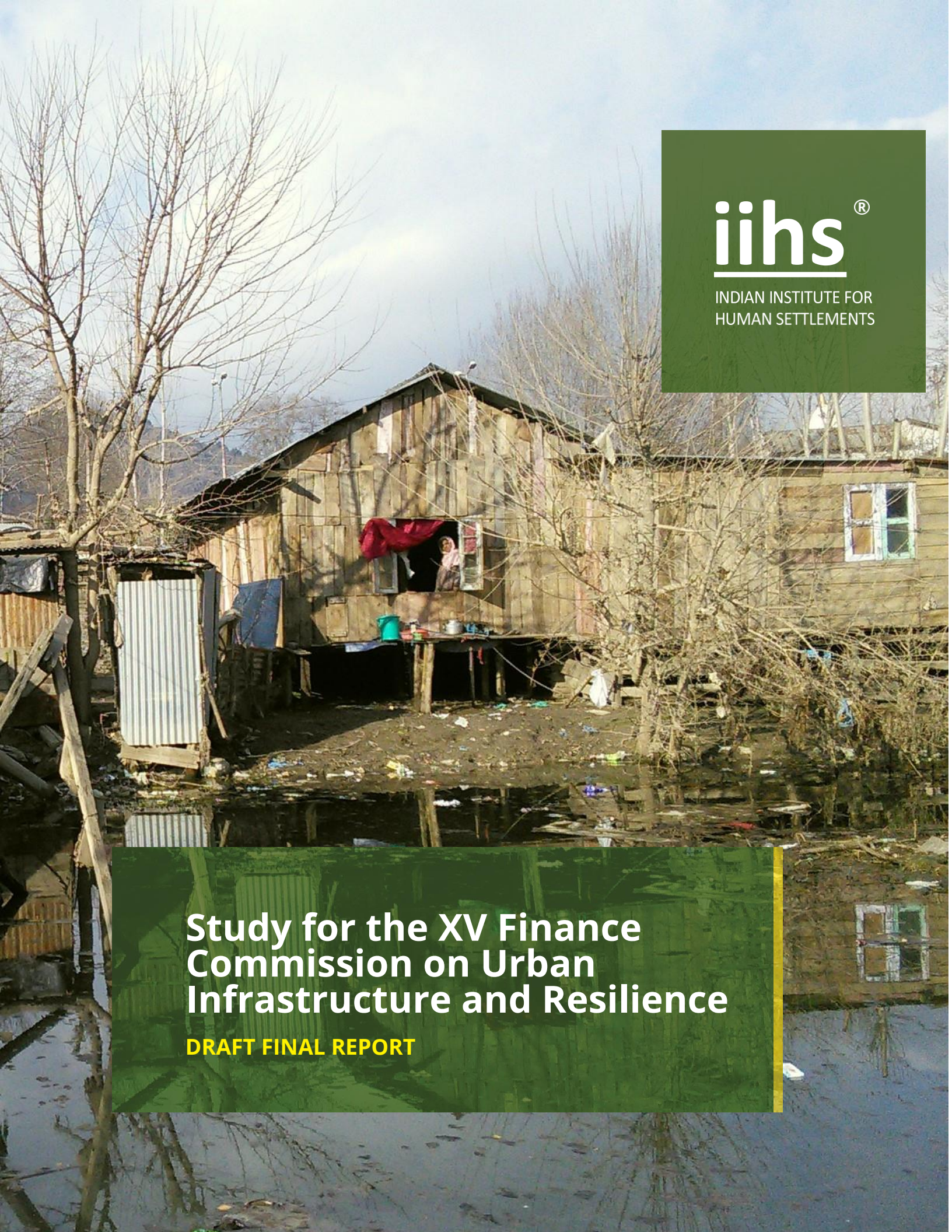

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Study for the XV Finance Commission on Urban Infrastructure and Resilience

DRAFT FINAL REPORT

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ASDMA	Assam State Disaster Management Authority
AUWSP	Accelerated Urban Water Supply Programme
BSUP	Basic Services for Urban Poor
BIS	Bureau of Indian Standards
CAG	Comptroller and Auditor General
CAGR	Compounded Annual Growth Rate
CDMP	City Disaster Management Plan
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSR	Corporate Social Responsibility
CSS	Centrally Sponsored Scheme
DM	Disaster Management
NDRF	National Disaster Response Fund
NDMA	National Disaster Management Authority
NDMF	National Disaster Mitigation Fund
NIDM	National Institute of Disaster Management
FC	Finance Commission (refers to Central Finance Commission)
GIS	Geographic Information System
GoI	Government of India
HPEC	High Powered Expert Committee on Urban Infrastructure
HRIDAY	Heritage City Development and Augmentation Yojana
HRVA	Hazard Risk and Vulnerability Assessment
IDSMT	Integrated Development of Small and Medium Towns
IHSDP	Integrated Housing and Slum Development Programme
IIHS	Indian Institute for Human Settlements
Lpcd	Litres per capita per day
O&M	Operation and Maintenance
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
MoUD	Ministry of Urban Development
MoHUA	Ministry of Housing and Urban Affairs
MoF	Ministry of Finance
MC	Municipal Corporation
PMAY	Pradhan Mantri Awas Yojana
SBM	Swachh Bharat Mission
SDMA	State Disaster Management Authority
TANGEDCO	Tamil Nadu Generation and Distribution Company Ltd.
UA	Urban Agglomeration
UIDSSMT	Urban Infrastructure Development in Small and Medium Towns
UIG	Urban Infrastructure and Governance
ULBs	Urban Local Bodies
VAMBAY	Valmiki Ambedkar Awas Yojana

Executive Summary

India has been rapidly urbanising since 1991, with significant economic and demographic changes in urban areas.[1] The urban population as per Census 1991 was 217 million, which increased to 285 million in 2001. Census 2011 reported the urban population as 377 million—a third of India's population—living in about 8,000 urban centres. Several studies including the World Urbanisation Prospects (UN, 2014) projects India's urban population to double by 2040 from 2014 levels, taking the total to about 800 million.[2] The GDP growth rate between 1970 and 2011 was about 6 per cent per annum in urban areas compared to 4.5 per cent in rural areas. The GDP from urban areas was estimated to be over 55 per cent of the national GDP in 2011,[3] and it is predicted to increase to over 77 per cent by 2030.[4]

Over the last three decades, rapid population growth, high building densities, increasing poverty and inequities in access to housing, and public services and infrastructure, have led to an increase in vulnerability in India's urban areas.[5] Climate change is expected to increase the frequency and intensity of hazards and the probability of extreme events, and spur the emergence of new hazards (e.g. sea-level rise), with differential spatial and socioeconomic impacts. Disaster risk in Indian cities is associated more with vulnerability than with hazard exposure.[6] Continuing with a business-as-usual development trajectory can further degrade the resilience of poor and vulnerable communities and compound risks in urban areas, potentially impacting quality of life and development prospects.[5]

While urban growth has positive impacts on the economy and employment, it also concentrates risks in urban areas due to their high population density, increased exposure and vulnerability. Cities are also exposed spatially to higher risks from natural and climate change related hazards, which are often highly spatially differentiated[6]. This necessitates robust planning, preparedness, and mitigation practices to address both vulnerability arising out of infrastructure gaps and service deficits, and emergency preparedness to enhance urban resilience.

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[1] Revi, A et al. (2011). Urban India 2011: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/9789350674307

[2] United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, Highlights https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.pdf

[3] Service sector growth in India, India Budget, 2011. https://www.indiabudget.gov.in/budget2012-2013/es2011-12/echap-10.pdf accessed on July 2018

[4] Sankhe et al. McKenzie Global Institute (2010) India's urban awakening; Building inclusive cities, sustaining economic growth https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Urban%20awakening%20in%20India/MGI_Indias_urban_awakening_full_report.ashx

[5] Mukhopadhyay, P., & Revi, A. (2009). Keeping India's economic engine going: climate change and the urbanisation question. Economic and Political Weekly, 59-70. . https://www.epw.in/journal/2009/31/climate-change-negotiations-special-issues-specials/keeping-indias-economic-engine

[6] Revi, A. (2008). Climate change risk: an adaptation and mitigation agenda for Indian cities. Environment and Urbanization, 20(1), 207-229. https://journals.sagepub.com/doi/pdf/10.1177/0956247808089157

Recent disasters in urban areas, such as the floods in Chennai in 2015, Srinagar in 2014, Kochi in 2018, and very severe cyclonic storms, particularly Hudhud in 2014, in Visakhapatnam had severe impacts on the economy and infrastructure of these cities with losses running into several thousand crores. Failure of lifeline infrastructure, poor and damaged building infrastructure, poor planning and inadequate preparedness are key drivers of loss of life and economic losses caused by disasters.[7] The High Powered Expert Committee (HPEC) on urban infrastructure in its report identifies a massive need for infrastructure investment from 2011 to 2030.[8] It is important to recognise that these investments need to be risk-informed, if development outcomes including the SDGs are to be achieved.[9]

The Urban Local Bodies (ULBs) play an important role in urban development, with several important functions relevant to urban infrastructure and resilience having been delegated, as per the 12th Schedule of the 74th Constitutional Amendment. Recognising the weak financial situation of the ULBs and the importance of financing them, the Finance Commissions in the past, beginning with the Tenth Finance Commission (FC), made direct allocations under the grants-in-aid to improve urban infrastructure and services. The Thirteenth FC made a total recommendation of ULB transfers of Rs. 23,111 crore. The Fourteenth FC increased it to Rs. 87,143 crore, considering population growth and incremental infrastructure needs.

This study presented to the Fifteenth FC aligns with the following Terms of Reference (ToR), as per the ToR defined by the Government of India, with a focus on understanding the current state of urban risk and resilience and thereby, making recommendations that could help enhance disaster resilience in urban areas:

- Review the present arrangements as regards the financing of Disaster Management (DM) with reference to the funds constituted under the Disaster Management Act, 2005, and make appropriate recommendations thereon (ToR Section 6).
- Consider proposing measurable performance-based incentives for States at the appropriate level of government, based on achievements in implementation of flagship schemes of the Government of India, disaster resilient infrastructure, sustainable development goals, and quality of expenditure (ToR Section 4 (iii)).
- Make provision of grants-in-aid to local bodies for basic services, including quality human resources, and implementation of performance grant system to improve delivery of services (Section 4 (vi)).

[7] Jain, G and Amir Bazaz (2016) Urban Risk and Resilience in India. IIHS working paper. http://iihs.co.in/knowledge-gateway/wp-content/uploads/2017/10/Urban-Risk-and-Resilience-in-India.pdf
[8] HPEC (2011) Report on Indian urban infrastructure and services http://icrier.org/pdf/FinalReport-hpec.pdf
[9] Jain, G et al. (2018). Localising SDGs for India. IIHS, Bengaluru. https://doi.org/10.24943/sdgsindia.2018

The Indian Institute for Human Settlements (IIHS) has conducted this study for the Fifteenth FC, focusing on urban infrastructure and resilience. The study examines the hypothesis that hazard risk and vulnerability, and financial and institutional capacities of ULBs vary considerably across cities and hence the States. The hypothesis is tested on six selected cities: Kochi, Chennai, Visakhapatnam, Patna, Guwahati and Shimla.

This study finds evidence to show that risk exposure levels vary considerably, having analysed infrastructure gaps, disaster risk reduction and resilience initiatives and financial strengths of the six ULBs. This included contributions made by the FC and Centrally Sponsored Schemes (CSS) to urban infrastructure and resilience.

Hence, FC financial allocations to ULBS should ideally be planned in accordance with the levels and extent of hazard risk, and in recognition of varying financial and institutional capacities of ULBs.

In consultation with the FC, this study selected six cities to examine in detail: Shimla, Patna, Guwahati, Visakhapatnam, Kochi and Chennai, considering geographical variation, population and city size and diverse hazard exposure. The following key parameters were assessed:

- Urban population growth from Census 2011 and IIHS analysis of projected population in 2017;[10]
- Infrastructure gaps and various resilience initiatives;
- State of municipal finances (2012-13 to 2016-17): specifically, revenue and expenditure related to Capital and Operation and Maintenance (O&M);
- The potential contribution of CSS resources to urban infrastructure development and resilience.

The analysis of urban growth and land use in the six cities showed that population growth was highest in peri-urban areas. Kochi, for example, showed high population growth (as per Census 2011 data) of over 34 per cent in nine municipalities and 45 census towns in the periphery of the Kochi Municipal Corporation.

An increase in built-up areas has significantly altered the land use in these cities, as revealed from remote sensing and Geographic Information System analysis done by IIHS.[11] In Chennai, over 20 per cent of open spaces, vegetation and water bodies have been converted to buildings between 2001 and 2017. An increase in the built-up areas in flood prone regions and linked land use changes have increased flood risks, as experienced in multiple events across urban regions.

[10] Revi, et al. (2015). Urban India 2015: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2015

[11] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

Infrastructure gaps in these cities were analysed from Census 2011 data and AMRUT Service Level Improvement Plan (SLIP) reports; particularly for water supply, sewerage and storm water drainage. The analysis shows high infrastructure gaps compared to established MoUD benchmarks. Household level water supply and sewerage coverage ranged from 50 to 80 per cent across six cities, but storm water drains along the major roads provided less than 50 percent coverage. Little data was available to analyse infrastructure provisioning for roads and power at the city level. There was also poor data on health facilities like primary health centres as per Census 2011. However, with the expansion of the National Urban Health Mission, it was noted that most cities now have improved primary health centres per 50,000 population.[12]

On urban governance, it was observed that several constitutional ULB functions under the 12th Schedule had not been transferred. Several parastatal bodies such as the Chennai Metropolitan Water Supply and Sewerage Board and Greater Kochi Development Authority, for example, are executing the constitutional and statutory functions of these ULBs.

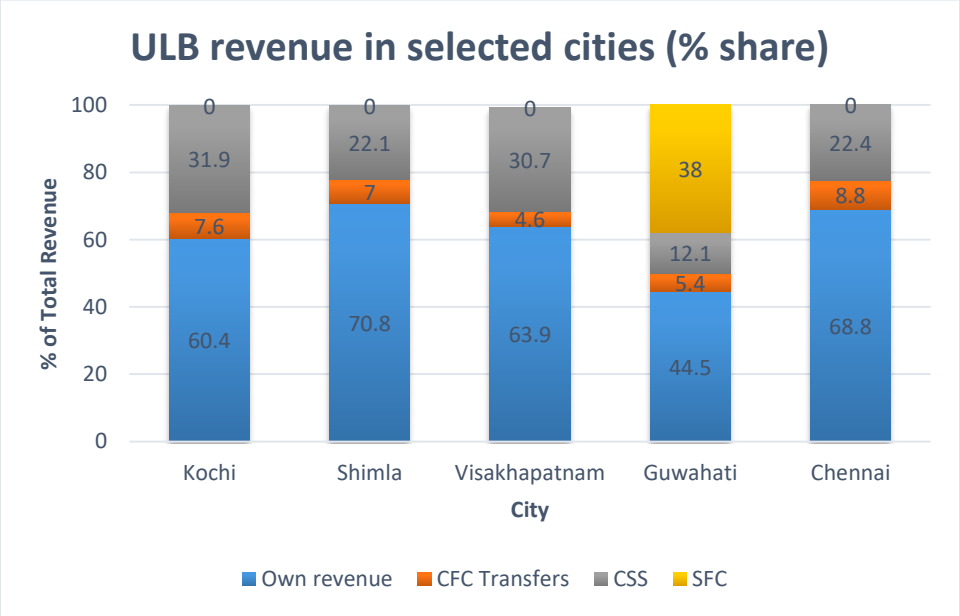
On disaster management and resilience initiatives, it was observed that most cities except Kochi have recently prepared Disaster Management (DM) plans. Yet, city-level Hazard Risk Vulnerability Assessment (HRVA) were available only for Visakhapatnam, Shimla and Guwahati. On emergency preparedness and institutional capacity, several gaps were found from a review of ULB and CAG audit reports. The CAG audit report on floods in Chennai showed gaps in Early Warning Systems, preparedness of district emergency operation centres, communication equipment as well as a lack of training and awareness within local communities. All cities have prepared a Land Use Master Plan till 2025. However, there is limited evidence of these development plans considering city HRVA analysis

The finances of the ULBs in the six cities were analysed using budget data for the period 2012-2017. Budgets were classified into revenue receipts and expenditure, with revenue receipts being further classified into sections of own revenue, own non-revenue, assigned revenue (including from state and centrally sponsored schemes) and Finance Commission transfers. Expenditure was classified into categories of establishment (including salaries), operation and maintenance (O&M) and others.

The results showed that the bulk of revenue and receipts in all the six cities were from own revenue, with Patna having the lowest at 33 per cent and Shimla the highest at 70 per cent calculated on a five-year average. The per capita contribution to own revenue also varied across the six cities from as low as Rs. 65 crore for Guwahati (Rs. 694 per capita) and as high as Rs. 631 crore for Visakhapatnam (Rs. 3,684 per capita).

[12] From the respective websites of the six city ULBs.

Central FC transfers contribute about 4-10 per cent of revenue receipts on average in the study cities. Centrally Sponsored Scheme and state contributions made up around 20-40 per cent of receipts and varies from an average of Rs. 12 crore for Shimla to Rs. 288 crore for Chennai, or a per capita basis of Rs. 740 and Rs. 626 respectively. Other than for Guwahati there were no transfers to the ULBs by the State FC.



Source: Compiled from an analysis of budget data of the six cities for the period 2012-17 accessed from openbudgetsindia.org in July, 2018

The High Powered Expert Committee (HPEC) report on urban infrastructure investment recommends that the total expenditure on O&M in water supply, sewerage, drainage, roads, street lighting, urban transport and solid waste management should be around Rs. 1,806 per capita per year estimated at 2009-10 prices. It also suggests that a large share of the O&M expenditures on urban infrastructure will have to be met by the ULBs from their own revenue.

This study compared average O&M expenditure in all infrastructure categories in the six study cities for the period 2012-2017, adjusted to 2009-10 prices. In order to compare the expenditure on a per capita basis, the population for 2009 in the six cities was estimated based on Census 2001 and 2011 figures. The average annual per capita expenditure on O&M for the period 2012-17 in all infrastructure categories for the six study cities was observed to be much less than the O&M expenditure recommendations made by the HPEC on a per capita basis at 2009-10 prices.

With regards to annual budgets of the study cities, all showed a budget deficit. About 30-50 per cent of total revenue was spent on O&M while the remaining was largely on

establishment and administration. Vizag and Shimla's expenditure on O&M was close to the HPEC recommendation particularly on water supply, sewerage and storm water drainage. Kochi did not show any O&M expenditure on storm water drains and the expenditure on water supply and sewerage was one-fourth that of the per capita expenditure recommended by the HPEC. Patna and Chennai's O&M expenditure on roads was less than 2 per cent of the total O&M requirements as recommended by the HPEC. With an actual spend of Rs. 15 crore as against a recommended spend of Rs. 80 crore, Guwahati's O&M expenditure in all sectors, on water supply, sewerage and storm water drain, was very poor.

The Chennai floods and the Hudhud cyclone were estimated to have caused loss and damage of over Rs. 10,000 crore, with a huge cost incurred towards restoring power infrastructure.[13] Such losses are high for ULBs to manage. Tamil Nadu received a central government contribution of Rs. 1,241 crore against an allocation of Rs. 3,376 crore towards the State Disaster Response Fund under the Thirteenth FC. The relief funds received by the Chennai Municipal Corporation was only Rs. 395 crore,[14] but the expenditure on reconstruction was higher. According to newspaper reports, the cost of restoring power infrastructure in Chennai post the Vardah cyclone was estimated to be over Rs. 1,000 crore.[15] The State Disaster Response Fund (SDRF) and NDRF are only meant for post-disaster relief expenditure and do not include reconstruction and rehabilitation, nor can they be used for mitigation and preparedness. Therefore, the bulk of the expenditure will have to be borne by the ULBs.

This study shows that the financial position of the six ULBs studied are poor, with each having a high fiscal deficit. Their infrastructure expenditure is also not risk-targeted or focused on resilience building. With the Central FC grants-in-aid, Centrally Sponsored Schemes and State Finance Commission grants covering a range of 10 to 40 per cent of the revenue receipts in these ULBs, **the bulk of ULB expenditure for infrastructure development and resilience building will have to be met from their own revenue. It is thus important for the Fifteenth FC to incentivise ULBs to enhance revenue generation and investments in critical infrastructure, without which resilience building will be close to impossible.** While the present analysis recognises the importance of CFC, SFC and CSS funds in bridging the investment needs, the importance of strengthening the financial position of ULBs and their ability to plan for disaster resilience on a sustainable basis must be reiterated.

[13] TANGEDCO (2017) Disaster Management Plan http://tneb.tnebnet.org/test1/dmpfinal%20combined.pdf accessed on 5 November, 2018

[14] Budget data of Chennai MC accessed at https://openbudgetsindia.org/organization/about/chennai-municipal-corporation on 5 September 2018.

[15] Cyclone Vardah costs Tangedco Rs 1,000 crore. Deccan Chronicle, Dec 17, 2016 https://www.deccanchronicle.com/nation/current-affairs/171216/cyclone-vardah-costs-tangedco-rs-1000-crore.html

The recommendations of this report, based on the analysis in six selected cities, are as follows.

On Vertical Devolution:

The Grants-in-aid, although contributing minimally to the total revenue of the ULBs, make a significant contribution to ULBs with low own-revenue. Hence, vertical devolution by the Fifteenth FC to ULBs should consider:

- Future population growth in urban areas, particularly to account for high-intensity peri-urban growth and pre-emptively taking into account changes in city size classes, balancing current, and future infrastructure investment needs.
- Urban infrastructure and resilience investments as important to reduce future economic losses, and fulfil the economic and livelihood creation role of urban areas.
- Using the HPEC recommendations on per capita investment needs for new urban infrastructure, especially critical infrastructure like storm water drainage, water supply and road networks, in line with city-level key risks and vulnerabilities.
- Strengthen ULB disaster mitigation capacities and incentivise resilience building initiatives, via a National Disaster Mitigation Fund and State Disaster Mitigation Fund. Regional, state and urban HRVAs and disaster mitigation plans, should be funded through earmarked resources from these funds.
- The use of the mitigation funds to strengthen Early Warning Systems and develop long-term plans for managing lifeline infrastructure like cyclone shelters, roads, underground power lines and emergency communication systems.

On Horizontal Devolution:

The Grants-in-aid, should focus on ensuring:

- Reducing loss of life by establishing agile and robust Early Warning and Emergency Response Systems;
- Mitigation of output losses (via robust economic production systems);
- Mitigation of capital losses (by reducing the vulnerability and exposure of buildings, production units, key economic facilities and lifeline infrastructure) and building of long-term resilience, as part of all new infrastructure investments; and
- Building of ULB institutional capacity to raise their own revenue, plan and execute retrofits and new resilient infrastructure and public buildings.

The basic grant-in-aid should provide for:

- An earmarked portion for institutional capacity building;
- Strengthening of emergency preparedness
- Institutionalisation of early warning and monitoring systems.

This could particularly be prioritised for cities with a large population and with high hazard exposure and vulnerability, and weaker financial and institutional capacities, such as the study cities of Guwahati and Patna.

Performance grants on improving own revenue and resilience initiatives

The Fourteenth Finance Commission ULB performance grant criteria included improvements in service level benchmarks, increase in own revenue, and availability of audited accounts with weightages of 50 per cent, 40 per cent and 10 per cent respectively. Since the performance grant was made available only from 2017, there is no detailed data available on the effectiveness of its impact. Past experience, indicates that incentives could encourage ULBs to improve their own revenue situation and institutional performance.

The Fifteenth FC, performance grant component could also be used to incentivise resilience building by:

- Improving ULB own-revenue share with incentivising investments in critical infrastructure;
- Undertaking a hazard risk and vulnerability (HRVA) assessment, with city-specific focus on high hazard risk and exposure and vulnerable sectors and areas;
- Requiring incorporation of HRVA assessments in Land use and Development plans (e.g. Master plans, Zonal plans and Local area plans);
- Preparing resilience and disaster management plans for critical infrastructure;
- Training and capacity building, particularly on emergency preparedness; and
- Effective implementation of Centrally Sponsored Schemes, with particular focus on established guidelines on resilience building.

Improvement in urban infrastructure and resilience via CSSs could be enabled by:

- Scheme implementation guidelines ensuring incorporation of hazard risk and vulnerability assessment (HRVA) in infrastructure plans;
- Targeted and prioritised spending on urban infrastructure in a risk-informed manner, based on city HRVA; and
- Land use planning, building regulations and bye-laws, following national standards and best practices, especially around enforcement.

Structure of the Report

The report is structured into five sections: (i) a review of the recommendations made by the Thirteenth and Fourteenth FCs to the ULBs; (ii) gaps in emergency preparedness in select cities; (iii) a review of ULB finances; and (iv) national schemes in the context of building urban resilience. The fifth section provides recommendations to the XV FC based on the analyses presented in this study.

Section I presents an introduction and overview of urban risk and resilience in the context of India's urbanisation, followed by the recommendations made by the Thirteenth and Fourteenth FC on the ULBs. Next, the effectiveness of the guidelines and performance grants of the FC in improving urban infrastructure and resilience is discussed and the context and methodology of the study are described.

Section II provides general context on urban infrastructure gaps and disaster risk in Indian cities and a detailed analysis of hazard risk, vulnerability, infrastructure and capacity gaps in six selected cities, discussed in relation to recent disaster events.

Section III provides a summary of the detailed analysis completed for the six ULBs on their financial strengths particularly examining their own revenue contribution, infrastructure investments and O&M expenditures in comparison to HPEC recommendations.

Section IV discusses current gaps in guidelines on National schemes such as Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission, Swachh Bharat Mission (SBM) and Pradhan Mantri Awas Yojana (PMAY), and the potential to improve urban infrastructure development and resilience with better guidelines.

Section V presents recommendations to the XV FC on financing and incentivising ULBs to improve their own revenue, increase investments in critical infrastructure and improve resilience.

Section I Introduction and Review of Thirteenth and Fourteenth FC Recommendations to ULBs

India's urbanisation

India's demographic transition and ensuing trends can be analysed from the population data in Census 2011. The criterion used to categorise an area as urban in Census 2011 was as follows: areas with a population of above 5000, where 75 per cent of the male population was engaged in non-agricultural activities; and the density of population was above 400 persons per sq. km. Based on this, Census 2011 identified 7,935 urban settlements, three cities with a population greater than 10 million, and 53 cities with a population greater than 1 million. In all, more than 377 million lived in India's urban areas. Figure 1 shows the spatial distribution of cities and city size classes. Although there are new greenfield cities and special economic zones, the bulk of population growth is in existing cities.

By 2031, it is projected that there will be six cities with a population greater than 10 million and more than 100 cities with a population greater than 1 million.[16] India's largest cities have a significant portion of both population and built-up areas outside their ULB boundary. Urban sprawl analysis by IIHS shows an increasing proportion of built-up areas between 2000 and 2010 and denser peri-urban development.

As the urban sprawl continues, much of the peri-urban and rural areas are brought into the Urban Agglomeration (UA). For example, in Chennai, the Municipal Corporation area was expanded from 176 sq.km to 426 sq. km in 2011, bringing in 42 local bodies like municipalities and town panchayats. Kochi UA showed a population growth of over 34 per cent in 2011 in nine municipalities, 45 census towns and the Kochi Municipal Corporation. A World Urbanisation Prospects (UN, 2014) projects that India would have doubled its urban population to over 800 million by 2040,[17] which could mean more expansion of smaller ULBs to Municipal Corporations and Metropolitan cities.

The increase in urban population growth also corresponds to an increase in the GDP contribution from Indian cities. The urban GDP made up 55 per cent of the total national GDP and was estimated to be around Rs. 28,000 billion in 2011. It grew at an average rate of 6 per cent per annum between 1970 and 2011, while the rural economy grew at 4.5 per cent. More recently the GDP grew at around 9 per cent per year between 2004 and 2011.

