REVISED CITY DEVELOPMENT PLAN
BANGALORE

2009

Jawarharlal Nehru National Urban Renewal Mission

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VOLUME 1 URBAN GOVERNANCE AND INFRASTRUCTURE

VOLUME 2 ANNEXURE TO URBAN GOVERNANCE AND INFRASTRUCTURE

VOLUME 3 BASIC SERVICES TO THE URBAN POOR

Jawaharlal Nehru National Urban Renewal Mission

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2009

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Jawarharlal Nehru National Urban Renewal Mission

CHAPTER 1: INTRODUCTION

1. Purpose

The City Development Plan (CDP) was prepared and approved for the city of Bangalore in 2006 as a prerequisite for availing financial assistance under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). The CDP is a 6-year policy and investment plan (2007-12) designed to articulate a vision of how Bangalore will grow in ways that sustain its citizens' values. The CDP makes basic policy choices and provides a flexible framework for adapting to real conditions over time. Through the CDP, the city residents share a vision for the future and identify key issues facing the city in the short, medium, and long-term. By providing clear directions for the future, the CDP establishes priorities through a consultative process, and facilitates investment decisions in the context of their desired future outcomes.

The Government of India has selected Bangalore, a metropolis, as a "Category A" city, for assistance under JNNURM. Bangalore, in the recent past, has been a favored destination for most high technology industries and has consequently witnessed a significant in-migration. While the city has embarked on initiatives such as construction of flyovers, construction of a Metro-rail system, developing a new international airport, remodeling of storm-water drains, augmenting water supply, and development of waste management facilities, there is still a substantial need for improvements in urban infrastructure.

The CDP seeks to address the needs and challenges of the city in a systematic manner with the participation of all its stakeholders and citizens. While the Comprehensive Development Plans that were prepared by all cities, under the provisions of the Town and Country Planning Acts, were largely land-use regulation and monitoring documents, this CDP for the JNNURM has wider objectives that seek, inter-alia:

- Guided growth of the city
- Citizen's participation
- Reform in governance leading to a well-managed society
- Clear estimates of financial investments and sustainability.

Since the CDP's approval by the Ministry of Urban Development, Government of India in 2006, Bangalore city has seen numerous changes with respect to new infrastructure projects, changes in governance structure such as formation of the Bruhat Bengaluru Mahanagara Palike (BBMP) along with the addition of 110 villages to the city area. Therefore, it was felt appropriate to revise the CDP to incorporate these changes and provide an update of the investment plan based on the inclusion of the new areas under the jurisdiction of the ULB (BBMP) since 2006.

2. Overview of JNNURM

Recognizing the critical importance of rapid urban development and growing contribution of the urban sector to the Country's GDP, the Government of India through the Ministry of Urban Development (MoUD) launched the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in December 2005. JNNURM is a "reform-driven and

fast track project, planned at developing identified cities by focusing on efficiency in urban infrastructure/services delivery mechanism, community participation, and accountability of Urban Local Bodies/Para-statals towards its citizens". The proposed duration of the Mission is seven years (2005-12), and it covers 65 important cities (the plan was initially set out for 63 cities, Porbandar and Tirupathi were added to the list subsequently in 2009) in the Country, with a substantial financial outlay. JNNURM has two sub-missions addressing different critical needs:

- Infrastructure & Governance
- Basic Services to the Urban Poor.

This revision of CDP has been carried out in accordance with the JNNURM guidelines to consider the city needs in an integrated and participatory manner, and prioritize investments in urban infrastructure and basic services for urban poor. This CDP attempts to set out a common vision shared by city-level stakeholders determining how the city should grow, the quality of life citizens expect, and the role of stakeholders (government, para-statals, industry, non-governmental organizations, and citizens) in ensuring that the common vision is attained and within a specified timeframe.

2.1. Process of Formulation of CDP

Based on analytical information on the city's infrastructure and a consultative process undertaken by Bangalore's institutions, the CDP has been prepared in line with JNNURM requirement. According to JNNURM norms, the sub-projects shall be financed in the following proportion:

- 35% (GoI)
- 15% (GoK)
- 50% from the institutions concerned (which include BBMP, BDA, BMTC, BWSSB, KSCB, etc.).

The sub-projects constituting the CDP cover water supply, sewerage, storm water drainage, solid waste management, civic amenities (lakes and parks, fire services, etc), poverty alleviation/slum upgradation, traffic management, road improvement, street lighting, tourism and heritage. Detailed Project Reports (DPRs) for various projects have been prepared/ are under preparation by the institutions concerned, for availing financial assistance under the provisions of JNNURM.

The methodology adopted for preparation and revision of the CDP comprised:

- Review of existing literature, which included:
  - Comprehensive Development Plan (Master Plan 2015) prepared for BDA (required as per the statute and primarily a land use directional document)
  - City Development Strategy Plan prepared for erstwhile BMP
  - Infrastructure Development & Investment Plan for Bangalore, prepared by STEM (for KUIDFC)
  - Crisil report on Bangalore city's capital investment needs (prepared for KUIDFC).
- Stakeholder Consultations setting out the Vision and priorities (including those with representatives from newly added areas)
- Data Analysis.

A broad-based consultative process was undertaken spanning the cross section of stakeholders – citizens (including the urban poor), elected representatives (Councilors, MLAs, and MPs), government agencies, non-governmental organizations, industry groups and resident welfare associations. In order to reach a wider audience, a multi-modal consultation framework was adopted, comprising workshops, one-to-one interviews, review meetings, feedback questionnaires and internet based response collection.

Around sixty stakeholder meetings/workshops were held, from which emerged the vision for the city, the strategies to achieve the vision, the policies required to provide an enabling environment for change and finally the projects and plans to realize the vision.

3. Structure of the Report

This CDP document has been prepared as per the toolkits provided by the Ministry of Urban Development and Ministry of Urban Employment and Poverty Alleviation, Government of India. The CDP is presented in three volumes:

- Volume I: Urban Infrastructure & Governance
- Volume II: Annexes – Urban Infrastructure
- Volume III: Basic Services to the Urban Poor

Volume 1 - Urban Infrastructure & Governance

Volume I is structured into four sections, each addressing a particular facet of the CDP:

- Section 1- This section covers the introductory framework, city profile, the consultation process undertaken to formulate the vision and strategy, the evolved vision & mission statements, the growth characteristics and growth drivers.
- Section 2- This section is structured in chapters that cover the key urban infrastructure sectors, with each chapter analyzing the existing situation in the sector, examining sectoral issues and strategies, and then setting out the estimated investment plans in the JNNURM period and in future block years.
- Section 3- The aggregated Capital Investment Plans and Financial Sustainability aspects are outlined in this Section.
- Section 4- The Governance Structure for the city is delineated in this Section.

Volume 2 - Annexes to Urban Infrastructure & Governance

The summary of the stakeholders consultations, maps of BBMP and its zones, project list of ABIDE, analysis of existing financial health of individual institutions and assumptions for projections of their finances are presented in Volume 2 of the CDP.

Volume 3 – Basic Services to the Urban Poor

The report on the second sub-mission of JNNURM, namely, Basic Services to Urban Poor is set out as Volume 3 of the CDP. Diagnosis of the existing situation, challenges in providing equitable urban infrastructure services, investment plans, and financing strategies for the urban poor are set out in this volume.

Chapter 2: City Profile

1. Background

Bangalore, the Capital of Karnataka, is the fifth largest metropolitan city in the country in terms of population. BBMP was formed in 2007, by amalgamating the erstwhile Bangalore Mahanagara Palike (BMP), surrounding eight smaller urban local bodies and 110 villages. BBMP now spans over an area of 800 sq km.

Bangalore is well known – nationally and internationally – as a destination of choice for high-technology industries, particularly in the IT/ITES and Biotechnology sectors. It is a city that has transformed itself from a "pensioners' paradise" to a modern thriving cosmopolitan metropolis. The pleasant climatic conditions, and the "garden city" image, as well as the availability of academic institutions and skilled workforce have led to this rapid development. It is divided into 198 wards owing to the delimitation regulations. Table 1 shows some salient details of Bangalore.

1.1. Topography

Bangalore is situated in the southeast of Karnataka, at an average elevation of 920m above mean sea level, and is positioned at 12.97°N, 77.56°E. Bangalore Urban District borders with Kolar District in the northeast, Tumkur District in the northwest, Mandya District in the southwest, Chamarajanagar District in the south and the neighboring state of Tamil Nadu in the southeast. The Bangalore Urban District is divided into three taluks: Bangalore North, Bangalore South, and Anekal. The Bangalore North taluk is a relatively level plateau, while the Bangalore South taluk has an uneven landscape with intermingling hills and valleys.

The topography of Bangalore is flat except for a ridge in the middle running NNE-SSW. The highest point in Bangalore is Doddabettahalli, which is 962 m and lies on this ridge. There are no major rivers running through the city. The river Arkavathi (a tributary of the Kaveri) passes near Nandi Hills, 60 km north of Bangalore, while the river Kaveri has its nearest approach near Srirangapatnam, southwest of Bangalore. Bangalore has a number of freshwater lakes and water tanks, the largest among them are Madivala Tank, Hebbal Lake, Ulsoor Lake, and Sankey Tank.

1.2. Climate

Due to its elevation, Bangalore enjoys a pleasant climate throughout the year, with temperatures ranging between 16°C and 33°C and an average of 24°C. The summer heat is moderated by occasional thunderstorms and squalls. Bangalore receives adequate rainfall of about 860 mm from the Northeast Monsoon as well as the Southwest Monsoon. The wettest months are August, September and October.

Table 1: Bangalore at a Glance

	Erstwhile BMP	Erstwhile CMC and TMC								Erstwhile BMP+CMC +TMC	Villages	
Parameters	**BMP**	**Bommanahalli**	**Byatarayanapura**	**Dasarahalli**	**KR Puram**	**Mahadevapura**	**RR Nagar***	**Yelahanka**	**Kengeri**	**TOTAL**	**110 villages**	**GRAND TOTAL**
Area (sqkm)	226.2	43.6	47.0	38.0	21.3	46.2	66.0	38.8	34.0	561.0	239	800.0
Population (2001)	4303033	243870	210007	309956	198991	163486	111553	99993	44995	5685884	304855	5990739
Gender ratio (female population per 1000 male)	915	867	908	844	911	866	879	863	936	906	NA	-
Literacy levels (%)	86	81	82	96	87	83	78	84	84	86	NA	-
Number of households	1225307	65885	52813	91071	50186	44927	30073	28953	14319	1603534	NA	-
Developed Properties	521939	41371	25800	26759	44824	18186	16715	24110	6009	725713	NA	-
Vacant land (ha)	57993	37193	10167	20689	15176	24575	27300	7555	5115	205763	NA	-

Source: CDP 2006, Values in red are newly added

* RR Nagar was formerly known as Pattanagere.

2. Population Trends

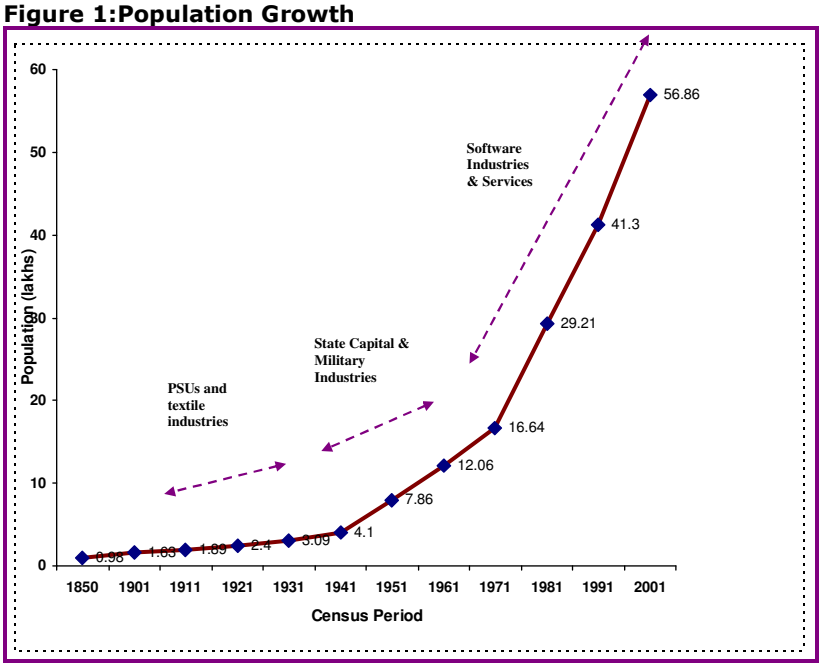
The city experienced rapid growth in the decades 1941-51, and by 1961 Bangalore became the fifth largest city in India. Employment opportunities - initially in the public sector, and then in textile and high technology industries - resulted in migration of people to Bangalore. The 2001 census population of erstwhile BMP was 56.86 lakhs, but the population of BBMP presently is estimated at 68 lakhs. The growth of Bangalore from a town to a metropolis has been a result of five growth events:

- Shifting of the State Capital from Mysore
- Establishment of the Cantonment
- Setting up Public Sector Undertakings/Academic Institutions
- Development of Textile Industry
- Development of Information Technology/ITES/Biotech based industries.

2.1. Decadal Growth

In the decade of 1991-2001, the growth rate of urban population in Karnataka was 28.85%, as against the aggregate population growth rate of 17.25%. Bangalore grew at a much faster rate, and the population of Bangalore increased from 41.30 lakh to 56.86 lakh during the decade 1991-2001, representing a decadal increase of 37.7%, which made Bangalore one of the fastest-growing Indian metropolises, after New Delhi (51.93%). displays the population growth and illustrates sharp spurts in population growth in the decades 1941-51 and 1971-1981.

Figure 1:Population Growth



2.2. Composition of Population Growth

About one third of the population increase in the Bangalore region is attributed to the fact that new areas were added to the Bangalore's urban agglomeration. Adjusting this

factor, the net increase in population during 1991-2001 was approximately 22%. Table 2 shows the growth composition of population.

Table 2: Composition of Population Growth

Composition	1981-91 (Lakhs)	% of total	1991-2001 (Lakhs)	% of total
Natural increase	2.66	22%	3.42	22%
In-migration	5.44	45%	7.00	45%
Jurisdictional change	4.03	33%	5.19	33%
Total increase	**12.09**	**100%**	**15.57**	**100%**

Source: Master Plan 2015 - BDA

2.3. Key Population Indicators

As per the 2001 census:

- The literacy rate is 86%
- The sex ratio is 906

The population density across the urban agglomeration is indicated in Figure 2

3. Land Use

As can be seen from Figure 3, Bangalore city has developed spatially in a concentric manner. However, the economic development has occurred in a different manner in different sectors of the city. The current urban structure is a factor of these aspects. Five major zones can be distinguished in the existing land occupation, indicated in Figure 4. The details of each of the zones are listed below:

- 1st Zone - The core area consists of the traditional business areas, the administrative centre, and the central business district. Basic infrastructure (acceptable road system and water conveyance), in the core areas is reasonably good – particularly in the south and west part of the city, from the industrial zone of Peenya to Koramangala. This space also has a large distribution of mixed housing/commercial activities.
- 2nd Zone – The peri-central area has older, planned residential areas, surrounding the core area. This area also has reasonably good infrastructure, though its development is more uneven than the core area.
- 3rd Zone – The recent extensions of the city (past 5-7 years) flanking both sides of the Outer Ring Road, portions of which are lacking infrastructure facilities, and is termed as a shadow area.
- 4th Zone – The new layouts that have developed in the peripheries of the city, with some vacant lots and agricultural lands. During the past few years of rapid growth, legal and illegal layouts have come up in the periphery of the city, particularly developed in the south and west. These areas are not systematically developed, though there are some opulent and up-market enclaves that have come up along Hosur Road, Whitefield, and Yelahanka. The rural world that surrounds these agglomerations is in a state of transition and speculation. This is also revealed by the "extensive building of houses/layouts" in the green belt. Both BDA and BMRDA are planning to release large lots of systematically developed land, with appropriate infrastructure, to address the need for developed urban spaces.

- 5th Zone – The green belt and agricultural area in the city's outskirts including small villages. This area is also seeing creeping urbanization.

While the core area has been the seat of traditional business and economy (markets and trading), the peri-central area has been the area of the PSU. The new technology industry is concentrated in the east & southeast. These patterns are obviously not rigid – especially with reference to the new technology industry and services that are light and mobile, and interspersed through the city, including the residential areas. Figure 4 shows a map of the urban area, indicating the patterns of these five zones.

Bangalore Development Authority (BDA) Area is indicated in Figure 5 and covers BBMP. Table 3 shows the land use pattern in the BDA area, while Figure 6 shows the existing land-use situation.

Table 3: Land use pattern in BDA

Category	Area in hectares	% Use
Residential	16,042	14.95
Commercial	1,708	1.59
Industrial	5,746	5.36
Park and open spaces	1,635	1.52
Public semi-public	4,641	4.33
Transportation	9,014	8.40
Public utility	192	0.18
Water sheet	4,066	3.79
Agricultural	64,243	59.88
Total	107,287	100

Source: Master Plan 2015 of BDA

4. Economy

Bangalore has a strong and balanced economy, stimulated by light and heavy engineering (automobiles, earthmoving, and aeronautics), textiles, and high technology (IT, ITES, Bio-tech, R&D). The United Nations Human Development Report 2001 has ranked the city fourth along with Austin (USA), San Francisco (USA), and Taipei (Taiwan) as the top "Technology Hubs of the World".

Public Sector Undertakings and the textile industry initially drove Bangalore's economy, but the focus in the last decade has shifted to high-technology service industries. Bangalore's USD 47.2 billion economy makes it a major economic centre in India, and as of 2001 Bangalore's share of USD 3.7 billion in Foreign Direct Investment made it the 3rd highest recipient of FDI for any Indian city.

With over 103 Central and State research and development institutions, Indian Institute of Science (globally ranked as one of the best universities), National Law School of India, 45 engineering colleges, world class health care facilities, medical colleges and institutions, and a host of other institutional infrastructure; Bangalore is a much sought-after destination for education and research.

Bangalore has also enjoyed a favorable positioning that has created job opportunities and rising income levels in excess of population growth. In effect, the annual growth percentages are about:

- 3% for the total population
- 6% for employment
- 9% for the incomes.

> *Between the longing for a Bangalore of a bygone era and the futuristic visions of the Singapore-in-the-making through a unique "Private-public partnership' lies a complex history of a city that has been marked by national, regional, and global forces and interests in its passage to a metropolitan status. In the five decades since Independence, a small and unremarkable town was transformed into an internationally known metropolis… No single metaphor adequately describes the new metropolitan experience, for Bangalore is not quite the industrial district, the technopole, the international city, nor the Silicon Valley of Asia that have been used to describe processes elsewhere… No other contemporary Indian city allows us to track the passage from small town to metropolitan status within a few decades as well as does Bangalore.*
>
> The Promise of the Metropolis – Bangalore's Twentieth Century (Oxford University Press 2005), Janaki Nair.

4.1. Contribution to Karnataka's Economy

The city of Bangalore is a key contributor to the economic growth of the State. Its contributions are substantial and its potential even greater. Salient features of Bangalore's economy comprise, the following:

- While the area of metropolitan Bangalore is less than 0.5% of the area of the State, it contributes 75% of the corporate tax collections, 80% of sales tax collections, and 90% of luxury tax collections in the State
- More than 11% of the FDI in the country is in Bangalore, which ranks only next to Delhi and Mumbai as an investment destination
- In 2004-05, more than 110 new foreign owned firms were established in Bangalore
- The city has seen a five-fold growth of state tax revenues during the period (1990-2003), which is unparalleled in the country. While tax revenues, as a ratio to GDP of most States have remained constant, there has been an increase in Karnataka, primarily because of Bangalore.

4.2. Industrial Scenario

Bangalore is headquarters to several public manufacturing heavy industries such as Hindustan Aeronautics Limited (HAL), National Aerospace Laboratories (NAL), Bharat Heavy Electricals Limited (BHEL), Bharat Electronics Ltd. (BEL), Bharat Earth Movers Limited (BEML), and Hindustan Machine Tools (HMT). In June 1972, the Indian Space Research Organization (ISRO) was established under the Department of Space and headquartered in the city.

Bangalore is called the "Silicon Valley" of India because of the large number of Information Technology companies located in the city, which form the largest contributor

to India's US$12.2 Billion (Rs.54,000 Crore) IT and software export market. Bangalore's IT industry is divided into three main "clusters" — Software Technology Parks of India, Bangalore (STPI); International Technology Park Ltd. (ITPL); and Electronics city. Infosys and Wipro, India's 2nd and 3rd largest software companies are headquartered in Electronics city. As headquarters to 38% of global SEI-CMM1 Level 5 Companies, Bangalore's place in the global IT map is prominent. Today Bangalore is home to 66 Fortune 500 companies, 682 MNCs, 1,685 IT/ITES and 131 Biotech companies.

Biotechnology is also a rapidly expanding field in the city. Bangalore accounts for half of the approximately 260 biotechnology companies in India. Biocon, headquartered in Bangalore, is the nation's leading biotechnology company and ranked 16th in the world in revenues in 2003-04.

John F. Welch Technology Research Center in Whitefield, Bangalore, is the second largest research facility of GE in the world. Spread over an area of 14.5 Ha, the research is carried out in the fields of nanotechnology, biotechnology, photonics, and advanced propulsion systems. Founded in 2000, the Research Center employs around 1600 employees, including more than 1000 doctorates.

4.2.1. Employment & Economic Base

In addition to prominent industry names and Fortune 500 companies operating out of the city, there are a large number of small and medium size industries that contribute significantly to the economic base of Bangalore. Industry turnover and employment base in various categories of industry is illustrated in table below.

Table 4: Industry Turnover and Employment

Size	Number	Investment (Rs. Crores)	Job Opportunities
Small-scale	55,162	1,682	5,78,000
Medium & Large Scale	546	4,725	2,24,287
Mega	17	3,808	33,830

Source: Bangalore Darshana – 2003-04

Given the above scenario, industrial/commercial employment is obviously the highest, at over 90%, while employment avenues in the rest of the sectors are relatively minor, which is listed in Table 5:

Table 5: Occupational Distribution

	No. of workers (lakhs)	% of total
Primary sector	0.05	0.80%
Manufacturing	2.54	43.36%
Electricity, gas and water supply	0.08	1.40%
Construction	0.06	0.99%
Transport, storage and communication	0.43	7.29%
Banking and insurance	0.65	11.07%
Trade and business	0.21	3.59%

[1] Software Engineering Institute – Capability Maturity Model

	No. of workers (lakhs)	% of total
Services	1.84	31.51%
Total	5.85	100.00%

Source: Department of Employment & Training, GoK (2002)

5. Social Sectors

The areas of Health and education come under the social sector. Therefore providing the health and education benefits to its people is the duty of a nation or government. With this concept in mind, BBMP has always proven to be successful. Bangalore is one among the fastest growing city in the world & therefore we share the city with a lot of migrants & job seekers. Consequently, the regional government must provide all infrastructure facilities to its citizens at a larger scale. BBMP strives to administrate health, hygeine and education to its citizens. Social sector is a clear indicator of the development status of a county, state or a city.

Health is defined by World Health Organisation (WHO) as "being "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity".

Providing and maintaining of better health facilities to the city dwellers is a core responsibility of the BBMP. But considering the existing population, the infrastructure available is quite insufficient to render services to the masses. Presently the area being covered by BBMP in providing social sector services is around 100 wards consisting of 30 lakh population in Bangalore of an area of 150 sqkm. With the formation of BBMP, the facilities which exist currently needs to be escalated in terms of increase in the number of hospitals, doctors and other infrastructure facilities.

5.1. Health Institutions

The Health Institutions in BBMP are as follows:

- 6 Referral Hospitals
- 24 Maternity Homes
- 29 Health Centers
- 19 UFWCs
- NGO Centers
- 2 Govt UFWCs
- 17 Dispensaries
- 3 Mobile Dispensaries
- 15 Not Sanctioned Hospitals
- 1 Ayurvedic Hospital
- 1 Unani Treatment Centers

5.2. Services Offered

The services offered by BBMP include:

- Reproductive Child Health program.
  - Antenatal care
  - Postnatal care

  - Family welfare program
  - Post natal kit
- Immunization against seven preventable diseases
- Reproductive track infection and sexually transmitted diseases screening
- HIV / AIDS screening / awareness
- Cancer detection screening / awareness
- Family planning counseling
- School health program
- Tuberculosis screening (Revised National Tuberculosis Control Program) and treatment (DOTS)
- Treatment of Dog bites
- Malaria screening program
- Family health awareness campaign
- In addition to the out patient services as mentioned under health centre, services offered in maternity hospital is as follows:
  - Normal deliveries
  - Sterilization:
    - Tubectomy
    - Laparoscopic sterilization
    - No scalpel vasectomy
    - Medical termination of pregnancy
- Prevention of mother to child transmission of HIV during lavour.
- Management of high risk pregnancies
- Gynecological surgery
- Advance endoscope surgery
- Sonography and colpescopy in RH
- Treatment of ARI and GE cases
- Measles and AFP surveillance
- H1N1, Dengue, Chikun gunya, treatment and awareness
- Training of nursing students
- Training centre for LSAS (Life saving anesthetic skills)
- Minimum Lab Facilities
  - HB estimation
  - Blood grouping and RH typing
  - Pregnancy tests
  - VDRL tests
  - Urine routine
  - Blood sugar urea

5.3. Other Programmes

Other Programmes of BBMP include:

- RNTCP (Revised National Tuberculosis Control Program)
- HIV / AIDS
- NTCP (National Tobacco Control Program)
- NICD
- BHUP (Bangalore Healthy Urbanization Program)
  - Nutrition
  - Yoga

  - School Health Program (Communicable and Non communicable diseases)
- CDC (Cancer Detection Clinics)
- IDSP
- School Health Program
- Family Health Awareness Campaign
- Malaria Screening Program
- Preventive Health Care Project
- CAMHAD- Preventive Cardiology Program
- Madilu Yojane
- Janani Suraksha Yojane
- BHAGYALAKSHMI Yojane
- Managed Health Care

BHUP is a partnership collaborative program with the WHO, KOBE centre (WKC) Japan, the World Health Organization (SEARO and INDIA) and BBMP. The project was inaugurated on 4th December 2006. The main objective is to optimize the impact of social determinants of health on exposed population in urban setting. It is a research project involving service organizations, different stake holders, non governmental agencies, social workers and medical college representatives. After completion of this project, BBMP has taken initiatives to mplement the recommendations.

6. Urban Poor

While Bangalore's employment increased twice as much as the population and incomes increased three times faster than the population, the inequality of this latest growth leads to the increased difficulties for the urban poor. However, the key challenge remains, growth devolution to all sections of the society. As per the 2001 census, the slum population in the erstwhile BMP area was 4.30 lakh, which was about 10% of the total erstwhile BMP population of 43.10 lakh. The present population of urban poor in BBMP is estimated to be over 7 lakh which is again 10% of the present population of BBMP which is approximately 68 lakh.

The increase in number of slums in Bangalore is a problem that has not yet been completely addressed. However, growth in poverty levels is mitigated to some extent due to availability of jobs provided by the growing Services sector. KSCB has focused on improving the amenities in slums to address basic issues relating to urban poor. The CDP has taken into account all slums spread throughout Bangalore (encompassing area under the control of BBMP). The total number of slums taken into account is 640 and the number of households proposed to be redeveloped is estimated to be 136486 of which developments are underway by BBMP and KSCB. Table 6 lists the details of slums, while Table 7 shows the access levels of the urban poor, to infrastructure services.

Table 6: Details of Slums

No.	Zone	Declared slums				Undeclared slums				Total No. of slums			
		No. of slums	Area	No. of households	Population	No. of slums	Area	No. of households	Population	No. of slums	Area	No. of house holds	Population
1	East	48	35.14	8724	48638	29	46.03	10821	45003	77	81.17	19545	93641
2	West	99	188.31	20661	120221	40	67	13166	89978	139	255.31	33827	210199
3	South	51	116.76	14822	80781	70	161.13	19327	117740	121	277.89	34149	198521
4	Dasarahalli	2	17.2	533	4490	33	61.2	17069	70293	35	78.4	17602	74783
5	Bommanahalli	2	13.37	80	625	38	0	715	3221	40	13.37	795	3846
6	Mahdevapura	25	69.45	6154	25688	46	59	6074	32789	71	128.45	12228	58477
7	Yelhanka	13	35.84	3297	18696	108	13.58	9313	42901	121	49.42	12610	61597
8	Rajarajeshwari nagar	1	0	250	1723	35	0.27	5480	250	36	0.27	5730	1973
		241	476.07	54521	300862	399	408.21	81965	402175	640	884.28	136486	703037

Source: BBMP- BSUP Division

Note: Area details are available for 431 slums, Household details are available for 505 slums and population details for 495 slums are available.

Table 7: Access of Slum Dwellers to Basic Services

Year	Percentage of slum dwellers having access to			
	Water supply	Drainage system	Waste service collection	Toilets
1991	N A	N A	N A	NA
2001	17.1	17.1	17.1	34
2005 (E)	17.0	17.0	17.0	Assumed to be same

Source: Infrastructure Development and Investment Plan for Bangalore 2006 - 30, STEM And NSS 58th Round 2002

7. Infrastructure Status

Economic growth is welcome to the city and the State, and the institutions concerned make every effort to see that the attractiveness of the city as an economic destination is maintained and increased. Growth brings prosperity to the citizens, improves the standard of life, and gives better avenues. At the same time, growth places greater strain on basic infrastructure and services, which have not been designed to cope with such growth. In many instances, economic growth may also not be equitable, and may create islands of prosperity and poverty. One key objective of this CDP is to ensure that the growth is sustainable – both in terms of infrastructure & services, and in terms of equity.

While infrastructure in the city is reasonably good in some aspects (water and sewerage, for instance), it is under stress in other aspects, particularly urban transport. Qualitatively, the urban infrastructure situation is profiled in the following:

- Water Supply: The present level water supply in the BBMP area is about 143 lpcd against the norm of 180 lpcd. Though the supply is satisfactory, it is not uniform throughout the city. The core BBMP area gets a supply of 205 lpcd; among ULBs, the supply varies from 17 lpcd in Dasarahalli to 76 lpcd in Kengeri. Finally, the average daily per capita supply in villages is 25 litres. To bring in uniformity in water supply, an investment of about Rs. 5,986 crores is needed to be made by 2011-12; this estimated sum would cover water augmentation by 476 MLD, construction of a 601 MLD capacity treatment plant, extension of the distribution network and the construction of about 416 ML capacity storage reservoirs.
- Sewerage: Under Ground Drainage (UGD) facility is available in all areas except in KR Nagar and 110 villages; however, the network coverage is not uniform. It is estimated that the Bangalore Water Supply and Sewerage Board (BWSSB) needs to develop a sewage treatment plant of the capacity of 446 MLD by 2012 and a sewer network of about 4,862 km. Also, it needs to carry out refurbishment and rehabilitation in the existing network. This will require an investment of about Rs. 2,203 crores by 2011-12.
- Roads and Transportation: Mostly the road network is underdeveloped in terms of size, structure, continuity and connectivity. Nearly 82% of the total existing road network of 1763 km (taken for travel demand modeling purposes) is with 2-lane carriageway. Length of roads with carriageway of 4 lanes and above is only 290 km. Thus most of the roads have inadequate carriageway widths to cater to growing traffic at an acceptable level of service. Most of the roads in the city are also used for on-street parking facility which even reduces the effective carriageway width available for traffic. Most of the major roads in Bangalore have V/C ratios > 1.0 indicating high congestion, low speeds and high delays. The intersections are also spaced quite closely which further increases the problem of traffic. Many of the intersections in core area are with five legs. BBMP needs to invest in flyovers, roads, over-bridges, traffic management, junction improvement, commuter-based systems, rolling stock, Bus Rapid Transit System (BRTS) systems, and other road-related infrastructure. It is assumed that about 60% of this additional infrastructure can be taken up using the public-private partnership route, which will reduce the total amount needed from BBMP for the purpose.

- Storm Water Drains: At present, about 50% of BBMP is covered by storm water drains, indicating coverage of 107% of the roads against the norm of 136%; 12% of these storm water drains are kutcha drains. By the year 2012, BBMP needs to construct 3,841 km of new drains and upgrade 2,734 km of existing drains, which will call for an investment of about Rs. 1,127 crores.

Apart from these main core services, other infrastructure like rainwater harvesting, beautification of gardens, lake development, fire system, urban renewal, and urban governance will need to be developed.

Table 8 sets out the status of environmental services in BBMP

Table 8: Status of Environmental Services

Environmental services	Quality
Air	Air quality in Bangalore is deteriorating as reported by KSPCB.
Water	Periodic tests indicate drinking water supplied meets CPHEEO standards. However, these tests are only for testing the bacteriological quality. Tests for other parameters including turbidity, tirhalomethane (THM), aluminum and pesticide residues are required to be carried out.
Waste water	Treatment capacity to treat 93% of estimated waste water generated is currently available.
Solid Waste	There is 100% coverage for door - to - door collection. Currently treatment plants with capacity adequate to treat 34% of waste generated are available. There are no scientific disposal facilities. Treatment and disposal facilities of 2000 TPD capacity are being developed and are expected to be operational by 2007.

Nevertheless, Bangalore continues to be one of the most livable cities, and a residential and investment destination. The challenge of the future is in sustaining the growth and the quality of life.

8. Institutional Framework

There are a number of institutions performing municipal and urban development functions in the Bangalore Metropolitan Area. These institutions can be categorized as Urban Local Bodies (ULB), Statutory Authorities, & Government departments. The functional responsibilities of various agencies are set out in Table 9.

8.1. Institutions in Bangalore

Urban Local Body

BBMP (City Corporation)

The BBMP includes the formerly elected bodies viz.

- Bommanahalli (CMC)
- Byatarayanapura (CMC)
- Dasarahalli (CMC)
- KR Puram (CMC)
- Mahedevapura (CMC)
- RR Nagar (CMC)
- Yelahanka (CMC)

- Kengeri (TMC)
- 110 villages (VP)

While the erstwhile BMP shares about 60 per cent of Greater Bangalore's area of 560 sq. km, their share of total population is only about 22 percent. The five-fold density levels of core area (erstwhile BMP area which is about 19,016 persons/ sqkm) compared to surrounding former ULBs areas (3600 persons/sq.km) is indicative of the concentration of population and activity in the core area. However, all of the former ULBs have shown a significant growth in population in the last decade.

Volume 2 of the CDP consists of political map of BBMP (ward wise) and zonal maps of BBMP.

Formation of Bruhat Bangalore Mahanagara Palike

The Bruhat Bangalore Mahanagara Palike is the newly created administrative body overseeing the activities related to and responsible for the civic and infrastructural assets of the city of Bangalore. It was formed in 2007 by merging 100 wards of erstwhile BMP, along with the 7 City Municipal Councils (CMCs) viz. Rajarajeshwari Nagar, Dasarahalli, Bommanahalli, Krishnarajapuram, Mahadevapura, Byatrayanapura, and Yelahanka; 1 Town Municipal Council, Kengeri; and 110 villages around the Bangalore region.

Government of Karnataka (GoK) on November 2, 2006 officially notified for creation of Greater Bangalore (Bruhat Bangalore Mahanagara Palike). In January 2007, GoK issued a notification to merge the fore mentioned areas with the erstwhile BMP, and rechristening of the body to Bruhat Bengaluru Mahanagara Palike. The process was completed by the month of April-May 2007 and BBMP came into existence.

GoK has constituted an expert committee to suggest strategies to ensure the planned growth of Bangalore agglomerate. This committee is headed by eminent space scientist and Rajya Sabha MP, Dr. K Kasturirangan. The committee is working on a new comprehensive legislation that would deal with the development and regulation of the Bangalore Metropolitan Region (BMR), which is witnessing rapid economic and demographic growth. This is a significant development that has not been addressed in the CDP prepared in 2006.

The area under greater Bangalore now extends to about 791 sq km with the total number of wards being 145. Additional 110 villages have been added to Greater Bangalore, which was not accounted for in the erstwhile CDP.

From the governance point of view, BBMP represents the third level of government (after the central and state governments respectively). BBMP is provided to be run by a set of elected officials collectively comprising the city council. Each of the elected members is designated as a 'corporator'; a corporator represents one ward of the city. Elections are held every five years and the member is elected by a popular vote.

Statutory Authorities

The statutory authorities in the city are listed below:

- Bangalore Development Authority
- Bangalore Metropolitan Region Development Authority
- Bangalore Water Supply & Sewerage Board
- Bangalore Metropolitan Transport Corporation
- Bangalore Metropolitan Land Transport Authority
- Lake Development Authority
- Karnataka Slum Clearance Board
- Karnataka Urban infrastructure Development and Finance Corporation
- Bangalore International Airport Area Planning Authority

Government Departments

A number of regulatory and development departments, including the Police Department, Public Works Department, Health Department, Education Department, Revenue Department, Town Planning Department, Horticulture Department, Motor Vehicles Department, et-al, also have an interplay in the metropolitan area. The multiplicity of organizations, operative laws, and overlapping jurisdictions has created conflicts in their functions and difficulties in governance.

Table 9: Functional Responsibilities of Various Agencies

Urban infrastructure	Planning and design	Construction	Operation and maintenance
Water supply	BWSSB, BBMP	BWSSB, BBMP	BWSSB, BBMP
Sewerage	BWSSB, BBMP	BWSSB, BBMP	BWSSB, BBMP
Storm water drainage	BBMP	BBMP	BBMP
Solid waste disposal	BBMP	BBMP	BBMP
Municipal Roads (incl. flyovers)	BDA, PWD, BBMP	BDA, PWD, BBMP	BDA, PWD, BBMP
Street lighting	BBMP	BBMP	BBMP

Source: STEM - Infrastructure Development & Investment Plan for Bangalore

8.2. Public Participation in Governance

The formal (legislated) mechanism for public participation is through the "Ward Committees," while there are also other semi-formal and informal mechanisms. Bangalore has a number of active and well-known Non-Government Organizations (NGO) that work in various areas of urban infrastructure, urban governance, urban poor, heritage, and environment. These include CIVIC Bangalore, Janaagraha, Public Affairs Center, et.al. Apart from the NGOs, there have been some attempts to improve citizen/ industry participation in urban affairs. Some of these are initiatives are mentioned in this section.

8.2.1. Ward Committees

With an objective to decentralize the functioning of the local administrative bodies, The Constitution (74th Amendment) Act, 1992 mandated the setting up of ward committees

in cities with population of more than 3 lakhs. The Karnataka Municipal Corporations (Ward Committee) Rules, 1997 set out the operating procedures for the ward committees. These rules mandate the ward committees to meet at least once every month and that they shall be open to public participation.

Accordingly, Government of Karnataka and the erstwhile BMP set up 30 ward committees in June 2003. Each committee comprises 3-4 wards with the Assistant Revenue Officers as conveners. The functions to be discharged include:

- Collection and removal of garbage
- Removal of accumulated water on streets, public places due to rain and other caused
- Health immunization services
- Improvement of slums including its clearance wherever necessary in accordance with the established law
- Redress public grievances that pertain to the Ward Committee
- Maintenance of essential statistics
- Organizing people's participation with regard to the functions allocated to the Ward Committee
- Numbering of streets and premises.

In addition, the Ward Committees are responsible for supervision and monitoring the implementation of the decisions by BBMP, in specified matters.

8.2.2. Semi-formal Mechanisms

Attempts have been made to involve industry/ prominent citizens in a partnership framework with the Government and two such mechanisms are mentioned below.

Bangalore Agenda Task Force

The Government constituted the Bangalore Agenda Task Force (BATF) by an order in 1999, as a task-force comprising of eminent industrialists, professionals, and citizens. BATF conceived projects at the city level and involved other authorities as and when required. The former Managing Director of Infosys was the Chairman, with eleven other members, including Commissioner of erstwhile BMP as Member Secretary. BATF sought to secure greater involvement of citizens, elected representatives, industry, and institutions in the orderly development of the city.

BATF went about developing and applying partnership models with participating service delivery agencies such as, BDA, BWSSB, BSNL, Bangalore Police, BMTC, BESCOM, and with erstwhile BMP. A structure was also evolved in the form periodic public summits. However, the absence of space for elected local representatives was a possible lacuna that impeded BATF from keeping pace with changing political scenarios, and it is not functioning currently.

City Infrastructure Review Committee

This committee, Chaired by the Chief Secretary, operates under a government-industry format. Senior officers of the government/ government agencies, BBMP, and industry/

industry associations, are members. The Committee identifies key infrastructure issues in the City, and attempts to coordinate strategies to address these issues.

ABIDe

Agenda for Bengaluru Infrastructure and Development Task Force (ABIDe) is an initiative by the Honourable Chief Minister Dr. B.S. Yeddyurappa and GoK to build a better Bengaluru for its citizens by adopting a new urban planning model, upgrading infrastructure, improving social facilities to create a better environment for a good quality of life. The task force will deliberate upon the challenges facing the city, develop blueprints for possible solutions to these, consult with city agencies, the public and other stakeholders, and provide recommendations for the way forward. Wherever needed, ABIDe will also facilitate the work of agencies and departments by resolving bottlenecks. ABIDe has formulated several draft reports and action plans and blueprints in the areas of Governance, Road Traffic Management & Transportation, Urban Poor, and Public Security. A list of all the ABIDE projects are set out in Volume 2 of the CDP.

JNNURM Consultations

The consultation process and citizen's interest in the JNNURM has provided a significant opportunity for various stakeholders to participate and give their opinion/ feedback. Apart from the consultation initiated by the ULBs and other agencies such as BMTC, NGOs such as Janaagraha, and newspapers such as Deccan Herald, also initiated a consultation/ feedback process. A wealth of archived material is now available, which the City intends to use in defining the projects and creating the Detailed Project Reports (DPR).

8.3. Public-Private Participation in Infrastructure

The new Bangalore International Airport stands testimony to the City's experience in implementing large infrastructure projects on a PPP format. A number of transport & road related projects are also being taken up on the PPP format – these include elevated roads, inter-modal exchanges, parking complexes and the proposed High Speed Rail Link to the airport. However, as far as urban infrastructure is concerned, the City has been able to attract private sector participation only in a limited manner,

Table 10: PPP in Urban Infrastructure

Urban Infrastructure	Role of the private sector
Water supply	Private sector is involved only in selected areas such as WTP maintenance. BWSSB is responsible for planning of water supply networks and supply of water for the whole of Bangalore, besides Operation and maintenance of existing infrastructure
Sewerage	No role of private sector in sewerage and related infrastructure, BWSSB is the sole Agency responsible for planning and execution, Operation and maintenance of sewerage system for the whole of Bangalore
Drainage	No role of Private sector, BBMP is responsible for planning and laying, operation and maintenance of drainage system in its concern jurisdiction.
Storm water drainage	No role of Private sector, the BBMP is responsible for planning and laying SWD infrastructure, operation, and maintenance of drainage system in their area of jurisdiction.

