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**Sustainable Management of Construction and Demolition Waste,
Affordable Housing, Satellite Towns**



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Editorial



This issue contains six papers. The first paper is on “Affordable Housing Provision in the Context of Kolkata Metropolitan Area”, and is authored by Joy Karmakar who highlights Government of India’s mission of affordable housing for all citizens by 2022. He argues that the mission has become a major talking point for the people including policy makers to private developers to scholars at different levels. The idea of affordability and affordable housing has been defined by various organizations over the years but no unanimous definition has emerged. The need for affordable housing in the urban area is not new to India and especially mega cities like Kolkata. The paper revisits and assesses the affordable housing provision in Kolkata Metropolitan Area and how the idea of affordable housing provision has evolved over the years. It becomes clear from the analysis that the role of the state in providing affordable housing to urban poor has not only been reduced but shifted to the middle class.

The second paper titled “Property Tax: Role of Technology in Process Improvement, Transparency and Revenue Enhancement” is written by Dinesh Ahlawat, Saurav Sen and Akshat Jain, discusses property tax reforms with a focus on current assessment, collection and record keeping of property tax data in the ULBs and how these issues can be resolved with the adoption of streamlined processes and use of technology. The author explains that property tax is evaluated differently for different properties. Presently, the traditional methods for tax assessment are causing delays in the process, a large number of unassessed properties remain, and several properties are not assessed correctly due to dependency on manual efforts. In this paper some approaches and innovative technologies have been illuminated to improve the current practice of data collection, record keeping, assessment, updation of property data and improvement in the overall process of property tax management system. The use of Geographic Information System, it is argued, can play a crucial role in the integration of property data with the spatial information essential for management of property tax systems. The paper concludes with the development of Property Tax Management System, which is expected to provide improved transparency between citizens and government, and also increase efficiency of urban local bodies.

The third paper on “Satellite Towns: An Emerging Need for Metropolitan Cities” is jointly written by Deepthi S. and Shobha M. N. who discuss that satellite towns are one of the spatial categories associated with secondary cities. Parent cities are progressively interlinked and become dependent on these satellite towns to boost trade, investments and local economic development. Satellite towns act as catalysts and supporting hubs for production, trade, transfer and transportation of goods, and people in the current system of global cities. Sometimes, these satellite towns are neglected as a part of development and often lack financial and technical influence of larger cities. This paper explains the concept and evolution of satellite towns along with the case studies of Navi Mumbai, Gurgaon, and Tokyo in the environs of the Metropolitan Regions. The paper concludes why urban sprawl needs a comprehensive approach in the field of planning.


The fourth paper titled “Does Benefits of Mixed Land Uses Match Up to People’s Expectations from their Living Environments?” is written by Poulomee Arun Ghosh and P. M. Raval. They put forward the view that environmental sustainability and improving quality of life are the two agendas that are said to be fulfilled by mixed land uses.



However, given the current practices of mixed land uses, there are certain aspects of quality of life that are compromised to avail certain benefits. Parameters of quality of life that are affected by physical living environment are taken from literature and are firstly segregated into positively affected or negatively affected by mixed land uses based on experts opinion and literature. They are next rated by people on a 7 point Likert scale based on 'How important they think each parameter is in determining their quality of life'. These ratings are compared with ratings by experts based on 'How much they think the parameter is affected by mixed land uses'. T-test comparison of both the ratings gave an overview of whether benefits of mixed land uses match with people's expectations from their living environment.

The fifth paper titled "Fifty Years of Development Planning: Master Plans and Urban Governance in Guwahati, Assam" is written jointly by Trishna Gogoi and J. S. Kakoty who underlines the fact that Guwahati was the first city to be taken up for master planning in the state of Assam in the early 1960s. Since then it has been administered under three master plans. With the release of a draft master plan in 2015, the city has crossed fifty years of planning. In this article, the authors trace the urban development trajectory of Guwahati via an empirical understanding of its land use and governance by taking up city's master plans as a point of reference. The authors argue that Guwahati provides an ideal case of post-colonial governance struggling with neoliberal development agenda, which has resulted in ad-hoc urban development in the city. The paper end with a critical comment on Guwahati's master plans and urban governance procedures, and show the relevance of master planning for the future of Indian cities.

The six paper themed "Sustainable Management of Construction and Demolition Waste in Cities of India" authored by Santosh Kumar discusses about construction and demolition waste (CDW), which he argues, is a grave concern for most developing countries with a harmful impact on the environment (increased pollution, land deterioration and resource depletion), society and economy. A significant quantity of CDW is generated in India due to rapid urbanization projected in the Indian cities. Construction in India is poised to become the world's third largest sector by 2018. In India, CDW is poorly managed, usually resulting in illegal dumping that causes nuisance and environmental degradation. Therefore, management of CDW assumes prime importance; with the potential to reduce environmental pollution as well as contributing to sustainable consumption of resources in the construction sector by decreasing reliance on mining of primary raw materials. This article in fact is an attempt to offer insights into the management practices of CDW along with the issues and challenges of sustainable management of CDW in India.


Ashok Kumar
Editor



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Affordable Housing Provision in the Context of Kolkata Metropolitan Area

Joy Karmakar, Ph.D.

Abstract

Government of India's mission of affordable housing for all the citizens by 2022 has become a major talking point for the people including policy makers to private developers to scholars at different levels. The idea of affordability and affordable housing has been defined by various organizations over the years but no unanimous definition has emerged. The need for affordable housing in the urban area is not new to India and especially mega cities like Kolkata. The paper makes an attempt to revisit and assess the affordable housing provision in Kolkata Metropolitan Area and how the idea of affordable housing provision has evolved over the years. It became clear from the analysis that role of the state in providing affordable housing to urban poor has not only been reduced but shifted to the middle class.

1. INTRODUCTION

With the growing population and increasing income disparity, housing accessibility, housing provisioning and housing availability will be a major challenge in Indian mega cities. The current economic, political and policy discourses offer the background within which the concerns about affordable housing, housing shortage and poor housing quality can be explored. In fact, availability of adequate affordable housing has become a key issue, impacting the lives of millions of Indian citizens' living in mega cities since the process of migration in India is lopsided¹ in which people migrate directly from rural areas to mega city (Kundu, not dated) by passing the intermediate or smaller towns. Therefore, need of affordable housing has been rapidly gaining recognition from the policy makers to scholars across the mega cities of various countries. Government of India has published a policy document which declares the aim of 'housing for all' by 2022 (Government of India, 2007). However, inadequate attention has been paid by the government on 'affordable housing' program formulation to implementation. More precisely it is reported that India needs five million houses each year but the actual supply is not even half a million per year (Gupta, 2018). Therefore, scholars

¹ In 2001, 68.7 percent of the total urban population was living in Class I cities (defined as cities having a population of over 100,000). The shares of medium and small towns in the total population stood at 21.9 percent and 9.4 percent respectively. In 2011 the concentration of urban population increased and 70 % of the total urban population was living in the Class I cities in India. However, the growth in population in the three Mega Cities i.e. Mumbai, Delhi and Kolkata has slowed down considerably during the last decade.

Joy Karmakar, Ph.D., Lecturer, Serampore College, West Bengal



raise questions about the concept and various government programs of this type of housing, since the idea varies at different level. This paper makes an attempt to revisit the trajectories of development of affordable housing as well as challenges related to such housing in the contexts of Kolkata Metropolitan Area (KMA).

After the introductory section second part of this paper illuminate briefly on the situation of affordable housing in India. Third section focus on the conceptual understanding of affordability and affordable housing; fourth section deals with the housing situation and emerging challenges and policy level intervention in the context of affordable housing in Kolkata Metropolitan Area. Conclusion is drawn out of synthesis based on the analysis.

2. HOUSING SITUATION IN INDIA

Among the significant issues in India's urbanization, affordable housing for all will be crucial one. There are different challenges of urban housing which include shortage, overcrowding, ownership of housing; available stock of houses, etc. There is a need to provide safe, secure and affordable housing for the urban people for the growth and development of the country and to create a more inclusive society.

Census of India 2011 figures reveal that the housing stock has increased from 24.9 crore in 2001 to 33.1 crore in 2011, indicating a growth of 33 per cent. However, housing shortage remain a challenge, since there is an inequality between the people for whom the houses are being built and those who need them. As per the estimated housing shortage for 2012-17, urban areas have about 95 per cent shortage in economically weaker sections and lower income group categories (GOI, 2014). Table 1 shows the shortage of urban housing across the different economic sections of the society.

Table 1: Estimated Urban Housing Shortage in India 2012-2017

Category	Shortage in Million	Percentage
Economically Weaker Sections (EWS)*	10.55	56.18
Lower Income Group (LIG)*	7.41	39.44
Middle Income Group (MIG)	0.82	4.38
Total	18.78	100

Source: *Urban Housing Shortage (2012-17) Report of the Ministry of Housing and Urban Poverty Alleviation to estimate the Urban Housing Shortage for the 12th Five Year (2012-17)*

Note: *The Ministry of Housing and Urban Poverty Alleviation (MoHUPA) vide their letter dated November 14, 2012 has advised that the income ceilings for Economically Weaker Sections (EWS) and Low Income Groups (LIG) have been revised as follows: (i) For Economically Weaker Sections (EWS) : - ₹ 1,00,000/- as household income per annum (ii) For Low Income Groups (LIG) : - ₹ 1,00,001/- to ₹ 2,00,000/- as household income per annum.

**Table 2: Estimates of Affordable Urban Housing**

Items	Slum Areas in Million	Non Slum Areas in Million	Total in Million
Need for fresh housing units	10.61	5.68	16.29
Incremental housing to address congestion	4.78	7.89	12.27
Provision of infrastructure for new housing units	10.61	5.68	10.61
Up gradation of infrastructure in existing slums	10.85	0.00	10.85

Source: Report on trend and progress on housing in India, 2012

It is evident from Table 1, that shortage of houses in urban areas is maximum among the EWS followed by Lower income groups. Apart from shortage of houses significant segments of the housing stock was characterized by congestion and obsolescence. Congestion is particularly acute in inner city slums and peripheral slums. The congestion factor contributes to 12.67 million of households and need for fresh housing contributes to 16.29 Million units (GOI, 2012). In fact, recent report on the affordable housing² 2022 by KPMG suggests that urban housing is to account for about 85 to 90 percent of the total investments and the focus should be on affordable urban houses, which is 70 percent of the total urban housing requirement (Bansal, 2014). Table 2, shows the estimates of affordable urban housing in India.

It is apparent from Table 2, that both slum and non slum areas need huge investment to create affordable houses and eradicate houseless and over congestion in urban areas. In fact, both State and the Union government have taken measures to provide affordable house across the country. Dedicated fund allocation in National Housing bank, cut in Goods and Service Tax (GST)³ are some of the steps proposed in 2018 (NK Realtors, 2018) as effective measure of affordable housing program.

3. CONCEPT OF AFFORDABILITY AND AFFORDABLE HOUSING

An extensive body of academic literature is available on affordable housing. However, there is no clear definition on 'affordable' since it is a relative concept and

² Affordable housing refers to housing units that are affordable by that section of society whose income is below the median household income. Though different countries have different definitions for affordable housing, but it is largely the same, i.e. affordable housing should address the housing needs of the lower or middle income households.

³ As per the new recommendations proposed by the GST Council, home buyers availing the credit-linked subsidy scheme (CLSS) under 'Pradhan Mantri Awas Yojana' will from now on get a relief of 4 percent in the Goods and Services Tax. The reduced rate of 8 percent, as compared to the existing 12 percent, will be applicable for all new and under-construction homes that are purchased under the credit-linked subsidy scheme.

has different meanings in different context. Oxley (2012) presents a general definition of affordable housing as housing allocated outside of market mechanisms according to need rather than ability to pay. Milligan and Gilmour (2012) explain this 'ability to pay' as housing that is available at a rent or purchase price that does not exceed a 'designated standard' of affordability. This standard of affordability is often defined as housing costs that should not exceed a proportion of household income and / or should result in a household income that is sufficient to meet other basic living costs after allowing for these housing costs. According to The Royal Institutions of Chartered Surveyors (RICS) report 2010 on 'Making Affordable Housing Work in India' noted that affordability in the context of urban housing means provision of adequate shelter on a sustained basis and it ensures the security of tenure within the means of common urban household. In India several organizations have defined affordable housing to fulfill their own objectives. As per KPMG report on 'Affordable Housing—a Key Growth Driver in Real Estate Sector', income level, size of the dwelling unit and affordability are the three basic parameters of affordable housing. The first two parameters are independent from each other while the third parameter is dependent on the level of income. The Table 3, discusses the details of each parameter.

From the Table 3 it is evident that apart from level of income, size of the dwelling unit is also reflects the sign of affordability as pointed out in the KPMG report. Likewise the JNNURM mission directorate of Ministry of Housing and Urban Poverty Alleviation (MHUPA) has also defined affordable housing in its amended guidelines, published in December 2011.

Table 3: Parameters of Affordable Housing by KPMG

Categories	Level of Income per annum	Size of Dwelling Unit in sq. Feet	Affordability
EWS	Less than Rs. 1.5 lakh	up to 300	EMI to monthly income: 30 percent to 40 percent House price to Annual Income Ratio: less than 5:1
LIG	Rs. 1.5-3.00 lakh	300-600	
MIG	Rs. 3.00-10.00 lakh	600-1200	

Source: JLL report 'on point affordable housing in India' 2012

Table 4: Affordable Housing by MHUPA, 2011

Income Category	Dwelling Size in sq. feet	EMI or Rent
EWS	Minimum 300 sq ft super built-up area	Not exceeding EMI 30-40 percent of the gross monthly income of the buyer
LIG	Minimum 500 sq ft super built-up area Maximum 517 sq ft super built-up area	
MIG	600-1200 sq ft super built-up area	

Source: Guidelines for Affordable Partnership Housing partnership by MHUPA, 2011

**Table 5: Affordable Housing Parameters by JLL Report**

	Minimum Volume of Habitation	Provision of Basic Amenities	Cost of the House	Location of the House
EWS	Minimum of 250 sq ft Minimum of 2250 cu ft internal volume	Adequate sanitation, Water supply and Power.	Not exceeding EMI 30-40 percent of the gross monthly income of the buyer.	Located within the 20 km of the major workplace hub in the city. Adequately connected to major public transit hubs.
LIG	300-600 sq ft Carpet Area 2,700-5,400 cu ft internal volume	Provision of community space such as school, park or health care facilities either within the project or neighborhood.		
MIG	600-1200 sq ft Carpet Area 5,400-10,800 cu ft internal volume			

Source: JLL report 'on point affordable housing in India' 2012

It is noteworthy that MHUPA has changed their guidelines in 2011 on affordable housing, which cost parameter of housing has been excluded. Size of the dwelling unit and EMI parameters remain same. Moreover, JLL 2012 report on point affordable housing in India has mentioned four parameters of affordable housing. This definition is incorporating some significant parameters that are crucial for living in affordable houses. Table 5 shows the details of the parameters.

It is clear enough that affordable housing depends on number of factors and among these factors level of income is crucial. Apart from income other important factors include lack of land in mega city, lack of access to home finance to the economically weaker section and low income group people. Therefore, affordability has multifaceted dimensions in the context of urban affordable housing particularly.

4. AFFORDABLE HOUSING - CASE OF KOLKATA METROPOLITAN AREA (KMA)

West Bengal is one of the highly urbanized states in Indian. 31.16 percentages of urban population lives in West Bengal and out of the total urban population almost 45 percent lives in the Kolkata Metropolitan Area (KMA). Kolkata Metropolitan Area encompasses a total area of 1886.67 sq km. The metropolitan area lies under the control of 41 municipalities. According to 2011 census in KMC (Kolkata Municipal Corporation) area total slum household is 285558 and they are living in 277333 resident houses so there is shortage of 8225 houses in slum areas only. This is a very crude example of housing shortage in the slums of third world mega cities like Kolkata.

4.1 Re-examining Affordable Housing Provision

Since Kolkata is one of the oldest mega cities in India, it has had long history of acute shortage of housing since the time of independence. In fact, acute



shortage and poor quality of housing has been mentioned in various official reports like BDP (Basic Development Plan), it was prepared by CMPO (Calcutta Metropolitan Planning Organization) for CMD (Calcutta Metropolitan District) in 1960, in which the existence of lack of shelter in the Kolkata Metropolitan District was pointed out. The plan noted two aspects of it; one is the overcrowding of the house which is the consequences of the migration and partition. It has been estimated that 77 percent of the Kolkata families in 1957 had less than 40 square feet of living space per person.⁴ Second is about the housing condition. The Largest share of the housing units was made of non-permanent material. The same report made a proposal of building few new townships to provide affordable housing. Four kinds of shelters were prepared to handle the situation which includes high income, middle income and low income of housing and low income open plot development. The areas which were being chosen for middle and low income housing development include Kamarhati-North Dum Dum, Salt Lake, Sonarpur, south suburban area, Bansberia and Kalyani (GOWB, 1966). Salt Lake (Bidhannagar) and Kalyani are purely a planned township. This is the period when the State acquired the land for providing housing to the people of different economic sections.

Parallel to middle and low income housing development, there was a program for *bustee*⁵ or slum improvement in Kolkata, Howrah and Bally. The slum improvement is focused on two types of areas; those in which clearance⁶ and new construction are proposed and areas in which existing slums to be improved. The improvement program had covered 5,37,000 which were approximately 57 percent of the slum population of Kolkata and Howrah and almost 100 percent slum population of Bally.

Development Perspective and Investment Plan published in 1976 recommended new strategy of slum modernization program⁷ in KMA. They categorized the schemes of slum development into three types i) Improvement ii)

4 *Government of West Bengal (1966) Basic Development Plan for CMD 1966-1986, Calcutta Metropolitan Planning Organization*

5 *A slum is defined in the Calcutta Municipal Act in 1951, as an "area of land occupied by, or for the purpose of any collection of huts standing on a plot of lands not less than 10 cottahs (i.e. equivalent to one sixth of an acre) in area". A hut means "any building, no substantial part of which excluding the walls up to a height of 18 inches up to the floor, is constructed of masonry, steel, iron or other material.*

6 *In 1950s slum clearance involved relocating dwellers to different site. This approach not only created hardship to the bustee dwellers but also became unacceptable to them from occupational point of view, because they live near their place of work.*

7 *In Slum Modernization Scheme of 1960s and 1970s, the dwellers were to be re-housed in four storied single room tenement and land released by the slum was utilized for remunerative purpose. This model did not run successfully because "apartment living" did not conform to the lifestyle of the slum dwellers who needed substantial open space in addition to the small covered area allotted to them.*



Table 6: Three Year Investment of IDA for Slum Improvement Programs

	1978-1979	1979-1980	1980-1981
	IDA II	IDA II	IDA II
Bustee Improvement	Rs 2.30 crores	Rs. 5.00 crores	Rs. 5.83 crores

Source: S. K. Roy and Kalyan Roy, *Planning for action - the CMDA's involvement edited volume of Jean Racine, Calcutta 1981, and pp 308*

Redevelopment iii) Relocation. Accordingly various schemes have been taken up. In 1990s it was reported that Slum Improvement program has covered 19.45 lakh of slum dwellers and 3 lakh of residents in Refugee Colonies. It is remarkable that "Thika Tenancy Act 1949" is repealed by a new

legislation i.e. Calcutta Thika Tenancy Act 1981 (CMDA, 1990). As per this act the ownership of the *bustee* land distributed by the landlords to Thika tenants would vest in state. This was a change in ownership from private to public. This move opened up new horizon for *bustee* dwellers with respect to shelter development and improvement of other infrastructural facilities through direct public intervention.

The failure of slum clearance and relocation model of 1960s and early 1970s led to the introduction of "Bustee improvement Program"⁸ by Kolkata Metropolitan Development Authority (KMDA). It involves the all-round improvement of infrastructure facilities. For the first time World Bank invested huge money for Kolkata's physical development. In 1973 the International Development Association (IDA) along with World Bank has agreed to provide soft loan for financial assistance against 44 schemes out of 100 ongoing schemes. Table 6 shows the investment of IDA for Bustee improvement program in Kolkata.

It was the beginning of slum transformation under global capitalism after the termination of colonial master's interference. Subsequently in late 1990s and thereafter again slum improvement program was taken with the financial assistance of Asian Development Bank and World Bank under the scheme of Calcutta Environmental Management and Strategy Action Plan (CEMSAP) and Kolkata Environmental Improvement Project (KEIP). Government of West Bengal is responsible for the implementation of the project at the municipal level. These programs have a component of slum improvement as well as rehabilitation.

In addition to the slum improvement program, Kolkata Metropolitan Development Authority (KMDA) took up a program for development of land suitable for housing across the different section of people. The following "composite township" project had developed by KMDA in late 1980s (Table 7). It is remarkable that

⁸ This program often termed as sanitation model recognized the existing arrangement of huts, pathway's, streets, etc.; within the slum area along with traditional tenancy system, and seeks to improve basic infrastructural and environmental deficiency

**Table 7: Housing Projects in KMA Proposed by KMDA**

Project	Project Area in Hectares	Expected Population	Density Per hectare
Baishnab Ghata-Patuli Township	120	40,000	183
East Calcutta Township	260	50,000	123
East Calcutta Extension (Nonadanga)	30	20,000	123
West Howrah Township	170	50,000	---
Bidhannagar	2023	2,75,000	55

Source: *Plan for Metropolitan Development 1990-2015*

in some of the above mentioned projects funded by World Bank. Development of new township was to be paid special attention to 'site and services' for economically weaker section and low income group people. In reality these townships are occupied by middle class as well upper middle class ruling elite of the city.

In 2000 onward there was some shifts regarding implementation of the slum improvement projects like Kolkata Environmental Improvement Program (KEIP)⁹. Earlier such slum improvement project was implemented by government of West Bengal despite having municipal governance. Now such projects like Kolkata Environmental Improvement Investment Program (KEIIP), Basic Services for Urban Poor (BSUP)¹⁰ are being implemented by urban local bodies like Kolkata Municipal Corporation.

As per census of India 2011, existing stocks of house shows that almost 96 percent of the houses are used as residence. Out of these non-slum residential houses, more than 9 percent houses are dilapidated in Uluberia and it is the highest among the different Urban Local Bodies (ULBs) in KMA. Halisahar and Barasat have also greater number of dilapidated non-slum residential houses followed by Uluberia. Lowest number of dilapidated non-slum residential houses existed in Bidhannagar. On an average 25 percent houses are being rented in different ULBs in KMA. Therefore, there is wide scope to provide affordable house for the urban poor. West Bengal Housing Board is one of the organizations that provides affordable house since 1970s across the West Bengal.

⁹ KEIP or Kolkata Environment Improvement Project was introduced in 2000 when ADB grant loan to Kolkata Municipal Corporation. The project has four components which include solid waste management, sewerage and drainage, canal rehabilitation and slum improvement. KMC is currently implementing the \$400 million Kolkata Environmental Improvement Investment Program (KEIIP) financed by ADB.

¹⁰ Basic Services for Urban Poor (BSUP) project started in 2006 by Union Government in order to cope with massive problems that have emerged as result of rapid urban growth. The major thrust of this program is to provide shelter and basic services to slum dwellers.

**Table 8: Housing Units Developed by West Bengal Housing Board**

Area	1974-1990			1991-2015		
	LIG & EWS	MIG	HIG	LIG & EWS	MIG	HIG
Kolkata Municipal Corporation (KMC)	27.73	30.41	41.86	14.17	18.59	67.24
Kolkata Metropolitan Area (KMA)	33.42	37.55	29.03	11.21	42.31	46.48
Outside of KMA	62.45	33.98	3.56	8.58	13.87	77.55
New Town Kolkata Area (NKDA)	----	----	----	32.38	27.30	40.32
Total Share	35.01	34.75	30.24	14.93	29.76	55.31

Source: West Bengal Housing Board, Data Compiled by author, figures are in percentage

4.1.1 Role of West Bengal Housing Board (WBHB)

In 1972 West Bengal Housing Board was established with a mission to provide shelter for the people of West Bengal at a reasonable as well as an affordable price. It started to function in 1973. The Housing Board provided number of houses for different economic sections over the years and later private real estate companies also started to develop affordable house after 1990. The Housing Board develops affordable houses which are grouped into four income categories namely high, middle and low income group and economically weaker section¹¹. Table 8 shows the distribution of different housing units produced by West Bengal Housing Board.

The table 8 clearly indicates that housing board produces greater number of LIG and MIG housing units in KMA and Outside KMA before 1990s. Share of the different housing units are almost nearer to each other before 1990s but later share of HIG projects increases. After 1990s West Bengal Housing Board reduces the production of LIG housing units across the different areas, especially in KMA as well as outside KMA. Reduction of LIG and EWS housing units as well as MIG housing units by WBHB suggests the dominance real estate companies in housing market as well as the state's indirect role as finance provider through various public and private financial agencies instead of providing affordable housing. This is one of a major shift in housing sector after 1990s in Kolkata like many other Indian metropolises.

4.1.2 Role of the Private Real Estate Developers

Liberalization of the Indian economy brings many changes and one of the significant change was the departure of state funded affordable housing scheme to privately develop affordable housing scheme. These projects are planned and built for-profit basis, often by a single developer or a consortium

¹¹ Economically weaker section is those household whose income remain below 2000 per month. In case of low income group households, income remains below 5000 per month. Middle and High income group household are those whose income remains 5000 to 10000 and above 10000 respectively (Perspective Plan of KMA 2025).

Table 9: Affordable Housing Projects within Planned Township

Name and Location	Proposed					
	Area in acre	Number of Dwelling Units	Population	Theme	Population Density per acre	Number of EWS Dwelling Unit
Kalyani (Samridhhi)	50	5,000	25,000	Analytic	500	1,250
Dumurjala (Howrah)	50	5,000	25,000	Sports	500	1,250
Baruipur (Uttam City)	86.2	8,620	43,100	Geriatrics	500	2,155
Amtala (Bishnupur)	233	---	----	Innovative*	---	----
Rajarhat	80.29	---	----	Innovative*	---	----

Source: West Bengal Urban Development Department, 2015

Note: Calculation is based on the figure prescribed by Urban Development Department of West Bengal. 50 acre land will have 5000 dwelling units and residence of 25000 populations.

*Innovative theme includes health, education and tourism

of investors, sometimes in partnership with government entities. As large-scale profit-oriented urban entities, these projects represent a vision for the transformation of the urban experience through the wholesale commodification of the urban fabric. However, this ensures market competitiveness for developers. Although, newly introduced policies make mandatory for the private real estate companies to keep 25 percent of the total project area for creation of residential units for economically weaker sections in different States in India¹². Size of the recommended affordable house has to be 25 to 30 sq mt (GoWB, 2016). Kolkata Metropolitan Area is one of the mega cities where implementation of such policies can be seen vividly through development of various large scale township projects which has provision of affordable housing. Following Table 9 identifies some of the affordable housing projects developed in the form 'planned township'.

It is apparent from the Table 9 that 'township' projects are developed by the private real estate companies at peripheries of the mega cities focusing on high and middle income group housing with provision of affordable housing in the townships. The choice of the themes for the township often provides by the State governments (Karmakar, Chatterjee and Basu, 2017). Land is seldom facilitates by the State government to the private developers in order to bypass the complexity of direct negotiation with the land losers. Population of these townships is equal

¹² Like many other Indian States, Government of West Bengal introduced New Township policy 2016 which makes mandatory for the private developer to keep 25 percent of the total project area for setting up residential units for economically weaker sections.



to or more than 25,000. Density of these townships adopted is of 500 people per acre, like 'Garden Cities' of the Europe. Minimum habitation volume for EWS is not apparent in such townships. In fact, such township model is a departure from the low density development to high density development through vertical growth. Scholars noted that such projects are represented by governments and developers as a means of mobilizing corporate entrepreneurship and technology to create urban spaces that attract investment, create efficiencies, and enable residents to realize their potential as actors in a global economy (Shatkin, 2014). There are several reasons for higher demand of such affordable houses in the townships. Rapid urbanization, unaffordable premium homes at the tier one city like Kolkata and culture of home ownership rather than rent are some of the significant reason for the rising demand of affordable house (IBEF, 2012). Developers claim this sort of residential development as world class housing at the periphery of mega city. Scholars noted this type of development at the peripheries of Indian cities as the "Globurb" and its American lifestyle (King 2004).

Apart from this trend of affordable housing within 'world class township' State Government recently declares a scheme called 'Nijasree' for middle income groups (monthly income ranging from 15k-30k) of the State with special focus on KMA¹³. In which private developer will play crucial role with the State Governments. However, it is alleged that such steps are to allure the middle class vote banks in the State. But, Kolkata Metropolitan Area faces major challenges to build townships having provision of affordable housing projects due to various reasons. Inefficient land market, complex land tenure system and lack of adequate information are some of the major challenges to build the large housing projects. In fact, 'land movement' in West Bengal makes it more critical to acquire land for development projects. State government is now unwilling to make any intervention as far as providing the land to the real-estate companies is concerned (Sengupta, 2017). Lack of access to home finance for low income groups is also a major reason for low demand of affordable housing.

It is worthwhile to note that some steps have been taken at different level to give big push towards development of affordable housing. The National Urban Housing and Habitat Policy issued by the Government of India in 2007 is one of the major steps and it recognizes that public sector resources solely cannot meet high demand of housing. It provides for the involvement of multiple stakeholders and seeks to promote public private partnerships to meet this demand. Some of the significant steps include.

¹³ <http://www.newindianexpress.com/nation/2018/jun/21/eying-on-2019-lok-sabha-and-2021-assembly-elections-mamata-plans-50000-affordable-flats-for-middle-1831524.html>



- The feasibility of a National Shelter Fund to be set up under the control of the National Housing Bank for providing subsidy support to EWS/LIG housing would be examined in consultation with Ministry of Finance. The NHB will act as a refinance institution for the housing sector.
- Efforts should be made to encourage Foreign Direct Investment (FDI) from International institutions, Non-Resident Indians (NRIs) and Persons of Indian Origin (PIOs) in the housing and infrastructure sector in consultation with the Ministry of Finance and RBI.
- Residential Mortgage Based Securitization (RMBS) need to be nurtured through NHB, Scheduled Banks and Housing Finance Corporation (HFCs).

Therefore, it is important to observe, for a time being, the changing dynamics of affordable housing in mega cities like KMA, then only it would be clear whether the new policy measure, at all have any positive impact on the affordable housing.

5. CONCLUSIONS

This paper made an attempt to revisit the affordable housing provision in Kolkata Metropolitan Area, since the time of independence. It acknowledges the fact that urban India needs affordable housing but there is wide gap between demand and supply of affordable housing. It also recognizes the changing role of the various stakeholders of affordable housing as well as the policies that introduced for coping up with the changing situation. Role of the State has been reduced in building affordable housing after nineties while private real estate companies became major player in developing affordable housing through township projects. Experience of Kolkata Metropolitan Area clearly reveals that idea of affordable housing has been changed gradually over the years. The process has gone through developing affordable housing in the large scale planned township by the State to slum reconstruction and rehabilitation by the State, to privately developed affordable housing projects within 'world class township projects'. Simultaneously it is noteworthy that this shift in the role of states from imposing modernist visions for the transformation of cities, to a more entrepreneurial role in facilitating private-sector development as a means of capitalizing on the economic opportunities presented by globalization (Holston and Appadurai, 1999; Brenner 2004, Ong, 2006). Moreover there is a shift to develop affordable housing for economically weaker sections and low income group to middle class people. Therefore, the pertinent question is how far affordable housing would be affordable to economically weaker sections of the people. Is it necessary for a 'welfare state' to follow the market logic for providing affordable housing?

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Property Tax: Role of Technology in Process Improvement, Transparency and Revenue Enhancement

Dinesh Ahlawat, Saurav Sen and Akshat Jain

Abstract

The author explains that property tax is evaluated differently for different properties. Presently, the traditional methods for tax assessment are causing delays in the process, a large number of unassessed properties remain, and several properties are not assessed correctly due to dependency on manual efforts. Some approaches and innovative technologies have been illuminated to improve the current practice of data collection, record keeping, assessment, updation of property data and improvement in the overall process of property tax management system. The use of Geographic Information System, it is argued, can play a crucial role in the integration of property data with the spatial information essential for management of property tax systems. The paper concludes with the development of Property Tax Management System, which is expected to provide improved transparency between citizens and government, and also increase efficiency of urban local bodies.

