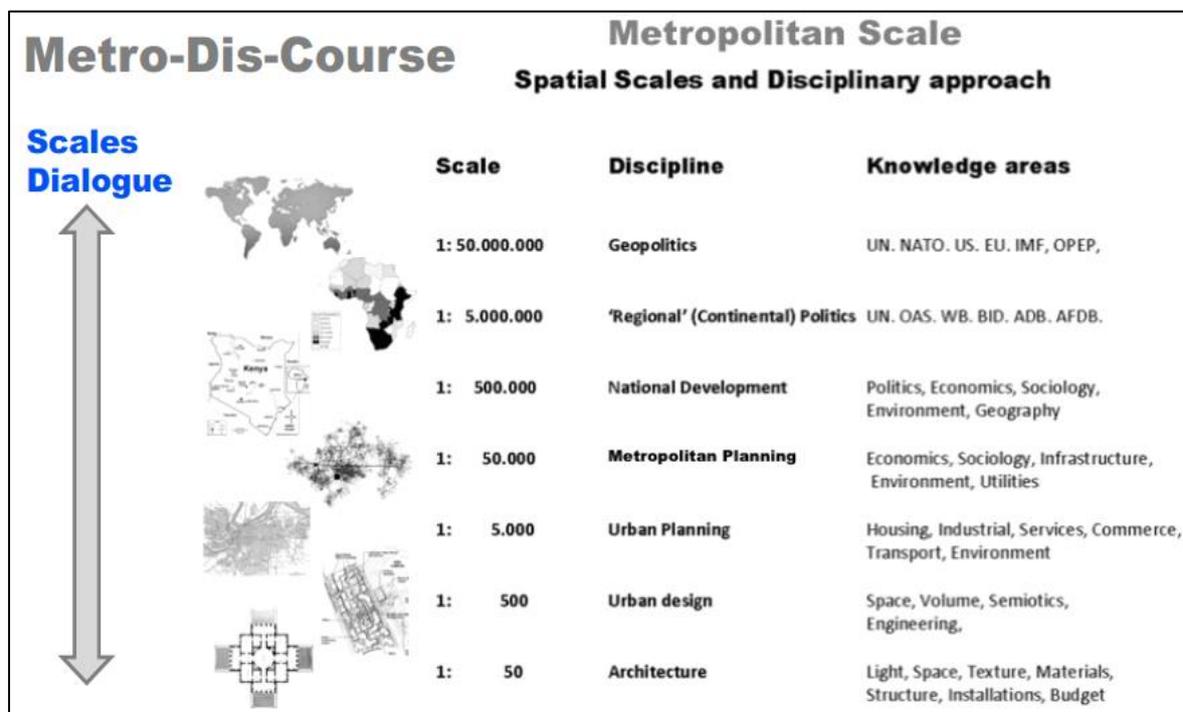


Figure 21: Metropolitan Scale. Source: [www.pedrobortiz.com](http://www.pedrobortiz.com)

As is seen in the above figure, the most appropriate approach to planning is the nested one with different uses and users requiring maps/plans at different scales. This approach ensures that planning considers critical parameters and delivers appropriate outcomes. This approach relies heavily on technology and modeling and visualization for informed decision making. While the technology per se does not take the decision, real-time and accurate data help decision-makers to make the right call and effectively use limited resources. Several cities under the Smart City Mission have demonstrated the utility of technology-based decision making in the pandemic through the Integrated Command and Control Centres – this needs to be scaled up and capacities built for real-time data analysis. Further, technology is also effective in implementing and monitoring decisions but, it cannot make the decisions.

2. **Introducing Working Density:** Guidelines for Master Plans recommend densities for various types of land use but have no scope of flexibility and do not make space for accommodating migrants to the city. It is recommended that along with regulating the residential density, the development plans must also regulate the working density at a zonal level -the more you concentrate, the more effective you are going to be. This approach allows the reduction of resource consumption and fosters economies of scale. The COVID pandemic has highlighted the issue of densities and the time is right to revisit the overall 'suitability' quotient of densities. At the metropolitan scale, the concept of TODs and urban centralities are based on the concentration of services and

people for ease of access. Acknowledging the need to address the influx of people in search of jobs to cities, the URDPFI Guidelines discuss 'Transport Oriented Development' at length and link decongestion to this approach. However, cities have a thriving informal sector and a symbiotic relationship exists between different income groups – while the Transport Oriented Development approach and the general density guidelines consider this, the problem is that of management of the informal sector. The informal sector is a key contributor to the growth of low-income settlements and congestion thus, it is rational to distribute the job opportunities within a region. The working population density can be regulated by the permissible built-up of commercial and industrial activities. After accounting for the jobs in the service sector, the networking population in a zone can be limited based upon the capacity of the zone to accommodate appropriate housing mix and corresponding infrastructure. This will help manage the risk of overcrowding in the planned residential density and subsequently avoid overburdening the designed infrastructure.

Decongesting the working population can have a ripple effect by reducing daily commute, reducing congestion, reducing pollution, and reducing the use of non-renewable energy. Specifically, the Guidelines may consider the following modifications with respect to issues of FAR; Density allocation/management; Intensification of land uses along transit corridors and City Sprawl vs Compact Development.

1	FAR Prescriptions	The urban density in a zone and at the plot level is mainly regulated by defining the FAR. The derivation of FAR is conceptually based on the carrying capacity of the land, however, the background calculation of land and infrastructure carrying capacity, to derive the optimum FAR is not available. In view of the change in the use of infrastructure pattern over the last few decades, URDPFI Guidelines must revisit the derivation of FAR that is most appropriate for current patterns of urban growth. Master Plans/Metropolitan Plans must link the density with the maximum permissible FAR in a zone and include permissible FAR along with purchasable FAR. Since FAR is linked to land use, any change must also link with corresponding change in other provisions like infrastructure, parking, etc. – this is not the current practice.
2	Density allocation/management	
3	Intensification of land uses along the transit corridor	Current thinking in urban planning (as has been argued in this Study), it is recommended that higher FAR should be permissible for mixed land use rather than for commercial

4	City sprawl vs Compact development	<p>use. The latter eventually increases the Working Density. The higher FAR in mixed-use shall also define the maximum and minimum of various mix of uses.</p> <p>Section 3.2 of URDPFI guidelines also introduces the Transfer of Development Rights (TDR) which can be very useful for regulating urban density in a congested city. The URDPFI Guidelines should elaborate on how this tool may be used to manage urbanization from metropolitan to city level. This may include guidelines for defining generating and receiving zones of a city.</p> <p>In view of the current pandemic, it is important to distinguish between density (people per unit area) and crowding (the number of people within an enclosed space, such as a vehicle or house). Contagion risks results from crowding, not density.</p> <p>Compact city development has certain inherent advantages as shown below<sup>23</sup>.</p> <table border="1" data-bbox="667 801 1390 1272"> <thead> <tr> <th data-bbox="667 801 906 846">Economic</th> <th data-bbox="906 801 1145 846">Social</th> <th data-bbox="1145 801 1390 846">Environmental</th> </tr> </thead> <tbody> <tr> <td data-bbox="667 846 906 1272"> <ul style="list-style-type: none"> <li>• 10-30% transport cost savings</li> <li>• Less time driving and congested</li> <li>• More productivity and innovation</li> <li>• Public services cost savings</li> </ul> </td> <td data-bbox="906 846 1145 1272"> <ul style="list-style-type: none"> <li>• Lower traffic casualty rates</li> <li>• Residents are healthier and live longer</li> <li>• Greater economic opportunity for disadvantaged people</li> </ul> </td> <td data-bbox="1145 846 1390 1272"> <ul style="list-style-type: none"> <li>• Requires less land for roads and parking, preserving open spaces</li> <li>• Energy savings and emission reductions</li> </ul> </td> </tr> </tbody> </table>	Economic	Social	Environmental	<ul style="list-style-type: none"> <li>• 10-30% transport cost savings</li> <li>• Less time driving and congested</li> <li>• More productivity and innovation</li> <li>• Public services cost savings</li> </ul>	<ul style="list-style-type: none"> <li>• Lower traffic casualty rates</li> <li>• Residents are healthier and live longer</li> <li>• Greater economic opportunity for disadvantaged people</li> </ul>	<ul style="list-style-type: none"> <li>• Requires less land for roads and parking, preserving open spaces</li> <li>• Energy savings and emission reductions</li> </ul>
Economic	Social	Environmental						
<ul style="list-style-type: none"> <li>• 10-30% transport cost savings</li> <li>• Less time driving and congested</li> <li>• More productivity and innovation</li> <li>• Public services cost savings</li> </ul>	<ul style="list-style-type: none"> <li>• Lower traffic casualty rates</li> <li>• Residents are healthier and live longer</li> <li>• Greater economic opportunity for disadvantaged people</li> </ul>	<ul style="list-style-type: none"> <li>• Requires less land for roads and parking, preserving open spaces</li> <li>• Energy savings and emission reductions</li> </ul>						

3. **Elaborate on the method of Housing Demand Estimation:** Section 7.5.3. of URDPFI Guidelines provides a brief on the methodology for estimating housing demand. There is a separate debate on affordable housing including rental housing that the government is now focusing on. The URDPFI Guidelines need to be flexible to incorporate emerging recommendations. In the future, the land use plan shall earmark residential land for various income groups based on the correlation of the housing demand and working density.
4. **Accessibility to Essential Services and Facilities:** Taking inspiration from ‘15 Minute City’ concept, the URDPFI Guidelines can redefine the services and facilities into essential and non-essential services and facilities (this shall broadly include neighborhood-level facilities such convenience shopping center, ATM, milk booths, etc.) Accessibility (within 15-minute cycling distance / to be defined) to these essential services and facilities shall be mandatory for approval of any layout plan. Expanding this analogy to the metropolitan scale, there is the ‘30-minute city’. Metropolitan planning defines its boundaries based on commuter train travel within 30 minutes to

<sup>23</sup> <https://www.vtapi.org/PRCP.pdf>

the city core. This defines the spread of different levels of services in the region and helps manage densities.

As, Dr. Pedro B. Ortiz<sup>24</sup> says, 'cities should have a submarine structure' – this allows isolation of parts under specific circumstances and then linking back to the superstructure - compartmentalizing the parts and acting specifically and proportionally to areas affected by an incident. The approach reiterates the symbiotic relationship between various parts of the city and different categories of services and, underlines the fact that services can very well be dispersed across an area not necessarily following rigid administrative boundaries.