[16] Revi, A et al. (2011). Urban India 2011: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/9789350674307

[17] United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, Highlights. https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.pdf

The services sector made up almost 55 per cent of the urban economy in 2011.[18] Figure 2 shows the rural urban split in GDP in India and sector-wise contribution of GDP in urban areas. The concentration of economic activity is also likely to be high in urban areas in future and as a McKinsey report predicts, the national GDP contribution from urban areas could be around 77 per cent by 2040.[19]

[18] Revi, A et al. (2011). Urban India 2011: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/9789350674307

[19] Sankhe et al. McKinsey Global Institute (2010) India's urban awakening; Building inclusive cities, sustaining economic growth https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Urban%20awakening%20in%20India/MGI_Indias_urban_awakening_full_report.ashx

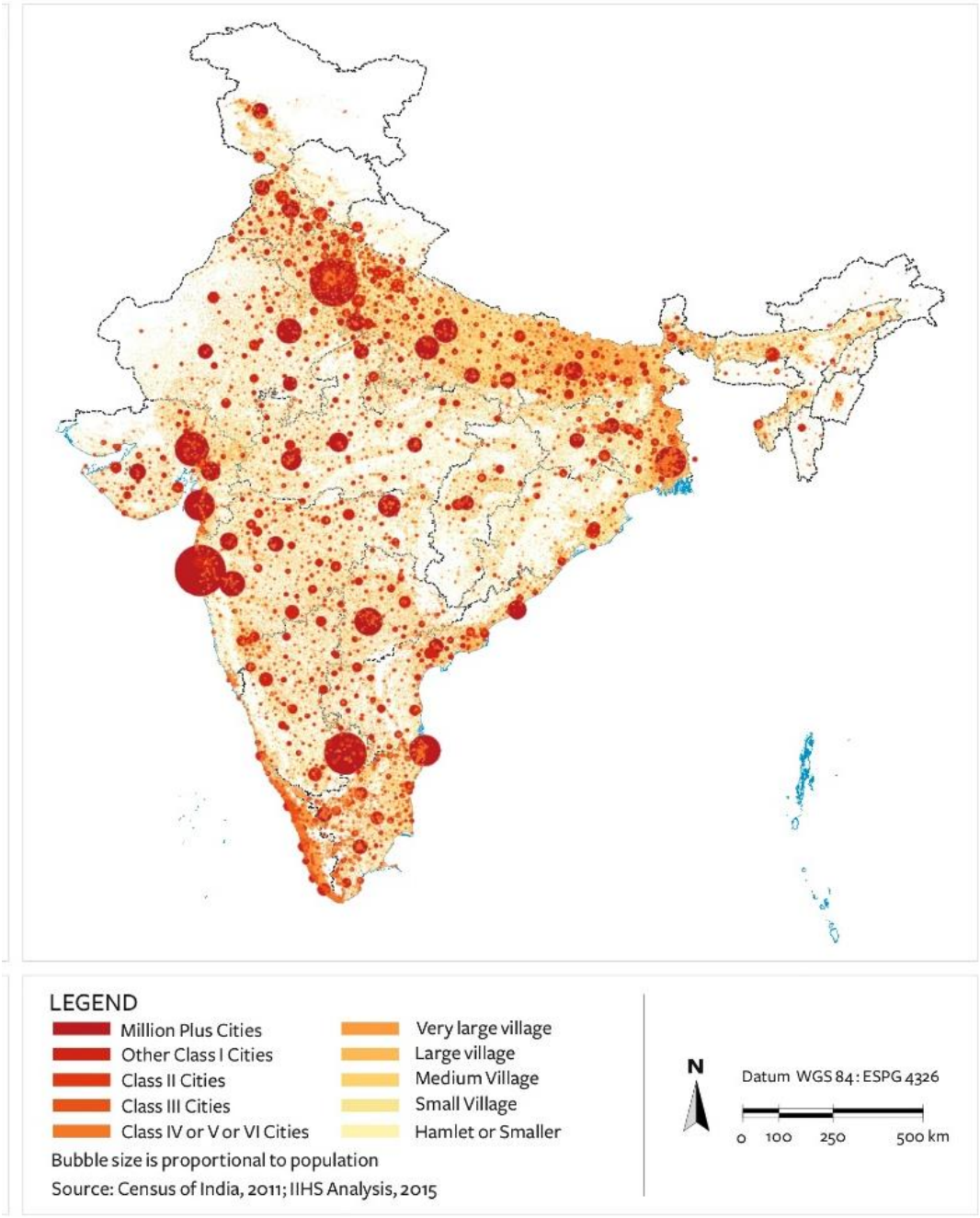


Figure 1: Population distribution in urban areas in 2011
Source: Census of India, 2011 and Revi et al. 2015[20]

[20] Revi, A et al.(2015). Urban India 2015: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2015

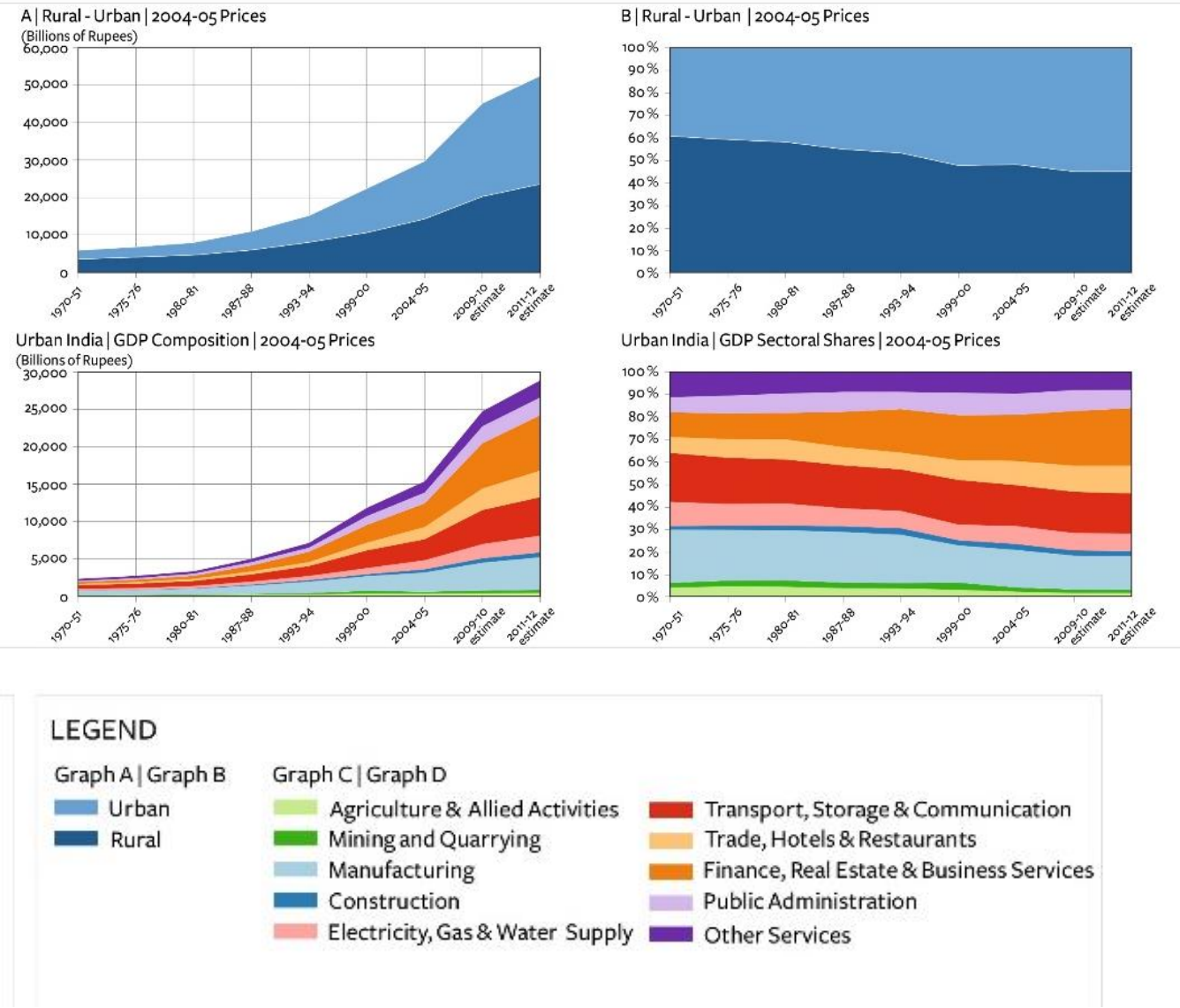


Figure 2: India GDP Rural-Urban split 1970-2011
Source: Central Statistics Office 2001-10 on GDP data and graph from Revi et al. 2011[21]

[21] Revi, A et al. (2011). Urban India 2011: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/9789350674307

Disaster risk and resilience in Indian cities

Increasing urbanisation also increases disaster risk due to increase in the concentration of infrastructure and human population density. Disaster risk is expressed as a combination of hazard, exposure, vulnerability, and adaptive capacity.[22] For example, buildings in high seismic zones, cyclone paths, flood prone areas, particularly inferior quality structures, such as with temporary roofs and walls increase physical vulnerability while low income and lack of basic services increases the social vulnerability in cities. The disaster risk of Indian cities is high due to a combination of hazard exposure, physical and socio-economic vulnerability and other factors such as planning and land use regulations.[23]

Other than planned greenfield cities, urban sprawl around many cities is not planned. Urban growth does not follow Master Plans and they sometimes deviate from preferred land suitability (e.g. Lucknow city).[24] In a situation of unplanned urban growth, the gross negligence of critical areas like natural wetlands, forests and open spaces costs urban areas dearly. In both the Chennai floods of 2015 and the Mumbai floods of 2005, inappropriate land use planning caused natural drainage lines to be blocked.[25]

Poor and inadequate infrastructure development can increase vulnerability at scale.[26] The urban infrastructure that critically affects a city's resilience includes: transport and mobility infrastructure (roads, bridges, railway airports); water, sanitation and storm water infrastructure (water supply, sewerage and drainage networks); public housing; and lifeline infrastructure (including early warning systems, schools, hospitals, public buildings, and communication and power infrastructure).

Risk management is enabled by a range of activities such as improved land use planning, building codes, emergency preparedness and risk mitigation measures including the use of Early Warning Systems. However, the capacities of ULBs in India on emergency

[22] Peduzzi, P et al. (2009). Assessing global exposure and vulnerability towards natural hazards: the Disaster Risk Index. Natural Hazards and Earth System Sciences, 9(4), 1149-1159. https://www.nat-hazards-earth-syst-sci.net/9/1149/2009/

[23] Huq et al. (2007) Reducing risks to cities from disasters and climate change. Environment and Urbanisation. https://journals.sagepub.com/doi/pdf/10.1177/0956247807078058

[24] Dutta, V. (2012). Land use dynamics and peri-urban growth characteristics: Reflections on master plan and urban suitability from a sprawling north Indian city. Environment and Urbanization Asia, 3(2), 277-301. https://journals.sagepub.com/doi/pdf/10.1177/0975425312473226?casa_token=0bPRzi5qRO8AAAAA:xm9kYEALH1JSyZB9Unh830VJMBimb2AI1SCSFl3EJrLklD3SL4ip-gKDd0DTQE3zPfwxh8YPwBtU

[25] Ranger et al. (2011). An assessment of the potential impact of climate change on flood risk in Mumbai. Climatic change, 104(1), 139-167. https://link.springer.com/content/pdf/10.1007/s10584-010-9979-2.pdf

[26] Leichenko, R. (2011). Climate change and urban resilience. Current opinion in environmental sustainability, 3(3), 164-168. https://www.sciencedirect.com/science/article/pii/S1877343510001533

preparedness and resilience building is poor, as observed from the CAG post-disaster audit reports in the case of the Chennai floods in 2015[27] and Srinagar floods in 2014. [28]

The 74th Constitution Amendment Act has empowered ULBs under the 12th Schedule of the Constitution on a range of urban functions including the following: town planning; regulation of land use and construction of buildings, roads, and bridges; the provision of water; public health; and sanitation and solid waste management. However, most ULBs are currently not backed by either adequate finances or the capacity for planning and management.[29]

In India, about 76 per cent of the population is exposed to high-to-medium multi-hazard risks, of which nearly 30 per cent live in the million-plus cities and many small and medium-sized towns, primarily owing to a higher concentration of people and capital investments, increasing socio-economic and physical vulnerabilities, and limited capacities to cope.[30] In addition, the existing infrastructure in most Indian cities is under tremendous stress due to ageing, overuse, and inadequacy, and may pose serious risks to people and urban systems.[31]

Infrastructure gaps

Census 2011 and Service Level Improvement Plans (SLIP) reports for 2014-2015 under the AMRUT scheme were two data sources used to analyse urban infrastructure. According to Census 2011, only 71 per cent of India's urban population has individual water connections with the duration of daily supply ranging from one to six hours, and supply from 37 to 298 litres per capita per day (lpcd).

The 2012 National Sample Survey Office (NSSO) survey notes that only 77 per cent of urban population has individual water connections, only 90 per cent of urban households get

[27] Comptroller and Auditor General of India. Report No. 4 of 2017 accessed on July 2018 at https://cag.gov.in/sites/default/files/audit_report_files/Report_No_4_of_2017_-_Performance_Audit_of_Flood_Management_and_Response_in_Chennai_and_its_Suburban_Area.pdf

[28] Comptroller and Auditor General of India. Report No. 4 of 2016 accessed on July 2018 at https://cag.gov.in/sites/default/files/audit_report_files/Report_No.4_of_2016_-_Performance_Audit_of_Disaster_Management_in_the_State_of_Jammu_and_Kashmir_Government_of_Jammu_and_Kashmir.pdf

[29] Ahluwalia, Isher Judge (2017): Urban governance in India, Journal of Urban Affairs http://dx.doi.org/10.1080/07352166.2016.1271614

[30] Jain, et al, (2015) Cities Provide Transformational Opportunity to Reduce Risk Accumulation. IIHS policy brief. http://iihs.co.in/knowledge-gateway/wp-content/uploads/2015/08/IIHS-RF-Paper-on-Indian-Urban-Risk-and-Resilience_reduced-file-size.pdf

[31] Sankhe et al. McKenzie Global Institute (2010) India's urban awakening; Building inclusive cities, sustainaing economic growth https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Urban%20awakening%20in%20India/MGI_Indias_urban_awakening_full_report.ashx

adequate drinking water; and 95 per cent of households had improved sources of drinking water.[32]

Census 2011 indicates that around 81 per cent of urban households have access to toilet facilities within the household premises, 6 per cent have access to public toilets, and 12 per cent have no access to toilet facilities and are forced to defecate in the open. Little data is available on storm water drainage, which in many urban areas is as low as 20 per cent (AMRUT SLIP reports). Most cities also do not have an effective sewerage system in place; partial sewerage networks are not in place in 4861 cities and towns in India.

The High Powered Expert Committee (HPEC) on urban infrastructure investments estimated that urban infrastructure investment needs in the core eight services of water supply, sewerage, solid waste management, storm water drains, urban roads, urban transport, street lighting and traffic support infrastructure could amount to Rs. 31 lakh crore over a 20-year period.[33] The HPEC report observes that a bulk of the investments in urban infrastructure are yet to be made in India given the projected urban growth. Consequently, there is a danger of long-term 'locking-in' of risks if these infrastructure investments are not risk-informed at the planning stages.[34]

The United Nations Global Assessment Report on Disaster Risks (2015) estimates that India's average annual economic loss due to disasters is likely to be $9.8 billion, which includes more than $7 billion loss on account of floods.[35] The report warns that development would be hindered without adequate state investments in disaster risk reduction (DRR). India has projected a $1 trillion investment in infrastructure in the next five years. Unless adequate steps are taken to make them resilient to floods, earthquake and other hazards this investment is at high risk.

In 2013, a study published in the journal Nature Climate Change, warned of severe economic losses from floods in Kochi, Chennai, Mumbai, Surat and Kolkata.[36] And the predictions were right. Chennai and Kochi reported high losses from damage to infrastructure and housing. The loss incurred by the Kochi International Airport due to

[32] National Sample Survey Office (2013). Key Indicators of Drinking Water, Sanitation, Hygiene and Housing Conditions. NSS 69th Round. Government of India. Accessed on July 2018 at http://mospi.nic.in/sites/default/files/publication_reports/nss_rep_556_14aug14.pdf
[33] HPEC (2011) Report on Indian urban infrastructure and services http://icrier.org/pdf/FinalReport-hpec.pdf
[34] Jain, G and Amir Bazaz (2016) Urban Risk and Resilience in India. IIHS working paper. http://iihs.co.in/knowledge-gateway/wp-content/uploads/2017/10/Urban-Risk-and-Resilience-in-India.pdf
[35] UNISDR (2015). The Pocket GAR 2015. Making Development Sustainable: The Future of Disaster Risk Management. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction (UNISDR) https://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/GAR15_Pocket_EN.pdf
[36] Hallegatte, et al (2013). Future flood losses in major coastal cities. Nature climate change, 3(9), 802. http://www.precaution.org/lib/hallegatte_major_flood_losses_threaten_cities_130815.pdf

floods was reported to be over Rs. 250 crore.[37] The flooded cities have multiple impacts on the economy. In Mumbai the restoration of power supply alone took more than a week's time, and the Srinagar floods had severe economic losses due to damages on both residential, commercial buildings and small-scale industries.[38]

The HPEC report on Indian Urban Infrastructure and Services (HPEC, 2011) has emphasised that India's urbanisation needs will have to be addressed through a combination of increased investments, strengthening the framework for governance and financing, and a comprehensive capacity building programme at all levels of government, particularly the ULBs. As per Census 2011, urban areas are home to around 31 per cent of India's total population (over 377 million people). With the UN report on global urbanisation predicting that India's urban population will double to over 800 million by 2040 (UN, 2014), urgent action to build resilience in urban areas is called for.

Box 1-Resilience: The UNISDR defines resilience as, "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management". This implies that urban areas need a system in place for risk management in addition to just basic infrastructure.

Disaster Relief Financing

India's post disaster relief financing started with the Ninth Finance Commission, when it recommended the setting up of a Calamity Relief Fund (CRF). The size of the fund was decided on the average of the actual ceiling of expenditure approved for a state over a 10-year period ending 1988-89. Seventy-five per cent of the fund was to be contributed to by the Centre and 25 per cent by the States. The Tenth FC recommended the setting up of a National Fund for Calamity Relief to assist any state affected by a calamity of rare severity. The Eleventh FC recommended the setting up of a National Calamity Contingency Fund (NCCF) with an initial corpus of Rs. 500 crore which was to be recouped through the levy of a special surcharge on central taxes. Between 2005 and 2009, the Central Government released Rs. 7,677 crore to many states related to particular calamities, highlighting the

[37] The Hindu Business Line (2018) Kerala floods: Kochi airport suffers estimated loss of over Rs 220 cr https://www.thehindubusinessline.com/economy/logistics/kerala-floods-kochi-airport-suffers-estimated-loss-of-over-rs-220-cr/article24744091.ece

[38] Tabish, S. A., & Nabil, S. (2015). Epic tragedy: Jammu & Kashmir floods: a clarion call. Emerg Med (Los Angel), 5(233), 2. https://www.researchgate.net/profile/S_A_Tabish2/publication/275352676_Epic_Tragedy_Jammu_Kashmir_Floods_A_Clarion_Call/links/5a0b13d50f7e9b0cc02520c9/Epic-Tragedy-Jammu-Kashmir-Floods-A-Clarion-Call.pdf

need for a larger corpus in this fund. The NCCF and CRF are meant exclusively for financing relief work and do not cover the costs of post-disaster recovery or rehabilitation.

The Twelfth FC observed that the CRF scheme was successful in meeting its objectives but, as a closing recommendation, suggested that unspent balances in the CRFs be used to finance State plans if the Thirteenth FC recommended discontinuing the scheme.

The Thirteenth FC recommended that NCCF and CRF be merged into a single entity called the National Disaster Response Fund (NDRF) as of 1 April 2010 and the balance of moneys as of end of FY 2009-10 be transferred to this fund, which was to be used only for post-disaster relief financing. No recommendations were made as regards the establishing of the National Disaster Mitigation Fund (NDMF). The Thirteenth FC advised that mitigation be met from State and National schemes, for which the respective ministries and National Disaster Mitigation Authority (NDMA) suggest recommendations. The NDRF, State DRF (SDRF), District DRF (DDRF) and NDMF were to be established as per the Disaster Management (DM) Act, 2005. The DM Act also shifted the primary responsibility of disaster relief to the States and mandated the establishing of National, State and District Level Disaster Mitigation Funds.

The Thirteenth FC recommended that the NDRF be financed through a levy of a cess on excise and customs duty and approved annually through the Finance Bill. The NDRF at the initiation of the Thirteenth FC period had a substantial corpus from NCCF and CRF transfers. Based on previous FC recommendations and analysing expenditure on calamity relief for the period 2001-08, it recommended Rs. 33,581 crore to SDRF. The horizontal devolution of the funds to the States was made largely based on past disasters and expenditures on relief for the period 2001-08 and adjusting for State GDP and other growth parameters. This would make up the 75 per cent of the SDRF share while the States would contribute the remaining 25 per cent.

In the Fourteenth FC consultations with the State governments, the States that were more vulnerable to disasters had raised the issue of increasing disaster relief financing., The Thirteenth FC found a lack of reliable and periodic data to populate Hazard Risk and Vulnerability Assessments that could underpin a rule-based financing arrangement. It recommended that the corpus of the NDRF should be financed through the levy of cess on selected items including contributions from Corporate Social Responsibility (CSR) initiatives from the private sector. To determine the allocations to SDRF, the Fourteenth FC analysed the relief expenditure for the period 2006-2013 and followed the same methodology as adopted by the Thirteenth FC, arriving at a total figure of Rs. 61,219 crore for all the SDRFs.

Both the Thirteenth and Fourteenth FCs recommended that mitigation and reconstruction activities be met out of overall development plan funds of the Centre and the states, and not be included in the FC grants. The Thirteenth FC recommended that disaster recovery expenditures be met through CSS in disaster affected areas, particularly through schemes

such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Indira Awas Yojana (IAW) and Accelerated Rural Water Supply Programme (ARWSP).

The NDMA strongly urged the Fourteenth FC to recommend the establishment of a Disaster Mitigation Fund as envisaged under the Disaster Management Act, with the states contributing 25 per cent of the corpus to be used exclusively for mitigation projects, cross-cutting themes and gap areas. The Ministry of Finance (MoF) has issued guidelines on 'flexi-funds,' under which 10 per cent of the funds available under GoI CSS can be used for disaster mitigation. However, the Fourteenth FC was unable to make a strong recommendation on the establishment of the National Disaster Mitigation Fund.

The Thirteenth FC also recommended a capacity building grant of Rs. 525 crore and the Fourteenth FC considered the doubling of the capacity building grant to Rs. 1,050 crore. This was to strengthen District Emergency Operation Centres, purchase disaster relief equipment, and to organise capacity building and awareness programmes. Given the importance of mitigating fire hazards the NDMA projected a requirement of Rs. 7,000 crore to the Thirteenth FC for revamping Fire and Emergency Services in the country. The Thirteenth FC recognised the need to restructure Fire and Emergency Services across urban and rural areas of the country and recommended that a portion of the grants provided to the ULBs be spent on revamping of Fire Services within their respective jurisdictions. One of the conditions placed by Thirteenth FC was, “all municipal corporations with a population of more than 1 million (2001 Census) must put in place a fire hazard response and mitigation plan for their respective area” to access the performance grant set by the Commission.

Recommendations by Thirteenth and Fourteenth FC on Urban Infrastructure and Resilience

Article 275 states that the FC shall make allocations of a certain percentage from a divisible pool as grants-in-aid to the ULBs. This process began in 1993 with the Tenth FC awarding a grant of Rs. 1,000 crore, which was then raised to Rs. 2,000 and Rs. 5,000 crore by the Eleventh and Twelfth FCs respectively. With growing urbanisation and the need for more financial resources, the allocation to the ULBs was significantly increased to Rs. 23,111 crore and Rs. 87,143 crore by the Thirteenth and Fourteenth FCs respectively. The Thirteenth FC estimated this at 3 per cent of the divisible pool and the Fourteenth FC used an allocation rate of Rs. 488 per capita.

The horizontal distribution of the ULB grant to the states was weighted as follows: population at 50 per cent; geographical area at 10 per cent; distance from highest per capita income at 20 per cent; index of devolution at 15 per cent; and finance commission grant utilisation index at 5 per cent. The Fourteenth FC allocation criteria simply followed 90:10 weightages for population based on Census 2011 and geographical area. While these criteria accounted for the size class of the city, they did not account for the risk implications

across different cities influenced by hazard exposure, vulnerabilities and infrastructure capacities, and the financial strengths of the ULBs.

The Fourteenth Finance Commission recommended Rs. 87,143 crore to the ULBs for the period 2015-2020. Eighty per cent of this amount was a basic grant and the remaining 20 per cent, a performance grant. The basic grant could be utilised for water supply, sanitation including septage management, sewerage and solid waste management, storm water drainage, maintenance of community assets, maintenance of roads, footpath and street lighting, burial and cremation ground. There was no distinction between operation and maintenance (O&M) and capital expenditure (Capex) within the components of the basic grant. However, it advised that the cost of technical and administrative support towards O&M and Capex should not exceed 10 per cent of the allocation to a Gram Panchayat or Municipality under any circumstance.

The performance grants effective 2011-12 was 0.50 per cent of the divisible pool in the first year and 1 per cent thereafter up to 2014-15. Only those states which met the stipulations outlined could access the performance grant. Eleven conditions were setup by the XIII FC to access the performance grant that included framing a fire hazard response and mitigation plan, increasing own revenue, and conducting an audit of ULB accounts.

The Fourteenth FC continued with the criteria for accessing performance grants, which was set at 20 per cent of the total grant.

The weightage set by the MoUD to access the Fourteenth FC's performance grant was as follows:

- Audit of annual accounts (10 per cent);
- Increase in own revenue (40 per cent); and
- Improvement in service level benchmarks (50 per cent).

The ULBs had to score 60 per cent to access the performance grant (50 per cent in the case of ULBs in Special Category States). The MoUD evaluated and approved the scores for ULBs for the performance grants and the MoF then released the grants. The performance grant system made available reliable data on local bodies' receipt and expenditure through audited accounts and improvement in own revenues. In addition, the ULBs had to measure and publish service level benchmarks for basic services, which would help the local bodies in programme implementation and serve as an effective monitoring mechanism.

Table 1: Summary of Thirteenth and Fourteenth FC Allocations to ULBs

FC	Allocation (crore Rs.)	Vertical distribution	Horizontal distribution
Thirteenth	23,111	3% of total divisible pool	• Population 50% • Area 10% • Per capita income differential 20% • Index of devolution 15% • FC grant utilization index 5%
Fourteenth	87,143	Rs. 488 per capita per year	• 90% based on population (Census, 2011) • 10% on area with (80% basic grant and 20% performance based)

Source: Thirteenth and Fourteenth FC reports, retrieved from https://fincomindia.nic.in/ShowPDFContent.aspx on July, 2018

Considering the limited quantum of the basic grants and hence, limited potential impact in improving urban infrastructure and services, the earlier FC's had recommended the performance grant as way of incentivising the capacity and performance of the ULBs. The Thirteenth and Fourteenth FCs also allocated additional finances to improve fire and emergency services and capacity building. The ToR of the Fifteenth FC also recognises the importance of incentivising the ULBs rather than attempting to finance urban infrastructure and resilience building, with a sub-optimal volume of resources.

Methodology

The recommendations of the Thirteenth and Fourteenth FCs on horizontal devolution of funds to ULBs did not consider the Hazard Risk Vulnerability of cities, infrastructure gaps or the financial capacities of the ULBs, but only urban population and area given that there are severe constraints on data and analysis on disaster risk as has been acknowledged by previous FCs.

It is important to recognise that urban areas are growing in population and size, and the hazard exposure of cities varies along with physical and socioeconomic vulnerability, and the adaptive capacity of the ULBs in terms of revenue generation and investment in infrastructure and resilience building. This study illustrates the need to calibrate resource support considering differences in disaster risks, own revenue for infrastructure

investments and capacities in emergency preparedness using a sample of six cities: Kochi, Chennai, Visakhapatnam, Patna, Guwahati and Shimla (Table 2).

Table 2: Selected Cities for the Study

No.	Select urban areas	Pop. In as per 2011 Census in Million	Terrain	Key Hazards
1	Kochi, Kerala	0.63	Coastal	Cyclone, storm surge, flood, earthquake, tsunami, coastal erosion
2.	Shimla, HP	0.16	Hilly	Earthquake, landslides
3	Guwahati, Assam	0.95	Riverine	Flood, earthquake
4	Visakhapatnam	1.71	Plains	Flood, earthquake
5	Chennai	4.62	Coastal	Cyclone, storm surge, flood, tsunami
6	Patna	1.68	Plains	Flood, earthquake

(i) For each of the selected cities, the hazard exposure and risk due to change in land use and population growth was analysed. The population growth of the cities was analysed from Census 2011 and the urban growth was analysed by IIHS based on the India Urban Atlas, 2017.[39] The hazard exposure was analysed in context of recent disasters faced by these cities and reasons thereof from secondary literature sources and government sources such as the CAG.

(ii) The vulnerability profile of the city was assessed in the context of infrastructure coverage (Table 3) and service level gaps including water supply, latrines, sewerage, storm water drainage, open and green spaces against the benchmarks provided by the MoUD and other standards.

(iii) The institutional mechanisms of the ULB on urban resilience and preparedness was assessed as given in Table 4.

(iv) For the selected ULBs, annual budgets were examined for revenue receipts such as own revenue, central and state FC share, central and state sponsored schemes and other income for the five financial years (2011-12 to 2016-17). The expenditure was categorised into salaries, establishment/ administration, O&M

[39] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

and others. The O&M was further analysed into revenue expenditure (actual O&M) and Capex.

(v) The average revenue expenditure on O&M activities on critical infrastructure was compared to the O&M expenditure for the ULBs recommended by the HPEC by readjusting the expenditure to 2009 prices. The role of CSS particularly AMRUT, Smart Cities Mission, Swachh Bharat Mission (SBM) and Pradhan Mantri Awas Yojana (PMAY) were studied for their contribution to urban infrastructure development and resilience. Guidelines of these schemes were analysed and recommendations are made on how these schemes can improve their contribution to urban resilience building.

(vi) Based on the analysis of hazard exposure of the six cities, vulnerability due to infrastructure gaps and institutional capacities challenges, the study derives possible recommendations for the Fifteenth FC to incentivise ULBs on urban infrastructure development and resilience building.

Table 3: MoUD Urban Infrastructure Benchmarks

Indicator	Benchmark MoUD
Water supply connections (%)	100%
Per capita supply of water (lpcd)	135
Latrine coverage (%)	100%
Sewerage coverage (%)	100%
Storm drain coverage (%)	100%
Per capita open space (sqm/person)	10-12
Power reliability Index	100%
Road density (Km/sq.Km)	12.25
Disaster (Cyclone) Shelters	NDMA guidelines

Source: Ministry of Urban Development, Service Level Benchmarks[40].

Although other infrastructure such as power and communication are important, lack of data at the city level makes it difficult to assess the risk to these services in a comparable framework.

[40] Urban Service Level Benchmarks http://mohua.gov.in/cms/Service-Level-Benchmarks.php accessed on August 2018

Table 4: Institutional Mechanisms on Resilience Building of ULBs

Institutional Mechanisms	Indicators
Disaster Management Plan	In place
Hazard Risk and Vulnerability Assessment	In place
Lifeline Infrastructure Disaster Management Plan	In place
Planning Regulations and Zonal Development Plan	In place
Infrastructure Development standards	In place/ practices
Early Warning Systems	In place
Emergency services & Preparedness plan	In place
Municipal building bylaws	In place

ULB regulations on setting up private and industrial infrastructure in urban areas such as land use zoning and building bye-laws particularly in the context of hazard risk and exposure are examined. Buildings and other industrial infrastructure have not been considered in this study due to lack of comparable data, and as many such large establishments and developments submit an environment and disaster management plan to the Ministry of Environment, Forest and Climate Change under mandatory environmental legislations like the Environment Protection Act, 1986.

Section II: Disaster Risk, Infrastructure Gaps and Capacity Gaps in Emergency Preparedness in Select Cities

This section examines hazard risk and vulnerability and adaptive capacity and emergency preparedness in six selected study cities. The data sources are from secondary and published literature. No primary survey or study was undertaken to inform this.

Kochi

The population of the Kochi Municipal Corporation (KMC) area was 0.6 million and that of the urban agglomeration was 2.1 million according to Census 2011. The population in 2017 is estimated at over 2.5 million,[41] with the bulk of decadal growth happening in peri-urban areas, particularly in six municipalities and 45 census towns.

The geographical area of Kochi city is about 98 sq. km. The city is bordered by the Arabian Sea and is interspersed with its backwaters and the Vembanad lake. Vulnerability assessment for Ernakulam district undertaken in 2009 shows that the city is extremely vulnerable to storm surges, coastal erosion and urban floods.[42] Much of the built-up area expansion of the city lies in hazard prone areas, increasing its disaster risk. Despite this, Kochi does not have a comprehensive disaster management or mitigation plan. The 2018 floods led to the Kochi airport being shut for two weeks due to flooding, causing an estimated loss of over Rs. 250 crore.[43]

Although Kochi has good infrastructure for water supply and sanitation with a household coverage of more than 95 per cent, its sewerage and storm water infrastructure is poor covering less than 50 per cent of the city. Kochi city has been making investments in infrastructure development projects under the new schemes particularly under the Kerala Sustainable Urban Development Programme funded by the ADB.[44] The city has prepared a Sanitation Plan under SBM, and a DPR for area-based development projects under the Smart Cities Mission.