1. INTRODUCTION

Property Tax, also known as House Tax, is levied by urban local bodies (ULBs) on the land and buildings located within their jurisdiction. The ULBs ability to deliver municipal functions greatly depends on their financial health. Property tax is one of the most important sources of revenue for ULBs in India. Revenue from Property Tax in select ULBs is in the range of 21 per cent to 35 per cent (Fig. 1).

CESPL along with its subsidiary DWICPL has completed a study on *Improvement in Revenue from Property Tax* in eight ULBs in India. It has been observed that in all the ULBs property tax management is given the least importance. There are lacunae in the process itself. This paper presents the issues in the current assessment, collection and record keeping of property tax data in the ULBs and how these can be resolved with adaptation of streamlined process and use of state-of-the-art technology. The experience in all the ULBs has shown that there is ample scope of improvement in the process to tap revenue potential. Presently there are three different approaches for assessing property tax. These are as follows:

- **Annual Rental Value (ARV)** - Annual rent of the property is fixed by the ULB and property tax is levied based on the estimated annual value of the property.

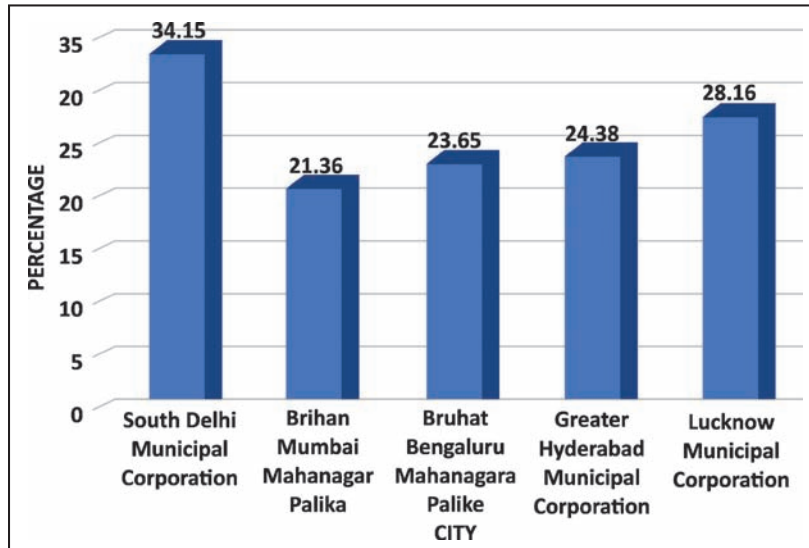
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Akshat Jain, Director, Caritas Eco Systems Pvt Ltd



Fig. 1: Property Tax in select ULBs



- **Capital Value System (CSV)** - The calculation of tax is based on capital value of the building, which is in turn based on the cost of land as well as the cost of the building, net of depreciation.
- **Unit Area System (UAS)** - Property tax is calculated based on the carpet area of the property.

2. CURRENT SCENARIO OF PROPERTY TAX ADMINISTRATION

Municipal acts empower ULBs to assess and collect property tax from properties situated within their jurisdictions. For this purpose, the city is divided into zones, wards and colonies. Property tax is assessed differently for residential properties and non-residential properties. Generally, there is a multiplier factor for non-residential properties, or the unit rates are higher than used for residential properties. Apart from the property use, other factors used in assessment of property tax include property location, structure type, age of the building and occupancy. According to the respective States Municipal Act, assessment and re-assessment of properties in the city is to be done with five-year cycle. Properties once assessed are not re-assessed after completion of five-year period. In some of the cities, the last assessment was done fifteen years ago. During this period, selective properties, mainly non-residential properties records are updated. This results in significant number of properties left out of the property tax base. In the recent past, ULBs have adopted the “Self-Assessment” process wherein the property owner provides the property details and calculate the property tax. The key issues identified in property tax management are presented below.

2.1 Physical Assessment and Re-assessment

It is mandated in the Municipal Acts that re-assessment of properties is to be done every five years. However, there is too much delay in re-assessment and the property records are not updated timely. For example, in Varanasi, the last assessment of properties was done in 2008 and in Lucknow it was 2010. During this period, the honest tax payers gets their records updated, if they have done any change in the property, or the municipal tax inspector register

Fig. 2: Boundary Dispute in Cuttack **Fig. 3: Boundary Dispute in Varanasi**

Description of the Ward no. 1
Bidanasi, Kumbharasahi, Gopalsahi(P), Harijan Sahi, Tareni Vihar, Laxmi Vihar, Jyoti Vihar, Satabdi Vihar, Krushak Bazar(P)
Four side boundary of the Ward no. 1
N - River Mahanadi S - Bidanasi Main Road - Krushak Bazar E - Bidanasi Chahata Ring Road W - River Mahanadi Ring Road



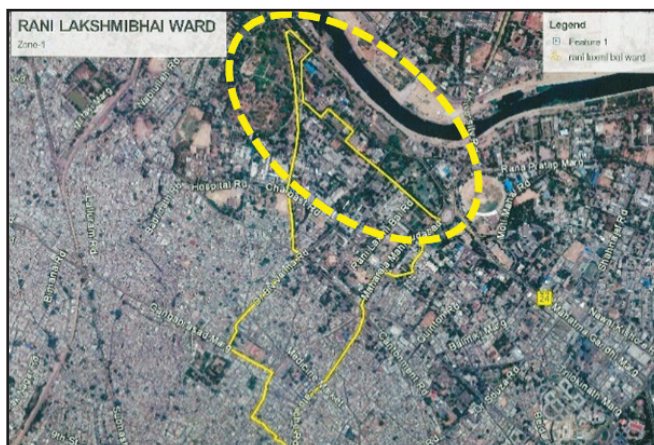
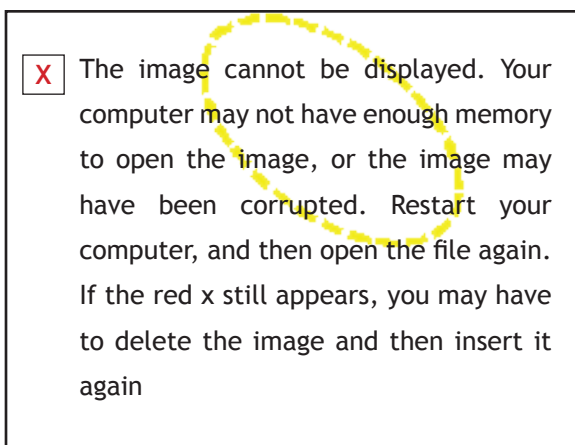
any change during random verification. This greatly affects the property tax current demand.

2.2 Knowledge with Individual not with ULB as an Institution

In the age of technology, our ULBs are greatly depended on the experience and individual knowledge of the municipal official. During the projects, it has been observed that basic information like ward boundary and colony boundary is not available on a map, rather it is kept in text format. Example from Cuttack is given in (Fig. 2) and (Fig. 3) respectively.

In the absence of proper maps, there is huge dependency on tax officials in demarcating boundaries. Even the ward and colony boundary changes with changing officials. Every official has their own explanations. One of the examples from Lucknow is illustrated below. Rani Laxmi Bai ward boundary was demarcated along with the municipal officials and was endorsed by them as shown in Fig. 4.

Fig. 4: Boundary Dispute in Rani Laxmi Bai Ward **Fig. 5: Boundary Dispute in Hazratganj Ward**





However, during demarcation of adjacent ward, Hazratganj, it was realized that some area demarcated in Rani Laxmi Bai ward is part of Hazratganj ward. So, the ward boundary was adjusted as shown in Fig. 5.

Similar was the experience with demarcation of colony boundary. Lack of actual knowledge about boundaries was experienced in all the cities CESPL has worked with. This establishes the fact that it is very important to institutionalize knowledge and information in ULBs and not with individuals.

2.3 Dependence on Manual Effort

Presently, the property tax assessment, collection and grievance handling are hugely dependent on manual effort. This brings in discretion, delay in the process, increase in unassessed properties, default by the tax payer and accumulation of arrears leading to poor financial health of the ULB.

2.4 Manual Process of Record Keeping

2.4.1 Demand and Collection Register (DCR)

Property tax information of demand and collection is recorded in the DCR. Any payment and general information about the property owner is updated in this register. The property assessment information is not included in this register.

Fig. 6: Property Tax Information of Demand and Collection as Recorded in the DCR

This makes it difficult to understand how the property tax has been calculated. This leads to many property owners filing objections seeking clarifications on assessment and non-payment of property tax (Fig. 6).

2.4.2 Duplicate and Defunct Properties

Irregular update of properties data and frequent change in the zone/ward boundaries is the main reason behind creation of duplicate properties. Other reasons for duplicate properties that in case of change of ownership of a property or there is a split / merger of plots, new records are created whereas the earlier one's are

not removed/deleted. It has been observed in Varanasi that in 10 wards surveyed by CESPL, the total number of properties as per ULB's records were 18,293. There were 94 duplicate house numbers which created 285 properties. It is imperative for the ULBs to keep property data updated and assess the properties accordingly.

2.5 Un-assessed Properties

As explained earlier, delay in assessment and random or selective assessment leaves the number of properties un-assessed. Other reason for un-assessed properties is inclusion of new areas within municipal jurisdictions. This is evident through the projects undertaken by CESPL. It is observed that there is large number of un-assessed properties in pilot wards (Table 1).

Table 1: Un-Assessed Properties in Pilot Wards

S. No.	City	Properties		% Increase
		ULB Records	CESPL Survey Data	
1.	Lucknow	28,836	41,039	42.32
2.	Varanasi	18,293	20,450	11.79
3.	Dehradun	7,205	11,051	53.38
4.	Haridwar	4,955	9,001	81.65
5.	Chhindwara	8,956	11,177	24.80
6.	Cuttack	6,885	7,812	13.46
7.	Puri	3,754	9,443	151.55

Source: *ULB Property Tax Data and CESPL Survey Data*

2.6 Discretion in Assessment

Presently, in most of the cities, property tax assessment is being done on the basis of self-assessment Form submitted by the property owner or through random checks by municipal officials. There is no authentic proof to substantiate the assessment is genuine. It has been observed during field surveys that commercial use in residential properties is assessed as residential use. The municipal officials defended it stating that:

- These are small establishments;
- Property owners are poor and the small shop is their only income source; and
- If assessed as commercial unit, the property owner may default on payment

By assessing the properties at unit level and assessing the properties on 'as is basis', the property tax demand can be increased significantly.

2.7 Mounting Arrears

The primary reason for property owner defaulting on payment is that the property is not assessed correctly. The other reason is that the property is locked for



Fig. 7: Partial Digitization of Property Records

long time and the owner is not residing in the city. The arrear accumulation in select cities is more than 30% of the total property tax demand for the current year. The city-wise percentage of arrear is presented in the table below.

2.8 Partial Digitization of Property Records

It has been observed that digitisation of property records has not been completed yet. Large number of properties are still continuing in DCR. The cities have partially digitised the demand and collection attributes of properties. Assessment data like property use (unit level), area, occupancy, construction type, etc., are yet to be digitised (Fig. 7).

2.9 Poor Grievance Redressal

The process of grievance redressal is provided in the Municipal Acts and the ULB’s Acts accordingly. The grievances are addressed in a hierarchical manner starting with the Tax Assessor to Superintendent to Zonal Officer to Additional Municipal Commissioner and finally Municipal Commissioner. In practice, the grievance redressal takes more time than given in Municipal Act. An effective and swift dispute redressal system enables maximum output in collection of property tax. It was observed that the ULBs having a poor dispute redressal mechanism obtain low collection efficiency of property tax due to pending disputes and court cases.

2.10 Capacity Building

There is huge dependency on manual efforts in assessment, verification and collection of property tax. The present processes and systems rely more on manual intervention rather than use of available technology. Municipal officials, though in favour of modern-day technology, are reluctant to make use of it. At times duplicate and false property tax demands are generated to show the demand potential. There has to be a reform in the functioning of the municipal officials through proper trainings and exposure to benefits of use of technology.

3. TECHNOLOGY AND PROCESS ENGINEERING

This section presents CESPL’s approach and technological innovation to improve the current practice of data collection, record keeping, assessment, updation of



property data and improvement in the overall process of property tax management system (Table 2). The approach adopted by the consultants ensures:

- **Credible and Buoyant Revenue Stream:** When Tax rates are reasonable and the administration is fair and transparent, the city would witness lower tax delinquency and attract more investments that trigger economic growth and development. This leads to higher incomes and property values.
- **Auditable, Verifiable and Updated Property and Tax Records:** Establishment of a Geo enabled property database increases auditability of the property data; spatial information is the constant attribute through which any property can be identified and monitored over time. This improves the coverage of property tax net and helps in dispute free revenue collection.
- **Maintaining Currency of Property Data Records and Linkages with Database of Other Departments:** The proposed System will help in updating the property data on a sustainable basis leading to identification of possible land use violations, currency and status of Trade Licenses issued or even any violations of building permissions / bye law provisions in the properties (e.g. exceeding the FAR, ground coverage, etc.). Also, this will ensure currency of data for all other municipal / government departments providing services and utilities to the properties, thereby increasing the revenue potential and ultimately higher realization.
- **Simplified Tax Assessment Methodology:** Simplified property tax assessment rules help in reducing efforts and conflicts in property tax assessment resulting in lesser number of grievances. As per Consultant's past experiences, it is observed that the ULB with a complex methodology of tax assessment faces huge number of grievances resulting in non-payment of property tax and high accumulation of arrears.
- **Swift and Effective Dispute Redressal System:** An efficient dispute redressal will enable faster disposal of grievances and reduce backlog of arrears, thus improving the ULB's revenue as well as its balance sheet, which helps building its fiscal creditability.

Performance and success of any system depends on the quality of data. CESPL ensures the quality of field data and emphasise on the quality process of data collection. The process is streamlined starting from the acquisition of aerial imagery to image processing and Quality Assessment (QA) / Quality Check (QC) of the property data collected from field. The GIS based property data is linked with the online web application. The web application provides the individual property information at city level and specific management reports for decision makers (Fig. 8).

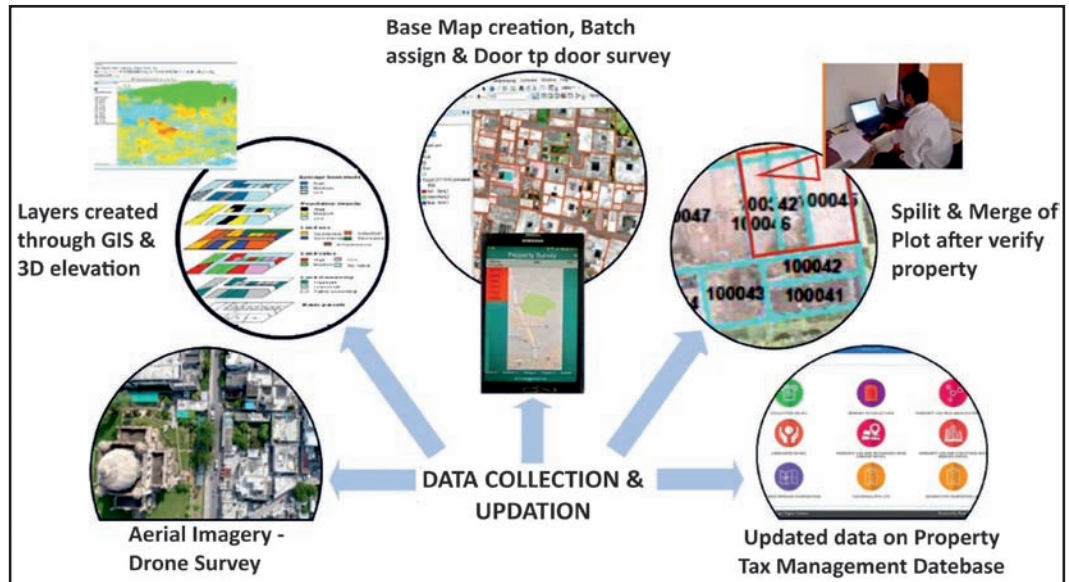
Table 2: Arrears in the ULBs

Year	ULB	Arrear (%)
2017-18	Lucknow	31.37
2017-18	Varanasi	51.03
2015-16	Chhindwara	46.87
2014-15	Dehradun	35.89
2015-16	Nagpur	36.00

Source: ULB Property Tax Data (2018).



Fig. 8: Streamlined Process



3.1 Defining Property

A property is defined at a unit level depending on the ownership status of the unit. This unit can be a plot, building, floor or separate units. A property is identified by a unique house/property number having single/multiple owners. A property can be defined at plot, building, floor or unit level provided the owner is same. Different property attributes are shown in Fig. 9.

Property tax in the ULBs is assessed based on certain factors including property use, construction type, occupancy, age of the building and its location, etc. Hence, a property may have different combination of assessment parameters which makes it imperative to do the property assessment at UNIT level. An example of such combination is also presented in the Fig. 9.

Fig. 9: Different Property Attributes

Property Type 1	Property Type 2	Property Type 3	Property Type 4	Property Type 5	Property Type 6	Property Type 7
Single Use	Mixed Use	Mixed Use	Single Use	Single Use	Single Use	Mixed Use
Single Structure	Single Structure	Mixed Structure	Mixed Structure	Single Structure	Mixed Structure	Mixed Structure
Single Occupancy	Single Occupancy	Single Occupancy	Single Occupancy	Mixed Occupancy	Mixed Occupancy	Mixed Occupancy

Fig. 10: Scales for Property Taxation (The Processes Involving Scale at which Property Taxes could be Imposed)

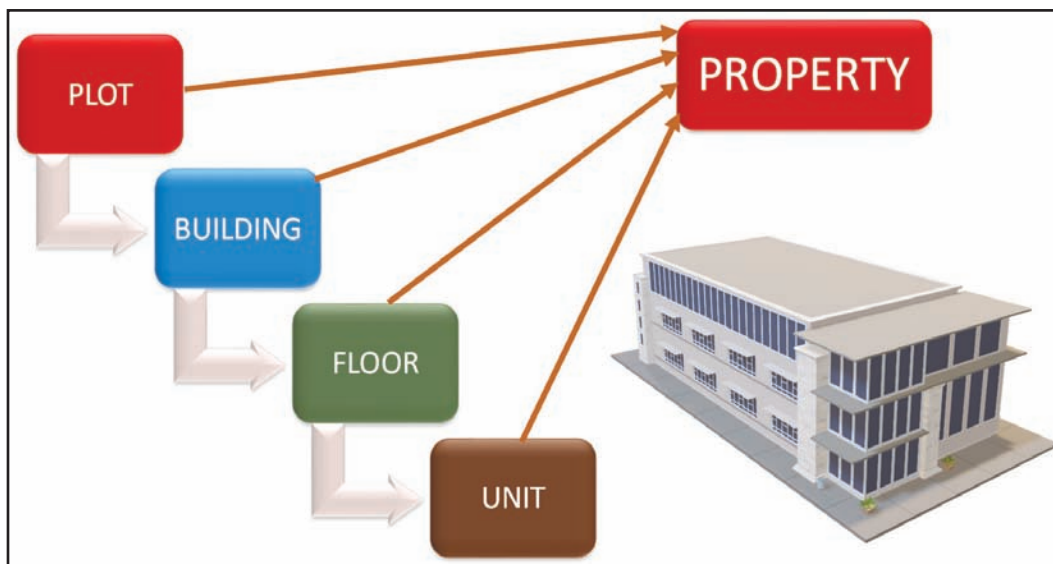
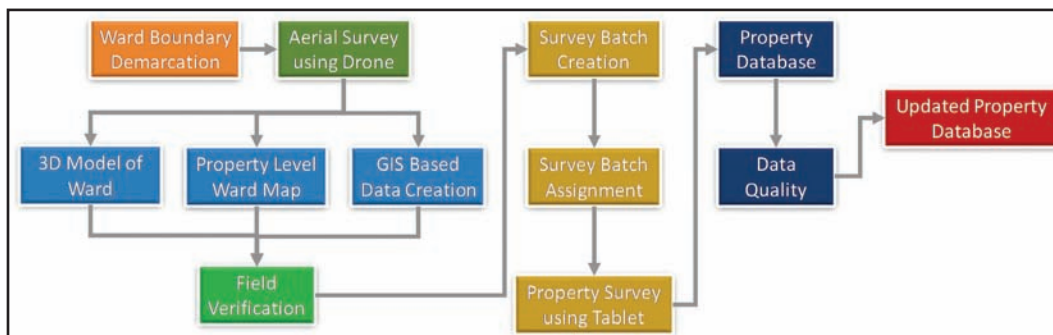


Fig. 11: Methodology



3.2 Methodology

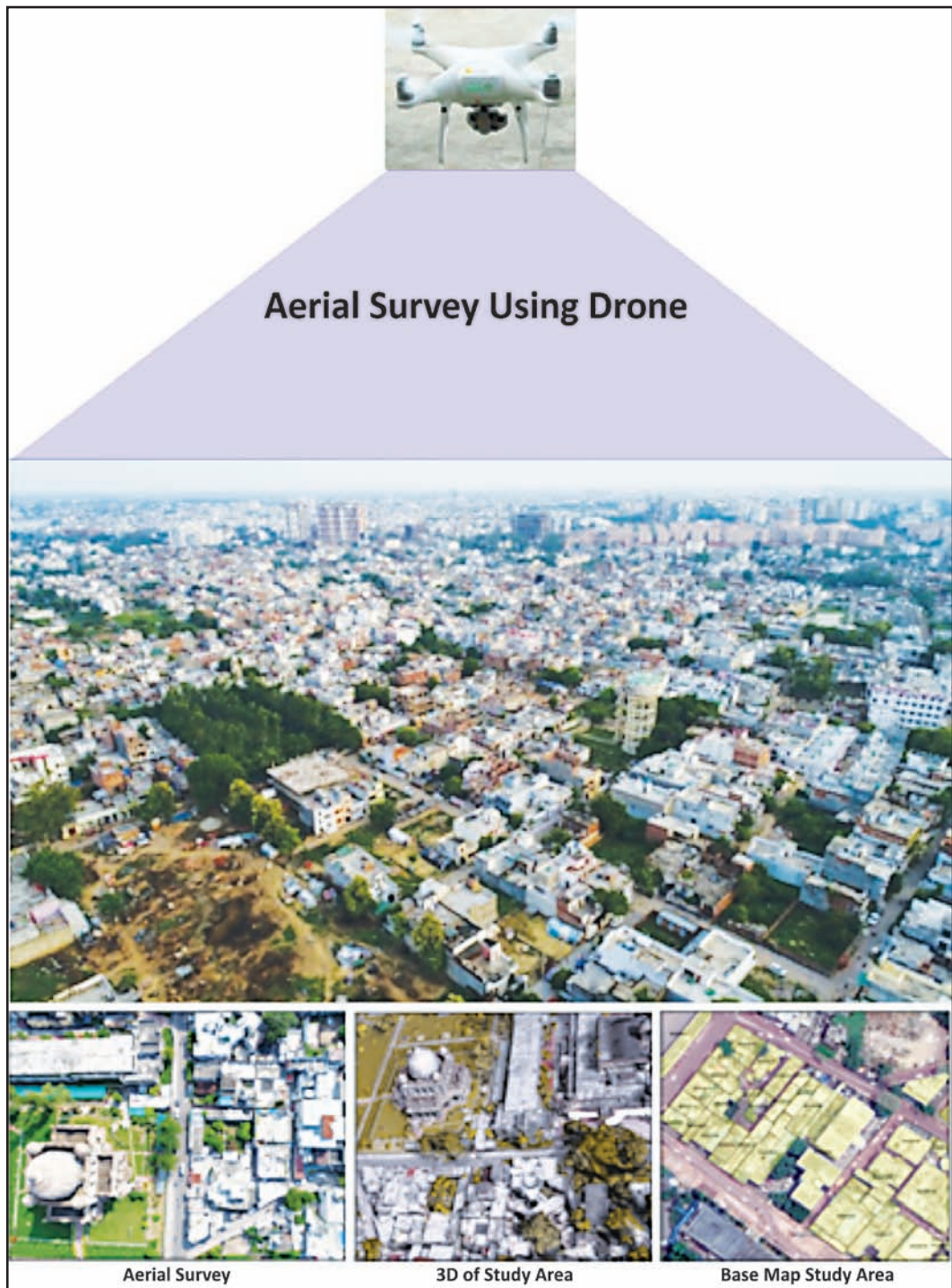
3.2.1 Data Collection

Modern technology and equipment are used for the data collection and management of data. Data collection and up-dation process include tasks like low altitude Drone based Aerial survey to get geo-referenced image, geo-referenced image processing to create 2D base map and 3D model of the area, GIS based mapping of all the properties, by manual door to door survey using tablet-based application, Quality Check and Quality Assessment of property survey data and reverification, if required. Image acquisition using Drone, 3D model and 2D base map of the area is depicted in (Fig. 12).

Based on the 3D Model developed using drone images, the area, ward, city can be viewed and verified in the office itself. Property data like use, location, structure



Fig. 12: Image Acquisition using Drone, 3D Model and 2D Base Map of an Area



type, building footprint, built-up area, number of floors, building height and other physical information can be extracted and verified from the 3D Model.

Other property information including household information may be integrated with the property database to develop a city level composite database. This information may be used by ULB and other city departments / organizations for planning and maintenance purposes. Some of the examples highlighting benefits of drone survey are presented in Figs. 13, 14, 15 and 16.

Fig. 13: Detail Accuracy up to 2 cm



Fig. 14: Estimation of Building Height and Number of Floors

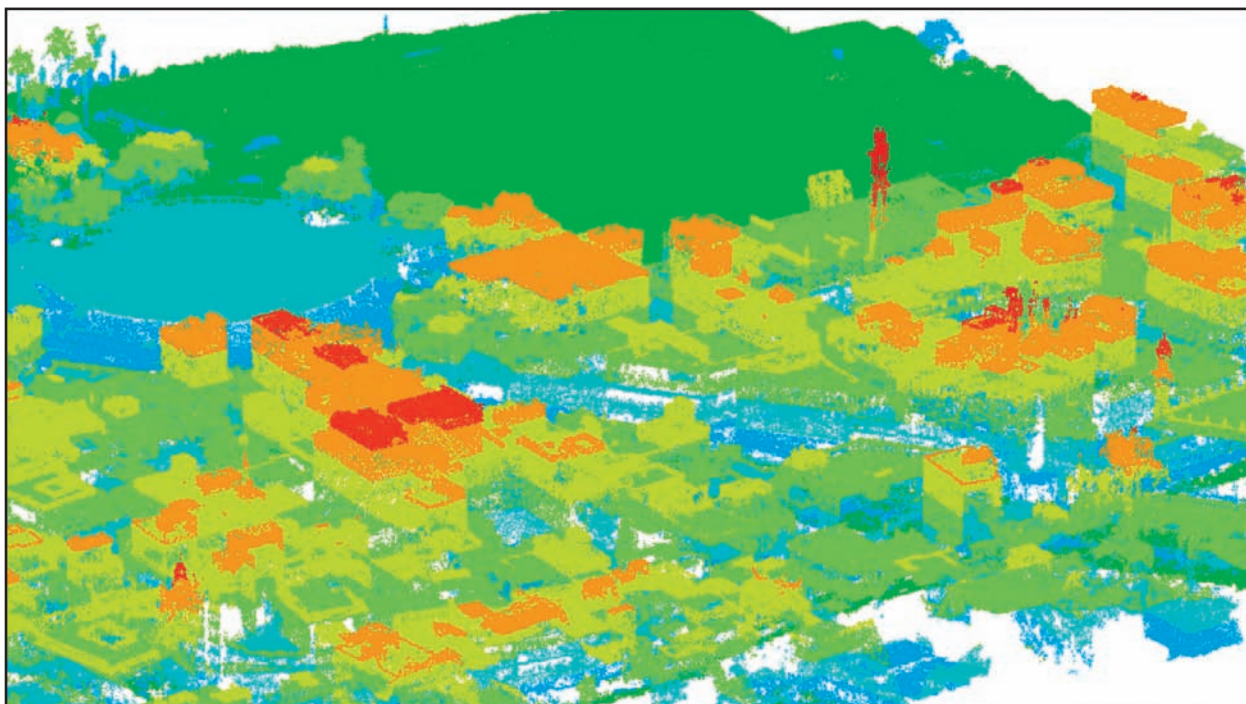


Fig. 15: Property Details Verification

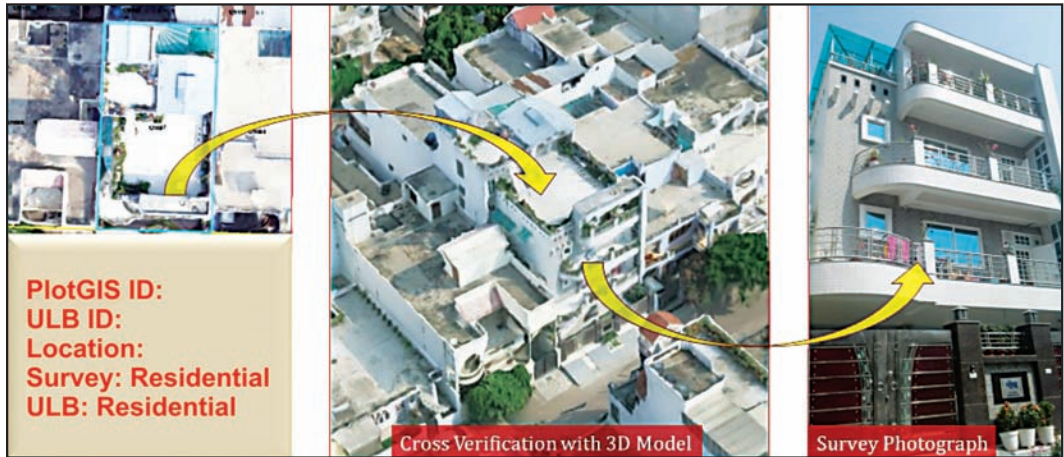


Fig. 16: Property Use Verification



Fig. 17: Ward Boundary Demarcation



3.2.2 Ward Boundary Demarcation

After conducting the reconnaissance survey, CESPL team demarcates the ward and colony boundaries with the help of municipal officials. The ward boundaries are demarcated using GPS devices to maintain accuracy (Fig. 17).

3.2.3 Field Survey

Once the GIS enabled base map is created, paperless field surveys are conducted using tablet application. Each land parcel is digitised and given a Unique ID. Apart from plot, each building, floor and units are given Unique ID. The tablet application provides location

of each property, which helps the surveyor on field to navigate to. During the survey, the property boundaries are verified and updated using split / merge feature. Door to door surveys are conducted for each property along with multiple photographs of the property. The tablet application is so designed that a surveyor has to save the information of one property before moving on to the next property. Once the surveyor saves / submits the property survey of one property, the application stores the survey location coordinates (Fig. 18).

The photographs clicked also saves its location coordinates. Once the property data is submitted, it is saved on the server on real time basis. This approach negates the possibility of data manipulation and brings transparency and auditability to the data collected. If the survey data of any property is to be edited, then it is reassigned to the surveyor to start afresh. The process of field survey is presented in Fig. 19.