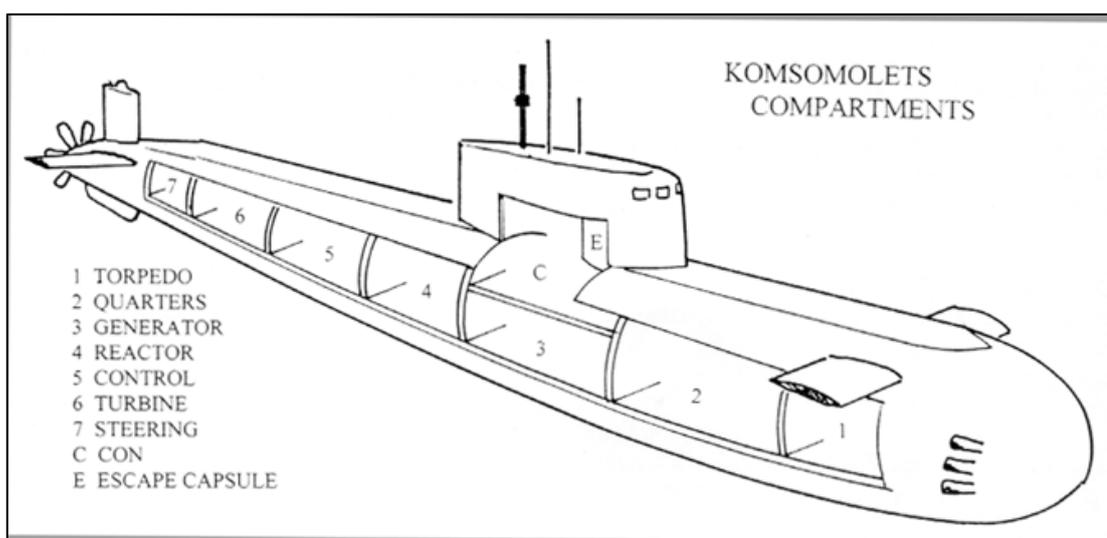


Figure 22: Compartmentalising the parts to act specifically in parts affected by an incident.  
Source: [www.pedrobortiz.com](http://www.pedrobortiz.com)

The approach to city planning should broadly follow the structure as is shown in the figure with the details becoming more granular as the scale reduces. This approach is described in the URDPFI Guidelines but needs reiteration.

<sup>24</sup> Author – The Art of Shaping the Metropolis – McGraw-Hill, New York, 2014

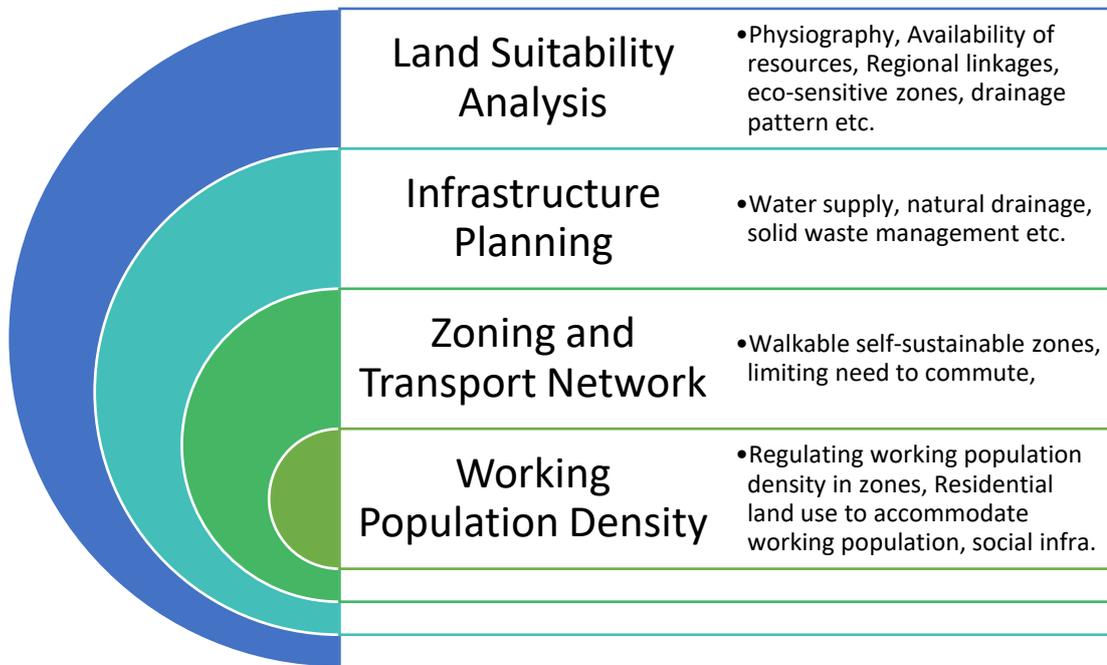


Figure 23: New approach to city planning

The COVID pandemic with its mandatory social distancing has underlined the need to ensure **provision of open spaces**. The practice in India shows that while Master Plans make provisions for open spaces, by the time they translate to implementation, these are no longer available. There are two reasons for this, Zonal and Layout plans rarely get completed on time and provisions there are not in line with the Master Plan and, the enforcement of the ‘no development area’ following the notification of Master Plans is very weak. Indian cities especially the older parts and the informal areas have virtually no open spaces – these have become restricted largely to the gated communities that are the norm for planned development today. The URDPFI Guidelines must comment on the concurrent planning of lower level plans to synchronise with Master Plan implementation including commenting on norms at the lower levels of the plan to ensure that open spaces are adequate post implementation of plans.

The COVID pandemic has generated debate on mix use development – compact, walkable and cyclable neighbourhoods where most of the essential services may be accessed without using automobiles. Section 5.4.2 of the URDPFI Guidelines defines mixed land use development and recognizes that this yields socio-economic benefits including a positive effect on housing and commercial values. The pandemic has identified additional services that are essential to deal with such emergencies e.g. primary health care facilities; communication lines; etc. The URDPFI Guidelines could revisit the services that are mandatory for mixed use development keeping in mind the lessons emerging from the pandemic. This will then need to be adopted in the planning norms and detailed in the Zonal and Layout Plans.

The following specific recommendations should also be considered.

Section	Existing Provision	Amendments Proposed
1.5.5	Special Purpose Plan	There needs to be some provisions to deal with pandemics (natural and man made) and the COVID has highlighted this. Pandemic resilient cities cannot be achieved unless there is creative use of cutting-edge technology. Urban planning and design play a prominent role in building resilience to pandemics – open spaces, mixed use, disaster management plans – these have been referred to throughout the document.
1.5.7	Projects/Research	At a more operational level (not really in the context of this Technical Study), the Ministry must encourage research into pandemic resilience, analyse learnings from elsewhere and revisit the norms for services in mix use development at all scales of planning.
2.2.5	Specific Purpose Plan	This section describes in details the contents of different plans like City Development Plans, City Sanitation Plans, etc. There are no comments on Emergency Preparedness Plans that should link with the Disaster Preparedness Plans that all cities must have. In light of the lessons emerging from the COVID situation, the innovations demonstrated to handle the situation should be considered while finalizing the contents. Some of the innovations include: <ul style="list-style-type: none"> <li>• Housing for migrant workers – converting hostels to house these workers</li> </ul>

		<ul style="list-style-type: none"> <li>• Quarantine facilities – use of hotels, homestays; conversion of train bogeys into these facilities with appropriate medical facilities; conversion of an indoor stadium in Dharavi slum to a quarantine facility</li> <li>• Medical camps and quarantine facilities – in Odisha, multi purpose flood and cyclone shelters used as medical camps and quarantine facilities</li> </ul>
2.2.5	Disaster Management Plan	The preparation of disaster management plans must be emphasized at city level. These plans must now include a section on dealing with pandemics and outline response at immediate-short-medium-long term timeframes. In addition to physical infrastructure, the plan must comment on various actions like response coordination surveillance and monitoring of illness trends; disease containment and mitigation; delivery of counter measures and public communication. When dealing with dense areas, harnessing novel data streams and new technological advances to manage epidemics, mitigating false information on social networks and creating informal technical networks. The better the preparedness, the greater capacities for dealing with the emergency.
4.5.2	Delineation of Area/Region	This section discusses the process of delineation of regions based on criteria like environment and land suitability; demographic, quality of life; flows, economic and investments; others. It also describes techniques for delineation i.e. the analysis . This section should also include emphasis on the use of technology like GIS, dynamic data sets, climate projection data, etc. to delineate areas of influence of specific components of plans. The point should be on demarcation of areas of influence that go beyond administrative boundaries.
4.8	Composition of Committees for Planning Committee	This section recommends composition of various committees in line with the requirements of the law. It is recommended that the composition be amended to include the position of ‘Resilience Officer’; an ‘ICT Expert’ and a ‘Green Infrastructure Expert’. It is also recommended that community level committees be emphasized – the pandemic has proved the effectiveness of such committees as the first responders and role in monitoring.
5.3	Distribution of Landuse	This section discusses the methodology for delineation of areas under various land uses. Density is considered as central to this delineation. The emphasis on ‘Blue-Green Infrastructure’ (BGI) in recent times warrants an amendment to this section to include suggestions on steps to be followed for demarcation of BGI. The suggested steps are: Step 1: Analysis of spatial morphology Step 2: Analysis of existing and potential blue and green network locations

		<p>Step 3: Proposing a framework for BGI at macro and micro scales.</p> <p>Among the many advantages of BGI is the preservation of natural waterways and green spaces by incorporating them into the infrastructure network. This is an approach that needs to be emphasized.</p>
5.5.8	Medicity	<p>This section describes the planning of cities specialized in medical facilities. The discussion here focuses on large facilities. The pandemic has shown that there is need for specialized treatment facilities especially for quarantine and isolation. The section needs to mention that such facilities should be mandatory in all medicities.</p>
8.4.3	Health care infrastructure	<p>This section provides norms for various health facilities per thousand population. The COVID has demonstrated the paucity of healthcare infrastructure to deal with the emergency. It is estimated that India has 131 beds/100,000 population across government, private and charitable facilities; 86.32 registered doctors/100,000 population; 3.7 ventilators/100,000 persons and 87979 ICU beds<sup>25</sup>. This study also shows that about 90% of health infrastructure is in the private sector and there are striking inter-state variations with Bihar and Uttar Pradesh having the lowest numbers. In response to COVID, private facilities were appropriated. It is recommended that the directives of the Health Ministry with regards to benchmarks for emergencies be incorporated in the URDPFI Guidelines.</p>
9.2	Simplified Development Regulations	<p>This section defines the permissible uses in each classified land use zone. It is recommended that guidance on inclusion of medical facilities in industrial/mixed use/primary activities zone be added to the URDPFI Guidelines. There is need to define the type and hierarchy of medical facility for each zone/land use category. The 15-minute city emphasizes the need to have access to all basic amenities including health care within the radius. Some specific inclusions could be:</p> <ul style="list-style-type: none"> <li>• Zoning codes and house retrofitting programmes that ensure structural safety from earthquakes and extreme weather conditions and are energy efficient</li> <li>• Housing norms such that there is sufficient space, cross ventilation</li> <li>• Design of neighbourhoods considering ‘social distancing’ e.g. houses with windows oriented to the street, front porches, wide sidewalks, recreation paths</li> </ul>