However, the Municipal Corporation did not have its own Disaster Management Plan or mitigation initiatives, including for lifeline infrastructure. Although the city has development regulations and building bye-laws, the powers of the Kochi Municipal Corporation on some

[41] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

[42] Sowmya, K., et al. (2015). Urban flood vulnerability zoning of Cochin City, southwest coast of India, using remote sensing and GIS. Natural Hazards, 75(2), 1271-1286. https://link.springer.com/article/10.1007/s11069-014-1372-4

[43] Business Today, Kerala floods: Kochi airport suffers Rs 250 crore. August 22, 2018. https://www.businesstoday.in/sectors/aviation/kerala-floods-kochi-airport-suffers-rs-250-crore-damage/story/222, 29181538.htmll

[44] Kerala Sustainable Urban Development Project. ADB Project implementation. Accessed on November 1, 2018 at http://ksudp.org/index.php/project-cities/project-cities-kochi

of these functions are limited, as responsibilities are shared with the Greater Kochi Development Authority. Further, Kochi city also lacks hazard risk and vulnerability assessments at the city level, which is essential for future land use planning and regulation of the city's peripheral area to make its growth more disaster resilient.

Although there was no audited report on the emergency preparedness, the disaster during the floods highlights the importance of increasing the ULB's capacity in emergency preparedness.

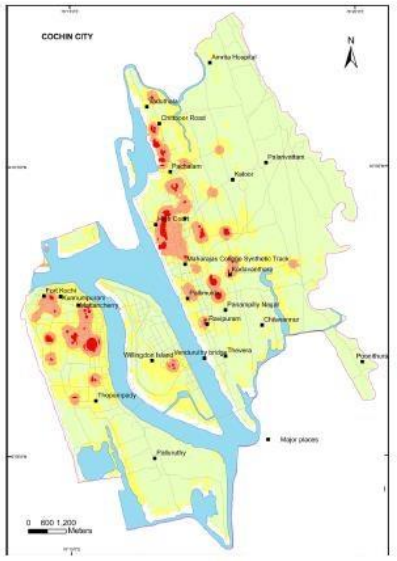
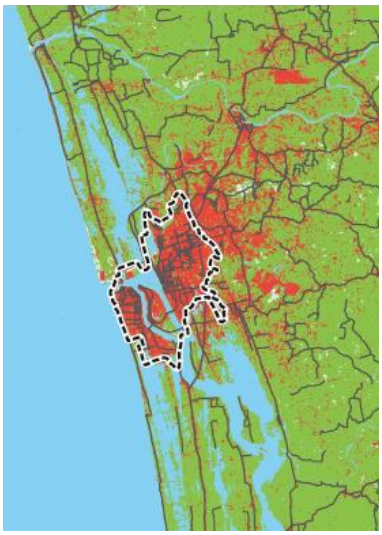
Year - 2017	Year- 2001	Year -2017
 45		
Legend: Areas shaded red indicate highly vulnerability. Areas shaded orange indicate moderate vulnerability, and yellow indicate low vulnerability.	Built-up Vegetation Water Others	
Source: Centre for Earth Science Studies, 2009 and Malladi et al. 2017[46]		

Figure 3: Flood and coastal erosion risk areas in Kochi and increasing built-up in Kochi city

[46] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

Chennai

According to Census 2011, the Chennai Municipal Corporation (CMC) had a population of 4.6 million and the urban agglomeration (UA) population was 6.5 million. The estimated population in 2017 of the Chennai UA was 9.7 million [45]. Recognising that the bulk of population growth was in peri-urban areas, the Chennai Municipal Corporation boundary was expanded from an earlier 176 sq. km. to 426 sq km in 2011.

The urban growth in built-up area has significantly altered the land use of Chennai.[46] The built-up area increased from 68 to 88 per cent, while vegetation, open spaces and water bodies reduced by 10, 9 and 1 per cent respectively during the period 1997 to 2017. It must be noted here that a large share of the increase in built-up area is in flood-prone areas.

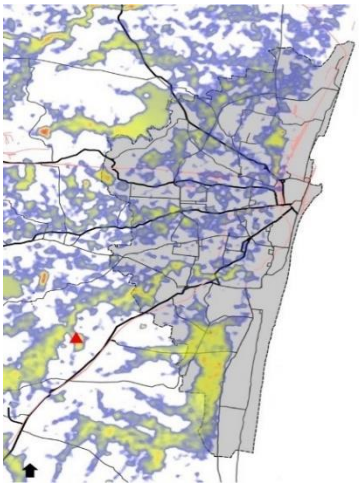
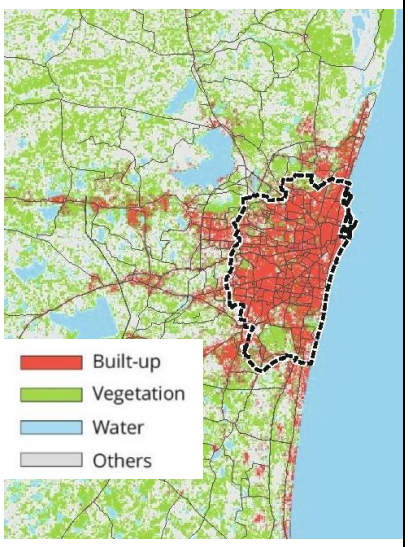
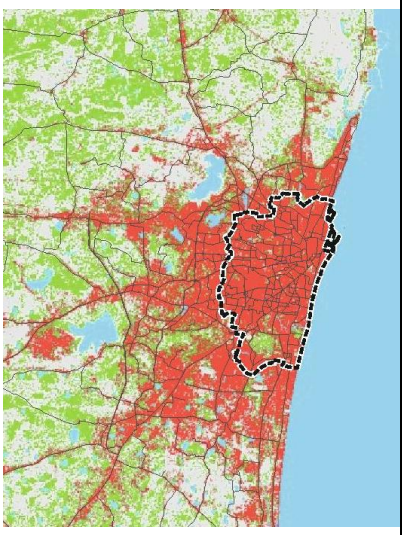
Flood Prone Areas- 2017 assessment	Year 2001	Year 2017
		
Legend: Areas shaded yellow are highly vulnerable to flooding. Areas shaded blue are moderately vulnerable to flooding.		
Source: Mallladi et al. 2017[46]		

Figure 4: Analysis on flood hazard zones and increase in built-up in Chennai

[46] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

Chennai receives an average of 1,300 mm of rainfall per year, most of it (~800 mm) during the northeast monsoon. Several catastrophic floods in the past (1943, 1976, 1985, 1996, 1998, 2005, 2010) were caused by heavy rain associated with depressions and cyclonic storms as well as poorly functioning drainage systems, which caused the city rivers to flood. The 2015 floods and the 2016 Vardah cyclone had severely impacted the city's power transmission lines and power infrastructure.[47]

Drainage is inadequate in Chennai city and land use change and encroachment of river banks are major reasons for flood related disasters.[48] This coastal city is also vulnerable to storm surges and tsunamis such as the one witnessed in 2004.

Chennai city comes up short when compared to MoUD infrastructure benchmark levels on many counts. Only 50 per cent of the population is connected to household water supply systems and 81 per cent have access to individual or community toilets. The storm water drain coverage which is important for flood prevention is low, covering only 50 per cent of the road network, while the MoUD benchmark recommends storm water drains along all major roads.

The Chennai MC prepared a City Disaster Management plan in 2017, and with support from the 100 Resilient Cities initiatives it also has prepared a Resilience plan in 2018 aimed at addressing vulnerability and reducing disaster risk. Chennai city also has a DM plan for power infrastructure prepared by TANGEDCO. Given the city's vulnerability to floods and cyclones, TANGEDCO is considering moving all overhead power lines underground.[47] There are still several other gaps in disaster preparedness in the city as observed by the CAG audit report post the Chennai floods in 2015.[49].

The CAG audit report on Chennai floods pointed to a lack of communication equipment and functioning of the District Emergency Operation Centre[49]. The ULB's audit report also observes that from a sanctioned amount of Rs. 2.6 crore for strengthening fire and emergency services, the MC has released only Rs. 1.5 crore to the Directorate of Fire Services, and the procurement of some of the fire service equipment is pending.[50]

Post the floods in 2015, the Chennai MC has initiated several initiatives to address urban infrastructure and resilience building. This includes improvements to the storm water drain

[47] TANGEDCO (2017). Tamil Nadu Energy Generation and Distribution Company. Disaster Management Plan http://tneb.tnebnet.org/test1/dmpfinal%20combined.pdf

[48] Gupta, A. K., & Nair, S. S. (2010). Flood risk and context of land-uses: Chennai city case. Journal of Geography and Regional Planning, 3(12), 365-372.

[49] CAG Report No. 4 of 2017, Performance audit of flood management and response in Chennai and its Suburban. Accessed on July 2018 from https://cag.gov.in/content/report-no4-2017-performance-audit-flood-management-and-response-chennai-and-its-suburban

[50] CAG report No. 8 of 2016, on Tamil Nadu Local Bodies for year ending 31 March, 2016. http://www.agtn.cag.gov.in/audit1/Reports/LB1516.pdf

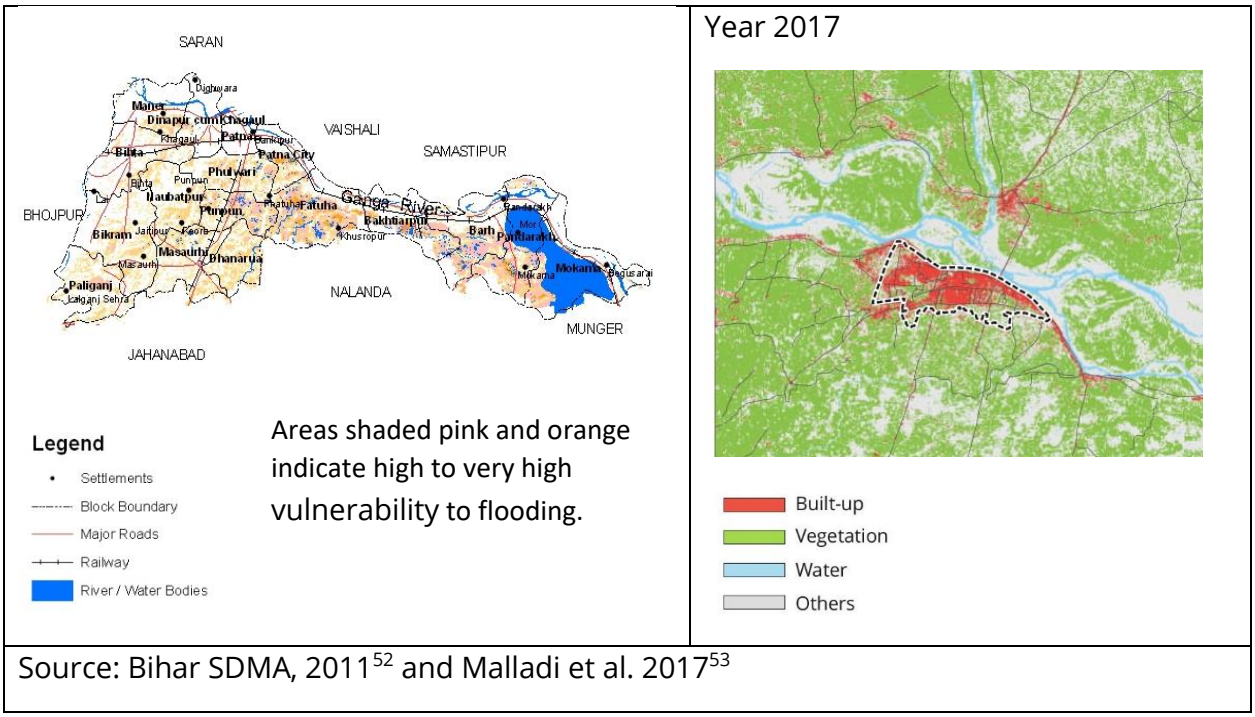
network by securing additional funding from the Chennai Metropolitan City Development Mission (State scheme) as well as externally aided funding. The jurisdiction of several ULB functions such as water supply, sewerage and urban development planning are not fully within the Chennai MC. They rest with other bodies such as the Chennai Water Supply and Sewerage Board and the Chennai Metropolitan Development Authority, which leads to challenges in coordination, planning and governance, and hence in resilience building.

Patna

The Patna Municipal Corporation covers an area of 99.45 sq. km and is divided into 72 wards. It is a metropolis and has a designated regional development area that covers 235 sq. km which includes outgrowths within Patna district – the Patna Urban Agglomeration (Danapur, Khagaul and Phulwarisharif), Saran district and Vaishali district. The decadal population growth in the city was 49 per cent between 1991 to 2001 and 33 per cent in period 2001 to 2011. The 2011 population of Patna MC and the urban agglomeration (UA) was 1.7 million and 2 million respectively. The estimated UA population in 2017 was 2.3 million.[51]

Patna city is located on a level strip of land on the south bank of the river Ganga that slopes to the south and the east. The topography is saucer shaped and because of poor drainage and overflow of the river, the city is vulnerable to pluvial flooding. The hazard risk map along with its built-up area is shown in Figure 5.

[51] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017



Source: Bihar SDMA, 2011[52] and Malladi et al. 2017[53]

Figure 5: Flood hazard risk and land use map of Patna in 2017

Patna city has not faced severe disasters in recent years. However, recurrent floods in parts of the city have become common and water logging is an annual problem. Given the city's topography, extreme rainfall events and high flow in the Ganga could mean recurring disasters which will require appropriate mitigation and preparedness. Apart from being flood-prone, Patna is also at risk of high intensity cyclones as it lies in the high wind damage risk zones and in Seismic Zone IV (severe earthquake intensity) of the Bureau of Indian Standards (BIS) classification.[54]

An analysis of Patna's infrastructure showed plenty of gaps. The water supply, sewerage and storm water drain network coverage was only 60 per cent, 22 per cent and 65 per cent respectively. Open and green spaces at 21 per cent are higher in Patna compared to the other studied cities. If this is not regulated it could well be impacted by future urbanisation. Patna MC lost over 35 per cent of green spaces between 1997-2017. The overall system of drainage is not very efficient due to the intermixing of storm water and sewerage, clogging

[52] Flood Risk Atlas of Patna District (2011) Bihar State Disaster Management Agency, accessed on September, 2018 from http://bsdma.org/Atlas.aspx

[53] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

[54] Patna Municipal Corporation (2014) Master plan for 2030, accessed on September 2018 at http://udhd.bihar.gov.in/PMP/Patna-MP-Report-18-11-2014.pdf

of garbage and silt, dysfunctional drainage pumping plants and the unplanned growth of the town.[55]

Patna is performing poorly in the context of resilience as there is no city level analysis on Hazard Risk and Vulnerability Analysis, although the Bihar SDMA has prepared a district level flood hazard map. Patna MC does not have its own disaster management or mitigation plan despite it having a Master Plan up to 2030. Hazard risk and vulnerability have not been taken into consideration in the Master Plan, although broad measures such as developing river embankments and protection of flood prone areas have been proposed. It has no emergency preparedness and disaster management plans for critical infrastructure.

Guwahati

Guwahati is situated on the banks of the Brahmaputra river, on an undulating plain with varying altitudes of 47 metres to 56 meters above mean sea level (amsl). It is dotted by hills and hillocks and receives an average annual rainfall of about 1,700 mm. The Guwahati Municipal Corporation administers an area of 216 sq. km, while the Guwahati Metropolitan Development Authority which is its planning and development body, administers an area of 262 sq. km. Per Census 2011, the population of the city was 0.96 million and the estimated population in 2017 was 1.09 million.[56]

According to the Guwahati City Municipal Corporation disaster management plan, the city is vulnerable to riverine floods, water logging, landslides, river bank erosion, earthquakes and cyclonic storms. The disaster risk in the city is largely due to the expansion of built-up areas into the flood plains, conventional/ riverine floods and erosion, low-lying area and areas with poor drainage, haphazard habitations in the hill-side, and thatched houses that are vulnerable to storms and cyclones. Badly constructed RCC/ brick buildings in the city are vulnerable to earthquakes. High population density of about 4400 persons per sq. km and narrow roads could compound disaster risk.

Urban population growth is high in Guwahati and the estimated 2017 population was 1.1 million which has also resulted in a built-up area that has tripled between 2001 and 2016 and reduced available open spaces.[56]

[55] Patna Municipal Corporation (2010) City Development Plan, accessed on September 2018 at http://urban.bih.nic.in/Docs/CDP/CDP-Patna.pdf

[56] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

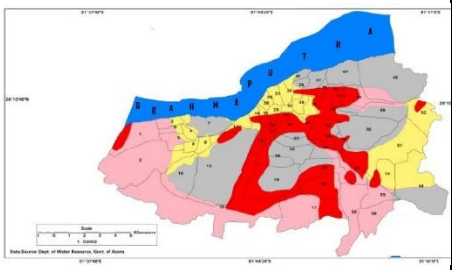
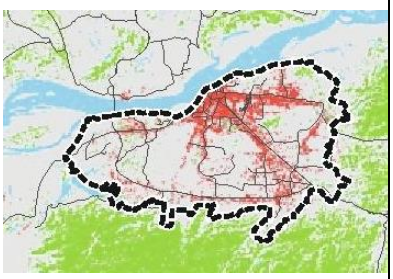
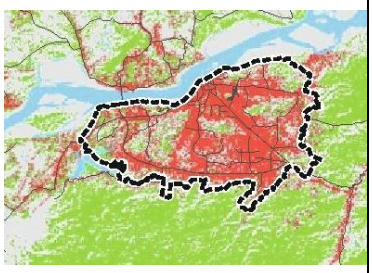
Year 2017	Year 2001	Year 2017
		
Areas shaded red and yellow experience frequent flooding.	Built-up Vegetation Water Others	
Source: Assam Disaster Management Authority (Hazard map)[57] and Malladi et al. 2017[56]		

Figure 6 : Flood hazard risk map of Guwahati Municipal Corporation, and urban growth in the period 2001 to 2017

The city experienced high flooding due to heavy rainfall in September 2014. The smaller hillocks in the city experience frequent landslides particularly in the rainy season due to unplanned cutting into the hillside and construction of buildings on unstable slopes .[57]

The city fares poorly in infrastructure provision. Housing shortage is high, with the Census 2011 noting that more than 24 per cent houses are with temporary roofs and walls. Household water supply and sewerage network coverage is at about 80 per cent and 77 per cent respectively. Storm water drains cover only about 20 per cent of the road networks. The data on critical infrastructure like power and roads were not available for Guwahati city. Under the AMRUT scheme, the city has just started to prepare a DPR for infrastructure projects. There are no accessible details of ongoing activities by the State government or from externally aided projects on infrastructure development.

The city lies between the Brahmaputra river on one side and hillocks on the other side, necessitating a focused disaster management plan for relief and rescue operations. The city has a Disaster Management Plan prepared with assistance from the Assam SDMA, which has strengthened its early warning systems and emergency preparedness to manage floods. The city does not have DMPs in place for lifeline infrastructure, particularly roads and bridges, water supply and power.

[57] Guwahati City Disaster Management Plan, 2017. https://gdd.assam.gov.in/frontimpotentdata/disaster-management-plan

The Guwahati MC undertakes the maintenance of roads and bridges, water supply, sanitation, and building regulation. However, urban planning and land use regulations fall under the purview of the Guwahati Metropolitan Development Authority. The Master Plan for 2025 will needs to include the integration of resilience initiatives to protect green spaces and wetlands, which can mitigate urban flooding.

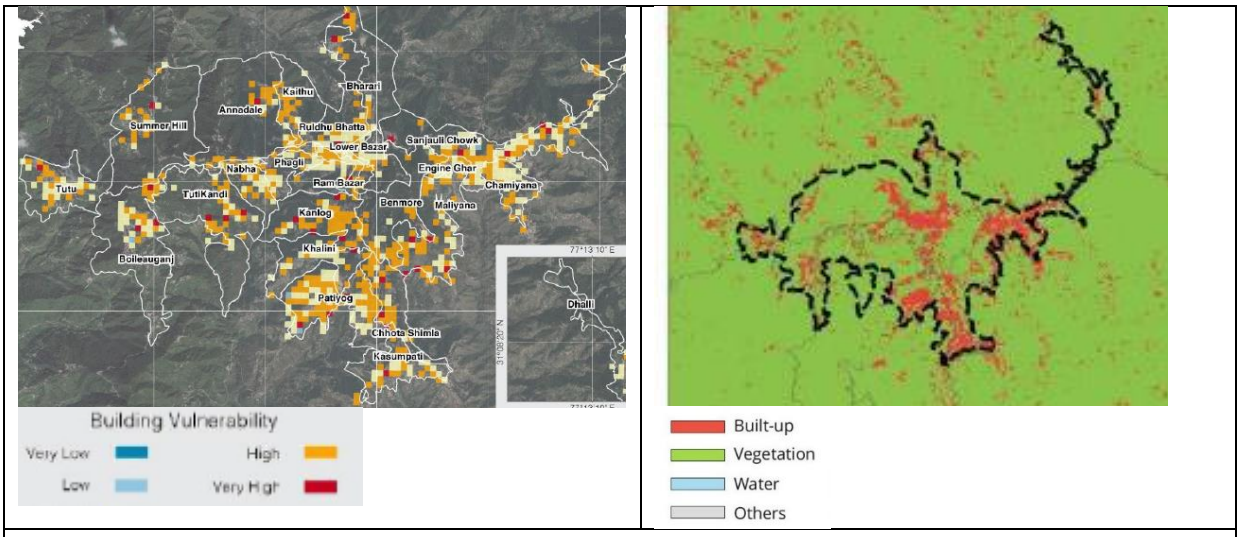
Shimla

Shimla MC is spread over an area of 22 sq. km. The Shimla Planning Area (SPA) covers about 100 sq. km and includes Shimla MC and three small towns, all managed by the Special Area Development Authority (SADA), a parastatal body. Per Census 2011, the population of the SPA is 0.20 million, while that of MC is 0.16 million. The decadal population growth was 15.5 per cent and is estimated to be around 0.23 million in 2017.[58]

The land use analysis for 2011 shows forests covering about 61 per cent of Shimla, and agriculture land covering 21 per cent of the SPA, with residential and commercial built-up spaces occupying only about 9.5 per cent. The proposed 2021 land use of SPA shows built-up areas to increase to 22 per cent while aiming to maintain the forest cover.[59] According to the land use map of Shimla MC in 2015, only a residual 6 per cent of land has open spaces and parks, which could make emergency evacuation and relief services challenging during disasters and emergencies. This is particularly of concern since Shimla lies in Seismic Zone IV according to the BIS and is prone to high intensity earthquakes.

Due to its hilly terrain, Shimla has 67 natural drains referred to as *nalahs*. The rainfall in hilly areas is channeled through natural open streams and *nalahs* into downstream areas thereby minimising water logging. The main spinal ridge is the drainage divide of Shimla city. These drains also carry waste water and solid waste.[60] According to HRVA assessments, drain lines are most often blocked as they are filled up with solid waste and debris from construction.

[58] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017 /
[59] Kumar, A. (2015). City profile: Shimla. Cities, 49, 149-158. https://www.sciencedirect.com/science/article/pii/S0264275115001171
[60] Katuri, A. K., & Rajasekar, U. (2016). Shimla: Report on Multi-Hazard mapping and Analysis, Development of Exposure and Vulnerability Assessment and Risk Assessment; Capacity Assessment. TARU.



Source: Katuri and Rajasekhar (2016)[60] and Malladi et al. 2017[62]

Figure 7: Building vulnerability in Shimla and built-up in the Shimla Planning Area

According to the City Disaster Management Plan (CDMP), residential buildings make up about 75 per cent of the total built-up area. About 7 per cent of residential buildings accommodate street level commercial activities.[61]

According to the city sanitation plan, the existing drainage network covers 60-70 per cent of the municipal area and 69 per cent of its population. About 29 per cent of the total population uses septic tanks, and the remaining 2 per cent uses open drains. Currently there is no coverage in special areas, which use septic tanks.

The city currently has 179 kms of drains connecting 12,500 properties. The new network is not linked to the old sewerage network due to a lack of information of the old drainage network which was built during the British Raj. The city generates about 29 MLD of sewage every day, of which only 5 MLD is treated in the Sewage Treatment Plants (STPs). With 11 reservoirs storing water received from six different locations, Shimla's total water supply is 54 MLD against a storage capacity of 37 MLD. Per capita consumption per day is about 135 LPCD but because of low storage capacity and high seasonal demand, frequent water shortages are experienced.

Visakhapatnam

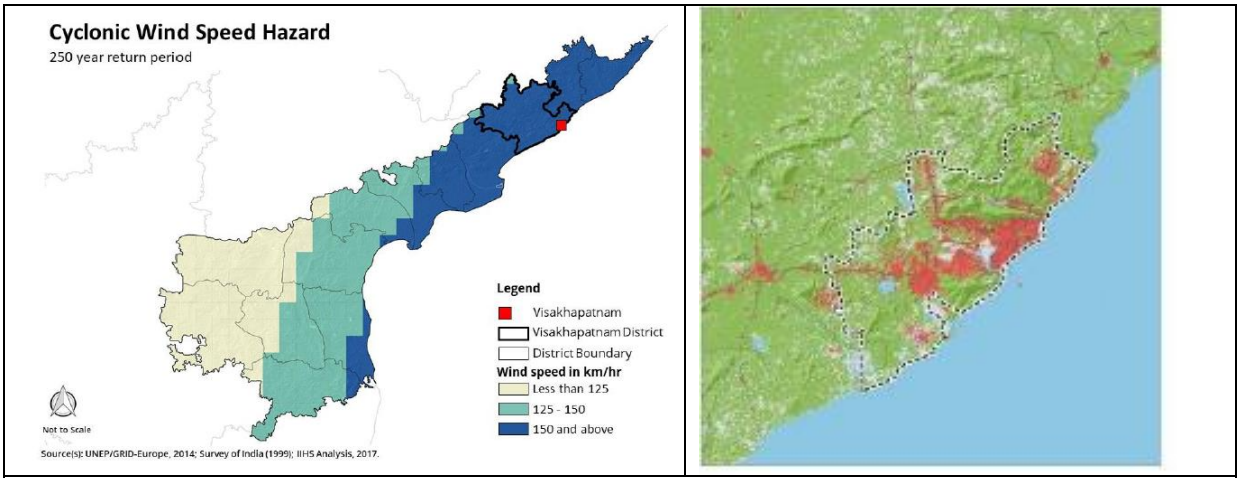
Visakhapatnam (Vizag) is a coastal port city located on the eastern shore of India. It is nestled among the hills of the Eastern Ghats and faces the Bay of Bengal to the east. Primarily an industrial city, it is the second largest city in Andhra Pradesh with an area of

[61] Shimla Municipal Corporation (2012) City Disaster Management plan. Accessed on September, 2018 at http://hp.gov.in/hpsdma/DisasterManagement/CDMP_MCShimla.pdf

550 sq. km. The city is surrounded by the Yarada hills popularly known as the Dolphin's nose (358m) on the side of the Kailasgiri hills on the north, the Bay of Bengal on the east, and East Godavari district in the south.

Visakhapatnam city was declared as Greater Visakhapatnam Municipal Corporation (GVMC) in 2005 and its geographical area was extended from 111 sq.km to 540 sq.km. The population in 2011 in the MC area was 2.2 million, and the decadal growth rate of Vizag UA was more than 30 per cent in 2011. In 2017 the projected population is over 2.7 million as estimated by IIHS analysis.[62]

Various cyclonic storms of different intensities have affected the city. Between 1877 and 2013, 44 tropical disturbances passed within 150 km of Visakhapatnam City, an average of 1 cyclone in 10 years (United Nations Development Program, 2014).Tropical cyclones affect this region twice a year: pre-monsoon (April-May) and post-monsoon (October-December). The peak frequency is in the months of June and November. In recent years, Phailin in October 2013, Hudhud in October 2014, Vardah in December 2016 and Titli in October 2018 are some of the very severe cyclonic storms that affected Visakhapatnam city. Hudhud in 2014 destroyed roads, houses and electric poles with wind speeds of over 185 km/hr. Although, early warning systems predicted the cyclone and timely evacuation of over 35,000 people led to minimal loss of life, damage to infrastructure was high. The cyclone caused about 102 deaths and infrastructure damage close to Rs. 7,000 crore.[63]



Source: UNEP/ GRID, 2014 and Malladi et al. 2017[62]

Figure 8: Vulnerability dimensions, to cyclones and Built up area in Vishakhapatnam

[62] Malladi, T., Chatterji, N., & Jana, A. (2017). India urban atlas: Mapping the growth and expansion of India's 100 largest cities. Bengaluru: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2017

[63] Ramuje, K., & Rao, B. N. M. (2015). Hudhud cyclone—a severe disaster in Visakhapatnam. Int J Res Eng Technol, 3, 156-163. https://ijret.org/volumes/2014v03/i28/IJRET20140328025.pdf

Due to its topography, Visakhapatnam city is prone to coastal flooding triggered by tsunami waves. The intensity of the tsunami along the Andhra coast decreased from the south to the north in the 2004 tsunami, with a run-up height of 4.5 m in the south and with a height of 2 m in the north.[64] The city has outward slopes along the west-east direction. Although the average rainfall in the city is only about 1,260 mm and steep east-west slopes provide natural drainage, water logging is persistent.

Despite the city's 22 natural storm water drains, city development coupled with solid waste dumping have severely altered the natural drainage of the city, causing water logging during the monsoon.[65] Since 2016, some areas of the city including those near the airport which were developed on reclaimed swamp land have experienced localised flooding due to clogged drains.

The city lags behind in many urban infrastructure services. Water supply coverage is only 61 per cent, the sewerage network covers only about 20 per cent of households, and storm water drains cover only about 45 per cent of the city's road networks. More than 30 per cent of the city lives in slums and informal settlements. Although basic services are extended to the 641 notified slums, there are over 100 slums that are not yet notified and lack basic services.[66]

The city has an open drainage system into which wastewater from 85 per cent of the households' flows. The remaining 15 per cent release it into the streets. Many of the slum dwellers do not have land ownership but the city has provided basic service facilities such as drinking water and access road/foot paths. There is a high incidence of skin diseases, vector and water borne diseases due to unhygienic living conditions. Overcrowding along with poor service facilities leads to poor living conditions.[67]

Visakhapatnam's disaster preparedness and resilience initiatives are far more advanced than the other five study cities. The MC has a city level Disaster Management plan and is implementing projects like the GoI-UNDP project on DRR, which includes Hazard Risk and Vulnerability Assessment for the city and capacity building of officials and community awareness generation. Under the Andhra Pradesh Cyclone Risk Mitigation Project there is

[64] Patnaik, et al. (2012). Observational analysis on the run-up height and inundation along the Andhra coast during December 26, 2004 Indian Ocean tsunami. Journal of Asian Earth Sciences, 45, 239-246.
[65] Visakhapatnam Municipal Corporation (2017). City Disaster Management Plan. http://www.gvmc.gov.in/wss/image_uploads/cdmp1.pdf
[66] Census 2011, Visakhapatnam city, accessed from https://www.census2011.co.in/census/city/402-visakhapatnam.html and AMRUT SAAP Report for Andhra Pradesh (2015) accessed from http://amrut.gov.in/writereaddata/SAAP_AP_28.09.2015.pdf
[67] United Nations Development Program. (2014). Hazard Risk and Vulnerability Analysis (HRVA) for the City of Visakhapatnam, Andhra Pradesh. Visakhapatnam. https://gvmc.gov.in/gvmc/images/hrvas.pdf accessed on July 2018

also additional support to the city in improving Early Warning Systems for Cyclones and for establishing cyclone shelters.