Fig. 18: Paperless Property Survey

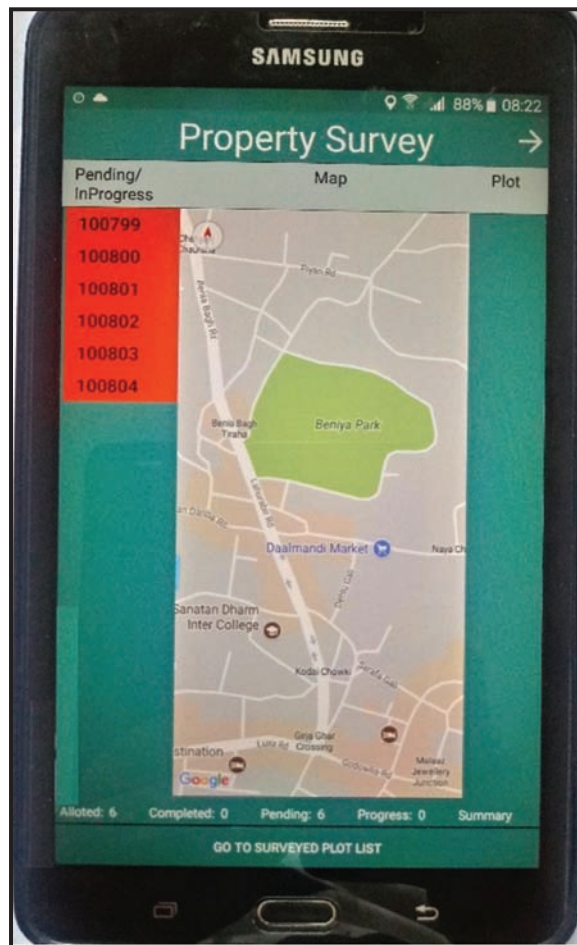


Fig. 19: Process of Field Surveys

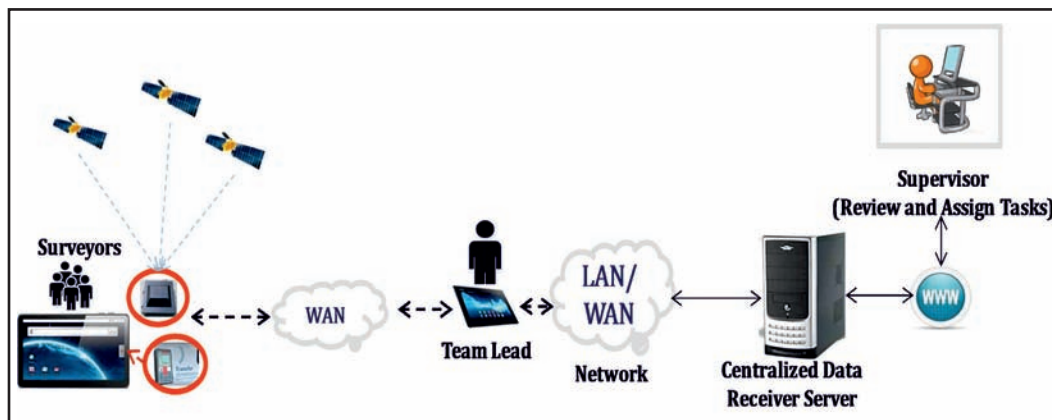




Fig. 20: Benefits of Tablet-Based Field Survey



Benefits of tablet-based field survey include:

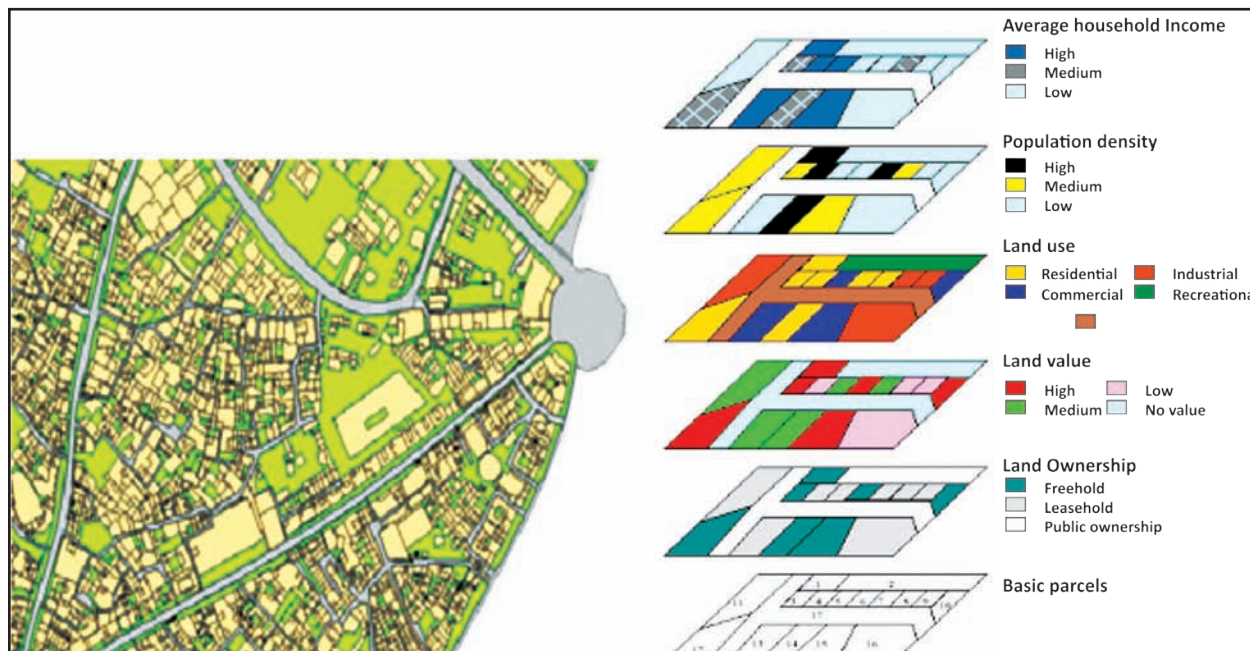
- **Ease of Access:** Location of property to be surveyed is shared in the application. The surveyor can navigate to the exact location easily and save time locating the property.
- **Ease of Survey:** Basic details like number of buildings in a plot, number of floors, construction type, location, etc., obtained through 3D model of the area, are prefilled in the application. The surveyor verifies these details and edit the data, if required.
- **Ease in Editing:** Any split or merge in a plot is reported by the surveyor and the same is updated at backend. The plots are reassigned to the surveyor to complete survey.
- **Zero data manipulation:** The application requires multiple photographs of the property and record the locational coordinates once the property survey is completed and submitted.
- **Synchronisation with server:** Once the survey data is submitted, it is saved on the server and is not available to the surveyor any editing. This ensures zero data manipulation on field (Fig. 20).
- **Data Auditability:** 3D model of the area along with property photographs, which are time stamped and have locational coordinates, ensures that the survey data is correct and auditable (Fig. 21).

Fig. 21: Data Auditability



- Attributes:**
- Plot Number
 - Address
 - Ward Number/Name
 - Plot Accessibility
 - Plot Area

Fig. 22: Use of GIS



3.3 Use of GIS

Integration of property data with spatial information has of late become indispensable for management of property tax systems. The GIS system also ensures higher efficiency (up to 100%) in coverage of properties under the tax net. The attributes of the data such as ownership, use, structure type, etc., may change over a period which could decrease the currency of data and linkage of such data with the data of other departments get disabled (Fig. 22).

3.4 Development of Property Tax Management System

Property Tax Management System (PTMS) was developed to provide a transparent, citizen to government interface for property tax management. The property tax management system comprised of 3 major components, which are:

- Assessment records and property tax database;
- Demand, billing and payment system; and
- Dispute redressal system.

Through PTMS, an interface was created between the government and citizens which enables the citizens to benefit from efficient delivery of a large range of public services. This expands the availability and accessibility of services on the one hand and improves quality of services on the other. With effective property data management, other e-governance modules can be linked with the property tax. Citizens can access all the information on property tax, assessment details



and use the system for performing a self-assessment. Overview of Property Tax Management System and property details is presented in (Fig. 23).

Fig. 23: Property Tax Management System

The screenshot displays the PTMS web interface for Nagpur Municipal Corporation. At the top, there is a navigation bar with 'HOME', 'CITIZEN MENU', and 'LOGOUT' options. The main content area is titled 'SELECT AN OPTION TO PROCEED' and contains five large circular icons: 'ENROLLED PROPERTIES' (red), 'PAY ONLINE' (green), 'DEMAND' (orange), 'PAYMENT HISTORY' (purple), and 'TRACK STATUS' (teal). Below this is the 'PROPERTY DETAILS' section, which includes a green banner with the instruction: 'For Objection: Click on 'File Objection' and check the edit box for each section.' To the right of this banner are buttons for 'FILE AN OBJECTION' and 'VIEW NEW FORMAT', and a link for 'View Objection History'. The 'Address' section contains several input fields: UPIC* (5000000000000052), Plot Name* (47), Plot Type* (Non-Vacant), Street Name* (LANE 4), Zone/Circle* (Dhantoli 1), Ward* (JAIL WARD), Colony* (URVELLA COLONY), and Post Code* (440015). To the right of these fields is a satellite map showing a residential area with a red plot highlighted. Below the address fields is the 'Municipal Services' section with dropdown menus for 'Water Connection', 'Sewerage', and 'Garbage Disposal'. To the right of this is the 'Land Data' section, which lists: Plot Area : 268.26, Number of Building : 1, Building Ground Coverage Area : 88.96 (33.16%), Built-Up Area : 88, Property Area : 85, and Vacant Land Portion : 179.3. A note at the bottom of this section states: 'Note: All areas are in SQ. Meter.' The 'Ownership' section at the bottom contains 'Owner 1 Details' with fields for Owner Name* (o1), Owner Type* (Govt Entry), % Share* (100), Mobile #* (9999999999), and Email. To the right of these fields is a 'New Values' box showing 'Share : 30'.



3.4.1 Assessment Records and Property Tax Database

Provision of demand notices online and collection of payments through e-Payment increases efficiency and bring in transparency. The data of each property can be viewed by the property owner and can update the same if required.

3.4.2 Demand, Billing and Collection

The property tax management system also enables generating demand online and payment of property tax online, one can view his property tax demand, arrears and payment history. This system will also provide the property owner the assessment details against the bill generated for the property tax to avoid any discrepancy in the assessment made.

3.4.3 Dispute Redressal System

An interactive dispute redressal was developed to provide the property owner easy access to interact with the government for any dispute or grievances. An effective and swift dispute redressal system enables maximum output in collection of property tax. It was observed that the ULBs having a poor dispute redressal mechanism obtain low collection efficiency of property tax due to pending disputes and court cases. The accumulation of arrears has adverse impact on the ULB not only due to low collection efficiency but also degrades the financial credibility as the balance sheet gets loaded with arrears which are practically irrecoverable. In a long term, such scenarios are reflected in low ratings and credibility of the ULB.

4. CONCLUSIONS

In addition to the benefits mentioned earlier, the immediate benefit to the ULBs was in terms of increased tax base and increased revenue potential from property tax.

4.1 Increase Tax Base

Based on the field survey, it was observed that there were number of unassessed properties in the wards surveyed. It was on older wards of the city where the properties have stabilized, the increase was minimal. However, in the newly developed wards, the field survey reported significant number of unassessed properties (Table 2).

4.2 Revenue Potential

With the increase in the property tax base, the revenue potential is increased significantly. In addition

Table 2: Increasing Tax Base

S. No.	ULB	Properties		% Increase
		ULB	CESPL	
1	Chhindwara*	8,956	11,177	24.80
2	Nagpur*	8,760	8,898	158
3	Puri*	3,529	9443	16758
4	Cuttack*	4,720	10445	121.29
5	Haridwar*	4,955	9,001	81.65
6	Dehradun*	7,205	11,051	5338
7	Lucknow#	28,836	41,039	4232
8	Varanasi#	18,293	21,657	1839

**Table 3: Property Tax Increase**

S. No.	ULB	Properties		% Increase
		ULB	CESPL	
1	Chhindwara*	72,52,040	2,20,22,147	203.67
2	Nagpur*	4,50,58,126	9,10,54,913	102.08
3	Puri*	31,48,982	1,67,98,415	433.46
4	Cuttack*	28,83,544	56,66,341	96.51
5	Haridwar*	28,51,655	2,78,58,457	876.92
6	Dehradun*	61,83,577	3,67,63,458	494.53
7	Lucknow#	17,70,00,000	32,10,00,000	81.36
8	Varanasi#	3,52,00,000	10,03,00,000	184.94

Note: *Assessment year 2015-16; #Assessment year 2017-18

- Auditable property data using GIS/location;
- Streamlined grievance redressal;
- Reduction in grievances;
- Analysis of estimated property tax demand and collection from a single application;
- Identification of unassessed and under assessed properties;
- Search / Report for tax defaulters;
- Improved collection efficiency;
- Reduced paper usages;
- Reduced human error and discretion;
- Voluntary payment will also reduce the collection effort by the ULB;
- Ease of communication between ULB officials; and
- Self-Assessment by the owner reduces ULB's effort of manual data collection.

4.3 Benefits to the Citizens

- Self-assessment of property tax;
- Timely payment of tax by the owners;
- View property details and assessment methodology for property tax;
- Tax payer living outside ULB jurisdiction/India can easily pay Online tax;
- Easy access to any grievance and tracks the status Online;
- Online payment portal will make it easy for the owner to pay the property tax without making visit to municipal office;
- Brings transparency to the calculation of property tax; and
- Track payment history of property tax.

to the inclusion of unassessed properties, reassessment of the under-assessed properties also contributed to the revenue potential (Table 3).

4.2 Benefits to ULB

- Increased revenue;
- Brings transparency, and accountability;
- Increased tax base;
- Updated property database;



Satellite Towns: An Emerging Need for Metropolitan Cities

Deepthi S and Shobha M N, Ph.D.

Abstract

Metropolitan cities are fast changing due to rapid urbanization over the last two decades. Population growth and urban transformations have created a tremendous strain on metropolitan cities causing many problems, leading to urban sprawl. According to the UN Habitat, satellite towns are one of the spatial categories associated with secondary cities. Parent cities are progressively interlinked and dependent on these satellite towns to boost trade, investment and local economic development. Satellite towns act as catalysts and supporting hubs for production, trade, transfer and transportation of goods, people in the current system of global cities. Majorly, these satellite towns are neglected as a part of development and often lack financial and technical influence of larger cities. This paper explains the concept and evolution of satellite towns along with the case studies of Navi Mumbai, Gurgaon, and Tokyo in the environs of the Metropolitan Region and concludes how urban sprawl needs a comprehensive approach in the field of planning.

1. INTRODUCTION

Over the last few decades metropolitan areas have become the magnets of investment and development and are nearing the stage of saturation. Increase in population density, socio-economic disparities and infrastructure problems have stressed required need for balanced city planning for the efficient running of cities. In order to address the problems caused by urbanization, UN Habitat initiative for developing countries asks them to adapt 5 guided urban expansion strategies such as planned city expansion, planned city in fill, connectivity and public spaces, city region and poles development and new town development (HABITAT, 2014). The approach of city region and poles development known as satellite town development is relevant in situations where large metropolises face congestion and there exists huge primacy in the city core and community needs. The growth of these satellite towns reduces the strain of increasing population and creates new areas for development.

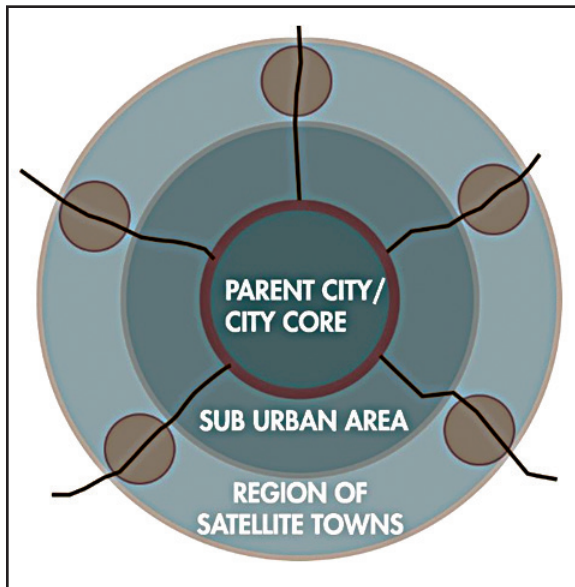
Globally, metropolitan regions in Asia, Europe, Latin America and Middle East have adopted the method of developing new satellite towns as a part of decentralizing employment and industrial development. Development of satellite towns has been successful as well as failures. One of the major successes of these satellites is strong economic base and transportation linkages with the parent city.

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Fig. 1: Conceptual Model of a Region with Satellite Towns



Source: Author Analysis

Secondly, the spatial planning principal plays a significant role in supporting the development of these towns driven by economic, political and social agenda. In India the major metropolitan cities like Delhi, Mumbai, Kolkata, Bangalore, Chennai, and Hyderabad are facing challenges due to population explosion, spatial sprawls and so on. The urban transformations in these cities have given rise to the development of satellite towns which are grown successfully as engines of economic growth. Few metropolitan cities are developing satellite towns which have become a part of master plan and regional plan preparation to have a balanced development.

2. CONCEPT AND EVOLUTION OF SATELLITE TOWN

The concept of “Satellite towns “was introduced by Graham Romeyn Taylor in 1915. The ideology of Garden City by Ebenezer Howard laid

the foundation of satellite towns. Satellite towns, are towns which are self-contained within the vicinity of the large metropolis. It is physically separated from the urban core but economically they are integral part of the large urban body (Golany, 1976) (Weissbourd, 1972).

The Satellite Towns are dependent on the growth node largely for employment. If developed well, satellite towns offer great scope in providing economic growth and employment for the benefit of the main city, subject to efficient transport connectivity (Ministry of Housing and Urban Affairs, (2015)). In some cases Satellites towns were strongly considered for the further development with regard to the regional context.

In the new towns and cities concept started evolving as higher level of satellite towns (Fig. 2) with more facilities and these practices are currently seen in

Fig. 2: Evolution of Satellite Towns in Western Countries and Parts of Asian Countries

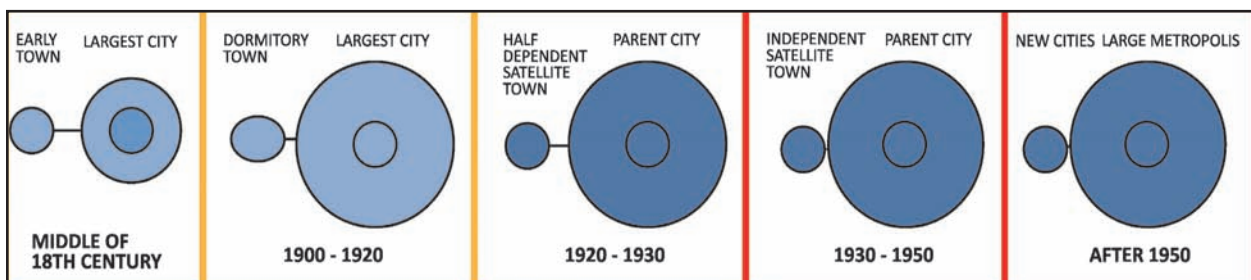
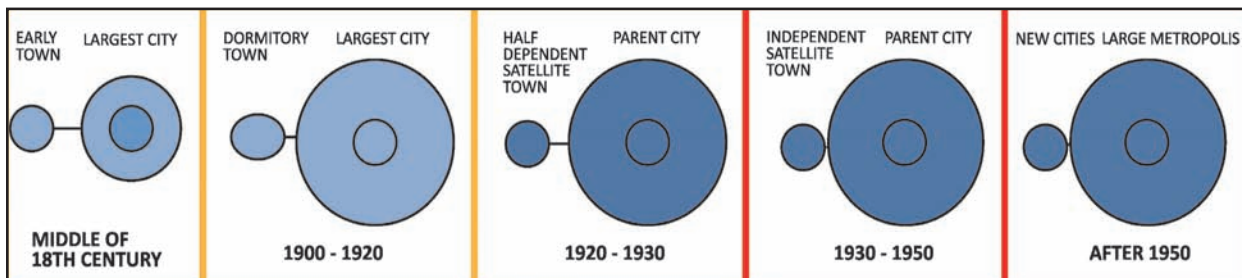


Fig. 3: Evolution of Satellite Towns in Indian Context



Source: *City Development Plan Sanad 2011-2015, Ministry of Urban and Housing Affairs, Government of India, Schemes of Satellite Towns around Megacities. (2009:3)*

China with diversified models. The fully developed Satellite Town Model - I (Fig 3) are seen in larger industrial area that provide independent economic base along with other services, for example, Gurgaon. The fully developed Satellite Town Model - II is witnessed where the satellite towns are closer to the parent city, and the administration of satellite town merges with the metropolis for example, Vejalpur in Ahmedabad.

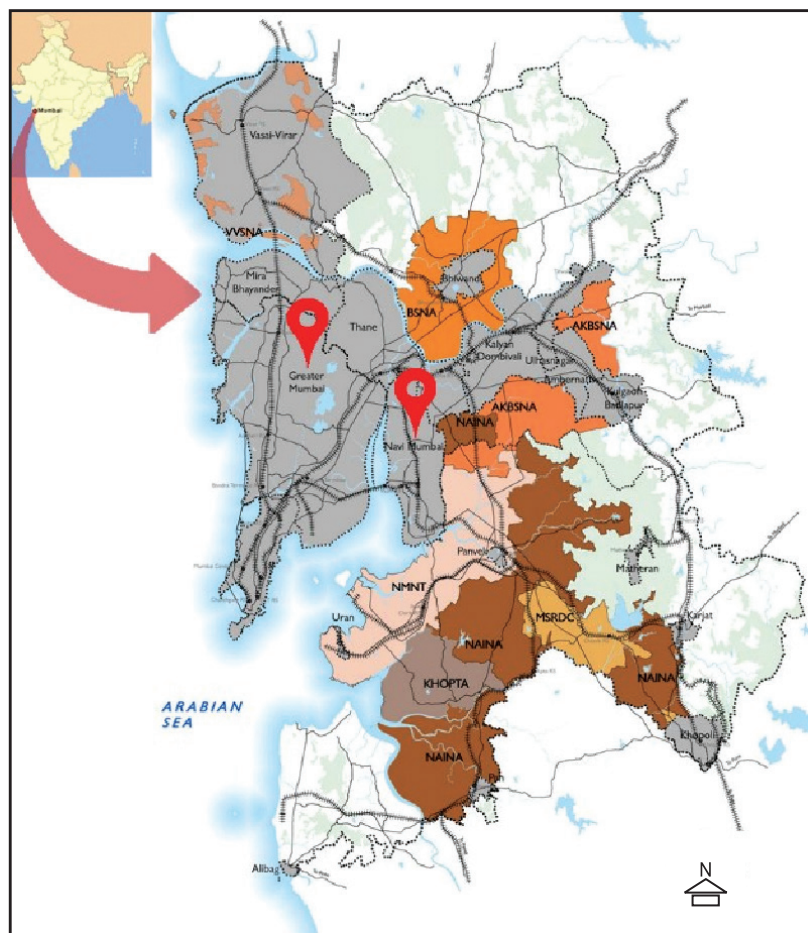
3. CASE STUDIES

3.1 Navi Mumbai

Navi Mumbai also known as New Mumbai established in 1972 is the best satellite town development in Asia. Bombay Metropolitan Regional Planning Board took an initiative to decongest Bombay and proposed a regional plan for BMR (BMR, 1974). Later City and Industrial Development Corporation (CIDCO) was officially designated as New Town Planning Authority for the development plan of New Bombay.

The foremost objective was to reduce the population growth rate in greater

Fig. 4: Location of Mumbai, Navi Mumbai and Greater Mumbai



Source: *Draft Mumbai Metropolitan Regional Plan 2016-2036 (2016:Map2)*



Bombay by creating an attractive urban area on the land across Bombay harbour (CIDCO, 1972). Later, during the preparation of draft plan the design principle adopted and implemented by CIDCO were Polycentric Mode of development and to use land as a major resource. Considering the success of Satellite Town for the distant future, employment base was mainly focused on manufacturing industries, trade and commerce along with service enabled sectors (Fig 5). Although job opportunities were the driving factor but the provision of housing were relatively successful. Another important factor were the commuting mode of transportation which has led to effective development over the period of time (Fig 5).

As a whole, the development of the satellite town has created a tremendous effect on the Metropolitan Region of Bombay suppressing the growth rate of Greater Bombay. It is found that the spill over of urbanization, industrialization were absorbed by these cities comparatively business and finance have become the strong pull factor of New Bombay along with government approval of commercial and upper class residential activities. However, the development

Fig. 5 : Sectoral Employment 2005

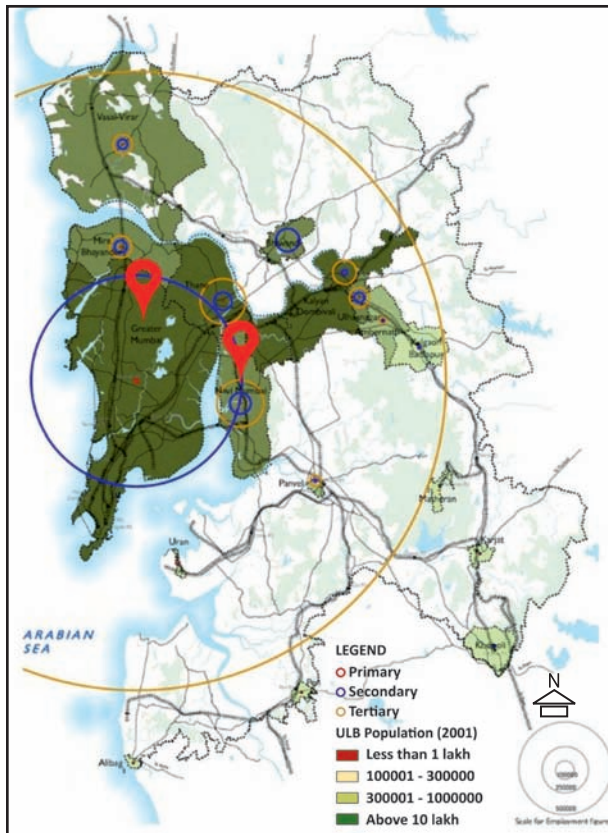
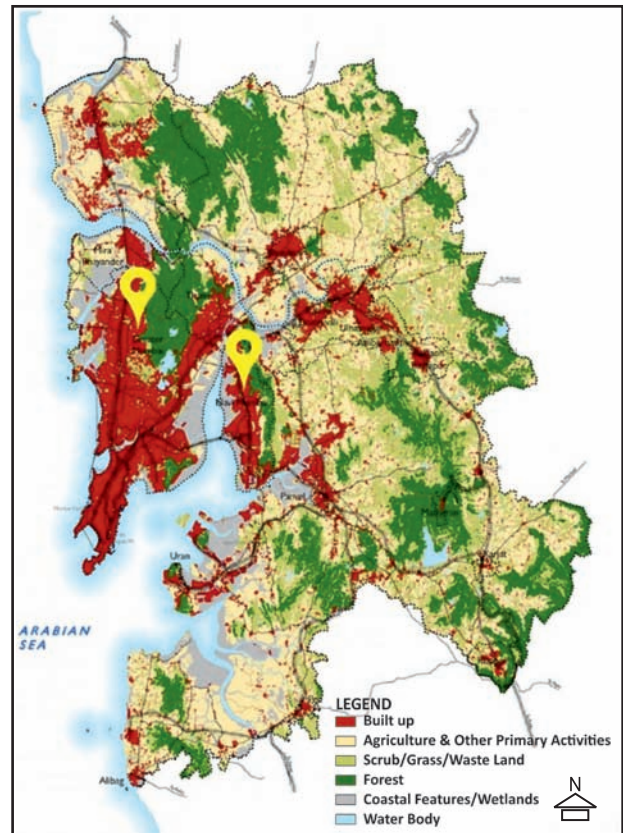


Fig. 6: Existing Land use 2016 of Greater Mumbai and Navi Mumbai



Source: Draft Mumbai Metropolitan regional Plan 2016-36 (2016: Map 7 &Map 8)

of Navi Mumbai symbolizes difficulties of a successful project but failed to consider different interest group of people (Shaw, 1995). The Overall, ideology of Satellite Town of New Bombay has created its own definite identity.