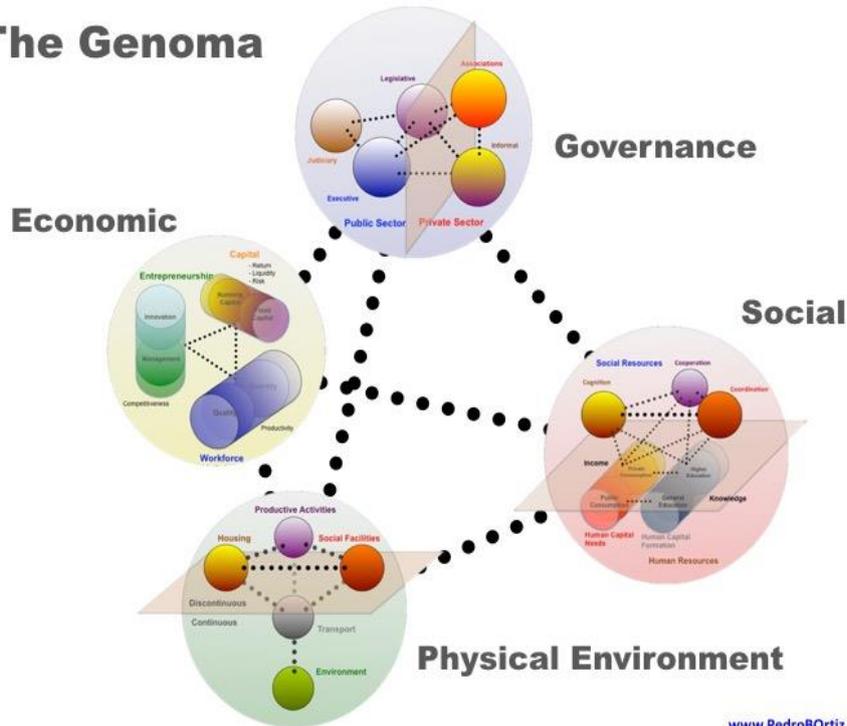
<sup>25</sup> Assessing Healthcare Capacity in India; Shruti Rajagopalan & Abishek Choutagunta. Mercatus Working Paper, Mercatus Centre, George Mason University, Virginia, USA; April 2020

- 
5. **Governance:** This differs at metropolitan and city levels. At the metropolitan level it is at a strategic level requiring agreement across departments and local governments on planning for a 40-year horizon. At the city level, this is at a much lower scale with a strong element of stakeholder participation in decision-making. The City Resilience characteristics consider 'inclusion' and the participation of people a very important decider for resilience. The way in which Dharavi handled the COVID-19 pandemic through community participation and communication has demonstrated this. The Government of India through the 74<sup>th</sup> Constitutional Amendment Act (CAA) has empowered the local government to prepare plans and generate revenue from its own sources. Local governments in India (barring very few) have the required skills and resources to address emerging planning needs and, in the absence of a decision-making framework that cascades planning-related decisions from the metropolitan to the city scale, the characteristic confusion and chaos in India cities will continue.

There are provisions for the constitution of a 'metropolitan planning committee' to lead on the integrated planning that is based on integrated development across the environment, transport, housing, social facilities and productive activity considerations but, these have not been constituted in most instances and where they have, are weak and ineffective. Kerala and Goa are examples of an integrated approach to planning that stand out and although not completely responsive and able to tackle hazards, are better placed than other cities in the country.

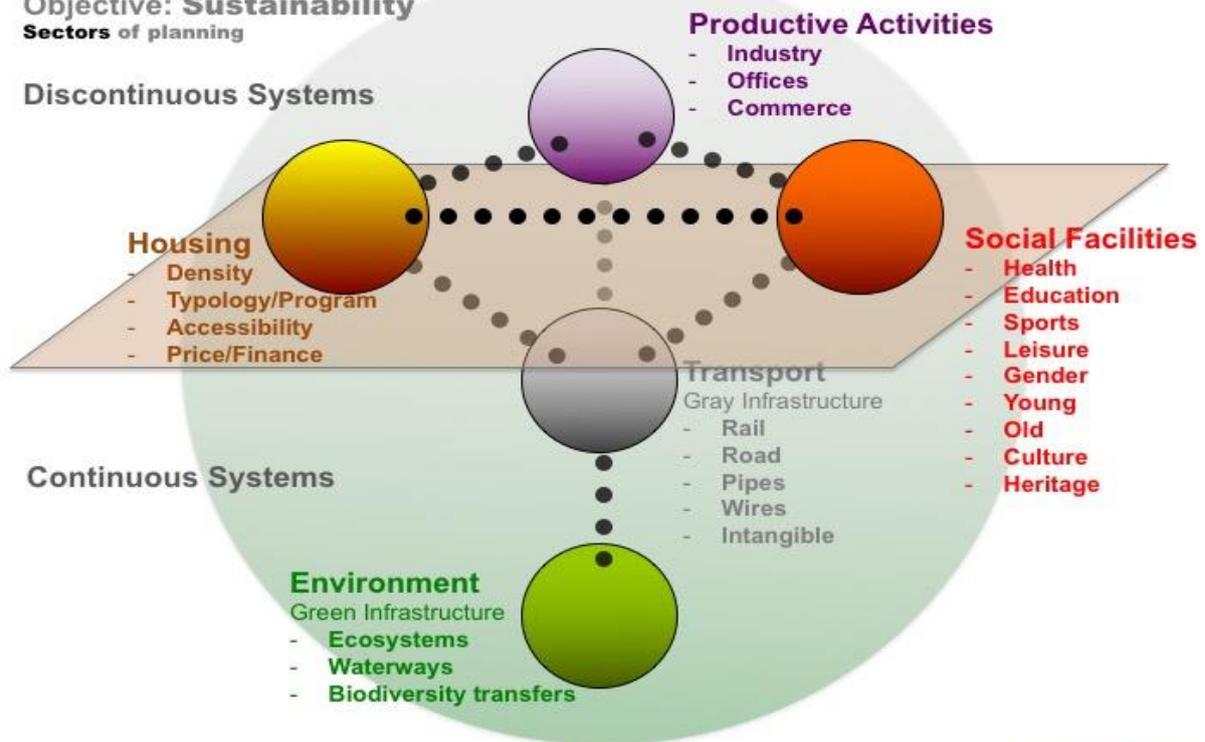
Metropolises have 4 components: Economic, Social, Physical, and Institutional. Economy seeks 'efficiency'; Social seeks 'equity'; Physical Sustainability and Institutional Governance seek 'equilibrium'. These components are often in tension and competing for limited resources with the Economy needing accumulation of indivisible capital to perform. This accumulation goes against an equitable share among all citizens, especially those that need it the most. The struggle among the Components must be addressed and solved by Governance, within the fair play of the different institutions set up for that purpose.

# The Genoma



[www.PedroBOrtiz.com](http://www.PedroBOrtiz.com)

**Physical Component**  
Objective: Sustainability  
Sectors of planning



[www.PedroBOrtiz.com](http://www.PedroBOrtiz.com)

Figure 24: Four Components of the metropolitan Genoma and five sectors of the Physical Components

Each of these Components has 'elements' and historical literature for each has identified these in different forms: Branches of Government, Administrative Tiers, Social Resources, Economic Factors, or Urban Sectors. Metropolises must address all these elements concurrently with the additional difficulty of policy action on any

ricocheting on the others. These ricochets must be foreseen to avoid mishaps due to ignorance since these can have terrible social and economic consequences as well as sustainability disruption and institutional confrontation – much like a pool table where all the balls are at stake at the same time and, this is to be done both in Managing and Planning the Metropolis.

The Town and Country Planning Organization, Government of India, as the custodian of the URDPFI Guidelines must take the necessary steps<sup>26</sup> to embed this approach to urban planning at all scales.

## 5.2 Recommendations for MBBL

1. **Green Infrastructure (GI):** The global examples in Chapter 4 have demonstrated the key role of GI in city-level resilience and sustainability of infrastructure. Rainwater harvesting, use of pervious pavement, and connected green spaces in urban areas can reduce the vulnerability to urban flooding. Similarly, reuse and reduce the use of drinking water can reduce the vulnerability to drought. It is recommended that both the MBBL and URDPFI incorporate the features of Green Infrastructure along with sustainable development. This shall not only address flooding, water quality, air quality, and urban green but shall also include consideration of green cover along the road cross-sections. At the metropolitan scale it will mean undertaking planning that is strictly guided by the centrality of the environment and the topography while at the city scale, these will be at the project level.
2. **Building safety norms for disasters such as flooding and cyclone:** The MBBL provisions sufficient norms and regulations to safeguards the building from the earthquake, however, it has not addressed the vulnerability of buildings due to disasters like flooding and cyclones. In many areas of the country urban flooding is a frequent phenomenon that disrupts the life of not only the urban poor but also in planned localities. Measures such as high plinth level, using stilt floor, structural safety against flooding, etc can be explored and recommended for flood-prone areas.

Some of the specific recommendations to sections are as shown in the table below.

Section	Subject	Amendment Proposed
3.1	Flexible FAR	Section 3.1 suggests using flexible FAR for the most efficient utilization of land. The available tools include the provision of Additional FAR, Purchasable FAR and Floating FAR. Flexible FAR shall be permitted while considering maximum permissible FAR in that zone while considering sufficient provisions are made to cater for the additional load generated. This section suggests methods to calculate additional load but it does not cover all factors. It is recommended that for calculation of additional load, factors such as additional traffic generated, parking requirements, additional social and physical infrastructure should also be estimated. The maximum FAR permitted including

<sup>26</sup> For more information refer: <https://www.pedrobortiz.com/display-articles/listforcountry/id/570>

		flexible FAR must account for maximum permissible density for that zone.
3.10.4	Development controls on Health Centres and Nursing Homes	Based on the learnings from COVID, it is recommended that 5% FAR in 'Hospital/Tertiary Health Care Centres' be reserved for 'Isolation Centres'. The Isolation Centre shall be a separate section of the building or shall be a section of the building that can be transformed into an isolation centre. This isolation centre shall meet all the requirements as defined by government regulations . This area should include provisions like high efficiency particulate arrestance (HEPA) fileters to ensure that there is no contamination of the surrounding environment.
4.2/4.3.1.2	Habitable room	The amendment should be made to ensure that the size of the habitable room and minimum plot size shall be redefined taking into consideration safety norms for a pandemic/communicable diseases. The size shall also define the maximum number of people allowed in the space.
3.4.5	Resettlement and slum in-situ upgradation or regularization of unauthorized colonies	
3.4.6	Low income housing	
4.3.44	Water and sanitary requirements	Sufficient provisions to be made to isolate the water supply and sanitation infrastructure in case of a pandemic.