Urban Infrastructure	Role of the private sector
Solid waste disposal	Private Developers have taken up and operated a number of projects in this sector on concession (BOT) basis. The spectrum of their involvement ranging from primary to secondary collection to transportation and setting up , O& M of landfills and other related infrastructure for Solid waste disposal.
Municipal Roads (incl. flyovers)	No role of Private sector, the BBMP is responsible for roads falling within their jurisdiction.
Street lighting	Private sector role in street lighting has been limited to construction and O&M of street lights in small segments/ roads falling within BBMP limits, however, BBMP authority has a major role in providing street lighting infrastructure, operation, and maintenance of the same.

Figure 2: Population Density

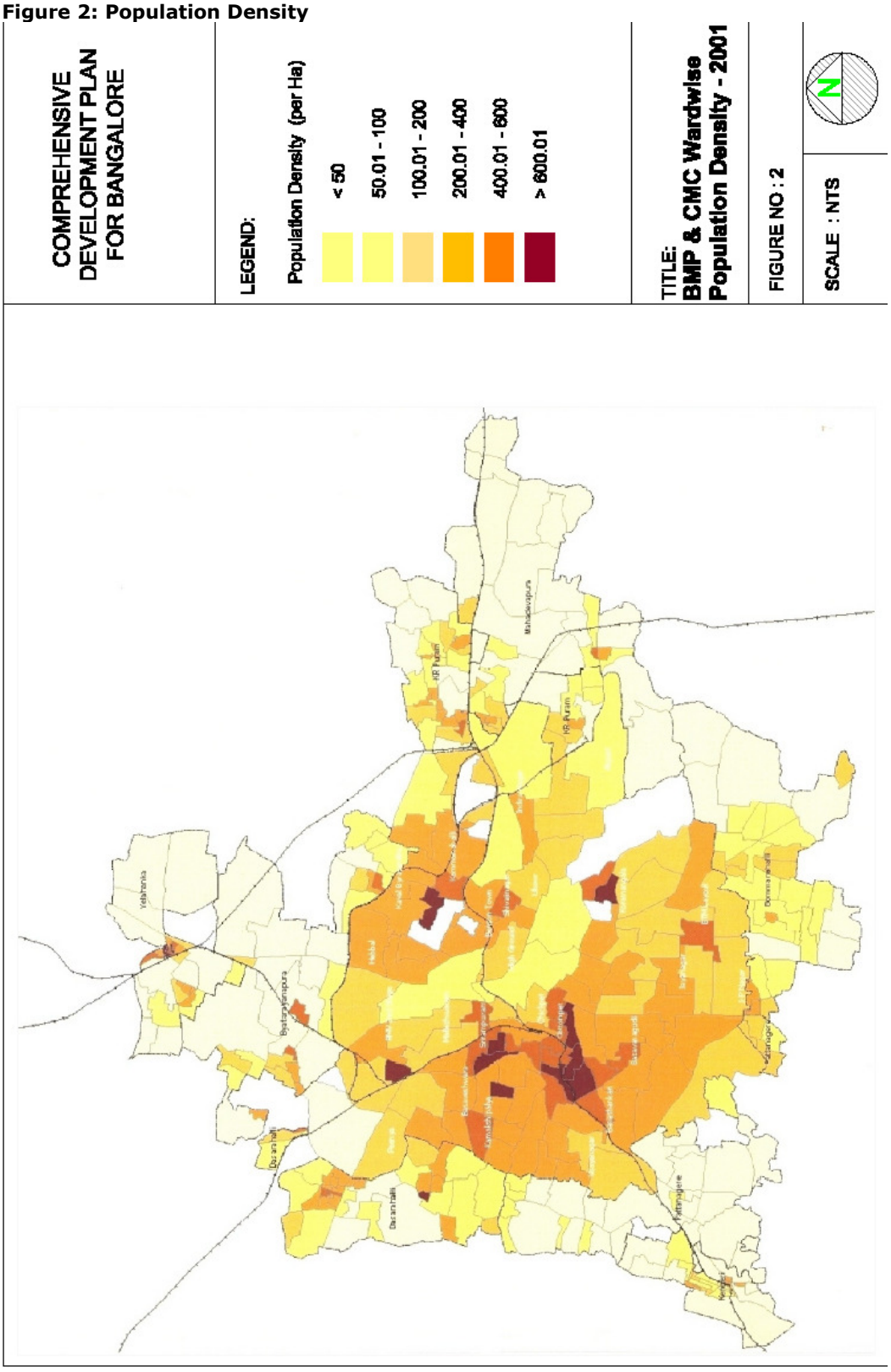


Figure 3: Growth of Bangalore

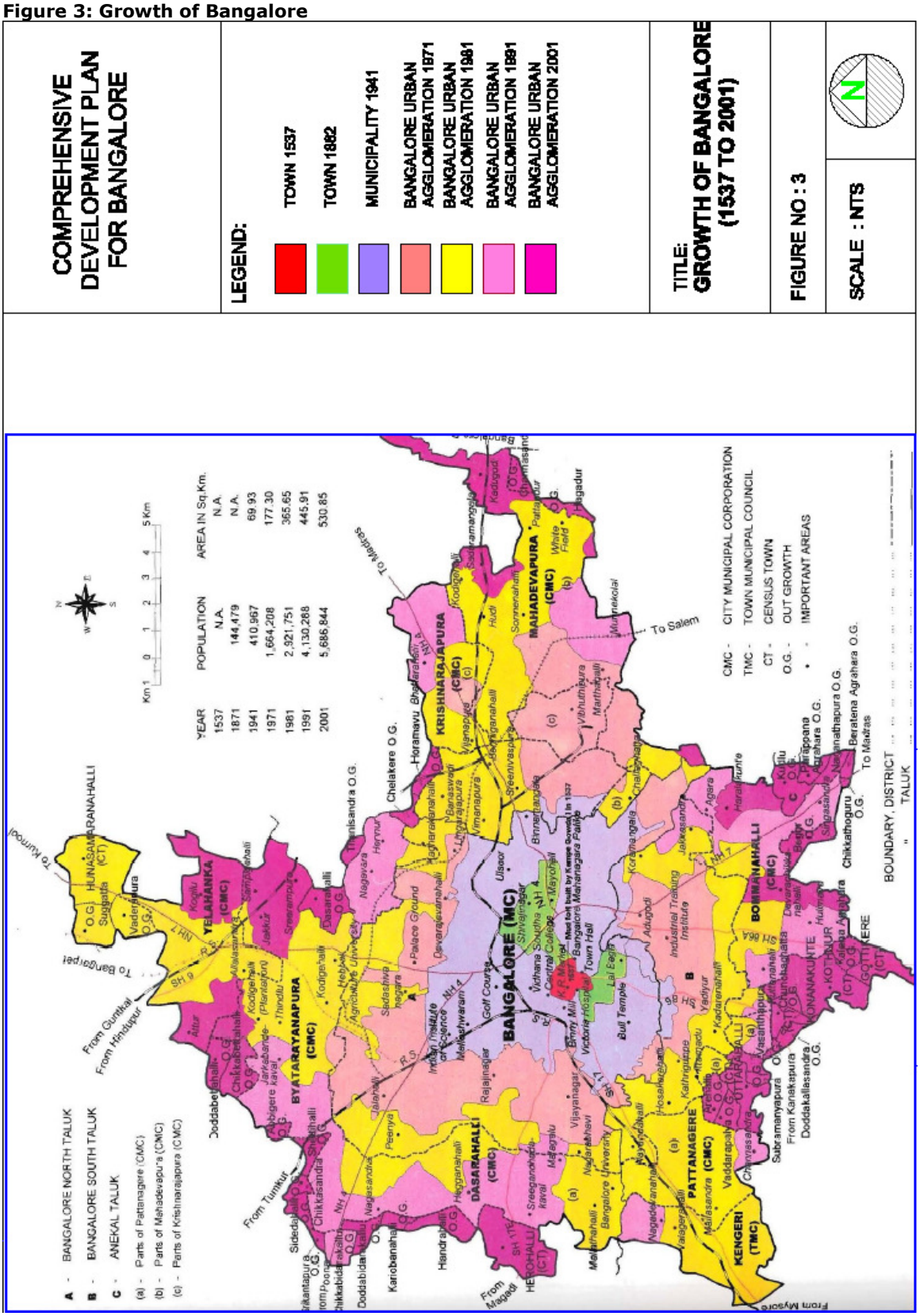


Figure 4: Structure Plan

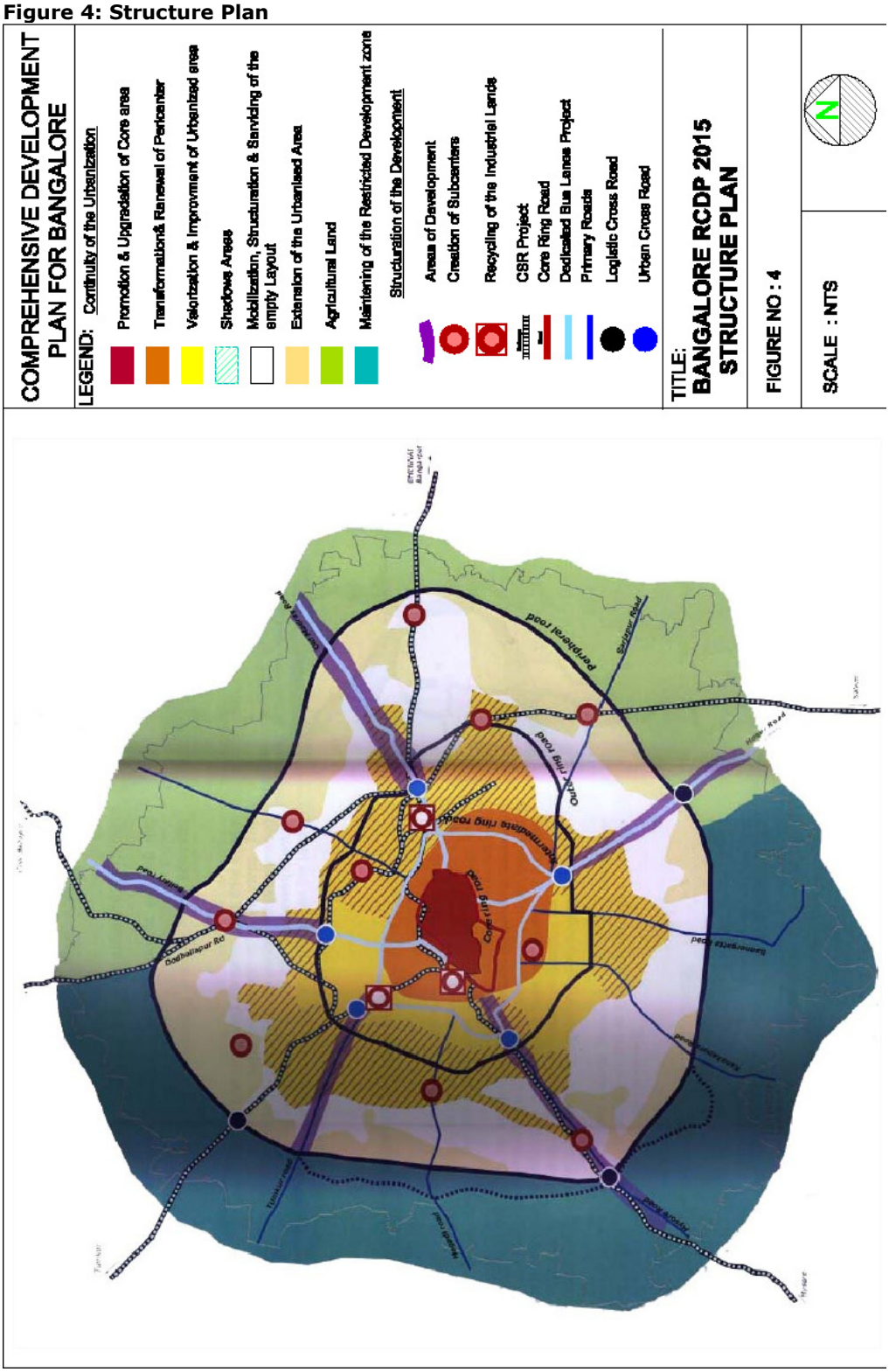


Figure 5: Administrative Area

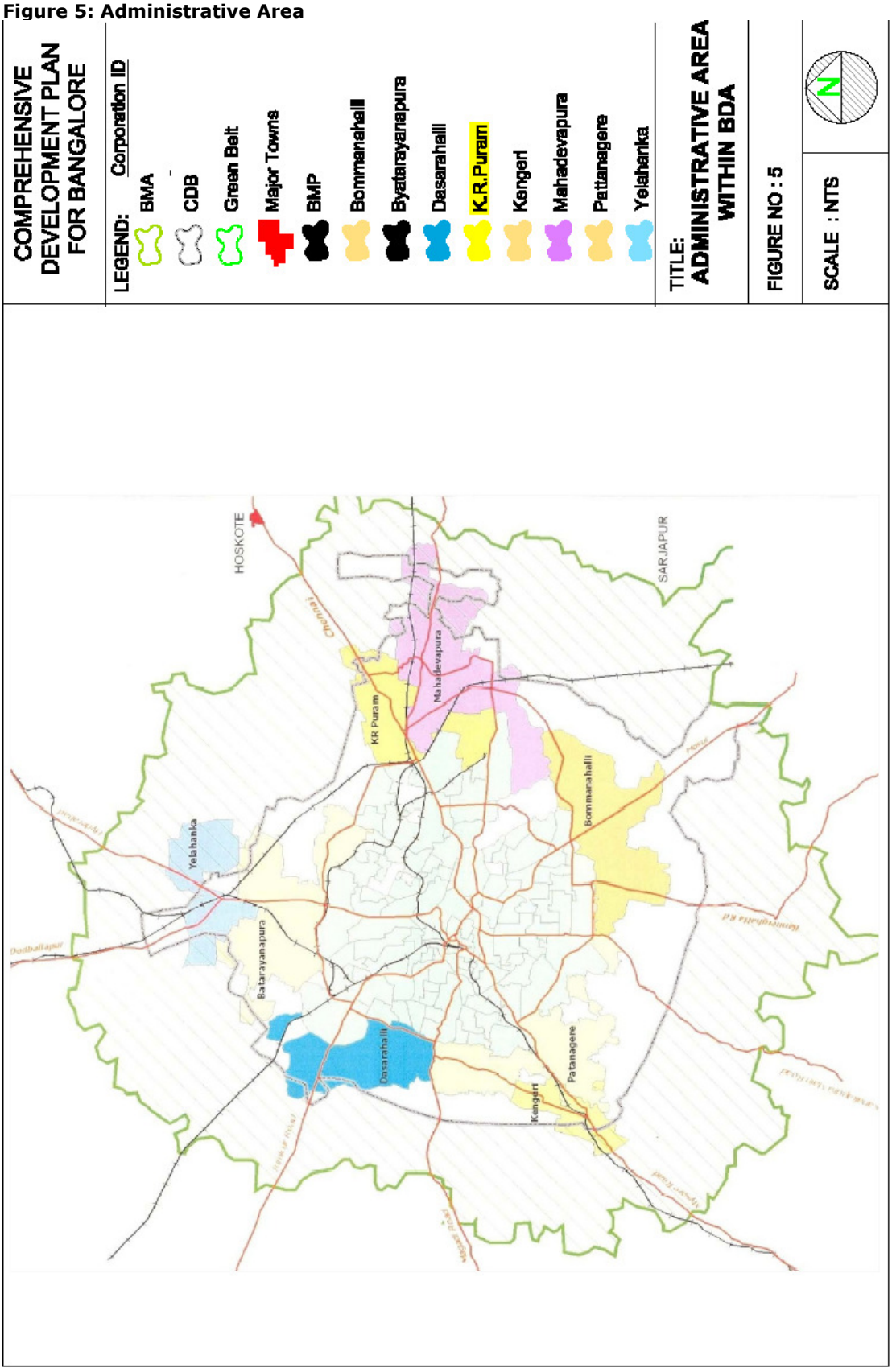
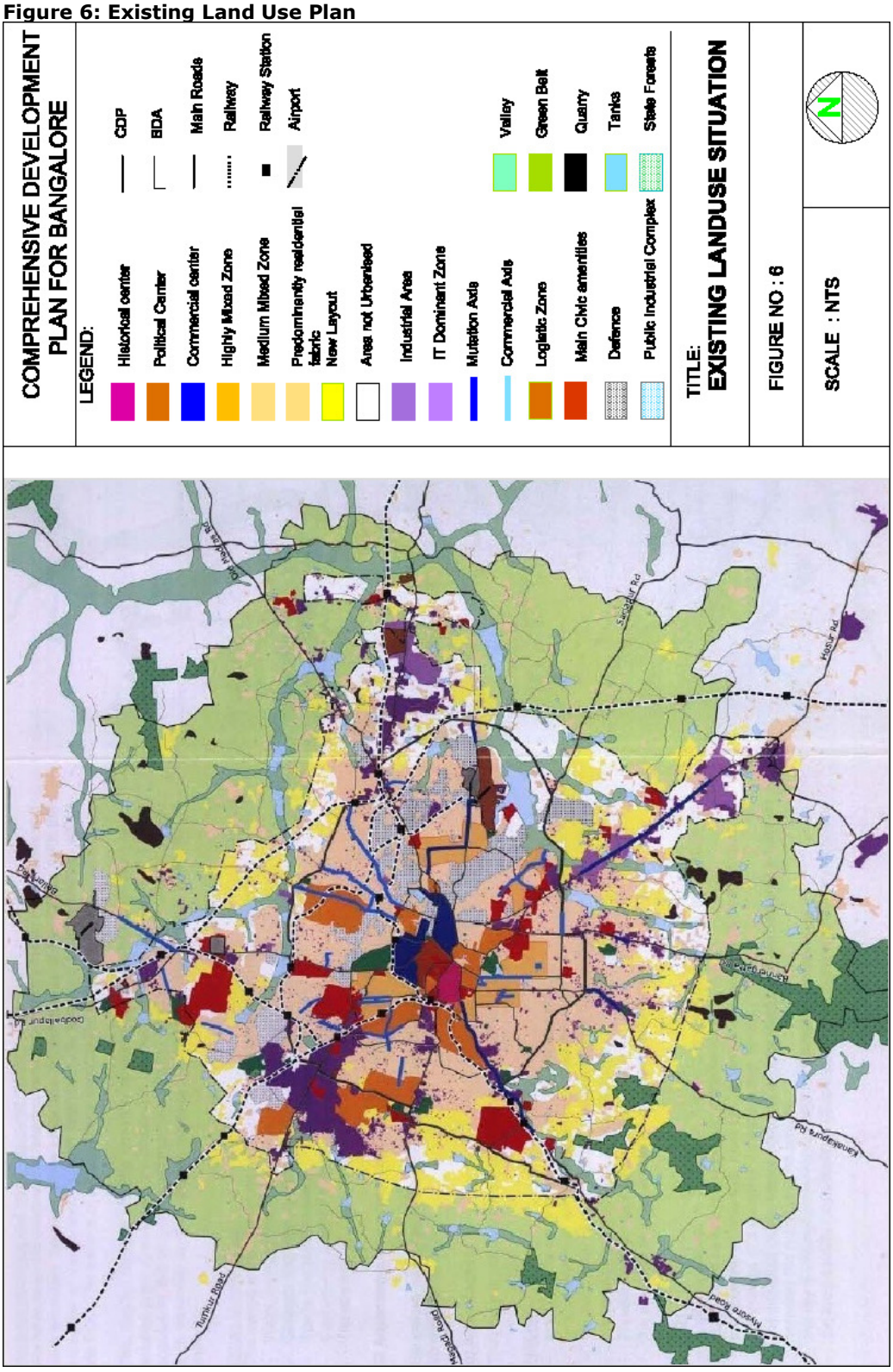


Figure 6: Existing Land Use Plan

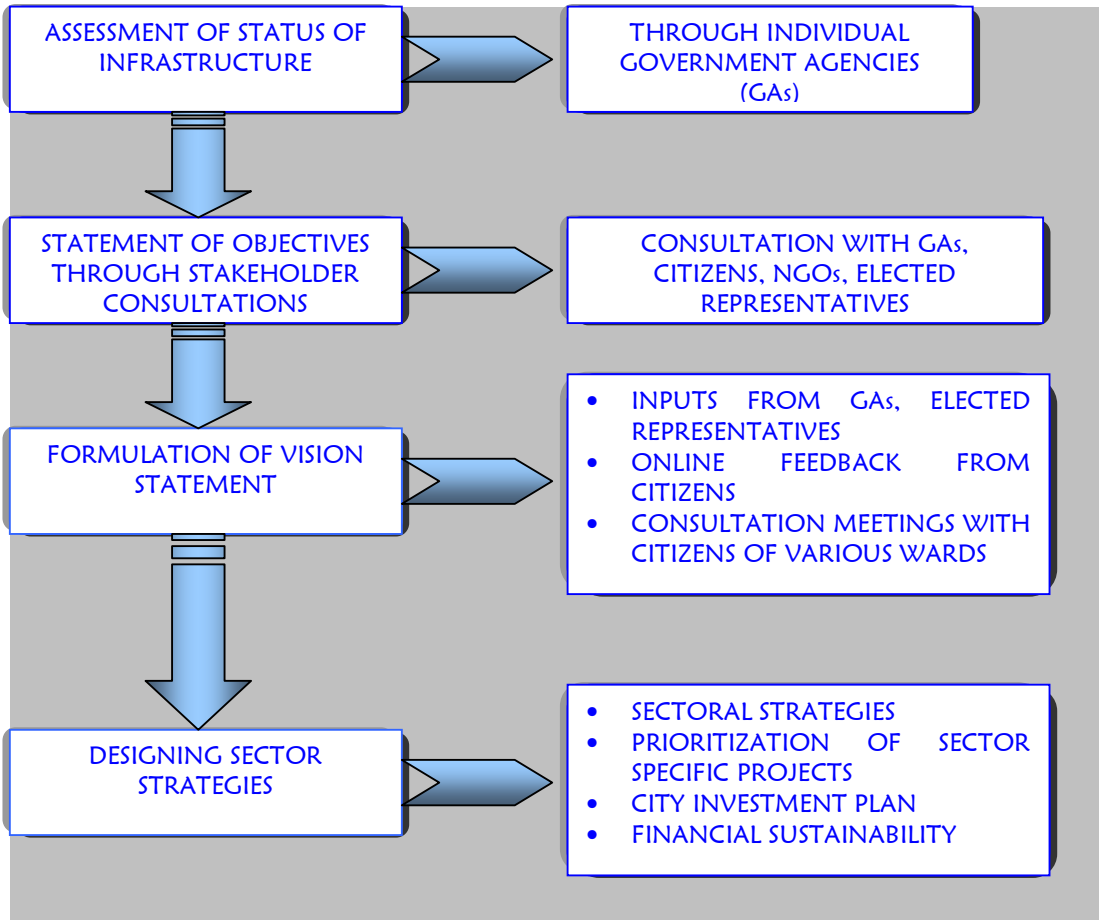


Chapter 3: Stakeholder Consultations & Vision

1. Approach

Preparation of the CDP under the JNNURM has been through a process of consultation, which has enabled the preparation of a document that charts the direction of development in Bangalore. The consultation process focused on the Vision and Mission Statements, but also provided a forum for discussion of various initiatives being taken by the government institutions and other stakeholders to meet the growing infrastructure needs of Bangalore. Figure 7 depicts the methodology adopted for formulation of CDP.

Figure 7: Flow Chart on CDP methodology



1.1. Need for Stakeholder Consultations

Diverse stakeholders participate in the City's growth, and the impact of such growth on each stakeholder varies. Each stakeholder group has its own priorities and requirements, which in some instances may be at variance with those of the other groups. In order to arrive at a preponderance of opinion among all the stakeholders, it was essential that all groups discuss their needs, expectations, and priorities to chart out the development plan. This has been the spirit of the CDP preparation process as envisaged in the toolkits provided under JNNURM. lists the various stakeholder groups and their role in the City's functioning.

Table 11: Stakeholder Groups & Roles

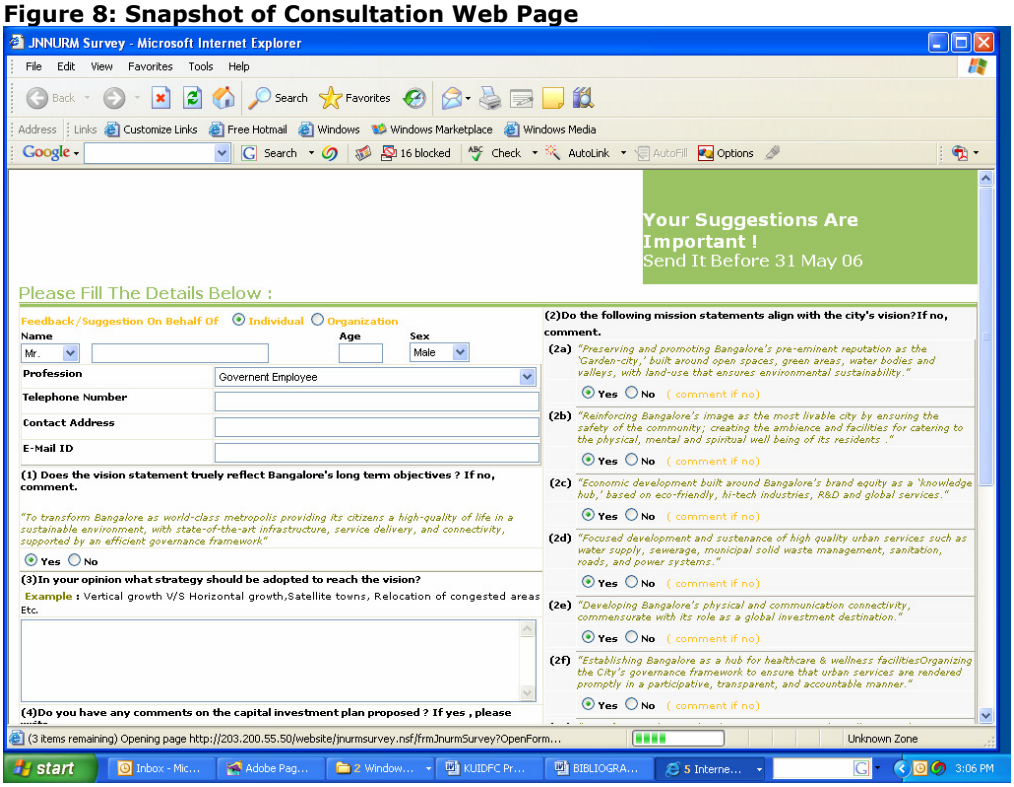
No	Group	Members	Role
1	Citizens		Receivers of the services Advice the Government on Vision, development issues and way forward.
2	Government	BBMP BDA BWSSB BMTC KSCB KHB KSRTC	Enabler, Regulator & Provider of civic services Develop a vision and strategy Prepare development plans Implement policies & plans
3	Elected Representatives	Councilors MPs MLAs	Voice the opinion of people Framing of policies & local level projects
4	Representatives from Citizen groups	NGOs RWAs	Voice the opinion of people Take up local issues
5	Institutional Stakeholders	Trade Industry Associations	Inform the Government on policy issues

1.2. Multi-pronged Approach

Given the diverse nature of the stakeholder group it was imperative that the consultation process be as broad based and participative as feasible. To ensure maximum participation, the following methods were adopted:

- Workshops were held to involve multiple stakeholders in the plan process-It proved to be an efficient and effective way of obtaining a range of public opinions on the CDP. More than 50 stakeholder consultation workshops were conducted across the city during March and June 2006. The profile of stakeholders included Government Agencies, ULB, NGOs, elected representatives, trade associations and the public
- One-on-one Meetings were held with prominent citizens, officials of different government agencies, and policy makers, to discuss the vision statement and the project proposals to be included in the CDP
- Structured questionnaires were used to obtain feedback on the CDP from various stakeholders
- Consultations by other agencies/NGOs-Other than BBMP, (which includes the former CMCs, and TMC) carrying out the consultation process, BMTC and certain NGOs such as Janaagraha also carried out focused consultations with user groups and citizens. Newspapers such as Deccan Herald also ran a month-long forum, soliciting views of readers about the JNNURM. A very large amount of archival feedback information is available with the City. A very large quantum of this material pertains to specific local issues and suggestions, which would be used by the agencies for designing specific projects
- On-line Feedback was another method used to obtain feedback from the public. A web page was created on KUIDFC's web site for this purpose and a feedback form was included to enable citizens to post their views and opinions on the Vision and Mission Statements, as well as on any other areas of interest. A screenshot of the web page is shown in Figure 8.

Figure 8: Snapshot of Consultation Web Page



1.3. Consultation Schedule

Table 12: Schedule of Stakeholder Consultations

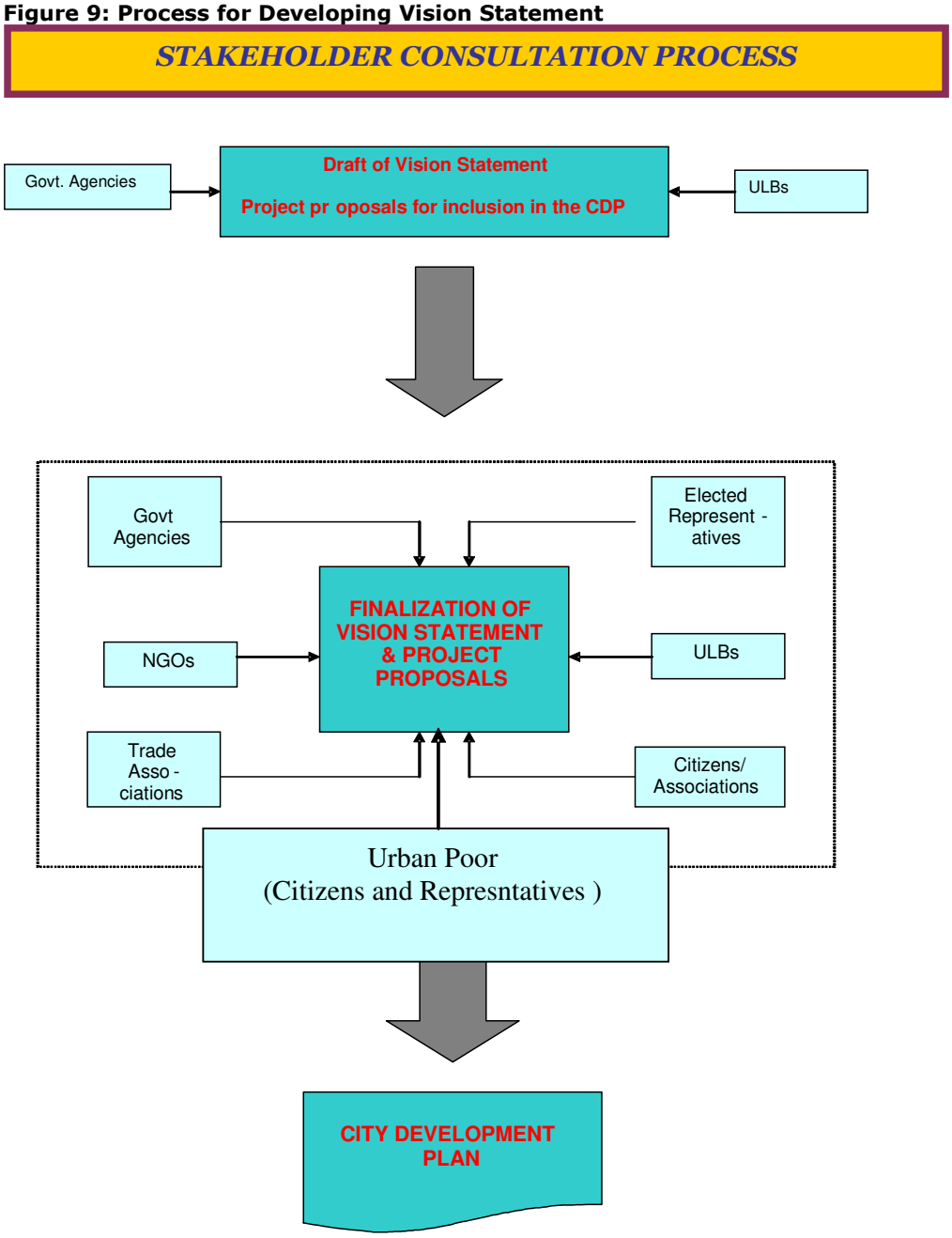
Date	Agencies	Venue	Purpose
15/03/06	Government Agencies - BMTC, BDA, BBMP, BWSSB, KSCB, ITBT, BMRDA, KSRTC, Heritage Board, KHB, Janaagraha, BIAAPA, Tourism	Conference Room, KSRTC	Developing a vision Statement for the City
25/03/06	BSUP – KSCB, KHB, BBMP, KUIDFC	Conference Room, KHB	Discussion on project proposals for the urban poor – includes housing, sanitation, etc
01/04/06	Government Agencies – BMTC, BDA, BBMP, BWSSB,	PS, UDD Chamber	Developing & refining the vision Statement for the City Key projects for inclusion in the CDP
07/04/06	NGOs	Conference Room, KSRTC	Developing & refining the vision Statement for the City Inputs to the CDP

Date	Agencies	Venue	Purpose
21/04/06 **24/04/06** **26/04/06** **27/04/06** **28/04/06**	Former ULBs RR Nagar & Kengeri Mahadevapura & KR Puram Yelahanka & Byatarayanapura Bommanahalli Dasarahalli	In respective zones	Inputs for Vision Statement Inputs for finalizing the CDP
06/05/06	BBMP	In 30 wards / ARO ranges across the city	Comments on vision statement Comments on project proposals Inputs to CDP
09/05/06	Elected representatives	KRISHNA CM's Residence Office	Approval of Vision statement Indicative Capital Investment Plan
10/05/06	Trade associations	Hotel Atria	Comments on vision statement Comments on project proposals Inputs to CDP
25/05/06	Government Agencies - BMTC, BDA, BBMP, BWSSB, ULBs, KSCB, ITBT, BMRDA, KSRTC, Heritage Board, KHB, Janaagraha, BIAAPA, Tourism	KUIDFC	Overall CDP, content and process, priorities of the project
27/05/06	NGOs	Hotel Atria	Basic services to urban Poor Vision, strategies and plans

Vision and Mission Statements

Figure 9 indicates the process adopted for finalization of the Vision and Mission statements.

Figure 9: Process for Developing Vision Statement



The key results areas, which emerged during the consultation process, were used to set out the decision parameters. These formed the basis for formulation of the Vision and mission statements. Multiple rounds of discussions and consultations were held to draft the statement in order to convey the intent and purpose. Stakeholder feedback was also given on the form and construct of the Vision Statement, based on which the statement was refined.

2. Profile of Stakeholder Groups

In addition to the workshops, a specific section on JNNURM was created at the website www.kuidfc.com. Questionnaires were circulated to various participants of the

workshops. The profiles of citizens, who participated in the web-based feedback process is set out in to Table 13 to Table 15.

Table 13: Profile of Respondents – By Gender

Gender	Number	Percentage
Male	186	89
Female	24	11
Total Respondents	**210**	**100**

Table 14: Profile of Respondents – By Age

Age	Number	Percentage
< 30 years	32	17
30 – 60 years	128	67
Above 60 years	31	16
Total Respondents	**191**	**100**

Table 15: Profile of Respondents – By Profession

Profession	Number	Percentage
Business	21	15
Housewives	9	6
Engineers	6	4
Retd Govt Servants	15	11
Students	6	4
Doctors	3	2
Private employee	38	27
Self employed	9	6
Others	32	23
Total Respondents	**139**	**100**

3. Feedback & Priorities

The consultations provided inputs on the Vision and Mission statements and on the priorities of the stakeholders groups and citizens. The feedback on the content of the Vision Statement is given in Table 16. Suggestions were also given on the form and construct of the Vision Statement.

Table 16: Feedback on Content of Vision Statement

Response	Number	Percentage
Yes (Agree)	207	96
No (Disagree)	7	4
Total Respondents	214	100

Similarly, Table 17 gives the feedback on the Mission Statements.

Table 17: Feedback on Mission Statements

Response	Number	Percentage
Yes (Agree)	205	95
No (Disagree)	9	5
Total Respondents	214	100

3.1. Key Priorities – Direct Consultations

Table 18 highlights the key priorities, which emerged during consultations.

Table 18: Key Priorities Stated by Stakeholders

Sector	Key Priorities
SWM	Importance of efficient Solid Waste collection and transportation Higher capacity transportation vehicles for SWM Create garbage dumping yard and landfill facilities
Roads & Transportation	Develop Ring road & construct flyovers to ease traffic congestion Improve strength of roads for HTV Improve Panchayat Roads & local roads Develop service roads next to ORR Speedy completion of national highway works Develop roads in accordance to the requirement of multi-storied buildings (apartments) Provide service roads along NH4 Provide Skywalks Develop inner roads and link roads that connect to the ring road Provide Multi-storied parking on all main roads to ease traffic congestion Widen Mysore road till Kengeri Provide bus terminals in the outskirts of the City Provide subways at Railway gates for pedestrians Improve footpaths Tarring of all street roads Provide bus shelters Not to write on the window panes of BMTC and BTS buses
Urban Poor	Housing for poor Develop slums Provide education and health facilities for the poor Improve basic services to urban Poor with clear plans
Water supply, sewerage, and drainage	Ensure regular water supply & distribution Improve storm water drains Provide proper UGD facility, cleaning of road side drains Regular supply of drinking water Construct overhead tank for drinking water Improve drainage system – create box type drainage Water distribution pipeline to be provided from Hessarghatta Provide proper drainage & road widening in Dasarahalli village Improve storm water drains
Other civic infrastructure, reform & participation	Provide more libraries Develop lakes, parks, playgrounds, slums & burial ground Provide UGD and street lights Provide Health services in all wards Curb unauthorized land encroachments and constructions Provide "kalashetras" for conducting cultural programs Provide health facilities, PHC Construct stadiums & commercial complexes Stop registration of sites in green belt area Rainwater Harvesting to be made compulsory Stop further development of unauthorized layouts and regularize the existing unauthorized layouts Plant trees & control mosquito menace to protect environment Provide police stations Involve citizens in reforms

3.2. Key Priorities – Web Feedback

The analysis of the individual responses on the website and the filled up questionnaires present a set of priorities, as perceived by citizens. Table 19 states the consolidated responses of the participants in the web feedback.

Table 19: Consolidated Web Responses of Participants

Sectors/Areas	Number	Percentage
Road Network	70	20
Water Supply	45	13
Urban Transport	44	13
Sewerage & Sanitation	44	13
Improvement of drains / drainage	33	10
Re-development of inner city areas	25	7
Infrastructure	20	6
Basic services to urban poor	13	4
Development of bus terminals	12	3
Preservation of water bodies	12	3
Solid Waste Management	12	3
Integrated development of slums	7	2
Development of heritage areas	4	1
Street lighting	3	1
Total	344	100

The key priorities as envisaged by different stakeholder groups are summarized in the table below.

Table 20: Priorities of Different Stakeholder Groups

	Priorities
Citizens	Primarily focused on urban infrastructure services such as roads, sewerage and sanitation, parks etc Most of the suggestions are localized in nature i.e. in relation to the wards they reside and nearby localities.
NGOs	Apart from basic services, the attention was on basic services to the urban poor There were ward level plans prepared by the group and the same were also highlighted Issues relating to the efficacy and conduct of JNNURM
Industries	Specific infrastructure in relation to the user groups such as road connectivity, urban drainage systems, water supply and sewerage sectors

4. Formulation of Vision Statement

The consultation process and citizen feedback formed the key input basis to formulating the Vision and Mission Statements, and formulating the strategy for the CDP. Since the formulation of the Vision and Mission Statements has been through a process of consultation, there were various choices for the form and content of the statements:

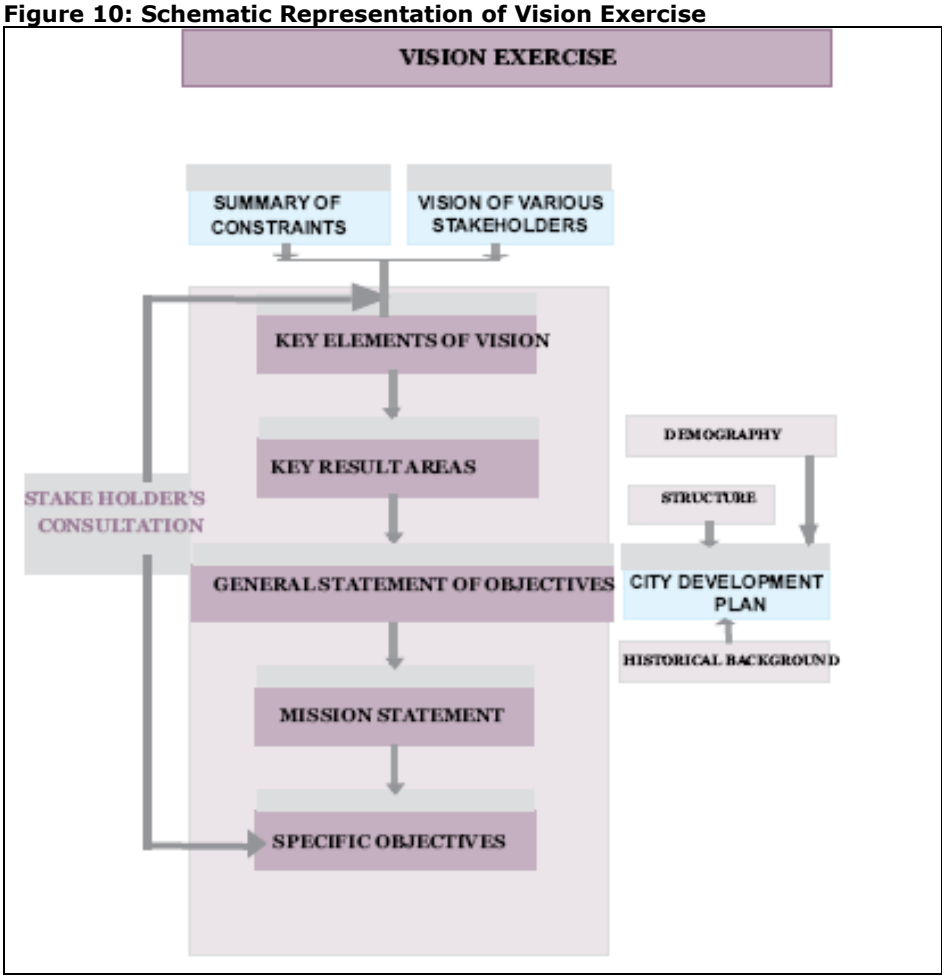
- Whether the statements could be long or short versions;
- What substance and essence was to be included; and

- The sectors that would be covered.

Possible formats, statements and areas, including the vision statements of other cities in the country and abroad, were examined, and an elaborate consultation exercise was carried out to arrive at the final Vision and Mission Statements.

By choice, Bangalore came out with a shorter Vision Statement and a more detailed set of Mission Statements. By the very nature of the process, it is clear that these cannot be all encompassing and completely satisfying every stakeholder, but the dominant feedback from stakeholders was very positive. Figure 10 shows the schematic representation of the process.