3.2. Tokyo

The first Asian country to control growth rate of metropolitan city was Japan. In 1953 National Capital Construction Committee was established for the scheme of Satellite Towns along with the concept plan of capital region in 1956. National capital development plan (NCRDP) in 1958 was created to hamper further urban sprawl and to earmark the area around built-up as greenbelt where urban land-use was not authorised. The first Capital Region Improvement Plan 1958 labelled greenbelt around the prevailing built-up area along with the development of satellite towns and maintain a segregation between Tokyo and suburban satellites (Alden, 1984) (Fig 9). The second NCRDP in 1968 rejected the greenbelt and incorporated Suburban Development Area

Fig. 7: Location of Tokyo

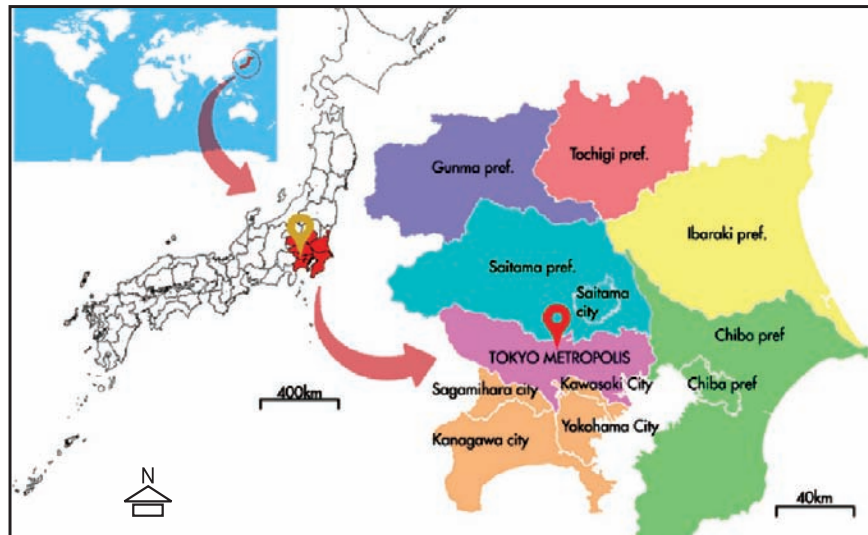
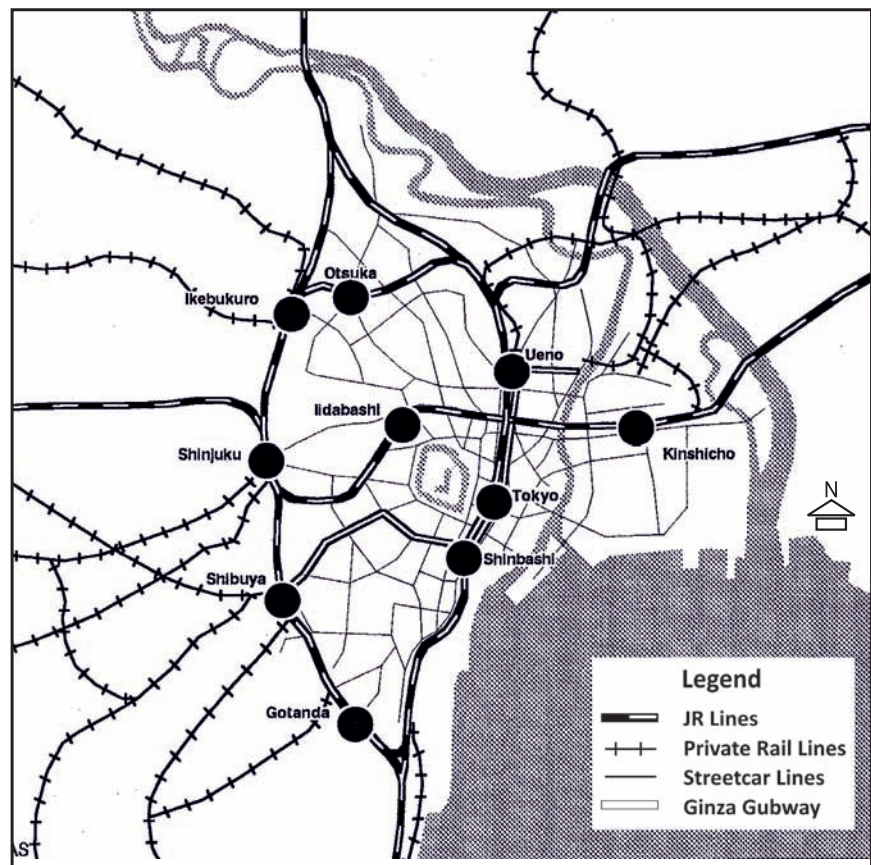


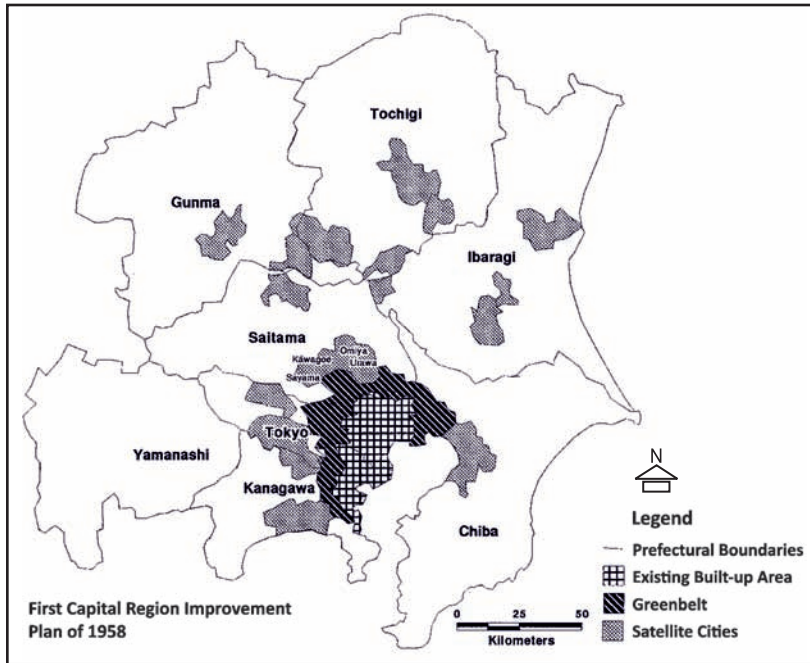
Fig. 8: Central Tokyo Rail System and Main Station 1930



Source: *Sub Centre and satellite cities: Tokyo's 20th Century Experience of Planned Polycentrism* (2010:13)

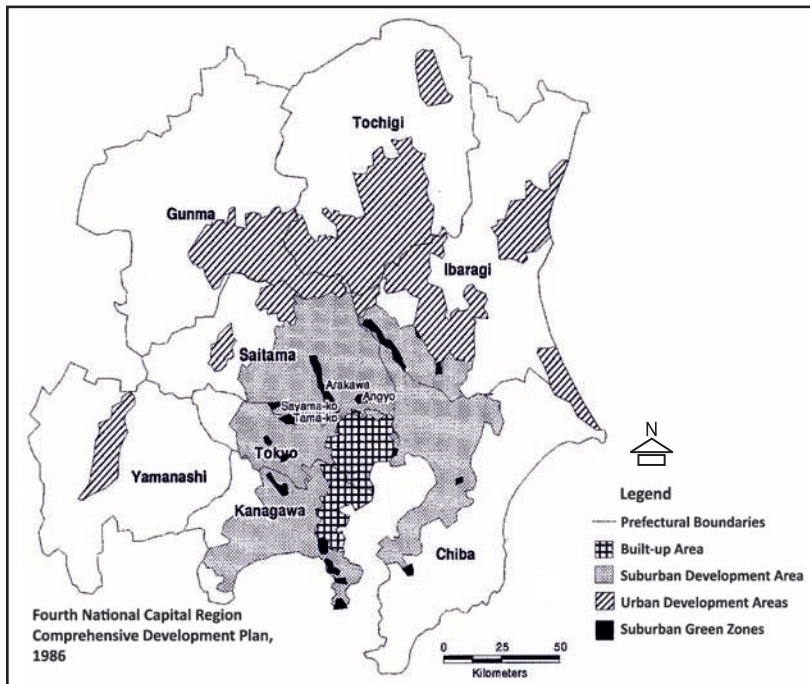


Fig. 9: Location of Tokyo along with Satellite Towns and Green Belt



Source: *First capital region improvement plan 1958(2010:17)*

Fig. 10: Location of Suburban Development Area



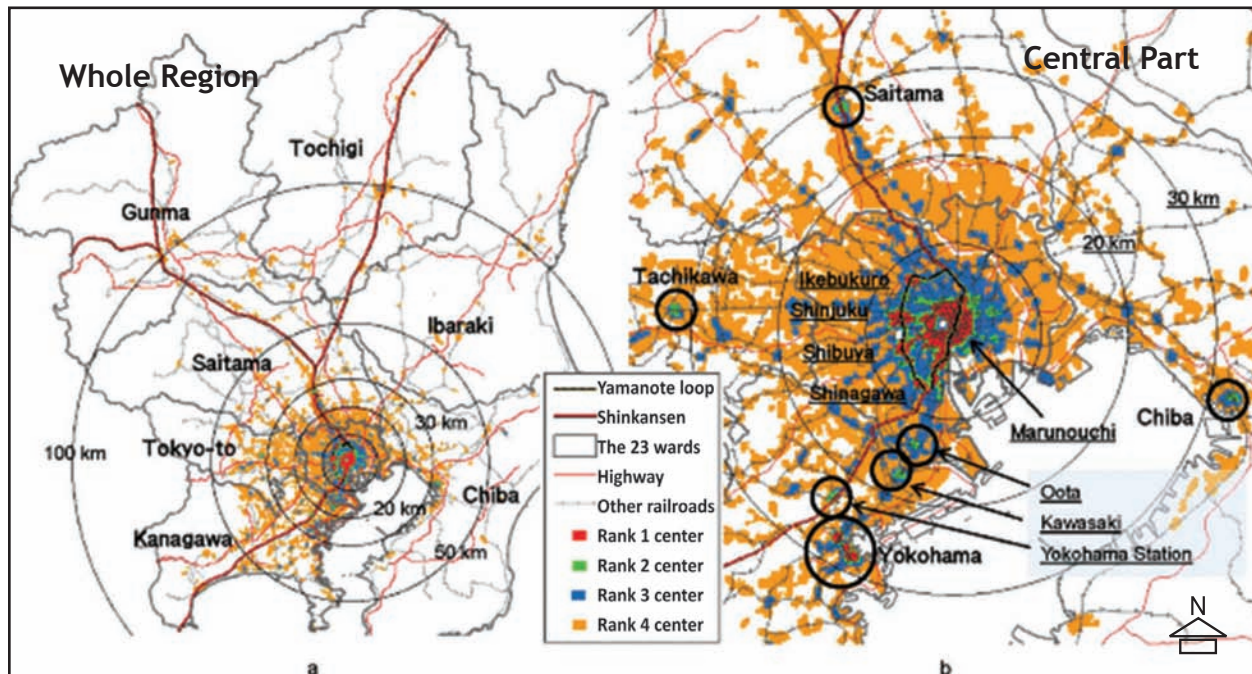
Source: *Fourth Capital Region Comprehensive Development Plan 1986(2010:17)*

within 50 km radius of Tokyo Station retaining Satellite towns.

In early 1970's the concept of bipolar metropolis with new CBD was proposed which eventually lead to the evolution of Multi-polar metropolis to reduce travel and distance as published in Tokyo longterm Plan 1991 (Tokyo Metropolitan Government, 1992). The establishment of sub centres and satellite towns become prominent due to the construction of new train service which created a natural growth point. It also played an important role in restructuring of Tokyo Metropolitan Region as per fourth CNDP (Fig 10) and included in fifth CNDP of 1999. Population and employment gained massive in the designated area of satellite towns and sub centres outside the city centre.

The suburban area surrounding the core city gained population over 10 million during 1970-1995 along the broad width of 20-40 km from the Tokyo station. On the other hand decrease in population is witnessed in the central areas. Few studies shows apart from the designed satellite towns and sub centre there are large

Fig. 11: Geographical Locations of Employment Centres in Tokyo



Source: *The Spatial Structure of Employment in the Metropolitan Region of Tokyo: A Scale-View* (2017:16)

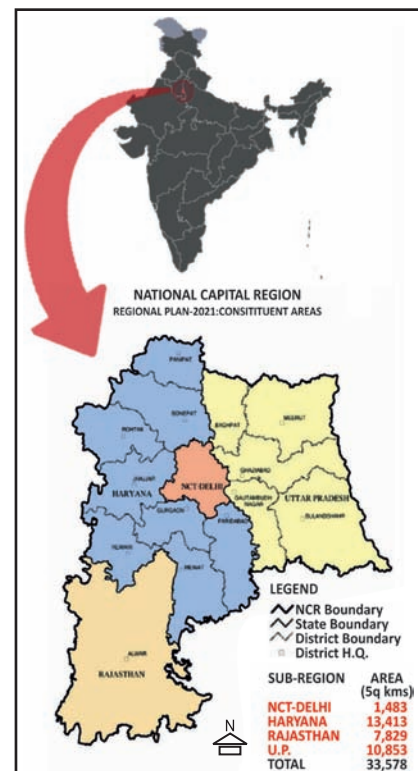
areas showing increased employment and similar pattern of growth. The prevailing data of population change and employment structure reveals that Tokyo Region has always experienced Polycentric development not only in designed satellites and sub centres but also in other centres which were not notified as growth points (Sorensen, 2010).

The development of polycentrism however, created successful benefits of satellites and sub centre schemes but the conservation of green belt area in TMR seems to be quality of life concern. As a whole the experiment of developing TMR (Fig 11) had positive impacts but still holds important practice of necessary protection of greenbelts or any other breaks in metropolitan fabric.

3.3 Gurgaon

The National Capital Territory of Delhi (NCTD), the giant metropolis have grown enormously and shown phenomenal changes in population and urban activities over the last five decades. Urban sprawl, being the major issue made the government to develop the city of Delhi linking to the surrounding area to be categorized as National Capital Region

Fig. 12: Location of NCT and NCR

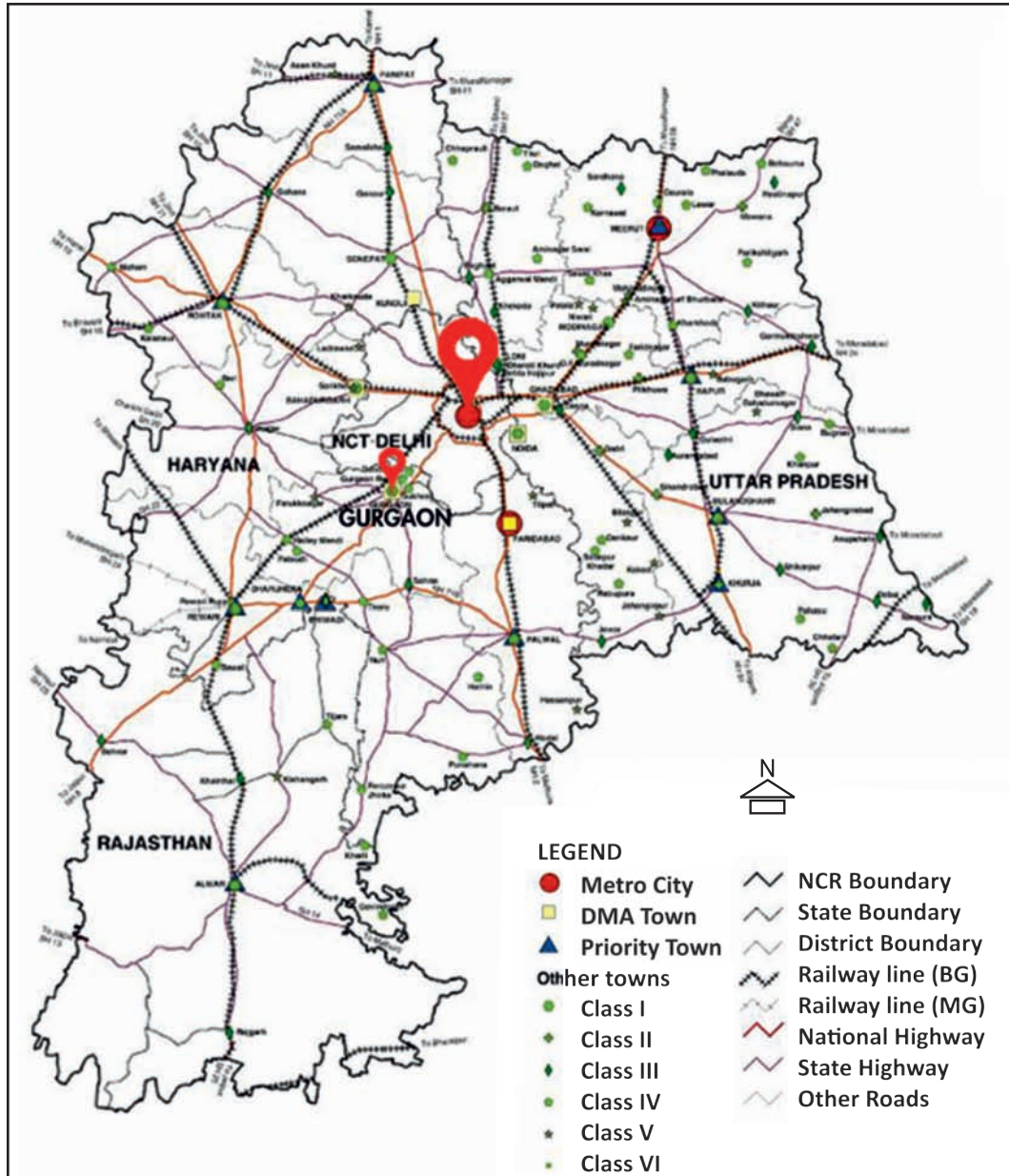




(World Energy Council, Indian Committee Team, 2010). Satellite towns were evolved to decentralize the industrial activities and migrating population from the parent city Delhi.

Gurgaon was established as one of the satellite town to counter act the uncontrollable growth of the parent city (Fig 13). The growth of the satellite

Fig. 13: Settlement Pattern of NCR 2001 Region and Satellite Town Gurgaon

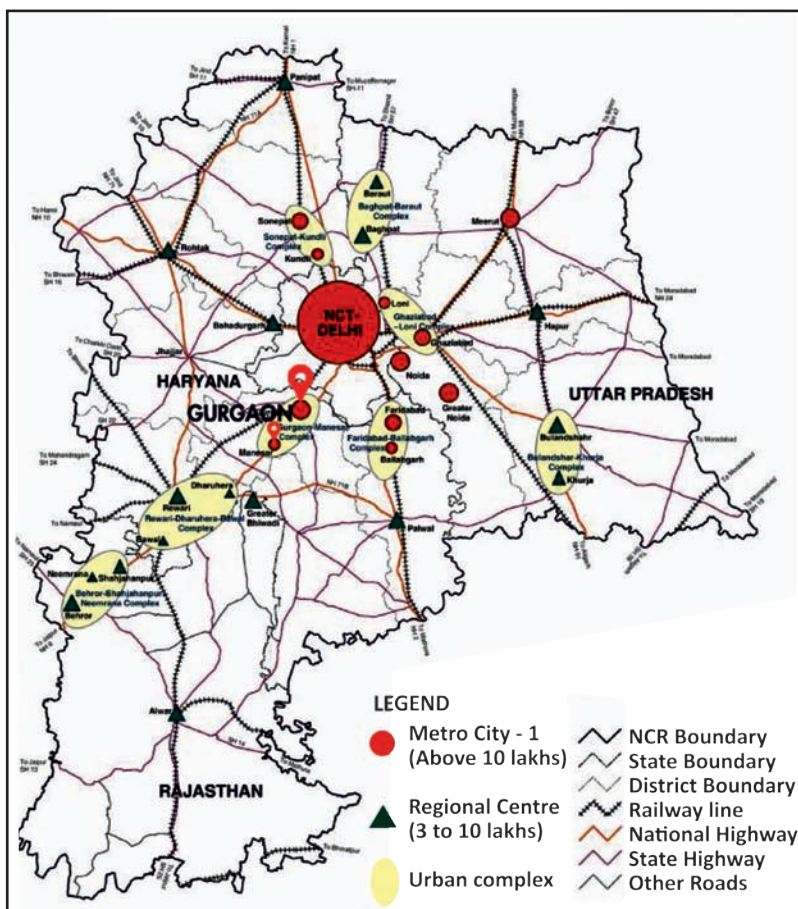


Source: Regional Plan 2021, National Capital Regional Planning board (Chapter 4:27: map 4.1)

towns took the advantages of the close proximity to Delhi more than growth induced by the government. The nodes of suburban development (satellite towns) were segregated by open spaces connected with parent city Delhi by National Highways.

Till 1977 the growth and development was characterized by nodes which are satellite towns. Later during 1999 the nodes were the important corridors of development with transportation of National Highway and regional railway connecting the parent city Delhi and its satellites. (Manisha Jain, et al., n.d.). After 2010 these nodes merged into one mass known as Megalopolis (Gottmann, 1957). Gurgaon has witnessed its major growth in industrial and residential sector which has transformed its characteristic of being satellite town to Satellite City (Fig 14) (Nath, 1995).

Fig. 14: Proposed Settlement Pattern of NCR 2021



Source: *Regional Plan 2021, National Capital Regional Planning Board (chapter 4:33:Map 4.2)*

As per Town and Country Planning Department of Haryana the urban complex of Gurgaon - Manesar is increasing its demand for software industries, as a whole Delhi serves as a unique case study of Mega City which has grown widely accommodating low and high skilled manpower. Although, Delhi is surrounded by its satellite towns the city remains as a place of attraction.

4. CONCLUSIONS

By understanding the concept and evolution of satellite towns along with the case studies of Navi Mumbai, Gurgaon and Tokyo, it is observed that urban development pattern is highly challenging in developing countries. It is important to manage unprecedented urban growth in an effective and efficient manner. One of the findings for success of satellite towns implies government intervention in various



stages of planning. Many questions were put forth by researchers whether the development of satellite towns cater to the needs of urban related problems but few practices served as the best example in a longer run. Although the concept was bizarre in the beginning of 20th Century, over the period of time these towns were equipped with facilities to balance living and employment. While identifying the major nodes (satellite towns) for a parent city, distance and population with relation to the parent city were to be analyzed effectively. Overall, it is observed strong economic base, mix of activities, transportation linkages, clustering of activities near high accessible area plays a significant role in effective running of the satellite towns. In some cases due to less significant character and close proximity the satellite town losses its identity and merges with the administrative boundary of the parent city. As a whole, the concept of satellite town is carried forward in regional context envisaging balanced development in the field of planning.

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Does Benefits of Mixed Land Uses Match Up to People's Expectations from their Living Environments?

Poulomee Arun Ghosh and P. M. Raval

Abstract

Environmental sustainability and improving quality of life are the two agendas that are said to be fulfilled by mixed land uses. However, given the current practices of mixed land uses, there are certain aspects of quality of life that are compromised to avail certain benefits. Parameters of quality of life that are affected by physical living environment are taken from literature and are firstly segregated into positively affected or negatively affected by mixed land uses based on experts opinion and literature. They are next rated by people on a 7 point Likert scale based on 'How important they think each parameter is in determining their quality of life'. These ratings are compared with ratings by experts based on 'How much they think the parameter is affected by mixed land uses'. T-test comparison of both the ratings gave an overview of whether benefits of mixed land uses match with people's expectations from their living environment.

1. INTRODUCTION

The place where people live influences their lives in many ways making their experience of living unique and impacting their satisfaction of living there. Although what people expect from their surroundings is a personal subjective matter, the overall experience that people desire is that of a peaceful, safe and happy living environment. The approach of city planning dwells on this ground of providing the best experience and improving people's quality of life through the physical living environment (Marans, 2012). One such modern city planning paradigm that is considered to improve the quality of life of people is that of mixed land uses. Even if the concept of mixed land use is not modern and has existed since the times of fortified cities, during the industrial era of strict zoning to protect people from poor environment, mixed land uses were eliminated. With the advent of transportation issues and lifestyle diseases mixed land use practice have gained eminence in modern days (Herndon, 2011). Jane Jacobs who was one of the first critic of zoning, in her epic book 'The Death and Life of Great American Cities' said 'city districts will reach their best potential if they have good mixtures of primary uses, frequent streets, close grained mingling of different ages in their buildings, and a high concentration of people' (Jacobs, 1961). Experimentation with mixed land use across the world has generated various ways of practicing it as well as shown the positive and negative effects it has on the quality of life of the people.

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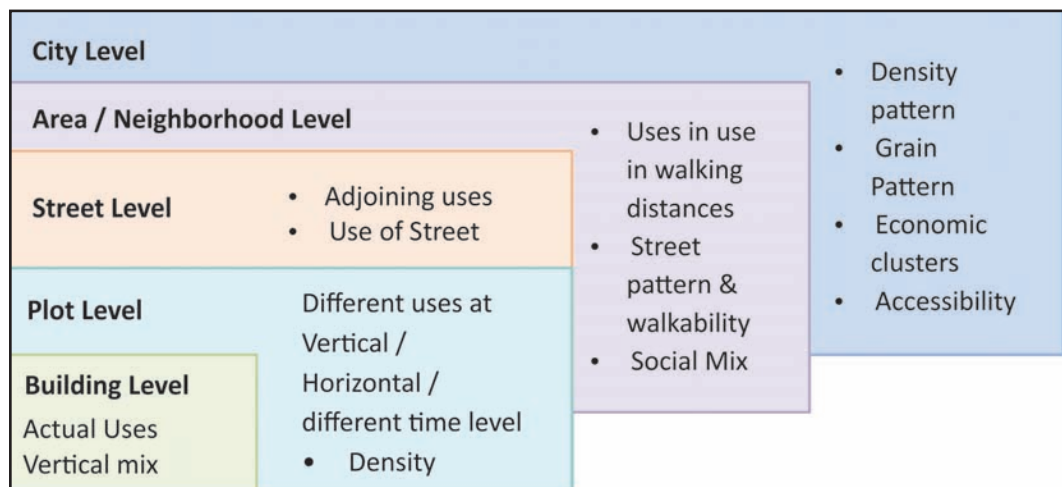
This paper through a methodological approach based on primary survey establishes the gap between what people expect from their living environment and what advantages mixed land use imparts on the lives of the residents. Pune, Maharashtra, India has topped among all the cities in India in 'Ease of Living Index 2018' conducted by Ministry of Housing and Urban Affairs and hence has been taken as the study area for this research. Since the study is based on the perception of general masses, the results are applicable to any Indian metropolitan city and can be generalized in international city planning context. The paper focuses on predominantly residential areas and its resident's quality of life.

2. MIXED LAND USES

Owing to the diversity of different possibilities, defining mixed land use in reality is complex and not precise to all situations. While diversity of land use i.e. co-existing of residential use with commercial, institutional or industrial use form the core of mixed land use concept; there are other parameters like density, location in the city, the type of mixed use, connectivity, etc., which determines how it functions (Rowley, 1996). Functionally, mixed land use can be identified in the context of smaller units of site, plot and building level with considerations of vertical and horizontal mix as well as at larger neighborhood and city level (Hoppenbrouwer, 2005). Thus, land use mix definition cannot be separated from the wider context of urban form and city pattern. In one of the research, mixed land use is aptly defined in three dimensions:

- increasing intensity of land use with different forms and tenures;
- increasing diversity of uses by encouraging compatible mix; and

Fig. 1: Mixed Land Use Identification Criteria



Source: Created by Author based on Literature

- integrating segregated uses for effective functioning (Grant, 2005).

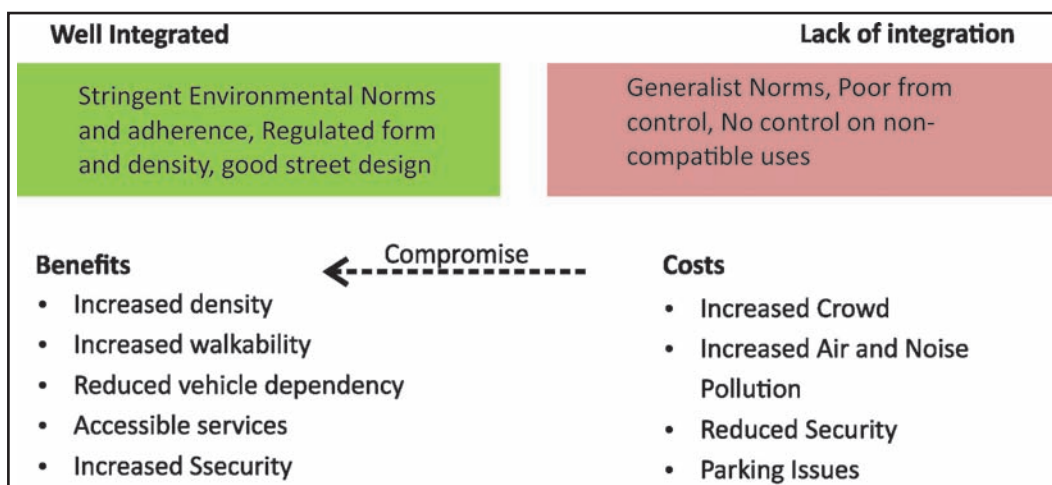
Failing in any of those aspects could nullify the benefits of mixed land uses.

2.1 Theoretical Benefits and Costs of Mixed Land Uses

From environmental perspective, mixed land use development fit ideally as a way of sustainable development by accommodating more people and activities thereby reducing on the demands of land for sub-urbanization and need to travel. Proximity of travel destinations and thereby reduced need of road transport and encouraging walking and cycling are quoted as key benefits for the people. Non-motorized trips are likely to increase in denser mixed-use neighborhood, while work trip mode depends on the density of the overall city (Cervero, 1996). Urban vitality, social cohesion and security in public places are other such benefits (Erik Louw, 2006). However, a lack of integration could call for a compromise of the desired quality of life where residents cope with noise and encroachments, and constantly make trade-offs to sustain mixed land use development (Foord, 2011). Crowd generated due to mixed land use can also hamper people’s privacy (Nabil, 2015). One of the objectives of mixed land use practice is to make the neighborhoods more inclusive by encouraging varied housing typologies with different areas and features. In practicality, the mixed land use neighborhoods are more expensive due to commercial demand and better accessibility and the absence of social housing norms renders such areas unaffordable for many (Markus Moos, 2018).

Do people want to avail the benefits of mixed land uses and to what level are they ready to compromise is a question to deliberate upon. Leaving aside the greater good of sustainable development, the costs and benefits of mixed land uses on their quality of life is considered in this study (Fig. 2).

Fig. 2: Benefits, Costs and Compromises of Mixed Land Uses



Source: Created by author based on literature



3. URBAN QUALITY OF LIFE

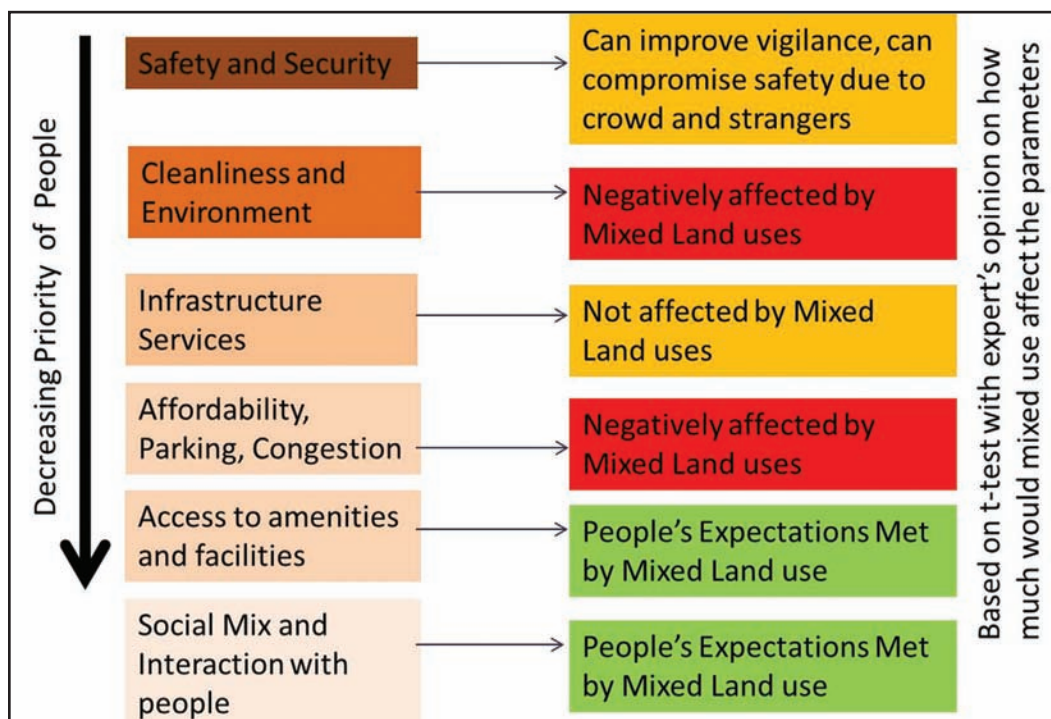
Concepts of quality of life is age old existing from the times of Aristotle talking about 'The Good Life' (Hamam Serag El Din, 2013). Quality of Life in itself have multiple dimensions each affected by independent multiple distinct factors. These could be personal like health, income and family life which might not be grossly affected by the micro environment one lives in, while some could be more physical like the safety and peace level in and around the dwelling unit affected by the micro environment. These aspects are directly influenced by the immediate physical environmental settings is deemed as 'Urban Quality of Life' considered in the study of the likes 'neighborhood satisfaction', 'Residential Quality of Life', etc. It could be defined as "Satisfaction received from meeting of needs and expectations by the surrounding physical conditions" (Poulomee Ghosh, 2018). A fundamental assumption in planning is that places are designed to improve quality of life (Marans, 2012) thereby making the factors of quality of life affected by physical environment as crucial. Even all aspects of urban quality of life may not be equally important or equally affected by the objective surrounding conditions which is discussed in further sections.

Measuring of quality of life gained prominence during the 1970s with the social indicators movement. There are two approaches to measuring quality of life - one objectively by actual statistical recordings of phenomenon like birth and death rates, income level, etc.; and other subjectively by capturing people's feelings and experiences (Andrews, 1974). Social reporting and conduction of citizen's survey is used to evaluate their quality of live in subjective manner. While objective indicators showcase to what degree a phenomenon is actually prevailing in a society, the subjective indicators capture how people feel about it in terms of satisfaction (Diener, 1997). To understand the true facet of quality of life of a person it might be best to let the person decide through subjective indicators. However, the objective conditions of people like their education level, cultural background, income, past experiences, opportunities and limitations, etc.; influence their decisions and expectations of quality of life and have to be considered as independent factors. Similarly objective conditions around the residence like mixed land use affect the subjective satisfaction of the people. Hence there are models as an approach to measure quality of life accommodating Objective conditions, subjective perception and their behavioral responses (Massam, 2002). More recently quality of life is being looked from cause's point of view and establishing links so as to find out reasons behind the satisfaction levels of quality of life (Noll, 2002).

3.1 Dimensions of Urban Quality of Life

The perception of a place with respect to urban quality of life can be divided into large parameters or domains which are differently affected by the surroundings.

Fig. 3: Observations from Survey



Source: Created by author based on results

Literature review reveals multiple ways of categorizing the parameters depending upon the need of study and context of place. One way would be categorizing indicators into parameters like environmental, social, mobility, physical, physiological, economic and political (Hamam Serag El Din, 2013) after which the decision of objective or subjective assessment can be made. Another way could be quality based like quality of schools, parks, traffic and crowding, friendliness of neighbors, etc. (Marans, 2012). Yet in another way the parameters can be directly labeled into crime, safety, privacy, social interactions, pollution, appearance and cleanliness (Mani Dhingra, 2016). Each of these domains would have a set of direct, measurable indicators which will cumulatively decide the quality of life. It is these indicators which are in relationships and competition, which are preferred or can be traded-off, based on which people choose and judge their physical environment. For the purpose of this study these indicators were subjectively and relatively rated. The final parameters and indicators used with due consideration of mixed land use and Indian city's context, are shown in Fig. 3.