Summary

Table 5: Infrastructure Benchmarks in Study Cities Compared to MoUD Benchmarks

Cities	Road density (sq. km.)	Coverage of water supply connection (%)	Per capita supply of water (lpcd)	Coverage of latrines – individual or community (%)	Coverage of sewerage network services (%)	Storm water drain coverage (%)	Open Spaces (sq. m)
MoUD Benchmarks	12.25	100	135	100	100	100	10 to 12
Chennai	5.98	55	58	80	50	50	2.14
Visakhapatnam	4.18	61	109	97	20	45	30
Kochi	10.34	96	NA	94	5	47	No data
Patna	No data	No data	No data	No data	No data	65	44.17
Guwahati	No data	80	NA	86	Nil	20	No data
Shimla	No data	57	136	84	15	56	3.09

Table 5 compares the status of urban infrastructure in the six study cities with MoUD benchmarks.

Despite constraints on data availability for storm water drain coverage and open spaces it can be seen that infrastructure and services gaps, particularly in critical infrastructure like water supply and storm water drains in comparison to MoUD benchmarks, is high for all six cities.

The per capita water supply in litres per capita per day is only 55 in Chennai against the MoUD recommendations of 135. Critical infrastructure like storm water drains is very poor for Guwahati and Kochi, which are both vulnerable to urban floods. The coverage of sewerage networks in all six cities is poor.

The service level gaps also vary within a city. Taking the example of Visakhapatnam city, it can be seen from Figures 9 and 10 that Wards having low access to drinking water and drainage access are particularly high in the southern zone of the city.

All six cities show an increase in population and rapid changes in land use from 2001 to 2017, but infrastructure and service level improvements did not grow in a corresponding manner especially in the context of hazard exposure and vulnerability, which has only

increased. The Hazard Risk and Vulnerability Assessment (HRVA) for these cities shows large areas prone to flooding and other natural hazards.

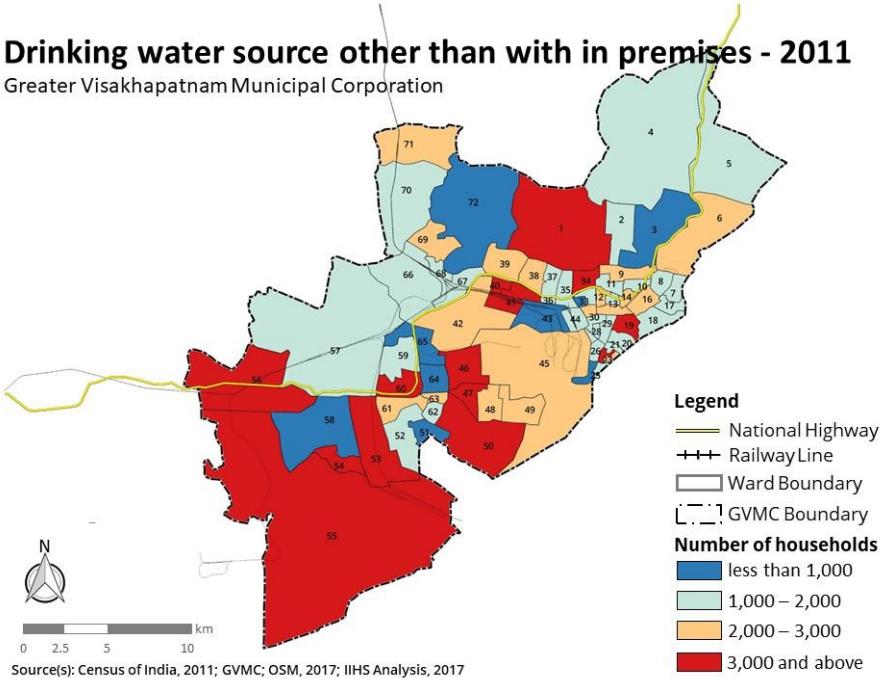


Figure 9: Ward level drinking water source in Visakhapatnam
Source: Census 2011 and IIHS analysis, 2017

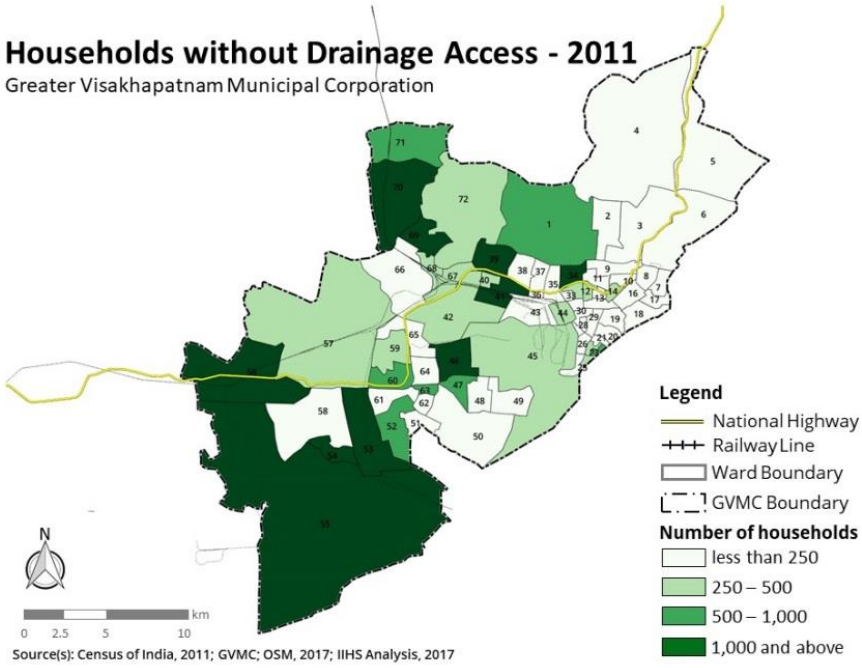


Figure 10: Ward level households without drainage access
Source: Census 2011 and IIHS analysis, 2017[68]

[68] IIHS Analysis, 2017. Ward level service coverage in Visakhapatnam city. Prepared from Census 2011 data

Fire and Emergency Preparedness

Fire services in most ULBs are still under the control of the State Directorate of Fire Services and have not been transferred to the ULBs as required under the 12th Schedule. Per the Thirteenth FC recommendation, all Municipal Corporations with a population of more than one million as of Census 2001 must put in place a fire hazard response and mitigation plan for their respective jurisdictions. The ULBs of all six cities studied have prepared and published their Fire Hazard Response and Mitigation Plan, and the requisite financial provisions for strengthening fire services in urban areas were made. The CAG audit for Chennai observes that the ULB utilised only Rs. 1.5 crore against a sanction of Rs. 2 crore to strengthen fire services.

The Thirteenth FC emphasised the need for training as well as equipping the District Emergency Operation Centre (DEOC) to handle complex disaster situations, and the capacity building grant was to be utilised for this purpose in addition to creating educational materials to build awareness.

The CAG performance audit of the Chennai flood disaster observed that the Thirteenth FC had sanctioned Rs. 25 crore for the period 2010-15 as a capacity building grant, with an annual tranche of Rs. 5 crore. However, this amount was only received in the first year. Nothing was received thereafter due to non-submission of utilisation certificates.

The audit observed that the funds released to the districts were inadequate, as the sampled Kancheepuram DEOC lacked even basic infrastructure such as a TV, fax machine, scanner and CCTV, which were essential for communication. None of the DEOCs had satellite phones as suggested by the GoI, which were crucial in situations where the communication network broke down. Further, the DEOCs had not put in place the online Decision Support System envisaged by the NDMA to ensure effective communication and swift decision making.

The CAG audit report on Chennai floods points to serious lapses on the utilisation of the capacity building grant in preparedness particularly for emergency preparedness, training and communication equipment. CAG audit reports for other ULBs were not available but from the ULBs annual report and budgets, there was no mention on utilisation of the grants for capacity building or fire services improvement.

The National Building Code of India, revised in 2016, is a comprehensive Building Code providing guidelines for regulating building construction activities across the country. Part IV of the Code covers requirements of fire prevention and safety. However, the compliance audit report of fire and emergency services in Kerala published for the year ending 31 March 2016, observed that the Government of Kerala has not followed this mandate.

Instead, it has its own Kerala Municipality Building Rules (KMBR), 1999. The CAG audit noted that the KMBR rules were inadequate and that the State should adhere to the National Building Code, 2016, which makes it mandatory for all multi-storeyed buildings to have fire prevention and extinguishing equipment in place. Thereafter, the government of Kerala passed the Municipality Building Rules amendment in 2013 and 2017, incorporating the National Building Code and NDMA guidelines on fire prevention.

The CAG audit report on disaster, fire and emergency preparedness was not available for the other four study cities.

Disaster risk reduction needs in cities

All six cities show an increase in population and rapid changes in land use from 2001 to 2017, but infrastructure and service level improvements did not grow in a corresponding manner especially in the context of hazard exposure and vulnerability, which has only increased. Kochi has shown a growth rate of about 34 per cent in peri-urban areas. Smaller municipalities in peri-urban towns are rapidly growing in population size as noted in the IIHS Remote Sensing and Geographic Information System analysis. This growth has largely been unplanned and has converted wetlands, forests and open spaces into buildings.

Critical infrastructure like water supply, sewerage, storm water drainage and roads are not well developed in smaller municipalities. Visakhapatnam city for example shows high gaps in basic services particularly in peri-urban areas, as is the case with the other five cities studied. Infrastructure gaps combined with changes in land use increase both the physical and socio-economic vulnerability of a city. As the CAG report on the Chennai floods in 2015 observed, disaster preparedness is lacking in peri-urban areas.[69]

While critical infrastructure in urban areas needs improvement, preparedness, disaster mitigation and resilience initiatives need equal attention. Cities like Visakhapatnam and Shimla have their own Disaster Management Plan (DMP) for the Municipal Corporation area, but they typically do not address resilience of critical infrastructure and the challenges of rapidly growing peri-urban areas. Chennai is the only city with a DMP for power infrastructure following the massive destruction of power infrastructure after cyclone Vardah.

Many of the important urban systems and functions delegated to the ULBs under the 12th Schedule have not been transferred but are managed by parastatal agencies, leading to fragmentation of planning and responsibility. In Chennai, water supply and sewerage are under the Tamil Nadu Water and Drainage (TWAD) Board as well as the Chennai Metropolitan Water Supply and Sewerage Board. In Kochi, land use planning and master planning are managed by the Greater Kochi Development Authority, with the Municipal Corporation having little say.

[69] CAG Report No. 4 of 2017, Performance audit of flood management and response in Chennai and its Suburban. Accessed from https://cag.gov.in/content/report-no4-2017-performance-audit-flood-management-and-response-chennai-and-its-suburban

Table 6: Institutional Mechanisms on Disaster Management in place in studied cities

Parameters	Chennai	Kochi	Vizag	Patna	Guwahati	Shimla
Disaster Management Plans	Yes, 2017	No	Yes, 2015	No	Yes	Yes, 2017
Emergency preparedness and IRS	Yes	Not in place	Yes	Not in place	Yes	Yes
Hazard Risk and Vulnerability Assessment Studies	Yes	Yes	Yes	Not in place	Yes	Yes
Early Warning Systems	Yes	Yes	Yes	Not in place	Yes	Yes
Regulations and zone development	Yes (Master plan 2026)	Yes	Yes	Yes, master plan 2031	Yes	Yes
Infrastructure development standards practiced	Yes (TN Combined Development Regulation and Building Rules, 2018)	Yes, Kerala Municipal Building Rules, 1994	Yes, building bye laws, 2017	Yes, building bye-laws 2013	Yes, Building construction bye-laws, 2014	Yes, Building bye laws-1998
DM plan for DISCOMS	Yes, for TANGEDCO	Not in place	Initiated under AP disaster recovery project	Not in place	Not in place	Not in place

Source: Compiled by IIHS for this study from a review of ULB websites and other DM plans of the cities. Accessed on September, 2018.[70]

[70] ULB websites of the six cities on September, 2018
Chennai Municipal Corporation at http://www.chennaicorporation.gov.in/NorthMonSoon2017/cdmcb.pdf
Patna Municipal Corporation at www.pmc.bihar.gov.in – No DM Plan
Kochi Municipal Corporation at www.cochinmunicipalcorporation.kerala.gov.in – No DM plan
Visakhapatnam Municipal Corporation at http://www.gvmc.gov.in/wss/image_uploads/cdmp1.pdf
Guwahati Municipal Corporation at https://gdd.assam.gov.in/frontimpotentdata/disaster-management-plan
Shimla Municipal Corporation at http://hp.gov.in/hpsdma/DisasterManagement/CDMP_MCShimla.pdf

Table 7: Resilience Building Initiatives in Studied Cities

Functions	Chennai	Kochi	Vizag	Patna	Guwahati	Shimla
Urban planning including town planning	Yes (CMDA)	Yes	Yes (VUDA)	Yes	Yes	Yes
Regulation of land-use and construction of buildings	Yes	Yes	Yes	Yes	Yes	Yes
Roads and bridges	Yes	Yes	Yes	No	Yes	Yes
Water supply for domestic, industrial and commercial purposes:	No (TNWSSB)	No (KWA)	Yes	Yes	Yes	Yes
Public health, sanitation conservancy and solid waste management:	Yes	Yes	Yes	Yes	Yes	Yes
Fire services	No	No	Yes	No	No	No

Source: Compiled by IIHS in this study from the ULB websites of the six cities[71].

[71] ULB websites of the six cities on September, 2018
Chennai Municipal Corporation at www.chennaicorporation.gov.in
Patna Municipal Corporation at www.pmc.bihar.gov.in
Kochi Municipal Corporation at www.cochinmunicipalcorporation.kerala.gov.in
Visakhapatnam Municipal Corporation at www.gvmc.gov.in
Guwahati Municipal Corporation at www.gmc.assam.gov.in
Shimla Municipal Corporation at www.shimlamc.org

Section III - Review of ULB Finances, Infrastructure Development, Operation and Maintenance

This section examines the revenue and expenditure structures as well as the fiscal performance of the municipal corporations of the six study cities—Chennai, Shimla, Kochi, Guwahati, Patna and Visakhapatnam. This was undertaken to understand the fiscal space of the six ULBs, with regards to revenue and expenditure. The own-revenue of these ULBs in addition to revenue from central transfers and SFCs were examined, and the expenditure on both capital and O&M on urban infrastructure was studied.

Various sources contribute to municipal revenue including tax and non-tax, state assignments and devolutions, and central and state grants including those from FCs and SFCs scheme funds, among others as listed in Annex I. Own-tax includes items such as property tax and advertisement tax, and non-tax revenue includes items such as user charges and market fees. Expenditure has been analysed for both revenue and capital from ULB annual budget documents from 2012-2017. Gaps in infrastructure expenditure for O&M was assessed against the per capita O&M maintenance requirement as per the HPEC per capita recommendation at 2009 prices. For comparison, the expenditure on O&M for 2012-17 was readjusted to 2009 prices using the Wholesale Price Index (WPI) and the per capita rate was calculated based on the projected 2009 population after computing CAGR based on 2001 and 2011 Census data.

The contribution of recent urban development schemes such as AMRUT and Smart Cities Mission on urban infrastructure development has also been reviewed.

Revenue and Expenditure of Selected Cities

Chennai

Among the six selected Municipal Corporations, Chennai is the biggest in terms of population and revenue receipts. The total revenue of Chennai has increased from Rs. 1,591 crore in 2012-13 to Rs. 2,567 crore 2016-17 (BE). The CAGR of revenue receipts over this time is 10 per cent. The growth of grants (14%) is higher than own revenue collection (11.5 %).

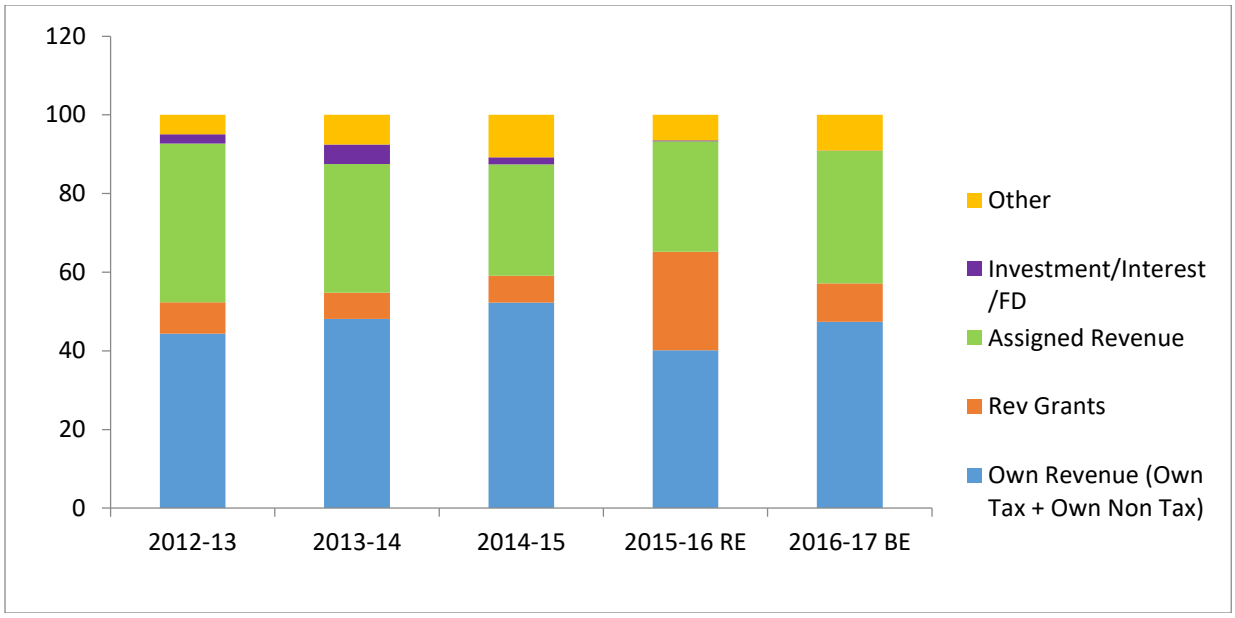


Figure 11: Chennai: Percent share of revenue receipts in total revenue (2012-2017)

Establishment and salaries, and O&M contribute to 60 per cent and 29 per cent of total revenue expenditure respectively.

To assess revenue deficit, own-revenue was deducted from total expenditure. Chennai's deficit has increased from Rs. 356 crore in 2012-13 to Rs. 1,392 crore in 2016-17 (BE). Further, an analysis of the sufficiency level (percent of expenditure covered with the help of own revenue generated by corporation) of the Corporation shows that it is only able to cover an average of 53 per cent of revenue expenditure and 64 per cent of salary plus O&M expenses from its own sources.

Figure 12: Chennai Revenues 2012-17

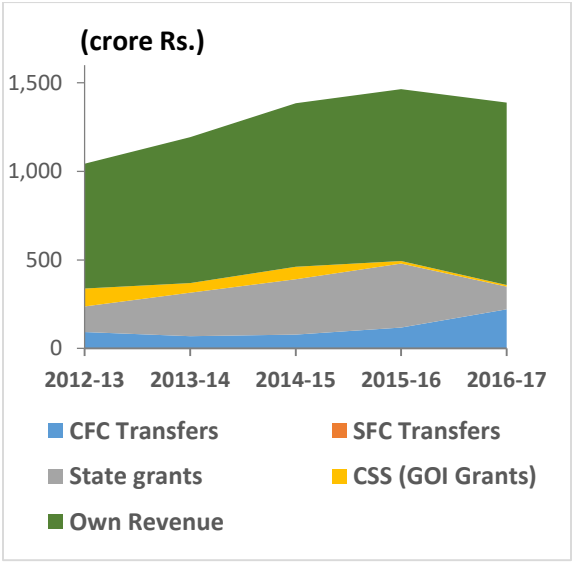


Figure 13: Revenue Surplus/Deficit (2012-17)

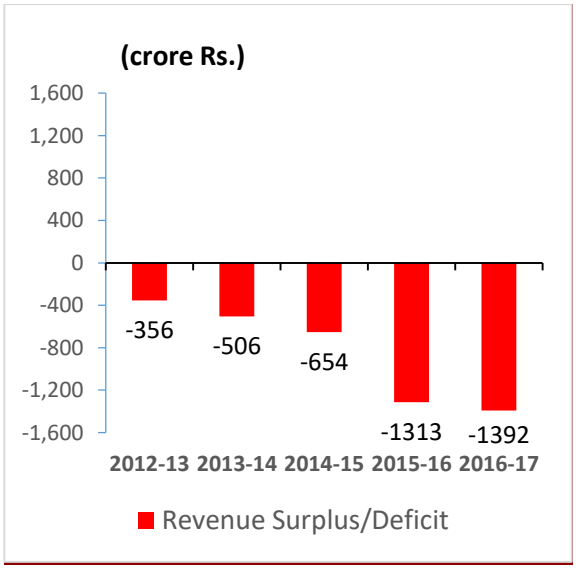


Figure 14: Chennai Expenditures, 2012-17

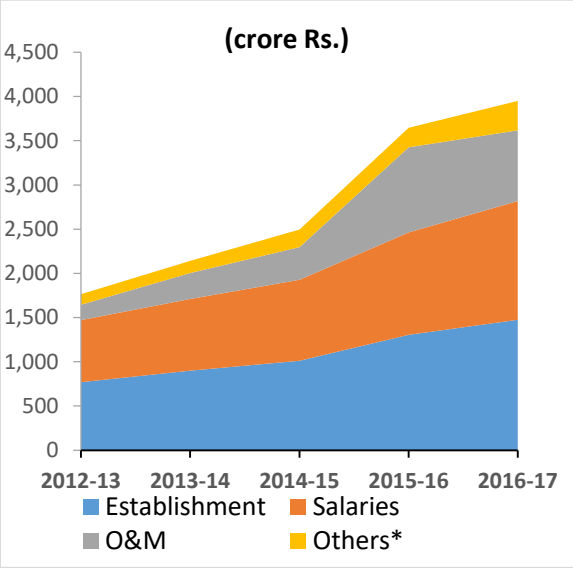
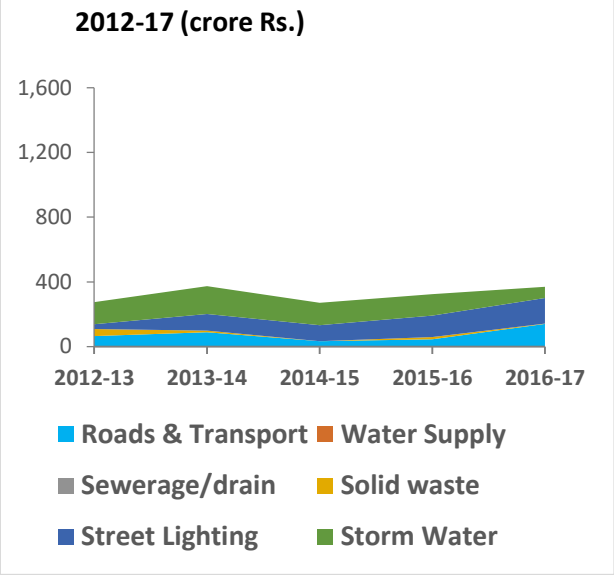


Figure 15: Sectoral Revenue & Capital Expenditure



Own revenue was the biggest source of revenue in Chennai, but the compound growth of CFC transfers to the ULB over the five years was nearly two times higher than the growth of its own revenue. Chennai Municipal Corporation did not receive any grants from the State Finance Commission. Receipt from CSS decreased from Rs. 101 crore in 2012-13 to Rs. 10 crore in 2016-17 (BE).

Of the total average expenditure (revenue + capital) of Rs. 2,490 crore, Chennai spent an average of Rs. 256 crore (12 per cent) in major infrastructure such as roads and transport, solid waste, street lighting and storm water, with a compound growth of 3.3 per cent for 2012-17. Of the nearly 12 per cent invested in six sectors (roads, street lighting/, storm water drain, solid waste management, sewerage/drain and water supply), 11 per cent has been spent by the Corporation on storm water drains and electricity while a negligible amount has been spent on roads, transport and solid waste. The Chennai MC website reports that the road relaying work is taken up only once in a three-year period.[72]

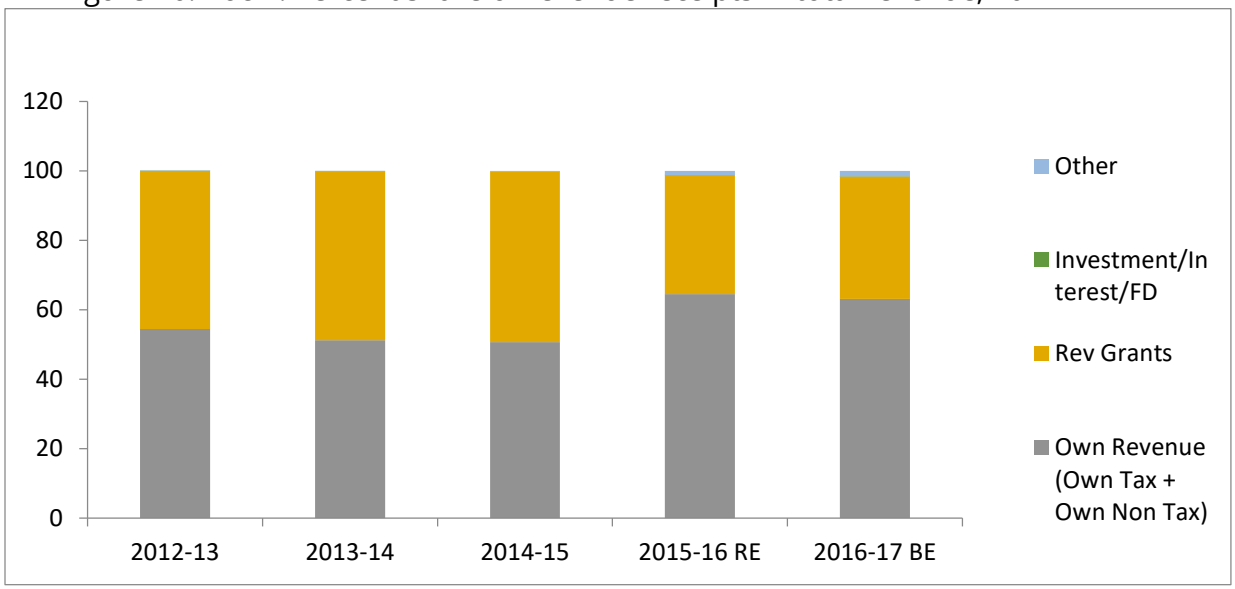
Kochi

The growth of total revenue in the Kochi MC is 13 per cent between 2012-2017 and the corresponding compound growth of own-revenue is 16 per cent. The Corporation receives an average of 56 per cent of revenue from its own sources. The revenue of Kochi MC includes own-revenue, revenue grants, income from investment and other minor sources. Kochi did

[72] Chennai Municipal Corporation, accessed on September 2018 http://www.chennaicorporation.gov.in/departments/roads/index.htm

not receive any 'assigned revenue' grants recommended by the State Finance Commission and also had a declining trend in revenue grants.

Figure 16: Kochi: Percent share of revenue receipts in total revenue, 2012-17



There is an 8 per cent growth in establishment and salary expenditure which contributes to around 29 per cent share in total expenditure. On the other hand, O&M expenditure growth is 21 per cent and it has an average share of 32 per cent in total expenditure.

Figure 17: Kochi expenditures, 2012-17

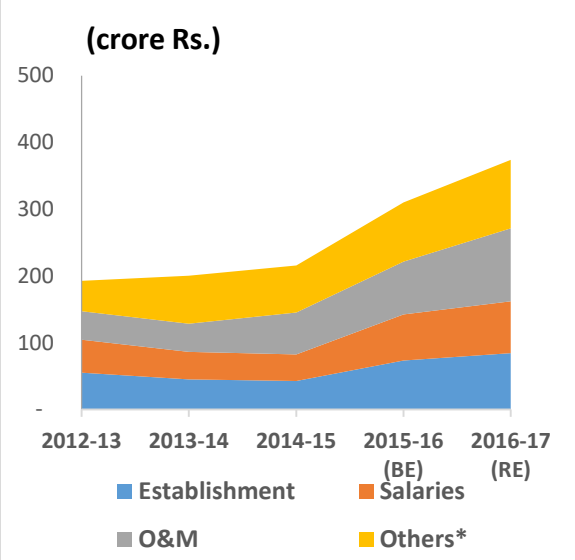
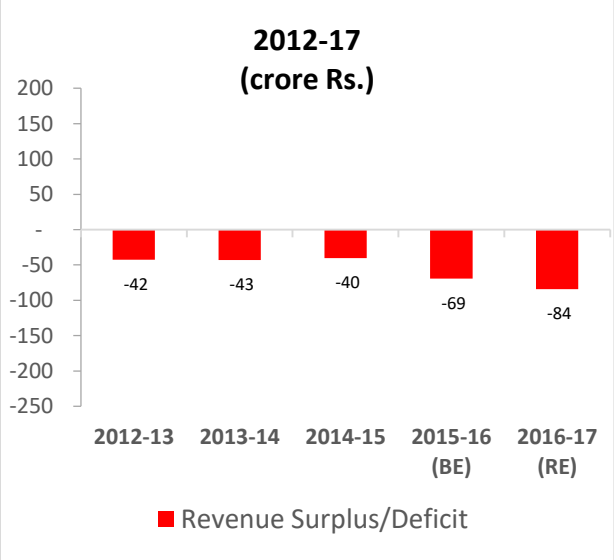


Figure 18: Kochi revenue surplus/deficit



Kochi Municipal Corporation has had a continuous deficit (own revenue – total revenue) of 21 per cent over the last five years, with the highest deficit at Rs. 84 crore in 2016-17 (BE).

However, if the deficit is computed by deducting total revenue from total revenue expenditure, Kochi witnessed an average revenue surplus of Rs. 52 crore.

Kochi is able to cover 72 per cent of its total revenue and 82 per cent of salary + O&M expenditure from its own sources.