### 5.3 Recommendation on Disaster Management

1. Identify, understand, and use current and future risk scenarios: Identify the most probable and most severe scenarios, including scenarios of future urbanization and climate variability at a metropolitan level. This can be used as the knowledge base from previous risk scenarios for future development decisions. While this is not a direct responsibility of the town planning departments, at the national government level, the need for a detailed 'vulnerability atlas' with modeling under different scenarios may be proposed. Such a document will have a variety of uses and contribute to informed decision-making and higher returns on investments.
2. Disaster Management Plan or better a 'contingency management plan' should be integrated within the context of the overall Master Plan. It is suggested that the existing land-use maps shall indicate hazard-prone areas keeping in view the regulations for land use zoning and regulations for natural hazard-prone areas.
3. Ensure strict compliance: One of the biggest challenges is compliance – accountability of the administration is not at desired levels. Disaster-resistant features specified in the National Building Code, Acts and policies should be adhered to. The Act may incorporate the local authorities with the responsibility of ensuring compliance with bye-laws, codes, and rules relating to building safety, and disasters.
4. The general guidelines for the SDMPs need to be refined into sharper prescriptions and directives.
5. Database of population and critical infrastructure: Timely and reliable data and statistics are needed for comprehensive resilience. Decisions and proposals have to be revised as the data evolves. A dynamic database capable and a flexible planning approach is important for decision making as well as monitoring all phases of disaster

---

risk management i.e. in reducing, preparing for, responding to, and recovering effectively from disasters and multiple shocks. It would also include mapping of key lifeline infrastructure for transport, power, telecommunications, and water.

6. Increase Infrastructure Resilience by assessing the capacity, adequacy, and life-cycle of the critical infrastructure. It is suggested to strengthen and retrofit the vulnerable infrastructure and recognize the relevance of priority services and operations during and after a disaster.
7. Identification of alternative building materials and building techniques that are better able to withstand shocks<sup>27</sup>. For example, a study led by ARUP<sup>28</sup>, International Organization for Migration (IOM), and supported by the Department for International Development (DFID) to develop a shelter design guide that will contribute to building the resilience of communities living in flood-prone areas in southern provinces of Pakistan was completed in 2017. The study focused on the design of shelter using vernacular forms of construction to improve the flood-resilience of communities to medium scale flooding. NED University in Karachi conducted the physical testing of the building elements at the site. **The study helped to evaluate the performance of existing shelter under simulated flooding and heavy rain and substantiate the water resilience indicator.** The key performance criteria of the study and analysis were: 'safe and resilient', 'acceptable to occupant', and 'sustainable'. Similarly, Japan<sup>29</sup> offers examples of dealing with the earthquake risk to buildings. The modern approach to the seismic design is based upon the inelastic response of structural members and systems to dissipate the energy imparted to structures by means of base isolation and energy dissipation devices. The concept of base isolation is quite different from the practice of conventional seismic design. In the base isolation concept, the upper portion from the base is isolated from the destructive vibrations of the earthquake by confining the severe distortions to a specifically designed portion of the base. Thus, the building is isolated from ground vibrations in such a way that only a fraction of the seismic ground vibrations are transmitted to the building. In other words, it can be said that the ground underneath the building vibrates violently, but the building itself gets a fraction of vibrations and will remain practically stable. Example: A building is resting on frictionless smooth rollers when the ground vibrates or shakes, the rollers move freely and the building above remains unaffected i.e. building does not move. Thus, force is not transmitted to the building due to the vibrations of the ground due to the earthquake. If the same building is rested on flexible pads that offer resistance to the horizontal movement, then some effect of the ground motion will be transferred to the building above. Base isolators are like shock absorbers between the building and the ground motion, letting a building slide back and forth while remaining upright during an earthquake.

---

<sup>27</sup> Although these are architectural decisions based on relevant bye-laws, these have been included to ensure that they are not missed out.

<sup>28</sup> Source: International Organization for Migration, Flood Resilient Shelter in Pakistan Phase 2: Evidence-based Research, DFID, ARUP, IOM, NDMA; October 2017

<sup>29</sup> Source: Principles of Earthquake Resistant Design of Structures and Tsunami 2010.

<https://www.nytimes.com/interactive/2019/06/03/us/earthquake-preparedness-usa-japan.html>

---

## 5.4 Dealing with Pandemics

The COVID has forced a rethink on urban planning the world over. The stress on public health that the pandemic has exposed globally and the success stories of pandemic management point to the close links between government and governance in dealing with the situation. Countries that have high grade public health facilities have not fared as well as expected in dealing with the pandemic and lot of it is to do with the community engagement in the process. The response has identified the following key issues that urban planning norms must consider:

- The use of technology to identify and monitor disease parameters.
- The use of technology in delineation of land use
- The need to revisit the public health infrastructure norms (in consultation with the Health Ministry) and define ways and means of utilising facilities in the private sector as needed
- Modifications in building design and lay out plans to account for the social distancing norms
- The need to plan self contained zones in cities that have access to basic services within a walking/cycling radius such that these units may be isolated as needed
- The examples that exist of cities using the Integrated Command and Control Centres for pandemic monitoring should be documented and shared

While this Technical Study focuses on the strategic elements of metropolitan and city planning especially on mainstreaming resilience, there are references to modifications in the URDPFI Guidelines, the Model Building Bye Laws and the Disaster Management Laws that should be considered in the wake of the pandemic. While these recommendations may not solve all issues related with the pandemic, they will contribute significantly to managing situations in the future.

## 5.5 Analysis of Master Plans from Indian cities to understand the mainstreaming of resilience

The Master Plans of Ahmedabad and Bengaluru were examined through the resilience lens to identify the gaps. A brief summary follows.

### Ahmedabad Development Plan

**City Context:** Ahmedabad is the seventh-largest metropolitan city located in Gujarat. Its population in 2011 was 5.8 million and 6.4 million in its urban agglomeration area which includes the AMC and its outgrowth. Ahmedabad is an important economic and industrial hub and is reported to be one of the fastest-growing cities of the decade (Forbe's 2010). Textiles, pharmaceuticals, and automobiles are the most prominent industries based in and around Ahmedabad. There are currently four SEZs in the city region, with another three new industrial estates in the planning, by the Gujarat Industrial Development Corporation (GIDC).

**Draft Comprehensive Development Plan 2021:** The Comprehensive Development Plan -2021 shall apply to the Ahmedabad Urban Development Area (AUDA) including the Ahmedabad Municipal Corporation (AMC) area. The spatial planning is undertaken by the AUDA which is set up under the Gujarat Town Planning and Urban Development (GTPUD) Act of 1976 whereas the AMC is the local government for providing the services in the city. The plan is prepared considering future population & economic growth by the year 2021 and 2031. *The key planning principles adopted in the Master Plan are the compact city, enhancing*

---

*accessibility, mobility, and connectivity, integration of land use and transport, increase in green cover, and conservation of heritage.*

The two levels of urban development and delivering serviced land in Gujarat are defined by the Gujarat Urban Development and Town Planning Act 1976 (GUDTP) (Government of Gujarat, 2000). This provides for the preparation of the macro-level urban Development Plan (DP), and the preparation of a number of area-level plans known as town planning schemes for areas delineated for new development in the DP. In the second level of planning, Gujarat follows the method of 'land readjustment and pooling', and is delivered using the Town Planning Schemes.

As land suitability is one of the critical parameters of resilient planning, it played an important role in the plan preparation process. Using the multilayered mapping feature of GIS, the city could visualize the environmental and landscape significant area, watercourses, water area buffers, flood frequency areas, roads, and established neighbourhoods. This information led to informed decisions such as avoiding developing areas with flood frequency, accessibility, built-form and density, protection of natural resources and heritage, and compact development. The maps generated provided the visual representation of the city's existing features, as well as select the areas where more intensive development can be allowed and identify the areas where development control should be imposed. As already discussed in this report, GIS was also used for the planning of metro rail routes in the city of Ahmedabad.

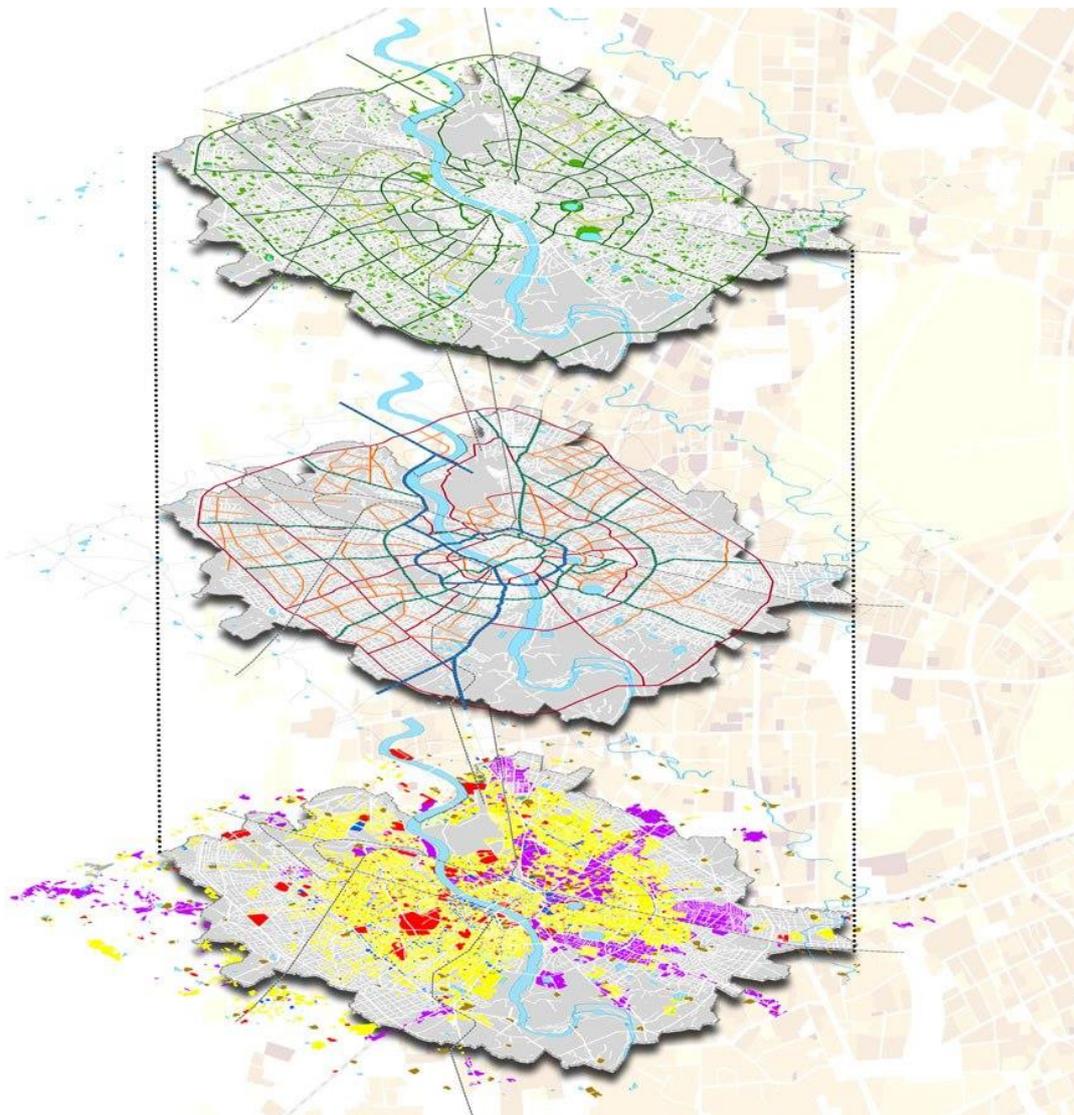


Figure 25: Evolving Street Network from Existing Development <sup>30</sup>

*The plan has identified the flood hazard zones but the strategies to adapt to climate change by building on good practices of risk reduction need to be integrated. The Master Plan does not discuss integrated infrastructure planning and services, environmental sustainability and disaster mitigation and neither is environmental protection and strengthening of ecosystems streamlined with the land use planning process. The planning strategies to protect ecosystems and natural buffers to mitigate floods, storm surges and other hazards to which the city may be vulnerable are not considered in planning. Although GIS-enabled maps have been prepared, vulnerability analysis has not been considered as another layer while planning the spatial distribution.*