4. THE INDIAN CITY CONTEXT

Indian cities traditionally tend to be denser than most of its peers. Given the urban growth trends of India there is a huge demand of urban land and its management. The concept of planning for urban land in India is based on pre-



colonial notions of land use plans and zones implemented through development or master plans and regulated through development control regulations. The regulations are in a way stringent with regards to density but a review of the development control reveals that most of the residential areas are inherently mixed use and compatible uses are mostly allowed to coexist. The plans however, have a low scope of accommodating market forces resulting in enforcement issues (Ahluwalia, 2015). While the uses existing are regulated, there arises a lack of integration as the amount and ways in which they might exist are not monitored. Moreover, social diversity and informality makes the system challenging (Roy, 2009). Informal spaces and activities are not an exception but is a generalized trend to be given due consideration in city planning to be inclusive. Whatever the lacunas in the formal system are; there is a parallel unofficial but not completely illegal system of meeting human needs in Indian cities. The street vendors in particular add comfort and convenience to every day life by bringing door step services, cheaper goods and fast food (Skinner, 2016). Their association with the quality of life of the people cannot be denied as they fulfill the gap between the access of services and goods eliminated by the formal planning system. The upcoming e-commerce for purchases, services and food delivery is enabling urban elite and busy ones to run errands sitting on their couch negating the need of convenience stores and facilities near their homes.

First, indicators of urban quality of life were taken from literature and grouped under parameters to identify areas of people's expectations from their surrounding or micro living environment (Table 1). As each indicator irrespective of the parameter or domain could be traded off for the advantage of another indicator, for the purpose of computing and rating they are treated independently of their domains.

Second, a sample of 135 adult residents were asked to rate each indicator on a 7 point Likert Scale based on how important a particular indicator is to them in determining their quality of life. Mixed land use was not considered and urban quality of life was treated independently. This reveals what are the expectations of people from their living environment and which of them are in priority. A higher mean or modal rating indicates that it is a priority and cannot be compromised while a lower score indicates that that aspect can be traded off to take the benefit of the higher score ones. They were also asked to list the desired and undesirable uses in their neighborhood with reasons to understand the dynamics of mixed land use better. The sample included representation from both gender, various income groups, home owners as well as renters, and marital status and from different housing typologies.



Third, the same quality of life indicators with consideration of the parameters were grouped based on whether they are positively affected by mixed land uses or negatively affected by mixed land uses with consultation of experts, literature and recognizance survey. Then 30 experts on mixed land use were asked to rate the same indicators based on to what degree the indicators are affected by mixed land uses (positively or negatively) on a 7 point Likert Scale. This indicates the deliverables of mixed land use and what aspects of life it improves and which aspects it deteriorates. The experts included academicians, representatives from NGOs, government agencies, planning agencies, research organizations, etc. The experts were also from varied background ranging from geography, sociology, planning and architecture. Lastly independent sample t-test is performed to see whether there is a significant difference in the scores arrived from people's rating and expert's rating and which is higher and conclusions are drawn from the same.

6. WHAT PEOPLE EXPECT FROM THEIR NEIGHBORHOODS?

The results of rating the parameters done by the people based on 'how important a parameter is in deciding their Urban Quality of Life' is used. Average rating of each parameter is indicated in Table 1. Rating of 'urban quality of life indicators analyzing the results without the notion of mixed land uses and therefore without the negatively or positively affected aspects revealed people's priority of the aspects of quality of life. A number of observations could be made by just sorting the indicators by their mean rating. Most parameters of security and natural as well as perceived environment received highest priority with score more than 6, even more than dwelling unit- their actual place of residence. This implies that certain aspects of the surrounding living environment are of higher significance than the actual residence to people. Individuals alone cannot do much to alter the surrounding environments which severely affect their lives, hence higher priority. Dwelling unit or their homes they have the liberty to improvise, therefore lower priority. Parameters relating to access to services and facilities and mobility aspects received second or medium priority (score between 5 to 6) implying that they are important but can be managed or compromised for better security, natural and perceived environment. Parameters relating to recreation, social mix and interaction have received lowest score i.e. between 4 and 5. This implies that they are important but as it is not a basic necessity for leading life and is a value addition, it is lowest in priority.

It could be deduced that surrounding parameters that affect health and day to day life and cannot be compromised but is beyond the control of the people are of highest priority. Necessary accessibility aspects which can be worked around or adjusted or alternate solutions can be made are second on priority. Voluntary



Table 1: Rating of Urban Quality of Life Indicators

Indicators	Mean Expert's Ratings	Mean People's Rating	Significance level from independent sample t-test
Urban Quality of Life Parameters Negatively Affected by Mixed Land Use	(based on how much mixed land use affect Urban Quality of Life)	(based on how important are the indicators for their quality of life)	Score less than 0.05 indicates significant difference
Air Quality (Natural Environment)	5.09	6.44	0.001
Noise Levels (Natural Environment)	5.27	5.53	0.474
Temperature- heat island effect (Natural Environment)	4.68	5.47	0.027
greenery (natural environment)	4.59	6.24	0.001
solid waste/ litter (perceived environment-cleanliness)	4.32	6.47	0.000
sanitation (perceived environment-cleanliness)	4.23	6.59	0.000
hygiene (perceived environment-cleanliness)	4.32	6.56	0.000
congestion and crowding (perceived environment-cleanliness)	5.50	5.32	0.635
Property value/ rental value (affordability)	5.45	5.68	0.559
Cost of Living (affordability)	5.41	5.53	0.741
Building Quality (Dwelling Unit)	4.18	6.15	0.000
Space, natural light, ventilation(Dwelling Unit)	4.27	6.38	0.000
Management and maintenance (Dwelling Unit)	4.41	6.09	0.000
requirement and ease of parking (mobility)	5.82	5.79	0.947
walkability and cyclability (ease of walking) (mobility)	5.91	6.09	0.642
Access to residence (mobility)	5.50	5.97	0.234
Petty Crimes (Security)	4.73	6.29	0.001
Heinous Crimes (Security)	4.95	6.68	0.000
Eve teasing (Security)	4.77	6.41	0.001
Nuisance Points (Security)	4.59	6.21	0.000
Safety of children (Security)	5.09	6.74	0.000
Communicable diseases (health)	4.55	6.47	0.000
visual quality (appearance)	4.95	5.29	0.392
pleasing milieu (outdoor ambiance) (appearance)	4.82	5.41	0.149
Mix of different income groups (social mix)	5.09	4.35	0.036
Mix of owners and renters (social mix)	4.77	4.09	0.086
Mix of different ethnic/ religious/ language groups (social mix)	4.41	4.91	0.279



Indicators	Mean Expert's Ratings	Mean People's Rating	Significance level from independent sample t-test
Urban Quality of Life Parameters Positively Affected by Mixed Land Use	(based on how much mixed land use affect Urban Quality of Life)	(based on how important are the indicators for their quality of life)	Score less than 0.05 indicates significant difference
Interaction with neighbors (interactions)	4.77	4.82	0.906
cultural life with people (interactions)	4.82	5.18	0.344
Leisure/ recreation (activity)	5.09	5.21	0.749
old age/ children/ women scope of activity (activity)	5.36	5.44	0.827
Local job opportunity (Occupation)	5.55	5.26	0.462
Business Survival (Occupation)	5.27	5.35	0.833
Parks (services)	5.09	5.94	0.018
Religious centers(services)	4.41	4.32	0.850
Schools(services)	4.55	5.71	0.003
clinics (services)	4.50	5.94	0.001
Petrol Pump	5.09	5.94	0.018
Police Station	4.55	5.71	0.003
ATM	4.50	5.94	0.001
fitness centers (commercial facility)	4.77	4.68	0.819
grocery and other stores	5.09	5.47	0.393
eateries(commercial facility)	5.05	4.56	0.278
entertainment centers(commercial facility)	4.95	4.56	0.341
Time of local travel (mobility)	5.91	6.03	0.737
cost of local travel (mobility)	5.64	5.71	0.867
Access to Public Transport (mobility)	5.23	6.29	0.011
Public Vigilance (Vigilance)	5.09	6.03	0.027
Night time security (Vigilance)	5.14	6.53	0.000
scope for physical exercise (health)	4.32	5.94	0.000
Water supply (Physical Infrastructure)	4.73	6.50	0.000
sewage disposal (Physical Infrastructure)	4.91	6.65	0.000
solid waste collection and disposal (Physical Infrastructure)	4.91	6.56	0.000
Electricity supply (Physical Infrastructure)	4.45	6.50	0.000
other municipal services (Physical Infrastructure)	4.55	5.91	0.001
other private services (Physical Infrastructure)	4.23	5.82	0.000



personal engagements are of least priority. People expect a clean and safe place to live with moderate ease and ability to access services and facilities and would welcome if social, cultural and recreational activities can be performed in their vicinity.

Some other observations that were made from the data collected which is not explicitly presented here are the differences among people groups. Affordability and occupation is of a higher priority of low income group but the difference is marginal. People with children attach more importance to the environment while younger unmarried people attach more importance to mobility. Some underlying characteristics of people like low affordability or ability to use alternate mode of travel in case of long distances lead people to compromise with their priorities.

7. HOW MIXED LAND USE PRACTICES ARE EXPECTED TO AFFECT QUALITY OF LIFE?

This is dealt in two parts, one the segregation of the urban quality of life indicators into positively affected and negatively affected and two, rating of the indicators by experts based on 'how much mixed land use affects the quality of life'. The average scores are indicated in Table 1.

7.1 Positively or Negatively Affected Urban Quality of Life Parameters by Mixed Land Uses

Even though benefits of mixed land uses are many, more than enjoying mixed land uses people might be merrily putting up with it and its negative effects as long as they are in limit to reap the benefits. People might be trading off poor environment like noise and disturbance, litter and cleanliness, open spaces, inconvenience in parking and low local community cohesion for the benefits of accessibility, nobility and location (Foord, 2011). Mixed uses can also increase property value and cost of living which could lead to income segregation (Markus Moos, 2018). Even though improved mobility with mixed land use is established in much literature, the way mixed land use is tailored with quantum and design ultimately determines the satisfaction of the people (Sarika Bahadure, 2015). It is totally possible to limit the negative externalities with appropriate regulations and urban designs. However, given the current case of affairs of Indian cities the negative externalities are a reality and need to be catered. Hence with due consideration of the above mentioned factors, literature and the general upkeep conditions of Indian cities, the indicators are segregated into positively and negatively affected by mixed land uses as indicated in Table 2.



Table 2: Quality of Life Parameters and Indicators

Positively Affected Parameters	Negatively Affected Parameters
<p>Social Mix</p> <ul style="list-style-type: none"> • Mix of different income groups • Mix of owners and renters • Mix of different religious / language groups <p>Interaction with Neighbors</p> <ul style="list-style-type: none"> • Interaction with neighbors • Scope of cultural life with people <p>Activities</p> <ul style="list-style-type: none"> • Provision of recreational activity in your area • Scope children / old age / women activity <p>Appearance</p> <ul style="list-style-type: none"> • Visual Quality • Pleasing Milieu (outdoor ambiance) <p>Occupation</p> <ul style="list-style-type: none"> • Distance traveled for job • Business Survival <p>Services</p> <ul style="list-style-type: none"> • Location of Parks, Religious Centers • Schools, Clinics • Petrol pump, Police station, ATM <p>Commercial Facilities</p> <ul style="list-style-type: none"> • Fitness Centers • Grocery and other stores • Eateries, Entertainment Centers <p>Mobility (Positive)</p> <ul style="list-style-type: none"> • Time required for Local Travel • Cost of Local Travel • Access to Public Transport <p>Vigilance</p> <ul style="list-style-type: none"> • Public Vigilance • Night time security <p>Health (Positive)</p> <ul style="list-style-type: none"> • Scope for physical exercise <p>Physical Infrastructure</p> <ul style="list-style-type: none"> • Water supply • Sewage disposal • Solid waste collection and disposal • Electricity supply 	<p>Natural Environment</p> <ul style="list-style-type: none"> • Air Quality • Noise • Temperature • Greenery <p>Perceived environment</p> <ul style="list-style-type: none"> • Solid Waste / Litter / garbage • Sanitation (Public Toilets / Open Defecation) • Hygiene • Congestion and Crowding <p>Dwelling Unit</p> <ul style="list-style-type: none"> • Building Quality • Space, Natural Light, Ventilation • Management and Maintenance <p>Affordability</p> <ul style="list-style-type: none"> • Property value / rental value • Cost of Living <p>Security</p> <ul style="list-style-type: none"> • Security against petty crimes • Security against heinous crimes • Security against eve teasing • Presence of Nuisance Points • Safety of children <p>Mobility (Negative)</p> <ul style="list-style-type: none"> • Requirement and ease of parking • Ease of walking/ cycling • Access road to residence <p>Health (Negative)</p> <ul style="list-style-type: none"> • Protection against communicable diseases

Source: Compiled from Literature



7.2 How much does Mixed Land Use affect Urban Quality of Life

Ratings of urban quality of life parameters by experts based on 'how much are the indicators affected by mixed land use' is used for analysis here. Amongst the urban quality of life indicators that are positively affected by mixed land uses, cost and time of local transport, access to amenities and social mix of people are rated by experts to be most positively affected. This is most evident as presence of non-residential uses in the living environment would survive in convention with demand of the use in the area thereby availed by the residential population. Therefore, at least some of the non-residential uses will be of local needs and services. Indicators that are less likely to get affected are physical infrastructure like water supply and electricity.

Walkability and cyclability is one of the highest rated parameters. Interestingly there are two sides to this which would require further research. Easy access to local goods and services in people's vicinity would generate more walking and cycling trips by the resident population to run errands. Presence of people on road would create public vigilance which is also a high rated positive indicator, would make it safe for the people to walk on the road. On the other hand, if presence of non-residential uses attract excess crowd, there might be encroachment of foot paths and increased traffic and parking on the road, making walking difficult. Hence, actual effect on walkability and safety are subjected to the actual on ground situations.

Of the most negatively affected indicators are congestion and crowding which would further lead to noise and hamper security to certain limit. Affordability is also rated high as property values will increase and rent will increase as households would be competing with firms for rent. This might ultimately result in social segregation instead of increased mix. The indicators rated least negatively affected are those of dwelling unit, physical infrastructure and certain aspects of natural environment like greenery and temperature.

8. THE GAP AND CONVERGENCE IN EXPECTATIONS AND DELIVERABLES

Priorities given by people and how they are affected by mix land use as opinionated by experts are considered. Independent sample t-test is performed to understand significant differences and convergences. The significant levels of the t-test are indicated in Table 1.

For positively affected parameters, no significant difference indicates mixed land use is matching up to people's expectations. If there is a significant difference with low rating by experts (low effect of mixed land use on the indicator) then it is concluded that mixed land use does not improve the quality of life of the



people w.r.t. that aspect. If there is a significant difference with low rating by people (aspect not very important to people) then it is concluded that mixed land use is improving the aspect of urban quality of life much more than people's expectations.

In case of negatively affected parameters, if both experts and people have rated it high with no significant difference in t-test it means the parameter is very important to people and is adversely affected by mixed land use. This category is of utmost importance from conclusion point of view. Low rating by both experts and people with no significant difference in t-test indicates that the parameter is not important to people and mixed land use only mildly deteriorates it. Negatively affected parameter which is rated high by experts and low by people indicates that a not so important parameter to people is adversely affected by mixed land use. Negatively affected parameter which is rated low by experts and high by people indicates that a parameter very important to people is only mildly affected by mixed land use.

Mixed land use has a high positive impact on social activities and mix which are not very important to people, e.g. mixed land use is expected to increase interactions with local population but that is of relatively less importance to many people as it is voluntary and not deemed as a necessity. But there is no significant difference in the t-test of these indicators indicating mixed land use would meet people's expectation in this regard. Then mixed land use improves local access to facilities and amenities which are important to people but not a priority and not more important than a few other indicators. There is no significant difference in the rating of these indicators given by people and experts indicating convergence. Physical infrastructure, one of the highly important rated parameter is expected to have low impact by mixed land use. T-test reveals significant difference in rating. It can be said that mixed land use has low impact on this very important aspect of urban quality of life. Similarly public vigilance is of high priority to people and even though it has a higher rating from experts (i.e. it is highly improved by mixed land uses), the rating is not as high as people's expectations and there is a significant difference.

Noise is one of the aspects which are highly and adversely affected by mixed land use. Even though noise level is not a primary priority of people, it is still rated high. There is no significant difference revealed in t-test indicating that this important parameter is adversely affected by mixed land use. Similarly affordability, ease of parking, congestion and crowding are all of moderate priority to people and there is no significant difference in the results indicating that mixed land use is affecting adversely something that is important to people. Security comprising of children's security,



safety, absence of nuisance and eve teasing, etc., are of highest priority to people followed by clean and pollution free environment. There is a significant difference in the rating of these parameters given by experts and people, as people have given high priorities to these and experts have indicated moderate impact of mixed land use on them. Security again has dual interpretation if considered with public vigilance. Security might be improved by presence of watchful people on the road attracted by non-residential uses. At the same time strange and unknown people on the road and uninvited visitors could also pose a threat. Similarly, environmental aspects like air quality are adversely affected by mixed land use but are very important to people.

Many of the negatively affected parameters which are very important to people have other aspects related to them like density, e.g. attraction of people will manifest into a problematic congestion only in case of high density. Similarly air and noise quality will suffer with poor environmental regulations and their implementations.

9. CONCLUSIONS

So, does benefits of mixed land use match up to people's expectations from their living environments? The true answer 'depends on the actual situation'. Most of the very important aspects of urban quality of life are either not addressed by mixed land use like those of physical infrastructure, or are negatively affected like affordability and environment in real time situations. Accessibility of services and facilities which a certain segment of society are ready to adjust with are definitely positively impacted by mixed land uses and improves urban quality of life of those who don't have alternate means through transport or e-services either by choice, situations or affordability. Hence mixed land use needs to be cautiously approached with details of quantum of mixed land uses, how they function in urban setting, the prevailing urban form what social and environmental impact it could have so that it is not detrimental to the overall Quality of Life.

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Fifty Years of Development Planning: Master Plans and Urban Governance in Guwahati, Assam

Trishna Gogoi and J. S. Kakoty

Abstract

Guwahati was the first city to be taken up for master planning in the state of Assam in the early 1960s. Since then it has been administered under three master plans. With the release of a draft master plan in 2015, the city has crossed fifty years of planning. In this article the authors trace the urban development trajectory of Guwahati via an empirical understanding of its land use and governance by taking up city's master plans as the points of reference. Through this study, the authors draw upon the larger challenges that have kept the plans at odds with the city's actual development. The authors argue that Guwahati provides an ideal case of post-colonial governance struggling with neoliberal development agenda, which has resulted in ad-hoc urban development in the city. Through retrospection on Guwahati's master plans and urban governance procedures, the authors comment on the relevance of master planning for the future of Indian cities.

1. INTRODUCTION

In 2016, the All India Institute of Medical Sciences (AIIMS) for the northeast region was proposed to be built in Guwahati, Assam. Around 561 acres of land in the north bank of the Brahmaputra was allocated by the state government for the institute in Guwahati (The Assam Tribune, 2017). However the selected site for the institute became the centre of a huge public contestation, requiring intervention from the National Green Tribunal. The master plan of Guwahati appeared to be at the centre of the controversy. The Guwahati master plan demarcated the designated AIIMS site as a low-lying water body thus, an eco-sensitive zone. This was picked by environmentalists and civil bodies to oppose the creation of AIIMS at this site. However, during examination, it was found that the cadastral maps used by the Guwahati Metropolitan Development Authority (GMDA) to prepare the master plan were outdated and did not reflect the revenue circle's written legal records which designated the concerned site as a village grazing reserve (VGR) and thus, permissible for establishing the institute. This incident is an example of the technical and bureaucratic fragmentation that challenges urban planning across Indian cities. Fragmented information, outdated mapping techniques, multiple authorities, lack of unified urban policy, etc., all lead to incomprehensive planning. At the city-level, Indian master

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plans have been heavily challenged in meeting the urban development agenda. Master plans have been criticized for remaining consumed with city aesthetics and orderliness, rather than evolving a rooted vision and function for the city (Menon, 1997).

Master plan is a British construct. It was first instituted in United Kingdom after the Second World War to manage poverty and public health by imposing order through urban design and public infrastructure services (Harris, 2015). The forecasting methods used to calculate the future development trends and population growth in the city gave it mass appeal. Master planning was initiated in India in the 1960s. Following the UK, a Town and Country Planning Department was established in most of the Indian states for preparing the master plans, under the Model Town and Regional Planning and Development Law of 1962 (Kshirsagar and Srinivas, 2014). In Assam, the first master plan was taken up for Guwahati in the early 1960s with the establishment of the Town and Country Planning Department in the state government. The Guwahati Master Plan and Zoning Regulations, 1965 were prepared under the Town and Country Planning Act, 1959 by the Town and Country Planning Department, as was the next plan in 1986. Thereafter, the Guwahati Metropolitan Development Authority (GMDA) was constituted through the GMDA Act, 1985, which took over the function of preparing the Master Plan released in 2009. With the latest draft master plan for greater Guwahati released in 2015, Guwahati has crossed the historic fifty years milestone in city planning. It is however to be noted that the draft master plan did not see the light of day as a final notified plan for Guwahati. It has been taken up for revision again.

Master plans have received renewed attention since the paradigmatic urban renewal and revival programs of the central government like, Smart City Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT) Mission and Pradhan Mantri Awas Yojna - Housing for All (PMAY-HFA) Urban Mission of 2015 and Shyama Prasad Mukherjee Rurban (SPMRM) Mission of 2016. In recent decades, Guwahati has been in the spotlight for leading urban development agenda in the north-eastern region. Since the shift of India's development policies towards urban areas with the launch of JNNURM in 2004, the city has been selected as the Mission City for Assam under JNNURM, as Smart City under Smart City Mission, as Mission City under AMRUT Mission¹,

¹ *These are centrally-funded urban re/development schemes, implemented in a mission-mode across selected towns and cities of India. Guwahati has been selected in almost all of the central schemes as the model city for project implementation. Under JNNURM, Guwahati took up water supply project and urban poor housing; under Smart city Mission plans for reviving the water channels of Guwahati is proposed, including river front development; under AMRUT Mission, projects for park development and non-motorized vehicular transport project are proposed.*



as well as it is the recipient of numerous other government and international funding for large-scale urban development. Parastatal agencies like Assam Urban Infrastructure Investment Program (AUIIP) and Guwahati Jal Board are partnering with Asian Development Bank, and Japan International Cooperation Agency (JICA) respectively, and investing millions of dollars in creating market-friendly infrastructure in the city. Likewise, recent PPP investments in development of five-star hotels by ITC, Radisson, etc., indicate towards a growing neoliberal standardization of the city with large-scale infrastructure and exclusive real estate.

The current study seeks to empirically understand the urban development trajectory of Guwahati through the master plans prepared for the city in 1965, 1986, 2009 and 2015. Critically studying the city over the different plan periods, the authors attempt to analyze how 'the city is constructed, regulated and inhabited' (Hull, 2012: 4) through the master plans. The analysis is in five parts, - firstly understanding the urbanization of Guwahati and its bureaucratic setup to build the context of the city; secondly, a macro-level study of the four master plans formulated for Guwahati till date; thirdly, comparative analysis of the four master plans; followed by their implementation issues and conclusion.

2. CONTEXT OF THE CITY

2.1 Urbanization of Guwahati

The British laid the genesis of present day Guwahati on the south bank in 1824, as a trade and garrison town. Prior to that, Guwahati was more prominent as Pragjyotishpur and concentrated more on the northern bank of the Brahmaputra in Guwahati during the Ahom rule. The city has been recognized as an urban entity since 1853 when it was declared as a municipal area by the British. In Census 2011, the city reported an urban population of 963,429 persons and is expected to have crossed the million plus mark since. Current Guwahati has a dominant service economy, with both formal and informal sectors, forged from the presence of the state administrative capital, educational and other institutional establishments, transport hubs as well as the major wholesale and retail markets within the city. Like other Indian metros, Guwahati has seen an increasing scarcity of affordable land as a result of fervent land speculations, rezoning and construction activities leading to rising real estate prices. The land scarcity in Guwahati is exacerbated due to its unique bowl-like topography, interspersed by hills, wildlife sanctuary, reserved forests and natural wetlands and water-bodies. Guwahati's expansion is straight-jacketed due to physical barriers of the Brahmaputra River on one side and the Khasi-Jayantia and other hill tracts on the south and south-east. Thus, Guwahati has grown along the axial roads within the city and leading out into other districts. In terms of urban area, the Guwahati Municipal Corporation (GMC)

Table 1: Comparative Population Growth in GMC and GMA (1951 to 2011)

Year	Guwahati Municipal Corporation (GMC) area		Guwahati Metropolitan Area (GMA) excluding GMC		Total GMA	
	Population	CAGR (%)	Population	CAGR (%)	Population	CAGR (%)
1961	100,707	-	98,775	-	199,482	-
1971	123,783	2.1	169,436	5.5	293, 219	3.9
1981*	268,945	8.1	102,351	- 4.9	435, 280	4.0
1991	584,342	8.1	61,827	- 4.9	646, 169	4.0
2001	809,895	3.3	80,878	2.7	890, 773	3.3
2011	963,429	1.8	85,998	0.6	968, 549	0.8

* No Census was undertaken in 1981, so the population figures are extrapolated on the basis of 1971-1991 Compound Annual Growth Rate (CAGR).

Source: GMDA (2009: 25) and Desai, R., Mahadevia, D. & Mishra, A. (2014: 4)

comprises of 216.79 sq km, while the Greater Guwahati Metropolitan Area (GMA) comprises of 328 sq km (GMDA, 2009).

Although Assam's level of urbanization at 14.1 per cent is low compared to rest of India, Guwahati has the largest urban agglomeration amongst the eight states in the region making it the primate city of north-east India^{2,3}. Table 1 depicts increase in the city population in the mid of the 20th century reaching its pinnacle in the post-70s and gradually dropping post 2001 creating a bell-shaped curve in the population growth trend of Guwahati. The period from 1971-1991 have the highest population increase at 8.1 per cent per annum increasing from 2.1 per cent per annum in the period between 1961 and 1971. It is evident that GMC area has witnessed the highest population growth in the period when the capital city was shifted from Shillong to Dispur in 1973. This clearly indicates towards large scale migration of the administrative staff and collateral businesses from the previous state capital of Shillong to Guwahati, assimilating with the existing migrants from Bihar, Andhra Pradesh, West Bengal and Punjab settled in Guwahati since the colonial times (Desai et al, 2014). Another lot of migration is attributed to migrants from Bangladesh after its creation in 1972. In the 1970s, nearly 66.17 per cent accommodations in Guwahati were reported to be rented, indicating the high percentage of migrants in the city (Town and Country Planning, 1986: 24). Thereafter Guwahati depicts population growth at a decreasing rate, indicative of decreasing migration and stabilization of population growth in the city. In spite of the declining population growth, GMA accounts for nearly 25 per cent of Assam's urban population (DMA, 2013)⁴.

2 Guwahati's urban population is eight times more than the next most populous town in Assam, Silchar, which has a population of 1.72 lakh.

3 In terms of percentage of urban population, Mizoram has the highest with 51.5 per cent population living in towns, followed by Sikkim at 25 per cent as per the Census 2011.

4 Collected from population details of notified towns of Assam as per Census 2011 from Directorate of Municipal Administration, Assam in May 2013



Table 2: Growth of Urban Population and Urban Areas in Surrounding Districts of Guwahati

District	Census 2011		Census 2001		Census 1991	
	Population	No. of Urban areas	Population	No of Urban areas	Population	No of Urban areas
Kamrup (M)	1,037,011	12	888,874	11	596,927	2
Kamrup	142,394	16	126,047	15	39,705	3
Nalbari	77,445	10	62,302	8	23,475	2
Marigaon	69,492	5	55,782	5	29,198	2
Darrang	44,490	2	41,703	2	36,089	2

Source: Collated from www.citypopulation.de/php/india-assam.php, accessed on 12 November 2018 and GMDA (2015)

Note: Kamrup (Metro) district was separated from the Kamrup district only in 2002. However, as these cumulative population figures have been arrived at by adding the population figures of urban areas falling within the segregated districts, the total figures are assumed to be a correct depiction of the urban scenario of the districts over the three Census periods.

Table 2 depicts the increasing urban population and urban areas in the surrounding districts around Guwahati. The city is growing along the axial roads - towards Palashbari-Mirza on the western periphery and towards Baihata Chariali towards the north of the Brahmaputra river. Compared to the other districts of Assam, Kamrup, Nalbari, Darrang and Marigaon have grown exponentially in the last three decades and have also seen a significant rise in both urbanization and number of urban areas, indicating both concentration and extension of urban activities outwards from Guwahati. In effect, the surrounding districts of Kamrup Metro are found to have some of the highest population growth rates in the state.

2.2 Fragmented Urban Governance

In order to understand the formulation and implementation of urban planning in Guwahati, it is imperative to understand the bureaucratic structure of the city⁵. Unlike the other towns of Assam, Guwahati has a unique urban administrative set up. Being the capital city encompassing the state capital, Guwahati receives the lion's share of all urban development activities and funding in the state as reported by the State Finance Commission's figures. Consequently, it has entailed the creation of a dedicated department, Guwahati Development Department (GDD) to administer the city's development activities, usually headed by either the Chief Minister or the Finance Minister. It may be the only city in India which

⁵ A census town, notified by the state's Urban Development Department, can form a municipality with delineated formal ward boundaries and receive public funds for development. In Assam, the urban local body (ULB) maybe a Municipal Board with more than 8 wards but less than 30 wards or a Municipal Corporation with more than 30 wards. GMC has 31 wards.



has a separate government department to administer its affairs. GDD administers Guwahati through two city-level agencies, - the Guwahati Municipal Corporation (GMC) which is the urban local body, and the Guwahati Metropolitan Development Authority (GMDA), which is the development authority.

Till before the 74th Constitutional Amendment Act (CAA) in 1992, the Town and Country Planning Department prepared the master plans of all the towns of Assam, under the Assam Town and Country Planning Act, 1959. Of the three master plans prepared for Guwahati till date, the first two were prepared by the Town and Country Planning Department (later reconfigured as Directorate of T&CP). Post the 74th CAA of 1992, the ULBs across India have been entrusted with the function of preparing their master plan. However, in the case of Guwahati, as per the Guwahati Metropolitan Development Authority Act, 1985, GMDA was entrusted with the authority to prepare the master plan - which is another exceptional urban practice where the development authority prepares and the master plan, instead of the Municipal Corporation. The section 6, sub-section (1) (b) and (e) of the GMDA Act, 1985, not only directs GMDA to prepare the master plan, but to also 'coordinate the development activities of all department and agencies of the State Government or local authorities operating in the Guwahati Metropolitan Area' (GMDA Act,1985:11). Thus, the city's current Master Plan was prepared under the supervision of GMDA and is in currency since 2009. For implementing the Master Plan, building permits have been prepared under the Guwahati Building Construction (Regulation) Byelaws, 2014 and planning or land use permits are validated through the land use zoning of the Master Plan. Before the notification of the building byelaws, the Assam Uniform Zoning Regulation, 2001, adapted in the Master Plans were used to administer the city's physical growth.

Here it is also imperative to understand the fragmented authority over Guwahati's urban land development in terms of land sale, transfers and reservation, etc.

Table 3: Authorities Involved in Master Plan Preparation and Implementation in Guwahati, Assam

Time-period	Master plan Period	Preparation	Implementation of Master plan
Prior to 1992	1) Master plan of 1965 (1965 to 1985) 2) Master plan of 1986 (1986 to 2009)	T and CP Department	a) Guwahati Development Authority from 1965 to 1992. b). GMDA and GMC as dual authority to administer master plan proposals from 1992 to 2014 c).From 2014 onwards, GMDA authorizes planning permission & land sale across the within GMDA limits
After 1992	3) Master plan of 2009 (2009 to 2025)	GMDA	d) GMC, North Guwahati Municipal Board, and eight Panchayats authorise building permits within their own jurisdictions within GMDA

Source: Collated by authors



The Revenue Department, through the Deputy Commissioner's office administers land registration, sale and transfers. Under the latest Assam Agricultural Land (Regulation of Reclassification and Transfer for Non-agricultural Purpose) Act, 2015, a district-level committee headed by the DC shall have to approve change of agricultural land to non-agricultural uses⁶, in spite of the land use zoning in the master plan. Thus, land use related decisions have to be approved by the DC's office before implementation. Again, Guwahati is interspersed by numerous hills, reserved forests, wildlife sanctuary, eco-sensitive zones and water bodies. The Assam Hill Land and Ecological Sites (Protection and Management) Act of 2006 and Guwahati Water bodies (Preservation and Conservation) Act of 2008 are meant to protect the hills, forests and water bodies (Deepor, Silsakoo, Sarusula, Borsola and Bondajan beels) of the city. This entails that the Environment and Forest Department also has major stakes in the physical development of Guwahati.