Figure 10: Schematic Representation of Vision Exercise



4.1. Setting Objectives

A clearly articulated Vision sets out the reasons for City's activities and the "ideal" position that the City aims to achieve. The Mission identifies major goals and performance objectives. Both are defined within the framework of an overarching philosophy and as a context for development and evaluation of intended and emergent strategies. In principle, the process of setting objectives is relatively straightforward; however, in practice the process is complex, particularly in a large metropolis like Bangalore.

The sequence of activities includes:

- Identification of the City's current position, including service delivery;
- A statement of environmental, political, inter-departmental, and government factors affecting the functioning;
- Agreement among the stakeholders as to objectives and vision; and
- Factoring in the reality of available resources.

4.2. Characteristics of Statements

It was envisaged that the Vision and Mission Statements should exhibit certain characteristics, principally:

- Focus on distinctive values rather than upon every opportunity that is likely to exist;
- Espouse the underlying role of the City Government under the Plan; and
- Emphasize the major policies that the City Government has to pursue.

The City Development Plan represents a dynamic process, and there is a need for redefinition either when its appropriateness is lost or when it no longer defines the optimal course desired by the citizens. The Vision and Mission Statements are currently made available to the public through the KUIDFC website.

5. Background to the Vision Exercise

The Vision exercise depended on certain basic principles and information that is summarized in the following sections.

5.1. The City Context

Bangalore is a unique city. It used to be called a "Pensioners' Paradise," where land was cheap, and so were fruits and vegetables that were available in abundance. The British set up a cantonment, and built beautiful villas to live in the comfort of the "Garden City." As the city began to expand, and industry, institutions of research and education, trade, commerce, and finally high-technology industry came in, Bangalore become a bustling metropolis with all the attendant charms and ills. The question before the City is to reconcile the compulsions of growth with the need to preserve the character of Bangalore, as the most livable city.

5.2. Assessment of Status

As discussed in Chapter II, the high growth being experienced in the City, and the changing profile of its economy, has put stress on the City's infrastructure. The status of the City's infrastructure and the urban poor issues has been detailed in subsequent chapters. Citizens and other stakeholders (Government and NGO) are well aware of the overall situation, and are striving to address these issues in their own capacity.

5.3. Vision Statement of Key Agencies

Almost all the key agencies, including BDA, BBMP, BMTC, and BWSSB, have their own Vision and Mission Statements. These statements are sector oriented, but also address "quality of life," citizen participation, and sustainability. The available vision statements of these key agencies were analyzed for drawing the City's priorities.

5.4. Coverage Area for the CDP

The region considered for the CDP for Bangalore covers the following areas

Table 21: Coverage Area for the CDP

Zones	Area (sq.km)
Erstwhile BMP area	226.2
Erstwhile CMCs/TMC area	
Bommanahalli	43.6
Byatarayanapura	47.0
Dasarahalli	38.0
KR Puram	21.3
Mahadevapura	46.2
RR Nagar	66.0
Yelahanka	38.8
Kengeri	34.0
Total BBMP area (excl. 110 villages)	561.1
BIAAPA	792.0
Total	**1353.1**

Bangalore International Airport Area Planning Authority is the nodal agency for development of the international airport and the surrounding areas. With large scale development expected in the region, BIAAPA would be one of the prominent authorities propelling development. In light of the same, area covered under BIAAPA's jurisdiction has been considered as a coverage area for CDP. However, as the development is in nascent stage, while the Vision Statement developed would extend to BIAAPA areas also, listing of projects/activities and estimation of investment requirement has not been carried out.

6. The Vision Statement

The Vision Statement for Bangalore had an initial formulation, which the stakeholders debated and discussed during the consultations. The previous sections have outlined the feedback obtained during the process of consultations, and this feedback was largely in agreement with the coverage of objectives in the vision statement. However, there were various suggestions on the actual construct of the statement, particularly with reference to some subjective clauses in the formulation. Based on these suggestions, the construct of the vision statement has been recast, and finalized.

6.1. Initial Formulation of Vision Statement

"To transform Bangalore as world-class metropolis providing its citizens a high-quality of life in a sustainable environment, with state-of-the-art infrastructure, service delivery, and connectivity, supported by an efficient governance framework."

6.2. The Final Vision Statement

"Bangalore has evolved as a cosmopolitan and livable City, with a global presence. To retain its pre-eminent position as a City of the future, the City shall enable and empower its citizens with:

- Growth opportunities to promote innovation and economic prosperity;
- A clean and green environment;
- High-quality infrastructure for transport and communication;
- Wide-ranging services aimed at improving the quality of life for all;
- Conservation of its heritage and diverse culture; and
- Responsive and efficient governance."

6.3. Mission Statements

2. Developing the economy around Bangalore's balanced economic base of its traditional industry and its brand-equity as a 'knowledge hub' based on eco-friendly, hi-tech industries, R&D and global services;
3. Preserving and promoting Bangalore's pre-eminent reputation as the "Garden City" built around open spaces, green areas, water bodies, and valleys, with land-use that ensures environmental sustainability;
4. Putting in place appropriate, comfortable, integrated, multi-modal public transport system for the region, based on efficiency and affordability.
5. Developing Bangalore's physical and communication connectivity, commensurate with its role as a global investment destination;
6. Transforming the peripheral areas into integrated satellite townships, interspersed with ample green spaces, with requisite human resources, thus enabling all the residents to benefit from the growth and opportunities afforded;
7. Providing focused development and sustenance of high-quality urban services such as water supply, sewerage, municipal solid waste management, sanitation, roads, and power systems;
8. Providing housing for all sections of the population, with special focus on developing low-cost and budget housing;
9. Caring for the needs of the urban poor, while ensuring their participation in the economic growth in an equitable manner, and ensuring their access to housing and other basic services;
10. Reinforcing Bangalore's image as the most livable City by conserving its heritage and diverse cultures, revitalizing its traditional business districts, ensuring the safety of the community, and creating the ambience and facilities for catering to the physical, mental, and spiritual well-being of its residents; and

11. Organizing the city's governance framework to render urban services promptly in a participative, transparent, and accountable manner.

7. Stakeholder meet for the newly added areas

As part of the revision of CDP, stakeholder meets were organized for all the erstwhile CMC areas. When BMP transformed into BBMP, not just the CMCs and the TMC, but also 110 villages formed a part of it. Five stakeholder meets were held in five of the newly formed zones. The purpose of the stakeholder meet was to assess the requirements of the citizens representatives in those villages. The Vision statement was to be followed as is. Inputs from the stakeholder meets and subsequently in the revision of the Capital Investment Plan.

Table 22 below shows the date and time for the stakeholder meet held at zonal headquarters in the villages that form a part of the five zones viz; Raja Rajeshwari Nagar, Dasarahalli, Mahadevapura, Bytarayanapura and Bommanahalli.

Table 22: Date and time of the stakeholder meetings

Sl. No.	Zone	Date	Time
1	Raja Rajeshwari Nagar	29-06-09	11:00 am
2	Dasarahalli	30-06-09	3:00 pm
3	Mahadevapura	01-07-09	3:00 pm
4	Bytarayanapura	02-07-09	3:00 pm
5	Bommanahalli	03-07-09	3:00 pm

All stakeholder meets were chaired by their respective zonal Commissioners or in their absentia by other officers of BBMP, were attended by personnel from KUIDFC, the nodal agency for JNNURM projects in the State and representatives from iDeCK. The priority sectors in infrastructure for the villages that form a part of the five zones are given in the Table 23 below;

Table 23: Priority sectors in each zone

Sl. No.	Zone	Rank	Priority Sectors
1	Raja Rajeshwari Nagar		
		1	Sewerage
		2	Water Supply
		3	Storm Water Drains
		4	Roads
		5	Solid waste Management
2	Dasarahalli		
		1	Water Supply
		2	Sewerage
		3	Roads
		4	Storm Water Drains
3	Mahadevapura		
		1	Sewerage
		2	Water Supply
		3	Roads
		4	Lake development
4	Bytarayanapura		
		1	Sewerage
		2	Water Supply
		3	Solid Waste Management
		4	Roads
5	Bommanahalli		

Sl. No.	Zone	Rank	Priority Sectors
		1	Sewerage
		2	Storm Water Drains
		3	Roads
		4	Lake development

It was evident from the meetings that all the newly added areas primarily faced issues of water supply and sewerage followed by drainage and roads. Annexure 2 provides details of each of the Stakeholder meetings.

Chapter 4: Growth Drivers for Bangalore

1. SWOT Analysis

The transformation of Bangalore into a metropolis has been a result of a combination of factors including climate, academic strengths, skill base, and industrialization, particularly in high-end services. Bangalore has some impressive and incontestable advantages, which have propelled the City into a "brand" on its own. However, it is imperative to ensure that the infrastructure needs of the mega-city are met, and that the social fabric is coherent, on a sustainable basis. Table 24 displays a SWOT analysis of Bangalore's position.

Table 24: SWOT Analysis of Bangalore's Position

Strengths	Weaknesses
• Salubrious climate • Water availability in Cauvery Basin • Presence of a rich bio-diverse lakes/tanks • Academic Institutions • Availability of a pool of talent/skill base • Cosmopolitan culture • Diverse and balanced industrial base – manufacturing to high-end services • Administrative and structural differences between former BMP and CMCs has been remedied with the formation of BBMP • Experience in building large infrastructure projects on PPP formats	• Land use/ Planning issues – absence of clear CBD, locked up land (defense and railways) • Infrastructure "shadow areas" and under equipped outskirts • Increasing economic disparity in the society • Shortage of middle and low income housing stock
Opportunities	**Threats**
• Continuing upwards on the value curve – in academics and in eco-friendly, high-technology industries and R&D (biotechnology, nano-technology, high end outsourcing, logistics) • Capacity for planned unlocking of land in the city and its periphery • Utilizing the citizen's/NGOs willingness and ability in participative governance of the city • Building upon experience gained in formulating infrastructure projects on a PPP format	• Growth of infrastructure seriously lagging growth of economy & population • Competition from other cities (both metropolises and tier 2 cities), especially from those in Southern India • Delays in policy formulation and implementation in the area of urban governance/management

2. Industrial Growth

Bangalore has outstanding advantages in terms of climate, reasonably good infrastructure, and human resources. Bangalore has acquired the brand of being a "Technology Capital" of the Country, and from an international perspective, Bangalore is now clearly associated with IT/ITeS. However, the City also has dominant presence in the areas of engineering, automobiles, aeronautics, machine tools, apparel textiles, silk, gems and jewelry. The economic position is therefore very balanced, and this is one of the key strengths of the City. In the future, it is anticipated that the resources fuelling the economy will flow from human capital. The new economic paradigm will include:

- Diffusion of technology
- Dominant anchor firms
- Building up fundamental human capital/skill base
- Dominant focus on "speed-to-market"
- Moving up the value chain in services.

Key sectors, which are envisaged to contribute to the growth of Bangalore, include the following:

- IT/ITES and Bio-technology
- Education
- Healthcare

2.1. Planning for Industry

Industry is not necessarily 'invited' but gets established because of base infrastructure, skilled manpower and communication facilities. Industrial development is focused on the provision of good support infrastructure as well as availability of suitable land. It is also important to caveat industrial growth – unless proper planning and zoning is done, the development may result in economic growth at the cost of lowering the quality of life by congestion and infrastructure stress. The imperatives for development of industry are, therefore:

- To maintain and enhance Bangalore's status as hub for eco-friendly, high technology industry and services
- Industrial development shall be in sequestered to planned zones
- Such areas to be designed to be self-sustained with basic infrastructure
- Basic infrastructure, including water supply and transportation to be strengthened.

2.1.1. IT/ ITES and Biotechnology

Bangalore has already been the international focus of development for Information Technology, Bio-Technology and other high-technology industries. However, in the face of land constraints (availability and price) and strain on basic infrastructure, most of the large 'anchor companies' are looking at expansion in other metropolises like Chennai and Hyderabad or tier-2 cities such as Mysore, Pune or Visakhapatnam.

The key issues that need to be addressed for encouraging high-technology industries relate to land and basic infrastructure.

2.1.2. Education

Developing human capital is the key to improving standards of living and economic growth. Bangalore is already at the forefront of education and research, which needs to be further strengthened. Premier institutions in Bangalore include Indian Institute of Science, Indian Institute of Management, National Law School, and many engineering and medical colleges. The objective would be:

- To promote Bangalore as a centre of excellence in education
- Strengthen existing institutions to cater to future requirements
- As before, the City shall play the role of a facilitator to catalyze the development of educational institutions, while the actual education infrastructure can come from private finance. In some cases the City may also be able to lobby with the State or Central Governments to locate specific centers of excellence in Bangalore
- Provision of land in urban corridors for enhancing the number of players that can enter the domain of education
- Creating land banks for educational institutions.

2.1.3. Healthcare

Bangalore's natural advantages, connectivity, and climate form an excellent base to develop the hub of healthcare/medical facilities/tourism. The City would build upon the base of excellent hospitals, medical care already available, and undertake some of the possible developments enumerated here:

- Clean environment, with green spaces, parks, and gardens
- Revival of lakes and water bodies
- Focus on developing special areas/facilities for medical care and rehabilitation.

Here again, the City would play a facilitator's role by setting the base infrastructure and planning/zoning. The private sector would be encouraged to invest in the actual projects/facilities. To make Bangalore a centre for healthcare, there are certain imperatives:

- Affordable medical facilities
- Promotion of alternate therapies
- High quality ambience
- High quality infrastructure amenities
- Emergence of budget accommodation
- Availability of low rental/budget accommodation
- Availability of excellent transportation facilities.

3. Spatial Growth

Bangalore is characterized by a radial system formed by the axes, which converge towards the centre of the city:

- Mysore road and Old Madras road (South, South-West, North, North-East);
- Bellary road and Hosur road (North, South-East); and
- Tumkur road (North-West)

In addition, five other secondary roads complete the main framework:

- Magadi road (West);

- Kanakapura road and Bannerghatta road (South); and
- Varthur road and Whitefield road (East).

The city today stretches in all directions and along these major road corridors. The growth of urbanization along these areas seems to be determined by the industry while the inhabitants occupy the intermediary spaces.

- Urbanization in the south is driven by services sector (Electronic City and Bommasandra) and the resultant boom in the real estate market.
- There has been a slowdown in the west (Dasarahalli, Magadi road, and Tumkur road) with the losing momentum of development in the Peenya Industrial Zone.
- Urbanization has increased in a substantial manner in the northeast and east, again due to services sector (Whitefield and ITPL), and the current airport being within the city.
- North side of Bangalore is now beginning to see an exponential growth as the new airport is located in that direction (Devanahalli).

The projected land-use in 2015 has been assessed in the Master Plan 2015 of BDA, and is indicated in Table 25.

Table 25: Projected Land Needs at Bangalore Metropolitan Area Level

Usage	Area (sq.km)	Percentage
Existing Urbanized Area	512	39
Proposed area to be urbanized as: **Housing** **Hi-Tech development** **Other Industries** **Logistics** **Large scale facilities** **Office spaces** **Other facilities**	300 135 25 15 13 24 2.5 85.5	23
Inside peripheral road	270	
Outside peripheral road	30	
Green belt	270	20.7
Inside peripheral road	40	
Outside peripheral road	402	
Agricultural land	174	13.5
BMICPA	50	3.8
TOTAL	**1306**	**100**

Source: BDA Master Plan 2015

3.1. Spatial Development Scenarios

The future spatial growth of the city can take form in many ways, or "scenarios." This section examines some of the possible spatial growth scenarios, which are illustrated in the referenced figures. Realistically speaking, the actual growth may be a hybrid of these scenarios, depending heavily on attractors and availability of base infrastructure.

3.1.1. Current Trends Scenario

This scenario envisages growth as per existing trends, with the existing major road corridors serving as the de-facto growth corridors. As can be seen from Figure 3, in this scenario, Bangalore will grow in all possible directions – "Sprawl."

3.1.2. IT Corridor Scenario

In this scenario (Figure 11), the growth is concentrated in the southeast quadrant, with some spillover into the northeast quadrant. This scenario depends on the fact that growth will be concentrated in a pattern that reflects the current spread of the IT Industry. However, given the fact that there are attractors elsewhere – north for the new airport, and south-west for the Bangalore-Mysore axis, this may not be very probable scenario.

3.1.3. Urban Integrated Scenario

This scenario (Figure 12) envisages growth along sectoral lines, depending on specific attractors. The developments in the south-east are IT and technology related, north draws logistics and general industry on account of the new airport, and south-west draws general industry, academic and other institutions along the Bangalore-Mysore axis.

3.1.4. Satellite Township Scenario

The rapid growth of Bangalore over the past decades has resulted in growth beyond the erstwhile BMP area into Bangalore Urban and Bangalore Rural districts. With increasing population - stress on the urban services and an objective to spread the growth around Bangalore, BMRDA is planning to set up five satellite townships and self-sustainable cities. The objective of developing these townships is to have a more rational and better use of land and water resource, and more equitable and efficient distribution of communication and technical facilities. The townships would have modern transport linkages to Bangalore to facilitate efficient transport. With the development of these townships, the pattern of growth would become "hub-and-spoke" based with decentralized development.

The advent of large metropolises sporting population of several million has given rise to a spectrum of problems. These problems stress on the need for enhanced infrastructure especially in the domain of waste management, water supply, electricity supply, and transportation.

Some of the commonly observed problems due increase in population density includes the following:

1. In a city where single use zoning plan has not been undertaken citizens will face numerous difficulties due to cross-commutation between zones. Since the primary activity areas are not demarcated suitably (e.g. there is a loose juxtaposition between various zones such as residential, commercial, industrial etc.) citizens of the city would be required to cross traverse between zones on a priority basis for work.

2. Densification of various commercial and industrial zones has put excessive stress on the need for parking space for motorized vehicles. This translates into need for sophisticated planning for land use in high density areas. This also impairs the flexibility overall plans for organized development.
3. Regular water supply and distribution could be affected due to heterogeneous composition of the city. It could also impact the quality of waste management of the city as densification increases.
4. Large metropolises are generally endowed with high income population and a large number of motorized vehicles (of which personal transport comprises a significant portion) which have a cumulative, pernicious effect on the ecology. Due to rising vehicle population in metropolis the quality of air deteriorates over a period of time due to rising pollution. This leads to poor quality of life.
5. Due to extreme concentration of economic activity at the metropolis, and little economic recourse available to nearby rural population, large cities are often subject to the phenomenon of rural exodus. As the rural population aspires for better economic prospects, working in the city could lead to the formation of ghettos (and sometimes slums). Formation of ghettos and slums has an unfortunate side effect of lack of hygiene, potential increase in crime rate, political disenfranchisement, rise in anti-social activities etc. The formation of economically backward ghettos is mostly around the periphery[2] of the city as high real estate value in the core area prevents this economic class from accessing the mainstream housing.

These are only few of the major problems likely to be faced by a large, fast growing city like Bangalore. Unless proper steps are taken for promoting organised growth of the city, there would be excessive stress on city's infrastructure assets due to burgeoning population. However, since the population influx into the city cannot be controlled, alternative means of promoting sustainable growth have to be considered. One such alternative is the development of Satellite Townships around the metropolis.

The Concept of Satellite Townships

The concept of a Satellite city / Satellite town in urban planning involves design of smaller towns governed under different municipalities that are adjacent to a major city which is the core of the metropolitan area. These markedly differ from suburbs[3], subdivisions and layouts. Conceptually, satellite cities could be self-sufficient communities outside of their larger metropolitan areas. However, functioning as part of a metropolis, a Satellite city experiences cross-commuting. It may involve consciously planned cities to act as spiller city.

The following Satellite cities are planned for design around Bangalore city:

1. Bidadi Integrated township
2. Ramanagara township

[2] Several economically backward slums were formed bordering centers of high economic activity in cities such as Mumbai and Delhi.

[3] Satellite towns are different from suburbs due to the fact that they governed by a different municipality which is free from direct influence of the metropolitan governing body.

3. Sathanur township
4. Solur township
5. Nandagudi township

Details of the proposed townships are given below in Table 26;

Table 26: Proposed townships

Satellite Township	Pvt. Land (in acres)	Govt. Land (in acres)	Total (in acres)
Bidadi Integrated Township	6959	2725	96844
Ramanagara Township	3621	392	4013
Sathanur Township	5891	10341	16232
Solur Township	9661	2864	12525
Nandagudi Township	13762	4745	18507
Total	39894	21067	60961

Source: BMRDA

Vision

To develop a self contained, integrated work, live & play infrastructure with minimum additional transportation load.

Development & Approach

This section gives an overview of approach to development of proposed new integrated townships. It is proposed that each town be developed on basic 'thematic premise' that suits it the best. That is, each town shall be developed to suit the requirements of envisioned economic activity. While some townships could be developed to house advanced technology centres (such as electronics, IT, bio-tech, automotive, R&D etc.), others could be developed for housing, manufacturing and agro based industries.

The development of these townships is slated to be carried out in partnership with the private sector through a competitive bid process. The development project shall be awarded to the preferred bidder who meets all the criteria set out in by the Government. The role of Private Partner is given as follows:

Role of Private Partner

The Private Partner shall finance and develop the entire internal project infrastructure (including commercial and residential establishments, civic amenities such as storm water drains, water supply, drainage, power and electrical connectivity, solid waste disposal, street lighting, roads etc.). The Private Partner shall take on the task of designing, financing, and development of townships. The Developer shall prepare and propose a Master Plan for township; the same shall be approved by a competent authority.

[4] Area of Bidadi Integrated Township (BITP) subsequently revised to 9178.29 acres vide Govt. Order: UDD 30 BMR 2007 dated 11-06-2007

The Developer shall shoulder the task of bringing potable water and power up to the periphery through BWSSB and BESCOM. This would require planning for the supply of the water and electrification needs and coordinating with the authorities. Cost of land acquisition and rehabilitation shall be borne by the Developer.

In addition, the role of Developer will extend to the following[5]:

- Marketing to attract other Tier-II developers and tenants
- Land development and internal infrastructure development such as road network, street lighting, parks and public spaces, gardening and beautification
- Provision of necessary services including telecommunication, water and power supply, effluent treatment, piped gas, steam, transportation and security
- Social amenities as may be required to make BITP a stand alone, self contained integrated township
- Operation and maintenance of infrastructure, provision of emergency services (fire fighting, healthcare etc.)
- Sub-leasing of developed land (after providing basic infrastructure) to Tier-II developers
- Administration and management of Township
- Provision of various types of facilities including: ready-built factories, residential apartments, multi-storied office buildings, commercial complex, institutional space etc.
- Developed plots may be provided to the Tier-II developers for further development into built space. Developed plots may also be provided to actual users (in industrial, commercial, institutional, and recreation categories)
- Developer to comply with rules and regulations as laid down by various legal and regulatory authorities
- Role of the Developer would include performance of municipal maintenance/service functions on behalf of BMRDA during the construction/development phase of Township and till Township is formally notified as a municipal area
- Any other activities that may be required for the successful planning, development and operationalisation of Township and meeting the user needs of the tenants
- The Developer may enter into agreements with service providers for provision of services including power, telecom, sewerage systems etc. to the tenants.

Role of BMRDA

The role of BMRDA would be to extend support activities to the development of townships by Private Partner. BMRDA would provide external infrastructure by way of access roads, development of Satellite Township Ring Roads (STRR), Intermediate Ring Road (IRR), and radial roads to provide speedy access to downtown Bangalore and to the new International Airport. Role of BMRDA would include monitoring of implementation of township development and ensure compliance with the project objectives.

[5] The scope under this section is proposed for development of BITP; and is intended to serve as indicative of the Developer's scope. The same may vary for each Township and Developer.

Approach to Bidder Selection

The selection process for the selection of Developer of townships would follow the legally prescribed process and would be transparent in nature. For the Bidadi Integrated Township (BITP), the Developer has been selected through a transparent, two stage competitive bid process. For development of other townships a similar process may be adopted or, as a JV route may also be considered depending on the requirement[6].

Participation of foreign based firms is not restricted. However for foreign firms to participate, the same has to be done through an Indian subsidiary or through a JV/ Consortium with Indian firms and would be subject to relevant FDI norms/ regulations. An innovative and inclusive approach is to be evolved for integration of project affected persons (mainly those who have relinquished land and local residents of the nearby places). Comprehensive land compensation, rehabilitation and resettlement package has been brought out on the same by the government[7].

In addition to these BMRDA townships, the private sector is also in the process of planning and developing large, self-sufficient townships, particularly along the Bangalore- Mysore corridor.

4. Population Growth

As can be seen from Table 27, population growth has surged in the decade 1971-81, and slowed down in the subsequent two census decades.

Table 27: Population Growth

Year	Population	Decadal Growth	CAGR
1901	1.63		
1911	1.89	15.95%	1.49%
1921	2.40	26.98%	2.42%
1931	3.10	29.17%	2.59%
1941	4.11	32.58%	2.86%
1951	7.86	91.24%	6.70%
1961	12.06	53.44%	4.37%
1971	16.64	37.98%	3.27%
1981	29.22	75.60%	5.79%
1991	41.30	41.34%	3.52%
2001	56.86	37.68%	3.25%
2011	78.28	37.68%	3.25%
2021	107.79	37.68%	3.25%

Source: Census Data upto 2001, projected at same rate for 2011 and 2021.

4.1. Basis for Population Projection

It is projected that in each scenario, the growth of population in absolute number will anyway continue–given the fact that the City continues to enjoy a strong economic base

[6] Selection of JV Partner would be carried out through a transparent, competitive process.

[7] Vide Government Order No. UDD 30 BMR 2007, dated 11-06-2007.

and a reasonably good quality of life. There are three possible scenarios for projecting population growth:

1. The rate of growth sustains at the present level;
2. The rate of growth slows down from the existing rate – possible reasons being reducing competitiveness of the city, for its economic growth and quality of life; and
3. The rate of growth is sustained at higher levels – possible reasons being the converse of the above.

4.1.1. Current Growth Scenario

On a straightforward extrapolation basis for the aggregated population of the urban agglomeration, if the growth in the 2001-1991 is maintained in the subsequent (future) decades, the population of shall reach about 108 lakh by 2021. Table 28 shows the population growth based on a simple linear extrapolation upto 2021.

The above method is simplistic, since the population growth depends on the aggregation of growth in the erstwhile BMP area and adjoining areas (CMCs and TMC), which have different characteristics. Aggregating these and using constant terms for growth may not be appropriate. If the population figures are disaggregated for BBMP core area and former peripheral CMC/TMC areas, and the same logic for growth forecast (linear extrapolation) is followed, the projected numbers are as given in Table 28.

Table 28: Population Growth - Core BMP area & Non-Core area (Sustained Scenario)

	1991	2001	2011	2021
BMP – Core Area	33.02	43.03	56.06	73.03
Former CMCs	8.28	18.67	42.10	94.92
Core Area Growth		2.68%	2.68%	2.68%
CMCs Growth		8.47%	8.47%	8.47%
Total	41.30	61.70	98.15	167.94
Total Growth		**4.10%**	**4.75%**	**5.52%**

Source: CDP 2006

The forecast population[8] in this case is much higher – since the erstwhile CMC/TMC growth has been much higher during 1991-2001, and using the same growth number to go forward under newly formed BBMP may not be realistic. The lacuna here is that the constant growth rate assumption relies on sustaining the high economic growth levels, land availability, and infrastructure availability.

4.1.2. Reduced Growth Rate Scenario

The Master Plan 2015 of BDA considers the constraints of land and infrastructure, and based on these parameters, it estimates the necessary surface area to be created in the new Comprehensive Development Plan framework that amounts to 300-350 sqkm.

[8] It may be noted that in this table the total population in 2001 is larger than the census 2001 figure of 56.86 lakh, by 4.84 lakh. This has been done in the new (draft final) CDP of BDA, to factor in the peripheral villages that are going to be drawn into the Urban Agglomeration, and maintain consistency in going forward. Since the CDP is the "master-plan" document for Bangalore, the same figures have been assumed here as well.

These figures have been arrived at by taking into consideration the above parameters as well as an improvement in the management of the new urban layouts. Apart from these, the following elements have also been considered:

- The land demand corresponding to the needs of the economical players
- The land needs for housing as well as major amenities
- The ongoing as well as future infrastructure project needs

The draft Comprehensive Development Plan estimates that there is a likely saturation of the current space dedicated to urbanization. Only 82 sqkm are available within the 1995 Comprehensive Development Plan perimeter. This phenomenon is found to be exerting a visible stress on the agglomeration. This stress is already leading to a trend in economic investment moving to Tier-II cities, such as Mysore.

Based on this assessment, the Comprehensive Development Plan (Master Plan) prepared by the BDA assumes that the rate of growth cannot be sustained at the current rates, but will reduce. The population is estimated to reach a level of about 100 lakh by 2021. Based on these planning considerations and analysis, the (draft) Comprehensive Development Plan forecasts the population, which is shown in Table 29. Since the BDA Comprehensive Development Plan is a document that has been widely discussed and is now being finalized, it appears appropriate to adopt the same basis for the population growth for this CDP.

Table 29: Population Forecast - Scenario Adopted in Comprehensive Development

	1991	2001	2011	2021
Former BMP (core) area	33.02	43.03	51.43	55.59
Former CMC areas	8.28	18.67	28.72	44.09
Core area growth rate		2.68%		
Peripheral area growth rate		8.47%	2.65%	2.22%
Total BBMP	41.30	61.70	80.15	99.68
Total Growth		**4.10%**	**2.65%**	**2.20%**

The above projections are used as the basis for service assessment and delivery for all infrastructure sectors considered in the subsequent sections.

4.1.3. Higher Growth Rate Scenario

The growth rate appears to have peaked in the 1971-81 decade on an aggregate, and 1991-2001 decade in the former CMC areas. Aggregate growth has been declining after the 1971-81 decade. As discussed earlier, there are constraints on land availability and infrastructure. Even in the current growth rate scenario, the population will reach 98 lakh by 2011 and 170 lakh by 2021 – which has been considered unsustainable in the draft Comprehensive Development Plan of BDA, on account of the constraints mentioned. In the circumstances, a higher-than-current scenario has not been considered.

Figure 11: IT Corridor Scenario

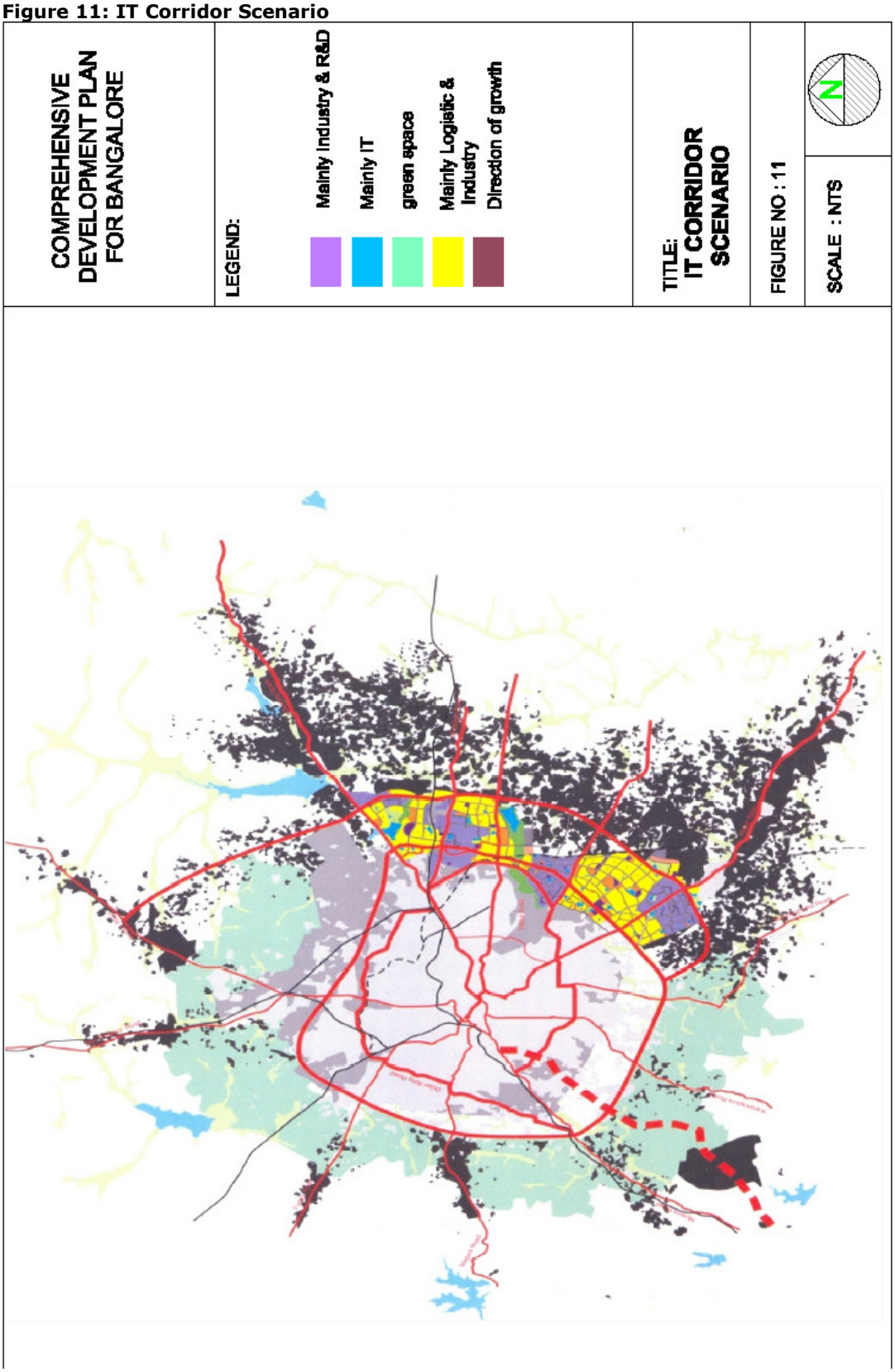


Figure 12: Integrated Urban Scenario

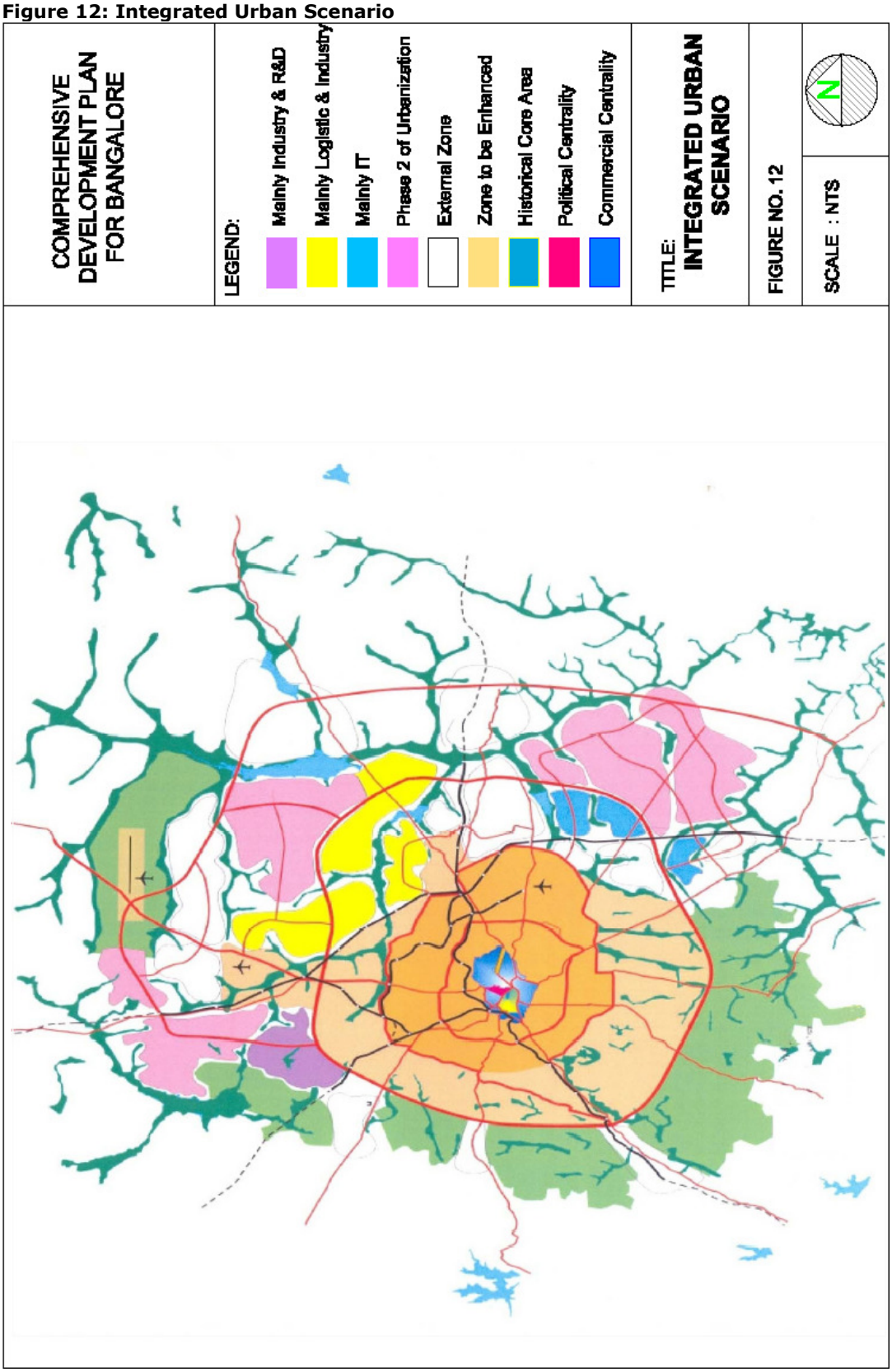


Figure 13: Master Plan 2005-2015

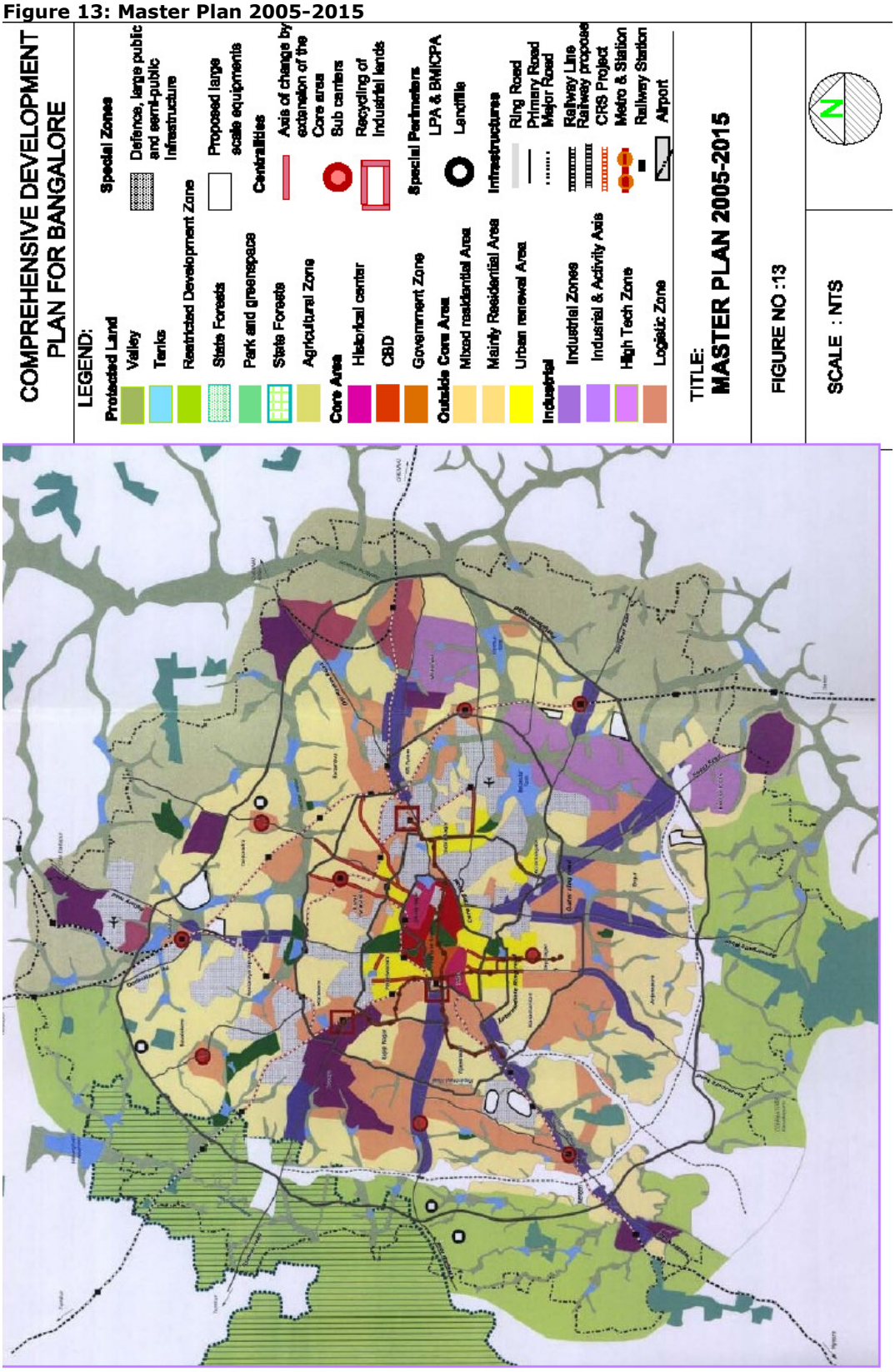
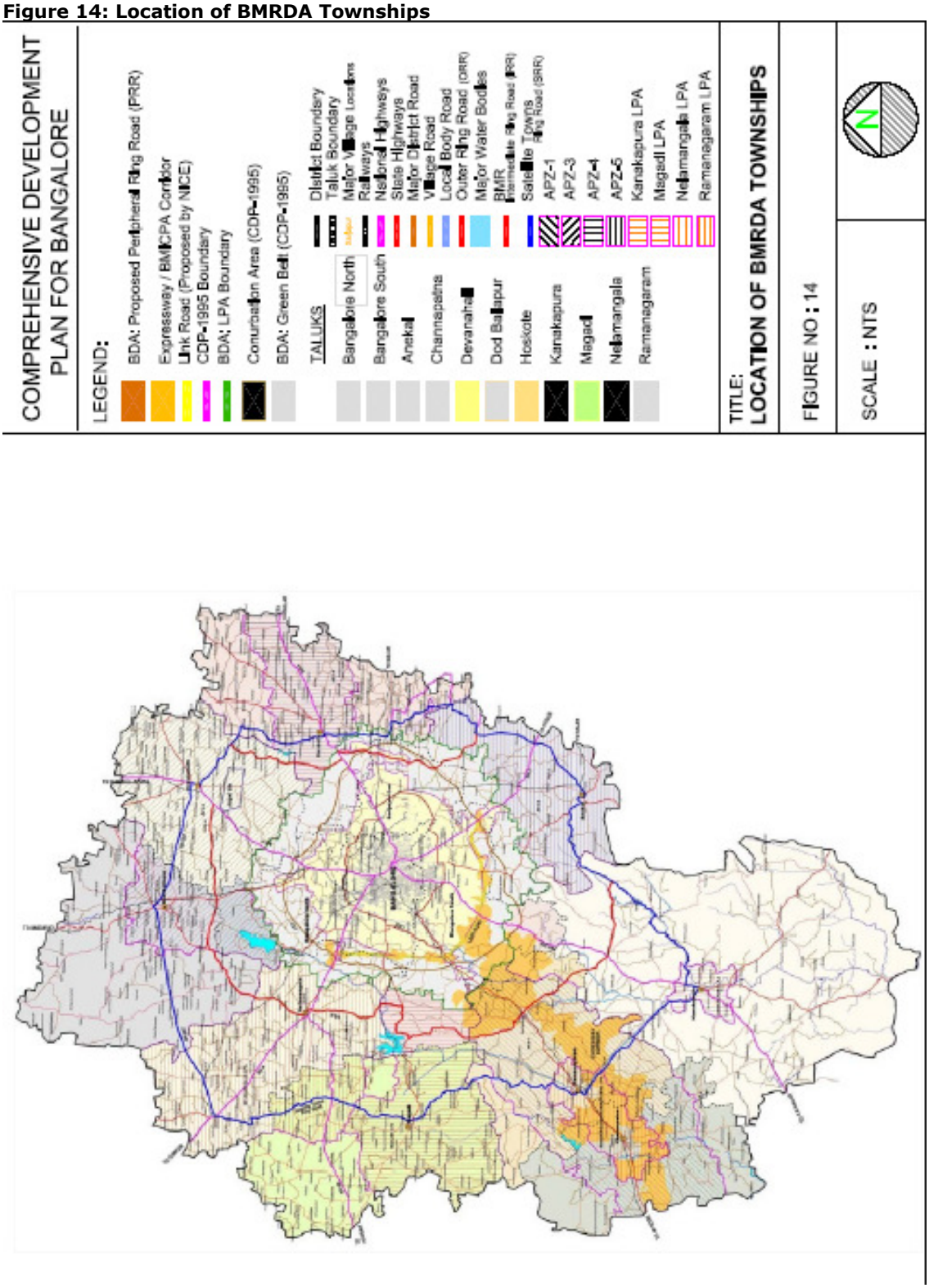


Figure 14: Location of BMRDA Townships



REVISED CITY DEVELOPMENT PLAN
BANGALORE
2009

SECTION II URBAN INFRASTRUCTURE SERVICES

Urban Renewal
Water Supply and Sewerage
Management of Solid Waste
Urban Drainage Systems
Roads and Transportation
Civic Amenities
Tourism and Heritage Conservation

Jawarharlal Nehru National Urban Renewal Mission

Chapter 5: Urban Renewal

1. Urban Renewal in the JNNURM Context

In the JNNURM context, the term renewal refers to the entire spectrum of urban services, institutional frameworks, and governance. There is a close linkage of each of these factors with the totality of the quality of urban life. From this perspective, the entire CDP refers to 'renewal' – renewal of the perspective and the vision, renewal of infrastructure, and renewal of the institutional frameworks. Each infrastructure sector in the subsequent chapters is in the same context of renewal – where existing systems are renewed, gaps are identified, and action is proposed to fill those gaps. As the city footprint increases, not only does the core gets denser, but also large peripheral areas get included into the city. The objective is to reduce congestion, and provide better infrastructure services across the entire extent of the city.