The city has identified the special development zones in the plan: walled city, Sabarmati River Front, Gandhi Ashram and Science city, Thol lake etc. The special planning regulations are proposed for the development of these zones.

The city has also catered to the affordable housing scheme in the plan through a provision of Affordable Housing Zone with an area of 76sqkm. Also, minimum norms are given for the development of social facilities for Socially & Economically Weaker Section Housing (SEWH)

<sup>30</sup> <https://www.hcp.co.in/project/auda-development-plan-2021>

---

and Other Infrastructure in the housing sector. *While the plan assures the location for affordable housing, its links with good public transport, adequate social infrastructure and facilities is tenuous. The land-use plan reveals that the area allocated for affordable housing is almost entirely outside the catchment area of Ahmedabad's mass rapid transit systems and lacks facilities – these are potential pockets of vulnerability and unplanned development.*

**Population density:** The plan has been divided into various zones with designated density for each zone. The plan promotes compact mixed-use development with high density in the Central Business District (CBD), transit-oriented zone (TOZ) i.e. Bus Rapid Transit (BRT) corridor, and Metro Rail Transit (MRT). To ensure that the high density is achieved in the TOZ in a planned manner, there is a provision of granting higher FSI permission at the time of the preparation of the local area plans. The increase of FSI along BRT and MRT from 1.8 to 3.6 or 4 based on chargeable FSI. The plan emphasizes the correlation between high-density mixed-use development and the public transport system. The city also promotes the redevelopment of the old mill areas spread across the city with the objective of regeneration and infill development. Another remarkable example is the redevelopment of CBD for efficient land use utilization through higher FAR and mixed-use development.

*The development plan has promoted mixed use development in various planning zones through ToD, increase in FAR and redevelopment of CBD. The mixed use development does not provide details of the infrastructure, public transport system, carrying capacity or the density restrictions, promotion of walkability, green spaces, etc. In absence of these details, the mixed development may not have the desired results.*

The city of Ahmedabad has a radial city plan, with the old city at the core, and sprawling on the peripheries as the city expands. The city has an excellent road network compared to other Indian cities, with adequate ring and radial roads, river crossings, and a well-defined road hierarchy. The city promotes a well-defined and comprehensive network, along with the city's mixed land use development. *Although the plan identifies a network of green streets, the green infrastructure features that are important resilient parameters for planning and design are not mentioned. There is no emphasis to promote walkability, cycle pathways, non-motorized transport corridors in the street design.*

The DP outlines several mechanisms that will help in promoting a compact city structure with higher densities in zones that have good public transport access. The plan also facilitates mixed-use development by offering a great deal of flexibility in the permitted land uses within each zone. The provision of parks at different planning hierarchies is also given in the plan.

Category	Area (Ha)	Pedestrian access	Catchment
Pocket Parks	<0.1	200m	Upto 3 min walk
Neighborhood Parks	0.1 – 0.4	400 m	Upto 5 min walk
Community Parks	0.4 – 2.0	600 m	Upto 10 min walk
City Parks	2.0 – 80.0	800 m	Upto 10 min drive
Regional Parks	>80.0	-	Upto 1 hour drive



**Neighbourhood park**  
(AUDA garden, Thaltej)



**Community Park**  
(Prahlanagar)



**City Park**  
(Law Garden)

Figure 26: Categorisation of Parks, gardens based on size, location and use

Regarding environmental sustainability, the provisions given in the MBL are incorporated in the development plan. Eco-friendly Practices (a) Sewage Treatment Plant (b) rainwater harvesting (c) waste management (d) pollution control method for air, water, and light (e) introduction of non CFC equipment for refrigeration and air conditioning, provisions reuse of water, solar water heating shall be applicable. It is also mentioned that the building shall preferably be designed as per the Energy Conservation Building Code. The local body offers incentives in the rate of chargeable FSI for the energy-efficient buildings (Green Building) as a 5% discount in the total payable amount for construction of GRIHA or any other Government recognized Institute certified building.

*The development plan does not include disaster and hazard management like the risks associated with earthquakes, urban flooding, water scarcity, traffic congestion, fire hazards, industrial hazards, etc. and does not mention mitigation techniques.*

This plan adheres to the parameters of resilience that have been defined under this study. The effective implementation and the flexibility in adjusting to emerging priorities remains to be seen.

### **Bengaluru Revised Master Plan (RMP) -2031**

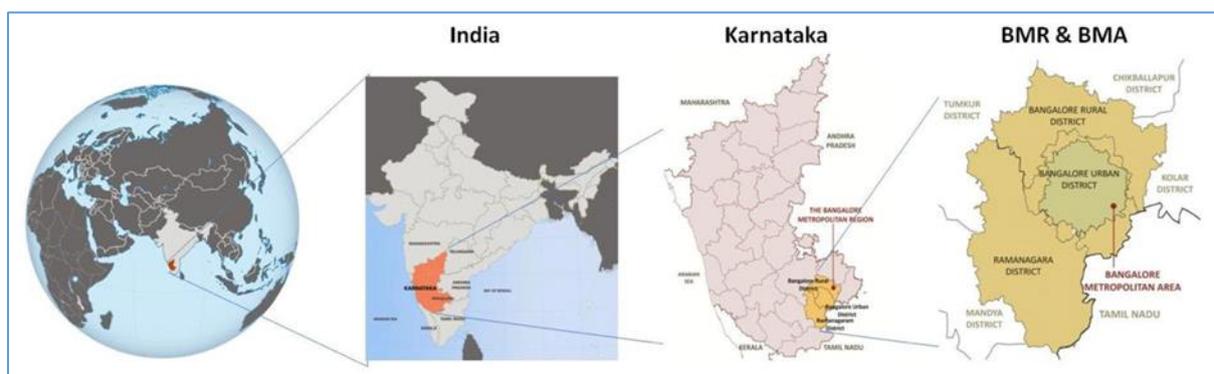
Bengaluru, a multifunctional metropolitan and the capital city of Karnataka, is one of the fastest-growing cities in India and is branded as the 'Silicon Valley of India' for spearheading the growth of Information and Communication Technology (ICT) based industries. The metropolis houses about 40% of the urban population of Karnataka and has witnessed 42% growth in population during the decade 2001-2011. The population in the city of Bengaluru accounts for nearly 14.60% of the State's population concentrated in only about 0.64% of land area.

As per the Karnataka Town and Country Planning Act 1961 (Act), the Bangalore Development Authority (BDA) is the Local Planning Authority for planning, development, enforcement, and implementation of the schemes under the master plan. The currently operational Master Plan for Local Planning Area (LPA) of the Bengaluru Metropolitan Area is termed as Revised Master Plan 2015 for the Horizon Year 2015 (RMP 2015). The Act mandates that the Master Plan be revised every 10 years, BDA is entrusted with the responsibility of preparing and revising the

Master Plan of the RMP-2015 for the horizon period of 2031 (herein referred as RMP-2031). The Local Planning Area (LPA) of Bangalore Development Authority (BDA) for RMP-2031 spreads over an area of about 1206.97 sqkm with an estimated population ranging between 18-20 million for 2031.

For this report, we will be critically analyzing the provisions under the Draft RMP 2031 with a focus on resilient planning and sustainable development. Few key parameters, under which the RMP 2031 will be observed are Land suitability exercise during the preparation of the base map, Provision and distribution of Infrastructure, Planning and distribution of population density, Mixed land use norms & distribution of services and Urban governance mechanism for implementation of this master plan.

In the context of Land Suitability, the planning of Bengaluru is following a well-defined special hierarchy i.e. Bengaluru Metropolitan Region – Bengaluru Metropolitan Area – Local Planning Area.



The regional context in RMP 2031 also accounts for urbanization, growth directions, economy, Industrial infrastructure, transport network, and environmentally sensitive zones. However, the regional data taken into consideration is limited to Lakes, Reserved forest and River basins only. Further, for preparation of the Base Map for RMP 2031, the BDA has integrated the Land Revenue Maps with a GIS-based base Map which was updated using field surveys. The Authority also conducted transportation surveys, socio-economic surveys and heritage surveys for preparation of RMP 2031. Later studies included Classification of Natural Drainage and Risk & Vulnerability Assessment. The assessment of natural drainage has been done based on contours and digital elevation model generated using high-resolution stereo pair satellite imagery assessment and delineation natural drainage system was taken up for classification of streams into primary, secondary and tertiary. Similarly, the main objective of the Hazard and Risk Assessment was to prepare a multi-hazard map (MHM) for the planning area. It is observed that the process of preparation of the Base Map has been very scientific with the use of GIS and various attributes. The RMP 2031 under the Environment sections has a detail assessment of various environmental factors such as temperature, geology, topography, eco-sensitive zones, natural drainage, mining and pollution.

*While the attempt is commendable, there is a lack of concluding land suitability analysis which can define the land bearing capacity based on various environmental features and can provide a basis for land use planning. A more resilient approach could have been identifying the land parcels fit for future development considering various layers of environmental data.*

For sustainable infrastructure, the RMP 2031 details the strategy for infrastructure wherein the BDA realizes the city dependency on a single source of water supply from the Cauvery River which is not sustainable considering the growth of the city. It also identifies the only

alternative as groundwater. However, the RMP 2031 also suggests the development of Integrated infrastructure across the planning area, Dual Pipeline for drinking and other purposes, Water conservation and Rejuvenation of the Lake and Valley System. *Though the master plan addresses the requirement of water supply, it does not talk about planning for stormwater and sewerage for the planning area. The provision of Stormwater and Sewerage is a municipal function but, the master plan based upon land suitability analysis may provide broad planning of these basic infrastructures. The absence of an integrated approach for the whole metropolitan region is often the reason for unplanned and poor infrastructure in peri-urban areas and thus reducing the resilience of the metropolitan region.*

As per the data of the census 2001 and 2011, the population growth is increasing in the region between the BMA boundary and outside Outer Ring Road.