Within this urbanization scenario and governance set-up, a macro-level analysis of the master plans of Guwahati was undertaken to deconstruct and understand the government's vision for the city over the decades. By doing this it is attempted to understand the influence of city planning on the urban landscape of Guwahati.

3. MASTER PLANS OF GUWAHATI FROM 1965 TO 2015

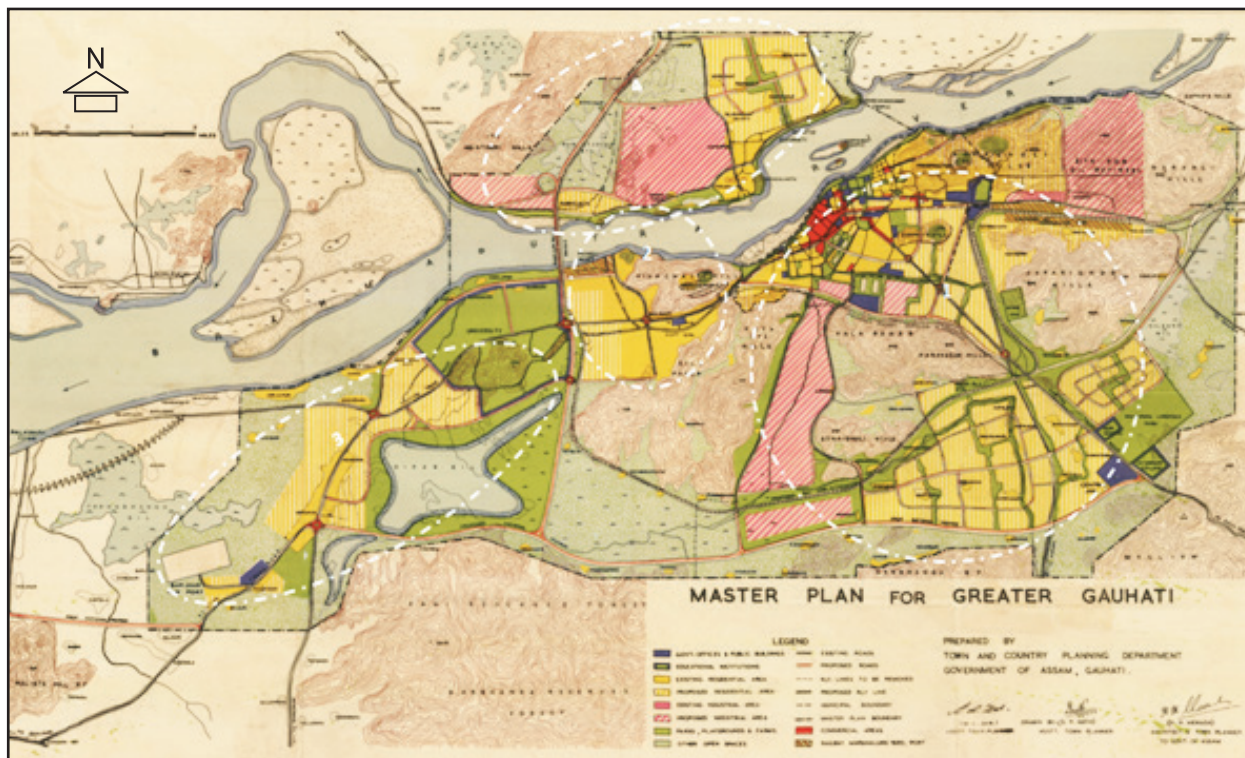
The three notified master plans of Guwahati, as well as the draft Master Plan have each had a distinct theme and guiding principal. Each of the plans is discussed in brief in the following sections.

3.1 Guwahati Master Plan - 1965

Formulated for a period of twenty years from 1965 to 1985, Guwahati's first Master Plan was heavily influenced by the utopian 'Garden City' concept of 1898 made popular by Sir Ebenezer Howard, an English town planner from United Kingdom. The idealized concept contained low density, self-sufficient units or neighborhood which would house mixed income groups, with access to urban services, facilities and markets and would also contain elements of the country or village with boulevards and green open spaces (Clark, 2003; Sharifi, 2016). Thus, the 1965 master plan envisaged neighborhood development in four core areas of Guwahati, linking each other through radial roads with green belts and open spaces. The municipal corporation was newly instituted in 1971 and the town area was increased from 7 sq km to 14 sq km to encompass the Noonmati Refinery and Northeast Frontier Railway headquarters which were till then outside the city limits. Fig. 1 depicts these four settlement neighborhoods as envisaged in the land use proposals. These areas would accommodate the rising additional population of nearly 0.58 million outside the core Guwahati city area.

⁶ This is applicable for land above 1 bigha upto 50 bigha. For less than 1 bigha, no permission is required for building own dwelling unit, not more than 2 floors, while for more than 50 bighas, permission must be accorded by the Revenue department of the state.

Fig. 1: Guwahati Land-Use Plan, 1965 with the Four Core Neighborhoods



Note: Neighbourhoods outlined in the master plan included: (1). Guwahati-Khanapra, encompassing the existing town along with additional outgrowth areas covering Kharguli, Khanapra, Basistha, Beltola and Fatasil (2). Maligaon-Jhalukbari, to accommodate the rising population around the Railway establishment at Maligaon (3). Jalukhbari Chariali-Airport at Borjhar and (4). Amingaon-North Guwahati on the north of the river Brahmaputra

Source: T and CP.(1965: 398-427)

The Guwahati Development Authority (GDA) was formed with the responsibility of implementing the first Master Plan and it notified three new development scheme areas for taking up affordable housing as per the provisions of the Assam Town and Country Planning Act, 1959 (Chapter IV, section 15 to 20). The GDA had proposed three schemes, namely, Kharguli riverfront as a residential area development, Amingaon as Industrial zone and Dispur as ‘Tea City’ or trade and commerce zone (Borah, 2017)⁷. Of the three schemes, the residential development in about 25-30 hectares of land at Kharguli was undertaken both for building multi-storied apartments (G+2) and sub-divided for selling the plots. The other two schemes were scrapped by the state government in favour of other priority projects.

However, before reaching the horizon year⁸ of the first plan in 1985, Dispur was established as the capital in 1973. Added to this was the Bangladesh war of 1971.

⁷ Personal interactions with retired Town Planner, M.N. Bora, who served as Town Planner GDA and Chairperson Assam State Housing Board.

⁸ The end of validity period of the Master Plan

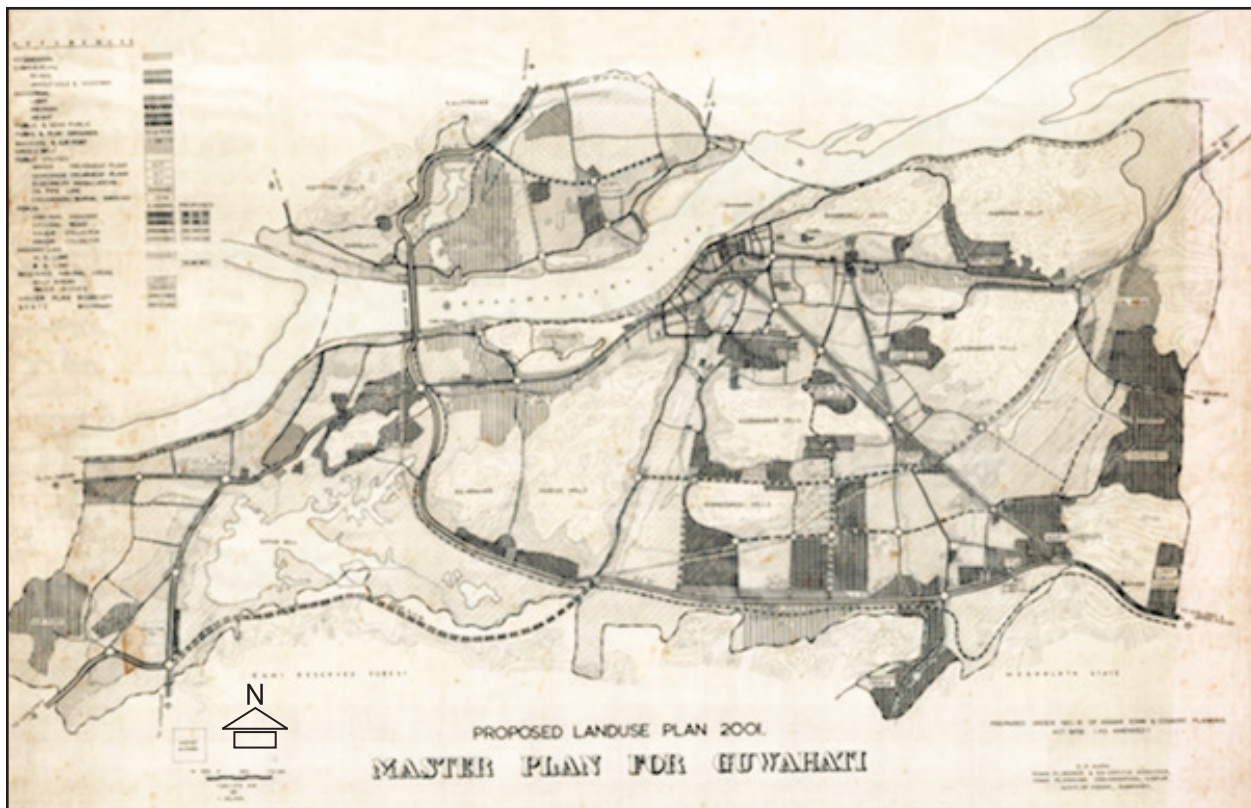


These political upheavals brought in large number of migrants to the city, as discussed already in section 2 of this paper. Moreover, Guwahati was established as a Municipal Corporation in 1971, expanding the spatial boundary of the GMC to encompass most of the GMA. These paradigmatic changes diverted attention from the original garden city concept for Guwahati towards a more robust plan for public and semi-public uses including administrative spaces, institutional buildings and markets, etc.

3.2 Guwahati Master Plan, 1986

The first plan of the garden city was made redundant when the capital shifted to Dispur. The city was left to deal with the large migrant population, not envisaged for the newly expanding trade town character of Guwahati in the early sixties. It is similar to what happened in Delhi's garden city development, after the capital of India was shifted there from Kolkata after 1911. The additional population was absorbed by Old Delhi. Likewise in Guwahati, the large population increase after the 1970s was absorbed by the city so much so that the original plan of a separate city of Dispur was abandoned and Dispur became a part of extended Guwahati.

Fig. 2: Proposed Land Use Plan for Guwahati Published in 1986

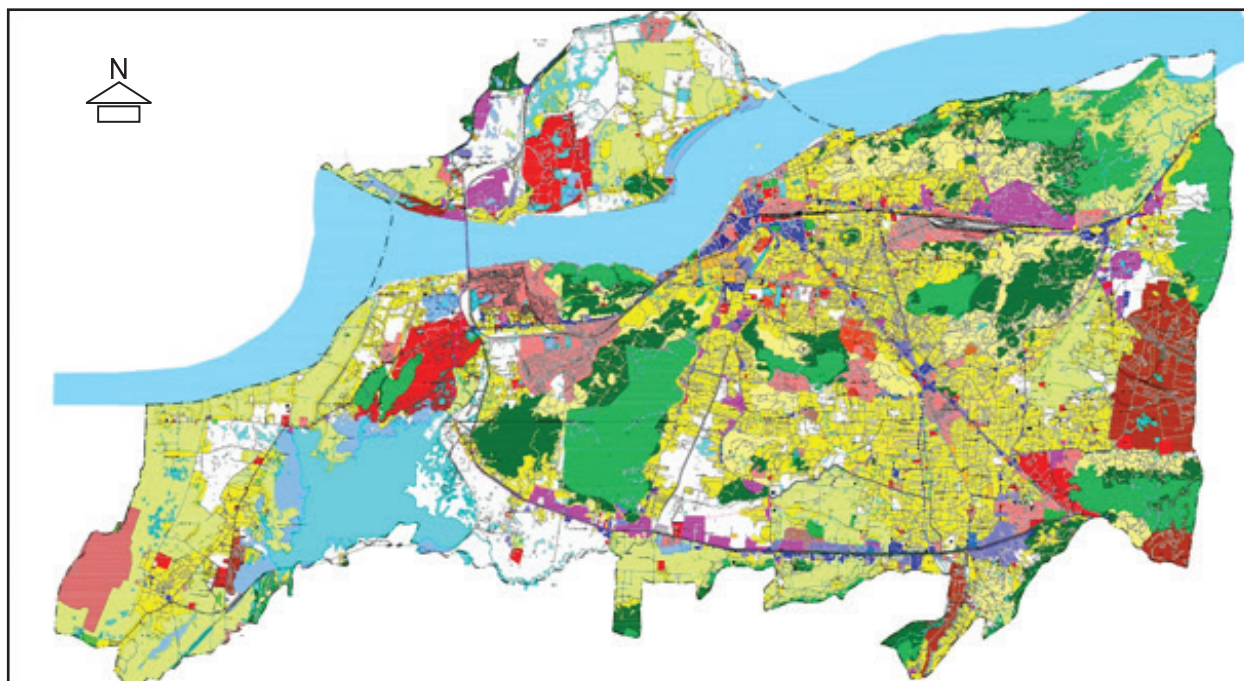


Source: T&CP, 1986

The new plan envisioned Guwahati as the administrative hub for the state of Assam as well as other north-eastern states. The High Court of Assam, the Tea Auction Centre, major educational institutions like the Guwahati University, Guwahati Medical College, Assam Engineering College, Veterinary College, etc., added to the city's importance in the region. In accordance, this plan saw a decisive shift from the previous Garden City concept towards Activity Corridor concept to disperse concentration of activities and population from a single point into a liner, corridor development connecting the core Guwahati city to Dispur and Jalukbari in a triangular development. The Guwahati-Shillong (GS) arterial road linking the traditional core of Guwahati to Dispur was strengthened by commercial and industrial activities by developing low-lying wetlands and natural depressions on both sides of the GS road with mills and commercial godowns. Land along the National Highway (NH) by-pass from Khanapara to Jalukbari on the southern periphery of the city was taken up for commercial truck terminals, godowns and transport businesses.

The 1986 Master Plan of Guwahati included foothills, hill slopes, buffer of water bodies, etc., previously classified under non-developable area in the master plan, into various use zones to meet the proposals. However, the lack of affordable housing and land availability led to the spill-over of residential land uses into areas demarcated under green belt, commercial, industrial and other uses, as evident in the land use map of existing uses prepared in the Master Plan of 2009 in Figure 3.

Fig. 3: Existing Land Use Plan in the Guwahati Master Plan 2025, Published in 2009



Source: GMDA(2009)

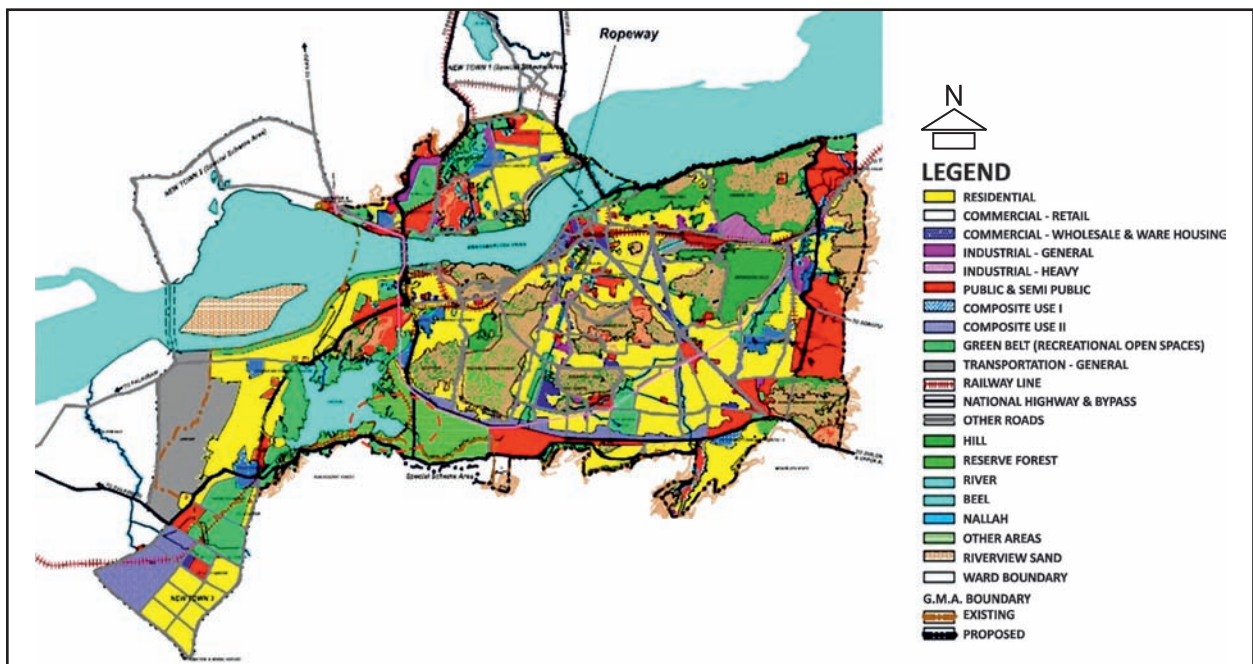


This plan period witnessed the GMDA created in 1985 with the passing of the GMDA act, which replaced the former Guwahati Development Authority in the early 1990s. This period also saw large-scale changes taking place in the country as a result of the liberalization of the economy. Although the industrial sector did not increase significantly, real estate and construction industry increased, employing much of the city’s secondary sector workers (Desai, et al, 2014:8). The most paradigmatic change brought about during this period was the central government’s focus on urban renewal, propagated through the JNNURM program. It brought renewed focus on the cities, importing neoliberal concepts of economic development along with introduction of private consultancies.

3.3 Guwahati Master Plan, 2009

The GMDA was mandated to prepare the Master Plan for Guwahati at the end of the plan period of 1986-2001. Following the on-going trends, GMDA engaged a private consultancy firm to prepare the master plan of Guwahati for the horizon year of 2025. Almost twenty different theme maps depicting detailed city-level land use and proposals (GMDA, 2009) were prepared. The new master plan, introduced concepts like, special economic zone and IT cum business centre towards the Guwahati airport; an integrated freight complex in North Guwahati; integrated intra-urban, multi-modal transport system across the city; river-front development on the south bank of the Brahmaputra; new district centres for commercial activities in different locations of the city, amongst others. In fact

Fig. 4: Proposed Land Use Zoning Plan for Guwahati Master Plan for 2025, Published in 2009



Source: GMDA (2009)

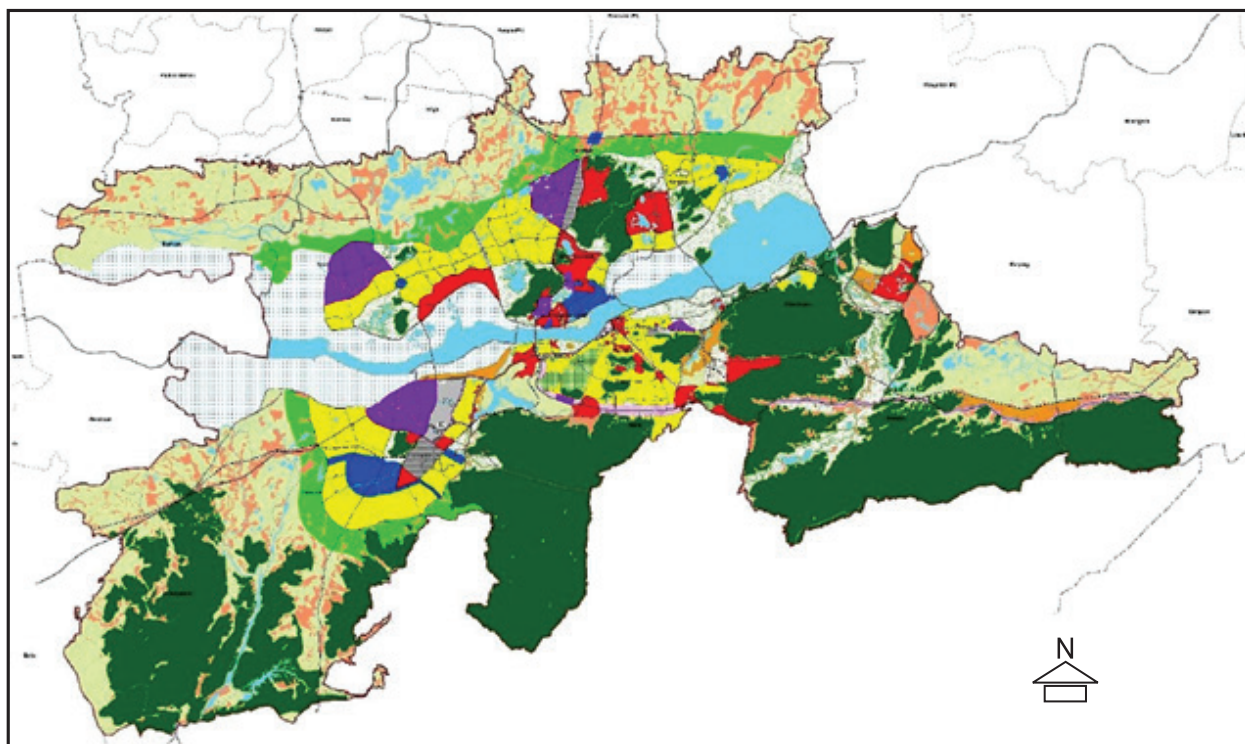
this plan presented category-wise plans under ten major project-heads which also includes physical infrastructure, slum up-gradation, residential development, commercial centres, etc. Thus, this master plan is an overhaul from the earlier master plans prepared by the state agencies themselves and presents a host of enterprising concepts aimed at expanding the economic profile of the city.

The 2009 Master Plan is currently being used in administering the development of the city. However, none of the specialized conceptual projects envisioned in the Master Plan have been taken up as development schemes by GMDA or GMC.

3.4 Draft Guwahati Master Plan, 2015

Although the 2009 Master Plan is valid till 2025, the GMDA Act 1985 provides that the Master Plan may be revised at regular intervals. Under this provision, GMDA undertook the delineation of new Guwahati Metropolitan Region and review and revision of the Guwahati Master Plan, by engaging a consultant. The draft plan was released in October 2015, calling for public debate, claims and objections. However, the plan was put on hold and never finalized. Yet it is pertinent to discuss the most salient feature of the draft plan to reveal the vision of the State for the future urban growth of Guwahati. The planning area for Guwahati Master Plan was proposed to be extended from the current 328 sq km in 2009 to encompass 3,471 sq km. It covered 1,072.14 sq km of forests and reserve forests

Fig. 5: Existing Land Use Plan as Per Draft Master Plan Published in 2015



Source: GMDA, 2015



and 403 sq km of water bodies (including Brahmaputra River) and proposed to cover in parts or full, the five districts of Kamrup, Kamrup Metro, Darrang, Morigaon and Nalbari, comprising a total urban population of 1.17 million.

3.5 Comparative Analysis of Land-Use Allocations under the Different Master Plan Proposals of Guwahati

Master Plan divides the city into land use zones, classifying it broadly into residential, commercial, circulation, public/semi-public uses, utilities and

Table 3: Comparative Analysis of Land Uses in the Various Master Plans of Guwahati from 1965 to 2015

Master Plan area	1965	1986	2009	2015 (draft)
GMC municipal area (sq.km)	14	216.19	216.79	216.79
GMDA planning area (sq.km)	243.46	261.77	328.06	3471.08
Total developable area within planning area (sq.km)	122.35	159.39	328.06	3471.08
Land uses	Land use as percentage of developable area (in %)			
Residential	63.74	41.40	31.65	14.2
Commercial	1.17	4.14	2.63	0.93
Industrial	9.51	8.63	2.80	1.85
Transport/Circulation	5.84	21.33	10.39	2,17
Public/Semi-public	17.89	15.53	10.99	2.33
Open Spaces/Recreation	1.85	8.87	11.00	4.88
Mixed land use			5.04	0.86
Defence				0.17
Eco /Conservation*			26.00	72.33
Non-developable are	Non-developable uses as percentage of total planning area (%)			
Green belt/ Forests/Hills/ Water Bodies	46.60	33.24	Concept of non-developable area discarded	
Special use by Govt.		5.86		

Sources: T&CP Dept (1965 and 1986), GMDA (2009 and 2015)

**Note: Some of the land use nomenclature and classification are different amongst the Master Plans. However, the common land uses have been clubbed together to make the comparison between the four master plans convenient. For example, the Guwahati Master Plan 2015 has created 20 land use categories. Within those Water bodies, Conservation Zone I, Conservation Zone II, Reserved Forest/Forest, Bio-conservation all form different categories of land uses which represent the environmental sensitive/friendly categories and have some form of control on its development have been clubbed together under the 'Eco/Conservation' category in the above table. Again sub-categories within a land use, like for example, High, Medium and Low density zones within Residential land use has been clubbed together under one broad category, like Residential land use.*



green/open spaces as well as forecasts the future land and infrastructure needed to meet the requirements of the projected population. Newer categories are added as more detailed classifications are taken up. The Table 3 provides an analysis of the land use allocations in the four master plans of Guwahati.

The physical expansion of the city has been gradual. Where the GMC boundary has maintained its limits at 216 sq km after being declared as a Municipal Corporation in 1972, the planning area has covered a little more at 261.77 sq km in 1986 and 328.06 sq km in 2009. However, the 2009 plan provided that without the three new proposed towns in the plan, the planning area covers only 270.08 sq km. None of the towns have been declared to be taken up as yet.

The master plans over the years have imagined a homogenized city that could be classified into clear land use zones. Residential land use has received the maximum share, though the share has been decreasing in percentage share over the plans. In comparison to the first plan, the allocation to transport and circulation was increased manifolds in the second plan from 5.84 per cent to 21.33 per cent, due to the establishment of the Northeast Frontier Railways in Maligaon. In the third plan, this allocation was again brought down to 10.39 per cent. The open spaces and recreation was proposed to be increased and given higher priority in the second plan in comparison to the first plan, though there has been very poor progress in this regard even in the third plan, where the percentage share was increased even more to cover 11 per cent of the planning area. Water bodies, hills and low lying lands were covered as undevelopable in the first two plans, but included as eco-sensitive / eco-friendly in the third master plan and brought under developable classification. The draft plan of 2015, ambitiously proposed to throw open the planning area of Guwahati to cover 3,471.08 sq km and including five districts. However, since the plan remains a draft, it has been discussed here only as an indication of the state's vision for the city in the future. The draft plan was proposed to cover 72 per cent of land use under the conservation zones, as the extended area would have covered reserved forests and hills of the neighboring districts. It also planned to allocate 4.88 per cent of the total planning area for open spaces and recreation, which is next in priority after residential land use which was allocated 14.2 per cent of the planning area.

4. URBAN CONTESTATIONS: PLANNED IMAGERY VERSUS ACTUAL CITY

The three notified master plans over the last fifty years provide an insight into the city's vision, which is rather an image of the city that Guwahati should develop into, rather than address the issues that Guwahati faces. The disassociation between the master plans and the city development is evident through numerous contestations in the city. An outcome of the increasing concentration of urban activities within the GMA is the degradation of the natural ecological sites. The Deepor beel, a wetland, natural lake and a channel of the Brahmaputra River



in Guwahati was originally recorded to have covered a surface area of 10 sq km perennially, extending to around 40 sq km during floods (Deka, 2016). It was designated as a Wildlife Bird Sanctuary in 1989 and a Ramsar site in 2002 (ibid). Since the beginning of the master plans in 1960s, the Deepor beel and its surrounding areas have been demarcated under the open public space or conservation zone in the master plans. In fact in the current master plan, the Deepor beel area and a contiguous zone along it has been demarcated as eco-sensitive zone. However, a railway track was built across the middle of the beel area by NF Railways during the 1990s, reducing it to nearly half its original expanse. The track disconnected the extended area of the Deepor beel, and converted it into a dry, low lying field, instead of acting as the reservoir of excess water during rainy season. Over time, the periphery of the Deepor beel has been encroached by institutional buildings, government offices, residential blocks, brick kilns, industries and godowns and is also the site of the GMC dumping ground. Currently, the Deepor beel covers only about 5 sq km of surface area. A case has been going on in the National Green Tribunal (East) regarding the railway track leading to numerous elephant deaths as well as the dumping ground of the city contaminating the Deepor beel.

Another contradiction in the plans and the actual city scape is the spread and development of residential land use. Residential use allocations have got the highest share within the planning area across the three master plans. However, this allocation is significantly reducing in each plan period. Plan allocation to residential land use has decreased from nearly 64 per cent in 1965 to 41.40 per cent in 1986 to 31.65 per cent in 2009, whereas the planning limit has remained more or less the same. The Urban and Regional Development Plan Formulation and Implementation (URDPFI) guidelines on planning in India by the Government of India suggests at least 45-50 per cent share to residential land use in cities with population density similar to Guwahati's⁹ (URDPFI,2014: 158). However, soaring real estate pricing, population increase and the economic growth of the city have led to construction across areas previously demarcated as unusable due to their terrain. Hills and reserved forest areas are increasingly encroached or transacted informally for residential purposes. The existing land use map prepared for the Guwahati (Figure - 3) depicts the spread of residential use across the city. The master plans have not dealt with residential aspect of the city in its entirety - issues of affordable middle-income and low-income housing, slum and informal housing, rental housing, etc., remain largely unaddressed in the master plan as well as policy regime of the state. Thus, a study by Desai and Mahadevia (2013) has shown the existence of large scale poor and unhygienic informal and rental accommodations across Guwahati. The study also deals in detail about the informal occupation of railway lands, reserved state government land, as well

⁹ *Guwahati's population density is taken to be 44 persons per hectare as per Census 2011 population size and GMC boundary of 216.79 sq km.*



as informal sub-division of agricultural lands classifying the modes of citizens' access to housing in the city. Such development can be also attributed to the disaggregated governance of land. The revenue department is the custodian of all land in the state, but the revenue department does not look at land as urban and rural like in the master plan - rather its focus is on land ownership as either private or public. On the other hand, the Assam Government land policy, 1989, allows encroachment on government land. On fulfilling citizenship eligibility and payment of premium, individuals can register occupied government land as private land. There are also provisions of short-term tenure for individuals housing on government land which get self-renewed on term expiry. Cities across India suffer from this contradictory role of the revenue and urban administrations.

A distinguishing feature in the land use zonation of the first two master plans of Guwahati was the segregation of the planning area into developable and non-developable zones. The non-developable areas were aimed at conserving the green zones in cities, like rivers, wetlands, hills and forests by controlling development in these zones. Nearly 46.60 per cent was allocated to green belt and water bodies in 1965; while in 1986 plan, nearly 15.47 per cent to green belt, 17.77 per cent to water bodies and hills other than keeping a small percentage to open spaces and recreation in both the plans. In the first two plans, the green belt, water bodies and forests / hills areas were not assigned for any large permanent built-up. Some temporary built-up could be established having 25-40 per cent coverage area, with controlled height (Town and Country Planning Department, 1986:128-129). However, in the Master Plan of 2009, the non-developable area concept was discarded (GMDA, 2009:2). In its place, green belt was reconfigured to include more permanent uses and structures like motels, planetarium, restaurants, stadiums, training institutes, etc., while new conservation concepts of 'eco - sensitive and eco-friendly' zone was introduced where private housing could be established. Although some developments were allowed in the green-belt zone in the earlier master plans, no land use activities were assigned to the hills and water bodies, keeping them completely without development. In the 2009 Master Plan, the concept of 'Eco - sensitive zone' was introduced to include the city's hills and forests, the rivers Brahmaputra and Bharalu, the natural water bodies, which require protection from any further development. However, as per the land use index in the Master Plan of 2009, the eco - sensitive zone can be developed as golf course, monuments, government facilities, etc. It is also to be considered that in the previous master plans, the green belt zone completely prohibited parcelling out of land for urban housing. However, the eco-friendly¹⁰ zone introduced in this plan allowed farm-houses,

¹⁰ Although the eco-friendly zone is not defined in the Master Plan of 2009, yet its uses are considered to be separate from eco - sensitive zones. To take up development in this zone, integrated land development proposal needs to be submitted with Environmental Impact Assessment (EIA) clearance from competent authority. It also places a bar on maximum coverage at 33 per cent and floor area ration (FAR) of 150.



bungalow type development, Assam-type low income housing and integrated townships. Thus, although in its nomenclature land seems to be considered for conservation, but in practice, more land was brought under private usage than before.