Figure 19: Kochi revenue, 2012-17

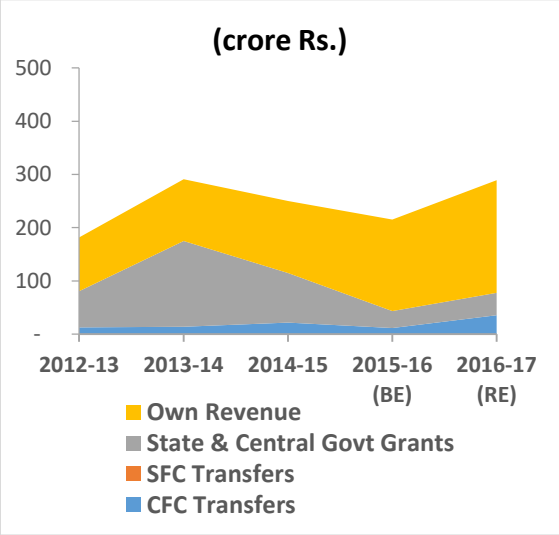
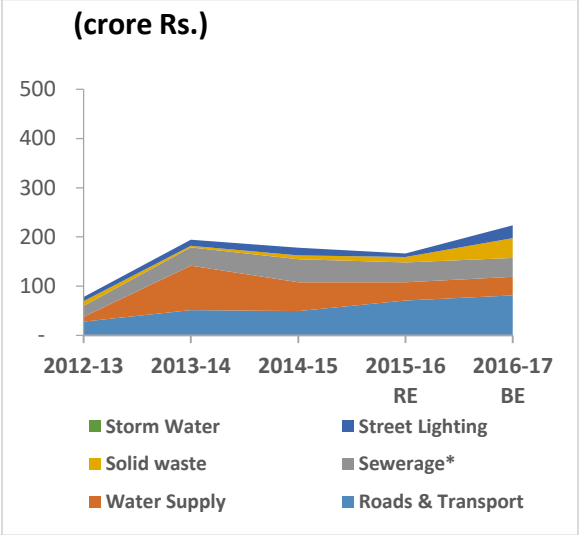


Figure 20: Kochi sectoral revenue & capital expenditure



As compared to 16 per cent growth of own revenue the Central Finance Commission grant has increased at a rate of 23 per cent for the period 2012-17. State and Central government grants (exclusive of SFC and CFC) have declined from Rs. 68 crore (2012-13) to Rs. 42 crore (2016-17). The Kochi Municipal Corporation receipt budget does not show any grants received from the State Finance Commission over the last five years.

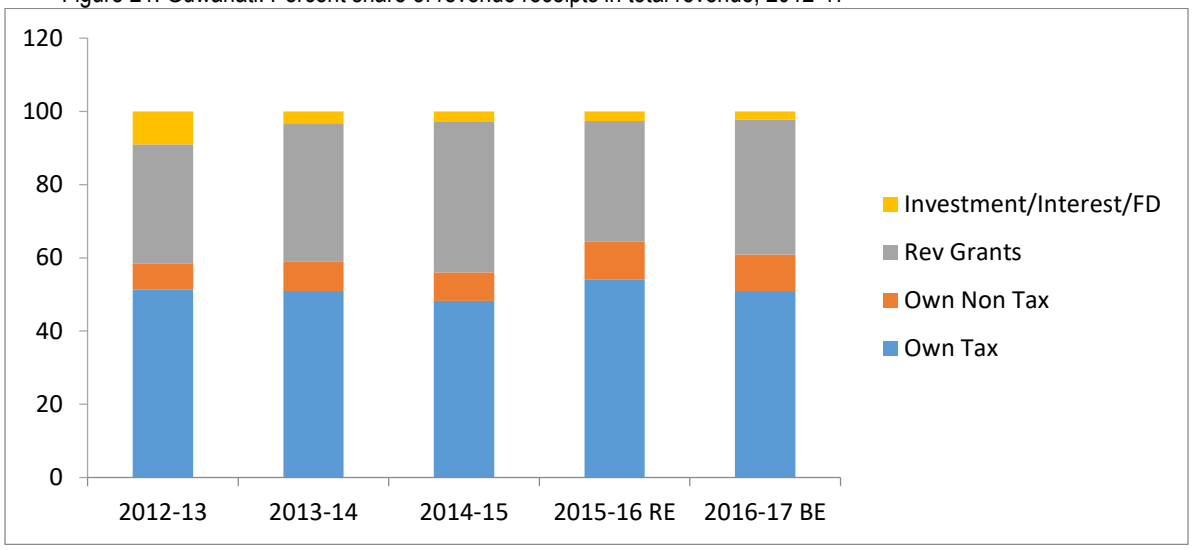
On average, Kochi invested around 36 per cent of total expenditure (2012-13 to 2016-17) in infrastructure including roads, street light, water supply, sewerage and solid waste management. Investment in roads, bridges and flyovers was high and contributed around 12 per cent, while solid waste received only an average investment share of 3 per cent of total expenditure (or Rs. 14 crore) in the period 2012-17.

Guwahati

An average revenue of Rs. 110 crore is generated by the Guwahati MC and 60 per cent of the revenue is collected from own sources which includes own tax revenue (property tax is the major contributor), own non-tax and revenue grants. The total compound growth of revenue is 13 per cent (2012-2017). The growth of own non-tax revenue is highest among the entire revenue receipt components. Guwahati does not receive any 'assigned revenue' grant from

the SFC which is one of the important contributors to municipal revenue. The second most important revenue is the 'revenue grant' which has 32 per cent share in total revenue.

Figure 21: Guwahati: Percent share of revenue receipts in total revenue, 2012-17



In five years, Guwahati spent an average of 57 per cent on establishment and salary and 28 per cent on O&M, which has increased at an average growth rate of 16 per cent. The total revenue expenditure growth was 24 per cent which is much higher than the growth rate of total revenue receipts at 13 per cent.

Figure 22: Guwahati expenditures, 2012-17

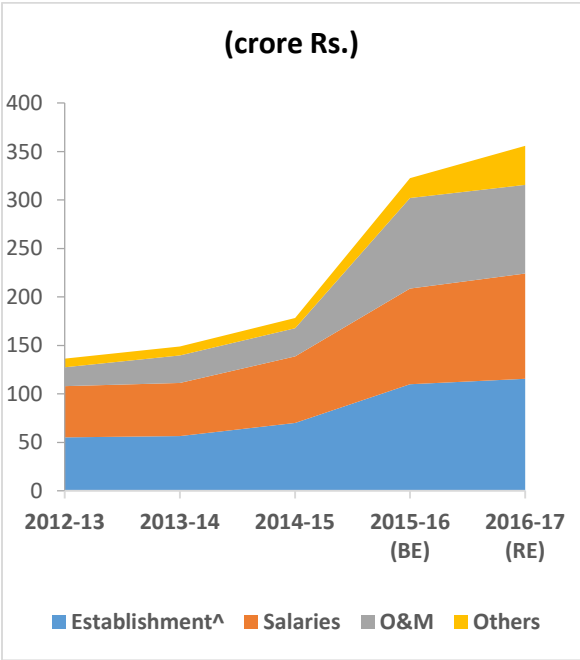
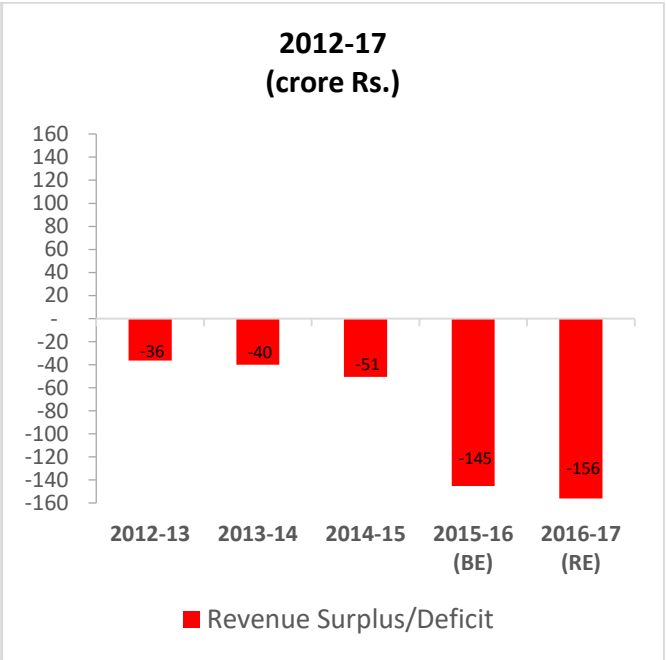


Figure 23: Guwahati revenue surplus/deficit



The deficit (own revenue – revenue expenditure) of Guwahati has increased over the years from Rs. 36 crore in 2012-13 to Rs. 156 crore in 2016-17. Guwahati's sufficiency level is low. It is able to cover only 50 per cent of its revenue expenditure and 54 per cent of salary and O & M expenditure from its own revenue.

Figure 24: Guwahati revenues, 2012-17

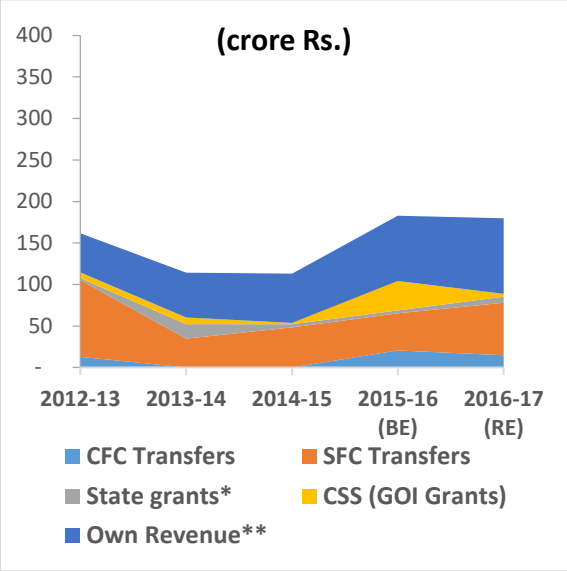
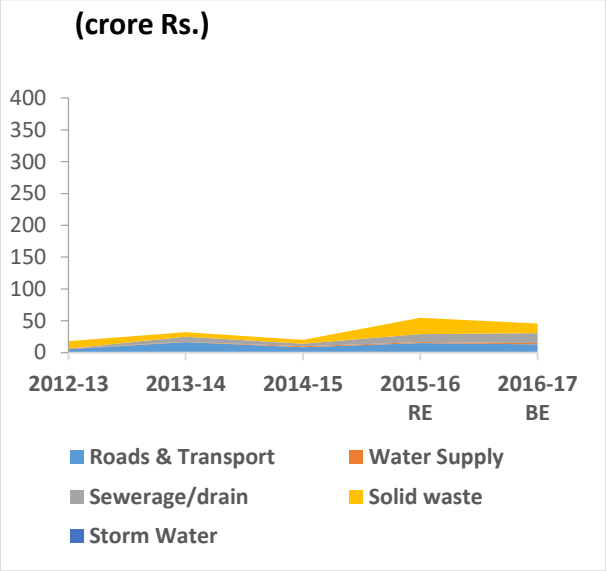


Figure 25: Guwahati sectoral revenue & capital expenditures, 2012-17



In the period of five years much of its grants (revenue and capital grants) came from state finance commission grants. CSS grants saw a declining CAGR of 13 per cent. Guwahati received only an average of Rs. 7 crore as state grants (exclusive of SFC). It spends an average of 20 per cent (revenue + capital) in six major infrastructure types (roads, electricity, storm water drain, solid waste management, sewerage/drain and water supply). Out of a total investment of Rs. 43 crore, Guwahati has spent Rs. 13 crore on solid waste, Rs. 11 crore on roads, bridges and flyovers, and Rs. 9 crore on electricity/street lights. The GMC, over the five-year period, has increased its spending on capital infrastructure at an average growth rate of 18 per cent.

Patna

Of the studied Corporations in terms of revenue generation, Patna is one of the weakest. In the period 2012-17 around 65 per cent of its revenue was from grants, and it was only able to collect 30 per cent of revenue from its own sources. The growth of grants was at 24 percent for the period 2012-17, which is higher than the total revenue growth of 22 per cent.

Figure 26: Patna: Percent share of revenue receipts in total revenue, 2012-17

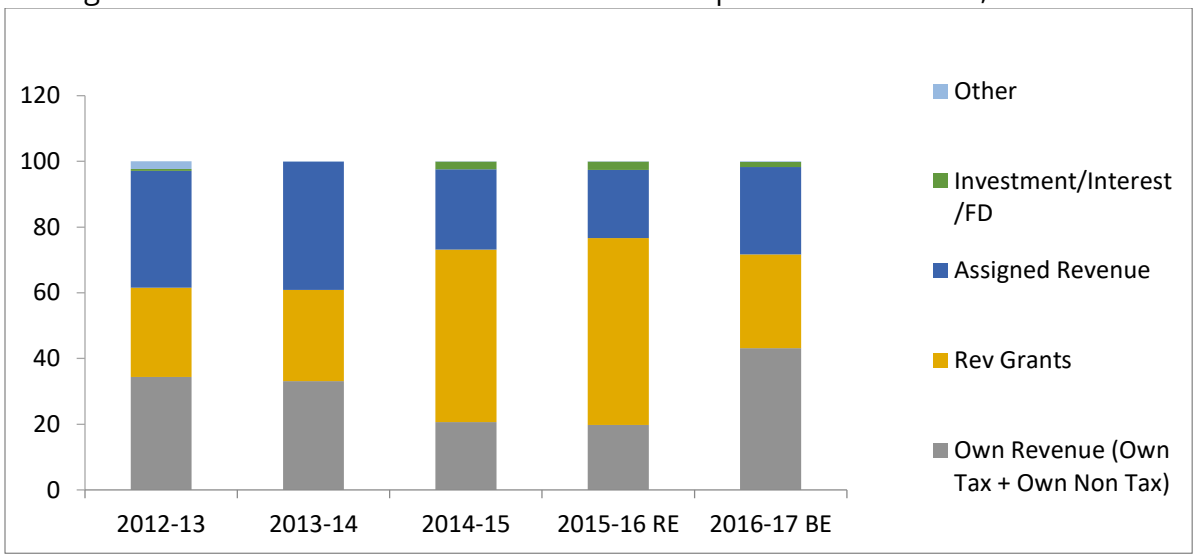


Figure 27: Patna expenditure, 2012-17

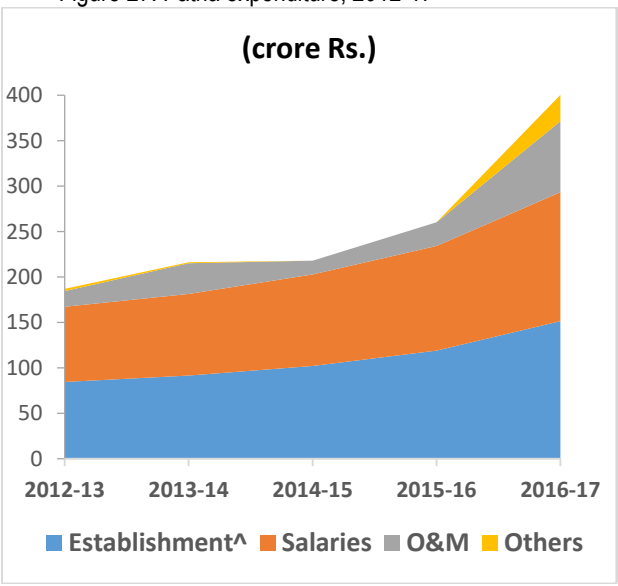
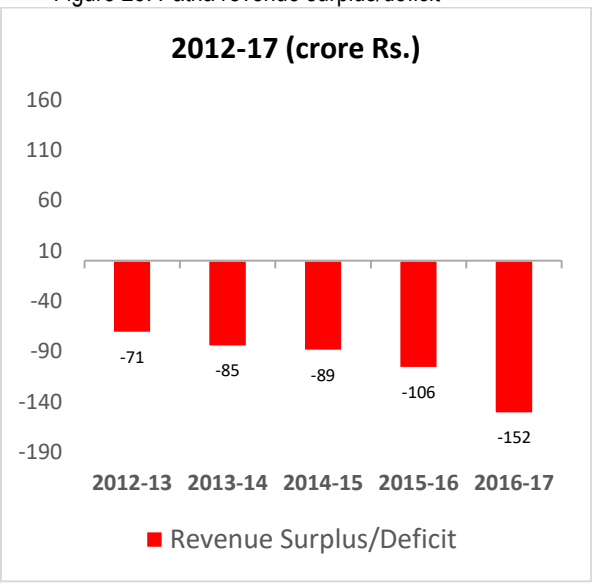


Figure 28: Patna revenue surplus/deficit



The growth of expenditure is 25 per cent which is 3 per cent higher than the growth of revenue receipts. Patna spends an average of 72 per cent of its income on establishment and salaries and 23 per cent on O&M.

Figure 29: Patna revenues, 2012-17

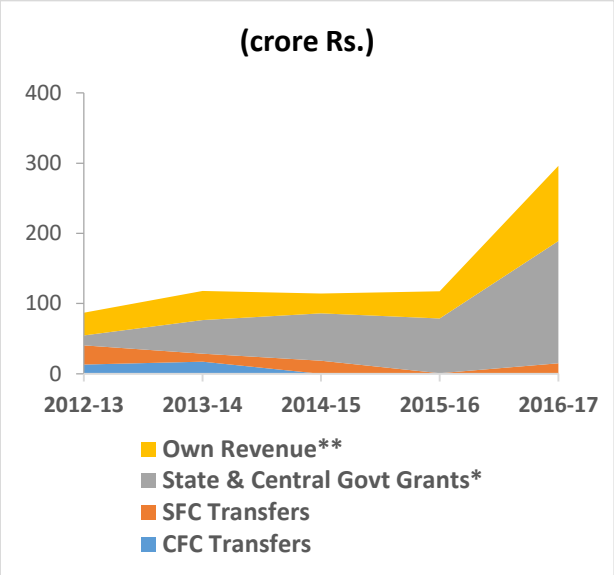
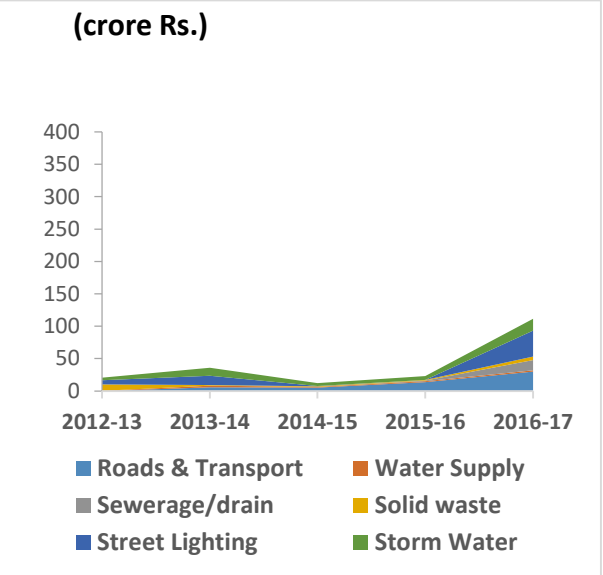


Figure 30: Patna sectoral revenue & capital expenditures, 2012-17



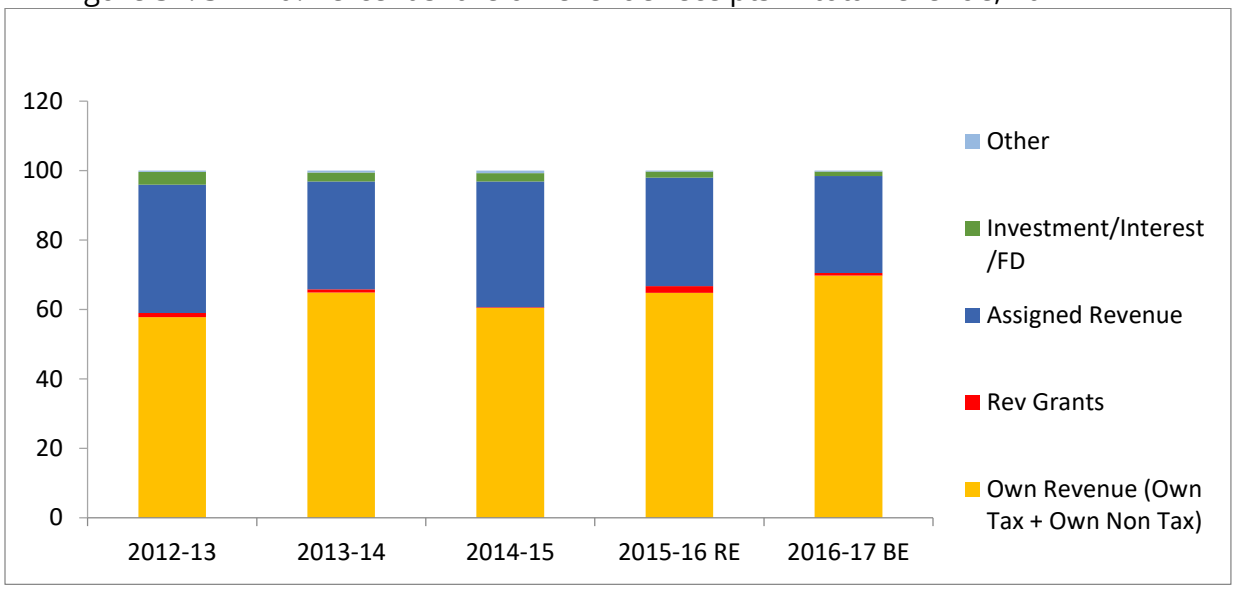
Patna has a deficit of 63 per cent in its revenue account, despite it having increased from Rs. 71 crore in 2012-13 to Rs. 152 crore in 2016-17. It has also only been able to pay 30 per cent of revenue expenditure from its own sources and meet 35 per cent of salary and O&M expenditure.

Patna MCs own revenue is very low at 30 per cent leaving it dependent on external sources of revenue. For the period 2012-17 Patna received a continuous flow of funds from SFC, CFC and state and central government grants (exclusive of CFC and SFC). The growth of the SFC grants has a declining compound growth rate whereas, state and central government grants saw a CAGR of 64 per cent.

Shimla

Shimla is the smallest studied Municipal Corporation and has collected an average revenue of Rs. 65 crore in five years from all sources. It receives a small amount of Rs. 0.5 crore as a revenue grant which has increased to 0.8 crore in 2016-17. Most of its revenue comes from fees and user charges and it received an average of Rs. 10 crore in property tax over the period 2012-17. The CAGR of the total revenue is 18 per cent.

Figure 31: Shimla: Percent share of revenue receipts in total revenue, 2012-17



Shimla's expenditure has increased from Rs. 50 crore in 2012-13 to 112 crore in 2016-17(BE). It is spending an average amount of Rs. 48 crore on establishment and salaries in the total expenditure budget of Rs. 69 crore. It spends only 28 per cent on the mandatory component of O&M but the growth of spending is 32 per cent which is much higher than the other expenditure heads.

Figure 32: Shimla revenue expenditure

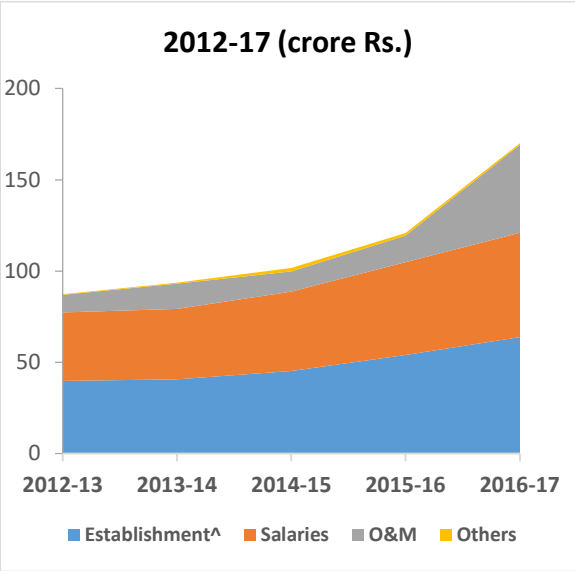
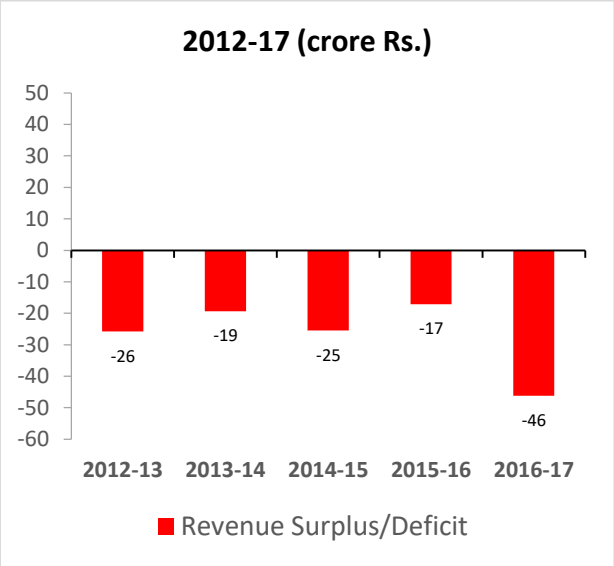


Figure 33: Shimla revenue surplus/deficit



Shimla's deficit (own revenue minus total revenue) ranges from Rs. 26 crore to Rs. 46 crore in the period 2012-13 to 2016-17. Own revenue to expenditure ratio is 62 per cent which implies that 38 per cent of the expenditure should be brought in from other sources like CFC, SFC and other revenue grants. Shimla is a small Corporation but it has managed to cover almost 65 per cent of its O&M and salary expenditure from its own sources.

Figure 34: Shimla revenues, 2012-17

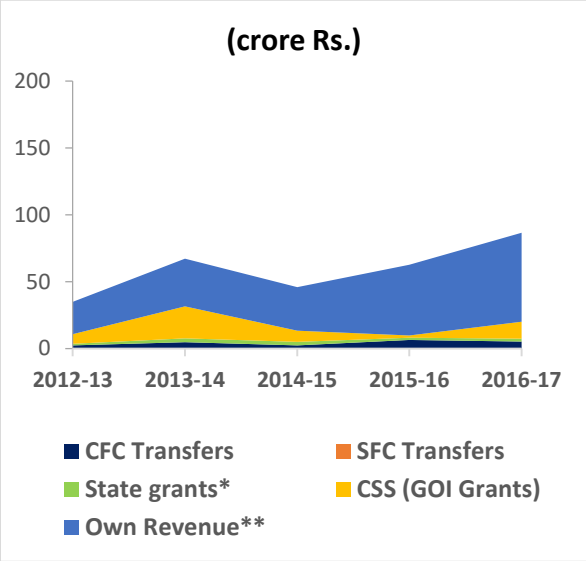
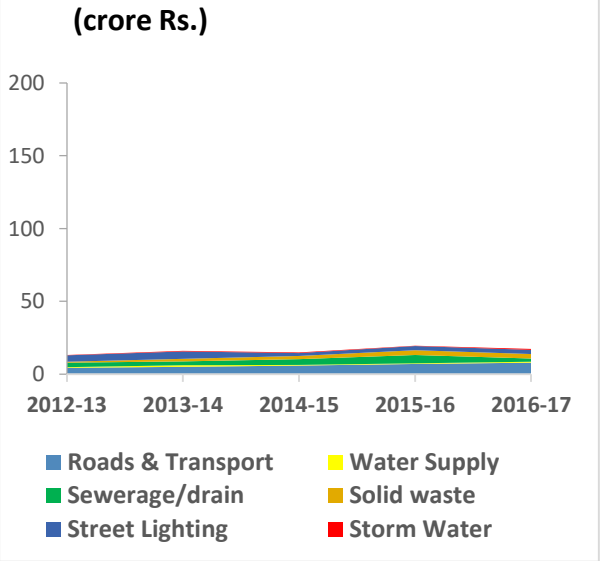


Figure 35: Shimla sectoral revenue & capital expenditures, 2012-17



It received an average amount of Rs. 11 crore as a grant from CSS, Rs. 4 crore from CFC and Rs. 2 crore from state grants. No data is available on SFC grants. The growth of state grants stands at 11 per cent which is lower than other transfers.

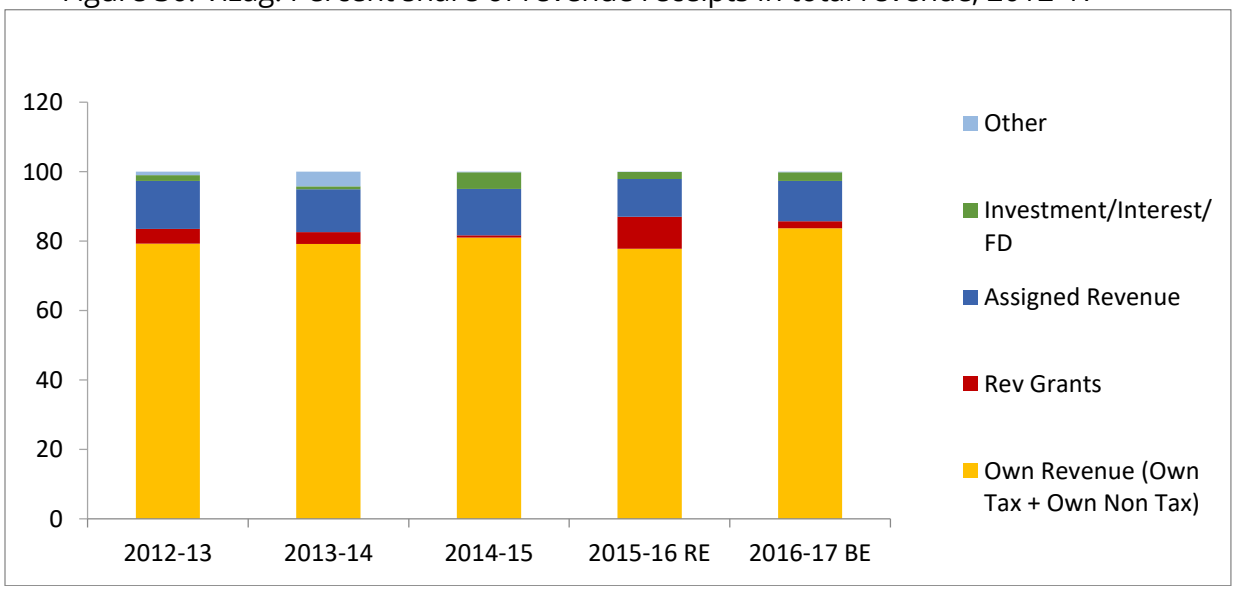
Shimla's investment in major infrastructure components has declined from 20 per cent in 2012-13 to 8 per cent in 2016-17 (BE). The expenditure in water supply and storm water drainage was much lower and witnessed an investment of Rs.0.4 crore and Rs. 0.6 crore respectively in 2016-17. The cumulative growth of expenditure in six major infrastructure types was only 7.3 per cent.