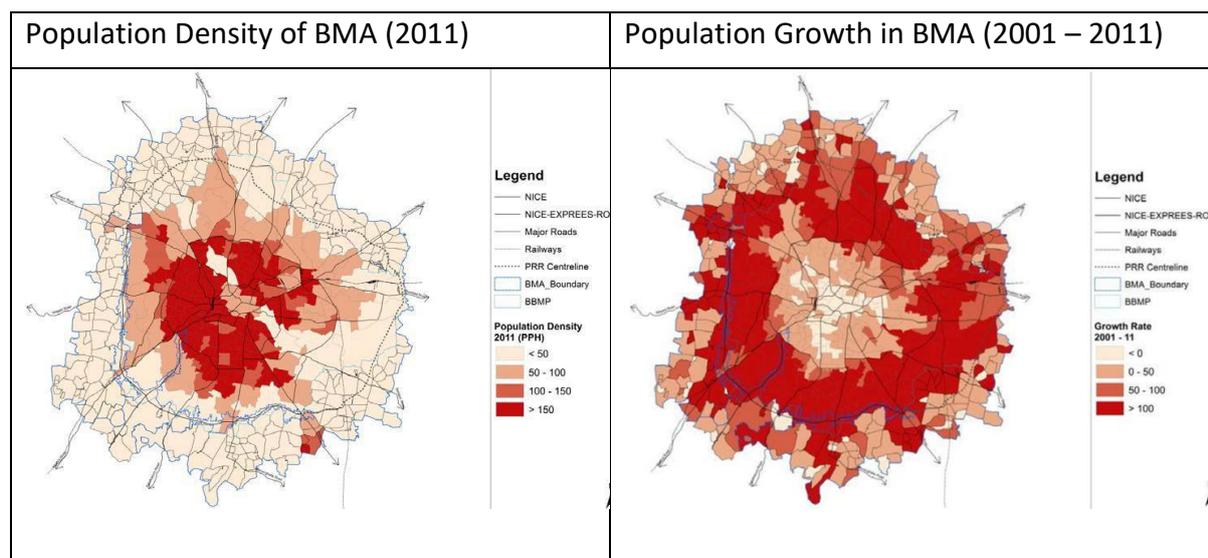


Figure 27: Population growth and density in BMA

The population growth is well distributed in all directions of the city which is a good example of the spatial distribution of population density and reducing the vulnerability because of high density in one area of the city. However, the RMP 2031 does not have any spatial planning of density. The land required for housing and other uses is calculated considering average FSI, which may lead to unregulated residential density in many areas of the city.

The figure below shows how facilities such as schools are concentrated on the western part of the city as are the slums. The gap in the distribution of services is a key reason for the development of vulnerable pockets in the city.

Spatial Distribution of Schools in BMA	Spatial Distribution of Slums in BMA
--	--------------------------------------

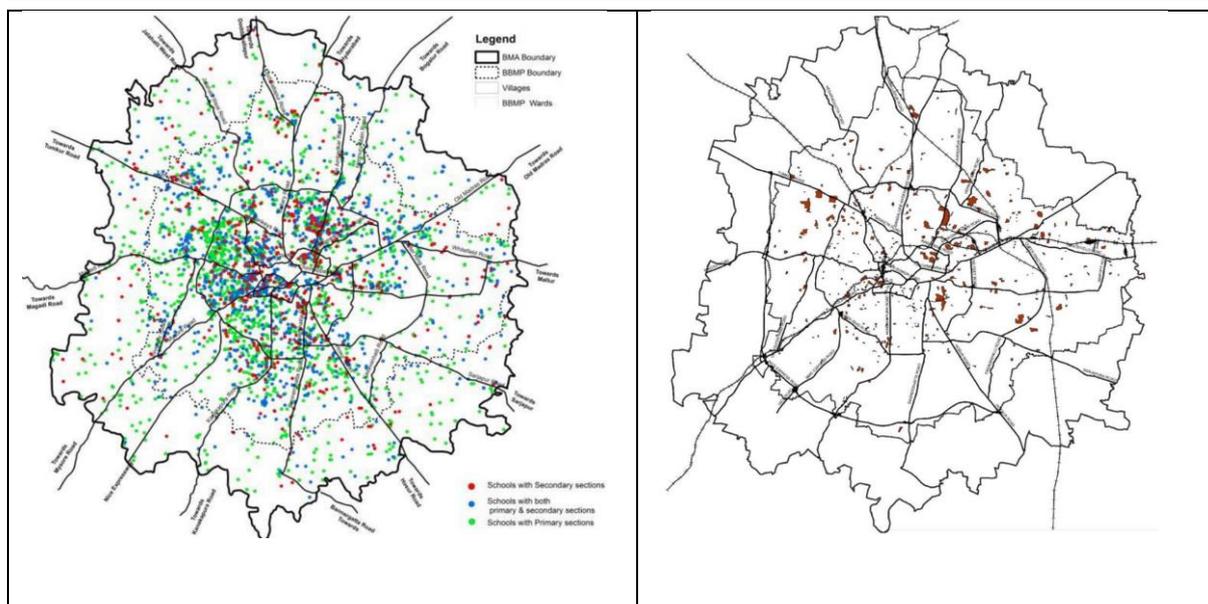


Figure 28: Spatial distribution of schools and slums

The master plan has a separate chapter for disaster and hazard management which identifies the risk of disasters like, earthquakes, urban flooding, water scarcity, hazard associated with hygiene, hazard associated with traffic, fire hazards and Industrial hazards. The master plan also mentions about existing institutional framework for disaster management, however, do not talk about mitigation techniques and city readiness for such disasters.

Volume 6 of RMP 2031 comprises zoning regulations that cover the Land Use Zoning, General Regulations (including regulations related to the building), and regulations related to each land use. The Volume covers the regulations related to sustainable development such as Rainwater Harvesting, Solar Water Heating, and Solar Lighting, however, the use of sustainable building materials has not been mentioned. The gap identified is that of promoting a more resilient and sustainable built environment. The master plan can provide incentives such as relaxation on tax or TDR for the development of green buildings.

## 5.6 Conclusion

The study of the Master Plans underlines the piecemeal approach to planning and reiterates improved integration for mainstreaming resilience. The planning authority thus needs to assess plans and programmes for resilience. There are two levels of assessment that could be considered – (i) at the city level i.e. more operational and (ii) at planning level i.e. more strategic.

Very recently, the Government of India launched the **Climate Smart Cities Assessment Framework**<sup>31</sup> with the objective of providing a roadmap for Indian cities to combat climate change. The Framework consists of indicators across five categories – (i) Energy and Green Buildings; (ii) Urban Planning, Green Cover and Biodiversity; (iii) Mobility and Air Quality; (iv) Water Management; and (v) Waste Management. The Framework provides an assessment of both mitigation and adaptation measures. These indicators are also aligned with the SDGs and it is expected that once the reporting is adopted, these will also contribute to reporting against other international targets such as the Sendai Framework and India's Nationally Determined Contributions (NDCs). The indicators are progressive in nature to support cities in assessing where they stand and encourage them to adopt appropriate actions enabling

<sup>31</sup> Source: Ministry of Housing and Urban Affairs, Government of India; National Institute of Urban Affairs

them to improve their score in the future and consequently build climate resilience. The MoHUA will assess and rank cities annually based on this Framework. The figure below shows the sector-wise weightage for Climate Smart Cities Assessment.

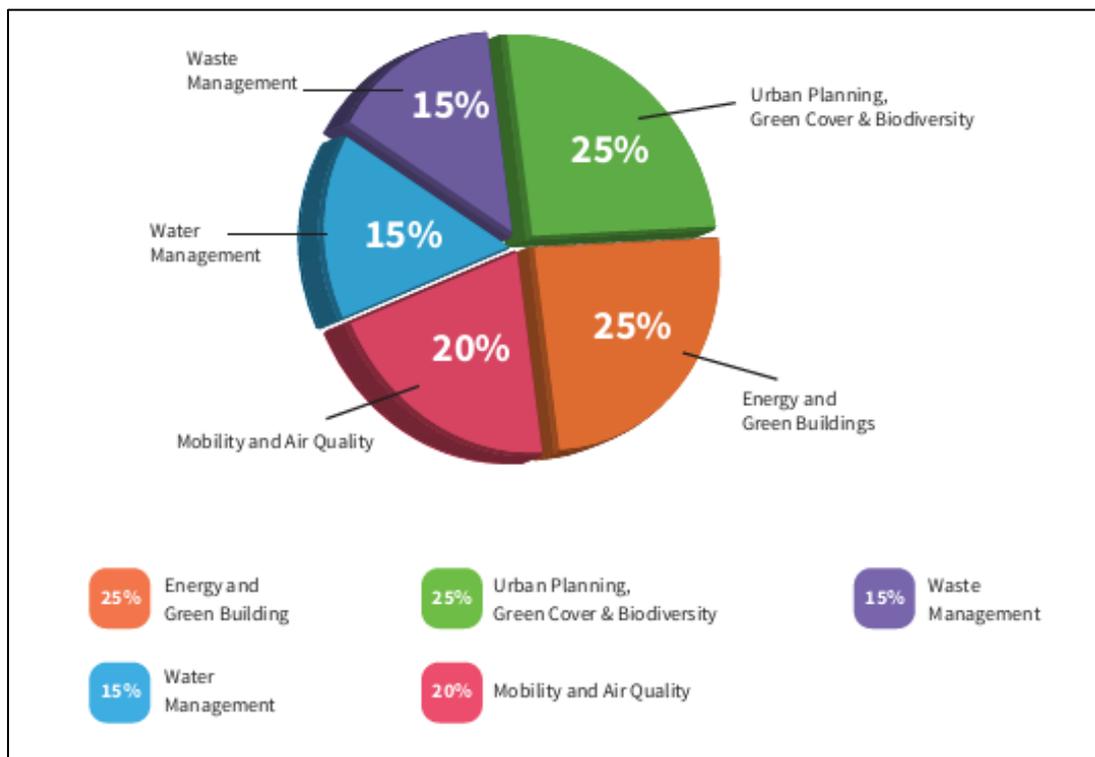


Figure 29: Sector-wise weightage for Climate Smart Cities Assessment

The Climate Resilient Framework at city level prepared by ARUP and the Rockefeller Foundation can also be used to facilitate a common understanding of resilience. The Framework measures resilience across four pillars – (i) Infrastructure and Systems, (ii) Leadership and Strategy, (iii) Health and Well Being, (iv) Economy and Society – each with sub sectors and indicators. This is an effective tool that may be used at both planning and operational levels to measure resilience. The figure below shows the details that are to be monitored.