5. ISSUES IN IMPLEMENTING THE MASTER PLANS

The implementation of the Master Plan can be undertaken in two ways. Firstly by declaring scheme areas for taking up specific projects and secondly, for providing land use, land sale / transfer and building permits. In Guwahati, implementation of Master Plan has come to encompass a regime of permissions. In fact, the revenue generation from land use and land sale permissions is the highest in GMDA, thus almost all of its energy is consumed in this function. Taking up projects through scheme area declaration has not been taken up since many years in Guwahati. The issues in plan implementation in Guwahati can be understood in the following sub-sections.

5.1 Land Authority is Disaggregated

As discussed in the AIIMS case earlier, the authority over land and urban development rests upon different agencies. The master plans are dependent on cadastral maps prepared by the revenue administration. The revenue department prepares the cadastral maps which provide the plot-level tenure details of each village and ward under the revenue circle. Guwahati has six revenue circles out of which five comprise the GMA. The changes taking place on the ground are not regularly updated in the cadastral maps, as it involves a very long-drawn and expensive survey and mapping exercise. Thus, information remains fragmented. On the other hand, GMDA prepares the Master Plan which forecasts the future development and land use within the GMA, and prepares the requisite land use maps. Both the departments work independent of each other while preparing their respective maps. This disaggregation lies at the core of the failure of formulating comprehensive land use plans, which can be successfully implemented on the ground. Master plans are prepared on the basis of cadastral maps, prepared mostly during the pre-independence period, which have been updated mostly up till the 1960s in Assam. As a result, the master plans prepared already become out dated before they are published by the government.

Another core issue impeding comprehensive and relevant master plans is the lack of coordination between different departments building physical infrastructure within the planning area. Railway, public works, power, public health and engineering are some of the major departments whose contribution to the master Plan at the district level remains weak or non-existent. This in turn, makes the Master Plan irrelevant to these departments. In effect, urban development remains piecemeal and contested.



5.2 Shifting Authorities for Permissions

Physical development over the city is controlled through an array of permissions. Construction of new buildings, changes in existing structures, use of a particular plot of land permission as well as land purchase are all controlled through permissions. The Guwahati Building Byelaws were formulated in 2006 to streamline the permissions to be provided on the basis of the Master Plan. Initially, the Building Bye-laws were implemented by both GMC and GMDA for over-lapping areas. This created inconsistencies in providing permissions. Discussions with town planners revealed that permissions denied in one authority were being acquired from the other through negotiations. There were examples where a single building had received permissions from both the authorities for different floors. This created a lack of accountability over the city's built-up landscape. It was only in 2014 that the Guwahati Byelaws were revised and the authority to provide permissions was streamlined. The new byelaws mandate that planning permission will be provided by the GMDA, while the building permission will be provided by the ULBs. This however, included eight Gaon *Panchayats* in providing building permissions outside the municipal boundaries of Guwahati and North Guwahati, but falling within the metropolitan planning limits. This fragmented authority of governance has diluted control over the development in the city.

5.3 Pressure on Current Technical Staff

The town planner is a crucial member of the planning process. Before providing the permissions, both GMDA and GMC have to undertake the following verifications - appropriate zone, road width, floor area ration (FAR), coverage, height of building, parking norms, layout, external space, etc., as per the Master Plan and Zoning Regulations, Acts, Rules and Byelaws. Thereafter, with the recommendation from the town planner, the permit / modification is issued. As the technical expert, town planner is ascribed with the accountability of the decisions made by these agencies. However, both GMC and GMDA essentially have only one town planner each to supervise their entire verification processes. In GMC, the town planner is supported by eight zonal engineers, while in GMDA, six site engineers undertake the field operations for supporting the town planner's recommendation. The *Panchayats* on the other hand lack strength of technical staff for giving permissions.

5.4 Ad Hoc Developmental Projects

Urban Renewal Programs of the Central Government have overshadowed the master plans since the early 2000s. The array of schemes proposed for strengthening urban infrastructure and amenities as well as provide affordable housing have demanded for updated land use maps and status quo of cities. Due to reasons stated earlier like outdated land records and weak enforcement mechanisms, the master plans have been sidelined and new city-level plans have been introduced. City Development Plan under JNNURM, Slum-free City Plan of



Action under Rajiv Awas Yojna and PMAY-U, technically-upgraded Master Plan under AMRUT, Smart City plan, etc., have been undertaken for Guwahati as a mission city under each of these schemes.

In spite of formulating city-level plans under each program, implementation of projects under these programs have remained ad hoc, and marred by the lack of a comprehensive land use plan and land inventory of the city. The proposals made on the basis of these plans are taken up on piece meal basis, on any land made available by the Government. In Guwahati, under the BSUP component of JNNURM, housing projects were undertaken only in the government-owned sweeper colonies. Under Rajiv Awas Yojna, no project could take off. Even under AMRUT's parks development concept, Guwahati is struggling to allocate appropriate sites.

6. CONCLUSIONS

In Guwahati, the Master Plan implementation is only evident in its regulatory nature. The Master Plan is used to streamline and inform building and planning permissions and land sales. It has not been used to facilitate the development of the city, which is the original intent of master planning. This poses questions on the future of plan-making for city development for the future. In India, there is no other urban plan which is as comprehensive as the Master Plan can be. It brings together all the aspects of the city, like, land use, transport, environmental conservation, disaster planning, housing and other basic infrastructure and services, etc., with the authority of informing other plans and programs. The URDPFI guidelines by the Government of India released in 2014 has streamlined the planning process to ensure inclusive and comprehensive planning processes. However, for master plans to remain relevant in urban planning, it is important to address the issues of disaggregated governance and technical finesse in data collection. The land ownership inventory and topographical information must be reflected in the base map of the master plans. To ensure this, the urban departments must work in coordination with the revenue department. The interdependence of the land authority with the urban development authorities will bring about a more comprehensive stand-point for decision-making in terms of physical development and environmental conservation. In terms of data collection, master plans must judiciously use GIS mapping techniques and drone surveys, along with updating cadastral data with the revenue circle offices. Again in terms of implementation, online permissions have been already initiated in both GMC and GMDA. This shall ensure non-duplicity of applications and faster and transparent processing of approvals. Guwahati is heralding the formation of the state capital region following the NCR Delhi model. The Assam State Capital Region Development Authority (ASCRDA) has been notified by the State Government in October 2017. It is estimated to encapsulate an area covering surrounding districts as proposed in the draft plan for Guwahati in 2015. In such



a scenario, master planning will play a crucial role in providing a framework for land, urban built-up and overall governance of the largest urban agglomeration of northeast India.

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Sustainable Management of Construction and Demolition Waste in Cities of India

Santosh Kumar

Abstract

Construction and Demolition waste (CDW) is a grave concern for most developing countries with a harmful impact on the environment (increased pollution, land deterioration and resource depletion), society and economy. Therefore, management of CDW assumes prime importance; with the potential to reduce environmental pollution as well as contributing to sustainable consumption of resources in the construction sector by decreasing reliance on mining of primary raw materials. This objective of this review article is an attempt to offer insights into the management practices of CDW along with the issues and challenges of sustainable management of CDW in India. The data collection strategy includes a thorough review of all CDW related academic papers, official reports and statistics, and Government legislation. The key findings of this study will contribute substantial evidences to both academicians and practitioners towards better management and planning of policies for CDW.

1. INTRODUCTION

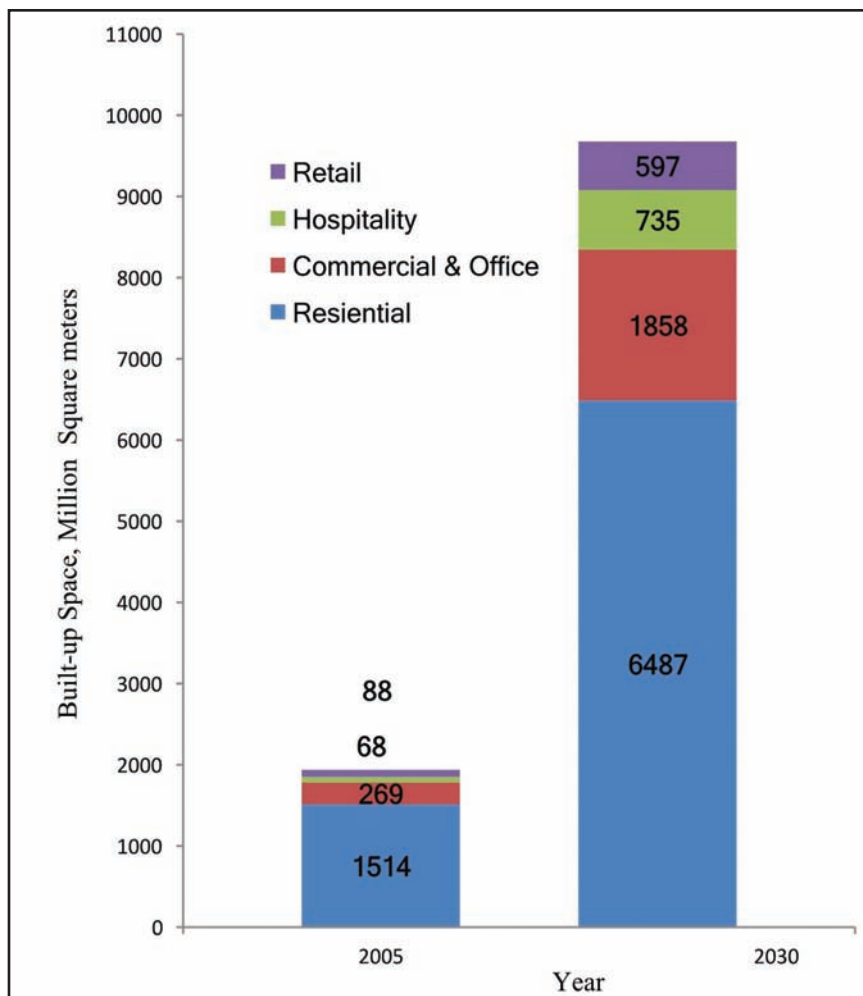
As per Construction and Demolition waste Management Rules, 2016, Construction and Demolition (CDW) means, the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure. It poses a significant threat to the environment and its adverse impacts include waste generation, increased pollution, land deterioration and resource depletion (Lu and Tam, 2013). C&D waste constitutes about 10 to 30 per cent of the total solid waste being generated in any society (Li and Zhang, 2013). A significant proportion of the CDW stream is inert and can be reused / recycled if properly managed (Rao et al., 2007). The contribution of construction industry in India is 7% of GDP in 2014 and it is growing at an annual growth rate of 10% over the last 10 years as against the world average of 5.5% per annum. Investments of one trillion USD were projected during 2012-17 towards infrastructure development (KPMG, 2014). A significant quantity of CDW is expected to be generated in India due to rapid urbanization projected in the Indian cities. Currently, 377 million people live 7,935 towns and cities (an increase from 5,161 in 2001) across the country which constitutes about 31.2 % of the total population and expected to rise 600 million by 2031 and almost 70% of the buildings likely to stand in India by 2030 have not been built yet (Make in India, 2016). Urban population is expected to be equal to rural population by the year 2039 (Ministry of Housing and Poverty Alleviation, 2011). It is estimated that by 2030, India will have 68 metropolitan

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cities, 13 cities with more than 4 million people and 6 mega cities with populations of 10 million or more (Mckinsey Global Institute, 2010).

This trend of urban population growth will increase the need for buildings, especially residential housing across all classes of towns. The current urban affordable housing deficit already stands at 18.78 million units (Ministry of Housing and Urban Poverty Alleviation, 2012), and is expected to reach 38 million units by 2030 (Mckinsey Global Institute, 2010). The overall residential built-up demand in 2030 is expected to increase

Fig. 1: Built-up Area Projection in India



Source: Climate Work Foundation India, 2010

over four fold from 2005 as shown in Figure 1. Large scale urbanization, urbanization rate and building construction and demolition activities will be the responsible factors for generation of large volume of CDW in the next several decades.

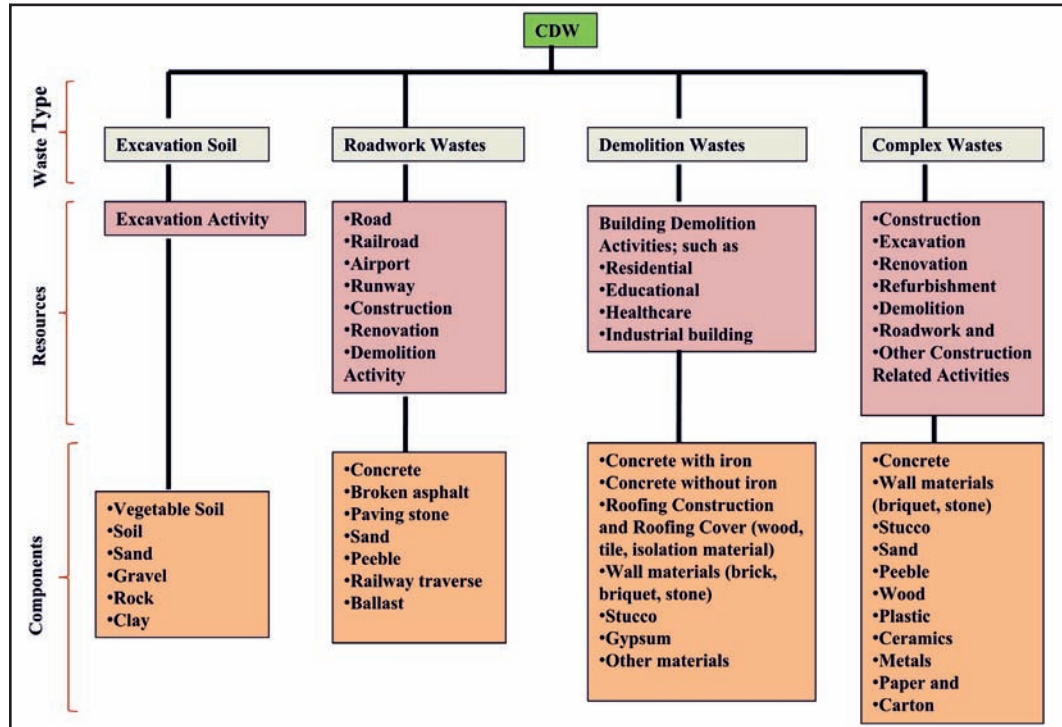
2. DATA COLLECTION AND METHODOLOGY

The objective of this review article is an attempt to offer insights into the management practices of CDW along with the issues, challenges and opportunity, best practices and way forward for sustainable management of CDW in India. The data collection strategy completely relies on secondary data through a review of all CDW related academic research papers, official reports and statistics and Government legislation.



3. CDW GENERATED FROM DIFFERENT TYPES OF SOURCES

Fig. 2: Composition of CDW



Source: CSE, Report, 2014

4. WHY DOES CDW NEED TO BE MANAGED?

In India, unauthorized and improper disposal is typically the norm leading to myriad problems. Moreover the resource potential of CDW is lost without recycling. The improperly managed CDW heaps impacts urban and natural environment in multiple ways which could broadly be classified into the following categories.

4.1 Social

- Huge heaps of CDW on footpaths, carries ways, alleys, etc.; is a common scene in Indian cities turning the surrounding neighborhood unaesthetic.
- C&D debris is bulky and usually cannot be removed by normal street sweeping or household waste collection staff as they usually do not carry the equipment neither enough capacity in the collection vehicle nor enough manpower.
- Local people often tend to dump municipal solid waste on the CDW heap making it a mix of waste further creating an unsanitary situation.
- CDW is also stealthily dumped in open drains and water channels. The debris clogs the drains and creates water logging during rains. Reports of water



logging of drains running to a source of disease epidemics are common in India.

- CDW dumped on streets and footpaths block traffic and pedestrians, frequently contributing to traffic congestion and even accidents.
- CDW can include hazardous substances such as sharps, broken glass boulders, broken wooden logs, rusted metal, broken ceramics, etc.; which creates a hazardous environment when dumped on unfenced open places.

4.2 Environmental

- C&D debris over course of time forms fine dust creating air pollution and reducing visibility.
- Dumping of CDW in wetlands water channels and riverbeds disrupts the hydrology and destroys the aquatic ecosystem.
- The leachate and fine chemical particles from CDW dumps degrade the soil leading to land and groundwater pollution. Hazardous components such as heavy metals, paints, oils, asbestos sheets and persistent organic pollutants exist in CDW during the demolition of chemical industry (electroplating factory), metallurgical industry (zinc smelting plant steel plant), light industry, processing enterprises, pesticide industry, fire explosion disaster sites. Once they become CDW and the concentrations of hazardous substances exceed a certain value, they will be the source of contamination. On one hand, such contaminated wastes may bring potential environmental risks to the atmospheric and subsurface system, volatilizing in to the air, accumulating in topsoil, and contaminating ground water when disposed of in unprotected landfills or randomly stacked over time. On the other hand, for every small fraction (approximately 5%) of CDW that flow in to the renewable building material industry, scarcely any environmental benign processes have been utilized because only the physical properties of the products are focused on (Youcai and Sheng, 2016). According to investigations carried out early on in the US, It was shown that 0.4% of the construction waste by weight disposed of in landfills is hazardous waste (USEPA, 1995).
- The four common environmental impacts from construction and demolition activity that may affect to its surroundings are dust, noise, smoke and odour through fugitive emission (CPCB, 2017).

4.3 Economical

- CDW usually gets mixed up with other municipal solid waste during the process of transfer or at the collection site. Once mixed with MSW, CDW is very difficult to segregate. The results in increased processing cost and reduced efficiency.

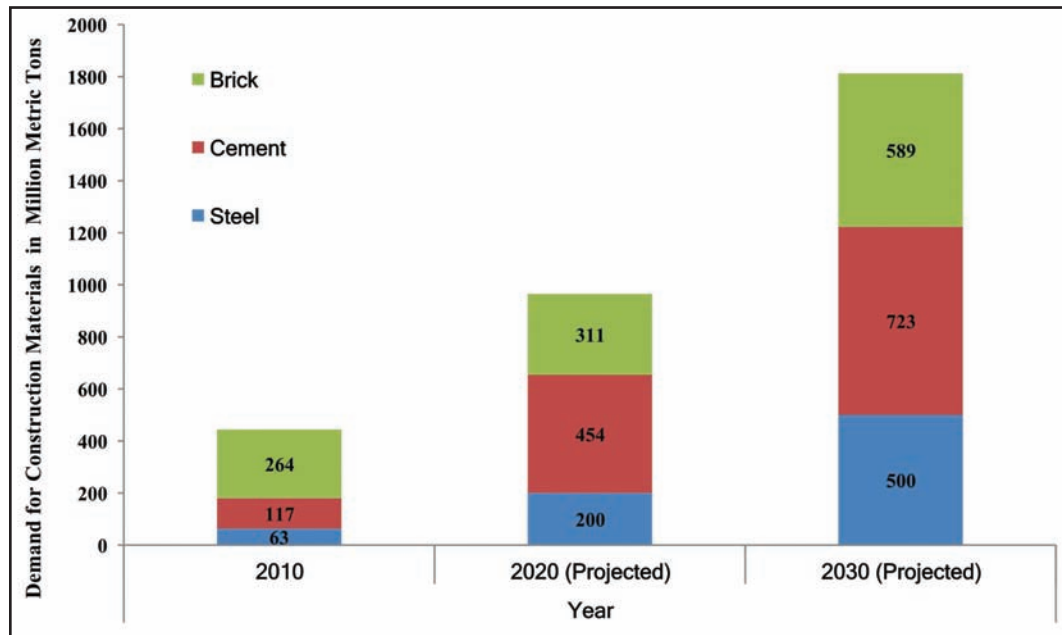


- CDW disposal imposes significant costs on local government agencies including costs of cleaning drains choked with CDW.
- The huge volume of CDW fills up landfills and dump-yards resulting in opening of more landfills or alternative dump sites.

4.4 Resource Shortage

India is witnessing a construction boom due to rapid urbanization which is leading to high rates of exploitation of primary resources for construction materials. For instance, almost 100% of cement and bricks, 40-60% of steel, 85% of paints, and 70% of glass produced in India goes in to the construction sector (Toolkit for CDW, 2017). The demand for construction materials are also increasing very steeply (Figure 3). Sand, soil, stone and limestone are critical resources used in the sector that are already facing supply disruptions and price spikes due to mining bans and restrictions. Annual turnover from illegal sand mining estimated to be INR10 billion. Therefore, use of secondary materials need to be produced to supplement the use of primary materials and recycled CDW is one of the best available options.

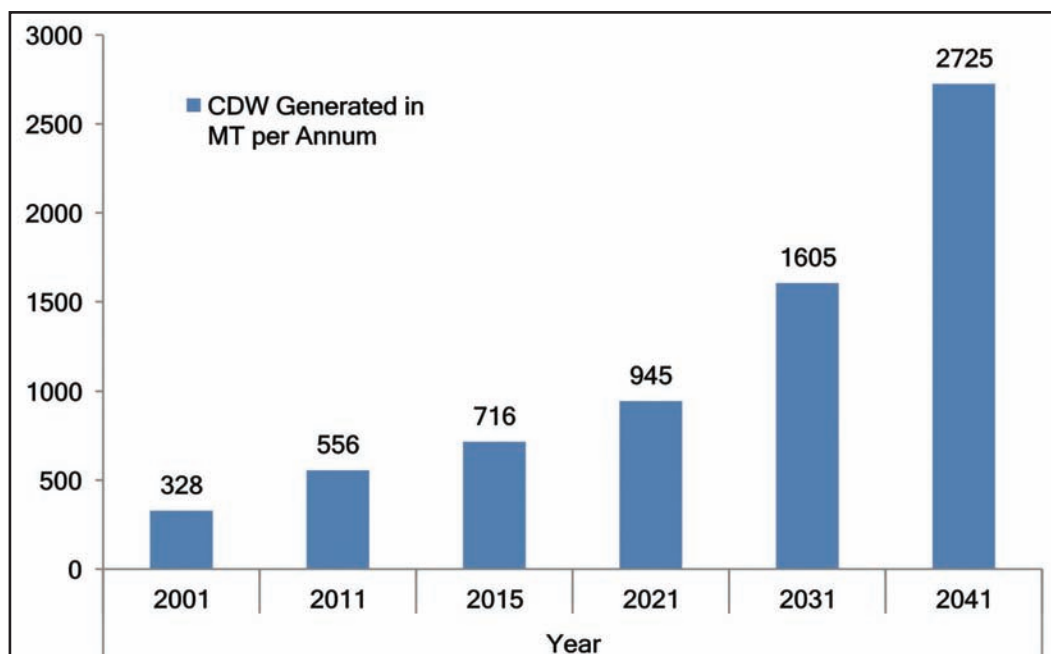
Fig. 3: Demand for Construction Materials



Source: European Union-Resource Efficiency Initiatives (EU-REI), 2017

4.5 Increasing quantity of CDW:

Literature survey also indicated that the quantum and composition of CDW is project specific and it varies accordingly. 10-15 MT (Million Ton) per year from MoUD (2000), 12-15 MT per year by TIFAC (2001), 10-12 MT per year by MoEF (2010), 12 MT per year by CPCB, 165-175 MT per year between (2005-

Fig. 4: Projected Estimate for CDW Generation in MT Per Annum


Source: Federal Ministry for the Environment, Nature conservation, Building and Nuclear Safety, Germany 2015

13). Based on thumb rules of TIFAC, the Center For Science and Environment (CSE) estimated total CDW waste generation in India at 530 MT (CSE, 2014). Per capita CDW generation was estimated at 10 kg per annum (CSE, 2013). The current study estimates the annual CDW generation to be 716 MT. Extrapolating data as per expected urban population growth, it would appear that India will generate approximately 2.7 billion tones of CDW by 2041 (Figure 4). It is estimated that 8% of the CDW come from new constructions, 44% from renewal activities, and 38% from demolition interventions (Altunku and Kasapseckin, 2011).

4.6 No Reuse and Recycling

CDW can be recycled and reused for multiple purposes depending on the composition and characteristics of the waste. The typical composition of waste CDW in India, Delhi and Coimbatore are shown in Figure 4. Although the major portion i.e. 90% of CDW is either recyclable or reusable (TIFAC, 2001) but in cities of India this potential of CDW has not been efficiently utilized yet. Reuse and recycling of waste has been promoted in Schedule I, II and III of Construction and Demolition Waste Management Rules, 2016. Recycling of CDW is important as it helps to reduce the dependence on natural resources and eliminates adverse environmental impacts. Recycling of CDW has the additional advantages of controlling the quantum of CDW

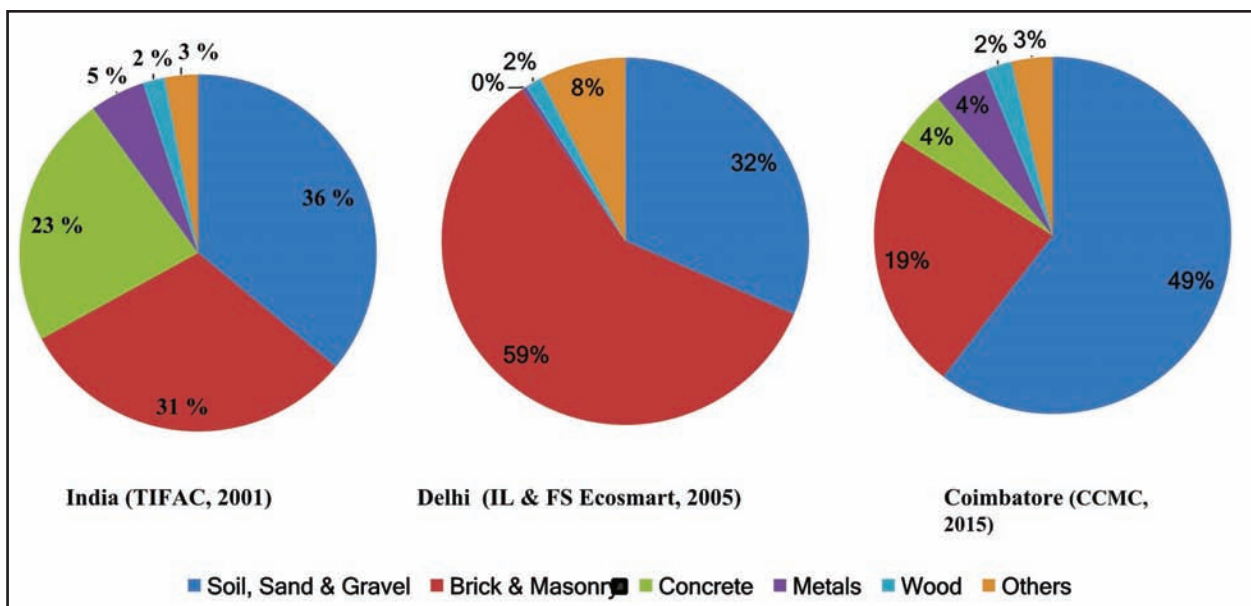


destined for disposal at landfills besides reducing transportation costs. When opportunities for reuse or salvage are exhausted, recycling is the next level. CDW materials that can be recycled include acoustical ceiling tiles asphalt shingles, carpets, concrete, drywall, fluorescent lights, land clearing debris (vegetation, stumpage, dirt), metals and metal alloys, structural steel, plastic film (sheeting, packaging), glass, wood, carpet, floor mats, flooring, cellulose insulation, ceiling tile, ceramic / porcelain tile, concrete masonry units, countertop, ductwork, fences / posts, fibre board, fibre glass, insulation, pilings, roofing, structural steel, wallboard, asphalt, concrete, drainage or backfill aggregate etc. (CPCB,2017)

The list of reuse and salvage materials include appliances, bathroom fixtures, bricks, blocks, masonry stone, structural steel, cabinets, carpeting, ceiling tiles, timber and timber based boards, door and window frames and shutters, flooring tiles, stone tiles / platforms, insulation, landscaping materials, lighting fixtures, metal framing including for partitions and ceiling, paneling, pipes, antique moldings, accessories and hardware of furniture, PVC water tanks, roofing sheets used for garages, outdoor areas, fabric of tensile structures, etc. (CPCB,2017). The major applications of CDW are:

- **Granular Sub-Base (GSB)** - Crushed CDW can be used as GSB layer for road construction, regardless of the type of construction. The granular sub-base layer is formed by piling and compacting CDW aggregates of different sizes

Fig. 5: Different CDW Characterization Studies in India



Source: TIFAC, 2001; IL&FS Ecosmart, 2005; CCMC, 2015



one over other directly below the pavement surface. This acts as the load bearing and strengthening component of the pavement structure; in addition, it provides drainage for the pavement structure and protects the structure from frost.

- **Recycled Concrete Aggregates (RCA)** - Pure concrete waste can be recycled to make aggregates of different standard sizes to replace natural aggregates in construction processes. According to Bureau of Indian Standard, RCA can be used in any kind of structural and non-structural applications.
- **Recycled Aggregates (RA)** - Crushed aggregates of standard size made from a mix of CDW materials is termed as Recycled Aggregates (RA). RA can be used for partial replacement of natural aggregates for construction of non-load bearing structures. According to Bureau of Indian standard, it can replace 20% natural aggregates in plain cement concrete and up to 30% natural aggregates in road construction but only if backed up by proven laboratory test results. RA can also be used for construction of pre-fabricated moulded structures like paver blocks, kerb stones, etc.
- **Manufactured Sand (M-Sand)** - Manufactured sand is also produced by crushing of CDW, and the finer particle fraction can be used to replace natural sand in construction of non-load bearing structures. According to Bureau of Indian Standard, only materials of sieve size between 0.075 mm - 4.750 mm is considered classified as M-sand and particles less than 0.075 mm are classified as dust particles, suitable only for daily cover for MSW.
- **Smelting** - Scrap metal recovered from CDW is melted through smelting process and recycled to make new products.
- **Backfilling** - The most common particle for CDW use in India is as a backfilling material. It is dumped in pits, trenches, etc.; and compacted for backfilling or used to increase elevation or to make top layer of surface for construction.
- **Direct reuse of valuables** - Materials of high reuse value like wood frames, unbroken bricks and ceramics are already widely recovered and sold in the secondary market. These are typically used for construction of temporary structures but if treated properly could be used for permanent structure as well.
- **Other applications** - CDW is also used in other minor applications like carrier materials in preparing fertilizers, filler material in roofing construction, wall decorative hips, etc.

**Table 1: Generation of CDW: An exemplification in 2013**

TIFAC* Thumb Rule	Activity	Assumption	Generation of CDW (2013)
40 - 60 kg/sqm	Construction	Take 50 kg/sqm (1 Billion sqm)	50 MT
300 - 500 kg/ sqm	Demolition	Take 400 kg/sqm & assume 5% of existing building stock get demolished	288 MT
40 - 50 kg/sqm	Repair/ Remodeling	Take 45 kg/sqm & assume 33% of existing building stock underwent some sort of repair or renovation	193 MT
Total			531 MT

*TIFAC (Technology Information, Forecasting and Assessment Council)

5. CURRENT ISSUES

5.1 CDW Generation in India: Gross Underestimation

The Union Ministry of Forests and Environment & Climate Change (MoEF & CC) has confessed there is no systematic database on CDW. As per the estimates of Center for Science and Environment (CSE-2014), since 2005, India has newly constructed 5.75 billion sqm of additional floor space with almost one billion sq m in 2013 itself. Thus, the total C&D waste generated in India just by buildings in one year -2013 - amounts to a humongous 531 MT, 44 times higher than the official estimate. Imagine the scenario if the waste generated by infrastructure projects such as roads and dams is added (Table 1). Not surprisingly, in India, if CDW is quantified, it will be more than all the other types of solid waste put together.