Visakhapatnam

The own revenue position of Visakhapatnam (Vizag) is better than the other selected cities. Greater Visakhapatnam Municipal Corporation's (GVMC) dependence on revenue grants is low; it received an average of only 4 per cent in the period 2012-2017. Assigned revenue from the state is the third major source of revenue in Visakhapatnam after property tax and fees, and user charges.

Of the total average expenditure of Rs. 607 crore Visakhapatnam spent Rs. 219 crore on establishment and salaries which is 36 per cent of the total expenditure. The expenditure on O&M saw a high share of 55 per cent which is generally not the case with other Municipal Corporations. The compound growth of total expenditure is 26 per cent which is 5 per cent higher than the growth of revenue receipts.

Figure 36: Vizag: Percent share of revenue receipts in total revenue, 2012-17



Out of the six corporations studied, Visakhapatnam is the only Municipal Corporation which has a revenue surplus. Years 2012-13, 2015-16 and 2016-17 saw a surplus of Rs. 25, 33 and 73 crore respectively. Almost all the revenue expenditure is covered by its own revenue.

Figure 37: Vizag expenditures, 2012-17

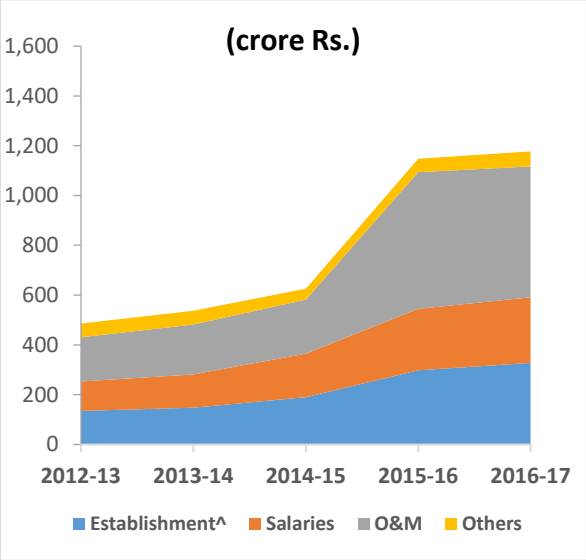
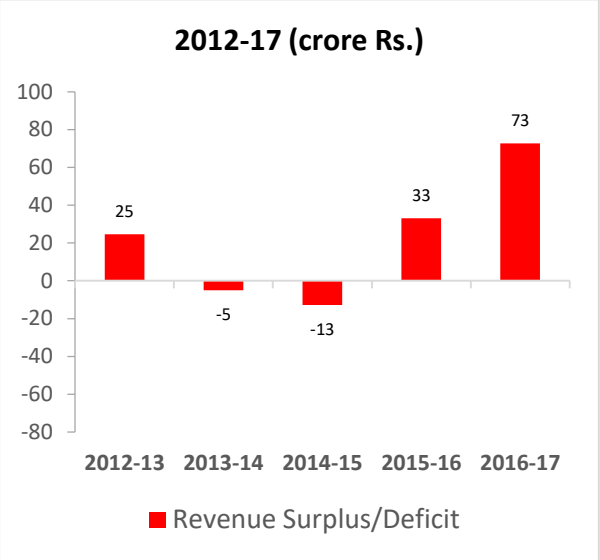


Figure 38: Vizag revenue surplus/deficit



Most of the grants are allocated from central and state government funds (exclusive of SFC and CFC grants). These increased from Rs. 300 crore in 2012-13 to 339 crore in 2016-17 (BE). SFC has not recommended any grants during these five years.

Figure 39: Vizag revenues, 2012-17

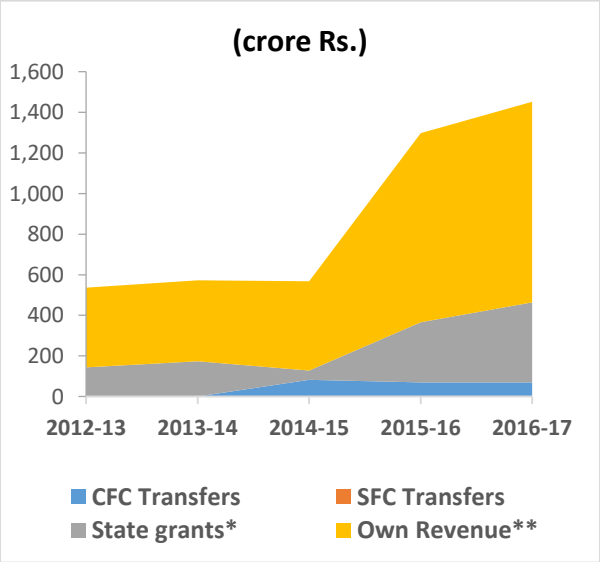
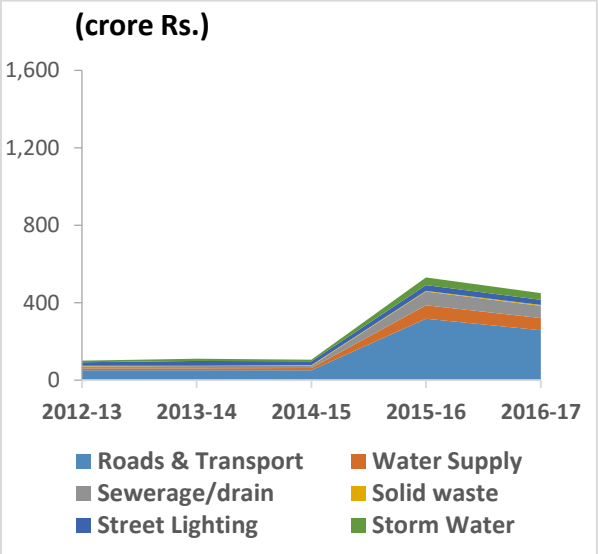


Figure 40: Vizag sectoral revenue & capital expenditures, 2012-17



The six major infrastructure types (road & transport, water supply, sewerage/drain, solid waste, electricity/street light and storm water) of GVMC received an average investment of

Rs. 263 crore over the five years which is 16 per cent of the total receipts (revenue + capital). Major expenditure was made on roads (Rs. 146 crore), electricity/street lights (Rs. 24 crore) and water supply (Rs. 36 crores). The CAGR of investment is 30 per cent.

Summary

The following section presents a longitudinal analysis of study ULB Finances over seven years from 2009-2016 with CAGR rates calculated for the period 2012-17.

Own Revenue Scenario

The share of own revenue in total revenue has declined over 2009-14 for all cities, except Visakhapatnam. The share for 2015-16 has increased in three cities (Guwahati, Kochi and Shimla), likely due to an increase in the accrual of arrears and restructuring of the CSS in 2014-15, which reduced the number of central schemes.

The bulk of revenue and receipts in all the five cities are from own revenue – Guwahati (44 per cent), Shimla (70 per cent), Chennai (68 per cent), Vizag (63 per cent) and Kochi (60 per cent). The own revenue contribution was as low as Rs. 65 crore for Guwahati (Rs. 694 per capita) and as high as Rs. 631 crore for Visakhapatnam (Rs.3684 per capita).

Table 8: Revenue Receipt (in Crore)

City/Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Chennai	541	538	529	706	824	925	-
Guwahati	-	-	-	47	54	59	80
Kochi	67	72	83	101	116	135	141
Patna	-	-	-	31	42	28	-
Shimla		22	25	24	36	33	52
Visakhapatnam	-	-	-	392	399	439	933

Source: Municipal Budget Document (Annex II)

Table 9: Own Revenue as a Share of Total Revenue (in percentage)

City/Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Chennai	58	53	43	44	48	52	-
Guwahati	-	-	-	58	59	56	73
Kochi	61	59	56	55	51	51	63
Patna	-	-	-	34	33	21	-
Shimla	-	63	62	58	65	60	64
Visakhapatnam	-	-	-	79	79	81	78

Source: Municipal Budget Documents; Calculated from Annex II

Expenditure

Revenue expenditure can be seen as a proxy for service levels based on an assumption that the higher the level of expenditure in basic infrastructure (e.g. water supply, sewerage, roads) the higher the service level in the city.[73] The expenditure levels of the selected Municipal Corporations has been analysed in terms of size, trends and composition in an attempt to distinguish between expenditure on establishment and wages and salaries, i.e., the non-mandatory component, from other vital expenditures which include expenditure related to operation and maintenance of services.

Table 10; Per Capita Revenue Expenditure (2012-2017)

Cities	Avg Per Capita Revenue Expenditure (in Rs.)	CAGR(%)
Chennai	3542	19.7
Guwahati	1378	24.3
Kochi	2817	15.7
Patna	654	20.0
Shimla	3459	17.8
Visakhapatnam	3532	22.7
Source: Municipal Budget Documents; calculated from Annex III		

Chennai (Rs. 3,542), Visakhapatnam (Rs. 3,532), Shimla (Rs.3,459) and Kochi (Rs. 2,817)have a higher relative per capita expenditure, while Guwahati (Rs. 1,378) and Patna (Rs. 654) are at the bottom of the per capita expenditure rank.

Table 11 analyses the performance of the Municipal Corporations on the basis of two supplementary criteria, namely expenditure on establishment/salaries, and operation and maintenance expenditure.

[73] HPEC (2011) Report on Indian urban infrastructure and services http://icrier.org/pdf/FinalReport-hpec.pdf

Table 11: Per Capita Expenditure on Establishment and Salaries Revenue Expenditure (2012-2017)

Cities	Establishment & Salaries (in Rs.)	CAGR (%)	O&M (in Rs.)	CAGR (%)
Chennai	2,133	13.9	1012	36.0
Guwahati	740	16.0	407	30.0
Kochi	831	8.9	933	20.7
Patna	477	12.4	148	35.4
Shimla	2,437	9.9	972	37.5
Vishakhapatnam	1,278	19.5	1942	23.3

Source: Municipal Budget Documents; calculated from Annex III (Establishment & Salaries includes salary wages bonus and administrative expenses)

Centrally Sponsored Schemes

The aim of JNNURM was to provide city-wide infrastructure and basic services to the urban poor, including land tenure, affordable housing, water, sanitation, education, health and social security. Since 2014, the GOI has launched several new schemes targeting urban areas, such as the Smart Cities Mission, AMRUT, SBM and PMAY. While the availability of financial resources is a cause of concern for the ULBs, the absorption of programme funds, as made available by the Central and State Government, is an equally significant challenge. As per the 2nd report of the Standing Committee on Urban Development (2017-18) the average utilisation for all schemes put together is less than 20 per cent. The funds allocated and released for various urban development schemes for the period 2014-2018 is presented in Figure 41.

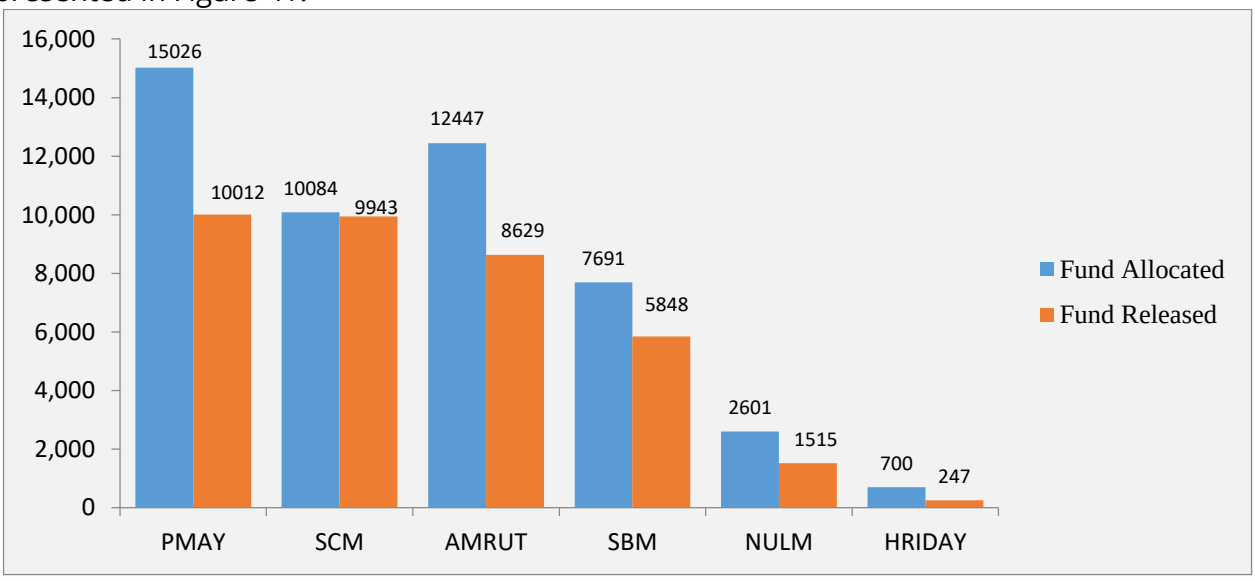


Figure 41: Fund allocation and released for urban schemes 2012-17 (in crore)

Source: Twenty second report standing committee on urban development-2017-18 (Annex IV)

The performance and progress of the Smart Cities Mission and AMRUT have been analysed for the six study cities.

Smart Cities Mission

As of January 04, 2018, 90 Smart Cities have been identified comprising 2,864 projects worth Rs.1,35,958 crore, of which 148 projects worth Rs. 1,872 crore have been completed; work is underway on 407 projects worth Rs. 15,600 crore; tendering has begun for 237 projects worth Rs. 13,514 crore. The remaining projects are at the Detailed Project Report (DPR) stage.[74]

Table 12: Smart City Mission: City-wise Breakup of Projects Under Progress / Completed

	Tender Issued		Work Order Issued		Work Completed	
City	**Number of Projects**	**Cost (Rs. crore)**	**Number of Projects**	**Cost (Rs. crore)**	**Number of Projects**	**Cost (Rs. crore)**
Chennai	3	20	.	.	.	.
Guwahati	8	354	.	.	.	.
Kochi	2	44	1	25	.	.
Vishakhapatnam	14	1055	23	233	.	.
India	**237**	**13514**	**407**	**15599**	**148**	**1872**

Source; MoHUA, 2018[74]

Only 5.2 per cent of the total identified projects have been completed with a spend of 1.4 per cent of the planned investment of Rs. 1,35,958 crore. Chennai, Guwahati, Kochi and Visakhapatnam are yet to complete a single project.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

The Government of India launched the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) on 25 June 2015. Under the Mission, States/Union Territories (UTs) have been empowered to select, appraise and implement individual projects. The Ministry does not approve individual projects but accords approval to the State Annual Action Plans (SAAPs) submitted by the States/UTs only. The Ministry has approved SAAPs worth Rs. 77,640 crore, including central assistance of Rs. 35,990 crore.

Special state level programmes are also helping improve city infrastructure and resilience such as the Chennai Mega City Development Mission (CMCDM) which was launched with an

[74] Ministry of Housing and Urban Affairs (2018), Report submitted to Rajya Sabha on Jan 4, 2018 on the Status of urban development schemes. Accessed at https://164.100.158.235/question/annex/244/Au1975.pdf on September 2018

objective of improving infrastructure facilities and basic amenities such as roads, water supply, sewerage and sanitation, storm water drains (SWDs) and street lights in an integrated manner in the Chennai metro region. The main thrust was to bring added areas at par with the erstwhile Chennai Corporation i.e. the core city. The funding for this was around Rs. 500 crore for a five-year period.

Infrastructure investments compared to HPEC recommendations

The HPEC has estimated on a per capita basis the investment requirement on both capital and O&M from 2012-2030.

Table 13: Per Capita O&M Cost (Annual) and Capital Expenditure by Sector as Recommended by HPEC Based on 2009-10 Prices

Sector	Capital investment	O&M Cost
Water Supply	5,099	501
Sewerage	4,704	286
Solid Waste Management	391	155
Urban Roads	22,974	397
Storm Water Drains	3,526	53
Urban Transport	5,380	371
Traffic Support Infrastructure	945	34
Street Lighting	366	8
Total	43,386	1,806

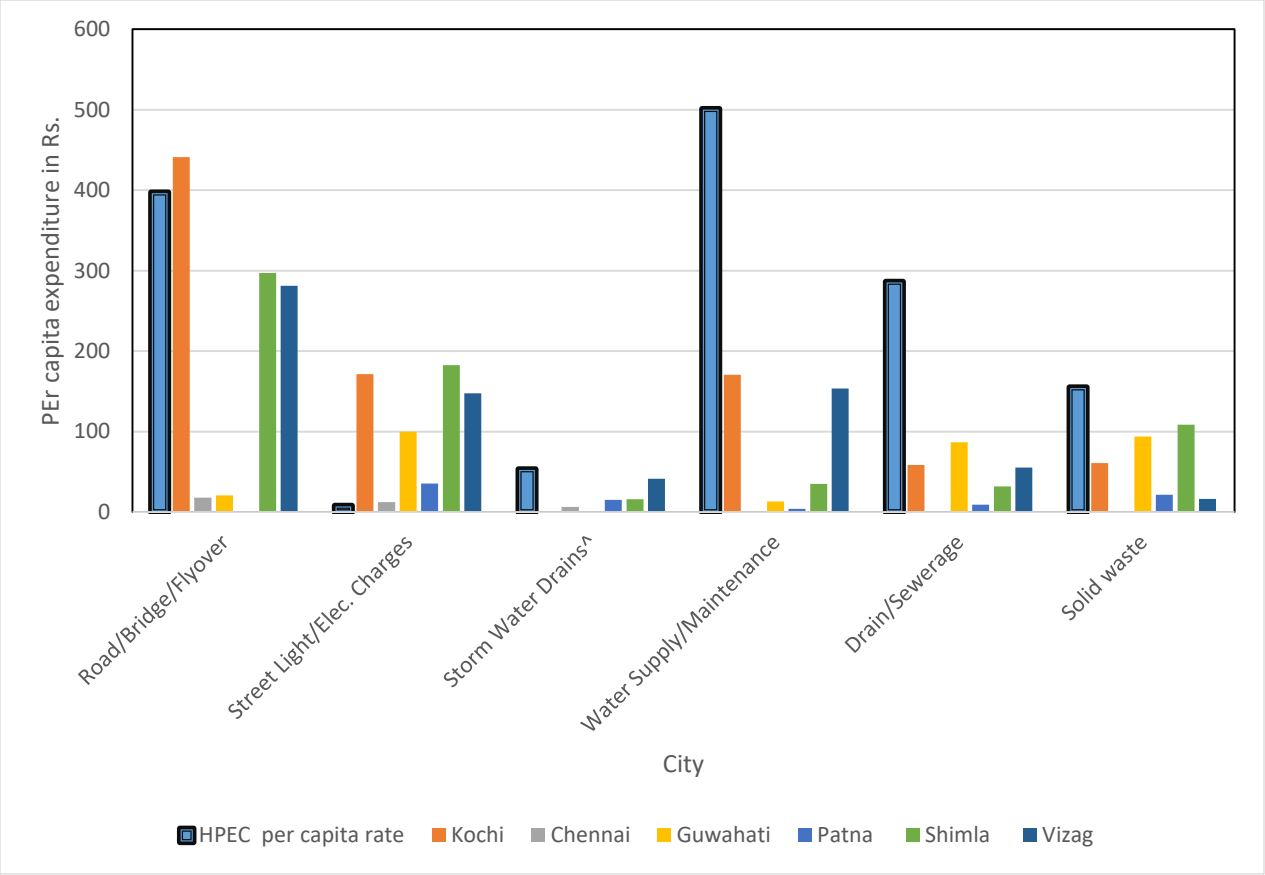
Source: HPEC report, 2011

O&M expenditure for the period 2012-17 for the six ULBs was adjusted to 2009-10 prices using Wholesale Price Index (WPI)[75] and changes in these years and the per capita average O&M expenditure was estimated. The population of the cities for the year 2009 was estimated based on 2001 and 2011 census figures and the CAGR was estimated based on population growth. The average per capita expenditure on O&M made by the six ULBs is compared against the figure recommended by HPEC for different infrastructure and services. In our study we used O&M as a proxy for assessing ULBs own ability to plan for resilience and our analysis shows that its lagging with respect to HPEC recommendations (in quantum).

The detailed analysis can be found in Tables 1 & 2 of Annex III.

[75] Operation and Management Expenditure of each city has been rescaled at 2009-10 constant prices to compare with the HPEC recommendations. Base shifting and forward splicing of WPI has been done to get the series at 2009-10 constant prices.

Figure 42: HPEC vs ULBs per capita O&M expenditure



The analysis shows that all the six cities have lower rates of average O&M expenditure per year than the rates prescribed by the HPEC on all major infrastructure and services. Similarly, the O&M expenditure per capita in the six cities is less than the HPEC recommended per capita expenditure by about 40 to 60 per cent. In critical sectors like water supply, the O&M expenditure was poor for Patna (0.8 per cent) and Guwahati (2.6 per cent). On storm water drains Kochi and Guwahati had almost nil O&M expenditure. On roads and bridges, Chennai had the lowest O&M expenditure at 0.5 per cent. Shimla fared poorly in O&M expenditure related to sewerage infrastructure having spent just 1 per cent of the recommended amount. Guwahati's O&M expenditure in water supply, sewerage and storm water drain was very poor (average of Rs. 15 crores per annum, while the required expenditure was around Rs. 80 crore per annum assessed for the period 2012-17). The O&M cost for water supply and drainage were not available for Chennai as services are delivered by the TN Water Supply and Sewerage Board. The lack of investment on critical infrastructure such as Storm Water Drains along with inappropriate land use planning has costed Kochi city significantly, during the 2018 floods (Box 2).

As has been seen from this analysis, the own revenue of the six study cities is poor, contributing to only about 40 to 60 percent of total revenue. As a result the ULBs are left with little fiscal space to spend on new infrastructure and upgradation of old infrastructure. The CSS transfers make up a high proportion of revenue for ULBs such as Guwahati and Patna with poor own revenue sources. However, it is important for the ULBs to become financially robust in the long term, which would require them to improve their own-revenue or create innovative means to finance capital and O&M expenditure.

Box 2: Kochi floods of 2018

The Kerala floods of 2018 were an unprecedented event due to record rainfall of over 3000 mm leading to overflowing of rivers and reservoirs. Kochi Urban Agglomeration that is already in the backwaters of Vembanad lake and coasts were most affected. The change in land use and infrastructure development in flood prone areas is one cause, while the lack of critical infrastructure of storm water drains to mitigate floods is the major gap that aggravated the flooding.

Studies such as Sowmya et al. 2015 have pointed that about 9 per cent of Kochi city's geographical area is flood prone and lack of drainage network and high tides from the coasts increases the impact of floods.

The Service Level Improvement Plan (SLIP) prepared under AMRUT notes that Kochi has a storm water drain network of only 43 per cent, while the MoUD benchmark recommends 100 per cent coverage.

IIHS analysis on land use land cover change and population growth shows an increase in built-up areas from 2001 to 2017. The decadal population growth has also been high at about 34 per cent. The capital and O&M expenditure on storm water drain are below par for the period 2012-17.

Source: Reuters

Section IV – Building Infrastructure and Resilience Through Centrally Sponsored Schemes

Centrally Sponsored Schemes have made an important contribution to urban infrastructure development particularly in states that are fiscally constrained and cities that have poor own-revenue. This section analyses the role of CSS in building urban infrastructure and resilience on the recent and currently implemented schemes related to: (i) investments on capital and O&M on infrastructure; (ii) improving urban development and planning, land use planning; and (iii) incentivising ULBs to improve their own revenue and build capacity.

India's Five-year plans which were started in 1950 initially focussed on rural and industrial development, and thereafter, on social development. Urban development was recognised as a separate subject only in the Fifth Five Year Plan (1974-79) particularly after the constitution of the Task Force on planning and development of Small and Medium Towns in 1975, which submitted its report in 1977.[76] The Fifth Five Year Plan recognised the importance of urban and regional development plans; town planning legislation; environmental improvements in slums; and water supply and sanitation. The Minimum Needs Programme (MNP) was initiated in 1975 to provide basic services to the urban poor on water supply, sanitation and housing.

The Seventh Five Year Plan (1985-90) heralded a shift in urban policy as it initiated a process of opening up avenues for private sector participation in urban development.[77] In order to boost the housing finance market, the Plan recommended setting up the National Housing Bank. It also proposed the setting up of the National Urban Infrastructure Development Finance Corporation to augment the capacity of ULBs to create infrastructure, particularly water supply and sewerage facilities.

The CSS of Integrated Development of Small & Medium Towns (IDSMT) was initiated in 1979-80 and was continued with timely amendments and modifications up to 2004-2005. In 1993-94, the Government of India financed a national-level Accelerated Urban Water Supply Programme (AUWSP) with the objective of providing safe drinking water to towns with a population of less than 20,000. The process of urban reforms reached its high point in December 2005 when the Prime Minister launched the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), a reform-linked incentive scheme which aided state governments and ULBs in 65 selected cities, for a period of seven years (up to 2012).

In 2002 the government allowed 100 per cent Foreign Direct Investment (FDI) in integrated townships, including housing, commercial premises, hotels, resorts, and infrastructural

[76] Lalit Batra (2009) A Review of Urbanisation and Urban Policy in Post-Independent India. Working Paper, JNU. https://www.jnu.ac.in/sites/default/files/u63/12-A%20Review%20of%20Urban%20%28Lalit%20Batra%29.pdf

[77] Government of India, 1985. Seventh Five Year Plan, Vol. I, Planning Commission, New Delhi.

projects based on the Tenth Five Year Plan. The plan opined that urban infrastructure could not be funded by budgetary support alone. To enable ULBs to raise their own resources the Plan advocated the following: (i) reforming property tax collection; (ii) levying user charges; (iii) increasing non-tax revenues; (iv) controlling establishment costs; (v) better utilisation of municipal assets; and (vi) overhauling of the municipal accounting systems.[78]

The previous section showed that the CSS contribute to about 20-40 per cent of total revenue receipts of the studied ULBs, targeted at infrastructure development. This is an important resource for urban infrastructure improvement especially for ULBs that have a small own-revenue share. However, CSS are generally oriented towards improving urban infrastructure and basic services and not particularly targeted at disaster risk reduction and resilience building, which makes them a blunt policy instrument to deliver on urban infrastructure resilience outcomes.

Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in December 2005 as a flagship project of the Government of India. The objective of the project was to lead "a reforms-driven, accelerated development of Indian cities, with a particular focus on urban infrastructure".[79] The Mission comprised two sub-missions: Urban Infrastructure and Governance (UIG), and Basic Services for the Urban Poor (BSUP). The main thrust of the UIG was on financing major infrastructure projects relating to water supply, sewerage, drainage, solid waste management, roads, urban transport and redevelopment of inner (old) city areas.

UIG was administered by the Ministry of Urban Development (MoUD), and BSUP was administered by the Ministry of Housing and Urban Poverty Alleviation (MoHUPA) – two separate ministries which led to a number of convergence challenges. These two sub-missions focussed on 65 select cities (35 million-plus cities and 30 other cities) including capital cities and cities of religious, historic and tourist importance.

For all other medium and small towns in the country, the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) and the Integrated Housing and Slum Development Programme (IHSDP) were launched. These sub-missions and programmes replaced a number of earlier government programmes including Accelerated Urban Water Supply Programme (AUWSP), Integrated Development of Small and Medium Town (IDSMT), Valmiki Ambedkar Awas Yojana (VAMBAY) and Integrated Housing and Slum Development Programme (IHSDP).

[78] Purohit (2016) Financing Urban Infrastructure in India. An Overview of Policy Lessons. UNESCAP Working Paper. https://www.unescap.org/sites/default/files/4.Financing%20urban%20infrastructure_Mahesh%20Purohit.pdf

[79] MoUD and MoUEPA, 2005 Jawaharlal Nehru National Urban Renewal Mission: Overview. New Delhi: Ministry of Urban Development and Ministry of Urban Employment and Poverty Alleviation, Government of India. http://mohua.gov.in/upload/uploadfiles/files/1Mission%20Overview%20English(1).pdf

The Mission was initially for a seven-year period (2005-2012) and was extended up to March 2014 to complete approved projects. It was estimated that over a seven-year period, 63 ULBs would require a total investment of Rs. 1,20,536 crore in basic infrastructure and services with an annual funding requirement of Rs. 17,219 crore.[79]

Reported data on the 65 JNNURM cities shows that the total utilisation under the mission was Rs. 36,110 crore against a total approved cost of Rs. 62,250 crore.[80] Per capita approved cost for this scheme was Rs. 10,000, while the utilisation for most of the cities was below Rs. 5,000 indicating an average 50 per cent utilisation for the seven-year period up to March 2012. The JNNURM expenditure analysis also shows that the bulk of investments has been for water supply followed by transport and sewerage projects. About Rs. 4,750 crore was spent on storm water drains, with about two-thirds going towards expanding storm water drains to new areas and the balance to improve older storm water drains.[81]

JNNURM had a precondition that O&M expenditure shall be met by the ULBs for which they should find ways to leverage funds. Financial sustainability of ULBs was recognised as a critical issue to ensure implementation of infrastructure projects under JNNURM, and the O&M processes were to enable effective cost recovery mechanisms.[81]

The UIG scheme compelled the ULBs to leverage 10-50 per cent of the total project cost from their own revenue or infrastructure development loans, while for UIDSSMT this was about 10 per cent. The BSUP sub-scheme was wholly funded by the Central and State governments under a 50-50 per cent share, while the IHSDP required a contribution of 20 per cent by the ULB or the parastatal implementing agency.

The bulk of capital expenditure by the JNNURM between 2006 and 2011 was in water supply (47 per cent), sewerage (22 per cent), drainage/storm water drain (11 per cent) and transportation (17 per cent). For O&M, JNNURM had set a pre-condition that it would need to be covered through a levy of reasonable user charges by the ULBs and parastatals. In addition, 5 per cent of the grant was to be reserved for the preparation of capacity building and plan preparation, funding for community participation, and information, education and communication.[81]

A research study found that, "The mission has succeeded in getting the state and city governments to commit themselves to structural reforms, which the central government had failed to achieve despite adopting several measures and incentive schemes proposed

[80] data available on http://jnnurm.nic.in/ as on 28th September 2012

[81] Wankhade (2012) JNNURM an opportunity for sustainable urbanization. IIHS report. http://iihs.co.in/knowledge-gateway/wp-content/uploads/2017/11/JNNURM-An-Opportunity-for-Sustainable-Urbanisation-Secondary-Review-Analysis_Final.pdf

since the early 1990s through other programmes and legislations".[82] The ULBs have also showed marked improvement in fund augmentation and spending on infrastructure.[83] However, the scheme did not focus on urban planning and development or other such resilience initiatives.