Following from the above, while this Chapter covers only the specific issues related to the traditional core areas, all the further chapters on infrastructure sectors are extensions of the same theme.

2. Overview of this Chapter

Each city has its "traditional" core, and so has Bangalore. Since Bangalore's establishment in 1537, the traditional areas have played a key role in the city's development. These areas are still the centers of conventional trade and economic activity, albeit constrained by inadequate infrastructure facilities, primarily due to lack of space and burgeoning population.

Improving basic infrastructure in the city will obviously have a beneficial impact on the traditional areas as well, and therefore the projects discussed in various sectors are relevant to these areas. However, this Chapter deals with the specific issues related to infrastructure in traditional areas.

2.1. Existing Situation

2.1.1. Key Features

Old/traditional areas in Bangalore comprise Chickpet, Cubbonpet, Cottonpet, Majestic, Gandhi Nagar, Vasanth Nagar, Shivaji Nagar, Richmond Town, and Chamarajpet. These areas are characterized by:

- Dense population with a density that is 3-4 times higher than the average of BBMP area
- Economy that is primarily dependent on trading activities
- Highly mixed land use
- Dotted with historic properties
- Slow transformation to accommodate new developments and changing culture
- Narrow roads that constrain provision of services such as water supply, drainage, and solid waste management.

2.2. Key Issues in Urban Renewal

While these areas continue to be centers of trade and commerce, proper infrastructure facilities would need to be provided along with preservation of the area's traditional flavor. However, constraints of space congestion would continue to play a part in the extent that such infrastructure improvement could take place. Social issues would also have a key part to play in attempting any large-scale intervention.

3. Strategy for Improved Service Delivery

Given the physical constraints and social issues that are likely to come up, the key challenge is to improve infrastructure service delivery. While the general sectoral infrastructure improvement that has been discussed in other Chapters is also relevant to traditional areas, there are certain specific interventions that are required.

3.1. Proposed Implementation Plan for Urban Renewal

The redevelopment of traditional areas would include the following activities:

- Diversion of traffic in these areas by introduction of "one-ways"
- Enforcement of new parking regulations
- Ban on entry of heavy goods vehicles in such areas
- Removal of encroachments
- Provision of appropriate transport system for the commuters to reduce the use of vehicles in these areas - development of pedestrian walkways
- Construction of cycling zones
- Demarcation into transport and utility zones
- Maintenance of open spaces
- Improvement of civic services.

4. Project Identification & Costing

While the overall nature of the projects envisaged has been defined, specific projects shall be formulated on the basis of the DPR that are prepared by the concerned agencies. The following sections outline the investment requirement for projects on urban renewal.

4.1. Investment Plan for Urban Renewal

4.1.1. Estimated Capital Investment Requirement

Table 30 sets out the estimated investment requirement on projects of urban renewal, during the implementation period of JNNURM. Table 31 sets out the estimated investment requirement on projects of urban renewal, in future blocks. It is to be noted that the investment estimates for Urban Renewal has been retained the same as was projected in CDP 2006 for the reason that it pertains to the investments within the core BBMP in particular.

Table 30: Investment Plan for Urban Renewal Projects – JNNURM Period

Description	Upto 2007-08	2008-09	2009-10	2010-11	2011-12	Total (Rs. Crore)
Capital Expenditure	3.3	2.0	2.2	2.2	2.3	12.0
O & M Expenses	0.0	0.5	0.6	0.6	0.7	2.4
Total	3.3	2.5	2.8	2.8	3.0	14.4

Source: CDP 2006

Table 31: Investment Plan for Urban Renewal Projects – Vision Period

Description/ (in Rs Crores)	2013-17	2018-22	2023-27	2028-31	Total upto 2031
Capital Expenditure	12	12	12	12	60
O & M Expenses	5	7	10	12	36.4
Total	17	19	22	24	96.4

Source: CDP 2006

5. Implementation Framework

Though located in prime localities, it might be difficult to evince private participation in such redevelopment due to the politico-social issues involved. It is therefore envisaged that redevelopment of old areas would be undertaken by the concerned GoK agencies, after proper project design and citizen consultation.

Chapter 6: Water Supply & Sewerage

1. Overview

The Bangalore Water Supply & Sewerage Board (BWSSB) provides water supply and sewerage services in Bangalore. Though initially restricted to the area under the the erstwhile BMP's jurisdiction, BWSSB is progressively increasing its services coverage area to the entire Bangalore Metropolitan Region. The former CMC areas currently manage drinking water and sewerage needs on their own; however BBMP has taken over the same since its formation. Table 32 presents the main features of the water supply system in Bangalore.

Table 32: Main Features of Water Supply System

Parameter	Unit	Amount	Comments
Water Availability			2009-10 estimates
Installed Capacity	MLD	Cauvery – 810 Arkavathi – 184	
Daily release	MLD	900	
Daily demand	MLD	1125	
Estimated ground water extraction	MLD	200	Decreasing levels of ground water (especially post monsoon)
Source of Water Supply	Km	98 km from Bangalore	
Water Supply Coverage and metering			
Consumption Domestic	%	52	
Non-domestic/ others	%	9	
Estimated UFW	%	39	20,000-30,000 unauthorized connections
Availability	lpcd	110	Complaints of non-uniform supply & low residual pressure in outlying areas
Wastage of water	%	47	
Area Coverage		100 % in core area Between 10% and 60% for none-core areas	
Sewerage			
Tertiary Capacity	MLD	72	At V-Valley & Yelahanka
Proposed Additional Capacity	MLD	339	From the major and minor STPs
Estimated usage of treated water in Industries	MLD	4	

Parameter	Unit	Amount	Comments
Estimated capacity utilization	%	75	
Area covered through sewer system	%	40	About 245 sq.km
Consumer Redress			Established system is in place, though there are occasional reports of delays

Source: BWSSB

1.1. Existing Situation

The existing situation of the water supply system, and the sewerage system, are summarized in this section.

1.1.1. Water Supply

Sources

Arkavathi River and TG Halli reservoir located at 18 km and 4.28 km from Bangalore, respectively, were the traditional surface water sources. However, increased demand necessitated the reliance of water supply source on Cauvery River. Water supply from Cauvery River is being implemented in Stages (Stages 1, 2 and 3 and Phase 1 of Stage 4 have been completed) from a distance of 98 km over a head of 490 m. While the Cauvery scheme assets are relatively new and in good condition, Arkavathi system requires rehabilitation. Figure 15 is a map depicting the source and the transmission network for water supply.

Ground water also plays an important role in meeting the needs of Bangalore. In core BBMP, groundwater is mainly for augmenting the supplies at households. Non-availability of Cauvery water supply in surrounding non-core area (former ULBs) has resulted in increased reliance on ground water.

Coverage

Cauvery schemes feed southern regions of the city, while Arkavathi schemes feed the northern part. Table 33 shows the coverage of piped water supply coverage.

Table 33: Water Supply Coverage in ULBs

ULBs	Water Supply Coverage (% Area)
Erstwhile BMP	100
Erstwhile CMC areas	
Yelahanka	60
Rajarajeshwari Nagar	25
Mahadevapura	20
KR Puram	20
Bommanahalli	Yet to be covered
Dasarahalli	10
Byatarayanapura	10
Erstwhile TMC-	60

ULBs	Water Supply Coverage (% Area)
Kengeri	

Source: CDP Bangalore 2006

Table 34 presents the number of water supply connections in the core area.

Table 34: Number of Water Supply Connections in BBMP Core area

Parameter	Unit	Amount
Domestic piped water connections	No.	3,44,376
Non-domestic connections	No.	10,882
Authorized public fountains	No.	6,350

Source: CDP Bangalore 2006

Quality

BWSSB monitors the bacteriological quality in the piped water system regularly. Periodic results have indicated that the drinking water meets the standards set out by WHO and CPHEEO. Table 35 shows the results of surveys carried out in the past by independent agencies and NGOs.

Table 35: Citizen Surveys on Water Supply

Aspect of Quality	Percentage of Respondents Finding Services to be of Acceptable Levels	
	Piped Water	Public Taps
Convenience of Water Supply Timings	79	26
Adequacy of Water	70	64
Accuracy of Billing	90	-
Convenience of Timings of Bill Payments Counters	100	-
Clarity of Water	98	99
Odor-free Water	81	83

Cost Recovery

Table 36 indicates the cost recovery situation in the provision of water & sewerage services, which is around 80% on the average.

Table 36: Cost Recovery Situation in Water & Sewerage

Cost incurred in service provision (Rs. Lakhs)			Direct recoveries (Rs. Lakhs)		
2002 - 03	2003 - 04	2004 - 05	2002 - 03	2003 - 04	2004 – 05
38403	44464	38670	31152	32483	33303

Source: CDP Bangalore 2006

Key Issues in Water Supply

Table 37 gives the key issues of the Water Supply System in Bangalore.

Table 37: Key Issues in Water Supply

Parameter	Description
Inadequacy of resource for Augmenting future growth	Limited availability of water from Cauvery (after utilization of 600 cusecs) No water available from adjoining river sources such

Parameter	Description
	as Hemavathy, Netravathi, etc Changing land use pattern
Groundwater	Indiscriminate drawal Sub-standard water quality
Water quality issues (in distribution network and raw water)	Cross connections/back-siphon in distribution resulting in water borne diseases Raw water deterioration due to pesticides and chemical pollutants from industries and sewage from upstream
Uneven Distribution and Intermittent Supply	Parts of the City receive a higher quantum of water and for a longer duration when compared to certain other areas which receive a lesser quantum and only for a short duration Erratic Growth Assets needing rehabilitation Some areas get water only for 3-5 hours on alternate days
Non-availability of Water to meet National Standards of 150 lpcd	Relatively high UFW Non-availability of distribution system in former CMCs/TMC and new added BMP wards Arkavathi source gradually depleting
High UFW	Absence of reliable source production (bulk metering) on all major water sources Absence of metering on public fountain consumption Poor accuracy and serviceability of consumer metering High non-physical loss due to consumption from unauthorized connections and inaccurate / inoperable meters
Water Wastage	The measures undertaken by BWSSB to avoid wastage of water are: • Replacing the frequently leaking pipes by DA pipes • Installation of bulk-flow meters to monitor equitable distribution to identify division wise losses • Rehabilitation of ground level reservoirs • BWSSB has taken up pilot study executed by Thames Water, England JV with L&T; in Vasasnthnagar to identify the reasons to reduce the wastage of water. The study revealed that 5% of leakage is attributed to faulty meters. Hence, the board has taken policy decision to replace the meters that are more than seven years old • Another pilot project was taken up in the Bangalore South division (having 1 lakh connections for distribution), with an objective to reduce NRW from 47% to 16% and to stabilize the same over a period of seven years. On the basis of the results of this project, the same would be replicated in other five divisions.

Source: CDP Bangalore 2006

1.1.2. Sewerage

While sewerage networks were available from 1922, treatment of sewage began in 1974. The features of the sewerage system include:

- Secondary treatment capacity - 721 MLD
- Tertiary treatment capacity - 70 MLD

- Proposed additional capacity - 328 MLD
- Estimated capacity utilization - 75%
- Estimated usage of treated water - 4 MLD (industries)
- Sewer systems exist in pockets with a coverage of 40% of total area

Key Issues in Sewerage

Table 38 shows the key issues for the Sewerage System.

Table 38: Key Issues in Sewerage

Parameter	Description
Inadequate Coverage	Covers only 40% of the area
Environmental Concerns	Pollution of lakes Mosquito Growth
Sewage entering drains and lakes	Health problems Nuisance to Public Environmental and Bio-diversity problems Measures taken to avoid sewage from entering the storm water drains are as follows: • Re-aligning the sewage line • By-passing storm water drains
Insufficient capacity of sewers (Trunk and Mains) both primary and secondary	Overflows from manholes Public Nuisance
Increased sewage flows in rainy season (due to mixing of storm water)	Some sewage has to be let out without treatment to river downstream thereby polluting the system (Arkavathi and Cauvery) Sewage flows on to roads and into low-lying areas
Damaged sewers	Public nuisance Mosquito problem
Silting up of sewers	Sewage flow from man-holes Complete stoppage of sewage and back-up
Direct connection of sewers from slums and low-lying areas to (primary and secondary drains) storm water drains	Flooding in slums and low areas Back flows during rainy season when storm water drains are full
Silt. grease and floating debris (Plastics, papers, etc) into open drains and into treatment plants	Problem in primary and secondary treatment, O&M problems Accessibility problems for manholes
Encroachments on sewer lines and manholes	Sewage over-flows into residential areas (slums, low-lying areas Sewer cleaning and removing silt difficult Nuisance and mosquito growth

Source: CDP Bangalore 2006

2. Strategy for Improved Service Delivery

The following sections outline the strategy for improving service delivery for water supply and sewerage services in Bangalore. The strategy also has to take into account the forecast growth in population given in Chapter 5.

2.1. Characteristics of the Sector

The characteristics of water supply and sewerage systems, which dictate the strategy, are set out below:

- Considered as a "free good" by citizens; while the costs of delivery are spiraling without adequate recovery
- Service provision and asset utilization remains sub optimal
- Preventive maintenance is not diligently practiced
- Under pricing of water provided and high commercial inefficiencies
- Sewerage system not amenable to levy of user fees, and hence investments need to be recovered as a part of other taxes, user charges and Cess (property tax, water charges, etc.)
- Not many examples of successful private participation in procuring services – reasons for the same include inadequate project development, financial viability issues, socio-political risks, and lack of adequate and reliable information.

2.2. Initiatives & Studies

To address the issues in water supply and sewerage, a number of initiatives are already under way. These are summarized in the following section.

2.2.1. GBWASP & Cauvery Stage IV

The project Greater Bangalore Water Supply and Sanitation Project (GBWASP) was originally conceptualised as a means to provide water and sanitation services to residents in the region of Greater Bangalore. The project envisages providing fresh water and, drainage and waste management services in phased manner to the 250 wards across eight zonal regions. The project had two components namely provision of Water Supply with an estimated cost of Rs.450 crores; and the second component which encompasses the provision of sanitation services with an estimated cost of Rs.753 crores.

The first component of the project i.e. supply of fresh water to targeted wards has taken off. The project on-ground implementation commenced from December 2007 and around 72 wards (out of 250) have been brought under its scope. Currently, the work on the main Feeder Line is being completed subsequent to which new wards will be brought under for provision of water.

2.2.2. Bulk Supply to Large Condominiums

Due to the rising demand for housing and growing labour pool in the city, several development projects have been undertaken to develop real estate for residential purpose. This has led to construction of large sized condominiums across several parts in the city. Salient features of such buildings are:

- Large scale construction of apartments/condominiums which involve construction of several hundred houses
- Consumption of power, water, and waste management resources on a significantly large scale basis vis-à-vis an individual house
- Generally designed and intended for use by residents of higher economic strata

Water is supplied in bulk by BWSSB to such facilities. The general practice is to supply water to the entire set of apartments as a whole[9]. The facility is metered on a whole and water tariff is collected from the management. The management divides the total tariff among the house owners (or occupants/tenants). BWSSB is charging the apartments on the same tariff slab as individual houses. However, a change in the same is being contemplated in moving the large apartments to a different tariff slab.

2.2.3. Other Initiatives

With an objective to improve the service delivery, BWSSB has been carrying out other measures, which include:

- Leak reduction project being implemented by Larsen & Toubro and Thames Water
- GIS mapping
- DBOT contracts for treatment plants
- Wastewater recycling
- IEC campaigns

2.2.4. Studies

BWSSB and other agencies have commissioned various studies to improve the service delivery standards, adopt contemporary technologies, and improve last mile connectivity. Table 39 summarizes the studies conducted.

Table 39: Summary of Studies in Water & Sewerage

Agency/Reports	Study Scope and Recommendations
KUIDFC/Samaj Vikas Report on Urban Poor Strategy for UGD component in eight ULBs around Bangalore under GBWASP	Improve Latrine coverage Create awareness through IEC activities Dovetail present sanitation activities Support poor in accessing sanitation facilities Involvement of women, poor, NGOs & CBOs Construction of community latrines, new latrines
KUIDFC/World Bank Report on Demand assessment for improved water and sewerage services in 8 ULBs	Introduction of slab-wise tariff structure linked to consumption Option of group connection among LIG/slums for better coverage Cross-subsidize the poor and vulnerable through charging appropriate rates from better-off residents and non-domestic consumers New revenue sources suggested (a) tax on ground water extraction by large industries & commercial establishments (b) sewerage tax on non-domestic consumers that do not take piped water connection from the new scheme

[9] Piping to individual apartments is done by the developer. BWSSB provides water to the premises of the developer, from whereon water is distributed to individual houses as per requirement.

Agency/Reports	Study Scope and Recommendations
KUIDFC/STEM	Energy audit study Reduction of unaccounted for water Rain water harvesting, aquifer recharging, ground water recharge Rehabilitation, replacement and extension of water supply Augmentation of source Computer network analysis Efficient management of water by re-zoning Removal of public taps/fountains Water saving plumbing fixtures
BWSSB/AUSAID Bangalore Water supply & Environmental Sanitation Master plan Project	Planning Timing of future development works to be planned as per actual development Reduction of NRW to 15% at the end of plan period from the present levels Water Resources Resource monitoring, population growth, demand measurement Reduction of UFW, Groundwater regulations for controlling abstraction of water Effluent reuse and rainwater harvesting W/s system to be sub-divided into sub zones to simplify operations Compliance with appropriate design standards Demand Management Water supply duration and timings need to be improved and regularized to reduce in-house storage Present tariff schedule to be regularly reviewed for eventual full cost recovery Environmental Management BWSSB to adopt draft Environmental Management Plan for ensuring implementation of all future works in an environmentally acceptable manner Social & Gender Issues Special attention to be given to women and lower socio-economic group Institutional change Donor assistance to be utilized for follow on capacity building plan Progressive restructuring of the BWSSB to better meet future needs BWSSB to inculcate a HRD strategy in line with modern best practices SP to be managed carefully
BBMP/Urban First	Recommendations are same as those proposed by AUSAID

Source: CDP Bangalore 2006

The common themes of these reports are as follows:

- Provision of water supply and sewerage facilities to the urban poor
- Community participation and IEC
- Tariff restructuring and lowering of slabs
- Developing alternative sources of revenue
- Reduction of Non-revenue Water and Unaccounted for Water
- Water conservation, recycling and rain water harvesting
- Use of information technology for planning and control
- Freshwater source identification

- Energy Audit at regular intervals
- Improve monitoring mechanism and surveillance
- Replacement and rehabilitation

2.3. Needs of Urban Poor

While it is the objective of governments to provide access to affordable potable water and sanitation facilities, such facilities continue to remain outside the access of the urban poor. It is well known that the urban poor spend a considerable portion of their income on getting access to such services.

Schemes would need to be customized suitably for effective universal service provision. This would include providing services based on affordability, devising suitable subsidies and increasing the participation of urban poor in service provision through IEC campaigns. Some of the services proposed could include:

- 100% coverage of water and sewer system
- Individual pipe connections
- Bulk metering
- UGD/low cost sanitation

Specific projects have been addressed in Volume III – Basic Services for Urban Poor, of this CDP.

3. Project Identification and Costing

Taking the strategy forward requires both capital investments and institutional reform. The key aspects addressed, specific initiatives/projects, and the required investments are covered in the following section.

3.1. Key Areas Proposed to be Addressed

The rapid economic growth of Bangalore in the last decade has resulted in a higher-than-national average annual growth of 3.25%, and Chapter 5 indicates the forecast population. Broadly, the activities/projects that are proposed for meeting the gaps in the service delivery levels are:

- Repairs and maintenance of bulk water supply system
- Rehabilitation/creation of distribution network and piped water supply connections
- Provision of water supply connections to uncovered areas
- Construction/rehabilitation/expansion of underground drainage system including service connections to all the households
- Construction/rehabilitation of STPs for treatment of raw sewage
- Development and management of testing facilities and customer services
- Safe disposal of treated effluent at specified locations
- Operation and maintenance of the water supply system
- Operation and maintenance of sewerage system and STP as per specifications
- Billing and collection activities of water connection and consumption charges
- Aquifer recharging and rain water harvesting
- Development and updating of the database and mapping of the system from time to time

- Institutional development and public awareness campaigns.

3.2. Status of Projects

3.2.1. Water Supply for 110 Villages and Sewerage Component for 8 ULBs and 110 Villages

Provision of adequate water supply to the newly added areas of the BBMP has been earmarked as a key requirement by BWSSB. As a step towards the same, BWSSB has initiated the preparation of a DPR for the fore mentioned project. Under this, the project is planned and designed for providing water supply system for 110 villages and sewerage system for 8 erstwhile ULBs and 110 villages.

The design horizon for design of water supply system for 110 villages is 2026, whereas the design horizon for providing sewerage system is taken as 2036 (considering design period as 30 years as per CPHEEO manual and 2006 as base year). For the purpose of planning for providing sewerage system to the BBMP area (other than core area), the total project area is divided into 8 drainage zones based on the topography.

Initially the scope of work was to plan a comprehensive sewerage system for 8 ULB areas surrounding core area (erstwhile BMP area). The sewage flow of some villages which are coming in old CDP boundary (as per CDP 1995) were considered for collection, convey and treatment for sewage generated in those area. Subsequently due to formation of Bruhat Bangalore Mahanagar Palike (BBMP), the PMC were initially informed to plan a comprehensive sewerage system for 8 ULBs only. Subsequently informed PMC to plan a comprehensive sewerage system for 110 villages are included in the planned drainage zones. It is observed that the sewage generated in some villages (out of 110 villages) is flowing by gravity towards the drainage zone and sewage from rest of the villages is flowing out of the planned drainage zones. The sewage of part of the villages which is flowing out of these planned drainage zones is proposed to be collected and pumped to the nearest ridge manhole of CDP area.

There is no systematic UGD system in 110 villages. It is reasonable to start service level analysis at zero level as the infrastructure of the 110 villages needs to be completely integrated with BBMP area. The work of providing water supply to 8 erstwhile ULBs is already taken up under GBWASP and is nearing completion. The work of providing sewerage system to 8 erstwhile ULBs is partly taken up under CWSS, Stage-IV, Phase I & II, which is funded by JBIC. The component includes planning, design and construction of few trunk sewers, sewage pumping stations and sewage treatment plants). Phase I of the project is already completed and the works under phase II is under progress. The rest of the work of sewerage system, which includes comprehensive collection system, providing trunk sewers and construction of new intermediate sewage pumping station(s) will be taken up under KMRP[10] funded by World Bank.

The work of providing water supply, sewerage system and other infrastructure facilities to 110 villages is proposed under JNNURM.

[10] Karnataka Municipal Reforms Program

Service Provision to Urban Poor

While it is the objective of the Government to provide access to affordable potable water and sanitation facilities, such facilities continued to remain outside the access of the urban poor. It is well known that the urban poor spend a considerable portion of their income on getting access to such services. Scheme would need to be customized suitable for effective universal service provision. This would include providing services based on affordability devising suitable subsidies and increasing the participation of urban poor in service provision through IEC campaign. Some of the services proposed could include following.

- 100% coverage of water and sewerage systems
- Individual pipe connections
- Bulk metering
- UGD connectivity

Cost Estimate

Basic cost estimate for various components includes proposed sewerage system, Road Restoration, works for Urban Poor and sewer cleaning equipments for the project area is arrived based on the prevailing Schedule of Rates of BWSSB, KUWS&DB, PWD and rate analysis based on the market rate for the items which are not available in any of the mentioned SRs. The cost for various packages under KMRP is given Table 40.

Table 40: Project Cost for provision of water supply to BBMP region

Sl. No.	Description	Amount (Rs.)
1	Providing Sewerage System and Road Restoration for erstwhile Yelahanka CMC	202,267,233
2	Providing Sewerage System and Road Restoration for erstwhile Bytarayanpura CMC	1,558,297,967
3	Providing Sewerage System and Road Restoration for erstwhile Mahadevpura CMC	1,034,762,514
4	Providing Sewerage System and Road Restoration for erstwhile K.R. Puram CMC	1,093,993,774
5	Providing Sewerage System and Road Restoration for erstwhile Bommanahalli CMC	1,654,648,168
6	Providing Sewerage System and Road Restoration for erstwhile R.R. Nagar CMC	473,621,265
7	Providing Sewerage System and Road Restoration for erstwhile Kengeri TMC	241,316,171
8	Providing Sewerage System and Road Restoration for erstwhile Dasarahalli CMC	1,279,283,385[11]
	T o t a l	**7,538,190,477**

Source: KUIDFC

Note: Cost of the project 110 villages is yet to be assessed

The cost includes providing sewerage system, road restoration, sewer cleaning equipments, restoration of storm water drains, urban poor component and contingencies at the rate of 3% and administrative charges at the rate of 0.5%.

[11] Cost is based on the preliminary design report and subject to change after detailed estimate.

BWSSB intends to take up this project through the assistance from Jawaharlal Nehru National Urban Renewal Mission (JNNURM) grants from GoI. It is proposed to integrate this project with KMR Project funded by World Bank and CWSS stage IV Phase II project funded by JBIC.

3.2.2. Water Reuse in Vrishabhavati Valley

BWSSB has initiated a project for the promoting water treatment and recycling which can enhance the quantum of water supplied to the newly added areas[12] under BBMP. BWSSB plans to reuse the treated sewage after appropriate advanced treatment in respect of the Vrishabhavati Valley by harnessing 200 mld (million litres per day) by 2011. However, as a first stage, the reuse will be for 135 mld; based on the performance of this stage, further tuning will be carried out to make the operation more feasible and the second phase will be taken up for next 65 mld.

Accordingly, the scheme could comprise of allowing the treated sewage from STPs located in the valley to flow down the Vrishabhavati valley for further natural self-purification, freshening and oxygenation besides attaining an environmental aquatic equilibrium and thereafter intercepting it for further treatment to remove suspended & dissolved impurities and water borne enteric pathogenic organisms before impounding the treated water in a natural water reservoir and finally conditioning it in a conventional water treatment plant and chlorination before distribution to the city. This is possible as the TG Halli reservoir with a volume of 95 million cu m is lying underutilized due to poor monsoons and the water treatment plant attached to it.

Components of Water Reuse Project

The STPs in this valley are Vrishabhavati valley STP, Mailasandra STP Kengeri STP and Chodenapura STP. Their combined discharge is presently 155 mld and will reach 355 mld by 2011. This sewage will be treated and will flow down along Vrishabhavati river valley for 18 km before being intercepted at Ampapura with no habitations around it and characterised by solid rocky outcrops which will permit the construction of a pick up and diversion.

Treatment of Sewage at the STPs

The existing facility at Mailasandra STP of 75 mld can process and carry out removal of BOD, COD and nitrogenous compounds. This plant is proposed to be supplied with phosphorous removal to eradicate algae growth upon discharge of treated sewage. In addition, the treated sewage will be chlorinated before discharge as per the guidelines of CPCB to eradicate the enteric pathogenic organisms.

Benefits of Water Treatment

The water treatment will be carried out:

- To remove stray organic matter that could ingress from river course travel

[12] Newly added areas include the: 7 CMCs, 1 TMC and 110 villages.

- To remove stray suspended matter that could ingress from river course travel
- To precipitate stray phosphorous that could ingress from river course travel
- To liberate nitrogen, stray ammonia that could ingress from river course travel
- To remove and chance odour that might ingress from river course travel
- To chlorinate the treated water for continued disinfection in onward pumping.

The proposed Water Treatment Plant (WTP) comprises the following unit operations:

- Collection well with screens
- Flash mixing
- Coagulation-flocculation
- Rapid sand filtration
- Chlorination

The Ultra Filtration (UF) plant at Tavarekere would utilise water pumped from Ampapura which will be discharged into an underground reservoir of 2 hours capacity. The essential aspect of the water treatment at this location is to be re-emphasised as enteric pathogen removal, and not hardness removal.

Upgradation of WTP at T G Halli

The existing WTP of 135 mld will be rehabilitated on the following lines:

- Dismantling the old settling tanks, filter houses and treated water tanks which have served their life cycle and which can be potential health hazard with leakages if continued in use.
- 2 new 22.5 mld clariflocculators with tube/plate settlers in lieu of settling tanks.
- Construction of 135 mld capacity filter house in place of existing filter house.
- Construction of 15.75 ML capacity treated water tank.
- Water recovery from clariflocculator underflow & filter back wash by filter process.
- Rehabilitation of 5 clarifloccutors with Mechanical & Electrical equipment.
- Installation of PLC, SCADA & Telemetry for auto operation of treatment plant.
- Replacing existing 530 HP pumps 6 numbers with 3 numbers of 1100 kW pumping machineries of 1620 m3/hr, 160/170 m head at TG Halli and Tavarakere respectively.
- Replacing of 24” and 27” existing CI pumping main 1000 mm dia MS pumping main including all civil works to a length of 16 km.
- Providing surge-suppression device at TG Halli and Tavarekere for the protection of proposed 1000 mm diameter pumping main during power failure.
- The water treatment plant sludge will be handled in secure landfill.

Project Sustainability

The proposed treatment scheme is sustainable in the light of the following:

- The expertise and proven track record for the design & implementation is available within the country and has been well established for over 15 years by way of the functioning of the sewage renovation plants of M/s MFL, M/s MRL, M/s GMR Chennai, and M/s RCF Mumbai, which are all yielding a consistent degree of recovered water over the period and managed by locally available staff

- There are no imported equipments other than the ultra filtration membranes, which also are produced by at least one manufacturer in India. These are hollow fibre and not spiral would unlike RO membranes
- The ability to operate the plants is also easily available. Also, the reliability of UF membranes for removal of hepatitis virus has been verified and endorsed by National Virological Institute (in 2004). Also, there are no dependencies from abroad in terms of procuring technologies or expertise in sustaining treatment operations.

Project Costs, Time Horizon & Funding

The cost of the project is estimated to be about Rs. 474.12 crores (BWSSB estimate), and Rs.471.33 crores (CPHEEOO estimate). The O&M cost of the project is estimated at Rs.15.64 per kilo litre of water recovered. The project is scheduled to be implemented over a 24 months period.

Since the proposed project is the first of its kind in India it may pave way for more such projects in other parts of the country. As BWSSB is willing to take up the costlier issue of O&M this project could be grant funded up to 80% through the central government. The rest of the financing would be met by JBIC / World Bank.

3.2.3. Environmental Action Plan 'C'

Through this project, efforts to improve the environment will be the focus with rehabilitation of existing sewer network as well as new coonstruction in core area including laterals. It is proposed to take up work in four major valleys and three minor valleys in the core area of Bengaluru, and the sizes of sewer lines will range from 450 to 2400 mm for a length of 135 km. The project cost is Rs.260 crores.

General Treatment Scheme & Benefits

- Sewage Treatment Plant – BOD, Organic matter reduced, dissolved oxygen improves.
- Blending with Lake Water – Diluted with fresh water for improving palatability
- Water Treatment with Coagulation and Microfiltration – removal of colour and odour; BOD reduced to zero; bacterial load is zero
- Reverse Osmosis – TDS reduced to 250 mg/L from 600 to 1000 mg/L; 100% removal of pathogens and virus.

3.3. Service Delivery Targets

Table 41 indicates projected demand based on the projected population, delivery targets, and the status.

Table 41: Projection of Demand, Water & Sewerage

Parameter	Quantum
Additional population to be covered by 2012	16.5 lakh
Bulk water requirement in 2012	1,167 MLD
Additional requirement based on current availability	183 MLD

Additional water connections	11.4 lakh
Additional sewer connections	11.5 lakh
Additional STP capacity	279 MLD

Source: CDP Bangalore 2006

Service delivery targets have been listed out in Table 42.

Table 42: Service Delivery Targets, Water & Sewerage

Parameter	2012
Coverage (Area)	100 %
Frequency of Water Supply	8 hours per day
Metering	100% metering
UFW	20%
Sanitation coverage	75%
Consumer redress system	Response time of less than two days

Source: CDP Bangalore 2006

3.4. Investment Plan for Water Supply & Sewerage

Based on the parameters outlined above the capital investment and operating expenses have been estimated as set out below.

3.4.1. Proposed Projects in Implementation Period

Rehabilitation of Bulk Water Supply Transmission Lines:

- Rehabilitation of head works;
- Installation / rehabilitation of bulk meters; and
- Plugging of leakages in the main transmission line to reduce UFW.

The rehabilitation expenses have been estimated at a normative standard of Rs. 2 Crore per kilometer length of the main transmission line (98 km). 75% of the rehabilitation works are proposed to be completed in the implementation period.

Rehabilitation / Extension of Distribution System

- Rehabilitation of the existing connections (15% of 3.6 lakhs existing water connections); and
- Provision of new connections in the uncovered areas.

The cost of rehabilitation and installation of new connections has been assumed at Rs. 6,500 and Rs. 8,000 per connection.

Rehabilitation/Extension of Sewerage System & Setting up of Sewage Treatment Plants

- Rehabilitation of the existing connections (40% of the existing connections); and
- Provision of new connections in the uncovered areas.
- Laying of sewers to prevent entry of sewage into storm water drains and avoiding inter-connection of SWD & sewers. Detailed studies would be taken up to identify the specific locations for laying separate sewers and for developing mechanisms for

preventing the inflow of sewage into SWDs. The project cost would be estimated based on the studies undertaken.

The cost of rehabilitation and installation of new connections has been assumed at Rs. 6,500 to 8,000 per connection. It is proposed to set up a sewage treatment plant with a capacity of 6 MLD at an estimated cost of Rs. 6 Crore.

Other Important Works

- Development of alternative water source
- Aquifer recharging
- Computer network analysis
- Efficient management of water by rezoning
- Public awareness campaigns
- Dual water systems
- Supply recharge
- Quality monitoring
- Energy audit studies
- Studies towards determination of UFW

These capital investment estimates for these works have been based on previous studies conducted by the concerned departments/agencies.

3.4.2. Investment Requirement

The estimated capital investment plan for BBMP area during the implementation period is set out in Table 43.

Table 43: Investment Plan for Water Supply and Sewerage – JNNURM Period

Bangalore Water Supply and Sewerage Board	Total	2007-08 (Rs. Cr)	2008-09 (Rs. Cr)	2009-10 (Rs. Cr)	2010-11 (Rs. Cr)	2011-12 (Rs. Cr)
Water Supply	5,986.00	540.05	795.05	1,535.26	1,465.28	1,650.36
Source augmentation	1,905.32	0.00	0.00	571.60	571.60	762.13
Treatment capacity	150.16	0.00	0.00	45.05	60.06	45.05
New distribution Network	931.17	279.35	279.35	186.23	186.23	0.00
Elevated Storage capacity w.r.t Supply	207.95	0.00	0.00	62.39	62.39	83.18
Refurbishment of old Distribution net work	600.00	180.00	240.00	180.00	0.00	0.00
Additional Source Auqumentation JBIC	1,750.00	0.00	175.00	350.00	525.00	700.00
Refurbishment reservoirs	200.00	60.00	80.00	60.00	0.00	0.00
Reuse of Water (dual pipeline and treatment facility	200.00	0.00	0.00	80.00	60.00	60.00
Metering System	41.39	20.70	20.70	0.00	0.00	0.00
Underground Drainage	2,203.37	264.98	339.93	636.93	452.22	509.31
New Sewer Network	972.30	0.00	0.00	291.69	291.69	388.92
Refurbishment of old sewer	749.49	224.85	299.80	224.85	0.00	0.00
Sewerage Treatment (against generation)	401.32	0.00	0.00	120.40	160.53	120.40
Inter Mediate Pumping Stations, Pumping machines	80.26	40.13	40.13	0.00	0.00	0.00
Total	8,189.37	805.03	1134.98	2172.19	1917.5	2159.67

Source: Crisil Report, 2007

The estimated capital investment plan for BBMP area during the vision period is set out in Table 44

Table 44: Investment Plan for Water Supply & Sewerage – Vision Period

(In Rs. Crores)	2013-17	2018-22	2023-27	2028-31	Total
Water Supply	2198	2721	3133	3487	11539
Source augmentation	700	866	997	1110	3673
Treatment capacity	55	68	79	87	289
New distribution Network	342	423	487	542	1795
Elevated Storage capacity w.r.t Supply	76	95	109	121	401
Refurbishment of old Distribution net work	220	273	314	350	1157
Additional Source Auqumentation JBIC	643	795	916	1019	3373
Refurbishment reservoirs	73	91	105	117	386
Reuse of Water (dual pipeline and treatment facility	73	91	105	117	386
Metering System	15	19	22	24	80
Underground Drainage	809	1001	1153	1284	4247
New Sewer Network	357	442	509	566	1874
Refurbishment of old sewer	275	341	392	437	1445
Sewerage Treatment (against generation)	147	182	210	234	774
Inter Mediate Pumping Stations, Pumping machines	29	36	42	47	155
Total	6015	7444	8572	9542	31572

4. Implementation Framework

The population growth in Bangalore has necessitated significant improvement in service delivery levels. Appropriate measures to maintain the sustainability would include conservation and harvesting of water (including measures to reduce UFW), and enhancing the financial and institutional capacities of BWSSB/BBMP. Given the increasing financial constraints, strategies for optimum utilization and management of existing resources would be needed.

4.1. Urban Water Supply and Sanitation Policy

GoK has announced an Urban Drinking Water and Sanitation Policy, with the following objectives:

- To ensure universal coverage of water and sanitation services that people want and are willing to pay for
- To provide such services in a manner that preserves the sustainability of the precious water resources of the State, protects and enhances the commercial and economic sustainability of the operations at the same time
- To ensure a minimum levels of service to all citizens.

To achieve these objectives, GoK would:

- Continue to formulate policies, set the standards for provision of water services, provide resources for capacity creation, regulate, monitor and evaluate the efficiency of the operations
- Prepare a demand driven urban water action plan for making capital investments based on the principles of optimal utilization of water, water systems and financial sources
- Propose a new tariff structure that would help recover O & M expenses, debt servicing, and ensure a reasonable return on capital
- Encourage private sector participation to achieve the sector goals, promote economic and commercial viability of water sector services, allowing the former ULBs the choice of providing the services directly through public bodies or through such appropriate private sector participation arrangements.

The main strategic drivers identified for achieving these objectives, could broadly be categorized as:

- Financial Management Practices – streamlining and adopting prudent financial practices; and
- Institutional Framework and Governance – setting out the systems, procedures and guidelines and up-gradation of technical and managerial skills.

4.2. Institutional Arrangements

BWSSB/BBMP would continue to retain the principal responsibility of service provision. The Policy envisages a redefinition of institutional roles to enable better service provision by BBMP, under the same operating framework. A State-level nodal agency is being considered to be set up to govern, facilitate, and regulate performance of the various stakeholders in the sector to ensure the Policy is implemented.

Institutionalizing professional governance also necessitates appropriate capacity building initiatives. The primary objective of capacity building measures is to enhance the financial and operational capabilities of institutional stakeholders, through structured training programs for personnel, both for technical and administrative staff.

4.3. Projects Approved under JNNURM Scheme

The following projects have been approved under the JNNURM scheme and are promoted by BWSSB.

Table 45: BWSSB Projects under JNNURM

No.	Project Undertaken	Investment Estimate (Rs. Cr)
1	Augmentation of 100 MLD Water	12.26
2	Bulk Flow Metering System	15.31
3	EAP (Part B)	176.75
4	Integrated Water Management at Vrishabhavati Valley	474.00
	Total	678.32

Source: KUIDFC

4.4. Public Private Partnerships

Large-scale private sector participation is not anticipated in the short-term, given the prevailing sector constraints. The lack of sufficient private sector interest, hitherto, is also indicative of the need for structural readjustment (primarily local body reforms and tariff rationalization), as a prerequisite for encouraging PPP. It is expected that tariff rationalization would also not adequately ensure cost-recovery in the short and medium term. In such a scenario, GoK/BBMP would assume the tariff or revenue risk till such time tariffs are adequate to recover full cost of service provision.