Figure 30: City Resilience Framework. Source: ARUP & The Rockefeller Foundation, 2015

To help Planning Authorities determine the level of resilience in their proposals, the following matrix developed under this Study is an easy to use tool. This matrix has been developed around the key resilience parameters that the Study has focused on.

Sectors	Parameter	Assessment Scale		
		Resilient	Moderately Resilient	Vulnerable
Base Data and Analysis	Availability of GIS-based Base Map	<i>Available and adaptive</i>	<i>Available but not updated</i>	<i>Not available</i>
	Availability of city-level data including property data, HH data, Infrastructure data, traffic data etc.	<i>Data Linked with GIS and updated</i>	<i>Data available but not linked with GIS</i>	<i>Data not updated or not available</i>
	Availability of integrated data platform	<i>Have established a data cell with integration from all the departments and maintain updated data</i>	<i>Have a centralized data policy but not functional</i>	<i>Do not have a policy for centralized data</i>
Development Plans	Site selection and avoiding risk areas and habitat areas (floodplain, flood-prone; exposed coastal zone, greenfield)	<i>Conduct Land suitability analysis before preparation/updating of development plans</i>	<i>Have the details of the existing situation on all the site selection parameters but do not use it in site selection</i>	<i>Do not have data for conducting land suitability analysis</i>
	Mixed Use and Multi-function zone	<i>The development plan incorporated provision of mixed use (Mixed use Zone and TOD) as per city demand</i>	<i>The development plan incorporates mixed use, but is not adequate as per city demand</i>	<i>The development plans do not have the provision of mixed use.</i>
	Density of Development	<i>Actual residential density as per development plans (No overcrowding and Slums with high density)</i>	<i>Few pockets of the city experience overcrowding in unplanned areas</i>	<i>Overcrowding is observed in all directions of the city</i>

Sectors	Parameter	Assessment Scale		
		Resilient	Moderately Resilient	Vulnerable
	Green and blue infrastructure	<i>The city has prepared a green and blue master plan</i>	<i>The city has identified green and blue infrastructure in the city</i>	<i>The city has not identified green and blue infrastructure</i>
<b>Physical and Social Infrastructure</b>	Distribution of Social infrastructure and Facilities (Social infrastructure includes, Health infrastructure, Education Infrastructure and community facilities)	<i>All Infrastructure at all hierarchies is well distributed in the city</i>	<i>Not all hierarchy of infrastructure is evenly distributed</i>	<i>Pockets in the city are lacking basic Infrastructure</i>
	Adequacy of vital Infrastructure (Water Supply, Sewerage and Drainage)	<i>The design capacity and supply of services are adequate as per city requirement and future demand</i>	<i>Few of the services such as Storm Water and Sewerage are not able to cater to the city demand</i>	<i>Most of the services including water supply, stormwater and sewerage are not adequate as per city demand</i>
	Robustness of Physical infrastructure	<i>Have a backup mechanism in place for vital infrastructure</i>	<i>Have planned for the backup mechanism of vital infrastructure</i>	<i>Do not have any plan for the backup mechanism for vital infrastructure</i>
	Adoption of Green infrastructure	<i>The city has provisioned Green Infrastructure</i>	<i>Policy for Green Infrastructure is in place</i>	<i>The city does not have any policy for green infrastructure</i>
	Efficiency of physical infrastructure	<i>Infrastructure is maintained and monitored through a SCADA based centralized system</i>	<i>Infrastructure is maintained and monitored by an individual SCADA system</i>	<i>There is no SCADA system or ICT based system for maintenance and monitoring of Infrastructure</i>

Sectors	Parameter	Assessment Scale		
		Resilient	Moderately Resilient	Vulnerable
Housing	Housing Gap in the city	<i>The city has a negligible housing gap or has identified projects to bridge the gap</i>	<i>The city has prepared a policy to cater to the housing gap</i>	<i>The city does not have any policy to address the housing gap</i>
	Availability of temporary shelter (Rental Housing, Hostels, Dormitories) and relief areas	<i>Adequate provision (based upon housing assessment) for temporary shelters and relief areas</i>	<i>Inadequate provision for temporary shelter but have policy/plan to provide adequate temporary shelter</i>	<i>The city does not have any policy for the provision of temporary shelter</i>
Accessibility	Inclusive and multi-modal transport networks and facilities	<i>Accessibility to all parts of the city through multi-modal transport networks</i>	<i>Accessibility to a few parts of the city through multi-modal transport networks</i>	<i>The city does not have a multi-modal transport network</i>
	Walkability	<i>Availability of pedestrian-friendly infrastructure across the city along with a plan to improve walkability in the city</i>	<i>Availability of pedestrian-friendly infrastructure in a few parts of the city along with a plan to improve walkability in the city</i>	<i>The city does not have any plan to improve walkability in the city.</i>
Built Environment	Use of resilient building materials and construction technology	<i>Promoting the use of resilient material and building technology through policy, programs and incentives</i>	<i>Promoting the use of resilient material and building technology through policies</i>	<i>No policy for promoting the use of resilient material and building technology</i>

Sectors	Parameter	Assessment Scale		
		Resilient	Moderately Resilient	Vulnerable
Disaster management and Resilience Policies	Disaster Management Plans	<i>Emergency planning with an operation plan that integrates different agencies and organizations</i>	<i>Emergency planning with an operation plan without integration plan</i>	<i>Emergency planning without any operation plan</i>
	Design guidelines and norms for disaster resilient buildings	<i>Incorporate design guidelines and norms for all possible disasters in the development regulations</i>	<i>Incorporate design guidelines and norms for few disasters in the development regulations</i>	<i>Do not have provisions of disaster-resilient design or norms</i>

---

Given the scale of challenges associated with urbanization that are aggravating the vulnerability of cities to shocks and stresses, and the recent initiatives of the Government of India like the Climate Smart City Assessment Framework, there is a need to embed resilience within the urban planning discourse with a people-centric approach. The three important areas that need to be addressed are<sup>32</sup>:

1. Mainstreaming resilience into national urban policies, infrastructure investment programmes and city planning processes
2. Bringing together different stakeholders to champion and prioritize the urban resilience agenda
3. Informed decision-making through data-driven governance and performance monitoring

---

<sup>32</sup> Mainstreaming Urban Resilience – Lessons from Indian Cities; National Institute of Urban Affairs; The Energy and Resources Institute (TERI), 2020

---

# ANNEXURE

## Annexure 1: New inclusions in the URDPFI Guidelines 2014

### VOLUME 1

#### Chapter 1: INTRODUCTION

- The Planning Scenario
- Information for the users
- Revised Classification of Urban Settlements
- Revised Recommended Planning System with its Scope and purpose of various plans
- Sustainable Urban & Regional Development covering
  - State land utilisation policy,
  - Land transport integration, & TOD
  - Focus on regional planning,
  - Flexibility in plans and speeding the process of planning and implementation

#### Chapter 2: PLAN FORMULATION

- Plan formulation process- site needs
- Stage of Vision Development
- Preparation of Alternative Concept Plans
- Importance of Statutory obligations
- Parameters for Inclusive planning
- People's participation – e-platform, consultation at various stages, low cost alternatives
- Key Parameters for evaluation of plan at various stages
- Contents of the new Plan including provisions from JnNURM CDP toolkit, guidelines and toolkit for urban transport development, CSP Manual, RAY guidelines

6

#### Chapter 3: RESOURCE MOBILISATION FOR PLAN IMPLEMENTATION

- Land assembly - Guided land development
- Innovative approaches for fiscal resource mobilisation including
  - Bilateral & multilateral agencies
  - Pooled Finance development fund scheme by GoI
  - Municipal bonds/debentures
  - PPP
  - FDI
- Existing Trend of Municipal expenditure pattern
- Private sector participation including
  - Systems of participation,
  - Possible roles of PPP in urban development process,
  - Toolkit for decision making for PPP
- City Infrastructure Fund
- Good Governance
- Institutional set up of TCP departments at State level, DPC's , ULB's
- Team requirement for plan formulation
- Institutional reforms
  - Urban- Regional Planning Development Regulatory Authority
  - Grievance Redressal system

---

## Chapter 4: REGIONAL PLANNING APPROACH

- Aspects of regional planning
- Planning regions in India
  - Administrative regions (District and Metropolitan regions)
  - Investment regions
  - Special regions (eco sensitive areas, socio economic sensitive areas)
- Framework for Kolkata Metropolitan Planning Committee
- Planning process for various planning regions, peri urban areas, village planning
- Criteria and techniques for area delineation
- Land use classification for regional planning
- Members of Regional Planning Board – Inter State Administrative set-up

## CHAPTER 5: URBAN PLANNING APPROACH

- Socio-Economic Profile of a city
- Urban planning approach for Green city, Compact city (TOD, intensive use of land) and SMART city
- Approaches for planning based on city typologies – Hill city, inner city, industrial city, heritage/religious/tourism city, port city, medi-city, sports city,
- Integrated townships - Space allocation/ land use mix for parks/ townships on the basis of HP, Rajasthan, Gujarat Integrated Township Policy
- Affordable Housing
- Special area planning- integration of Cantonment area planning

8

## Chapter 6: SUSTAINABILITY GUIDELINES

- Guidelines for Sustainability and Urban Development
  - Generic Energy Efficiency Guidelines- Energy efficiency
  - Urban Transport & infrastructure
- Impact of climate change (Green Building, Climate proofing, Resilience strategy)
- Bio diversity index and indicators
- Environment Policies and Statutory Obligations -
  - National Environment Policy 2006
  - EIA Notification 2006
  - Environment Protection Act 1986
  - Forest Conservation Act 1980
  - Strategic plan for new and renewable energy sector for the period 2011-17, MNRE
- Environment Guidelines for -
  - Environmental Guidelines for Industries
  - Guidelines for Rain Water Harvesting
  - Guidelines for Buffer Zones for various types of development
  - Environmental Guidelines for Planning Eco fragile zones
  - Eco fragile zones
    - CRZ Notification
    - Eco sensitive zones around protected areas; national parks and wildlife sanctuaries
    - Water bodies in urban areas, - Advisory Report for Conservation and Restoration of Water Bodies in Urban Areas' & Repair, Renovation & Restoration (RRR)
    - National Environmental Policy 2006, MOEF - desert areas & wet lands,
    - Hilly areas

- Disaster Management
  - Institutional set up
  - **National Disaster Management Guidelines**
  - **State Disaster Management Plan**
  - **District Disaster Management Plan**

▪Flood Management	▪Chemical (terrorism) Disasters (CTD) Management
▪Earthquake Management	▪Chemical (industrial) Disaster Management
▪Drought Management	▪Nuclear & Radiological Disaster Management
▪Cyclones Management	▪Fire Services Management
▪Tsunami Management	
▪Landslides/ Snow Avalanches Management	
▪Urban Flooding Management	