Table 14: JNNURM Sub-missions

Sl.No	Sub-missions	Sectors	Coverage	Funding Pattern
1.	Urban Infrastructure and Governance	Water supply Sewerage Drainage Solid waste management Road network Urban transport	65 Mission Cities	Centre: 35-90% State: 10-20% ULB/Parastatal: 10-50%
2.	Urban Infrastructure Development Scheme for Small and Medium Towns		Remaining cities and towns	Centre: 80% State: 10% Nodal/implementing agencies: 10%
3.	Basic Services to the Urban Poor	Shelter for the urban poor Re-development of slums.	65 Mission Cities	Centre: 50-90% State: 10-50%
4.	Integrated Housing and Slum Development Programme		Remaining cities and towns	Centre: 80% State/ULB/Parastatal: 20%

Source: JNNURM scheme details accessed from MoHUA[84]

Atal Mission on Rejuvenation and Urban Transformation (AMRUT)

The Atal Mission on Rejuvenation and Urban Transformation (AMRUT) was launched by the Government of India as a second-generation urban development programme in June 2015. The Mission focuses on the following areas: (i) water supply; (ii) sewerage facilities and septage management; (iii) storm water drains to reduce flooding; (iv) pedestrian, non-motorised and public transport facilities, parking spaces; and (v) enhancing the amenity

[82] Kundu, D., & Samanta, D. (2011). Redefining the inclusive urban agenda in India. Economic and Political Weekly, 55-63. https://www.epw.in/journal/2011/05/special-articles/redefining-inclusive-urban-agenda-india.html
[83] Garg, A., & Avashia, V. (2016). Urban infrastructure and governance mission under JNNURM: Have the reforms delivered?. Economic and Political Weekly. Pg 41-53 https://www.epw.in/journal/2016/2/special-articles/urban-infrastructure-and-governance-mission-under-jnnurm.html
[84] MoHUPA (2012). Interactive Q&A on JNNURM. http://mohua.gov.in/upload/uploadfiles/files/3jnnurm.pdf

value of cities by creating and upgrading green spaces, parks and recreation centres, especially for children.

The total outlay for AMRUT is Rs. 50,000 crore for five years from FY 2015-16 to FY 2019-20. An equitable formula has been used to distribute the annual budgetary allocation in which equal weightage is given to the urban population of each State/UT (Census 2011) and the number of statutory towns in the State/UT.

The Service Level Improvement Plan (SLIP) and the State Annual Action Plan (SAAP) report that the funding for the ULBs was made by the MoUD as grants in the following manner: one third of the project cost for cities with a population of more than one million, and 50 per cent of the project cost for cities with a population of less than one million. The balance was to be mobilised from state, city governments and the private sector, with a minimum of 20 per cent coming from State Governments.

On financing, the AMRUT guideline mentions that "Financing of projects, including the O&M costs, is a key aspect of the SLIPs. For each option, the capital cost and O&M cost has to be estimated. Different sources of finance have to be identified. At the ULB level, the contribution from internal sources (e.g. taxes, fees, others), external sources (e.g. transfers from States, project fund from Central/State Governments, others) and possibilities of debt, bonds and others has to be assessed". AMRUT guidelines do provide for urban infrastructure resilience building in principle, as noted in the guideline, "Incorporation of resilience and securing projects against disasters will be done at the stage of preparation of the SLIP itself, particularly for the vulnerable and the poor, and at the project development stage where disaster-secure engineering and structural norms would be included in the design".[85] This will be ensured by the States/ULBs while preparing the SAAPs.

Based on the reforms and targets set for the cities, AMRUT guidelines also focus on capacity building of ULB staff and engineers. The Mission proposed several steps and a set of implementation timelines (Table 5.1 of AMRUT guidelines).[51] In addition to infrastructure (which is relevant to urban disaster risk reduction and resilience), the focus was also on urban planning and city development plans and periodic review and revision of building bye-laws.

A sub-mission under AMRUT, which is the Formulation of GIS-Based Master Plans for the 500 Cities (part of AMRUT), aims at developing digital geo-referenced base maps and land use maps using Geographical Information System (GIS) and Master Plans. This assistance will aid with the formulation of a master plan for decision-making; effective land use management and utilisation; spatial growth management; enabling project planning and

[85] MoUD (2015) AMRUT Mission Guidelines. Reference on resilience is given in section 6.11 page 13 http://amrut.gov.in/writereaddata/AMRUT%20Guidelines%20.pdf

urban management – all of which could contribute towards non-structural resilience building.

A major gap is the very limited consideration to disaster risk and hazard risk vulnerability in spatial analysis, such as the exclusion of flood and other hazard prone areas from development in Master Plans. Along with land use it would be important to consider other spatial parameters such as slope, elevation, soil, water bodies and other natural ecosystems in the planning processes. Environmental planning tools and ecosystem-based approaches such as protection of natural creeks and water bodies and developing natural drainages like bioswales are proven to be effective disaster mitigation tools.[86]

On the building bye-laws front, it is imperative to follow national guidelines such as the ones put forth by the BIS and NDMA. The CAG audit report had observed that Kerala has not followed the National Building Code of India (2016), but instead used its own Kerala Municipality Building Rules (KMBR), 1999. Similarly, for infrastructure projects, AMRUT guidelines could explicitly recommend following guidelines from CPHEEO, BIS and NDMA in addition to following MoUD manuals and guidelines on infrastructure development.

Heritage City Development and Augmentation Yojana (HRIDAY)

The Heritage City Development and Augmentation Yojana (HRIDAY) scheme was launched on 21 January 2015 and is being implemented in 12 cities. Although the city infrastructure on water and sanitation shall be developed from other schemes such as AMRUT, the infrastructure component of this scheme is on “service delivery and infrastructure provisioning in core areas of historic cities”.

The scheme which is completely funded by the central government requires cities to prepare DPRs on the proposed activities that are within the scope of the scheme. Funding will be released by the MoUD post evaluation of the DPR. Currently the HRIDAY guidelines prepared by the National Institute of Urban Affairs does not mention any consideration for hazard risk, mitigation or preparedness by the HRIDAY cities.[87] The heritage cities of Velankanni, Dwarka and Puri are located in coastal regions making them extremely vulnerable to cyclones and coastal storm surges. They also require proper emergency preparedness given the number of people who gather during specific occasions and for pilgrimages year-round. Therefore, it is crucial that such hazard risks be factored into the preparation of the HRIDAY city management and development plan. The guidelines can

[86] Jabareen, Yosef. "Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk." Cities 31 (2013): 220-229. https://www.sciencedirect.com/science/article/pii/S0264275112000832

[87] MoUD (2015) HRIDAY Guidelines. Ministry of Urban Development https://hridayindia.in/wp-content/uploads/2015/01/hriday-brochure.pdf

also make it mandatory for HRVA and the integration of resilience and disaster management in the heritage city management plan.

Smart Cities Mission

The Smart Cities Mission aims at area-based development via improvement (retrofitting), city renewal (redevelopment), and city extension (greenfield development) plus a pan-city initiative in which smart solutions are applied across larger parts of the city. One hundred cities were selected through a competition to participate for this mission, which operates as a CSS.[88] The Central Government financial support to the Mission is budgeted at Rs. 48,000 crore over five years i.e. on an average Rs. 100 crore per city per year. An equal amount, on a matching basis, will have to be contributed by the State/ULB.

The mission guidelines on infrastructure reads as, "The objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions' and the core infrastructure elements include water supply, electricity, mobility, housing and sanitation." The focus is on the application of smart solutions and use of information technology to improve infrastructure and services.[89]

On disaster risk reduction and resilience, the guidelines claim that "Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, making areas less vulnerable to disasters, using fewer resources, and providing cheaper services".

However, the Mission guidelines do not specifically mention the use of information technology to improve early warning systems, communication during emergencies, and preparedness, which are of considerable importance to increasing disaster resilience. Further, Area Based Development Plans could also consider Hazard Risk and Vulnerability and incorporate disaster mitigation into the development plans. The mission guidelines could also include incorporating hazard risk assessment, vulnerability and disaster mitigation in Area Based Development Plans, and encourage better use of ICT in strengthening early warning systems.

Swachh Bharat Mission

The Swachh Bharat Mission (SBM) launched in 2014 aims at achieving total sanitation by 2019. Additionally, in urban areas, it focuses on the development of community toilets and

[88] Selection process of Smart Cities accessed from http://smartcities.gov.in/content/innerpage/process-of-selection.php on September, 2018

[89] MoUD (2015). Smart Cities Mission Statement and Guidelines. Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines(1).pdf

treatment of solid waste management, which could contribute to increased urban resilience, especially to public health.

In urban areas, City Sanitation Plans (CSP) are prepared by the ULBs that then leverage several schemes such as SBM and AMRUT to invest in infrastructure to improve water and sanitation services. These are linked to Central Public Health and Environmental Engineering Organisation (CPHEEO) guidelines, which provide high level guidance on disaster risk and vulnerability while preparing the CSP, and mandate that the CSP should incorporate disaster mitigation and preparedness strategies.

The SBM guidelines which were revised in October 2017 do not mention the preparation of a CSP nor disaster risk and vulnerability and disaster mitigation and preparedness in the water and sanitation sector.[90] The revision of the SBM guidelines enable risk mitigation, and post-disaster recovery of water and sanitation services which are important to curtail outbreaks of water- and vector-borne diseases such as diarrhoea, dengue and chikungunya. Mandatory incorporation of HRVA in the preparation of City Sanitation Plans (CSP) and developing appropriate mitigation and preparedness strategies is required.

Pradhan Mantri Awas Yojana (PMAY)

The Pradhan Mantri Awas Yojana (urban) scheme focuses on providing affordable housing to urban residents. The Mission provides central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs for: in-situ rehabilitation of existing slum dwellers using land as a resource through private participation; credit-linked subsidy; affordable housing; and subsidy for beneficiary-led individual house construction/ enhancement. Five per cent of the total grant is allotted for capacity building, administration and overhead expenses.

The Mission supports the construction of housing for the urban poor up to 30 sq. m. carpet area with basic civic infrastructure for water and sanitation, along with credit-linked subsidies and beneficiary-led construction. The sub-mission of the scheme focusing on technology promotes the preparation and adoption of layout designs and building plans suitable for various geo-climatic zones. It has a provision to assist states/ cities in deploying disaster resistant and environment friendly technologies.

The PMAY scheme guidelines, 2015, mandates that CPHEEO norms be followed for the construction of housing and civic infrastructure and also advises that disaster resilient features in concept, design and project implementation be adhered to in addition to the prevailing building construction bye-laws of the State government or ULBs.[91] The guideline

[90] MoHUA (2017) Guidelines for Swacch Bharat Mission- Urban, Ministry of Housing and Urban Affairs. http://164.100.228.143:8080/sbm/content/writereaddata/SBM_Guideline.pdf

[91] MoHUPA (2015) Pradhan Mantri Awas Yojana, Scheme Guidelines. Ministry of Housing and Urban Poverty Alleviation https://pmaymis.gov.in/PDF/HFA_Guidelines/hfa_Guidelines.pdf

could also mandate integrating National Building Code, 2016 on housing for particularly vulnerable communities in house construction.

Table 15: Centrally Sponsored Scheme Funding

Sl. No.	Scheme	Mission Period	Total Central Allocation (INR, crore)	State/ULB/Parastatal/Other agencies Share	Cities/Towns Covered
1.	JNNURM	2005-2012 2013- (extension phase)	66,085 (2005-2012) 14,000 (2013-2014)	UIG (10-50%), BSUP (10-50%), UIDSSMT (20%), IHDSP (20%)	65 metropolitan cities
2.	AMRUT	2015-2020	50,000	State: not less than 20% ULBs/Private: balance amount	500 cities (all Class I cities, capitals and others)
3.	Smart Cities	2015-2020	48,000	Central and State: equal amount, on a match-funding basis + private sector	100
4.	Swachh Bharat	2014-2019	14,623	State/ULBs: minimum 25% of central funding + private sector	All statutory towns (4,041)
5.	HRIDAY	2014-2019	500	-	12 heritage cities
6.	PMAY (U)	2015-2022	Varies by component	-	All statutory towns (4,041)

Sources: CAG, 2012[92]; MoHUA, 2018[93]

[92] CAG report No. 15 of 2012. Performance Audit report of JNNURM https://cag.gov.in/content/report-no-15-2012-13-%E2%80%93-performance-audit-jawaharlal-nehru-national-urban-renewal-mission

[93] MoHUA (2018) Twenty third report of the 16th Lok Sabha Standing Committee on Urban Development on demand for grants. Accessed on September, 2018 from http://164.100.47.193/lsscommittee/Urban%20Development/16_Urban_Development_23.pdf

Section V – Recommendations to the Fifteenth FC from this Study

Sections I to IV present evidence of India's rapid urbanisation signified by growth in population and built-up areas, particularly high-density built-up growth in fragile peri-urban areas, coupled with a lag in the provisioning of infrastructure and services. It also presents varying hazard risk and exposure profiles, with high levels of infrastructure deficits and a mismatch between sectoral investments and risk profiles.

This section provides **evidence-based recommendations** to the Fifteenth FC to improve urban infrastructure and resilience.

The Thirteenth and Fourteenth FC had acknowledged urban growth and related infrastructure needs in India as a critical challenge to manage the economic growth and development expectations of the country. Consequently, they increased allocations under the grants-in-aid to the ULBs. Basic grants available to all ULBs focused on service delivery improvements, while performance grants created additional incentives to improve local governance, response and accountability, although the Thirteenth FC had placed considerable emphasis on capacity building and emergency preparedness.

The Fourteenth FC considered only population and city size as a basis for horizontal devolution of funds under the grants-in-aid, and did not consider disaster risk exposure of cities as a factor in the devolution of funds. The Fourteenth FC recommendations acknowledged the relevance of disaster risk in cities but in the absence of robust risk assessments available for the country and at comparable scale, it felt that disaster risk would be difficult to be used as a financing/devolution criteria. In addition, ULB capacities to generate revenue to localise urban infrastructure development, and disaster preparedness and resilience initiatives, were not considered as explicit criteria while making horizontal devolution decisions.

Selected Cities and Study Approach

To demonstrate the variation in hazard exposure, vulnerability and capacities of the cities to cope and recover from disaster impacts, this study selected six cities to study in detail: Shimla, Patna, Guwahati, Visakhapatnam, Kochi and Chennai, considering geographical variation, population and city size and diverse hazard exposure. The following key parameters were assessed:

- Urban population growth from Census 2011 and IIHS analysis of projected population in 2017[94];
- Infrastructure gaps and various resilience initiatives;
- State of municipal finances (2012-13 to 2016-17): specifically, revenue and expenditure related to Capital and Operation and Maintenance (O&M);

[94] Revi, et al. (2015). Urban India 2015: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2015

- The potential contribution of CSS resources to urban infrastructure development and resilience.

Key Findings from this Study

- The study shows that the urban population in the studied six cities have grown at a rapid pace between 1997 and 2017, ranging between 25 to 35 per cent. Kochi showed a high population growth of about 34 per cent in its peri-urban areas. In addition, the built-up area in the emerging urban agglomerations also increased in the range of 20 to 30 per cent, which was identified using satellite imagery to assess land use changes[95]. Chennai's built-up area increased by more than 20 per cent between 2001 and 2017 impacting many wetlands, waterbodies and open spaces.

- The infrastructure gaps in the studied six cities, compared to MoUD benchmarks, were very high. Kochi had only 43 per cent storm water drain coverage against a benchmark of 100 per cent in all major roads. Guwahati had the lowest storm water drain coverage at 20 per cent. On the household level, water supply and sewerage coverage ranged from 60 to 80 per cent in the six cities. While the per capita drinking water supply was lowest at 55 litres per capita (lpcd) in Chennai, other cities were also well short of the MoUD benchmark of 135 lpcd.[96] The infrastructure data on roads and power could not be analysed due to non-availability of data at the city level.

- Disaster risk varied at an intra-city level due to varying physical and socio-economic vulnerability. The gaps in service levels were higher in some wards as illustrated in the cases of Visakhapatnam and Shimla, and generally poor in the new wards of peri-urban areas. On socio economic vulnerability, Visakhapatnam had a population of about 770,091 living in slums as per Census 2011, which is 44 per cent of the city's total population.[97] In Guwahati, the city disaster management plan observes that the urban poor routinely settle in vulnerable areas like flood plains and hillocks and have poor housing and limited basic services.[98]

- An analysis of budget data for the ULBs in the six cities for the period 2012-17 showed that 'own revenue' was the major source of revenue, with the Central FC transfer contributing to between 4 to 10 per cent of the total revenue and the CSS contributing in the range of 20 to 40 per cent. This translates to an average of Rs. 12 crore per year

[95] Revi, et al. (2015). Urban India 2015: Evidence. Bangalore: Indian Institute for Human Settlements. https://doi.org/10.24943/urbindia.2015
[96] Analysis of service level gaps are from Census 2011 and SLIP reports for these cities.
[97] Slum population in Visakhapatnam accessed from https://www.census2011.co.in/census/city/402-visakhapatnam.html
[98] Guwahati Municipal Corporation (2017) City Disaster Management Plan. Accessed from https://gdd.assam.gov.in/frontimpotentdata/disaster-management-plan

in Shimla and Rs. 288 crore in Chennai. On a per capita basis, this equals Rs. 750 and Rs. 626 respectively. This study notes that other than in Assam, there were no State FC transfers to the ULBs in the period 2012-17. This clearly shows the need for the ULBs to develop additional financial resources to invest in infrastructure and plan for O&M expenditure, in advance of their targeting risk reduction.

- An analysis of the per capita infrastructure investments by the ULBs showed that the investments on O&M were low in all six cities when compared to the HPEC recommendations. This study notes that in all six cities, expenditure was higher than revenue, leading to a high budget deficit.[99] The bulk of the revenue in the studied ULBs is from own revenue sources: Guwahati (44 per cent), Kochi (60 per cent), Vizag (63 per cent), Chennai (68 per cent), Shimla (70 per cent). The own revenue contribution ranges from Rs. 65 crore for Guwahati (Rs. 694 per capita) to Rs. 631 crore for Visakhapatnam (Rs. 3,684 per capita). This study has shown that ULBs have a serious fiscal deficit and require institutional strengthening to enhance their own revenue potential.

> Box 3: Illustration of high levels of damage costs in the absence of adequate protection to key infrastructure
>
> Recent disasters like the Kochi floods in 2018, Chennai floods in 2015 and the cyclone Hudhud in 2014 in Visakhapatnam caused high levels of infrastructure damage and property losses in these cities. Although Early Warning Systems helped with evacuation and saved lives, the damage to infrastructure was high. Nilam cyclone in 2012 had damaged around 562 transformers, resulting in a restoration cost of about Rs. 19 crore, while cyclone Vardah in 2016 had affected the power infrastructure necessitating a restoration cost close to Rs. 715 crore. (Source: TANGEDCO)

- This study finds that over two-thirds of ULB expenditure is on Establishment and Administration and between 30 to 40 per cent is on revenue and capital expenditure on infrastructure. The per capita O&M expenditure of the ULBs is much lower than the recommendations of the HPEC (all expenditures adjusted to 2009 prices) in all six cities and O&M expenditure was very low for some critical infrastructure like water supply, sewerage, and storm water drains.
- In critical sectors like water supply, the O&M expenditure (as a percentage of average annual budget) was poor for Patna (0.8 per cent) and Guwahati (2.6 per cent). On storm water drainage systems, Kochi and Guwahati had negligible O&M expenditure. On

[99] Analysis of budget document of six ULBs for the period 2012-17 accessed from www.openbudgetsindia.org in September, 2018

roads and bridges, O&M expenditure in Chennai (0.5 per cent) was the lowest. Shimla fared poorly in O&M expenditure at levels with approximately 1 per cent of the required O&M expenditure recommendations (as per HPEC recommendations) in sewerage infrastructure.

- On the capital expenditure side, analysis shows that less than 3 per cent of the required infrastructure investment, as recommended by HPEC for the period 2012-31, has been made in the six cities. The expenditure was rarely risk-targeted, with misalignments across resilience and infrastructure expansion/development.

- It is also important to note here that ULBs alone are not responsible for the development of infrastructure and resilience building in urban areas. Several functions of the ULBs under the 12th Schedule are managed by parastatal bodies (such as the Chennai Water Supply and Sewerage Board and the Greater Kochi Development Authority). These parastatal agencies do not come under the purview of the ULBs, which can make governance and implementation more challenging in the context of urban infrastructure development and resilience building.

- This study also assessed disaster preparedness and various resilience initiatives taken up by select ULBs, relying on information available on the ULB websites and from various CAG audit reports. It was found, for example, that Kochi, despite its high vulnerability, does not have a detailed Hazard Risk Vulnerability Assessment (HRVA) and a Disaster Management (DM) plan at the city level. Although the other five cities have DM plans at the city level, there was no DM plan for critical infrastructure, except for Chennai, where TANGEDCO had developed a DM plan for power infrastructure.

- The CAG audit report of the Chennai floods in 2015 observed severe lapses in disaster preparedness. It highlighted a lack of communication and relief equipment at the District Emergency Operation Centre, as well as a lack of training and awareness.[100] Although five of the studied six cities had prepared Disaster Management Plans after careful assessment of hazards, risk and vulnerability (HRVA)—particularly socio-economic vulnerability—most DM plans (e.g. Visakhapatnam[101]) focused on post-disaster relief and rescue and paid little attention to disaster mitigation or improved resilience.

- On Early Warning Systems (EWS), most cities report in their DM plan that the EWS are available from national agencies such as the Indian Meteorological Department (IMD)

[100] CAG Report No. 4 of 2017, Performance audit of flood management and response in Chennai and its Suburban. Accessed from https://cag.gov.in/content/report-no4-2017-performance-audit-flood-management-and-response-chennai-and-its-suburban

[101] Visakhapatnam Municipal Corporation (2017) City Disaster Management Plan, https://gvmc.gov.in/gvmc/index.php/dmp-gvmc

and Central Water Commission (CWC). The CAG audit report of the Chennai floods, however, observed serious gaps in early warnings and mentions a lack of flood gauges and flood monitoring system in the Chembarambakkam Lake. While the Thirteenth FC had sanctioned Rs. 2.5 crore for the procurement of fire services equipment and Rs. 25 crore for capacity building, the CAG audit report post Chennai floods 2015, observed that only about Rs. 1.6 crore and Rs. 15 crore respectively had been utilised.

- It is to be noted that disaster risk is usually Pareto-partitioned, which means that 70-80 per cent of the impacts can be attributed to 20-30 per cent of the causes, both spatially and sectorally. In Visakhapatnam city, for example, a high slum population living in peri-urban and coastal areas with low basic services of water supply and sanitation has a higher risk exposure than the population living in other parts of the city.

- On resilience building initiatives, the study shows that except Kochi, all five other cities have a DM plan but the focus largely is on post-disaster relief and management. Resilience Action Plans, particularly to reduce and mitigate disaster risk, do not exist.[102] It is important that Resilience Action Plans are integrated into urban development plans and programmes, including those under the purview of CSSs.

- ULBs need to acquire much greater capabilities to optimise and raise financial resources from both conventional sources, such as property tax, professional tax, user charges, entertainment tax and license fees, and non-conventional sources such as increasing the net use value of land and other real estate, creating new property rights and using existing rights more effectively, deploying human resources more productively, treasury management, setting up various modes of public-private partnerships (PPPs), and municipal bonds.[103] The AMRUT mission recognised Credit Rating as one of the prerequisites to improve revenue generation by accessing the capital market or attracting private investors to enable ULBs ar to create a sustainable internal financial architecture for sustained and effective borrowing and thereby, smoothly manage infrastructure development and expansion. The Mission has issued a Reforms Incentives Claim process, where the ULBs can submit credit ratings obtained from a rating agency like CRISIL, ICRA, and claim for the reforms incentives funds allotted for this purpose. Such reforms have helped a few ULBs raise additional resources for infrastructure investments, for example, Ahmedabad Municipal Corporation raised Rs. 200 Crore via municipal bonds in January 2019.[104]

[102] Chennai resilience initiative http://www.100resilientcities.org/cities/chennai/
[103] Sheikh, S., & Asher, M. (2012). A case for developing the municipal bond market in India. ASCI Journal of Management, Vol. 42, No. 1, pp. 1-19, https://asci.org.in/journal/Vol.42(2012-13)/Shahana_Mukul.pdf
[104] Manikandan, Ashwin (2019) Ahmedabad Municipal Corporation raises Rs 200 crore via bonds. Economic Times dated Jan 11, 2019. https://economictimes.indiatimes.com/markets/bonds/ahmedabad-municipal-corporation-raises-rs-200-crore-via-bonds/articleshow/67491868.cms

Recommendations

Although the FC grant and CSS provide limited financial support, they could potentially incentivise ULBs to improve infrastructure provisioning, particularly those that are responding to the local hazard and risk profile. Currently, many Indian cities generate own revenue below their potential. Improving municipal revenue could, therefore, contribute towards responsive and quick localised urban infrastructure development.[105]

The recommendations of this study are in three parts: vertical devolution concerning grants-in-aid to the ULBs, horizontal devolution of these funds, and leveraging Centrally Sponsored Schemes for urban infrastructure development and linked resilience building.

On Vertical devolution

The Thirteenth FC made a vertical devolution of 3 per cent of the total divisible pool while the Fourteenth FC used Rs. 488 per capita per annum of urban population on aggregate as the devolution criteria. An analysis of aggregate revenue and expenditure of municipal corporations in India in 2007-08 showed that the per capita revenue, on average, was Rs. 1,430 and per capita expenditure, on average, was Rs 1,513 (Rs. 915 per capita of revenue expenditure and Rs. 598 per capita of capital expenditure).[106] This expenditure is highly inadequate compared to established norms of per capita expenditure on urban infrastructure (as per HPEC recommendations). The HPEC report identifies that India currently spends only about 27-28 per cent of what is necessary for efficient delivery and management of services. A McKinsey report in 2010 notes that, "The current level of infrastructure spending in India is estimated at US $17 per capita as against US $134 per capita needed to sustain its growth momentum and other macroeconomic development goals".[107]

A study on municipal finances by National Institute of Public Finance and Policy (NIPFP) observes that the fiscal health of municipalities in India is unsatisfactory. Actual municipal revenues are less than a third of what is needed to maintain services at standard levels, assessed based on actual budget reports for year 2007-08. The fiscal capacity of the ULBs to meet the urban infrastructure investment needs presented in the HPEC are highly

[105] Bandyopadhyay, S. (2014). Municipal Finance in India: Some Critical Issues. International Centre for Public Policy, Working paper. Accessed from https://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1010&context=icepp

[106] Working Group of State Urban Development Secretaries on Issues before the 14th Finance Commission. November (2013). Approach to the Finances of Municipalities: A Report to the 14th Finance Commission. http://mohua.gov.in/upload/uploadfiles/files/Approach%20to%20the%20Finance07.pdf

[107] Sankhe et al. McKenzie Global Institute (2010) India's urban awakening; Building inclusive cities, sustainaing economic growth https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Urban%20awakening%20in%20India/MGI_Indias_urban_awakening_full_report.ashx

improbable.[108] Though this study is dated, the analysis presented in this report shows that the municipal finance situation has not, improved in substantial ways.

This study further notes that the infrastructure gaps in cities are high, thus making them more vulnerable to disaster risk, and the current capacities of ULBs on developing resilient infrastructure, early warning systems and disaster preparedness are limited. This has also been observed in available studies, including the post-disaster audit reports of CAG in case of Chennai floods in 2015.

Key Recommendations

The Grants-in-aid, although contributing minimally to the total revenue of the ULBs, make a significant contribution to ULBs with low own revenue. Hence, vertical devolution by the Fifteenth FC to ULBs should consider:

- Future population growth in urban areas, particularly to account for high-intensity peri-urban growth and pre-emptively taking into account changes in city size classes balancing current, and future infrastructure investment needs;
- Urban infrastructure and resilience investments as important to reduce future economic losses, and fulfil the economic and livelihood creation role of urban areas;
- Using the HPEC recommendations on per capita investment needs for new urban infrastructure, especially critical infrastructure like storm water drainage, water supply and road networks, in line with city-level key risks and vulnerabilities;
- Strengthening ULB disaster mitigation capacities and incentivising resilience building initiatives, via a National Disaster Mitigation Fund and State Disaster Mitigation Fund. Regional, state and urban HRVAs and disaster mitigation plans, should be funded through earmarked resources from these Funds; and
- The use of the Mitigation funds to strengthen Early Warning Systems and develop long-term plans for managing lifeline infrastructure like cyclone shelters, roads, underground power lines and emergency communication systems.

On Horizontal Devolution

The overall guiding principle underpinning the Fifteenth FC recommendations should primarily be to help ULBs mitigate output losses and develop long term resilience to natural (current and future projected) climate change related hazards. Recent disasters like the Kochi flood in 2018, Hudhud in Visakhapatnam in 2014 and Chennai floods in 2015 have shown that intensive disasters lead to heavy financial (assets and output) losses. For example, TANGEDCO reported that losses in power infrastructure due to Chennai floods

[108] Mathur, O.P (2011) Municipal Finances Matters, India Municipal Finance Report. National Institute of Public Finance and Policy https://www.nipfp.org.in/media/medialibrary/2013/08/IMFR_FINAL_REPORT.pdf

and Vardah cyclone in the city alone stood close to Rs. 17,000- crore.[109] Neither can this loss be borne by the ULBs alone nor can they manage recovery and rehabilitation work as well as long-term reconstruction. The ULBs are especially constrained post-disaster relief funds from the NDRF and SDRF pool is available only for immediate relief and not for recovery and resilience building.

The Fifteenth FC needs to also consider incremental urban growth rate, infrastructure needs and incremental exposure to natural and climate change related hazards, while finalising horizontal devolution as important guiding principles.

The Grants-in-aid, should focus on ensuring:

- Reducing loss of life by establishing agile and robust Early Warning and Emergency Response Systems;
- Mitigation of output losses (via robust economic production systems);
- Mitigation of capital losses (by reducing the vulnerability and exposure of buildings, production units, key economic facilities and lifeline infrastructure) and building of long term resilience, as part of all new infrastructure investments; and
- Building of ULB institutional capacity to raise their own revenue, plan and execute retrofits and new resilient infrastructure and public buildings.

The Early Warning Systems in place are at the national level but the forecasting and communication of warnings to the community at risk requires local level resources. In Visakhapatnam city, a cyclone forecasting and warning system has been developed by the Indian Meteorological Department with the assistance from the Andhra Pradesh Cyclone Risk Mitigation Project.[110]

The loss and damage caused by the Chennai flood in 2015 due to the overflow of the Chembarambakkam lake was extensive but could have been minimised had a proper flood forecasting and monitoring systems been in place. Such examples illustrate the need for a localised early warning and monitoring system, which draws from national level experiences but is locally managed.

The institutions involved in urban development and disaster management require extensive capacity building. This includes ULBs and other parastatal agencies like water Supply Boards and Planning and Development Authorities. The Fifteenth FC should incentivise such capacity building efforts and it is equally important that such capacity building grants be utilised through accountable channels like the NDMA or the National Institute of Disaster Management, in collaboration with State Administrative Training Institutes or other local institutes.