BWSSB/BBMP would review options of procuring specific private services to improve the quality and efficiency of service provision and administer the same through limited service contracts (say, metering and collection, distribution mapping) in select areas, on a pay-per-task basis. BWSSB/BBMP would consider entering into contracts of varying tenure depending on the nature of service provision, where the risks of construction, financing and O&M could be passed on to the private developer/operator, while the revenue risk could be retained by the government until such time the tariffs are able to meet full cost recovery. Table 46 indicates activities for various PPP models.

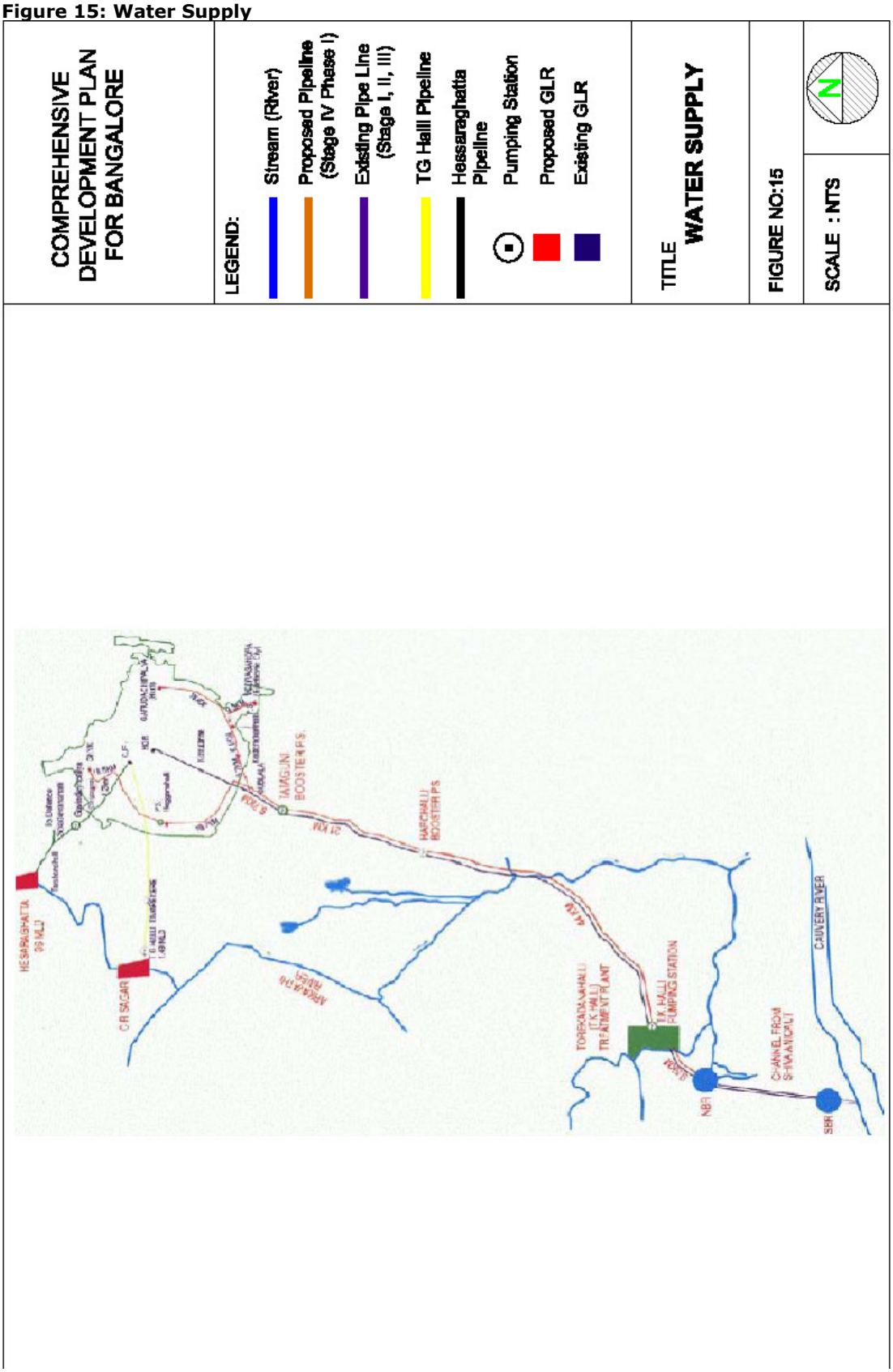
Table 46: PPP Models in Water Supply & Sewerage

No.	PPP Model	Indicative Activities
1.	Service Contract	Consumer census Metering Regularization of billing Network mapping Billing & collection
2.	Operating Contract	Reduction in UFW Increase in service levels
3.	Management Contracts	Improve service levels Reduction in UFW
4.	Lease / Concession	Improve service levels

No.	PPP Model	Indicative Activities
		Reduction in UFW

The choice of the implementation framework would be made after a detailed due-diligence of all options available; including those set out above, and based on consultations with stakeholders.

Figure 15: Water Supply



Chapter 7: Management of Solid Waste

1. Overview

The rapid growth of population in Bangalore metropolitan area, and changing lifestyles, has resulted in increased waste generation. Consequently, waste management has become a key issue needing be addressed. The various waste streams include municipal solid waste (households, commercial establishments), biomedical waste (hospitals, dispensaries), industrial waste (industries) and electronic waste (discards from electronic equipments including PCs). While handling of MSW is the responsibility of the newly formed BBMP, separate statutes and institutional frameworks address hazardous wastes, and biomedical wastes.

1.1. Existing Situation

The service delivery status of MSW and other waste streams in BBMP area is set out below. A map depicting location of the existing and proposed treatment and disposal facilities is in Figure 16.

1.1.1. Municipal Solid Waste Management in BBMP Area

BBMP area is divided into health wards for the purpose of MSW management. The per capita residential waste generation is estimated at around 380 gm per capita per day[13]. While no accurate current assessment of MSW exists, Table 47shows studies of a waste quantification survey carried out in 2001 by the erstwhile BMP.

Table 47: MSW Generation in core Area

Source	Quantity (TPD)
Residences	1,562
Markets	84
Hotels and Restaurants	96
Total	1,742

Source: MSW Master Plan, 2008

Table 48 indicates the prevailing management practices in BBMP area.

Table 48: Prevailing MSW Management Practices in BBMP Area

Component	Features	Issues
Collection	Near 100% collection efficiency in core area 100% door to door collection in residential localities of core area Private participation in several wards	Segregation practiced only in few areas
Transportation	Private participation in 182 wards of core area Covered vehicles being used in most areas Compactors and mechanical	No transfer station available

[13] MSW Master Plan for BBMP (2007-08)

Component	Features	Issues
	sweeping of roads proposed	
Treatment	Existing treatment capacity of 700 - 800 TPD (biggest plant KCDC - 350 TPD) Compost plants of 1000 TPD and Waste - to - energy plant of 1000 TPD being developed with private participation on BOT basis	Treatment capacity inadequate (shortfall of more than 1000 TPD) to treat entire waste generation
Disposal	Engineered sanitary landfills being developed with private participation on BOT basis	Expected to be operational only by 2008 Waste currently dumped on roadsides and low lying areas

Institutional Framework

The Health Department of BBMP currently manages the SWM activities; however, recognizing the need for better MSW management activities, BBMP has constituted an SWM cell.

Finances

The MSW Management Master Plan (2008) for Bangalore city recommends budgetary allocation for SWM which is estimated at Rs. 553.35 Crores, of which Rs. 333.63 Crore is towards contractor payment for collection and transportation.

Cost Recovery

Table 49 indicates the cost recovery situation for SWM services. Since there is no explicit charge for the provision of these services, the cost recovery is 0%.

Table 49: Cost Recovery Situation in SWM

Cost incurred in service provision (Rs. Lakhs)			Direct recoveries (Rs. Lakhs)		
2002 - 03	2003 - 04	2004 - 05	2002 – 03	2003 - 04	2004 - 05
3258	4207	4773	0	0	0

Source: CDP Bangalore 2006

1.1.2. MSW Management in former CMC Areas

Earlier the respective ULBs carried out MSW management activities in their areas, with support from GoK agencies. However since the formation of BBMP and the annexation of the ULBs has placed the responsibility of MSW with BBMP. Table 50 shows the estimated MSW generation.

Table 50: MSW Generation in former CMCs/TMC

Area	Waste Generated (TPD)	Collection Efficiency (%)
Yelahanka	61	80%
Byatarayanapura	75	80%
KR Puram	75	80%
Bommannahalli	141	80%
Dasarahalli	131	80%
R R Nagar	38	79%

Area	Waste Generated (TPD)	Collection Efficiency (%)
Mahadevapura	81	80%
Kengeri	30	80%
	TOTAL: 632	AVERAGE: 80%

Source: CDP Bangalore 2006

1.1.3. Biomedical Waste

Table 51 indicates the typical quantities of biomedical waste generated in Bangalore.

Table 51: Bio-medical Waste Generation

Type of Institution	Number of Institutions	Number of Beds	Waste Generated (Kg / day)
Major Hospitals (500 and Above beds)	12	7,533	3,766
Major Hospitals (200 to 499 beds)	15	4,868	2,434
Less than 200 beds	608	5,849	2,924
Non Bedded Health Care Establishments such as Clinics, Lab, Blood Banks, Dispensaries, medical Centers	683	0	100
Total	1,318	18,250	9,224

- 40-70% of the biomedical waste comprise kitchen, office, uninfected non-hazardous waste
- Hazardous chemicals and drugs form only a minor portion
- Private medical institutions include such as Malleswaram Health Care Waste Management Project, scientific waste management system by St. John's Medical College Hospital and MS Ramaiah Medical College have taken multiple initiatives to scientifically manage biomedical waste stream.

1.1.4. Industrial Waste

- Industrial waste generated by more than 200 industrial premises in Bangalore
- Estimated annual generation: 3,100 MT (additional discarded hazardous waste containers and liners-3,222 numbers)
- Accumulated waste stored-6,300 MT
- Waste oil and oil emulsions account for nearly 70% of hazardous waste
- On the treatment and disposal side:
  - 75% is reprocessed
  - Nearly 10% is incinerated
  - 10% is being stored
  - Approximately 5% is being treated/disposed of by other methods.

1.1.5. E-waste

Bangalore, with its dominant IT industry, has accumulated electronic waste in excess of 6,000 MT which could result in the following hazards:

- Chemicals such as beryllium, found in computer motherboards, and cadmium in chip resistors and semiconductors are toxic and can lead to cancer

- Chromium in floppy disks, lead in batteries & computer monitors, and mercury in alkaline batteries and fluorescent lamps poses severe health risks.

E-parisara is India's first eco-friendly recycling unit, located in Dobaspet (about 50 km north of Bangalore). It processes obsolete computers and electronic gadgets and brings most of it back into applications by industries. Other end products where recycled e-waste is used include flowerpots and birdhouses, plastic screens, and uses in casting industry. There are proposals to develop more such similar facilities.

1.2. Key Issues in SWM

The key issues facing the sector include the following:

- Lack of awareness and absence of comprehensive segregation of waste at source, resulting in large quantities of non-biodegradable waste being collected and sent to the facilities for biological processing
- While in most cases the waste is being transported in covered vehicles, it has been observed that in some areas waste is still being transported by open vehicles resulting in spilling of waste during transportation
- Absence of transfer stations for transferring MSW into bigger vehicles for transportation to the treatment and landfill facilities
- Inadequate waste treatment capacity when compared to the quantum of waste generated
- Dumping of MSW in drains, along the roads and in low-lying areas
- Absence of policy and regulations to promote waste reuse and recycling and a favorable environment to promote manufacture of reusable material
- Limited participation of the community in sharing the costs for SWM
- Absence of capacity building for Pourakarmikas regarding waste handling.

2. Strategy for Improved Service Delivery

Given the population growth in Bangalore, the key challenge for the BMMP is to provide adequate MSWM services within its limited finances. MSWM services would require universal coverage since it has a direct bearing on the City's environment and citizens' heath. The requirements for collection and transportation equipment and the estimate of tipping fee for composting and landfill are based on the waste generated and in turn the projected population as set out in Chapter 5.

The estimated waste generation is expected to increase to 4002 TPD in 2013 and to 7372 TPD in 2023, based on the population growth forecasts. While the per capita waste generation is expected to increase (~600 gm) with economic growth, various initiatives for segregation, recycling and reduction are proposed to be implemented. As a result, the per capita generation coming into the municipal stream is estimated to be approximately 400 gm/day.

The strategy for improved service delivery would need to be concurrence with the MSW Rules 2000 while addressing the issues constraining the sector and its impact on the urban poor.

2.1. Characteristics of Sector

The characteristics of the MSW sector comprise:

- Significant involvement of waste generators, local communities, and NGOs for effective segregation, collection, and transportation of waste
- Substantial investments required in treatment and disposal technologies
- Success of these projects depends on adequate project development and off-take structures (compost market, power purchase agreements, etc.)
- Strict environmental conditions need to be adhered to and the facilities should operate for a longer periods
- Coordination issues between different contractors/agencies for system design, collection, transportation, and landfill management.

2.2. Proposed Implementation Plan for MSW Management

The MSW Master Plan, 2008 is set out in compliance with MSW Rules, 2000 and the accepted waste hierarchy principles of reduction, reuse, recovery, and disposal. The other key principles include the following:

- Waste minimization at source
- Waste management closest to generation
- Generator to pay for management
- Efforts for conversion of waste to energy should be made
- Addressing social and environmental aspects

The contours of the proposed strategy include:

- Door to door collection at household level
- Transportation to treatment and disposal facilities
- Providing flexibility in MSW management for addressing local issues
- Leveraging the existing initiatives including Swachha Bangalore and experimentation on mechanical sweeping
- Development of scientific MSW treatment (including waste to energy projects) and disposal facilities, and possible common facilities for BBMP area.

2.3. Needs of Urban Poor

Ensuring that the development policies of the BBMP reach the urban poor is critical to the inclusive growth. Given the socio-economic strata, schemes would need to be customized suitably for effective universal service provision. The services proposed to be provided include:

- 100% coverage
- SHG involvement in collection and transportation
- Specific / custom made vehicles including tricycles
- Dumper bins at community locations
- Free service / subsidized user fees

Details of specific projects are given in Volume-III of this CDP, "Basic Services for Urban Poor."

3. Project Identification & Costing

The projects identified would need to address the entire chain of service delivery and other aspects including financial management, capacity building of BBMP and best practices in MSWM. Though BBMP has undertaken many initiatives for MSWM in its areas, service levels need to be constantly upgraded to cater to the projected population. Best practices would also need to be implemented by the authority for improved service delivery.

3.1. Service Delivery Targets

Based on the above circumstance and strategies discussed, Table 52 shows the indicative targets for the sector:

Table 52: Service Delivery Targets, MSW

Parameter	2012
Coverage	100% for entire Bangalore Region
Collection Efficiency	100% of waste generated
Segregation	85% of waste generated
Capacity of Treatment and Disposal Facilities	100% of waste generated in Bangalore Region
Recovery of Costs	100% of collection and transportation costs
Training	100% staff trained
Standardisation of Procedures	Standardization of guidelines and pilot implementation

3.2. Investment Plan for Solid Waste Management

3.2.1. Projects in Implementation Period

The estimated quantum of MSW is based on projected population during the implementation period as set out in Chapter 5, and the normative per capita MSW generation standards.

Preparation of MSW Master Plan for BBMP

BBMP has undertaken the initiative of preparing a Master Plan for management of MSW in the areas under its purview. The task of preparing the Master Plan was awarded to M/s iDeCK and M/s MACE in 2007. The Master Plan is slated to be prepared under the JNNURM scheme for which the brief Scope of Work is detailed as follows:

Study of MSW generation and sources.

This includes study of living standards of citizens, types of waste generated (classified according to zones/wards), types of waste generators (such as households, institutional, commercial etc.). The Master Plan also necessitates the preparation and submission of maps.

The Master Plan shall include a detailed analysis of existing system of MSW collection, transportation, processing and final disposal. Details of ongoing activities related to SWM in and around areas of Bangalore city taking into account the deficiencies in the current system.

The project requires the assigned Consultants to carry out field surveys, provide estimation of Quantities, and projections of waste generation. Suitable methods of treating/disposing of the MSW shall be recommended by clients considering the available technological options and economic feasibility.

Preparation of DPR, engineering drawings, implementation methodology, bid documents and preparation of Tender documents include Bid Schedules and Agreements.

Other tasks in the MSW Master Plan preparation include exploration of potential for Clean Development Mechanism (CDM) technologies. The Consultants shall formulate legal provision and draft byelaws for protection of city environment through good SWM practices. The rules shall be drafted in consideration with State and BBMP policy.

Collection and transportation of MSW

Tools and equipment for MSWM would need to be continuously upgraded to meet the increased demands and performance requirements.
Capital expenditure would include:

- Procurement of plant and machinery for treatment and disposal facilities; and
- Collection and transportation equipment (primary collection vehicles - auto tippers and pushcarts, transportation vehicles)

O&M expenses would include:

- Repairs and maintenance of the vehicles
- Fuel expenses
- Salaries

Collection and transportation expenses have been estimated on a cost per MT basis and MSW generated. The components of expenses include:

- Equipment - 35%
- Vehicles - 30%
- O&M - 35%

Development of treatment and disposal facilities

The City has treatment and disposal facilities with combined capacity of 2,000 and 1,600 MT/D, respectively. It is proposed to develop new facilities based on the increased quantum of MSW generated (unmet demand of 1,000 TPD and additional generation of 400 TPD) during the implementation period. The costs for development of treatment and disposal facilities have been estimated at Rs. 2 lakh per MT and Rs. 8 lakh per MT of waste, respectively.

3.2.2. Estimated Capital Investment Requirement

BBMP is developing engineered sanitary landfills with private participation. These integrated waste processing and landfill facilities at Kannahalli & Mavallipura are being implemented under a build-operate-transfer concession framework. A waste-to-energy plant is also being developed by the private developer. BBMP has also been incurring expenditure for provision of MSW management services in wards being serviced by its

employees. The investments required for these projects and expenses have not been included in the estimated capital investment requirements.

The estimated investment as per CDP 2006 was Rs.800 Crores for the BMP area. The Master Plan prepared by BBMP for Integrated Solid Waste Management for BBMP was estimated at Rs.562 Crores. Hence, the investment estimates that were have been retained for this CDP. Table 53 shows the estimated capital investment plan for BBMP area during the implementation period.

Table 53: Investment Plan for MSW – JNNURM Period

Description	Upto 2007-08	2008-09	2009-10	2010-11	2011-12	Total (Rs. Crore)
CAPEX towards Equipment	70	42.6	45.1	45.1	47.6	250.3
Rolling stock – Vehicles	60.5	36.8	39.0	39.0	41.1	216.4
OPEX	13.2	39.6	65.9	65.9	79.1	263.7
Land Acquisition	7.4	4.5	4.8	4.8	5.0	26.5
Installation of GIS System	2.6	1.5	1.6	1.6	1.7	9.0
Tipping Fee for existing landfills	9.5	5.8	6.1	6.1	6.5	34.1
Grand Total	163.3	130.7	162.5	162.5	181.0	800.0

Source: CDP Bangalore 2006

The actual requirement would be set out in individual DPR which are to be prepared for each activity of which the Master Plan is already prepared by BBMP. The management of SWM would also require vast lands to the extent of 2000 acres hence, the investment required for the purchase of land would be approximately Rs.1000 Crores (at the rate of Rs.50 lakhs per acre). The investment for land requirements would not be funded under JNNURM and as such is not included in the Mission period estimate. The purchase of land would be undertaken by BBMP.

Table 54 indicates the investments required in future blocks which are again the investment estimates retained from CDP 2006.

Table 54: Investment Plan for MSW – Vision Period and beyond

Description	2013-17	2018-22	2023-27	2028-31	Total by 2031 (Rs. Crores)
Capital Expenditure towards Equipment	307.8	356.9	413.7	479.6	1808.3
Rolling stock - Vehicles	266.1	308.5	357.7	414.6	1563.3
Operation and Maintenance Expenses	324.3	375.9	435.8	505.2	1904.9
Land acquisition	14.5	20.1	23.3	21.3	105.7
Installation of GIS system	0.0	0.0	0.0	0.0	9
Tipping Fee for existing landfills	35.8	37.6	39.5	41.5	188.5

Description	2013-17	2018-22	2023-27	2028-31	Total by 2031 (Rs. Crores)
Grand Total	948.6	1099.0	1270.0	1462.2	5579.8

Source: CDP Bangalore 2006

4. Implementation Framework

The responsibility for managing the MSW sector is squarely with the BBMP, while the sectors of industrial and biomedical waste are governed by other statutes, and are the responsibility of the industry.

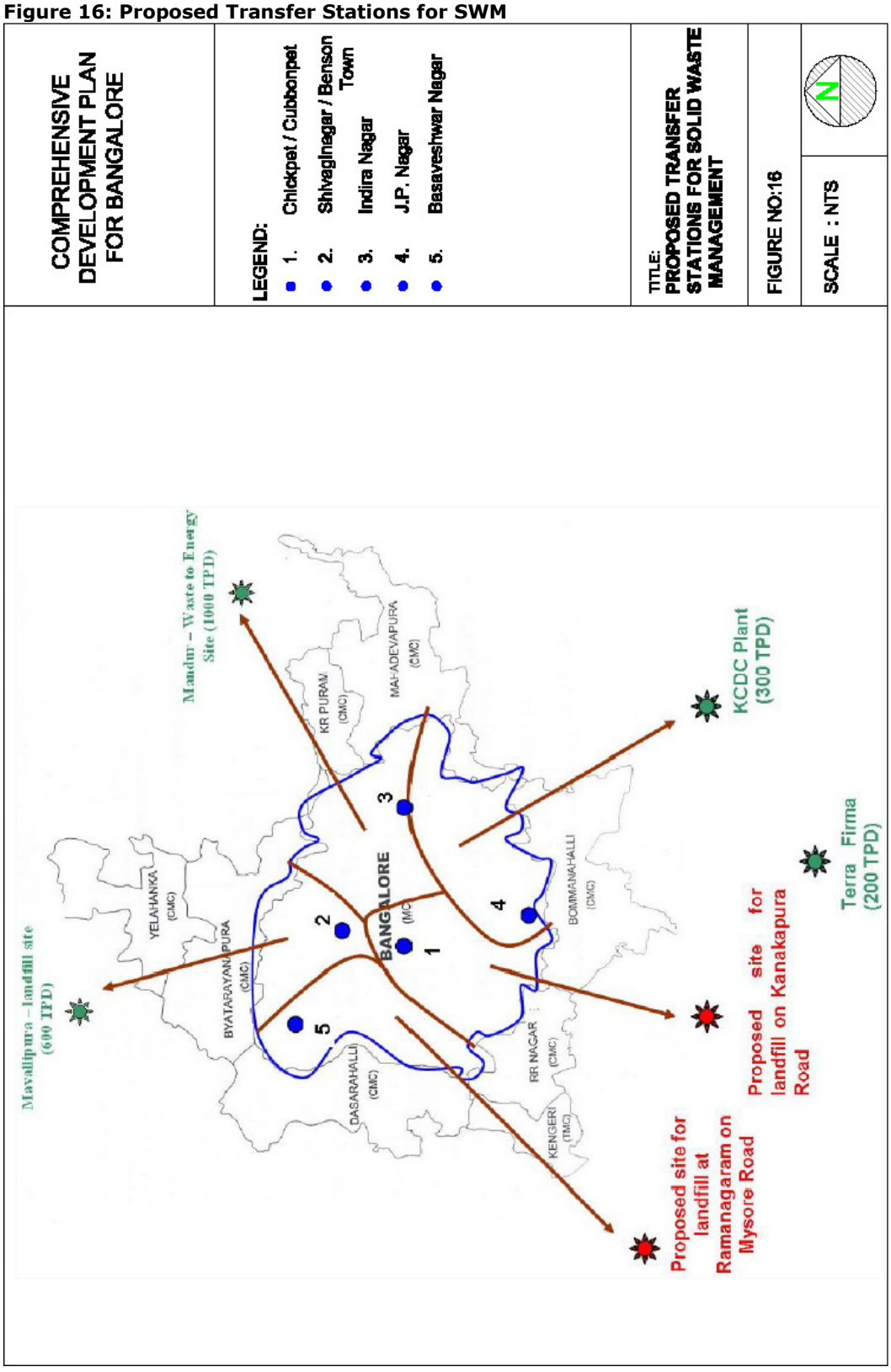
On the MSW side, BBMP has implemented projects with private sector participation in collection, transportation, treatment, and disposal. While treatment and landfill facilities are being developed under BOT framework, collection and transportation in 60% of health wards has been contracted out. Private participation in newly added BBMP areas is limited to contracting out collection and transportation activities.

BBMP would explore more performance based service/management contracts for collection and transportation. BBMP would also participate in the integrated treatment-cum-disposal facilities developed across its area. An indicative framework for private participation is presented in Table 55

Table 55: Framework for PPP in MSW

Activity	Key Characteristics	Contract Type
Collection & Transportation	Large number of employees and informal workforce Logistics intensive Citizen interface Investment depends widely depending on scope of work	Service contracts, Management contracts and Concession
Street Sweeping	Labour oriented Minimal investment No requisite skills / technical skills Logistics intensive	Service contracts
Treatment	Technology intensive More capital intensive Ongoing O&M	Concession Contracts
Disposal	Capital intensive Technically skilled manpower required Ongoing O&M	Concession Contracts

Figure 16: Proposed Transfer Stations for SWM



Chapter 8: Urban Drainage Systems

1. Overview

The growing geographic spread of Bangalore and accompanying construction activity has interrupted the natural valley system of the region. Construction has also resulted in filling up small water bodies and low-lying areas. The flooding of drains during each monsoon exposes its poor state and their inadequate capacity, and impacts the City's overall infrastructure. Therefore, improving the drainage system is a key and critical element in the City's infrastructure.

1.1. Existing Situation

The City built by Kempegowda, 468 years ago, has a well-developed natural drainage system. Bangalore had more than 400 lakes, interlinked by a system of canals that followed the natural gradient of the land in which excess water from one lake would flow through waste-weirs into the next lake/tank, thereby preventing flooding. This system could be maintained for a long time, through the colonial period, till more recent times. With the formation of the BBMP, the newly added areas which include the erstwhile ULB and the 110 villages do not have appropriate storm water drain facilities. At present only 50% of the total BBMP area is covered with drains. The features of the existing system comprise:

- Naturally undulating terrain of Bangalore City:
  - Ideally suited for development of lakes that can capture and store rainwater
  - Each valley at the ridge top gives rise to small streams which cascade down to form major stream systems.
- Lakes form chains of reservoirs in each of the three valley systems in Bangalore:
  - Flow of the water runs from North to South-east as well as South-west along the natural gradient of the land
  - The lakes harvest rainwater from their catchments, and the surplus flows downstream spilling into the next lake in the chain
  - This connectivity ensured that additional water is continuously transferred to other lakes
  - The system serves as an excellent flood controller and storage for rainwater
  - Pipe networks carry the collected wastewater to treatment plants – Vrishabhavathi Valley on Mysore Road (180 MLD), Koramangla Challghatta Valley near HAL Airport (163 MLD), and Hebbal Valley on Bellary Road (60 MLD)
  - Incomplete sewerage systems results in sewage being let out into storm water drains or lakes, polluting the water.

1.2. Key Issues of Urban Drainage Systems

With the growth of the City, the number of lakes has reduced to 64, and small lakes and tank beds have vanished because of encroachment and construction activities. This has resulted in storm-water drains reducing to gutters of insufficient capacity, leading to flooding during monsoon. Dumping of MSW in the drains compounds the problems, leading to blockages. To control floods, it is important to remove silt and widen these storm water drains to maintain the chain flow and avoid water from stagnating at one point.

2. Strategy for Improved Service Delivery

2.1. Characteristics of Sector

Urban drainage has a direct impact on the City's image, citizens' life, and health. If the system does not work properly, it leads to environmental hazards. However, the status is that urban drainage has become a victim of rapid urbanization.

Improving the urban drainage system requires not only capital infusion, but also ongoing funding for operation and maintenance. A single point obstruction in a storm-water drain would have a cascading overall impact. Citizen awareness is therefore a critical issue, citizens and NGOs can play a key part in monitoring development in the region to ensure that drainage is not obstructed, and dumping of debris and MSW in drains does not occur.

2.2. Proposed Implementation for Urban Drainage Improvement

The proposed plan includes:

- Construction/remodeling/rehabilitation of storm water drains and road side drains
- Removing silting
- Constructing retaining walls
- Laying of beds
- Provision of enabling and awareness information architecture
- Green area development.

3. Project Identification & Costing

The "Valley Projects" as they are called, are the most critical element of the system. Improvement of storm water drainage system and roadside drainage and breaking the interconnectivity of sewerage and storm-water are crucial elements of the project.

3.1. Investment Plan for Urban Drainage Improvement

3.1.1. Projects in Implementation Period

- Constructing 1500 km of roadside drains (cost of construction assumed at Rs.30 lakh per km for a 5-metre drain)
- Extension of the SWD network to entire BBMP area; including the former CMCs
- Clearing all encroachments that come in the way of the storm water drain network in the city
- Aligning the drain network and checking blockage and overflowing of drains
- Reviewing existing storm water drains, ensuring connectivity of primary, secondary and tertiary drains
- Redesigning for current load conditions along with building barriers between roads and open drains at crossings.

3.1.2. Estimated Capital Investment Requirement

Table 56 gives the estimated investment requirement in the JNNURM period, while Table 57 gives the estimated investment in future blocks.

Table 56: Investment Plan for Urban Drainage - JNNURM Period

Description	Upto 2007-08	2008 -09	2009 -10	2010-11	2011-12	Total
Carrying Capacity Improvement	-	-	-	1075.8	717.2	1793.0
Rehabilitation/ Strengthening	-	-	-	9.5	6.3	15.7
Culverts/ Bridges	-	-	-	124.0	82.7	206.7
Allied Drain Works	-	-	-	728.9	485.9	1214.9
Decentralised STPs	-	-	-	172.2	114.8	287.0
Non-Structural Works	-	-	-	195.2	130.1	325.4
Total	-	-	-	2305.6	1537.1	3842.7

The investment estimate for Mission period would include the investments for development of primary and secondary drains for BBMP area (based on the study undertaken by BBMP). However, an investment estimate for tertiary drains in BBMP area (data provided by BBMP) to the extent of Rs.3000 Crores have been included in the estimates for the Vision period.

Table 57: Investment Plan for Urban Drainage for Vision Period

Description	2013-17	2018 -22	2023-27	2028-31	Total
Capital expenditure	821.1	0.00	0.00	0.00	821.09
Rehabilitation expenses	82.1	184.1	308.4	430.6	1005.2
O&M expenses	246.3	248.5	308.4	370.5	1173.7
Total	1149.4	432.7	616.8	801.1	3000.0

4. Implementation Framework

One of the critical issues to be addressed relates to the fact that inadequate drainage in a particular area may not have the impact in the same zone but elsewhere. Coordination and continuity in action of BBMP is of critical importance.

- The importance of Agency coordination:
  - Inadequate drainage in a peripheral areas may impact drainage in BBMP areas;
  - Improper drainage of BWSSB's system may pollute the valley system and impact quality of life across the City; and
  - Improper roadside drainage and cross-connectivity may similarly impair system performance;
- Citizens to be involved to monitor contractor's activity on clearing of drain systems in their area:
  - Citizens who dump debris into storm water drains could be penalized; and
- Removing silt to be a regular activity before the monsoons starting with the main (primary) drain.

The City is proposing to have a coordinated action plan to address the issue of urban drainage. At present BBMP is coordinating the "Valley projects" and is carrying out the works in coordination with other agencies, facilitated by the GoK.

5. Projects Approved under JNNURM Scheme

Table 58 sets out the projects that have been approved under the JNNURM scheme and is promoted by BBMP and BWSSB.

Table 58: Projects approved under JNNURM scheme

Sl. No.	Project Undertaken	Investment Estimate (Rs. Cr)
1	Remodelling of SWD in Hebbal Valley	184.74
2	Remodelling of SWD in Vrushabhavathi Valley	228.26
3	Remodelling of SWD in Koramanagala Valley	111.49
4	Remodelling of SWD in Challaghatta Valley	118.57
5	Under Ground Drainage system & Road Restoration for Yelahanka Drainage Zone-I	15.01
6	Under Ground Drainage system & Road Restoration for Kengeri Drainage Zone-I	18.76
	Total	676.83

Source: KUIDFC

Chapter 9: Roads & Transportation

1. Overview

When citizens and visitors refer to the infrastructure in Bangalore being "under stress," a large part of such reference is to the transportation infrastructure and congestion in the road and transport system. Roads and transportation infrastructure is probably the area where the most critical and immediate interventions are required. This section of the CDP deals with the roads/urban transport situation, the strategy forward, the "big picture" of interventions, and finally specific interventions.

1.1. Existing Situation

The status of various elements that constitute the urban transport system of the City is examined in the following sections. This section also discusses studies on which the strategies for improving the delivery of urban transport services are based. The population projections, provided in the earlier sections, form the basis for the trip assignment models in the studies that are being undertaken (under the Comprehensive Traffic and Transportation Scheme being prepared for Bangalore).

1.1.1. Road Network

NH7 and NH4 (part of North South Corridor and Golden Quadrilateral, respectively) and NH209 pass through Bangalore forming five important radial roads within the Bangalore Metropolitan Area. State Highways linking Bangalore with Mysore, Bangalore with Bannerghatta, and Bangalore with Magadi form other major radial corridors. Developed as a radial town, Bangalore does not have a strong circumferential road system, except for the Outer Ring Road, despite the intervening space between the corridors developed. The main highways include:

- NH4 running from Mumbai to Chennai
- NH7 from Varanasi to Kanyakumari
- NH209 connecting Kanakapura and Kerala
- SH17 connecting Bangalore to Mysore.

BBMP has about 5900 km of road (including 250 km of arterial roads and 100 km of NH and SH), 38,000 intersections, 41,000 small roads, 162 signalized intersections, and 600 manual intersections. The existing urban road system is summarized in Table 59.

Table 59: Details of Urban Roads under BBMP

Zone	Area (sq. km)	Proposed Norms (km per sq.km)	Normative Road Length Reqmt (km)	Existing road length (km)
Core area	226.16	17.33	3919	3500
Bommanahalli	43.27	8.00	349	518
Byatarayanapura	47.00	8.00	376	337
Dasarahalli	38.00	8.00	304	412
KR Puram	21.25	8.00	170	362
Mahadevapura	45.18	8.00	361	275
RR Nagar	66.00	8.00	528	217
Yelahanka	38.80	8.00	310	190
Kengeri	34.00	5.33	181	111

Zone	Area (sq. km)	Proposed Norms (km per sq.km)	Normative Road Length Reqmt (km)	Existing road length (km)
Total BBMP	559.66		6498	5922

Source: CDP Bangalore 2006

While the standards of "length" are more or less in order, the problem relates more to the fact that the width of roads is inadequate, which is apparent from Table 69. Any transport intervention would therefore need to consider this constraint. For instance, this could imply that bus service would be self-limiting thereby, reach saturation at some stage, and that higher quality wide-bodied buses would be difficult to run. Consequently, the importance of having other rail-based systems that use a different or elevated right-of-way, such as a Metro or Light Rail Transit (LRT) system, is therefore established.

Table 60: Existing Road Widths

Road Type	Percentage
Two lane	02.24
Three lane	25.09
Four lane divided	38.49
Four lane undivided	13.91
Six lane divided	06.50
Six lane undivided	13.78
Total	100.00

Source: CDP Bangalore 2006

1.1.2. Rail

Bangalore is also served by five broad-gauge radial rail corridors. Attempts are being made to use the existing lines and capacity (with some augmentation), as a "Commuter Rail System." However, these do not presently serve as commuter corridors.

- Chennai on the East
- Mumbai (Pune) on the Northwest
- Guntakal on the North
- Salem/Thiruvananthapuram on the East
- Mysore on the Southwest

1.1.3. Vehicle Statistics

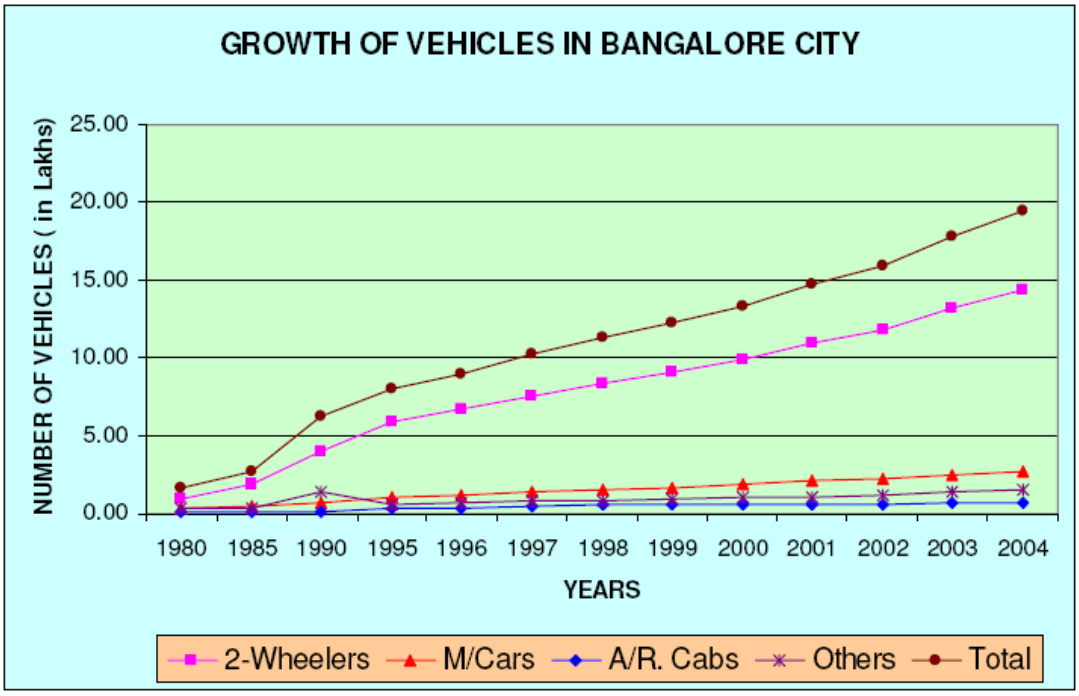
The number of registered vehicles in Bangalore has increased rapidly from 4 lakh (1987) to 23 lakh (2005). The CAGR was over 10%, and the growth rate of 2-wheelers, in particular, was around 17%. The average number of vehicles per household has increased six-fold in the last 25 years i.e. approximately 0.3 (1980) to 1.7 (2005). Table 61 shows the vehicular population, and the vehicular growth is illustrated in Figure 17.

Table 61: Vehicle Population (March 2008)

Vehicle Type	(in Lakh)
Two Wheeler	22.83
Light Motor Vehicle	5.05
Auto-rickshaws	0.92
HTV	NA
HGV	NA
Others	2.91
TOTAL	31.29

Source: Transport Department, GoK

Figure 17: Growth of Traffic



Private vehicular transport constitutes a very sizeable proportion. Of the 21.4 lakh registered vehicles, 15.83 lakh vehicles account for 2-Wheelers, and 3.04 lakh vehicles are cars – 88% of total vehicles are personal vehicles. 2-wheelers, which constitute about 72% of total vehicles, are growing at about 17% per annum. Considering that 2-wheelers occupy between 0.4 to 0.7 PCU, this is a critical issue needing to be addressed.

1.1.4. Modal Split

The modal split for travel trips is given in Table 62 and this again illustrates the fact that 2-Wheeler trips are high.

Table 62: Modal Split for Travel Trips

Mode	With walk trips (%)	Without walk trips (%)
Public Transport	41.91	45.72
Car	6.62	7.22
2-Wheeler	29.36	32.03
IPT	11.56	12.61
Cycle	2.22	2.42
Walk	8.33	0.00
TOTAL	100.00	100.00

Source: CTTP, 2007

1.1.5. Mass Transport

Bangalore Metropolitan Transport Corporation (BMTC) is currently the only provider of urban mass transport services. BMTC operates a fleet of about 4,185 buses undertaking 60,621 trips, to service over 40% of the trips (35 lakh passenger trips) daily in the

metropolitan area. Table 63 indicates the cost recovery situation in provision of bus transport services, which is full recovery. In any transport model scenario, it can be seen that BMTC - public bus services - would continue to play the central role in urban public transport systems, even if other mass rapid transit systems are introduced.

Table 63: Cost Recovery Situation in Public Bus Services

Cost incurred in service provision (Rs. Lakhs)			Direct recoveries (Rs. Lakhs)		
2005 – 06	2006 - 07	2007 - 08	2005 –06	2006 – 07	2007 - 08
58,851.8	66,326.56	79957.83	62,333.68	70,743.59	80,148.93

Source: BMTC

1.1.6. Environment

The rapid increase in vehicular traffic has clearly impacted environmental parameters. Reports by KSPCB mobile laboratories in Table 64 show that pollution levels in some places are above standard values.

Table 64: Air Pollution Levels

Stations	O3 (mog/m)	SO2 (mog/m)	NOX (mog/m)	CO (mog/m)	SPM (mog/m3)
Yeshwanthpur, NH4 (O)	3.4	3.9	58	3.18	141.9
M.G Road (O)	2.3	4.6	26.8	5.1	96.5
Town Hall (O)	2.4	4.8	38.2	4.8	154.1
K.G Circle (O)	2.4	4.4	47.2	4.6	164.5
Peenya Indl Area (I)	2	4.8	19.4	3.5	153.7
Victoria Hospital (S)	2.1	3.6	3.1	2.5	65.2
Jayanagar Residential Area (R)	1.7	3.9	10.7	3.3	72
Opp. B.C.G.H.S Residency Road (S)	1.9	4.6	24	4.8	115
Indian Express (O)	2.2	4.5	79.3	4.5	147.9

Table 65 gives the Central Pollution Control Board (Environment Protection Act, 1986) prescribed noise standards in different areas.

Table 65: Standards for Noise Pollution

Area	Permissible levels (in decibels)	
	Day	Night
Residential	55	45
Commercial	65	55
Silent zones	50	40

Source: CDP Bangalore 2006

Table 66 gives the noise levels measured in about ten areas of the City on April 23, 2006, which are beyond permissible limits.