- **Prevention, preparedness and mitigation**
- **Capacity Building**
- **Response Mechanisms:** National Disaster Response Force
- **Response & Relief:** Psycho-Social Support and Mental Health Services, medical preparedness

## Chapter 7: SIMPLIFIED PLANNING TECHNIQUES

- Data Checklist and Data collection techniques – primary and secondary data collection techniques
- Types of surveys –
  - socio economic survey
  - land use survey
  - density survey
  - infrastructure survey
  - transportation survey
- Carrying capacity - Process of using Carrying Capacity for Urban and Regional planning, Case Study and Methodology for measuring Tourism Carrying Capacity
- Threshold analysis – methodology
- Land suitability analysis – factors & methodology
- Population projection techniques
- Scale of the planning system
- Data Collection Information checklist with updated sources
- Methodology of Base map and Development Plan Preparation including *Bhuvan* GIS application for planning
- Smart City application using *Bhuvan*

---

## Chapter 8: INFRASTRUCTURE PLANNING - PHYSICAL INFRASTRUCTURE

- **Water supply**
  - 24X7 supply
  - district area meter planning
  - leakage control
  - water quality standards- permissible limits (ISO)
  - Land requirement for Water Supply System
- **Sewage and Sanitation**
  - National Urban Sanitation Policy
  - Recommended design period for sewerage systems components
  - Decentralized wastewater management system – decision tree
  - Effluent standards - norms for sewage & its use
  - Recycling of Waste Water (Facts Sheet for Various Treatment Process)
  - Septage management (Guidelines for the selection of system)
  - Recommended Norms for public toilets in public area
- **Drainage**
  - Methods for Estimation of Storm water runoff
  - Rain water harvesting including requirements of artificial recharge, techniques
- **Electricity**
  - National Electricity Policy 2005 - recommended consumption levels
- **Solid waste management**
  - Systematic process
  - Solid Waste Treatment Technologies & comparison
  - Disposal of Waste - Landfill Gas Extraction (LFG), Regional Solid Waste Management
  - Construction Waste
  - Specific Waste Handling- Nuclear or Radioactive Waste, E-Waste, Bio Medical Waste,
- **Domestic gas supply pipelines**
- **Service level benchmarking for infrastructure**

---

## Chapter 8: INFRASTRUCTURE PLANNING (contd.) -SOCIAL INFRASTRUCTURE

- Provision of infrastructure- hierarchy, proximity, multiple uses, utilisation threshold, self-sufficiency
- Health Care Facilities –As per the Indian Public Health Standards (IPHS), 2012, NBC 2005 Part 3 and MPD 2021
- Social infrastructure norms as per NBC 2005 for:
  - Open spaces
  - Sports facilities
  - Distribution services
  - Police, civil defence and home guards
  - Norms for safety facilities
  - Norms for Commercial Centres
- Planning norms for Urban street vendors
- Norms for cremation/ burial ground, banking facilities
- Planning for *mandis* & wholesale agricultural produce markets, livestock management/ animal management center
- Provisions for hilly areas- NBC 2005, TCPO Draft Indian Standard for Development Planning in Hilly Areas
- Access provisions for Barrier Free Built Environment

## Chapter 8: INFRASTRUCTURE PLANNING (contd.) - TRANSPORTATION PLANNING

- Design considerations for urban roads, footpaths, cycle tracks, design service volume
- Parking based on land use type
- Travel Demand modelling – detailed process
- MRT options for the city including technical parameters for public transport options, Technical Parameters of Public Transport Options
- Urban buses & characteristics
- TOD norms
  - Demarcation of influence zone
  - Development Types within Influence Zones
  - Influence Zone Plan
  - Redevelopment Criteria and Minimum Project Size Criteria,
  - TOD Development Control Norms
- Provisions for promoting Non Motorized vehicles
- Inland Water Transportation- National Transport Policy Committee (1980) recommended the principles for declaration of a National Waterway
- Airport planning- Approximate Land Requirement for Airport infrastructure, Unit area norms for Airport Terminal

---

## **Chapter 9: SIMPLIFIED DEVELOPMENT PROMOTION REGULATIONS**

- Revised urban land use classification
- Revised plot requirement regulations in land use zones as per NBC (setbacks based on abutting road widths, rear and side setback, distance from electrical lines)
- Norms for low income housing
- Revisions and inclusions in development promotion regulations for specific land use zones
- Special requirements for barrier free built environment for disabled and elderly persons
- Gender specific planning
- Building norms for Natural Habitat
- Form Based Codes

## **VOLUME II**

### **Chapter 1: Implications of 74th Constitution Amendment Act**

- Provisions of 74<sup>th</sup> Constitution Amendment Act
- New Roles and Functions of State Town and Country Planning Department
- Status of the Provisions of 74<sup>th</sup> CAA on Urban Local Bodies
- Implications on Development Authorities/ Boards

### **Chapter 2: The Right to Fair Compensation and Transparency in LAAR Act, 2013**

- Basis of the new Act
- Key Features

### **Chapter 3: Model Regional and Town Planning and Development Law, 1985**

- Key features
- Suggested modifications in the law

### **Chapter 4: Model Municipal Law , 2003**

- Key features
- Suggested changes in the Law

### **Chapter 5: State Level Planning – Existing Legal Framework**

- Key features of various state level legislations – Maharashtra, HP, TN, Gujarat, Karnataka, Bihar, Mizoram

---

## **Chapter 6: Legal Requirements for Industrial Development**

- Industries (Development and Regulation) Act, 1951
- Industrial Policy, 1991
- Policy for Foreign Direct Investment
- Manufacturing Policy and Guidelines including
  - National Manufacturing Policy 2011
  - NIMZ Guidelines
  - SEZ Act 2005
  - Scheme for cluster development under Ministries

## **Chapter 7: Other National Level – Legal Requirements**

- National Heritage Conservation including AMASR Act 2010
- National Environmental Legal Requirements, including
  - EIA Notification 2006
  - Environment Protection Act 1986
  - Forest Conservation Act 1980
- Coastal Regulation Zone, 2011
- Eco-Sensitive Zones

---

## BIBLIOGRAPHY

- Alyse Nelson, City of Water, Stockholm, Sweden. Accessed in July 2020 <<https://docplayer.net/47172387-Stockholm-sweden-alyse-nelson-city-of-water.html>>
- Anna Kaczorowska, Ecosystem Services and Urban Resilience – Case of Stockholm 50<sup>th</sup> ISOCARP Congress 2014, Gdynia.
- ARUP & Rockefeller Foundation, 2015. City Resilience Framework, December 2015
- Barcelona: Nature-based Solutions (NBS) Enhancing Resilience to Climate Change. Accessed in July 2020, <<https://oppla.eu/casestudy/17283>>
- Barcelona City Council Barcelona, February 2015. Barcelona, a city committed to the environment.
- Councillor of Environment and Urban Services - Urban Habitat. Barcelona City Council, 2013. Barcelona green infrastructure and biodiversity plan 2020
- Cities Alliance, N-AERUS Working Groups, 2016. Recommendations for the New Urban Agenda.
- DFID, ARUP & IOM, 2017. Flood Resilient Shelter in Pakistan Phase 2: Evidence-Based Research.
- Desai, B., Sindhu, B., & Kumari, N. (2019). Sustainable Cities in India: A Governance Challenge. Yearbook of International Environmental Law.
- European Commission (EU), 2014. Building Resilience: The EU's Approach.
- European Commission (EU), Resilient Europe- 2016. Urban Resilience A concept for co-creating cities of the future.
- Fraunhofer IAO, 2016 City Lab Lisbon – Executive Summary
- Gonsalves, C. (2013). Framework and Indicators to Measure Urban Resilience. Retrieved July 17, 2020, from <<https://www.researchgate.net>>
- Gopinath, D. D. (2010, April). Emerging spatial planning systems in the global south: A case study of India.
- Indian Institute for Human Settlements, Urban Risks and Resilience in India. <<http://imd.gov.in/section/nhac/wxfaq.pdf>>
- IIED, Rockefeller Foundation, ACCCRN, Teri-2013. Urban Climate Resilience: A review of the methodologies adopted under the ACCCRN initiative in Indian cities, IIED, December 2013.
- IIED, November 2013. A framework for mainstreaming climate resilience into development planning, IIED Working Paper, Climate Change.
- Living with water: integrating blue, green and grey infrastructure to manage urban floods, 2020. Accessed in September 2020.<<https://wricitiesindia.org/content/living-water-integrating-blue-green-and-grey-infrastructure-manage-urban-floods>>
- National Disaster Management Plan, 2016. A publication of the National Disaster Management Authority, Government of India. May 2016.
- NIUA & TERI (2020). Mainstreaming Urban Resilience: Lessons from Indian cities. Policy Brief. New Delhi.
- Pune Municipal Corporation. Pune Resilience Strategy. Retrieved September 21, 2020. <<https://www.pmc.gov.in/sites/default/files/pune-resilience-strategy.pdf>>
- Samuels, Sophia and Karasapan, Altinay, 2014. Copenhagen: a Case Study of one of the Most Sustainable Cities in the World. CLAS: Colby Liberal Arts Symposium.
- TERI, 2011. Mainstreaming Urban Resilience Planning in Indian Cities: A Policy Perspective. A Report prepared for the Asian Cities Climate Change Resilience Network (ACCCRN) in India.
- UNHABITAT, 2020. Participatory Incremental Urban Planning
- United Nations, 2019. Department of Economic and Social Affairs, 2018. World Urbanization Prospects, The 2018 Revision
- United Nations, 2020. Shared Responsibility, Global Solidarity: Responding to the socio-economic impacts of COVID-19

- 
- Urban Development and Urban Housing Department-2019. Ahmedabad Revised Development Plan 2021
  - UNDP-IIHS Working Paper on Integrated Planning for Development. A Framework of Urban Resilience Planning
  - UNDRR 2019. Making Cities Resilient Report 2019: A snapshot of how local governments progress in reducing disaster risks in alignment with the Sendai Framework for Disaster Risk Reduction. United Nation
  - World Bank. 2019. Building Urban Resilience: An Evaluation of the World Bank Group’s Evolving Experience (2007–17). Independent Evaluation Group. Washington, DC: World Bank.
  - Wilkinson, C. & Porter, Libby & Colding, Johan. (2010). Metropolitan planning and resilience thinking: A practitioner's perspective. *Critical Planning*. 17. 2-20.
  - Y.Yamagata and A. Sharifi, February 2018. Resilience-Oriented Urban Planning <[https://www.researchgate.net/publication/323281125\\_Resilience-Oriented\\_Urban\\_Planning](https://www.researchgate.net/publication/323281125_Resilience-Oriented_Urban_Planning)>