[109] TANGEDCO (2017). Disaster Management Plan for Power Infrastructure in Tamil Nadu. Tamil Nadu Energy Generation and Distribution Company http://tneb.tnebnet.org/test1/dmpfinal%20combined.pdf
[110] National Cyclone Risk Mitigation Project in Andhra Pradesh, Government of Andhra Pradesh http://apsdma.ap.gov.in/view-ncrmp

Training courses which cover not only post-disaster management but also mitigation and resilience building need to be designed and delivered. A study by the National Institute of Urban Affairs in 2015 on capacity building of ULBs notes that capacity building should cover a range of issues including municipal finances, urban infrastructure, urban planning, land use, and socio-economic development.[111]

We recommend that the basic grant should have the following elements:

- An earmarked portion for institutional capacity building;
- Strengthening of emergency preparedness; and
- Institutionalisation of early warning and monitoring systems.

This could particularly be prioritised for cities with a large population and with high hazard exposure and vulnerability and weaker financial and institutional capacities, such as the study cities of Guwahati and Patna.

Performance grants on improving own revenue and resilience initiatives

The Fourteenth Finance Commission ULB performance grant criteria included improvements in service level benchmarks, increase in own revenue, and availability of audited accounts with weightages of 50 per cent, 40 per cent and 10 per cent respectively. Since the performance grant was made available only from 2017, there is no detailed data available on the effectiveness of its impact. Past experience indicates that incentives could encourage ULBs to improve their own revenue situation and institutional performance.

The Fifteenth FC, performance grant component could also be used to incentivise resilience building by:

- Improving ULB own-revenue share with incentivising investments in critical infrastructure;
- Undertaking a hazard risk and vulnerability (HRVA) assessment, with city-specific focus on high hazard risk and exposure and vulnerable sectors and areas;
- Requiring incorporation of HRVA assessments in Land use and Development plans (e.g. Master plans, Zonal plans and Local area plans);
- Preparing resilience and disaster management plans for critical infrastructure;
- Training and capacity building, particularly on emergency preparedness; and
- Effective implementation of Centrally Sponsored Schemes, with particular focus on established guidelines on resilience building.

[111] NIUA (2015), A Study to Qualitatively Assess the Capacity Building Needs of Urban Local Bodies (ULBs) https://www.niti.gov.in/writereaddata/files/document_publication/report-ULB_0.pdf

Leveraging CSS for urban infrastructure and resilience building

The CSS, which are six flagship programmes under the Ministry of Housing and Urban Affairs viz. AMRUT, HRIDAY, Smart Cities, Swachh Bharat, National Urban Livelihood Mission and PM Awas Yojna have been active since 2014.

AMRUT is the largest of the urban development schemes under implementation, and it covers basic services: water supply, sewerage, storm water drains, public transport and open space development. All the six studied cities are AMRUT cities. The CSS have been helping ULBs bridge high spatial differentials in service levels. In addition, because of high differential vulnerability within cities, sufficient flexibility should be given to the ULBs to prioritise projects and expenditure. For example, they should be able to prioritise storm water drainage in cities that are prone to flooding and also, prioritise service delivery to unserviced areas and vulnerable wards in cities. The AMRUT guidelines provide for incorporating Hazard Risk and Vulnerability Assessment and GIS-based master planning, while responding to infrastructure needs.[112] It is suggested that appropriate institutional monitoring systems are put in place to ensure strict adherence to these guidelines.

Patna and Guwahati city are lagging behind on sanitation coverage and are prone to local flooding, putting them at high risk of waterborne diseases. SBM can play an important role in improving water and sanitation in cities thereby reducing the risk of waterborne diseases that are particularly high in post disaster situations. The SBM guidelines could mandate sanitation coverage, as a priority, for vulnerable populations and incorporate them in city sanitation plans.

Although the Smart Cities Mission mentions disaster risk reduction in cities as one of the agreed elements, its guidelines can be improved by making explicit directions on DRR interventions. Examples would be to encourage the use of Information and Communication Technology (ICT) in strengthening Early Warning Systems and emergency preparedness, and incorporating hazard risk and vulnerability and disaster mitigation in area-based development plans. Such actions are a high priority for cities like Chennai and Kochi that recently experienced extreme rainfall and local flooding.

Although none of the six cities studied here are under the HRIDAY category, the mission guidelines could be modified to mandate the incorporation of hazard risk and vulnerability assessments in heritage city management plans.

In Visakhapatnam and Guwahati, housing emerged as an important area related to vulnerability in the city. Both cities have a high slum population and informal settlements along vulnerable flood prone areas and hills. Although the PMAY scheme has been set up

[112] MoUD (2015) Guidelines on formulation of GIS based master plan for AMRUT cities. http://amrut.gov.in/writereaddata/designandStandards_AMRUT.pdf

to improve housing provision, the scheme could have greater impact by formulating appropriate guidelines which could ensure inclusion of hazard risk and vulnerability assessments in housing plans and strict adherence to the National Building Code (2016) and other municipal corporation level building bye-laws.

It is important, is to strengthen the guidelines of Central and State Schemes on urban infrastructure development to ensure that they mandate strict adherence to national standards provided by various agencies such as the Bureau of Indian Standards (BIS), Central Public Health and Environmental Engineering Organisation (CPHEEO), National Disaster Management Authority (NDMA) and the Ministry of Urban Development. Further, best practices and methodologies in GIS and risk assessment can help prioritise the sectors and areas (spatially) where intervention will help build urban resilience.

In summary, it can be noted that the CSS make important contributions to urban infrastructure in India, particularly in the context of providing additional financial resources to cover for infrastructure deficits. This needs to be effectively leveraged to increase urban resilience.

Improvement in urban infrastructure and resilience via CSSs could be enabled by:

- Scheme implementation guidelines ensuring incorporation of hazard risk and vulnerability assessment (HRVA) in infrastructure plans;
- Targeted and prioritised spending on urban infrastructure in a risk-informed manner, based on city HRVAs; and
- Land use planning, building regulations and bye-laws, following national standards and best practices, especially around enforcement.

Annexure I

Revenue Sources of Municipal Corporations in India

Revenue Head/Category	Sources of Revenue
Own tax revenue	Property tax, advertisement tax, tax on animals, vacant land tax, taxes on carriages and carts, tax on consumption and sale of electricity, toll tax
Own non-tax revenue	User charges, trade licensing fee, town planning charges, building permission fees, sale and hire charges, lease rentals
Other receipts	Law charges/costs recovered, lapsed deposits, fees, fines and forfeitures, rent on tools and plants, miscellaneous sales
Assigned revenue	Entertainment tax, surcharge on stamp duty, profession tax, motor vehicles tax
Grants-in-aid	(a) Plan grants from state and central govt. under programmes, for eg. JNNURM, NULM, etc. (b) Non-Plan grants from state govt. to compensate for loss of income, specific transfers
Municipal Assets	Rent on shopping complex, shops, playgrounds, marriage and community halls, stadium etc.
Investment/Interest/FD	Income from investment, interest on saving bank account, house building advance, etc.

Source: Municipal budget document

Annexure: II

Revenue of Selected ULBs: Actual figures (In Crore)

Chennai	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax	491.39	516.15	470.31	616.4	692.7	794.2	-
Own Non Tax	49.12	21.31	58.94	89.5	131.6	131.1	-
Own Revenue	540.51	537.46	529.25	706.0	824.4	925.3	-
Total Revenue	940.04	1022.58	1239.13	1591.4	1714.3	1770.3	-

Guwahati	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax	-	-	-	41.4	46.8	50.8	69.7
Own Non Tax	-	-	-	5.6	7.2	8.2	10.6
Own Revenue	-	-	-	47.0	54.0	59.0	80.3
Total Revenue	-	-	-	80.6	91.7	105.4	110

Kochi	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax	53.00	58.93	69.99	82.37	101.06	104.87	103.61
Own Non Tax	13.50	13.03	12.74	18.20	15.06	30.26	37.08
Own Revenue	66.50	71.95	82.73	100.57	116.12	135.13	140.69
Total Revenue	109.34	123.01	147.26	184.58	226.51	266.87	224

Patna	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax	-	-	-	24.16	34.62	22.47	-
Own Non Tax	-	-	-	6.56	6.85	5.74	-
Own Revenue	-	-	-	30.72	41.47	28.21	-
Total Revenue	-	-	-	89.23	125.30	136.92	-

Shimla	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax		8.3	9.8	2.6	7.7	7.3	22.0
Own Non Tax		13.4	14.8	21.5	28.0	25.3	30.0
Own Revenue		21.7	24.6	24.1	35.8	32.5	52.1

Total Revenue	34.4	39.9	41.6	55.1	53.8	81.0

Visakhapatnam	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Own Tax	-	-	-	175.6	173.1	182.3	546.4
Own Non Tax	-	-	-	216.3	225.7	256.4	386.6
Own Revenue	-	-	-	391.9	398.8	438.7	933.0
Total Revenue	-	-	-	783.8	797.7	877.5	1866.0

Source: Municipal Budget Document

Annexure: III

Revenue receipts of selected municipal corporations (In Crore)

Chennai	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Own Tax	616.4	692.7	794.2	851.6	951.6
Own Non Tax	89.5	131.6	131.1	321.9	265.0
Own Revenue (Own Tax + Own Non Tax)	706.0	824.4	925.3	1173.5	1216.6
Rev Grants	127.5	114.7	121.7	731.0	250.1
Assigned Revenue	641.8	561.5	500.3	820.0	865.0
Investment/Interest/FD	37.9	84.7	32.8	6.6	3.6
Other	78.3	129.0	190.3	189.7	232.4
Total Revenue	**1591.4**	**1714.3**	**1770.3**	**2920.8**	**2567.7**

Guwahati	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Own Tax	41.4	46.8	50.8	65.8	76.2
Own Non Tax	5.6	7.2	8.2	12.8	14.9
Own Revenue (Own Tax + Own Non Tax)	47.0	54.0	59.0	78.6	91.1
Rev Grants	26.3	34.7	43.3	40.0	55.0
Assigned Revenue	0.0	0.0	0.0	0.0	0.0
Investment/Interest/FD	7.3	3.0	3.1	3.2	3.5
Others	0.0	0.0	0.0	0.0	0.0
Total Revenue	**80.6**	**91.7**	**105.4**	**121.8**	**149.6**

Kochi	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Own Tax	82.4	101.1	104.9	133.3	163.0
Own Non Tax	18.2	15.1	30.3	38.2	48.5
Own Revenue (Own Tax + Own Non Tax)	100.6	116.1	135.1	171.5	211.4
Rev Grants	84.0	110.1	131.0	91.0	118.1
Assigned Revenue	0.0	0.0	0.0	0.0	0.0
Investment/Interest/FD	0.0	0.1	0.1	0.2	0.1
Other	0.0	0.2	0.7	3.1	5.3
Total Revenue	**184.6**	**226.5**	**266.9**	**265.7**	**335.0**

Patna	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Own Tax	24.2	34.6	22.5	34.3	82.2
Own Non Tax	6.6	6.8	5.7	4.3	25.0
Own Revenue (Own Tax + Own Non Tax)	30.7	41.5	28.2	38.6	107.2
Rev Grants	24.2	34.8	72.0	111.0	71.1
Assigned Revenue	31.7	48.9	33.5	40.3	66.0
Investment/Interest/FD	0.5	0.0	3.2	5.0	4.0
Other	2.1	0.1	0.1	0.1	0.3
Total Revenue	**89.2**	**125.3**	**136.9**	**195.0**	**248.6**

Shimla	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**

Visakhapatnam	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**

Own Tax	2.6	7.7	7.3	22.0	15.0	Own Tax	175.6	173.1	182.3	546.4	555.4
Own Non Tax	21.5	28.0	25.3	30.8	51.7	Own Non Tax	216.3	225.7	256.4	386.6	432.6
Own Revenue (Own Tax + Own Non Tax)	24.1	35.8	32.5	52.8	66.7	Own Revenue (Own Tax + Own Non Tax)	391.9	398.8	438.7	933.0	987.9
Rev Grants	0.5	0.6	0.1	1.6	0.8	Rev Grants	21.4	16.8	3.4	111.0	24.0
Assigned Revenue	15.4	17.1	19.5	25.5	26.7	Assigned Revenue	68.4	62.5	72.5	130.5	136.7
Investment/Interest/FD	1.6	1.4	1.3	1.4	1.3	Investment/Interest/FD	8.0	4.0	26.0	24.0	30.0
Other	0.1	0.3	0.4	0.2	0.2	Other	4.8	21.3	0.8	1.0	1.2
Total Revenue	**41.6**	**55.1**	**53.8**	**81.6**	**95.7**	**Total Revenue**	**494.5**	**503.4**	**541.3**	**1199.5**	**1179.8**

Source: Municipal budget documents; Total revenue = own revenue + revenue grants+ assigned revenue + Investment/interest/FD + Others

Annexure: IV

Revenue receipts from state and central government grants

Chennai	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**	**Guwahati**	**2012-13**	**2013-14**	**2014-15**	**2015-16 (BE)**	**2016-17 (RE)**
CFC Transfers	91.9	69.1	77.3	117.5	220.0	CFC Transfers	12.8	0.0	0.0	20.5	15.0
SFC Transfers	0.0	0.0	0.0	0.0	0.0	SFC Transfers	92.5	34.7	48.3	45.0	63.0
State grants	144.5	245.9	313.4	361.6	128.4	State grants*	2.5	17.4	4.0	3.2	7.4
CSS (GOI Grants)	101.1	53.3	69.8	14.2	10.4	CSS (GOI Grants)	7.0	8.3	1.6	35.5	3.3

Kochi	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**	**Patna**	**2012-13**	**2013-14**	**2014-15**	**2015-16(RE)**	**2016-17(BE)**
CFC Transfers	12.7	13.8	22.0	11.5	35.5	CFC Transfers	13.2	17.3	0.0	0.0	0.0
SFC Transfers	0.0	0.0	0.0	0.0	0.0	SFC Transfers	27.1	11.4	18.5	0.9	15.0
State & Central Govt Grants*	68.2	161.2	92.9	32.1	42.3	State & Central Govt Grants*	14.3	48.0	67.7	78.0	174.0

Shimla	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**	**Vizag**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
CFC Transfers	2.3	4.8	2.3	6.3	5.2	CFC Transfers	1.3		82.1	70.0	70.0
SFC Transfers	0.0	0.0	0.0	0.0	0.0	SFC Transfers	0.0	0.0	0.0	0.0	0.0
State grants**	1.2	2.7	2.7	1.7	2.1	State grants**	143.0	174.1	46.7	295.4	393.5
CSS (GOI Grants)	7.3	24.0	8.3	1.7	12.7	CSS (GOI Grants)	149.5	151.1	75.7	18.0	2.0

Source: Municipal budget document

*Details of central government grants are not given separately

* State grants include grants for state sponsored schemes and minor grants for infrastructure.

Annexure: V

Expenditure summary of selected municipal corporations (In Crore)

Chennai

Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	769.1	899.4	1011.7	1304.9	1474.2	1091.9	2132.6
Salary	703.5	809.3	914.8	1159.5	1343.0	986.0	1925.8
O&M (B)	171.7	293.5	369.4	959.1	798.0	518.3	1012.4
Others (C)	120.9	137.2	198.4	222.8	336.1	203.1	396.7
Total (A+B+C)	**1061.8**	**1330.0**	**1579.5**	**2486.8**	**2608.4**	**1813.3**	**3541.6**

Visakhapatnam

Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	134.8	147.8	190.5	297.8	328.0	219.8	1277.8
Salary	118.2	133.4	174.6	247.4	262.5	187.2	1088.5
O&M (B)	177.2	200.8	217.6	548.7	526.2	334.1	1942.3
Others (C)	55.3	55.2	43.5	53.4	61.1	53.7	312.2
Total (A+B+C)	**367.2**	**403.8**	**451.5**	**899.9**	**915.2**	**607.5**	**3532.2**

Shimla

Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	39.8	40.8	45.2	54.0	63.9	48.7	2437.0
Salary	37.5	38.5	43.6	50.9	57.2	45.5	2277.4

O&M (B)	9.8	13.8	11.0	14.5	48.1	19.4	971.8
Others (C)	0.3	0.6	1.9	1.4	0.9	1.0	50.1
Total (A+B+C)	**49.9**	**55.2**	**58.0**	**69.9**	**112.9**	**69.2**	**3458.8**
Kochi							
Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	54.88	44.79	42.35	73.11	84.15	59.86	831.32
Salary	49.64	41.42	39.88	69.19	77.88	55.60	772.22
O&M (B)	42.54	42.03	63.00	79.09	109.04	67.14	932.52
Others (C)	45.54	72.09	70.26	88.76	102.61	75.85	1053.51
Total (A+B+C)	**142.96**	**158.92**	**175.62**	**240.96**	**295.80**	**202.85**	**2817.35**
Guwahati							
Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	55.0	56.5	69.9	109.8	115.4	81.4	739.6
Salary	53.0	54.9	68.8	98.7	108.8	76.8	698.6
O&M (B)	19.5	28.1	28.9	74.7	72.6	44.8	407.0
Others (C)	8.8	9.4	10.7	39.2	59.0	25.4	230.9
Total (A+B+C)	**83.3**	**94.0**	**109.5**	**223.8**	**247.1**	**151.5**	**1377.5**
Patna							
Expenditure	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE	Avg Exp	PC Exp (In Rs.)
Estab./Admin*(A)	84.3	91.5	102.0	118.9	151.4	109.6	476.6
Salary	83.0	89.9	100.7	115.3	141.9	106.2	461.6
O&M (B)	17.2	33.9	15.3	25.8	78.3	34.1	148.3
Others (C)	2.4	1.1	0.0	0.2	29.2	6.6	28.6
Total (A+B+C)	**104.0**	**126.5**	**117.4**	**145.0**	**258.8**	**150.3**	**653.6**

Source: Municipal Budget Document

Note: 1) Establishment expenses majorly includes salary wages bonus.;
Administrative expenses includes rent, electricity charges, petrol & diesel, consultancy charges and other minor expenses
2) *Estab./Admin includes salary

Annexure: VI

Actual Utilization of Funds under Flagship Programmes (In crore)

Scheme	Fund Allocated	Fund Released	Fund Utilized	Fund Utilized vs. Fund Released in % age
AMRUT	12447.2	8629.4	2480.4	28.7
HRIDAY	700.0	247.2	33.6	13.6
Smart Cities	10084.2	9943.2	182.6	1.8
Swachh Bharat	7690.5	5847.9	2223.2	38.0
National Urban Livelihood Mission	2600.8	1514.9	850.3	56.1
PM Awas Yojana	15025.9	10011.9	2080.5	20.8
Total	**48548.6**	**36194.4**	**7850.7**	**21.6**

Source: Twenty second report standing committee on urban development (2017-18)

Annexure: VII

Table: 1 Funds allotted and released under AMRUT mission (In Crore)

Shimla					
Year	Allotted Central Assistance	Central Assistance Released	State Assistance	State Assistance Released	Total (SAAP)
2015-16	79.4	15.9	8.8	.	88.2
2016-17	62.8	12.6	7.0	.	69.7
2017-18	72.4	14.5	8.0	.	80.5
Total	**214.6**	**42.9**	**23.8**	**.**	**238.4**
Chennai					
Year	Allotted Central Assistance	Central Assistance Released	State Assistance	State Assistance Released	Total (SAAP)
2015-16	320.3	64.1	644.7	143.8	965.0
2016-17	404.8	81.0	815.1	197.1	1219.9
2017-20	139.2	27.8	280.4	N.A	419.6
Total	**864.4**	**172.9**	**1740.2**	**340.8**	**2604.5**
Surat					
Year	Allotted Central Assistance	Central Assistance Released	State Assistance	State Assistance Released	Total (SAAP)
2015-16	19.0	3.8	38.5	.	57.5
2016-17	53.5	10.7	107.5	.	161.0
2017-20	128.0	25.6	260.0	.	388.0
Total	**200.5**	**40.1**	**406.0**	**.**	**606.5**
Guwahati					
Year	Allotted Central Assistance	Central Assistance Released	State Assistance	State Assistance Released	Total (SAAP)
2015-16	1.5	0.3	0.2	0.0	1.7

2016-17	1.7	0.3	0.2	0.0	1.9
2017-20	75.2	NA	8.4	0.0	83.6
Total	**78.4**	**0.6**	**8.7**	**0.0**	**87.1**
Patna					
Year	Allotted Central Assistance	Central Assistance Released	State Assistance	State Assistance Released	Total (SAAP)
2015-16	0.9	0.2	0.9	.	1.9
2016-17	1.5	0.3	1.5	.	3.1
2017-20	22.2	4.4	41.7	.	63.9
Total	**24.7**	**4.9**	**44.2**	**.**	**68.9**

Source: SAAP 2015-16; 2016-17 and 2017-20

Note: 1) Centre will contribute 1/3 rd of the project to the cities which are having population more than ten lakh such as Chennai

2) Centre will contribute 90 percent of the project for the cities which are having special status such as shimla and Guwahati; 3) there would be 50:50 ratio for rest of the cities; 4) Centre will transfer SAAP amount in ratio of 20:40:40.

Almost all the state has received its first 20% instalment from the centre

Table: 2 Sectoral Investment under AMRUT (In Crore)

Chennai*	Water supply	Sewerage	Drainage	Urban Transport	Green space	Total
2015-16	954.0	0.0	0.0	0.0	11.0	965.0
2016-17	724.0	482.7	0.0	0.0	13.2	1219.9
2017-20	88.7	317.3	0.0	0.0	13.7	419.6
Total Chennai	**1766.7**	**800.0**	**0.0**	**0.0**	**37.9**	**2604.5**
Tamil Nadu	**5743.9**	**5285.0**	**0.0**	**0.0**	**232.9**	**11261.8**

Shimla**	Water supply	Sewerage	Drainage	Urban Transport	Green space	Total
2015-16	41.7	37.3	0.8	6.3	2.2	88.2
2016-17	20.4	10.8	12.0	25.0	1.5	69.7
2017-18	27.5	19.5	7.7	23.7	2.0	80.5
Total Shimla	**89.6**	**67.6**	**20.6**	**55.0**	**5.7**	**238.4**
Himanchal Pradesh	**98.35**	**84.66**	**36.37**	**77.65**	**7.49**	**304.5**

Guwahati$	Water supply	Sewerage	Drainage	Urban Transport	Green space	Total
2015-16	0.0	0.0	0.0	0.0	1.7	1.7
2016-17	0.0	0.0	0.0	0.0	1.9	1.9
2017-20	0.0	0.0	0.0	82.7	0.8	83.6
Total Guwahati	**0.0**	**0.0**	**0.0**	**82.7**	**4.4**	**87.1**
Assam	**558.0**	**0.0**	**0.0**	**82.7**	**16.4**	**657.1**

Patna#	Water supply	Sewerage	Drainage	Urban Transport	Green space	Total
2015-16	0.0	0.0	0.0	0.0	1.9	1.9
2016-17	0.0	0.0	0.0	0.0	3.1	3.1
2017-20	0.0	0.0	58.4	0.0	5.5	63.9
Total Patna	**0.0**	**0.0**	**58.4**	**0.0**	**10.4**	**68.9**
Bihar	**2064.3**	**37.8**	**182.3**	**0.0**	**65.4**	**2349.8**

Source: SAAP 2015-16; 2016-17 and 2017-20

*Work of water supply in Chennai will be executed by Chennai Metro Water Supply and Sewerage Board;

**Only Shimla and Kullu have been selected for smart city.

$Considering the financial position of the state Assam it is decided to take schemes under only three sectors, namely water supply, non-motorised transport, and Green spaces and parks (Funding pattern: Centre 90% and State 10%); Only two projects have been assigned to Guwahati Green space and transport. Guwahati already has ongoing projects of Water supply and Sewerage funded by ADB and JICA.

#Bihar is only spending on Drainage and Parks and Open Spaces in Patna; The sewerage projects already approved under NGRBA / Namami Gange have not been included in the action plan.

Annexure: VIII

Expenditure made by ULBs on Major Infrastructure (In Crore)

Table: 1 Revenue Expenditure

Vishakhapatnam	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	14.2	18.0	15.4	103.1	80.0
Street Light/Elec. Charges	18.6	25.0	21.4	30.0	26.0
Storm Water Drains	3.1	4.4	2.9	13.6	10.0
Water Supply/Maintenance	13.4	13.4	14.5	43.9	40.8
Drain/Sewerage	3.1	1.3	1.9	21.2	17.9
Solid waste	3.5	1.2	1.9	3.2	3.5
Total	55.8	63.4	58.0	214.9	178.2

Shimla	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	3.0	3.6	5.0	6.1	6.0
Street Light/Elec. Charges	4.0	5.0	1.6	1.8	2.2
Storm Water Drains	0.1	0.5	0.2	0.2	0.3
Water Supply/Maintenance	0.5	1.0	0.3	0.5	0.6
Drain/Sewerage	0.2	0.3	0.5	0.8	0.9
Solid waste	0.7	1.0	1.5	2.5	3.0
Total	8.5	11.4	9.1	11.8	13.0

Guwahati	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	1.2	0.4	0.1	5.1	3.0

Table: 2 Capital Expenditure

Vishakhapatnam	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	37.2	33.9	37.0	214.8	177.8
Street Light/Elec. Charges	.	.	.	.	.
Storm Water Drains	5.4	6.8	4.3	25.5	25.0
Water Supply/Maintenance	10.4	9.3	10.9	12.0	12.5
Drain/Sewerage	7.0	9.3	9.6	48.8	45.5
Solid waste	0.0	0.2	0.4	1.0	1.5
Total	60.1	59.4	62.2	302.1	262.3

Shimla	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	1.4	1.4	0.8	0.8	2.0
Street Light/Elec. Charges s	0.4	0.0	0.4	1.0	0.5
Storm Water Drains	0.1	0.1	0.1	0.1	0.5
Water Supply/Maintenance	0.0	0.0	0.3	0.0	0.0
Drain/Sewerage	2.8	2.4	3.3	5.1	1.4
Solid waste	0.1	0.8	0.8	0.7	0.1
Total	4.7	4.7	5.7	7.7	4.5

Guwahati	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover^	4.4	15.9	8.6	9.8	10.0

Street Light/Elec. Charges	5.9	8.5	7.9	13.1	11.0
Storm Water Drains	.	.	.	.	.
Water Supply/Maintenance	0.9	0.6	1.1	1.7	1.9
Drain/Sewerage	0.0	8.2	4.1	12.7	15.5
Solid waste	6.3	7.1	6.2	11.5	12.5
Total	14.4	24.8	19.4	44.0	43.9

Street Light/Elec. Charges	.	.	.	.	.
Storm Water Drains	.	.	.	.	.
Water Supply/Maintenance	.	.	.	.	.
Drain/Sewerage	.	.	.	.	.
Solid waste	5.3	0.0	0.0	14.0	3.0
Total	9.7	15.9	8.6	23.7	13.0

Kochi	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Road/Bridge/Flyover	15.9	11.4	28.0	40.6	43.0
Street Light/Elec. Charges	8.3	8.2	15.3	3.2	19.0
Storm Water Drains	.	.	.	.	.
Water Supply/Maintenance	4.0	38.2	2.7	4.2	4.9
Drain/Sewerage**	1.6	3.4	1.0	6.0	6.5
Solid waste	3.0	2.7	3.1	5.0	5.5
Total	32.7	63.8	50.1	58.9	78.9

Kochi	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Road/Bridge/Flyover	11.9	39.7	21.4	30.3	38.5
Street Light/Elec. Charges	0.1	4.3	0.1	4.0	7.0
Storm Water Drains	.	.	.	.	.
Water Supply/Maintenance	6.0	52.7	55.5	32.9	32.4
Drain/Sewerage	20.5	33.3	46.1	34.0	32.0
Solid waste	6.9	0.8	4.6	6.5	35.0
Total	45.4	130.7	127.8	107.6	144.9

Chennai*	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Road/Bridge/Flyover	3.4	4.3	6.1	14.3	13.2
Street Light/Elec. Charges	4.4	4.6	5.2	7.1	7.1
Storm Water Drains	1.1	1.0	2.6	6.0	3.6
Water Supply/Maintenance	.	.	.	.	.
Drain/Sewerage	.	.	.	.	.
Solid waste	.	.	.	.	.
Total	8.8	9.9	13.9	27.4	23.8

Chennai	**2012-13**	**2013-14**	**2014-15**	**2015-16 RE**	**2016-17 BE**
Road/Bridge/Flyover	61.3	84.1	27.5	31.0	127.0
Street Light/Elec. Charges	24.4	98.2	93.3	126.4	151.0
Storm Water Drains	136.0	172.2	136.1	125.0	65.0
Water Supply/Maintenance	.	.	.	.	.
Drain/Sewerage	.	.	.	.	.
Solid waste	43.9	9.6	0.0	13.3	2.0
Total	265.6	364.0	257.0	295.7	345.0

Patna	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover		.	.	.	.
Street Light/Electricity Charges	6.2	13.6	0.0	0.0	10.0
Storm Water Drains	0.0	1.8	1.4	4.7	5.0
Water Supply/Maintenance	0.4	1.0	0.4	0.6	1.0
Drain/Sewerage	0.1	0.0	0.2	0.9	6.5
Solid waste	9.8	1.0	0.8	0.7	5.8
Total	16.5	17.4	2.8	6.9	28.3

Patna	2012-13	2013-14	2014-15	2015-16 RE	2016-17 BE
Road/Bridge/Flyover	.	5.965	5.231	13.832	30
Street Light/Elec. Charges	.	0.473	0.461	0.344	30
Storm Water Drains	4.108	10.511	3.224	1.293	13
Water Supply/Maintenance	.	1.12	0.469	0.692	1
Drain/Sewerage	.	0.215	0.166	0.182	9
Solid waste	0.025	.	.	.	.
Total	4.133	18.284	9.551	16.344	83

Source: Municipal Budget Documents

*Chennai metro water supply and sewerage board is responsible for water supply and sewerage

**Though Kochi is investing on drains but there is no specific term 'storm water' used in Kochi budget document

^ Includes investment on drains

Note: Here we try to estimate major investment made by Municipal corporations on major infrastructure
by adding up each component given above which are available in budget both in revenue and capital expenditure side

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197/36, 2nd Main Road, Sadashivanagar, Bengaluru 560 080. India.
T +91 80 6760 6666 | F +91 80 2361 6814

IIHS CHENNAI
Floor 7A, Chaitanya Exotica, 24/51 Venkatnarayana Road, T Nagar
Chennai 600 017. India. T +91 44 6630 5500/6555 6590

IIHS DELHI
803, Surya Kiran, 19, Kasturba Gandhi Marg, New Delhi 110 001. India.
T +91 11 4360 2798 | F +91 11 2332 0477

IIHS MUMBAI
Flat No. 2, Purnima Building, Patel Compound, 20-C, Napean Sea Road
Mumbai 400 006. India. T +91 22 6525 3874

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