Table 66: Noise Pollution Levels

Area	Noise levels (in decibels)
Jayanagar 4th Block	82
South end circle	82
JC Road	80
Mekhri Circle	100
KH Road	95
Wilson Garden	82
BTM Layout	79
Forum Mall	78
Brigade Road	98

Source: CDP Bangalore 2006

1.1.7. Traffic Congestion

Given the congruence of lesser road widths and high personal modes, it is clear that congestion would be a direct consequence. A recent study[14] has shown that over 52 corridors/links could be classified as "congested," with V/C over 1. The average speed of vehicles in Bangalore varies between 12-18 kmph, in peak hours, with clear start-stop and obstructed flows on many corridors. Congestion indicators at major intersections are greater than 1.5 (against a standard of 0.8 for free movement). Introduction of one-ways and construction of grade-separated intersections have only served as a palliative. Table 67 gives V/C ratios of some key roads.

Table 67: Volume - Capacity Ratios of Roads

Name of road	Volume/Capacity Ratio
Nrupantunga Road	3.62
District office Road	2.51
K.G Road	2.51
Lalbagh Fort Road	2.67
Puttanna Chetty Road	2.45
Richmond Road	2.26
M.G Road	2.76
Chord Road	2.51
Tumkur Road	2.62
Sankey Road	1.52

Source: CDP Bangalore 2006

1.2. Transport Studies for Bangalore

1.2.1. Rapid Traffic Study

iDeCK and RITES carried out a study to identify the high-density and medium density corridors, taking into account the Commuter Rail System (CRS) and the Metro-Rail. The study is based on 2005 data, and estimates traffic demand by 2015, the horizon year, under a "Do Minimum" scenario, and a "CRS & Metro-Rail" scenario. shows the

[14] iDeCK and RITES, November 2005

identified high and medium density corridors in the horizon year, with the metro-rail and CRS in place.

RITES has used a traffic assignment model for the analysis, and the key conclusions are:

- Despite introduction of the Metro-Rail (Phase-I) and the CRS, 52 key road corridors would have Volume/Capacity ratios of 0.75 and above. Of these, 21 high-density corridors would have Peak Hour Peak Direction Trips (PHPDT) > 20,000 and 31 medium density corridors would have PHPDT between 10,000 and 20,000.
- Free flow speeds of private transport modes are 1.75 to 2.0 times that using public transport, and there is a clear need to remedy this.
- The BMTC would continue to be the key public transport facility, and will continue to carry over 40% of the trips, while the Metro-Rail and CRS together will cater to about 20% of the trips in the horizon year. Private modes (car and 2-wheeler) would account for about 35% trips.

1.2.2. Comprehensive Traffic and Transportation Plan for Bangalore

The study for preparing the Comprehensive Traffic and Transportation Plan (CTTP) was awarded to RITES Ltd. by UDD through KUIDFC. The primary reason for undertaking the study was to assess the pattern and growth traffic in Bangalore city and draw up a comprehensive plan to meet the needs of the future.

The CTTP was submitted by RITES in October, 2007. Key findings and recommendations from the CTTP has been given below;

The primary objective for the preparation of a Comprehensive Traffic & Transportation Plan (CTTP) for the city of Bangalore was shed light on the key issues, problems faced by the citizens in the domain of intra-city transportation. The CTTP makes a comprehensive study of transport infrastructure in the city, and projections are made based on city and economic growth.

Development Trend

There have been significant changes that have taken place with respect to traffic and transportation scenario in Bangalore. The general trend depicts a movement of traffic away from modes of public transport in favour of two wheelers, four wheelers and intermediate means of transport (IPT).

A major cause for such a shift is the rising per capita income levels which Bangalore city has witnessed over the past decade. However, there are several other reasons which have contributed to this switchover to means of private transport. These include:

- Longer access distance, low frequency and high travel time combined with longer waiting times have caused lower patronage of bus transport
- Majority of customers are reluctant to walk more than a quarter kilometre to the bus stop or from bus stop to destination
- Lack of availability of rapid transport modes for the public has caused the move towards use of personal 2 wheelers, which are mostly pursued for point-to-point commuting and flexibility

- Patronage of intermediate public transport (IPT) owing to fact that there is inadequate integration between various modes. As such the commuters do not have the opportunity for seamlessly switching over from one mode of public transport to another
- Of late 2 wheeler users have been switching over to cars due to rising income levels. Share of public transport has declined to some extent although in terms of absolute numbers it has increased.

Problems and Issues

The CTTP prepared by RITES has uncovered several problems which could be pernicious to overall development of Bangalore city. These issues are as follows.

- Road network capacity is grossly inadequate. Most of the major roads are with four lanes or less with small scope of widening. This indicates the need for judicious use of available road space.
- The junction spacing are with small length on many roads. Many junctions in core are with 5 legs. This makes traffic circulation difficult. There is need to optimise the available capacity by adopting transport system management measures and by making use of intelligent transportation system.
- Traffic composition on roads indicates very high share of 2 wheelers. The share of cars is also growing. This indicates inadequate public transport system.
- V/C ratios on most of the roads are more than 1. Overall average traffic speed is about 13.5 kmph in peak hour. This not only indicates the need of widening of the roads but the also the need to plan high capacity mass transport systems on many corridors.
- Outer cordon surveys indicate high through traffic to the city. This point to the need for road bypasses not only for BMA but also for BMRDA area. High goods traffic also indicates the need for truck terminals at the periphery of the city.
- Household surveys indicate high household incomes. So the vehicle ownership levels are increasing. In the absence of adequate and comfortable public transport system, people are using their personal modes creating congestion problems but also environmental pollution.
- The household surveys indicate high share of work trips. This segment of travel demand needs to be mostly satisfied by public transport system. considering the large employment centres being planned in the BMA, the public/mass transport system needs to be upgraded substantially.
- Modal split in favour of public transport is about 46%. The trends show a decline in this share over the last two decades. This is further expected to fall unless adequate and quality public transport system is provided to the people of Bangalore. Share of two wheelers and cars in travel demand is disturbingly high. This trend needs to be checked.
- There is high pedestrian traffic in core area and some other areas in Bangalore. Footpath facilities are generally not adequate and their condition is deteriorating. Therefore up-gradation of these facilities is important.
- Parking is assuming critical dimensions in Bangalore. Parking facilities need to be augmented substantially. In the long run, city-wide public transport system needs to provide not only to reduce congestion on roads but also to reduce parking demand.

- Share of cycle traffic has declined over the years. This mode of transport needs to be promoted by providing cycle tracks along the roads.
- Area of the BMA has been increased as per Revised Master Plan (2015). This plan has provided for densification of existing areas, mutation corridors, hi-tech areas etc. in various parts of the city. This is likely to have a major impact on the traffic demand. The transport network including mass transport system needs to be planned taking the proposed development in to consideration.
- Large areas are being planned by BMRDA in the BMR. This is likely to increase interaction between Bangalore and suburban towns. There will be need to provide commuter rail services to these towns from Bangalore.
- Opinion surveys indicate most of respondents will prefer to Metro system. They may also be willing to pay slightly extra for the improved services.

Recommendation on Land Use Integration

A team consisting of urban planners and transportation planners preferably led by an urban planner with a holistic understanding of urban transport issues should put together an integrated land use – transport strategy for Bangalore. This strategy should incorporate modern concepts in land use planning, urban transportation, planning road network and street design in a complementary manner.

No such body exists as of today which has a statutory backing as such. Therefore for this strategy to be implemented, it should be mandated by an overarching body which can sway all the stakeholders concerned. Therefore a possibility of an Integrated Land and Transport Management Authority for Bangalore may be considered to mandate the preparation and operationalization of this strategy.

Other steps which can be taken to promote land use integration are as follows:

- Revised Land Use Plan and Development Controls-The land use and density component of the above strategy can be implemented via revisions in the master plan. High traffic generating activities and high density (high FSI) zones should be realigned around mass transport nodes along major transportation corridors. Such a strategy may require land appropriation for implementation of developmental projects such as improvement of road network, street design and supporting infrastructure.

In new growth areas, a mechanism for micro level planning (such as Town Planning Schemes in Gujarat) will need to be introduced to ensure that all new development is adequately served by primary, tertiary and secondary road network with provision for public transport facilities. These would also essentially have to be translated into land management process.

- Road Network & Street Design: In many places, particularly in the already developed areas, these modifications can be realised only through carefully structured redevelopment projects as the missing links in the primary road network will have to go through existing development.
- Pockets of economic activities like Hi-Tech & Electronic City having very large employment potential are planned. Of course a large part of the human resources to be engaged in these activities is expected to come from with in the BMA, but a significant number is also expected from BMR and even from towns like Hosur, Tumkur, etc. This will require special High capacity mass transport system

connecting these work centres with the living areas within Bangalore as well as meeting the needs of the long distance / suburban commuters, especially along the corridors leading to these centres.

- The present radial network is bringing the entire load of traffic to the ORR & core areas causing congestion. The trend needs to be checked through the use of:
  - Dispersal of traffic at the periphery by completing the PRR, & the other Ring Roads planned at the Regional level like the Intermediate Ring Road & Satellite Town Ring Road.
  - Creating Transport Hubs for goods traffic and the junctions of PRR & selected Radials
  - Banning the entry of Heavy vehicles at the Transport hubs & allowing only LCV to transport the goods from the Transport Hubs to the inner city areas and that too during the non-peak hours (i.e. No Entry between 9 am to 9 pm)

- The core areas inside the core ring road are proposed to be fully traversed by the Metro. Therefore the vehicular movement inside this area should be minimized & if possible completely avoided during working hours for 9am to 9pm through:
  - Complete pedestrianisation of narrow commercial streets.
  - Providing adequate parking along the CRR and running dedicated BRT on the lower level of the CRR and restricting all private vehicles on the elevated portion thereof.
  - Smooth & free flow of emergency vehicles like Ambulance, Fire Engines etc in side the core area.
  - The goods feeder services like LCV be allowed to come in only doing 9 PM to 9 AM to unload materials etc.
  - Attempts may be made to decentralize certain trades requiring bulk carriage like heavy machinery, hardware, building material etc in organized markets beyond the ORR and preferably near the PRR.
  - On a few of the wide roads inside the core area the feasibility of running BRT etc. may be examined.

Based on the above observations it is clear that the already planned network will be insufficient to cope up with the future requirements especially after the target year of 2015. As such in order to prepare the Comprehensive Transport Plan the following policy measures are required to be taken based on which the CTTP will be finalized.

- Extension of mass transport system to provide wide coverage and interchange facilities with other modes of transport
- Provide substantially large network of medium level mass transport system such as BRT to cover the areas beyond the Metro network and on over loaded corridors
- Land use adjustments and densification of corridors along mass transport corridors where possible
- Extension of commuter rail system upto the BMRDA's New Townships & beyond upto Tumkur, Hosur etc. to act as sub-urban services
- Introducing BRT and wherever possible dedicated bus lanes
- Rationalisation of Local Bus system and its augmentation
- Improvement in traffic management through TSM measures
- Special facilities for pedestrians within the entire network especially in the core areas; pedestrianisation of selected shopping streets in side the core area going to

be served by underground sections of Metro. Provision of pedestrian sky walks, under passes, footpaths and other road furniture along the roads where necessary

- Diverting through traffic on Peripheral Ring Road. Providing transport hubs at the junctions of Peripheral Ring Road with important radials such as; the National Highways and other heavily loaded roads
- Improving Primary, Arterial and other important roads by providing grade separation, junction improvements, adding missing links, widening and other road side facilities wherever necessary. The Arterial roads outside the PRR need to be improved up to the New BMRDA townships in order to take the increased load of commuters. Transport integration of various modes

Future Demand Analysis and System Selection

The evaluation of various scenarios[15] reveals that the public/mass transport system has to be extensive with high capacity mass transport systems on major corridors in order to achieve a modal split of more than 70% in favour of public/mass transport.

Provision of citywide extensive public/mass transport is the only way to solve the mobility problem of Bangalore. The mass transit system should be aimed at catering to the travel demand of 2025 and beyond. The hiatus in the demand can be met by augmentation of road system in the form of new roads, road widening, provision of grade separators, pedestrian facilities, traffic management measures etc.

Choice of System Selection

The choice of system selection could be based on the following criteria:

- Choice of mode will depend mainly on demand level on a corridor, available road right-of-way (ROW) and the capacity of the mode. Other considerations are the land-use along the corridor, the location of building lines, and the potential for increasing the ROW. Cost of the same mode of transport can vary at different locations depending on engineering constraints. It is therefore important that the final choice of mode is based on techno-economic considerations.
- In choosing a mode for a corridor, first priority should be given to at-grade services and BRT. It offers convenience to commuters particularly the short distance users. Commuters do not have to walk up and down to use the services. The construction cost is low. It offers the best financial sustainability. If road ROW is inadequate and it cannot be widened, and/or the route is congested, an elevated mode needs to be proposed.

Suggested Mass Transport Systems for Bangalore

On the basis of expected traffic demand for 2025 on the proposed mass transport corridors, available RoW on the corridors, capacity of various mass transport modes and already available mass transport system along a corridor, the mass transport systems on various corridors have been suggested in Table 68

[15] Carried out in detail in the CTTP prepared by RITES.

Table 68: Mass transportation systems - CTTP

No.	Corridor	Expected Maximum Traffic (PHPDT)	Available RoW (m)	System Recommended
1	Mysore Road to Baiyyappanahalli	75,000		Metro
2	Peenya to RV Road	75,000		Metro
3	Baiyyappanahalli to Benniganahalli	25,000	25	Metro
4	RV Terminal to PRR	25,000	25	Metro
5	Yelahanka Road to junction of Hi-tech corridor and Hosur Road via Nagavara, Electronic City	45,000	30	Metro
6	Indiranagar to Whitefield Road	35,000	25	Metro
7	Devenahalli Airport to MG Road via Bellary Road (New Airport)	20,000	24	Metro
8	Hebbal to Bannerghatta Road along Western portion of ORR	20,000	20	Monorail / LRT
9	PRR to Toll Gate along Magadi Road	12,000	22	Monorail / LRT
10	Kattriguppe Road / Ring Road Junction to National College	14,000	18	Monorail / LRT
11	Hosur Road to PRR along Bannerghatta Road	18,000	22	Monorail / LRT
12	Hebbal to Bannerghatta Road along Eastern portion of ORR	15,000	40	BRT
13	Benniganahalli (ORR) to PRR along Old Madras road	10,000	30	BRT
14	From ORR to Hosur Road along Hi-tech corridor	12,000	60	BRT
15	Hosur Road to Tumkur Road along PRR	8,000	100	BRT
16	Tumkur Road to Hosur Road along eastern side of PRR	6,000	100	BRT
17	Along Core Ring Road	12,000	25	BRT
18	Vidyaranyapura to Nagavarapaya	12,000	25	BRT
19	Kengeri Satellite Town to JP Nagar along Uttarahalli Road, Kodipura	12,000	30	BRT
20	Banashankari 3rd Stage to Banashankari 4th Stage Extension along Ittamadu	9,000	35	BRT

No.	Corridor	Expected Maximum Traffic (PHPDT)	Available RoW (m)	System Recommended
	Road, Turahalli, Thalaghattapura			
21	Domlur Extension to Koramangala along inner Ring Road	10,000	25	BRT
22	PRR to Maruti Nagar (up to Hi-tech Corridor) along Sarjapur Road	15,000	25	BRT
23	Peenya to PRR along Tumkur Road	12,000	30	BRT
24	Old Madras Road near Indranagar to ORR near Banaswadi along Baiyyappanahalli Road – Banaswadi Road	10,000	22	BRT
25	Commuter Rail Corridors (10 Corridors)	10,000	-	Commuter Rail System

Source: CTTP

Considering the various proposed schemes and unit rates, cost estimates of these schemes have been worked out at 2007 prices and are given for proposed mass Transport Corridors, City Bus System, Road Infrastructure, Grade Separators, Pedestrian Facilities, Parking Facilities, Integrated Freight Complexes and Transport System Management Measures. The entire transport development plan is not required to be implemented in one go.

Considering the existing problems, expected traffic demand levels and schemes already under implementation/ active consideration of the Government, phasing of implementation of various projects has been suggested in three phases (2007- 12, 2013-18 and 2019-24).

Cost estimates for each project to be implemented in the three phases have also been given in the tables.

Table 69: Cost estimates

No.	Transportation Projects	Implementing Agency	Length (km)	Total Cost (Rs. Cr)
1	Commuter Rail System	Railways / GoK / BMRDA	204	3060
2	BRT System	BMTC / BBMP / BDA	291.5	3498
3	City Bus System & IMTCs	BMTC / KSRTC	--	5721
4	New Roads	BBMP / BDA	209.17	5192
5	Outer Ring Road Re-alignment	BBMP	16.6	311
6	Road Improvements (inside ORR)	BBMP, BDA/ NHAI	--	141.73
7	Road Improvements & Feeder Roads	BBMP, BDA	502.75	433.31
8	Grade Separators-Roads	BBMP / NHAI	--	713

No.	Transportation Projects	Implementing Agency	Length (km)	Total Cost (Rs. Cr)
		/BDA		
9	Road over Bridges / Road under Bridges	BBMP	--	990
10	Skywalks & Subways	BBMP	68	281
11	Parking Facilities	BBMP	--	380
12	Integrated Freight Complexes	BDA	--	270
13	Transport System Management	BBMP / Traffic Police	--	500

Source: CTTP

2. Strategy for Improved Service Delivery

Transport interventions can broadly be classified as under:

- Roads and Road Related Infrastructure
- Bus based Mass Transit Systems
- Other Mass Transit Systems

For Bangalore, it is proposed to configure the urban transport systems on the basis of the recently formalized National Transport Policy, the key elements of which are highlighted in the subsequent section.

2.1. National Urban Transport Policy

The National Urban Transport Policy, seeks to encourage integrated land use and transport planning in cities and focus on greater use of public transport and non-motorized modes by offering central financial assistance. The policy incorporates urban transportation as an important parameter at the urban planning stage. It emphasizes on integrated land use, transport planning to minimize travel distance, access to livelihood, education and other social needs, especially for the marginal segments of the urban population. The objective of this policy is to ensure safe, affordable, quick, comfortable, reliable, and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within our cities.

Keeping in line with the proposed National Urban Transport Policy, Bangalore City shall strive to provide a good public transport system that allows seamless travel between one mode and another as between systems managed by different operators. Besides an integrated public transport system, the following initiatives would be helpful to ensure safe, affordable, quick, comfortable, reliable, and sustainable access for the growing number of city residents to jobs, education, recreation and other such needs within the city. It is desired to make the Bangalore transport system "NUTP Compliant."

2.2. Priority to Public Transport

Not only does public transport occupy less road space per passenger, but also aggregate operating costs, including environmental impacts, are lower. Public transport also serves the needs of the urban poor, who can be subsidized if the direct fare for the mode is beyond their affordability. To achieve this objective, public transport and mass transport have to be encouraged, and private modes discouraged. This can be achieved by:

- Increasing public transport modes (coverage and quality):
  - Expansion and improvement of bus systems
  - Introduction of new modes such as Metro-Rail, LRT/Monorail systems
- Discouraging private modes:
  - Higher costs: initial and operations, including parking
  - Congestion pricing
  - Lower right of way

2.3. Priority to Non-motorized Transport

Non-motorized modes of transport such as bicycles are gradually losing their importance as they are exposed to a greater risk of accidents as they share a common right of way with motorized vehicles. However, non-motorized modes are environmentally friendly and have to be given their due share in the transport system of the city.

Safety concerns of cyclists and pedestrians have to be addressed by encouraging the construction of segregated rights of way for bicycles and pedestrians. Apart from improving safety, the segregation of vehicles moving at different speeds would help improve traffic flow, increase the average speed of traffic, and reduce emissions resulting from sub-optimal speeds.

2.4. Use of Cleaner Technologies

Cleaner technologies like CNG, Electric Trolley Buses, Electric Vehicles need to be encouraged so that the problem of vehicular pollution can be more effectively dealt with. Besides, renewable sources need to be tapped as a measure of sustainable development and in recognition of India's energy security concerns.

2.5. Need for Public Awareness & Cooperation

Urban transport polices cannot succeed without the fullest cooperation of all the city residents. It is therefore, necessary to launch intensive awareness campaigns that educate people on the ill effects of the growing transport problems in urban areas – especially on their health and well-being. Encouraging use of public transport (after creating adequate infrastructure), use of vehicle pooling, conversion of some modes to CNG, etc., are some of the measures to mitigate the associated problems.

2.6. The "Big Picture" of Interventions

While the strategy outlined in the previous section sets the direction forward, it is important to develop some "vision" of what the major interventions in the city's transport infrastructure are going to be. shows the general concept of the proposal – ring roads, metro, monorail/LRT, and the grid routes of BMTC.

2.6.1. Ring Roads

The City would be looking at significantly altering the radial, "through the core" traffic pattern by improving/developing key "rings," in the BMP, BDA, and BMRDA

jurisdictions. A map of the ring road system (existing and proposed) is given in Figure 18:

- Core Ring Road (CRR): Of about 30 km length, in the BMP periphery, this would form the primary "bypass" to the inner core BMP area. This road may be constructed as an elevated corridor, to reduce land acquisition.
- Outer Ring Road (ORR): Is at a radius of 7 to 10 km from the city center. The project was successfully completed in just 8 months at a total cost of Rs.182 Crore. The outer ring road covers a total length of 62 km and connects all major roads and highways in and around Bangalore. However, by efflux of time, the ORR has almost become a city road, with local traffic and many signaled intersections, and development all around.
- Peripheral Ring Road (PRR): BDA is in the process of acquiring land for implementing a peripheral ring road. The total length of the peripheral ring road proposed to be constructed is 114 km around Bangalore at a radial distance of 2.80 to 11.50 km from the existing outer ring road.
- Intermediate Ring Road (IRR): BMRDA is planning this ring to connect Nelamangala, Bidadi, Harohalli, Tattekere, Hosakote, Aradeshanahalli, and Mylenahalli, which would have a length of 188 km. The estimated cost of the project is Rs. 750 Crore. The roads would be constructed as per IRC Standards and would have eight lanes including two service roads.
- Satellite Township Ring Road (STRR): Beyond the IRR, BMRDA is planning a set of satellite townships, which would be connected by the STRR. Surveys for the IRR and STRR are in progress.

2.6.2. Bus-based Mass Transport

BMTC shall continue to provide a vital and leading role in public transport, in any scenario of the City's development. To meet this challenge, BMTC has plans for over 20 initiatives, including, inter-alia:

- Increasing fleet capacity
- Bringing in newer and higher quality bus systems, to cater to all sections
- Introducing the grid-route concept to provide one-change bus services that avoid the city centers where possible
- Setting in place automation and modernization of systems
- Implementing high-capacity bus systems in corridors such as the Outer Ring Road, where widths allow dedicated bus lanes.

2.6.3. Rail-based Systems

Bangalore's road network configuration has constraints because of the fact that most roads do not have adequate widths. To overcome such a limitation, and to enable rapid intra-city transport, the Government has already taken up two initiatives, and is seriously considering the third. The initiatives comprise:

- The Metro Railway, being implemented by the BMRC, details of which are provided in subsequent sections
- The Commuter Rail System, which uses existing at-grade railway system to serve intra-city and suburban needs. The exact configuration shall be finalized as part of the CTTP

- The third proposal (under consideration) is the option of Monorail[16] or Light Rail Transit as feeder routes to the Metro Rail. The exact configuration shall be finalized as part of the CTTP.

2.6.4. Elevated Corridors

To reduce traffic on key at-grade corridors, the city is planning to put in place a number of elevated corridors. One of these has already been bid out on a PPP basis, while others are in the planning stage. The corridors comprise:

- Electronic City – Silk Board junction (already bid under PPP)
- Madivala – Shoolay Circle (connecting Core Ring Road to Silk Board)
- Mosque road – Bagalur Road – Hennur Road (connecting CRR to ORR)
- Yeshwantpur – Peenya (Connecting CRR to ORR)
- KR Puram – Murphy Road – Ulsoor Lake (Connecting CRR to ORR)

2.6.5. Inter-modal Interchanges

The proper integration of modes – bus, MRTS, and railway – is a vital need for the future. The city is planning two such inter-modal interchanges:

1. The first such interchange is already under bid – the Kempe Gowda bus terminus at Subhashnagar is proposed to be converted into an interchange that accommodates the BMTC, KSRTC, BMRC, and a "city center" complex
2. The second interchange is proposed at Byappanahalli, which will have the BMTC, KSRTC, Railways, BMRC, and the Airport Rail Link.

2.6.6. Parking

Creation of parking facilities–on street and off street–is a clear need. Levy of a parking fee that truly represents the value of the land occupied shall be considered as a means to make the use of public transport more attractive. A graded scale of parking fee, that recovers the economic cost of the land used in parking, shall be adopted.

2.6.7. Amenities for Freight Traffic

In addition to bypasses, facilities for the parking of freight vehicles, outside city limits, such as truck terminals are being proposed through Public-Private Partnerships.

2.6.8. Other Interventions

Apart from the above project-type key interventions, many initiatives would be taken by the City Government and its citizens. These initiatives would make a significant impact on the quality of life, by way of sustainable urban transport systems, and would include:

- Pedestrian walkways/skywalks
- Cycle paths and cycle facilities
- CNG based vehicular systems

[16] Monorail is not strictly rail-based, but has the characteristics of a fixed-guide following train system.

- Reduction of emissions and introducing eco-audit
- Technology Up-gradation in public transport systems to increase load factors and speeds
- Measures to reduce the level of accidents – target 50% reduction
- Reduce two-wheelers and cars population growth by 50%
- Increase modal share of BMTC from 56%, or 35 lakh passengers carried per day to 50 lakhs
- Enhance average speed of buses from 17.5 km per hour to 22.5 km/hour
- Clean Development Mechanism.

While it is difficult to specify and cost these interventions with any exactitude at the level of the CDP, the concerned agencies would detail the specific projects and prepare the DPRs.

2.6.9. Specific Targets - CM's 10 Point Program

To give a clear direction and target for improving the urban transportation scenario, the Chief Minister has charted a 10-point program covering various aspects, including citizen interface comprising the following:

1. Road Engineering

Drain Improvement-Removal and diversion of surface water from the roadway and adjoining land	30 Locations
Junction Redesign-Widening of the mouth of the intersections, etc.	At 50 junctions to facilitate faster traffic clearance
Asphalting-to provide smooth surface for driving	200 km
Medians-longitudinal cement blocks separating dual carriageways to separate the opposing streams of traffic	To provide 0.2m ready to fix concrete median blocks on 10 km of road, at junctions, to facilitate smooth traffic
Road Marking-made of lines, patterns, words, symbols of reflectors on the pavement, kerb, sides of islands, etc.	To provide for clear delineation and guidance for road users to facilitate compliance and smoother traffic on 300 km of arterial roads
Right of Way clearance-clearing of obstructing trees, utilities such as electric poles, telephone poles, transformers etc.	100 km of arterial roads to be cleared of all obstructions for safe and smooth traffic movement

2. Public Transport Infrastructure

Passenger Info System-service users are provided information about the arrival time of the buses	5 major routes
Construction of Bus Bays-specially designed or designated locations on the road at which a bus stops to allow passengers to board and alight without the buses blocking the stream of traffic on the carriage way	50 nos. so that buses do not block the main traffic
Relocation of Auto Stands-specific place for auto parking such that they do not obstruct the movement of other vehicles	50 nos.
Relocation of Bus Stands-relocation of	100 nos.

bus stops or stands which are obstructing the free flow of traffic	
Bus Rapid Transit System-bus systems such as dedicated bus ways that have their own rights-of-way to bus services that utilize HOV lanes and dedicated expressway lanes to limited stop buses on pre-existing routes	Outer Ring Road based on the feasibility study report
Prepaid Auto stands-for facilitating the travel by auto passengers	50 nos.

3. Parking Management

Park and Ride-providing parking facilities at bus depots at periphery and induce the motorists to park there and travel to the center of the city by public transportation	10 Nos.
Restriction of On-Street Parking-Identifying roads/road stretches where on-street parking is to be prohibited	50 Locations
Mini Parking lots/At-grade parking-Setting up of parking lots on vacant lands owned by various government agencies/BMP etc.	25 Nos.

4. Pedestrian Facilities

Restoration of footpaths-Improvement of old/worn out footpaths and restoration of footpaths where they do not exist and removal and relocating utilities that are present on footpath to provide right of way to pedestrians	100 Km.
Barricading of footpaths-Footpaths to be barricaded with openings only at strategic locations to regulate pedestrian movement, to improve traffic safety and also pedestrian safety	10,000 m
Raised Crosswalks/Pelican Signals-the pavement is raised by a smooth gradient such that the vehicles have to slow down when they encounter them and in the meanwhile the pedestrians can safely cross the road, particularly with the help of pelican signals	50 Locations
Pedestrian Walkovers-to be provided at high pedestrian activity links and zones	10 Locations

5. Traffic Control and Regulation

Tubular Cones-for ensuring Lane Discipline	10,000 Nos.
Deployment of additional manpower-for better regulation	500 Home Guards
Vehicle Actuated (VA) and synchronized traffic system-to reduce congestion through efficient movement of vehicles	VA for all existing RTS (160) Synchronization of 5 corridors
Traffic Signage-for proper guidance of vehicular traffic	300 Km of arterial roads
Traffic Control center, Monitoring Cameras and Variable Message Systems (VMS)-Application of Intelligent Transport Systems (ITS)	Control center at P.U.B 50 Cameras 50 VMS

6. Traffic Management

Traffic Management Plans-controlling the traffic, imposing regulatory measures and enforcing traffic management techniques like one ways etc.	Central area review and Improvement
Banning of Right and U-turns	30 Locations
Banning of entry of certain types of vehicles	50 Locations
Local Area Traffic Management Plans-Formulating traffic management plans for residential or local areas with scientific approach for the safety of the residents, particularly senior citizens and children	6 areas: Rajajinagar, Jayanagar, Indiranagar, Koramangala, BTM Layout, RT Nagar
Dedicated Auto Lanes-To restrict movement of autos to left lane so that other vehicles can ply smoothly	20 Roads

7. Traffic Enforcement

Automated Enforcement-Issue of computerized challans to offenders for better enforcement and deterrence	Use of 200 simputers for enforcement Issue 5,000 challans per day
Suspension/revocation of DLs/Permits	For repeat offenders

8. Traffic Education & Publicity

Education Campaigns-to educate the road users for the various precautionary measures to use the roadway facilities with safety and to follow road rules	Various interventions including hoardings, media, meetings, etc.

9. Public Interface

Traffic Help Desk-setting up of a modern help line which is a citizens' grievance redressal forum	To function on the lines of a professional customer relationship management center
Local Area Committees/Public Suggestions-To be set up to voice the problems faced in the respective residential/local areas and to find local solutions with citizen participation	In the 35 traffic police station areas
Public Private Partnership-Projects to improve traffic conditions to be taken up through Public Private Partnership	Involvement of the private sector as partners in traffic improvement

10. Road Safety

Accident Analysis and Reduction Program-systematic identification, analysis and treatment of hazardous locations on roads commonly termed as black spots	100 most accident prone locations to be treated
School Area Safety-to improve Road Safety of Children around schools.	50 Schools

Indicative service delivery targets, specific to roads and road infrastructure, are given in Table 70.

Table 70: Standards for Road Infrastructure

Parameter	Current Status	Short Term	Medium Term	Long Term
Length of good quality roads	80% tarred	All	All	All
Pavements	Only on main roads	All	All	All
Absence of potholes, depressions and waves		70% of the roads	70% of the roads	90% of the roads
Signage and markings on main roads		All	All	All

Source: CDP Bangalore 2006

3. Project Identification

Projects envisaged to be taken up are based on the strategy outlined in the previous section, and are delineated in the following sections under various categories.

3.1. Ring Roads

The projects envisaged comprise construction, operation, and maintenance of the following:

- Elevated Core Ring Road: It is proposed to develop an elevated Core Ring Road along with key axial roads, with the objective of decongesting the city. The proposed length of the elevated core ring road is 29.5 km, with an equivalent length proposed for axial roads, which would be connecting the elevated core ring road to different parts of the City. The project is proposed to be developed in 2007-2012 and the costs of construction of the elevated core ring road and the axial roads have been assumed at Rs. 50 Crores per km and Rs. 10 Crores per km respectively. indicates the alignment of the CRR
- Peripheral Ring Road: It is proposed to construct a Peripheral Ring Road, for a length of 114 km around Bangalore, at a radial distance of 2.80 to 11.50 km from the existing ORR. The proposed road would be a 6-lane bi-directional divided carriageway. The road will be on par with IRC standards with 1.5-meter central median on a 100 meters right-of-way. The project is proposed to be developed in two equal phases spanning over the implementation periods of 2007-2012 and 2013-2017. The cost of construction is assumed at Rs.10 Crore per km of road length.

3.2. Improvements to Key Roads

Access Controlled Highway along NH4

The NH-4 stretch from the city limits of Bangalore (near km 10) to the Nelamangala (near km 29.5) is an important section of the National Highway on the Golden Quadrilateral. The traffic volume in the entire stretch (of Nelamangala section) of NH-4 is very high, thereby creating congestion on the existing 4- lane divided highway.

NHAI proposes to construct a 19.5 km long, access controlled highway, out of this length, about 4.35 km length is 4-lane elevated highway and 15 km length is access controlled stretch. NHAI also proposes to widen the existing 4-lane section (from 14.5 to 29.5 km) to 6-lanes.

It is proposed to toll the traffic using the highway. The brief scope of work is as under:

- Elevated highway approx. 4.35 km long
- Ground level improvement of existing highway
- Toll collection system including six toll plazas, related structures, toll collection hardware and software
- Six vehicular underpasses and one flyover
- Illumination system for elevated highway, interchange, highway at ground level, for the underpasses and toll plazas
- Service roads improvement including construction of missing links

The construction work for the project has commenced in November, 2007 and is scheduled to be completed in 24 months.

Other Improvement Projects

Other than the ring roads and associated axial roads being improved, it is proposed to improve other key roads in the City:

- Arterial Roads: These roads include the roads connecting important roads like National Highways and State Highways, those leading to well developed commercial centers and important entry and exit points to and from the city, like the Airport, the Railway Station etc. Arterial Roads also include the roads that run along the periphery of the city.
- Sub-arterial Roads: These roads connect the arterial roads.
- Link Roads: These roads include local roads that take off from the residential layouts and join the sub-arterial roads.

It is proposed to undertake rehabilitation of a part of the city roads in 2007-12. The normative standards assumed for rehabilitation are Rs. 80 lakh/km, Rs. 60 lakh/km and Rs.40 lakh/km of arterial roads, sub-arterial roads and link/collector roads, respectively. The lengths of the roads proposed to be rehabilitated are 5% of the total road length under each of the three categories.

3.3. Railway over Bridges (ROB) and Railway under Bridges (RUB)

ROB and RUB are proposed to be constructed at key locations in the City. The projects are proposed to improve the connectivity and the indicative locations are listed below:

- Nehru Circle Seshadripuram RUB
- Cantonment Station RUB
- Frazer Town RUB
- ROB at ITC factory level crossing
- ROB at Lingarajapuram level crossing
- ROB at crossing of outer ring road and Chennai railway line.

These ROB and RUB are proposed to be constructed at an estimated cost of Rs.160 Crores.

3.4. Bus-based Transport Systems

3.4.1. High-capacity Buses on ORR

A proposal to develop a high-capacity bus system on the Outer Ring Road is under development. The bus system would have a dedicated corridor in contiguous stretches where width is available, and operate new technology buses designed for urban environment. The fare would be affordable and worked out on the basis of route zones, with higher fare for points more distant from the terminal points. Both the BMTC and commuters will benefit, while the City as a whole will have a better image with reduced congestion, lesser air pollution, and a better public transport system.

The project involves infrastructure such as bus lanes, road improvement, upgrading bus terminals, traffic signals, and bus stops. The buses shall have two-way radio communication facility. The estimated cost of the first phase of the High-capacity Bus System is Rs.475 Crore.

3.4.2. The Grid-route Concept

BMTC at present operates services on 1,726 routes by utilizing 4,185 buses. 25 high-density trunk corridors have been identified for increased frequency of services, and providing direction-oriented services in place of the present destination oriented services. These 25 routes are more or less straight-line routes moving from South to North, East to West, and also diagonally from South-East to North-West and South-West to North-East. Two circular routes one in the central CBD area and the other at the outer ring road area are planned. BMTC has started operation of buses on these 25 grid routes.

3.4.3. Other Initiatives of BMTC

Augmentation of Schedules and Fleet: BMTC has planned to augment 2,407 new schedules taking the schedule strength to 6,234 by March 2010. It is proposed to add 2,528 new vehicles exclusively for augmentation by inducting new type of buses. It is planned to replace 1,415 old buses to maintain service standards. These buses will be used for providing specific services as proposed below:

- 1000 peak hour split services leads to peak hour decongestion (BMTC)
- 1000 state of the art buses for ladies, children and senior citizens and others in BRTS and grid routes (GOK and BMTC)
- 1020 layout rounds with battery operated mini buses (BMTC)
- Euro-III buses (BMTC)
- Big 10 buses under ABiDe

Strengthening of Depots-BMTC shall strengthen its workshops for preventive maintenance.

New Depots-BMTC proposes to add 24 new depots taking the strength to 51.

New Bus Stations-Currently four major bus stations and 27 sub-nodal bus stations are operating to which BMTC plans to add another 23 bus stations.

Commuter's Amenity Centre-This is necessary for the benefit of commuters. The corporation proposes to construct 45 Commuters' Amenity Centres in Bangalore city by utilising the present depot land area. All facilities required for commuters such as banking facilities, various reservation counters, pass issue counters, medical assistance etc., will be made available. Parking facilities can also be created at multi-floor spaces, which facilitate and promote park and ride concept BMTC proposes to construct 45 such centers by utilizing the present depot area.

Bus Shelters on the ORR-BMTC has proposed to construct 288 bus shelters along the Outer Ring Road at every half kilometer apart on either side of the road.
Skywalks on ORR: BMTC proposes to build Skywalks (pedestrian overpasses) at about 144 places.

Establishment of Training Centers-BMTC proposes to procure 50 acres of land, for including all high technology activities in the building of a training institute. BMTC is proposing to establish well-designed employee training activities, for developing the skill base.

Rain Water Harvesting at Depots-BMTC proposes to establish 25 rainwater-harvesting plants at depots and workshops.

Works Related to Environmental Concerns-Environmental aspects include protecting the environment by reducing air pollution, water pollution, and noise pollution. For this, BMTC is proposing environmental activities at 45 locations. BMTC is also proposing to introduce Depot-wise emission checking (BMTC), and obtain ISO 9001 and 14001 certification.

Solar Lighting Systems-BMTC proposes to install solar lighting systems at all Depots and Bus Stations, thereby reducing electricity consumption in its facilities.
On-Line GPS System: BMTC has gained experience in the usage of GPS technology for monitoring and tracking of vehicles and has now planned to implement on-line GPS technology on all vehicles on a BOOT format.

Online PIS and IVRS system-In order to provide commuter friendly information, BMTC proposes to transfer the GPS generated positional details of the buses to commuters in the form of Passenger Information System (PIS) and Interactive Voice Response System (IVRS).

Electronic Destination Boards-BMTC proposes to introduce electronic display systems with three multilingual destination boards, at the front, back, and the side of the bus.

Electronic Ticketing System-A high-tech ticketing system using smart cards or electronic ticketing system (automatic fare collection system) is proposed to be provided.

Computerization of Depots-All 24 depots have been computerized and BMTC intends to computerize other activities like administration, traffic, etc.

Computerization of Corporate Office-It is planned to implement projects like file tracking system, local email, and data server, etc.

Surveillance System-For improving security, it is proposed to install Closed Circuit TV (CCTV) at depots and bus stations, and establishment of a Central Control Room.

3.4.4. Club-pyramid Project

There are proposals to use the right-of-ways adjacent to large storm-water drain systems, and the air-space over such drains, to create elevated new bus corridors that can benefit the commuting public, including the urban poor, in an affordable and non-congesting manner. These elevated bus lanes would open new corridors, and thereby bypass the constraints of road widths on existing corridors. The costing and feasibility for this project shall be done after the CTTS for Bangalore is completed.

3.4.5. Inter-modal Interchanges

Two inter-modal interchanges are planned to be developed on a PPP basis. The first such interchange is already under bid – the Kempe Gowda bus terminus at Subhashnagar is proposed to be converted into an interchange that accommodates the BMTC, KSRTC, BMRC, and a "city center" complex. The second interchange is proposed at Byappanahalli, which will have the BMTC, KSRTC, Railways, BMRC, and the Airport Rail Link.

B-TRAC 2010

Bangalore City Police have envisaged the Bangalore Traffic Improvement Program (B-TRAC 2010), with an estimated cost of about Rs. 350 Crore, and for the financial year 2006-07, the Government has set apart Rs. 44 Crore. The objectives of B-TRAC 2010 would be two-fold:

- Operational Objectives:
  - Reduce traffic congestion by 30% in the central area of Bangalore City
  - Reduce accidents by 30% in the city of Bangalore
  - Achieve significant reduction in pollution
  - Achieve substantial compliance of Traffic Laws and Rules
  - Set up an effective Trauma Care System
- Institutional Objectives:
  - Coordinated traffic management by developing mechanisms for the same, like institutionalizing Traffic Task Force, Road Safety Committee, Traffic Action Committee, etc
  - Robust revenue model (traffic funds to pay for traffic management infrastructure and maintenance)
- Legal and Institutional reforms
- Capacity Building (modernizing and upgrading of Traffic Training Institute etc.)
- Strengthening of the traffic police force by augmenting officers and staff, provision of civil and communication infrastructure.

Benefits would include:

- Traffic congestion will be reduced by 30% in the Central Area of Bangalore City
- Accidents will be reduced by 30%
- There will be significant reduction in pollution
- Substantial compliance of Traffic Laws and Rules will be achieved
- Effective Trauma Care System will be set up
- Coordinated traffic management will be achieved
- Level of traffic and road safety awareness will be enhanced
- State of the art traffic policing and regulation will lead to substantial compliance.

Table 71 shows the estimated costs for B-TRAC activities over the years.

Table 71: Cost Phasing for B-TRAC

No.	Components	Nos.	Unit Cost (in Rs. Crores)	Total Cost (in Rs. Crores)	Phase 1 (2007-2012)
1	Junction Improvements	250	0.7	175	175
2	Street Furniture and Road making			100	100
3	Intelligent Transportation System including ATC, VMS etc for 250 intersections			150	150
4	Surveillance/ monitoring and enforcement cameras etc			50	50
5	Education and Training and others			25	25
				500	500

Source: CDP Bangalore 2006

3.5. Bengaluru New International Airport

Bengaluru International Airport[17] is a 4,050-acre (16.4 km²) international airport that is built to serve the city of Bangalore. The airport is located in Devanahalli, which is 30 km from the city. Construction of the airport began in July 2005, after a decade long postponement. It is expected to be completed and operational by March 30, 2008. It is then expected to take all the commercial flights (domestic and international) that are currently operating out of the HAL Airport.

Future plans for the airport site envisage expansion of the terminal and runways and generous commercial development, including business centers, tax-free shops, entertainment centers, malls and office space.

Construction & Design

The new Airport was originally planned to accommodate 3.5 million passengers a year, but this has now been redesigned to handle 11 million passengers. The redesign will see an increase in the size of the terminal, number of aircraft stands, new taxiway

[17] Data for the section is sourced from BIAL official website, Project Reports and Consultant studies (as secondary data).

layouts and supporting infrastructure. However, the redesign was to be incorporated into the project schedule of BIAL.