Where is all this CDW going? A lot of it is being used by land sharks to illegally fill up water bodies and wetlands around urban centers for real estate development. The rest is just being dumped in to rivers and open spaces.

A gross underestimation of CDW generation in some earlier studies in India has also been highlighted. Many studies on estimating CDW generation are available in literature (Table 2), and reported values ranges from 110 kg per capita per year in Taiwan to 842 kg per capita per year. CDW generation in India is reported to be 10 to 12 million tones annually (MOEF&CC, 2010). It comes out around 8.29 to 9.95 kg per capita per year. Also the value quoted by TIFAC for construction activities are within the range of values reported in the literature (17-158 kg m⁻²). However, the quoted waste generation rates for demolition activities in India is less as compared with demolition waste generation rates reported in the literature from other countries (910-1636 kg m⁻²). Thus, reliable estimate

Table 2: Review of Studies on Waste Generation Rates in Literature

Region/ Country	Author	Waste generation				Year of data
		Million Ton per year	Kg per capita per year	Kg per Sq.meter (C)	Kg per Sq.meter (D)	
Brazil	Paz and Lafayeate (2016)	NA	NA	97	NA	2013
China	Lu et al. (2016)	1130	NA	NA	NA	2014
Florida, USA	Cochran et al. (2007)	3.75	471	43.7	910	2003
Galicia, Spain	Lage et al. (2010)	2.2	800	80	1350	2011
Greece	Fatta et al. (2003)	2.09	181	NA	NA	2000
Hong Kong	Poon et al. (2004)	NA	NA	0.14 to 0.20 [^]	NA	2004
Kuwait	Kartam et al. (2004)	1.6	800	45	1450	2002
Lisbon, Portugal	De Melo et al. (2011)	1.13	400	158	NA	2007
	Bernardo et al. (2016)	0.564	NA	NA	1050 to 3591	2012
Malaysia	Mah et al. (2016)	NA	NA	32.9 to 98.8	1042.8	2016
Norway	Al-sari et al. (2012)	1.25	NA	30.77	NA	2002
Palestine	Coelho and de Brito (2011)	NA	NA	17 to 81	1265	2012
Portugal	Seo and Hwang (1999)	1.97	186	114.3	NA	2008
Seol, korea	Ding and Xiao (2014)	6.44	NA	NA	1116 to 1634	1994
Shanghai, China	Li et al. (2013)	13.71	842	NA	NA	2012
Shenzhen China	Rexiach et al. (2000)	NA	NA	40.7	1635.97	2013
Spain	Malia et al. (2013)	NA	NA	114.47	NA	2000
	Saez et al. (2014)	NA	NA	NA	NA	NA
	Solis-Guzman et al. (2009)	NA	NA	117.5	1.27	2014
	Llatas (2011)	NA	NA	0.14 [^]	NA	2009
	Moyano and Agudo (2013)	NA	NA	80	NA	2011
Taiwan	Hsiao et al. (2003)	2.4	110	NA	NA	2013
Thailand	Kofoworola and Gheewala (2009)	1.1	18	21.38	NA	2005
USA	United State Environmental Protection Agency (2009)	170	530	NA	NA	2003

[^] Values are in cubic meter per square meter

C: Construction; D: Demolition



of CDW generation is not available in India. As a result, the policies that address CDW management in India are inadequate. Hence, it is recommended that during the process of issuing development permits by Government Agencies, the documentation is to be revised to include building details, such as the type of structural and roofing systems; materials used, total floor area and intended usage (residential, commercial and industrial). Collecting details of waste generation, such as type, quantity and plans for managing them, is also recommended. An updated database can facilitate urban planners and policy makers in devising effective strategies for sustainable management of CDW.

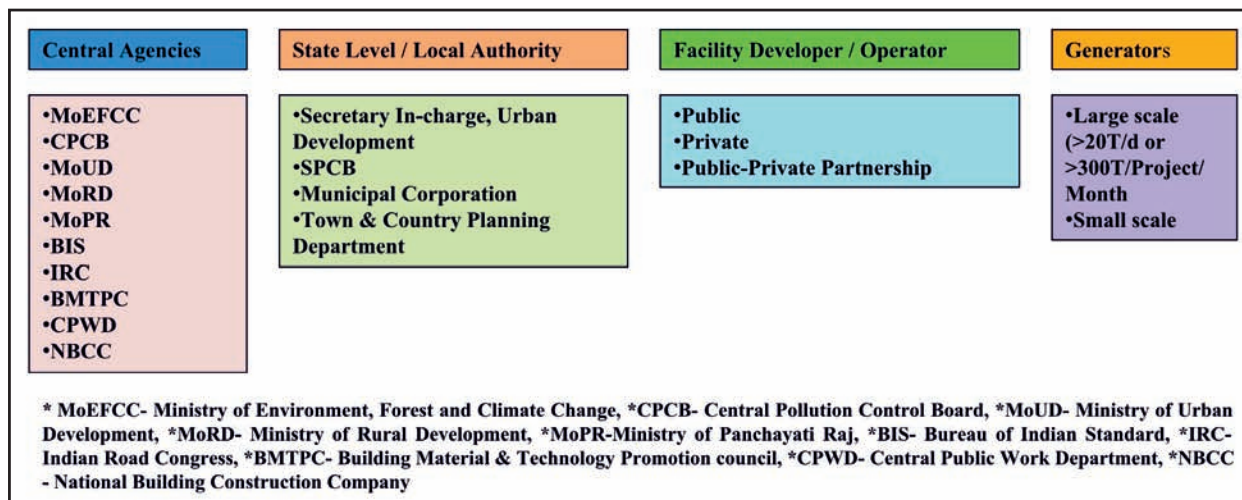
5.2 Sand Mining Ban Due to Environmental Concern Results in Building Material Crisis.

Indiscriminate mining of sand and other minor minerals has caused extensive damage to the environment, scarred rivers, made many areas susceptible to floods, and destroyed the crucial recharge zones. The Supreme Court in February 2012, ruled that approval under the 2006 Environment Impact Assessment (EIA) notification is needed for all sand mining and gravel collection activities, even if the area being mined is less than 5 hectares (12.5 acres). Then in May of 2012, the (MoEF & CC) issued an order mandating compliance with the Supreme Court's February 2012 judgment and directing that permissions must come from the respective State Environment Impact Assessment Authorities (SEIAA) constituted under the 2006 EIA notification. On August 5, 2013 the National Green Tribunal (NGT) declared sand mining without environmental clearance illegal. However, the concern for a deteriorating environment is being seen in the context of a growing shortage of these materials. The Union Ministry of Housing and Urban Poverty Alleviation had told the Rajya Sabha in 2012 about the shortage of building material, especially for aggregates and concrete owing to mining bans / restrictions on environmental grounds. The shortage has been so severe that several civic projects in India are facing delays. This is aggravating the housing crisis and affecting the construction of roads, bridges, canals, etc. If the sand mining and other naturally sourced materials have to be restricted and regulated, other strategies must be put in place to reduce demand.

6. CDW MANAGEMENT POLICY IN INDIA

Prior to 2016, responsibilities for CDW management were included under the Municipal Solid Waste (Management and Handling) Rules 2000, notified by the erstwhile Ministry of Environment and Forests. After reviewing the existing rules, the Ministry considered it necessary to make separate rules in 2016 for the management of CDW in order to give thrust to

Fig. 6: Stakeholders Involved in the Implementation of CDW Management



Source: CDW Management Rule 2016 & Guidelines on Environmental Management of CDW

segregation, recovery, reuse and recycling as well as to emphasize roles and accountability of waste generators and other stakeholders related to waste management. According to the new rules, various stakeholders involved in CDW generation (Figure 6) and various assigned specific responsibilities and their activity interrelationship has been indicated in Figure 7. Local government entities are designated to play a key role in organizing CDW management in their jurisdiction and targets / time lines have been set for implementation.

6.1 Schedules

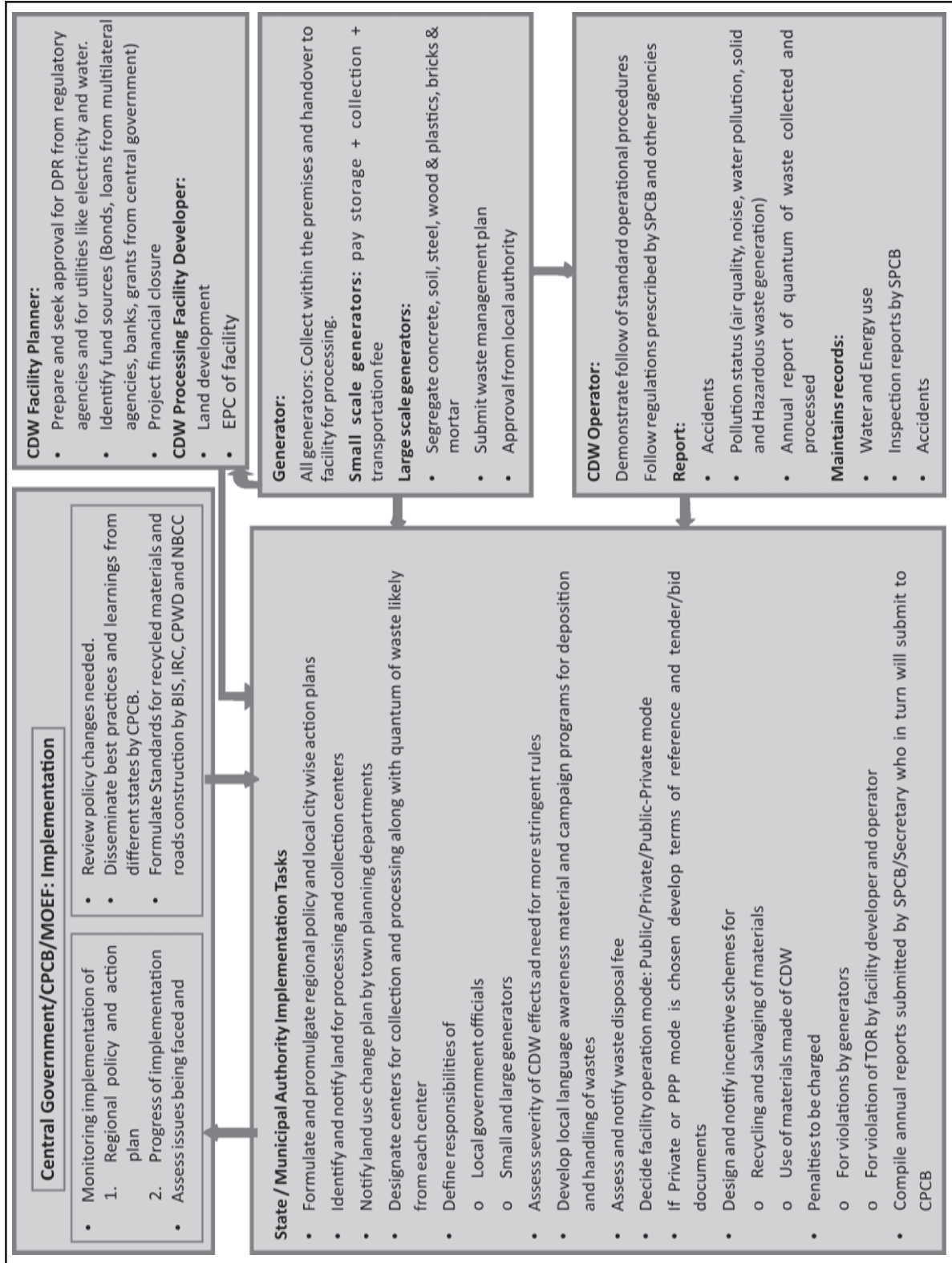
There are 3 schedules in the rules:

Schedule I: It defines criteria for the site selection for Storage and Processing facilities of CDW.

The schedule describes the administrative route (Fig. 8) through which suitable sites for storage and processing of CDW will be selected and handed over to operators of the processing facility. It also mentions the site compliance criteria for the processing facility. After the land is handed over to operator of the facility it has to be developed in accordance with the compliance criteria set in the rules. These criteria focus largely on abatement of pollution (air, water and noise), and smooth movement of vehicles during operation of the processing facility. It is the responsibility of the local authority to monitor the compliance of these criteria in consultation with the State Pollution Control Boards.

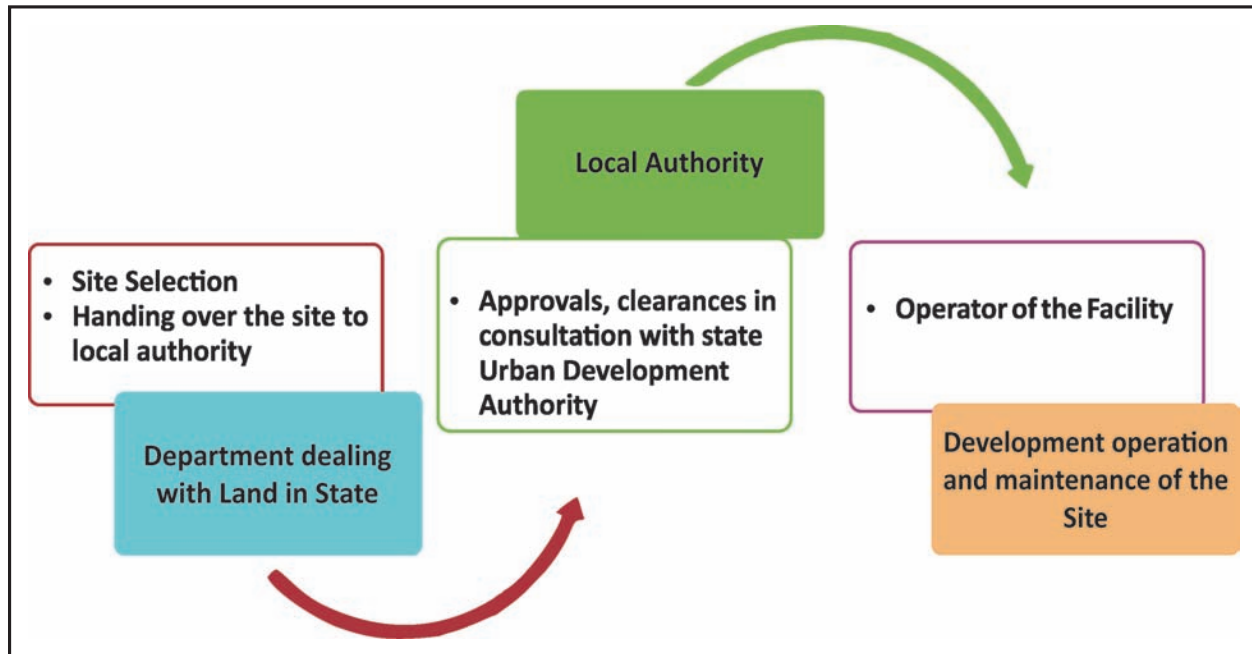


Fig 7: Activity Interrelationship for Implementation of CDW Management Rule, 2016



Source: CDW Management Rule, 2016

Fig. 8: Administrative Process for Site Selection and Handover to Operator of Facility



Source: Construction and Demolition waste management Rule 2016

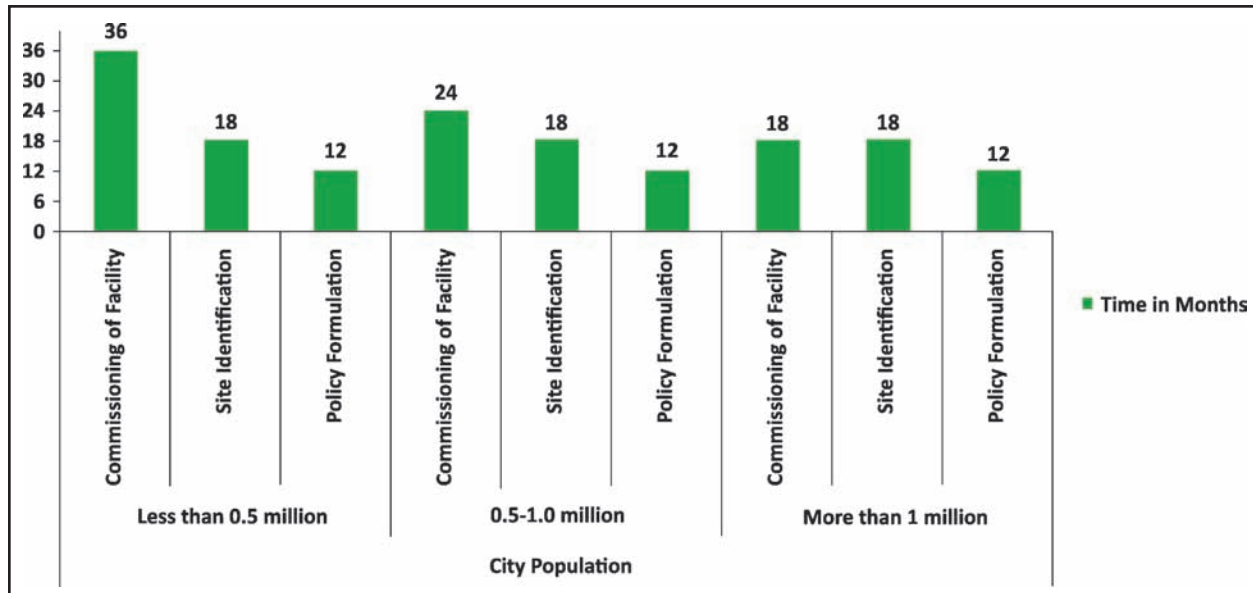
Schedule II: It defines parameters for application and compliance criteria of materials made from CDW in a sanitary landfill. The schedule mentions use of processed CDW in 3 ways at a sanitary landfill.

- Drainage Layer (leachate collection, top cover system) and capping
 - Crushed and graded stone or concrete material between 2 mm - 4.75 mm standard sieve size
- Daily Cover
 - Fines from processed CDW with sizes up to 2 mm;
 - Mandatory to use CDW if available;
 - Fresh soil except soil excavated during landfill construction shall not be used
- Civil Construction
 - Non structural applications such as kerb stones, paving blocks, etc., made with CDW can be used

Schedule III: It defines time line for planning and implementation of CDW Rules. The time line is effective from date of notification of the CDW Rules, i.e. 29th March 2016. The Figure 9 provides the time lines of completion of compliance criteria by cities mentioned in the Rules.



Fig. 9: Timeline for Planning and Implementation of Rules



Source: Construction and Demolition waste management Rule 2016

6.2 Forms

The rules prescribe five forms with fixed formats (Table 3) for the purpose of obtaining authorization for processing facilities, annual reports and accident reporting.

7. CHALLENGES IN CDW MANAGEMENT IN INDIA

Effective management of CDW is hampered by several challenges like:

7.1 Regulatory Challenges

CDW management is still a new area for Urban Local Bodies in India and the following challenges exist for implementation of the Rules.

7.1.1 Estimation and Characterization of CDW:

Estimation and characterization of CDW is the basic challenge faced by Urban Local Bodies since there are no monitoring mechanisms available with most Urban Local Bodies in India. The unorganized and unaccounted demolition and transportation of waste makes it difficult to track the waste generation and hence its estimation and characterization. Endeavors to estimation are also hampered by illegal dumping of waste in open areas and low-lying areas. The lack of adequately skilled and driven manpower is another major challenge that cities are facing. The CDW Management Rule, 2016 do not specify penalties for generators for non compliance. It specifically provides guidelines on demolition permits, which will help track and document the generation of CDW. But Chennai



Table 3: Summary of all Forms Attached to the Rules

Sl. No.	Form I	Form II	Form III	Form IV	Form V
Purpose	Application for obtaining authorization	Issue of authorization to the operator of CDW processing facility	Annual Report submitted by Local authority to State Pollution Control Board	Annual Report submitted by Central Pollution Control Board to State Pollution Control Board	Accident Reporting
Responsibility	Operator of the Facility	Member Secretary, State Pollution Control Board	Local Authority	State Pollution Control Board	Operation in-charge of facility in local authority OR operator of facility
Concerned Clause in the Rules	Rule 7 (2)	Rule 7 (3)	Rule 8 (2)	Rule 8 (3)	Rule 14
Information to be Submitted	<ul style="list-style-type: none"> Detailed proposal of processing facility Plan for utilization of recycled products Preventive plan for accident during collection transportation, treatment and processing of CDW 	<ul style="list-style-type: none"> Name of the authorized processing facility Addresses of administrative office and processing site of the authorized processing facility Validity of the authorization 	<ul style="list-style-type: none"> Quantity and composition of CDW generated Details of storage facilities and transportation Information of PPP proposals made for processing CDW along with details of technologies used for processing Provisions made to check unauthorized mixing of CDW and MSW, filling of low lying areas, encroachment on river banks, water bodies, parks, footpaths etc. Cases registered/ settled against non-compliance by appointed legal entities. Vessels provided to slums for collection of CDW 	<ul style="list-style-type: none"> Number of municipal authorities in the State for managing solid waste Summary statements as per Schedule I and III in the rules. To be attached as Annex I and Annex II respectively with the Annual Report. 	<ul style="list-style-type: none"> Type of CDW involved in accident Date and time of accident and sequence of events leading to accident Assessment of effects of accident Emergency measures taken Steps taken to alleviate the effects and recurrence of accident

Source: Construction and Demolition Waste Management Rule 2016



Municipal Corporation is the only Urban Local Body in India which keeps record of demolition of each building by providing demolition permits (Ram VG and Kalidindi SN, 2017).

7.1.3 Tendering a PPP contract for CDW Processing and Recycling Unit:

The CDW Management Rules, 2016 have statuted Urban Local Bodies to devise appropriate measures for a processing facility. In order to accomplish this requirement the local bodies should orient themselves in drafting an appropriate tender for the waste processing unit. Limited knowledge on CDW logistics and management sometimes leads to ill-suited tendering prevents entrepreneurs from investing in a processing plant.

7.2 Economic Challenges

Time and cost are the determining factors that decide methods of demolition in a city. In the southern parts of India, buildings are demolished by mechanized means, minimizing the amount of building materials that can be reused. Lack of profitability due to time constraints, high labour costs and poor quality of some building materials (i.e., bricks) compels the contractors to demolish buildings all-inclusive and dispose the mixed debris. This inhibits segregation and reuse of materials. It is often a practice of earning more profits by the transporters. They sell the CDW to the Landowners / builders of plots having low-lying areas instead of paying to dump in the designated landfill. Landowners and the builders typically pay for such debris since they utilize it as fill materials before new construction can take place. While CDW processing has been introduced in some cities, the market demand of the materials produced is unreliable due to the low levels of acknowledgement of users about such products and concern about inferior quality. Users are also not getting any incentives for the use of these products as compared to predominant materials.

Cities like Delhi and Ahmadabad process the CDW to produce building materials like paver blocks, aggregates and sands. However, the markets for such products are limited due to lack of Codes and Standards of these materials and their usage in construction sector.

7.3 Technological Challenges

Effective CDW processing systems have been successfully operational in many countries. However, limited information on the available processing technologies and limited technology service providers discourage ULBs from setting up processing facilities in their cities. Also, in India, these units are seen as operational only in a PPP mode so far, of which many ULBs are still unfamiliar with. The lack of technical understanding and capability of ULB officials is another constraint.



Demolition of buildings quickly and cheaply and disposal of the resulting debris retrains recovery and reuse of suitable materials. Deconstruction is a suitable alternative that maximizes the recovery of materials from a building. It is a process of carefully dismantling a building in order to salvage maximum number of components for reuse and recycling. This process is acceptable in several countries like the USA, Belgium, Germany, Spain, etc. However, it is not followed in India due to lack of awareness and the favorable designs of building for deconstruction.

7.4 Resource Challenge

Land for disposal of waste is increasingly becoming inadequate. Most ULBs cannot be able to designate more land as landfills or dump yards. Currently, Kolkata has one dump yard (Dhapa) which is encroaching a Ramsar wetland site, threatening to pollute it (Time of India, 2013). As a result the KMC is in the course of action for identifying other sites. However, the ULBs have cited land constraints as a major hurdle. The CDW of Mumbai is being dumped in adjoining areas like Navi Mumbai, Thane, etc., due to unavailability of land in the city proper. This concern emphasizes the urgent need for looking at alternatives.

8. GLOBAL BEST PRACTICES IN CDW MANAGEMENT

Globally, cities have employed the legal process to maximize reuse of CDW in construction.

Hong Kong, has serious land constraints and therefore cannot afford landfills, has very stringent controls over CDW. It imposes a construction waste charge on developers. The system has lowered the quantity of CDW needing disposal at landfills at 60%. Also, the rates have been structured to incentivize on-site recycling and reuse. 100% waste utilization is charged at HKD 27 dollar per tonne while more than 50% waste needing landfill disposal is charged at HKD 125 dollar per ton (CSE, 2014). Revenue generated is used to maintain and subsidize CDW recycling centers. This has created incentives for reuse and also for very efficient construction practices that minimize the generation of construction debris. Instead of demolishing structures, Hong Kong dismantles systematically. It also offers tax concessions to C&D recycling centers. Singapore, yet another land constrained country, recycled 98 percent of its CDW (CSE, 2014)

South Korea has one of the most extensive and the oldest recycling policies for CDW. CDW management is part of its low carbon green growth strategy. The country has a law on Acceleration of CDW reuse / recycling 2005 that provides for step-by-step demolition, and utilization of recycled aggregates. It has adopted separate building codes for recycled asphalt concrete aggregates,



recycled concrete aggregates, and road pavements. The Architectural Institute of Korea's Standard Building Construction Specification recommends increased use of recycled C&D materials. The effective recycling rate in Korea is 36 percent, with a target of increasing this to 45 percent by 2016 (CSE, 2014).

European Union recommended the clear rules regarding the use of recycled material in buildings. The Waste Framework Directive 2008/98/EC of the European Union set quantitative targets for reuse of CDW. It states " by 2020, the preparing for reuse, recycling and another material recovery, including backfilling operation using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 percent by weight" (ECDGENV, 2011). They focus on fitness of use and do not discriminate between resources. While CDW is not used in structural and foundation frames in the EU, it is extensively used in non-structural frameworks. Some member countries have reported that over 20 percent of their national consumption is from recycled material.

United Kingdom, the Northern Ireland Environmental Agency has published the quality protocol for the production aggregate waste from inert waste in 2004. This has helped in promoting uses of recycled and secondary aggregates. Almost 280 MT of aggregates are used every year, which is 28 percent of the total CDW waste generated (CSE, 2014)

In the US, New York has stringent measures for CDW as it is a land-locked and has limited space for disposal. Its disposal practices are more efficient than the rest of the US. It forces the developers to segregate waste at site, dismantle and not demolish, in addition to other measures.

Green ratings for buildings and infrastructure utilizing materials from CDW in Australia, Germany and United Kingdom have been instrumental in popularizing the use of recycled materials. The Green Building Council of Australia (GBCA) has developed Green Star tools for rating buildings on sustainability. Leadership in Energy & Environmental Design (LEED) is the US based green rating system developed by the United State Green Building Council (USGBC) which gives green ratings to buildings. CDW reduction and management is one of the criteria for these ratings. The Green rating tool for infrastructure by the Australian Green Infrastructure Rating Council specifies the use low embodied materials in construction (Edge Environment Pvt. Ltd., 2011). The German Sustainable Building Certificate, a voluntary scheme run by German Sustainable Building Council (DGNB26) sets criteria to ensure the sustainability of buildings. These criteria also include CDW:



- Ease of dismantling and recycling; and
- Construction site / Construction process, establishing that the waste produced on-site should be prevented or recycled, and, if not recyclable, disposed of in a way that prevents harm to the environment.

The construction industry in Germany took the initiative to reduce the amount of land filled CDW by 50%. It monitors its progress against voluntary commitments and issues bi-annual reports to the authorities, showing levels of accomplishment above EU targets (ECDGENV, 2011).

9. BEST PRACTICES EXAMPLES FROM INDIA

In India Deconstruction initiatives are being taken by building administrators or Resident Welfare Associations (RWA) in townships in India to collect and dispose CDW. RWAs in condominiums in Gurgaon have issued notices to home owners to not mix CDW with MSW. The waste is collected in separate bins and transported to designated dump sites by contractors. Such initiatives show the increasing levels of awareness on CDW in India.

CDW Recycling Plant, Burari, Delhi: Delhi Municipal Corporation is the pioneer in India in terms of initiating the first CDW management system in the country. The recycling facility in Burari, north Delhi is installed, operated and maintained on a Public Private Partnership (PPP) basis between the Delhi Municipal Corporation and IL&FS environment. The processing plant, currently operating at 2,000 TPD capacity was commissioned in 2010 for only 500 TPD on a pilot basis. It has been running successfully ever since and is an excellent case study for business models that could be adopted across India. Under the PPP agreement, the DMC pays IL&FS a fee for collection and transportation. DMC has designated 168 intermediate collection points across the city from which waste is transported to the processing facility. The processing technology includes both dry and wet processing and around 95% of the incoming CDW is recycled and processed into aggregates and M-sand. Utilizing the recycled materials, the unit produces finished products such as kerb stones, paver blocks, concrete bricks and pre-cast reinforced cement concrete structures like drain slabs, roofing structures, etc.; the materials have been tested and meet Bureau of Indian Standards (BIS) codes for usages in construction applications. The Delhi Government has also recommended preferential procurement of recycled products by public agencies. Building on the success of the Burari Plant, the Delhi government has commissioned 3 other recycling units to cover all zones of mega city. A second 500 TPD processing plant has already started operation in Shastri Park from 2016

CDW Recycling Plant, Ahmadabad: Following the success of DMC, the Ahmadabad Municipal Corporation (AMC) also initiated CDW management and processing.



AMC is running the project in PPP mode with Amdavad Enviro Projects Pvt. Ltd. (AEP) since 2014. The facility has the processing capacity of 1,100 TPD but is currently at 300 TPD. CDW is processed and recycled into aggregates which in turn are used to prepare finished products including paver blocks, kerb-stones, hollow bricks, concrete tiles, prefabricated structures like pre-cast toilets, park benches, etc. Due to AMC's preferential procurement policy, many of their products are used in government infrastructure projects.

10. CONCLUSIONS

The key components of a 'Sustainable Model' on CDW Management Rules, 2016 can include the following:

- Practical estimation and characterization of CDW generation: Methods adopted to estimate C&D waste generation in the literature varies depending on the scope of estimation i.e. project level or regional level (Wu et al., 2014) therefore, there is a need to validate the waste generation rates through case studies. Moreover, data required for regional-level estimation of C&D waste such as total floor area of buildings, details regarding classification of buildings such as structural typology, usage (residential or commercial), and roofing systems adopted are not available in Indian cities. Unavailability of explicit documentation on C&D waste generation has been reported in several other countries, including Brazil, Malaysia and Portugal (De Melo et al., 2011; Mah et al., 2016; Paz and Lafayette, 2016).
- Identified sites and timely acquisition of land for development of integrated C&D processing facilities with necessary approval from local administration / civic bodies
- Specifications / Standards for recycled CDW products for quality acceptance
- List out and mandate use of recycled products from CDW
- **Penalty** - Landfill levy
- **Map water bodies in a city / region** - Encroachment of water bodies in cities for generating 'land' is a common practice observed several cities.
- **Research on economically viable C&D recycling options**
- **Awareness campaign** - tools for sensitization of general public
- **Build Capacities of ULBs** - Good practice guidelines and manuals for the
- Entire waste management cycle ranging from estimation, collection, segregation, processing and final disposal of CDW should be developed and shared with the ULBs.
- **Provide Technical Support to New Entrepreneurs:** The hurdle faced in the effective use of secondary material streams like CDW is the availability and accessibility of suitable technologies. There is often a knowledge gap in



knowing where to go to seek such solutions, i.e., a lack of technology and service providers. Furthermore, if such technology is imported, as is often the case, there may not be adequate in-house capacity to operate and manage. This lack of technical support often deters entrepreneurs from engaging in waste management ventures. Technical support to new entrepreneurs from the current processing units will encourage more entrepreneurs to engage in the processing of C&D.

- Hazardous CDW: The Industrial CDW contaminated by heavy metals, organic pollutants, or those generated in earthquakes and explosion accidents should be treated properly before use.

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