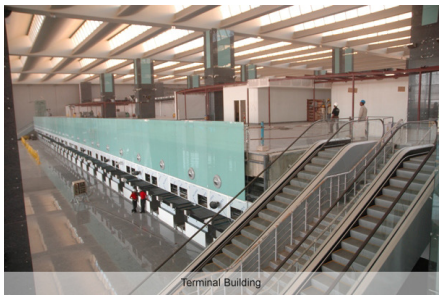

Air Traffic Control Tower

A plan is also being processed for a direct rail service from Bangalore Cantonment Railway Station to the Basement Rail terminal at the new International Airport. Access on the National Highway is being widenend to a six lane expressway, with a 3 feet (0.91 m) boundary wall, construction is moving ahead. A new expressway is planned to connect the International Airport to the City's Ring Road. The Expressway, expected to be a tolled road, would begin at Hennur on the Outer Ring Road.

Table 72: Key facts pertaining to the BIAL

Owner & Operator	Bangalore International Airport Ltd.
Location	Devanahalli, Bangalore, Karnataka
Length of Runway	4000 m (13,123 feet) (fully asphalted surface)
Traffic Projections for BIAL (estimate for 2010)	8.54 million passengers 234,017 metric tonnes Movement for peak hours = 27 Total movements = 106,191
Start of Operations	March 30th, 2008
Design Capacity	About 11 million passengers per annum
Aircraft Stands	45
Aero Bridges / Gates / Check-in Counters	9 Bridges / 16 Gates / 54 Counters
Approximate Cost of Project	Rs.28 billion

Layout


Terminal Building

The passenger terminal is proposed as a single, fully air-conditioned, two-level building capable of accommodating international and domestic operations. The basement houses the retail storage, rest areas and services. The arrival and departure areas are separated vertically with a modern, simple, straight-ahead flow system. The domestic and international departure lounges, and the majority of the retail outlets are located on level 2 (first floor). The check-in facilities and baggage reclaim are located on level 1 (ground floor). The terminal is designed for ease of operation and minimum maintenance.

Capacity

The total floor area planned is approximately 71,000 square metres. The terminal building is designed to accommodate 2733 passengers at peak hour. The design reflects

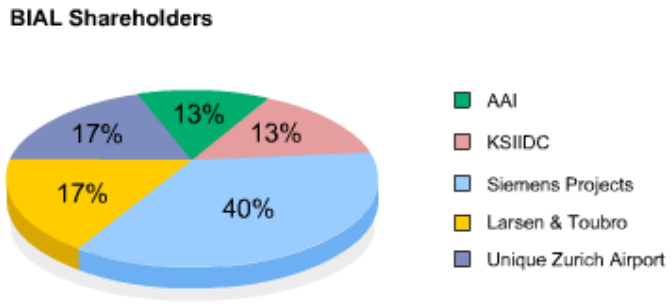
the best industry practice and caters for 24-hour-operations, under all weather conditions. All facilities provided will meet IATA standards.

Terminal parking

In the first phase of development, a car park for 2,000 cars in front of the terminal building at the ground level will be developed for the convenience of passengers and visitors to the airport.

BIAL Ownership Structure

The BIAL shareholding pattern consists of private promoters holding 74% equity stake and the state holding the remaining 26%. The private promoters include Siemens Projects Ventures, Larsen & Toubro and Unique Zurich Airport.



The two state promoters are the Karnataka State Investment and Industrial Development Corporation and the Airports Authority of India.

Water Supply to New International Airport

Water supply arrangement has been made for the New International Airport coming up near the Devanahalli area. The Bangalore Water Supply and Sewerage Board (BWSSB) and BIAL have entered into a formal arrangement wherein BWSSB would provide potable water to the International Airport facility by laying a dedicated pipeline. The dedicated pipeline is a necessary step as the International Airport is located beyond the administrative limits of BWSSB.

The airport is equipped with an in-house water recycling facility which can be used to treat and recycle used water. This combination of utilizing both recycled and fresh water lends greater efficiency to the overall operations of the facility. Currently the facility is utilizing approximately 1 to 1.2 MLD of water supplied by BWSSB. However the quantum of water supply can be increased depending on the utilisation at the facility.

3.6. Airport Rail Link

The Airport Rail Link (ARL) project envisages commencement of dedicated high-speed airport rail service between the city and the new international airport. The project is

proposed to be developed under a public private partnership framework with Infrastructure Development Department (IDD) of GoK being the nodal agency.

The Delhi Metro Rail Corporation Ltd (DMRC) was commissioned by the State Government of Karnataka for preparing a Detailed project Report (DPR) for a High Speed Rail Link to the International Airport, with check-in facilities at the city end. Accordingly, DMRC undertook necessary studies and investigations and has prepared this DPR.

DMRC is joint venture of Government of India and Government of Delhi. The Detailed Project Report (DPR) for the Bangalore Metro Rail Project has also been prepared any DMRC proposing two lines, the East West line (18.10kms – 18stations) and the North-south line (14.90kms – 14 Stations) consisting of elevated and underground sections.

3.7. Road Connectivity to International Airport

At present the primary connectivity to the Bangalore International Airport is under construction, is through the NH-7. Traffic from the city to the Airport has to reach this road and then proceed towards the International Airport. As NH-7 is a divided dual carriageway with 3 lanes in each direction. As NH -7 is a busy highway, connecting Bangalore to Hyderabad, the traffic volume on it is about 50,000 vehicles (each way per day, with the peak hour traffic being about 5,000 vehicles per hour each way. As on date the temporary access to the Airport area is taking off from the NH-7about 5kms short of the airport, which is purely for the construction purposes only. The BIAL is building the main access road connecting NH-7 at the proposed trumpet interchange on the south western side. The total distance to be covered from City Centre (M.G. Road) to the new Airport will be about 33.41 km.

The Government of Karnataka (GoK) has proposed a new Access Express Way from Bangalore North, starting from Horamavu accessible from the Ring Road. This will be a Toll Highway with three lanes each way. After traversing about 21 kms it will join the main access road of BIAL in a loop and proceed to reach the Airport. This Expressway is also proposed to be continued beyond the crossing of the BIAL MAIN access road towards Devenahalli to join NH-7.The Express way will also link the Aero City of BIAL. This road is proposed to be taken up on BOT basis and land acquisition by the Govt. (KRDCL) is being launched. When this toll Expressway will be ready cannot be stated at present.

GOK is also planning a Peripheral Ring Road for Bangalore, about 6km beyond the Ring Road and 16 kms short of BIAL main access road. This Road also crosses the Expressway giving access to the Airport in a loop from this point. The Peripheral Road crosses the NH-7, beyond Yelahanka which might also give connection to BIAL access road through NH-7. This project, being executed by BDA, is in the initial stages as only land acquisition has been launched so far.

3.8. High Speed Rail Connection

Keeping the new International Airport far away from the City about 35 kms from Centre of the City has many advantages but equally many disadvantages. While land

availability for such an Airport is easy and would be cheap and the Airport can be expanded as the traffic grows, the real sufferers are the air travelers and Airport employees who have to cover this long distance to reach the Airport employees who have to cover this long distance to reach the Airport. Apart from the high cost of travel to reach the Airport from the City, the time taken for the travel will be more than an hour and uncertainties due to traffic hold-ups enroute will have to be reckoned with. On the other hand, a High Speed express Rail Connection will make such a travel comfortable, hassle free cheap and reliable. Therefore, even when the proposed access Express way materializes, the majority of the travelers to the Airport would prefer a fast and reliable rail journey.

Advantages of Rail Connectivity over road access:

- The rail journey will take less than 25 minute as against more than one hour by road.
- Rail journey will be in air-conditioned comfort. Very safe and reliable. There will be no uncertainty in regard to traffic hold-ups.
- The energy needed for a passenger km. by rail is only1/5th of the energy needed by road. Therefore, there will be considerable fuel saving if bulk of the travelers choose rail journey.
- Air travelers can have check-in facilities at the City itself. Would be available both for international and Domestic travelers and would reduce the congestion at the check- in counters at the Airport as also the need for parking facilities at the Airport end.
- By rail, there will be no pollution, can have a relaxed travel without any tension and passengers can be sure of the time by which they can reach the Airport.
- The travel by rail would be far cheaper than the road journey apart from being very safe.
- A rail Connection has flexibility of increasing the capacity by reducing the headway between the trains.
- The need for many visitors to reach the Airport for seeing off or meeting the relatives can be considerably reduced since this activity can take place at the City Air Terminal itself.

Despite the above it has to be reckoned that many of the rail travelers may still have to take another made of journey to reach the City Air Terminals.

Route Alignment

The High Speed Rail Link to the new International Airport starts from the Police Grounds situated between M.G. Road and Cubbon Road. Police Grounds represents practically the city centre well connected on all sides to the entire city and its outskirts. The ramp of the Bangalore Metro is also located in this area. The structure of the City Airport Terminal (CAT) is being planned in such a way that the needs of Bangalore Metro are fully met while at the same time the remaining area is utilized for the CAT. The proposed Bangalore Metro Rail crosses police Grounds diagonally as a ramp from the underground station of Minsk square t the elevated station on the M.G.Road. it is possible to accommodate in the Police Grounds the requirements of both the Bangalore Metro and CAT of the Airport Rail Link. The CAT structure will be put up around the Bangalore Metro Ramp.

In other words the Metro ramp structure will go through the CAT Building the two systems totally isolated, at the same time integrated together.

Train Operation Plan

The train operation plan (headway and train composition) planned for year 2011 and 2021 is gives as under:

Cost Estimates

Cost estimates have been prepared based on the price levels prevailing in June, 2007. it has been assumed that land owned by Government / Municipal Corporation will be provided free of cost to the project. It has been further assumed that cost of civil works of the airport line including the terminal stations located within BIAL premises will be provided as one time grant to the owner of the Airport Rail Link. The length of the Rail Link up to terminal – I inside BIAL premises comes to 3.57 kms and its estimated costs at June 2007 price level is 148 crores (i/c taxes). This cost does from part of the completion cost of the project.

- Estimated cost (excluding land cost) :Rs.2677 Crores
- Estimated cost (including land cost) :Rs.2832 Crores
- Estimated Central & State Taxes :Rs.344 Crores
- Estimated cost (including Taxes) :Rs.3176 Crores
- Completion cost by March,2012 with Taxes and land :Rs.3716 Crores

Financing of the Project

For funding of this project, two options, namely:
1. Public Private Partnership (PPP) model
2. Build Operate and Transfer (BOT) model

with a concession period of 30 years are examined as under:

Under PPP Model, the civil construction job will be done by SPV with funds to be made available by GOI & Government of Karnataka (GoK) and the systems and O&M works will be down by the concessionaire by bringing required funds in the debt equity ratio of 2:1. Under BOT model the BOT operator will construct the project and run the system for 30 years including construction period. To attract concessionaire to implement the project on BOT basis a minimum post tax return of 14% on his equity has been assured. It is further assumed that concessionaire will be able to arrange loans at the rate of 12% interest. Land is to be provided free of cost (Rs.155 Crores) in both the options.

Since, under the PPP model, the governments' outflow will be Rs.978 Crores (Rs.1328 Crores- Rs.350 Crores from Property Development) and under the BOT model the VGF is only Rs. 50 Crores, the latter is recommended for adoption. The Request for Qualification (RFQ) for Project was issued and bids from five bidders were received in response to it and are being evaluated.

Institutional Arrangements

The State Government of Karnataka (GoK), Government of India (GoI), and Bangalore International Airport Limited (BIAL) will set up a joint Venture which will own the proposed high Speed Express Rail link to the International Airport. The initial share capital of this Joint Venture will be International Airport. The Initial share capital of this Joint Venture will be international Airport. The initial share capital of this Joint Venture will be international Airport. The initial share capital of this Joint Venture will be contributed by GoK, GoI and BIAL in the proportions of 45:45:10. The initial share capital of Joint Venture will be Rs.300 crores. An additional amount of Rs.300 crores will be raised by SVP. The land required for the project will be acquired by the GoK at its own cost. Whereas the land owned by the State Government/ Municipal Corporation will be made available free of cost, cost of private land acquired by the GoK will count towards its equity contribution to the Joint venture BIAL premises. This cost will be treated as one time grant by BIAL to the Joint Venture.

The proposed Rail Link will be implemented on BOT basis. With a concession period of 30 years including the construction period. To supplement the revenues, the Concessionaire will be given full property development rights within the following areas:

- Depot area
- Hebbal station
- Yelahanka station

The concessionaire will also have full advertising rights within trains and stations. Property development at the City Air Terminal CAT will be done by the owner of this rail link i.e. the Joint Venture. Property development rights at the terminal station which will be within the limits BIAL area will be with BIAL. The Joint Venture will have Directors, the number of Directors of the three partners being the proportion of their share capital of Joint Venture. The executive Chairman of the Joint Venture will be nominee of the state Government.

In brief:

- Concessionaire equity — Rs.1004 Crores
- Viability gap funding after adjusting for Up front of Rs.350 Crores as PD Receipt — Rs.50 Crores
- Post tax return on concessionaire equity — 14%
- Completion cost without Land cost but with taxes — Rs.3561 crores

It is expected that the project will be financially viable. The concession agreement shall, therefore provide for sharing of revenues between the Concessionaire and the Joint Venture after the actual traffic on the proposed Rail Link exceeds 120% of the projected traffic. To assist in the implementation of the project, the joint Venture will engage Consultants.

The role of the consultants will be:

- To finalise the Concession Agreement
- To monitor implementation of the project by the concessionaire including Contract management.

3.9. Development of Commuter Railway System

The CRS project is been viewed as an option in improving the City infrastructure and reducing road congestion. The process comprises of integrating the commuter rail project providing connectivity on existing surface railway lines in Bangalore with the proposed metro rail project. The commuter rail project envisages providing a mass urban transportation system along the existing railway lines covering 62 km on the north-south and east-west axis of the City — from Kengeri to Bangalore City Railway Station, to Yeshwantpur, and Whitefield via Cantonment and Yeshwantpur to Byappanahalli via Hebbal.

The project is proposed to be developed in two equal phases spanning over the implementation periods of 2007-2012 and 2013-2017. The estimated capital expenditure for the total project is Rs. 650 Crore, with Rs. 325 Crore being incurred in each block. The land requirement for the project is approximately 62 hectares, which has been assumed to be acquired at a cost of Rs. 3.2 Crore per hectare. The rolling stock comprises 26 wagons at a cost of Rs. 10 Crore per wagon.

3.10. Bangalore Metro Rail

The Metro-Rail Project is proposed as a mass transport system to decongest the traffic in the City roads. Planning commission of India has accorded its "In-principle" approval in February 2004. The Karnataka State Cabinet approved the project on 03-03-2005 and gave its go-ahead to land acquisition, preliminary works like short listing of vendors/contractors and identification and shifting of utilities. The Project Investment Board has (PIB), and the Cabinet Committee in Economic Affairs (CCEA) has approved the project, and the Japanese Bank for International Cooperation (JBIC) has accorded its approval for debt finance to the project. The implementation period will be 5 years.

Out of Rs.19,921 crore of investment for the 137 km of Metro, financing for Rs.5605 crore corresponding to the present phase I corridors under implementation now (about 34 km) has already been arranged and the project is implemented by BMRCL, a company incorporated for the purpose. Balance investment for Metro would also be mobilized by the company through a combination of contributions from Government of India, Government of Karnataka and debt financing. It is also recommended that JNNURM funding from Government of India to an extent of Rs.532 crores be sought to finance the balance Rs 1521 crores for the Phase I.

The recommended funding pattern for Rs.1521 crores for Phase I is as follows:

- Government of India (JNNURM) funding: Rs.532 Cr
- Government of Karnataka (JNNURM) funding: Rs.228 Cr
- BMRCL / Debt funding: Rs.761 Cr

The Bengaluru Metro will be integrated with railways and other mode of transport at Byappanahalli Railway Station in the East, Yeshwantpur railway station, and Jalahalli in the North, Mysore Road Terminal in the West, Banashankari in the South and Bengaluru City Railway Station / Kempegowda Bus Stand in the central part of the city.

The metro system is configured on two busy corridors of the City-East-West and North-South on similar lines as the Delhi Metro Railway. The East-West corridor is to start at Byappanahalli and end at Mysore Road/Ring Road junction, a total length of 18.1 km. The North-South corridor is to start form Yeshwantapur in the North and extend up to JP Nagar in the South, a total length of 14.9 km. The two lines would be crossing each other at Majestic, close to the City Railway station, where a rake interchange line connecting the two corridors is proposed. shows the map of the proposed metro system.

Schedule and Train Headway

The Metro rail construction work on the first elevated section from Bayappanahalli to Cricket Stadium (7km i.e. Reach 1) has begun in January, 2007, and is expected to be completed by December, 2010. The full network is expected to be commissioned by December 2011. BMRCL is seeking to minimize public inconvenience during the construction period.

The frequency of the Metro trains will be every four minutes initially. This would increase to three minutes by 2021. The travel time from end to end on the E-W corridor will be 33 minutes, and on the N-S corridor will be 28 minutes. The system is designed for maximum operational speed of 80 kmph.

Carrying Capacity

The Metro has been designed for a capacity of 40,000 PHPDT. The number of passengers expected to travel on the metro everyday is estimated at 10.20 lakhs in 2011 and 16.10 lakhs in 2021. With expected addition of the extension to NS corridors in the course of implementation of the project, it is estimated at 12.22 lakhs in 2011 and 19.72 lakhs in 2021.

Some of the Project highlights are:

- North-South Corridor - 18.40 km
- Total - 36.50 km
- Elevated - 29.15 km·
- At Grade - 00.65 km
- Underground - 6.70 km
- Gauge - Standard Gauge
- Traction - 750 V dc Third Rail
- No. of Stations - 35
- Travel Time -33 Mins. (End to end)

Based on the construction cost estimates provided in the DPR, the completed cost of the Project is estimated at Rs. 5,605 Crore.

4. Projects Approved under JNNURM Scheme

Table 73 given below set outs the projects have been approved under the JNNURM scheme and are individually being promoted by BMTC, BDA, and BBMP.

Table 73: Projects approved under JNNURM scheme

No.	Project Undertaken	Investment Estimate (Rs. Cr)
1	Passenger amenity centre at Jayanagar	8.90
2	Development of TTMC at Shanthinagar	84.68
3	Development of TTMC at ITPL (Whitefield)	26.56
4	Development of TTMC at Vijayanagar	38.12
5	Development of TTMC at Koramangala	50.58
6	Development of TTMC at Banashankari	22.24
7	Development of TTMC at Bannerghatta	3.93
8	Development of TTMC at Kengeri	21.13
9	Construction of Grade separator at Agara junction	38.10
10	Construction of Grade separator at Iblur Junction	18.74
11	Construction of Under Pass along Chord Road at the Junction of Magadi Road and Chord Road	27.82
12	Construction of Grade separator at Malleshwaram	12.45
13	Construction of Grade separator at R V College	13.49
14	Construction of Grade separator at Tagore Circle	17.56
15	Improvement of Roads - MG Road	43.61
16	Improvement of Roads - Koramangala	50.45
17	Construction of Bridge at Gali Anjaneya Junction	31.93
18	Construction of Grade Separator at Yeshawathpur circle	21.58
19	Construction of Underpass at Hennur Bansawaadi Junction	25.44
20	Construction of Underpass at Ring Road & Nagavara Road Junction	21.63
	Total	578.94

Source: KUIDFC

4.1. Other Road/Transport Related Projects

There are other projects in the sector, that are smaller but critical, and these include:

- Construction and rehabilitation of footpaths and medians
- Construction of subways, skywalks
- Development of pedestrian/ cycling zones
- Rehabilitation and installation of street lights
- Multistoried car parking facilities
- Improvement of junctions and traffic management systems
- Asphalting of 1,500 km of internal roads
- Construction of flyovers and grade separators.

The projected investments for these projects have been estimated on benchmark costs by the concerned agencies, and indicated in the CIP.

5. Investment Plan for Roads and Transportation

Table 74 shows the estimated investment for transport infrastructure projects, and Vision Period.

Cost Estimates and Financing

Considering the various proposed schemes and unit rates, cost estimates of these schemes have been worked out at 2007 prices and are given for proposed mass Transport Corridors, City Bus System, Road Infrastructure, Grade Separators, Pedestrian Facilities, Parking Facilities, Integrated Freight Complexes and Transport System Management Measures. The entire transport development plan is not required to be implemented in one go.

Considering the existing problems, expected traffic demand levels and schemes already under implementation/ active consideration of the Government, phasing of implementation of various projects has been suggested in three phases (2007- 12, 2013-18 and 2019-24). Cost estimates for each project to be implemented in the Mission period of JnNURM are given in Table 75 below; The inputs in the table below are taken from CTTP.

Table 74: Investment Plan Upto JnNURM period

Proposed Developments	2011-2012
Metro System	15000
Mono Rail/ LRT System	3825
Commuter Rail System	690
BRT System	1866
Improvement in City Bus System	4401
New Roads	5192
Outer Ring Road Alignment	311
Road improvement (Inside ORR)	142
Road Improvement (Outside ORR)	433
Graded Separators Roads	713
Rail over Bridges/ RUB	432
Elevated Roads	990
Pedestrian Facilities	281
PARKING (No. of CAR space)	380
Integrated Freight Complexes	135
B TRAC	500
High Speed Rail Link	6000
Road on road project to BIAL	700
Hebbal Elevated Expressway	10000
Total (in Rs. Crores)	51991

Table 75 shows the estimated investment for transport infrastructure projects, and Vision Period

Table 75: Investment Plan Vision period JnNURM

Item	Phase 1 2007-12	Phase 2 2013-18	Phase 3 2019-24	Total
Mass Transport Corridors				36658
Metro System	15000	10000	0	25000
Mono Rail/ LRT System	3825	1275	0	5100
Commutor Rail System	690	1620	750	3060
BRT System	1866	1632	0	3498
Improvement in City Bus System				5721
Improvement in City Bus System	4401	660	660	5721
Road Infrastructure				6078
New Roads	5192	0	0	5192
Outer Ring Road Alingment	311	0	0	311
Road improvement (Inside ORR)	142	0	0	142
Road Improvement (Outside ORR)	433	0	0	433
Grade seperators				2135
Graded Separators Roads	713	0	0	713
Rail over Bridgs/ RUB	432	0	0	432
Elevated Roads	990	0	0	990
Pedestrian facilities	281	0	0	281
Parking (No. of CAR space)	380	0	0	380
Integrated Frieght Complexes	135	135	0	270
B TRAC	500	0	0	500
High Speed Rail Link	6000	0	0	6000
Road on road project to BIAL	700	0	0	700
Hebbal Elevated Expressway	10000	0	0	10000
Total	51991	15322	1410	68723

6. Implementation Framework

Road and transportation related investments constitute the largest portion of infrastructure investment in the City, even excluding very large investments in the Metro-Rail. It is therefore vital to have adequate institutional capacity, frameworks, and coordination, to ensure that such investments can be mobilized and the projects implemented. Two important aspects of the framework are addressed in the following section, and these pertain to having a Unified Authority to coordinate between city agencies and implement the projects, and having capacity to carry out projects on a PPP format.

6.1. Unified Transport Authority

The previous CDP recommended the creation of a unified transport authority for coordinating the land transport efforts for Bangalore city. Direct service providers are the BMTC and BMRCL (when operational), Indian Railways (for CRS, when operational),

and any operational agencies for other systems such as ARL or LRT/Monorail. Indirect service providers are the Statutory Authorities for basic infrastructure, Traffic Police, and the Transport Department of GoK.

It was clear that there had to be very strong coordination between various agencies, not only in initial investments in creating a system, but also in its operations. The GoK was previously doing such coordination. However, GoK has recognized the clear need, also articulated in the National Urban Transport Policy, for a separate Urban Transport Authority. Such Authority will provide the necessary planning, coordination, and skill base that is needed to implement the critical and specialized urban transport function.

Such an authority was created in the name of Bengaluru Metropolitan Land Transport Authority (BMLTA). At present the Directorate of Urban Land Transport would act as the secretariat for BMLTA which is created as unified metropolitan transport authority.

PPP Frameworks

Some of the projects discussed above may be funded on a PPP basis, where the entire cost would be met by the private sector partner, or through a viability grant support. Bangalore already has experience in setting in place several projects on a PPP format – notably, the new Bangalore International Airport and the elevated expressway from Electronic City to Silk Board Junction. BBMP has also implemented projects for development of parking facilities/bus and truck terminals under appropriate PPP frameworks. Going forward, some of the projects that are being contemplated on a PPP format are:

- Airport Rail Link
- Inter-modal exchanges
- Parking complexes
- Bus/truck terminals

GoK is currently revising its Infrastructure Policy to take into account the need for developing infrastructure projects on PPP basis, and setting in place the requisite policy framework.

Figure 18: High Density Traffic Corridor

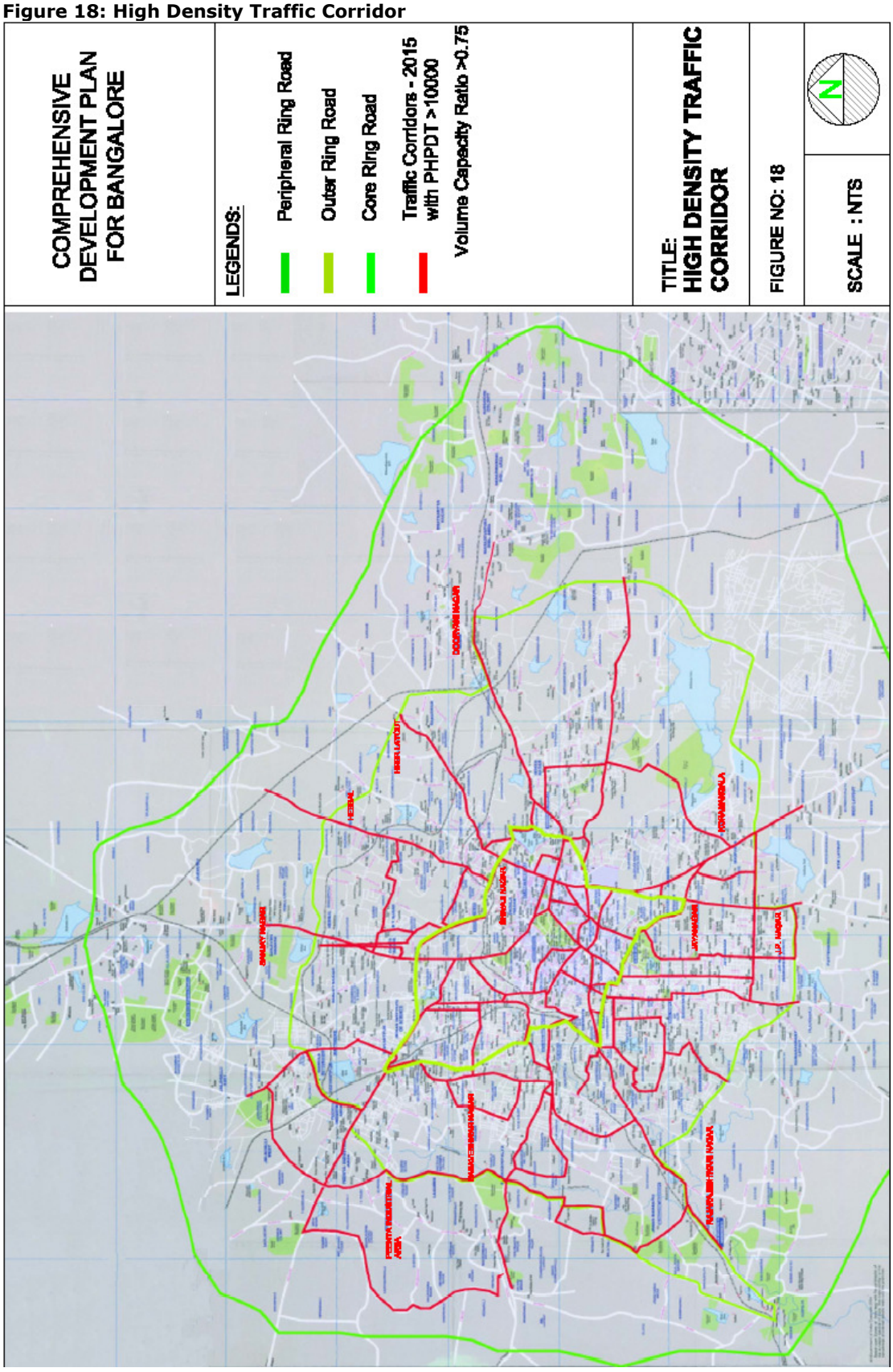


Figure 19: Overview of City Transport System

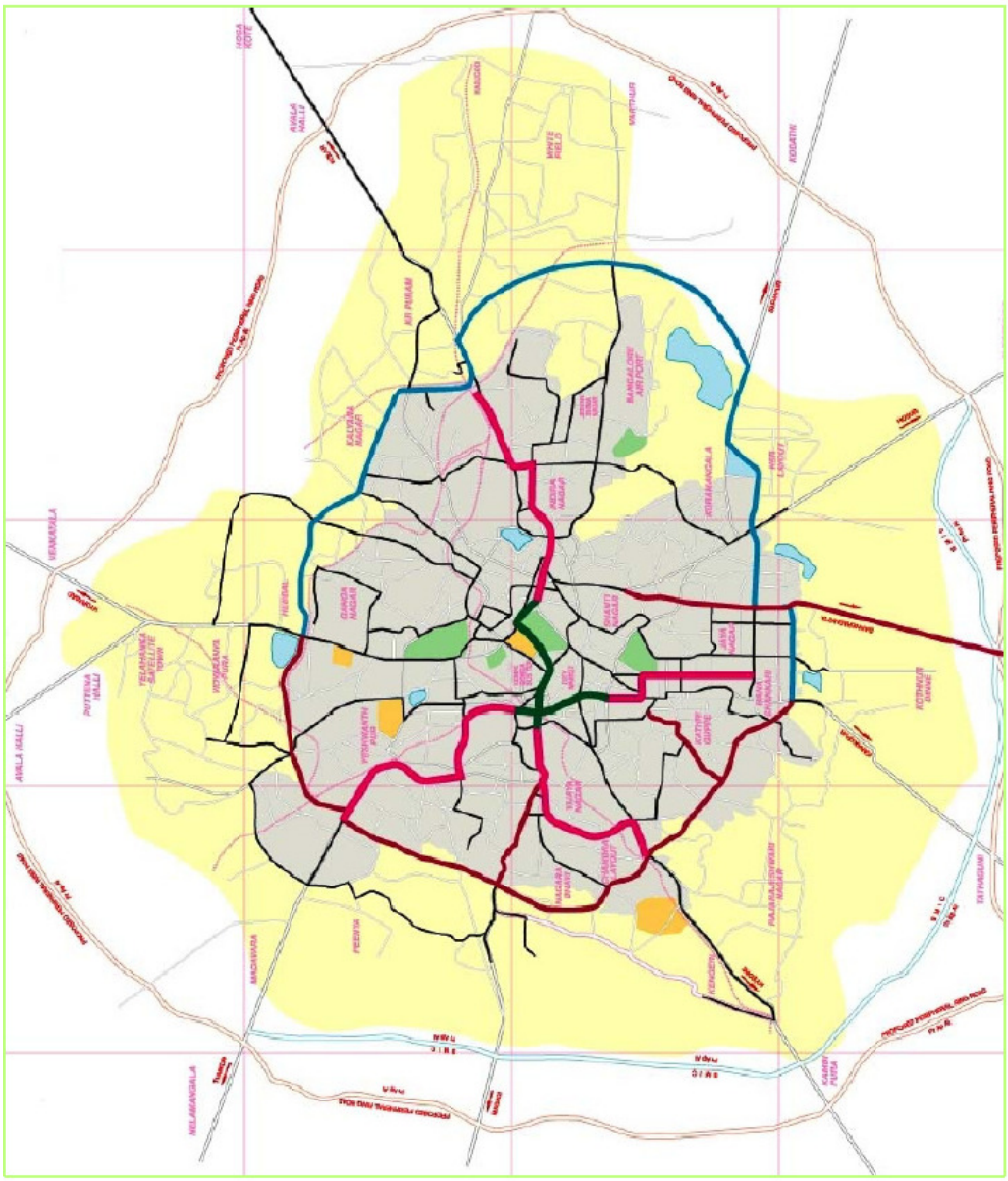
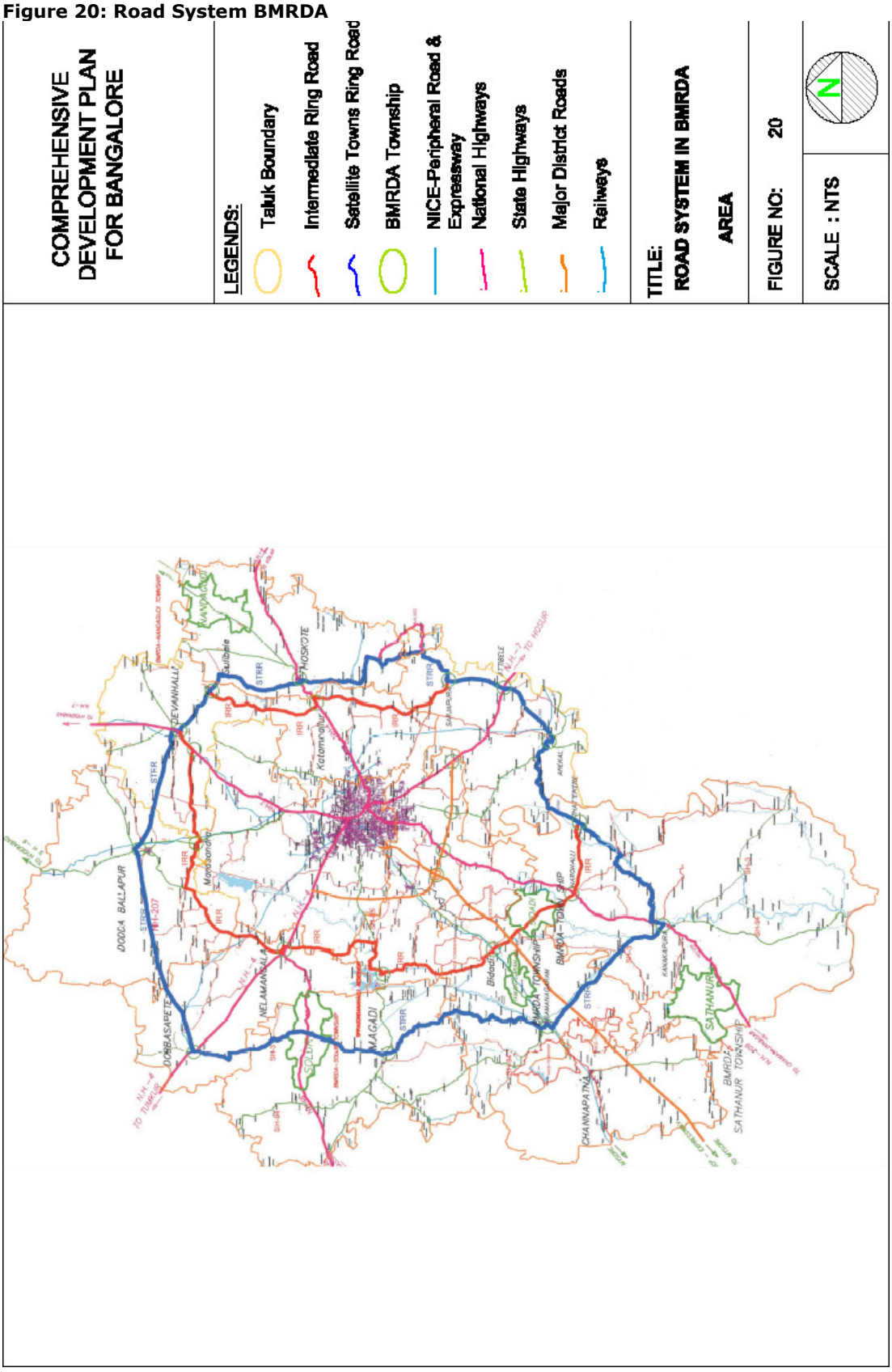


Figure 20: Road System BMRDA



Chapter 10: Civic Amenities

1. Overview

The City has to provide certain "quality of life" civic amenities/facilities, apart from the basic urban infrastructure. "Civic Amenities" includes parks, lakes, streetlights, markets, etc. This chapter outlines these infrastructure/amenities and identifies investments required to improve the same in Bangalore.

1.1. Existing Situation

1.1.1. Parks

Important parks in Bangalore are:

- Lalbagh Botanical Garden (area - 97 acres, 1854 species, 673 gene and 890 cultivars of plants)
- Cubbon Park (68 genera, 96 species, total of 6000 plants/trees)
- Bannerghatta National Park, located 25 km from the city houses important flora and fauna
- Dhanvantarivana at Jnana Bharathi, spread over 37 acres is a garden of medical plants and consists of 414 species
- Parks maintained by Department of Horticulture - 365 (well developed - 55, partially maintained - 130, undeveloped - 180).

There are other regulations and initiatives for open spaces and green areas:

- Land earmarked for park and open spaces in CDP, 1995: 77.9 sq. km. (14%)
- Requirement under BDA–not less than 15% of the area for parks and open spaces in any newly formed layout
- 22 theme parks and 16 tree parks under "Greener Bangalore" being implemented by BBMP and BDA
- The Forest Department has raised plantations of around 130 sq. km by planting around 35 lakh plants
- BBMP has developed 48% of the 560 parks in the City.

The budget for development of park and gardens is about Rs.59 Crore for 2005-06, out of which Rs.6 Crore is earmarked for maintenance.

1.1.2. Lakes

Around 25 lakes have been developed by initiatives taken by BDA, BBMP and Lake Development Authority:

- Perceiving the imperative need to conserve the lakes in and around Bangalore, GoK constituted the "Lake Development Authority" in 2002. LDA so far has developed five lakes in Bangalore using funding from the National Lake Conservation Program fund;
- BDA has developed three lakes including the Lalbagh Lake;
- The Forest Department has also taken initiatives for development of 17 lakes, planned for maintenance of 11 lakes, and developed a Master Plan for five lakes; and

- BBMP has developed four lakes.

1.1.3. Street Lights

In all, there are 2.5 lakh streetlights in Bangalore, XX% of which are in the BBMP jurisdiction. Majority of the streetlights illuminating the roads are fluorescent and sodium vapor lamps. The provision of streetlights is in line with planning standards, which indicate 30 m spacing between streetlights, i.e. 33 streetlights per km of road. The position of available streetlights is shown in Table 76.

Table 76: Street Light Situation in the current BBMP Area

Zone	Total	Streetlight Per km
Core area	1,75,019	50
Bommanahalli	12,786	25
Byatarayanapura	12,860	38
Dasarahalli	9,310	23
KR Puram	7,610	21
Mahadevapura	6,845	25
RR Nagar	13,296	61
Yelahanka	9,077	48
Kengeri	2,764	25
Total	2,49,567	42

1.1.4. BBMP Markets

The City has created, under the BBMP jurisdiction, several markets in the past. Among these are Malleswaram Market, Johnson Market, Russel Market, and KR Market. There are a number of other old properties owned by BBMP at strategic locations. These can also be redeveloped to unlock value and provide better services to citizens. Such properties also require rehabilitation due to lack of maintenance, and surplus space to be commercially exploited with little or no investment from BBMP.

Key Issues in Civic Amenities

The key issues in each of the aforesaid themes comprise:

- The main problems faced by lakes are eutrophication, mud lifting, brick making, and tile making, lake conversion and the encroachment of lakebeds, land-filling, garbage dumping and immersion of idols.
- While the existing parks suffer from lack of maintenance, development of parks and open spaces in new layouts would need to be actively enforced.
- Due to increase in working hours and economic activity during the night, and in order to ensure law and order and prevent crime, provision of street lighting is necessary in all areas.
- While the former ULBs have developed markets with an effort to provide improved commercial facilities, lack of marketing and proper maintenance have left the markets in poor conditions, in spite of being situated in prime locations.

2. Strategy for Improved Service Delivery

Bangalore has been a witness to the decline in the number of lakes and inadequate maintenance of parks, which are the symbols of Bangalore. Recognizing the need to

revive the same, the City proposes to adopt a systematic approach to the creation and maintenance of civic infrastructure.

For Bangalore to retain its position as a "Green City," creation of urban spaces becomes imperative. The city envisages improving the quality of life for its citizens by implementing the following projects:

- Developing/redeveloping markets;
- Creating green spaces and social forestry, and efficient maintenance of its existing parks/green assets; and
- Introducing pedestrian only/cyclist only zones.

3. Project Identification & Costing

The concerned agencies have proposed certain projects that are to be taken up in this sector, and these are indicated in the following section.

3.1. Investment Plan for Civic Amenities

3.1.1. Projects in Implementation Period

Development of Existing & New Parks – Beautification of Gardens

Parks, playgrounds, urban forestry, etc., cover an area of approximately 14% of the total area of the city vis-à-vis the norm of 20%. The cost of development has been assumed as Rs. 50 lakh and Rs. 25 lakh, for parks in BMP area and ULBs, respectively.

Development of Modern Abattoir

At present, there are slaughterhouses at Yeshwanthpur, Frazer Town and Tannery Road–these do not have modern facilities and are located within the City. Subsequently, the High Court of Karnataka obligated BBMP to set up a modern slaughterhouse outside the City. For this purpose, BBMP has identified land for developing a modern abattoir at Iggalur in Anekal taluk. The estimated capital investment is Rs. 30 Crore.

Fire Systems

Fire systems in the City are proposed to be upgraded to reduce the response time for emergencies. The stations are to be located in zones formed on a scientific basis, with modern equipment. The project components proposed include:

- Expansion of services in areas not covered;
- Procurement of plant and machinery;
- Modernization of the system and functions; and
- Capacity building and skill enhancement.

Redevelopment of Lakes & Urban Afforestation

The projects proposed include development of recreational spots, fencing, desilting of lakes, diversion of sewage, prevention of garbage dumping in the lakes and initiation of activities such as gardening.

Development of Markets

BBMP proposes to develop the following markets under a PPP format:

- Cox Town Market
- Johnson Market
- Krumbigal Road Market
- Malleswaram Market
- Seshadripuram Market
- Cubbonpet Market
- Ulsoor Market
- Yediyur Market

3.1.2. Estimated Capital Investment Requirement

Table 77 indicates the estimated investment in Civic Infrastructure projects, during the JNNURM period.

Table 77: Investment Plan for Civic Infrastructure - JNNURM Period

(In Rs. Crores)	2007-08	2008-09	2009-10	2010-11	2011-12	Total
Parks/ Play grounds	1.9	1.9	1.9	1.9	1.9	9.6
Fire System	27.7	27.7	27.7	27.7	27.7	138.6
Lake Development	25.9	25.9	25.9	25.9	25.9	129.7
Slaughter House	9.6	9.6	9.6	9.6	9.6	48.1
Sports/ Stadium Improvements	6.4	6.4	6.4	6.4	6.4	32.0
Office Building	3.2	3.2	3.2	3.2	3.2	16.0
Street Lighting	35.2	35.2	35.2	35.2	35.2	176.2
Markets	16.0	16.0	16.0	16.0	16.0	80.1
Crematoria	9.6	9.6	9.6	9.6	9.6	48.1
Grand Total	135.7	135.7	135.7	135.7	135.7	678.3

Table 78 indicates the estimated investment in Civic Infrastructure projects, during future blocks.

Table 78: Investment Plan for Civic Infrastructure – Vision Period

(In Rs. Crores)	2013-17	2018-22	2023-27	2028-31	Total
Parks/ Play grounds	6	4	3	1	15
Fire System	84	63	42	21	210
Lake Development	79	59	39	20	196
Slaughter House	29	22	15	7	73
Sports/ Stadium Improvements	19	15	10	5	48
Office Building	10	7	5	2	24
Street Lighting	107	80	53	27	267
Markets	48	36	24	12	121
Crematoria	29	22	15	7	73
Grand Total	411	308	205	103	1027

Source: Crisil, 2007

4. Implementation Framework

The projects to be implemented in the area of civic infrastructure shall be developed by the respective agencies. As far as possible, the projects shall be structured on a PPP basis. In some cases, sponsorship by private agencies, such as "Adopt a lake/park" scheme will also be adopted.

Chapter 10: Tourism & Heritage Conservation

1. Overview

Bangalore is one of the most visited destinations – primarily due to its economic growth, but also as a tourist spot and as a transit hub for other tourist destinations in South India. The City also has heritage buildings and sites that reflect its culture and heritage. The emergence of Bangalore on the global technology map coupled with the increasing number of visitors would need translation into enhanced tourism potential for the city, while conserving its heritage.

1.1. Existing Situation

1.1.1. Tourism in Bangalore

Bangalore, which is known as the "Garden City" due to its gardens and parks, is one of the fastest growing cities in Asia. Bangalore has now transformed into a bustling metropolis providing numerous options for visitors, and in addition to its parks and gardens, now provides a multitude of modern attractions for the visitors - including global cuisine and a contemporary shopping experience.

1.1.2. Heritage Aspects

Bangalore is endowed with numerous heritage landmarks given its rich history including Vidhana Soudha, Tipu's Palace, Bangalore Palace, High Court Building and others as shown below.

Bangalore Palace

The palace is considered an architectural splendor in Tudor architecture. It was built by Chamaraja Wodeyar, Maharaja of Mysore in 1887.

Tipu's Fort Palace

The Fort was built by Chikkadeva Raya and was later extended, dismantled and rebuilt by Haider Ali and Tipu Sultan.

Tipu Sultan's Summer Palace

Built all in wood, this elegant palace is situated to the west of Kote Venkataramana temple in the present Albert Victor Road. The construction of the palace was started by Hyder Ali Khan, but was completed by his son in 1791.

Vidhana Soudha

The Vidhana Soudha houses the State Legislature, and is the largest Secretariat in India. Kengal Hanumanthaiah, Chief Minister of the then Mysore State was responsible for the concept, the structure and the setting of this building. Built entirely from Bangalore granite in the Dravidian style, it has floral motifs on stone carvings drawn from the celebrated temple craft of South India.

Cubbon Park

In 1864, Lord Cubbon, the then viceroy of India, laid out 300 acres of verdant tranquility. Complementing the natural beauty of the park are the red Gothic structures of the State Central Library and the High Court.

Attara Kacheri (High Court)

Attara Kacheri literally means "eighteen offices" or departments. In 1864, Commissioner Bowring conceived and prepared the plans for setting up a full-fledged courthouse building. It is an impressive two-storied building of stone and brick, red in color and has been built in the Greco-Roman style.

Seshadri Iyer Memorial Hall

The red building with gables, in Cubbon Park, was built to commemorate Sir K.Seshadri Iyer, who was the Dewan of Mysore State from 1883 to 1901. The building with the statue in front forms a focal point of a long avenue coming from Hudson Circle

Museum

The State Archeological Museum is also a red Greco-Roman building. The original block was designed and built by Colonel Sankey, in 1876. Several wings have been added in the later years, all of which conform to the parent style. The original collection in the museum belonged to B. L. Rice of the Mysore Gazetteer.

Lalbagh Gardens

Hyder Ali and Tipu Sultan laid out the 240-acre gardens during the 18th century. They contain a large collection of rare tropical and sub-tropical plants, century-old trees, fountains, terraces, lotus pools, rose gardens, and

a deer park. Lalbagh has a magnificent glass house built in 1840, on the lines of London's Crystal Palace.

Visvesvaraya Industrial & Technological Museum

The museum is a tribute to Sir M. Visvesvaraya, one of the architects of modern Karnataka. There is a comprehensive range of exhibits on electronics, motor power, and the uses and properties of wood and metal, with display of an airplane and steam engine in its compound.

Jawaharlal Nehru Planetarium

Founded in the year 1989, to commemorate the birth centenary of Jawaharlal Nehru, the Planetarium aims to introduce an awareness of astronomy. The sky theater with a dome of fifteen meters in diameter has a seating capacity of 225. It also has an observatory with a professional six-inch code refractor telescope.

Bull Temple

The Bull Temple is famous its awesome monolithic deity of Nandi, the celestial bull, carved out in the typical Dravidian style of architecture. The size of the structure is 4.57 meters in height and 6.10 meters in length.

St. Mary's Basilica

The Church situated opposite the Russel Market Square was built as a small chapel in 1818 by Abbe Dubois, but was later converted into an ornate Gothic style Church by Rev. L.E.Kleiner. By 1882 a large number of stained glass windows from Paris adorned the Basilica, but these were removed during World War II. These were restored in 1947.

Ulsoor Lake and Sankey Tank

Ulsoor lake is centrally located, extended over an area of 125 acres and was constructed by Kempe Gowda during the second half of the second century.

Sankey tank was one of the tanks that played an important ecological role in maintaining the health and beauty of Bangalore. Major Sankey, the architect of the High Court, built it more than 100 years ago. A picturesque expanse of green lined, sky blue water and the surrounding park makes

it a tourist attraction.

2. Strategy for Improvement

Tourism, when promoted efficiently, would be a growth engine for the entire State, with proven examples across the world of economies thriving only on this sector. At the same time, it is imperative that the heritage structures are preserved from the impacts of rapid urbanization. Key activities include:

- Branding and "top-of-the-mind" recall
- Promotional activities for establishing the image of the city as a tourist destination;
- Developing the image of the city as a health and wellness centre
- Promotion of theatre festivals, Bangalore Habba, museums in the city
- Promotion of Meetings, Incentives, Conventions and Exhibitions (MICE) related tourism
- Setting in place efficient support infrastructure including key transport linkages – air, road and rail
- Promotion of theme based tourism, travel circuits, and new attractions
- Private participation in provision of infrastructure facilities
- Develop adequate support infrastructure viz., basic amenities, transportation facilities and information kiosks
- Build the capacity of implementing agencies and service providers.

3. Project Identification & Costing

Many tourism projects can be developed by the private sector–particularly with reference to hotels and resorts. However, there are projects in the basic tourism infrastructure area, which may not be directly viable, or may need to be developed as "catalysts" or boosting other tourism related outcomes. The projects taken up in the following section refer to this latter category.

3.1. Project Identification

Renovation of Heritage Buildings

It is proposed to renovate the 300 heritage buildings in the City in two equal phases at an estimated expense of Rs. 15 lakh per building for renovation.

Development of Cultural Centers, Convention Centers, Budget Hotels

- It is proposed to develop nine cultural centers during the JNNURM implementation period at an estimated expenditure of Rs. 1 Crore for each cultural centre
- It is proposed to develop four convention centers during the JNNURM implementation period at an estimated expenditure of Rs. 4 Crore for each convention centre
- It is proposed to develop four budget hotels the JNNURM implementation period at an estimated expenditure of Rs. 2 Crore for each hotel.

Construction of Tourist Facilitation Centers

It is proposed to develop twenty tourist facilitation centers during the JNNURM implementation period at an estimated expenditure of Rs. 5 lakh for each centre.

Local Tourist Shuttles

It is proposed to procure Volvo buses under the project at a cost Rs. 65 lakh per unit.

Information Kiosks/ centers

It is proposed to develop nine such projects during the JNNURM implementation period at an estimated expenditure of Rs. 10 lakh for each project.

Construction of Toilets

It is proposed to develop ninety public-use toilets during the JNNURM implementation period at an estimated expenditure of Rs. 2 lakh for each toilet block.

Development of Multi-storied Parking Facilities

It is proposed to develop five parking places during the JNNURM implementation period in an area of approximately 1 acre. Permissible Floor Space Index has been assumed at 2.5 at an average construction cost of approximately Rs.6000 per sqm.

Signage adhering to International Standards

The number of signs required has been estimated as one per 0.75 km stretch of main road at an average construction cost of Rs. 10 lakh per sign.

3.2. Estimated Capital Investment Requirement

The estimates for the Mission period is listed in Table 79.

Table 79: Investment Plan for Tourism & Heritage - JUNNURM Period

Description	Upto 2007-08	2008-09	2009-10	2010-11	2011-12	Total Cost (Rs. Crore)
Capital Expenditure						
Cultural Centre	3.2	1.6	1.6	2.2	2.2	10.8
Local tourist shuttles / circuits / Heritage walks / ticketing	1.2	0.6	0.6	0.8	0.8	3.9
Facilitation centre for tourists	0.4	0.2	0.2	0.2	0.2	1.2
Toilets	6.4	3.2	3.2	4.3	4.3	21.6
Parking Spaces	10.6	5.3	5.3	7.1	7.1	35.3
Information Kiosks/ centers/drinking water	0.4	0.2	0.2	0.2	0.2	1.1
Signage conforming to international tourist	1	0.5	0.5	0.7	0.7	3.3

Description	Upto 2007-08	2008-09	2009-10	2010-11	2011-12	Total Cost (Rs. Crore)
norms						
Renovation of heritage buildings	8.2	4.1	4.1	5.4	5.4	27.0
Convention Centers	2.8	1.4	1.4	1.9	1.9	9.6
Budget Hotel	6.4	3.2	3.2	4.3	4.3	21.6
Development of Bannerghatta Biological park	10.6	5.3	5.3	7.0	7.0	35.0
Total-CAPEX	51.2	25.6	25.6	34.1	34.1	170.4
Operation and Maintenance Expenses	0					
Cultural Centre	1.1	1.7	2.3	2.8	3.4	11.3
Local tourist shuttles/circuits/Heritage walks/ticketing	0	0.0	0.1	0.1	0.1	0.3
Facilitation centre for tourists	0	0.0	0.0	0.0	0.0	0.1
Toilets	0.2	0.3	0.4	0.5	0.5	1.8
Parking Spaces	0.3	0.4	0.6	0.7	0.9	2.9
Information Kiosks/ centers/drinking water	0	0.0	0.0	0.0	0.0	0.1
Signage conforming to international tourist norms	0	0.0	0.1	0.1	0.1	0.3
Renovation of heritage buildings	0.2	0.3	0.5	0.6	0.7	2.3
Convention Centers	0.1	0.1	0.2	0.2	0.2	0.8
Budget Hotel	0.2	0.3	0.4	0.5	0.5	1.8
Development of Bannerghatta Biological park	0.7	1.1	1.4	1.8	2.1	7.0
Total-OPEX	2.9	4.3	5.7	7.2	8.6	28.7
Land Acquisition	0					
Cultural Centre	0.6	0.3	0.3	0.4	0.4	1.8
Toilets	0	0.0	0.0	0.0	0.0	0.2
Parking Spaces	1.4	0.7	0.7	0.9	0.9	4.5
Convention Centers	0.6	0.3	0.3	0.4	0.4	2.0
Budget Hotel	1.4	0.7	0.7	0.9	0.9	4.5
Total-LA	4	2.0	2.0	2.6	2.6	13.0
Grand Total	57.9	31.8	33.2	43.9	45.3	212.1

Source: CDP Bangalore 2006

Table 80 gives the estimated investment requirement in future blocks.

Table 80: Investment Plan for Tourism & Heritage – Vision Period

Description	2013-17	2018-22	2023-27	2028-31	Total by 2031
	In Rs.. Crore				
Capital Expenditure					
Cultural Centre	12.6	6.8	14.0	18.0	62.2
Local tourist shuttles / circuits/Heritage	4.6	2.9	5.5	6.9	23.8

Description	2013-17	2018-22	2023-27	2028-31	Total by 2031
walks/ticketing					
Facilitation centre for tourists	1.4	0.9	1.7	2.1	7.3
Toilets	14.4	31.0	34.6	42.5	144.1
Parking Spaces	41.2	71.9	83.6	109.5	341.5
Information Kiosks/ centers/drinking water	1.3	1.4	2.1	2.5	8.4
Signage conforming to international tourist norms	3.9	23.8	26.0	27.2	84.2
Renovation of heritage buildings	31.5	19.8	37.8	47.7	163.8
Convention Centers	11.2	7.0	13.4	17.0	58.2
Budget Hotel	25.2	7.2	18.0	21.6	93.6
Development of Bannerghatta Biological park	35.0	0.0	0.0	0.0	70
Total- CAPEX	182.1	172.7	236.8	295.0	1057
Operation and Maintenance Expenses					0
Cultural Centre	12.2	3.2	13.5	14.5	54.7
Local tourist shuttles/circuits/Heritage walks/ticketing	0.7	1.6	1.1	1.5	5.2
Facilitation centre for tourists	0.2	0.5	0.3	0.5	1.6
Toilets	2.7	13.0	6.3	8.5	32.3
Parking Spaces	5.9	13.1	17.6	24.7	64.2
Information Kiosks/ centers/drinking water	0.2	1.0	0.3	0.4	2
Signage conforming to international tourist norms	0.6	22.7	0.9	1.3	25.8
Renovation of heritage buildings	4.5	10.8	7.7	10.4	35.7
Convention Centers	1.6	3.8	2.7	3.7	12.6
Budget Hotel	3.6	5.6	6.1	8.3	25.4
Development of Bannerghatta Biological park	14.0	14.0	14.0	14.0	63
Land acquisition	17.4	0.0	0.0	0.0	46.1
Cultural Centre	1.8	0.0	0.0	0.0	14.8
Toilets	0.1	0.0	0.0	0.0	1.9
Parking Spaces	9.0	0.0	0.0	0.0	9.2
Convention Centers	2.0	0.0	0.0	0.0	6.5
Budget Hotel	4.5	0.0	0.0	0.0	6.5
Total-OPEX	46.1	89.3	70.6	87.6	298.1
Grand Total	245.6	262.0	307.3	382.7	1409.7

Source: CDP Bangalore 2006

4. Implementation Framework

The projects shall be implemented by the concerned agencies, using appropriate PPP frameworks. DoT would act as a facilitator for promoting tourism related activities, promoting Habba, and attracting private players.

REVISED CITY DEVELOPMENT PLAN
BANGALORE
2009

SECTION III CITY INVESTMENT PLAN & FINANCIAL SUSTAINABILITY

Jawarharlal Nehru National Urban Renewal Mission

Chapter 12: City Investment Plan & Financial Sustainability

1. Investments in Urban Infrastructure

The following section summarizes the investments in urban infrastructure, over the JNNURM period, as well as the vision period. Investments are also categorized under various heads – expense related and agency related.

1.1. Investments in JNNURM Period

Following from the sector-wise investment analysis in the previous section (Section 2), the summary of the estimated investment requirements for the sectors during the JNNURM period is set out in Table 81.

Table 81: Summary of Sectoral Investments - JNNURM Period (In Rs. Crore)

Item	Upto 2007-08	2008-09	2009-10	2010-11	2011-12	Total
Water Supply and Sewerage	805	1135	2172	1918	2160	8189
Solid Waste Management	164	131	162	162	181	800
Urban Drainage	0	0	0	2306	1537	3843
Urban Renewal	3	3	3	3	3	14
Tourism	58	32	33	44	45	212
Civic Amenities	136	136	136	136	136	678
Roads and road related infrastructure	20796	10398	10398	5199	5199	51991
Basic Services to Urban Poor	385	137	1915	1915	1642	5995
Total	23473	12185	15035	11682	10903	71723

The investments set out in the above table have been estimated based on normative standards. The actual cost of the projects proposed to be implemented would be finalized at the time of preparation of DPRs, which would be posed for financial assistance under the JNNURM scheme.

The investment requirements for the projects have been categorized into four groups namely, capital expenditure, operations and maintenance expenses, costs towards land acquisition, and expenditure on rolling stock. Table 82 sets out the estimated investment requirement in these categories.

Table 82: Breakup of Investments – Category of Expense (In Rs. Crore)

Item	Capital Expenses	O&M	Land Acquisition	Rolling Stock	Total
Water Supply and Sewerage	2835	5331	24	0	8189
Solid Waste Management	293	264	27	216	800
Urban Drainage	3128	715	0	0	3843
Urban Renewal	12	2	0	0	14

Item	Capital Expenses	O&M	Land Acquisition	Rolling Stock	Total
Tourism	170	29	13	0	212
Civic Amenities	559	112	7	0	678
Roads and road related infrastructure	39420	3205	3191	6175	51991
Basic Services to Urban Poor	4796	1199	0	0	5995
Total	51214	10857	3261	6391	71723

1.2. Investments during Vision Period

While the above tables set out the estimated investment requirements for the JNNURM period (2007-2012), the development activities would continue in future years and the Vision for the City has been accordingly envisaged for a period of 25 years (till 2031). The capital investment requirements for the Vision period are set out in Table 83

Table 83: Summary of Sectoral Investments – Vision Period (In Rs. Crore)

Item	2013-17	2018-22	2023-27	2028-31	Total
Water Supply and Sewerage	6015	7444	8572	9542	31572
Solid Waste Management	949	1099	1270	1462	4780
Urban Drainage	1149	433	617	801	3000
Urban Renewal	17	19	22	24	82
Tourism	246	262	307	383	1198
Civic Amenities	411	308	205	103	1027
Roads and road related infrastructure	51991	15322	1410	0	68723
Basic Services to Urban Poor	2570	1028	1028	514	5140
Total	63348	25915	13431	12828	115522

1.3. Agency-wise Breakup of Investments

The projects identified under the sectors shall be implemented by different agencies, and the summary of investment requirements for different agencies is set out in Table below.

Table 84: Summary of Investments – Agency-wise Breakup (In Rs. Crore)

Agency	Water Supply & Sewerage	Solid Waste Management	Roads, transport and traffic	Urban poor slums improvement	Other Projects	Total
BBMP	-	800	8630	5995	3985	19410
BWSSB	8189	-	-	-		8189
BDA	-	-	879	-		879
BMTC	-	-	6267	-		6267
DoT	-	-	-	-	212	212
LDA	-	-	-	-	130	130
Other Agencies	-	-	36215	-	420	36635
Total	8189	800	51991	5995	4748	71723

*The expenditure towards BSUP component has been assumed to be funded by BBMP. However, BBMP, Karnataka Slum Clearance Board, Karnataka Housing Board, and the other concerned ULBs would actually source the fund requirements for the project.

1.4. Prioritization of Projects

Cities exist for its citizens, and the governance structure has to serve the citizens based on their needs and expectations. As discussed earlier, multiple stakeholder consultations were conducted, each commencing with a perspective of the vision of the City. The summary of the discussions and the inputs obtained from feedback forms (circulated physically, and made available on the internet) have provided a basis for the prioritization of projects.

1.4.1. Stakeholder Discussions

The city needs simultaneous interventions on various urban services to upgrade the quality of life. The emphasis on these interventions could be varied with some sectors yielding significant gains with appropriate governance frameworks, while most others would need infusion of capital. In a metropolis like Bangalore, these issues are always on the forefront, resulting in a competitive dynamics of various service providers. However, given the constraints imposed by available finances, ability to collect user fees, and prevailing governance structures, the interventions would need to be prioritized. The following emerge as the priorities from these consultations:

Storm Water Drains

The key activities include construction & rehabilitation of roadside drains, remodeling and strengthening, clearing silt, constructing of walls, laying of beds, provision of enabling & awareness information architecture and green area development.

Improvement of road and related infrastructure

These include ring roads, improvements in key existing roads, railway over/under bridges, road drainage system, high capacity bus systems, grid route systems, dedicated bus lanes, rail link to international airport, development of commuter railway system and the metro rail.

Rehabilitation of Urban poor

The rehabilitation of urban poor includes the provision of basic services including housing, internal roads, solid waste management, street lighting, community toilets and halls

Water supply & sewerage

The key priorities would be rehabilitation of bulk, transmission and distribution systems, and increase in service coverage.

Municipal Solid Waste Management

MSWM would include improvement in collection and transportation coverage and efficiency and development of treatment and disposal facilities.

2. Financial Sustainability Analysis

This section presents the financial operating plan for each agency (BBMP, 7 CMCs and 1 TMC, BDA, BWSSB, and BMTC) comprising the status of finances, drivers of growth, and the projections for the plan period. The analysis is based on discussions with respective officials and estimated benefits to the agencies due to reforms, resource mobilization, improved revenues, and implementation of efficient practices.

2.1. Status of BBMP Finances

Table 85 presents status of finance of BBMP

Table 85: Status of BBMP Finances (Rs. Crores)

Item	2005-06	2006-07	2007-08	2008-09
Revenue Account				
Income	611.98	759.05	1341.97	1410.52
Expenditure	389.31	367.28	584.04	677.58
Surplus (Deficit)	222.67	391.77	757.93	732.94
Capital Account				
Receipts	211.33	447.00	592.37	877.79
Payments	439.68	633.37	1053.52	1511.77
Surplus (Deficit)	(228.35)	(186.37)	(461.15)	(633.98)
Net	(5.68)	205.4	296.78	98.96

Source: BBMP

- Despite an overall deficit, BBMP maintains a cash surplus because of its resource base taking into account the changes in current assets and liabilities.
- BBMP's operational income comprises property tax, Cess on the same, penalty payments, improvement charges, charges for khatha certificate, stamp duty, rents from leased properties and parking fees.
- Property tax comprises approximately half of the operating income and about 30% of total receipts (revenue and capital receipts).
- Increase in property tax due to various measures including SAS scheme and widening of tax base
- Decline in revenues from stamp duty due to the downward revision of the same
- Corresponding increase in salaries and general administrative expenses has resulted in a deficit.
- Given that grants from GoK are being used primarily used for salaries, BMP continues to rely on loans from financial institutions for implementing capital works compared to internal funds.
- Grants have increased by 137% primarily due to the increase in SFC devolutions.

- There is a drop of 96% in user fee due to the withdrawal of the pay and park system
- Increase in administrative expenses is primarily due to the 10 - fold increase in electricity charges.

2.1.1. Forecast of BBMP Finances

The forecast of BBMP finances are set out in Table 86.

Table 86: Forecast of BBMP Finances (in Rs. Crores)

Item	2009-10	2010-11	2011-12	2012-13
Revenue Account				
Income Surplus	1863.20	2461.16	3251.03	4294.39
Expenditure	815.05	980.40	1179.30	1418.56
Surplus (Deficit)	1048.16	1480.76	2071.73	2875.84
Capital Account				
Receipts	1411.022	2268.177	3646.029	5860.886
Payments	2281.754	3443.91	5197.982	7845.448
Surplus (Deficit)	-870.731	-1175.73	-1551.95	-1984.56
Net	177.42	305.03	519.78	891.27

2.2. Status of BWSSB Finances

The status of BWSSB finances is set out in Table 87

Table 87: Status of BWSSB finances (in Rs. Crores)

Item	2005-06	2006-07	2007-08	2008-09
Revenue Account				
Income Surplus	437.29	487.21	486.94	536.48
Expenditure	451.01	509.31	529.22	594.32
Surplus (Deficit)	(13.72)	(22.1)	(42.28	(57.84)
Capital Account				
Receipts	44.32	94.37	200.94	427.86
Payments	92.1	46.12	164.18	155.4
Surplus (Deficit)	(47.78)	48.25	36.76	272.46
Net	(61.5)	26.15	(5.52)	214.62

Source: BWSSB

- Water revenues have increased due to revision of tariffs over the past years (44% for domestic connections over last 3 years on a weighted average)
- Power charges accounting for 45 - 50% of expenses have also increased due to increase in pumping capacity coupled with increase in power tariffs. Increase in expenses is also due to increased debt servicing.

2.2.1. Forecast of BWSSB Finances

- BWSSB has been implementing water supply and sewerage schemes in Bangalore with multilateral assistance and capital receipts are likely to increase with increased demand due to population growth and growth drivers mentioned below.
- Key growth drivers include the following:

  Proposed increased role of BWSSB to provide water supply and sewerage services in Bangalore metropolitan region and thereby increased coverage

  Increased consumer base and number of connections

  Implementation of cost - recovering tariffs

  Reduction of unaccounted for water quantum

  Implementation of energy efficiency programs which would reduce the energy cost which account for 50% of the expenses

  Capital receipts are expected to increase due top increased capital expense for increased service coverage and supply augmentation. For the purpose of projections of the receipts under capital account, the rate of escalation is stagnated at 10%

Table 88 shows the financial projections for BWSSB, based on the indicated growth drivers.

Table 88: Forecast BWSSB Finances (in Rs. Crores)

Item	2009-10	2010-11	2011-12
Revenue Account			
Income Surplus	574.31	614.81	658.17
Expenditure	651.58	714.35	783.17
Surplus (Deficit)	(77.26)	(99.54)	(125.00)
Capital Account			
Reciepts	492.04	565.85	650.72
Payments	185.00	220.25	262.21
Surplus (Deficit)	307.04	345.60	388.52
Net	229.77	246.06	263.52

2.3. Status of BMTC Finances

Table 89 presents the finances of BMTC.

Table 89: Status of BMTC Finances (in Rs. Crores)

	2002 - 03	2003 - 04	2004 - 05	2005 – 06
Receipts				
Traffic Revenue	341	441	506	615
Other Revenue	31	42	66	95
Total Revenue	373	483	572	710
Expenses				
Salaries	120	132	141	153
Fuel	87	101	144	185
Other Consumables	15	15	19	21
General Administration	9	12	15	20
Others	112	145	171	212

	2002 - 03	2003 - 04	2004 - 05	2005 – 06
Total Expenses	345	406	492	591
Surplus / (Deficit)	28	77	80	119

Source: CDP Bangalore 2006

- The final details of BMTC for the year 2007 - 08 were not available at the time of preparation of this report.
- Traffic revenues accounting for 90% of revenues have increased due to increase in tariffs, number of services and coverage.
- The increase in number of services and coverage has resulted in corresponding increase in salaries and fuel expenses.
- The increase in fuel expenses (68% over last 3 years and 40% over the last 2 years) over the past years has resulted in the same becoming the largest component in expenses.
- BMTC financial statements are in the form of a balance sheet and profit and loss account and hence do not have opening and closing balances.

2.3.1. Forecast of BMTC Finances

The key aspects likely to impact the future growth include the following:

- The increasing population would necessitate the increase in bus services and coverage
- Key growth drivers include:
  - Various measures being implemented including the introduction of Volvo bus services and grid – services
  - Growth in population resulting in more users
  - Possible feeder services upon implementation of mass rapid systems
- The growth in traffic revenues is assumed to follow the past trend and so are fuel expenses and salaries.

Table 90 presents the financial projections based on the above drivers.

Table 90: Forecast of BMTC Finances (in Rs. Crores)

	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
Receipts						
Traffic Revenue	749	911	1,109	1,349	1,641	1,997
Other Revenue	138	201	292	424	615	892
Total Receipts	888	1,113	1,401	1,773	2,256	2,889
Expenses						
Salaries	165	179	193	210	227	246
Fuel	236	302	387	496	635	813
Other Consumables	24	27	30	34	38	42
General Administration	26	34	44	57	73	95
Others	263	325	402	498	616	762
Total Expenses	715	868	1,058	1,295	1,591	1,960
Surplus / (Deficit)	172	244	342	477	665	928

Source: CDP Bangalore 2006

2.4. Status of BDA Finances

presents the summary of finances of BDA.

Table 91: Status of BDA Finances (in Rs. Crores)

	2001 – 02	2002 - 03	2003 – 04	2004 – 05	2005 – 06
Opening Balance	120	294	695	611	959
Revenue Receipts	40	58	84	151	182
Revenue Expenses	42	34	33	33	35
Capital Receipts	223	398	384	286	315
Capital Expenses	148	225	300	232	255
Other Receipts					
Loans / Advances	67	113	42	45	47
Deposits	129	316	444	974	1,004
Other Expenses					
Loans / Advances	17	18	116	23	24
Deposits	78	205	588	820	845
Revenue Surplus / (Deficit)	(2)	24	51	118	147
Capital Surplus / (Deficit)	75	173	84	54	60
Other Surplus / (Deficit)	101	206	(218)	176	182
Overall Surplus / (Deficit)	174	403	(83)	348	389
Closing Balance	294	695	611	959	1,347

Source: CDP Bangalore 2006

- The financial details of BDA for the year 2007 - 08 were not available at the time of preparation of this report.
- ICRA Ratings Limited has published a credit perspective for Bangalore Development Authority. The key strengths identified include authority to acquire and develop land in Bangalore metropolitan region, inventory of high value auction sites and existing healthy cash and bank balances, key concerns include rising land acquisition and development cost, increasing capital works being funded by BDA's internal funds and sensitivity of managerial autonomy to political environment.
- BDA's site development activity has renewed again post resolution of dispute regarding Arkavathi Layout. BDA's strength also lies in the inventory of corner sites it retains for auction in future. While, reducing supply of land is likely to impact BDA, the proposed Master Plan 2015 of BDA intends to make available 189 sq. km. for urban development. BDA also proposes to develop sites on joint venture basis and augment revenues from commercial complexes.
- Growth in capital receipts has been due to the implementation of large infrastructure projects including site / layout development and construction of flyovers, grade separators and other urban infrastructure projects.
- A large increase in deposits has resulted due to increased demand of sites, which is likely to continue in the future.

2.4.1. Forecast of BDA Finances

- Revenues of BDA have been increasing rapidly (in excess of 40% CAGR) due to the:
  - Demand for sites
  - Corresponding deposit flow into BDA
  - Increasing real estate prices
- Key growth drivers in the future include:
  - Growth in natural and migratory population
  - Release of additional land (189 sq. km.) for urban development by the proposed CDP
- Inventory of corner sites and other sites located in prime location likely to fetch increased revenues through commercial exploitation

Table 92 shows the financial projections based on the above drivers.

Table 92: Forecast of BDA Finances (in Rs. Crores)

	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
Opening Balance	1,347	1,780	2,269	2,821	3,449	4,165
Revenue Receipts	218	262	314	377	453	543
Revenue Expenses	37	39	41	43	45	48
Capital Receipts	347	382	420	462	508	559
Capital Expenses	281	309	340	374	412	453
Other Receipts						
Loans / Advances	50	52	54	57	60	63
Deposits	1,034	1,065	1,097	1,130	1,163	1,198
Other Expenses						
Loans / Advances	26	27	28	29	31	33
Deposits	870	896	923	951	980	1,009
Revenue Surplus / (Deficit)	181	222	273	334	407	496
Capital Surplus / (Deficit)	65	72	79	87	96	106
Other Surplus / (Deficit)	188	194	200	207	212	220
Closing Balance	1,780	2,269	2,821	3,499	4,165	4,987

Source: CDP Bangalore 2006

3. The Financing Plan

The CIP sums up the investment requirements for the City in the period of the CDP horizon. This investment ('Project Cost') will be financed through various sources ('Means of Finance'). The means of finance will, inter-alia, be:

- Funding under the JNNURM in the JNNURM tenure (the first block period), will be 35% of the project cost. For Basic Services for Urban Poor projects, the eligible funding is 50%. There are certain excluded items such as land, which are not considered under the JNNURM finance for Urban Infrastructure Projects.
- State contribution, which is 15% of the eligible project cost;

- State contribution, beyond the JNNURM co-financing, i.e., over 15%;
- Surpluses of the implementing agencies, which have been estimated in the previous section;
- Private sector finances, or PPP projects;
- Borrowings by the implementing agencies/other stakeholders from banks and institutions;
- Capital market borrowings by the implementing agencies;

The financing plan has been prepared and is as set out in the Table below;

3.1. Project Cost including Expenditure

Table 93 presents the summary Project Cost and Means of Finance in this scenario.

Table 93: Financing Plan

	2010-2011	2011- 12
Total Project Cost	11682	10903
Amount to be funded under JNNURM (Share of Central Government and State Government). This amount includes only the eligible costs, excluding land, rolling stock, etc.	5841	5451
Share of Central Government in eligible amount	4376	4062
Share of State Government in eligible amount	1465	1389
Amount to be funded by BMP and other agencies, which includes the co-financing share of 50% of the eligible amount, as well as ALL other costs towards land acquisition, rolling stock, etc.	5841	5451
Budgetary Surplus of BBMP and other agencies carried forward over the years	5538	6988

4. Conclusions

For Bangalore, the funding structure under JNNURM is 35% from GoI, 15% from State Government, and 50% from ULB/para-statal own sources or from commercial capital/ borrowings. There is a clear connection between the aspect of reform and the ability to raise commercial finances and deliver infrastructure services:

- The budgetary surplus indicated above table is the summation of all the agencies as stated in the respective projections.
- On an aggregate basis, it appears that financing requirements as projected in the CDP could be met by the surpluses of the implementing agencies, and that there is no requirement of market borrowing. These projections assume significant structural and operational reform implementation.

- However, the entire surplus would not be available for projects under JNNURM, as each agency could be implementing projects outside of JNNURM. Moreover, each agency may need to look at market borrowings to finance the respective projects also.
- As cross-subsidization of financing of the projects being implemented by different agencies is not envisaged, the actual fund surpluses for each of the implementing agencies for the projects being developed by them would need to be detailed out during the process of preparation of DPR. The fund requirement would be substantiated in the financial sustainability analysis in the DPR prepared for projects being posed for JNNURM funding.

REVISED CITY DEVELOPMENT PLAN
BANGALORE
2009

SECTION IV INSTITUTIONAL REFORM

Urban Governance Framework
Governance Structures & Reform Agenda

Jawarharlal Nehru National Urban Renewal Mission

Chapter 13: Urban Governance Framework

In the Indian context, there is no clear "owner" department or ULB for the metropolises/ mega-cities, and the same situation exists in Bangalore. This chapter discusses the institutional and legal framework in the City's governance, and the functional areas and overlaps.

1. Institutions in Bangalore

Institutions in the City are

1. Local Authority / Elected ULB
2. Statutory Authorities and
3. Government Departments.

Elected ULB

BBMP (City Corporation)

Statutory Authorities

1. Bangalore Development Authority (BDA)
2. Bangalore Metropolitan Region Development Authority (BMRDA)
3. Bangalore Water Supply & Sewerage Board (BWSSB)
4. Bangalore Metropolitan Transport Corporation (BMTC)
5. Lake Development Authority
6. Karnataka Slum Clearance Board (KSCB)
7. Karnataka Urban infrastructure Development and Finance Corporation (KUIDFC)
8. Bangalore International Airport Area Planning Authority (BIAAPA)
9. Bangalore Metropolitan Land Transport Authority (BMLTA)
10. Bengaluru Traffic Improvement Programme (B-TRAC)

Government Departments

A number of regulatory and development departments, including the Police Department, Public Works Department, Health Department, Education Department, Revenue Department, Town Planning Department, Horticulture Department, Motor Vehicles Department, et-al, also have an interplay in the metropolitan area.

1.1. Bruhat Bangalore Mahanagara Palike

The Bruhat Bangalore Mahanagara Palike (BBMP) (City Corporation) as it exists today represents the traditional form of local government. The City Municipality and Cantonment Municipality were amalgamated to form the Corporation of the city of Bangalore in December 1949. The erstwhile BMP was merged with the 7 CMCs, 1 TMC and 110 villages to form the Bruhat Bangalore Mahanagara Palike in 2007. The Corporation area is divided into 198 wards, with elected "Councilors."

1.2. Bangalore Development Authority

Bangalore Development Authority (BDA) was constituted on 16 January 1976 under the Act of State Legislature. The mission of BDA is to control, monitor, and facilitate urban development in Bangalore Metropolitan Area to ensure sustainable and orderly growth. Its brief is to develop plans, create quality infrastructure, provide sites, and integrated urban environment improvement.

1.3. Bangalore Metropolitan Transport Corporation

BMTC was incorporated in 1997 as a separate entity having been bifurcated from its parent body KSRTC. Apart from ferrying lakhs of Citizens from home to work and back in the City proper, BMTC operates its bus services in 400 villages in a 25-km radius around the City.

1.4. Bangalore Water Supply and Sewerage Board

BWSSB was constituted under the Act of the Karnataka State Legislature on 2nd October 1964. BWSSB is responsible for providing drinking water to the City and village areas. It maintains about 6000 km. of existing water distribution lines and 4000 km. of underground sewerage lines.

1.5. Lake Development Authority

The Lake Development Authority (LDA) is an autonomous regulatory, planning and policy body for protection, conservation, reclamation, restoration, regeneration, and integrated development of lakes, whether natural or man-made in the state of Karnataka. It is a non-profit organization working solely for the regeneration and conservation of lakes within BMRDA jurisdiction.

1.6. Karnataka Urban Infrastructure Development and Finance Corporation

KUIDFC was set up in 1993 to assist the urban agencies in the state in planning, financing, and providing expertise to develop urban infrastructure. KUIDFC is the nodal agency for the externally aided projects and the centrally sponsored Mega City Scheme.

1.7. Karnataka Slum Clearance Board

The KSCB was constituted in July 1975 under the provisions of the Karnataka Slum Areas (Improvement and Clearance) Act 1973. The functions of the Karnataka Slum Clearance Board include rehabilitation of all the declared slum areas in the jurisdictions of the City Corporation in the State.

1.8. Bangalore Metropolitan Region Development Authority

BMRDA is an autonomous body created by the Government of Karnataka under the BMRDA Act 1985 for the purpose of planning, coordinating, and supervising the proper and orderly development of the areas within the Bangalore Metropolitan Region (BMR) which comprises Bangalore urban district and Bangalore rural district.

1.9. Bangalore International Airport Area Planning Authority

Sanction of land-use of the airport area is vested with the BIAAPA, an authority set up for the Devanahalli new international airport project. BIAAPA is expected to review the construction plans, land-use planning, building plans, and other parameters, and ensure that safety norms are followed.

1.10. Bangalore Metropolitan Land Transport Authority (BMLTA)

The BMLTA was created to co-ordinate all land transport matters in Bangalore Metropolitan Region (BMR). GoK through KUIDFC initiated a Comprehensive Traffic and Transportation Plan (CTTP) for Bangalore and its peripheral areas. The Directorate of Urban Land Transport would act as the secretariat for BMLTA which is created as unified metropolitan transport authority. From the review of the CTTP and the rising demands towards easing mobility and accessibility of the BMR, the need is felt to initiate independent studies to fill certain gaps are not captured in CTTP.

1.11. Bangalore Traffic Improvement Programme (B-TRAC)

B-TRAC was created to improve the traffic management in Bangalore. Since many of the arterial roads and intersections are operating at over-capacity and average journey speeds on some of the key roads in the central area is less than 10 kmph in the peak hour. Overall objective of the B-TRAC program is to reduce traffic congestion in the core area, abate the number of accidents, reduce pollution, monitor compliance of laws, and provide emergency services.

2. Planning & Development Laws

A number of Acts and Legislations govern the planning and development in the Bangalore Metropolitan Region. These are briefly outlined in the following section.

The Karnataka Town & Country Planning Act 1961

The Karnataka Town & Country Planning Act aims at providing for planned regulation of growth, development, and land use, for formulation and execution of town planning schemes.

The Bangalore Development Authority Act, 1976

The Bangalore Development Authority Act was primarily aimed at establishing a Development Authority for the city of Bangalore and its adjoining areas. However, by an amendment to the Karnataka Town & Country Planning Act, the BDA has been made the Local Planning Authority for the Local Planning Area comprising the city of Bangalore & adjoining areas. The BDA thus functions as the Planning Authority in addition to being a Development Authority.

The Bangalore Metropolitan Region Development Authority Act, 1985

The objective of the Bangalore Metropolitan Region Development Authority Act are to establish an Authority for the purposes of planning, coordination, and supervision of the proper and orderly development of the areas coming under the Bangalore Metropolitan Region, which covers the Bangalore District. The main functions of the BMRDA are to carry out a survey of the region, and to prepare a structure plan for the development of the Bangalore Metropolitan Region. It may also formulate schemes to implement the Structure Plan, and entrust to any Local Authority the task for execution of any Town Planning Scheme.

Municipal Laws

- The Karnataka Municipal Corporation Act, 1976
- The Karnataka Municipal Councils Act, 1964

Law Relating to Land & Accommodation

- The Land Acquisition Act, 1894
- The Karnataka Land Reforms Act, 1961
- The Karnataka Land Revenue Act, 1964
- The Urban Land Ceiling & Regulation Act, 1976 - REPEALED vide Urban Land (Ceiling & Regulation Act 1999)
- The Karnataka Housing Board Act, 1973
- The Karnataka Rent Control Act, 1962 - AMENDED by the Karnataka Rent Act 1999
- The Karnataka Slum Areas (Improvement and Clearance) Act, 1973
- The Karnataka Apartment Ownership Act, 1972
- The Karnataka Public Premises (Eviction of Unauthorized Occupants) Act, 1971
- The Karnataka Industrial Areas Development Act, 1966

Pollution Control Laws

- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention & Control of Pollution) Act, 1981
- The Environment (Protection) Act, 1986

Other Laws

- The Indian Registration Act, 1908
- The Karnataka Police Act, 1963
- The Motor Vehicles Act, 1939
- The Cinematography Act, 1952
- The National Highways Act, 1988
- The Karnataka Stamp Act, 1957

As discussed in Chapter 2, there is plethora of legislations and a number of institutions that operate in the Bangalore Metropolitan area, which impact the process of urban management. Since the jurisdictions, legislative frameworks, and functional areas of

the institutions overlapping in many cases, there are issues of discord and lack of clarity. Table 94 shows the functional areas of various institutions, and the overlaps.

Table 94: Functional Areas of Various Institutions

Functions	Agency	Accountability structure	Entries in the Lists II and III of the Seventh Schedule
Urban Planning including town planning	BDA, BMRDA	State Government, Board	Entry 18 of List n
Regulation of land-use and construction of buildings	BDA, BMRDA, BBMP	State Government, Board, BBMP	Entry 18 of List II Entry 20 of List II
Planning for economic and social development	State Government	State Government	Entry 20 of List m
Roads and bridges	BDA, BBMP	State Government, Board, BBMP	Entry 13 of List II
Water supply for domestic, industrial and commercial purposes	BWSSB	State Government, Board	Entry 17 of List II
Public health, sanitation conservancy and solid waste	BWSSB (Sewerage), BBMP	State Government, Board, BBMP	Entry 6 of List II
Fire services	Fire Department	State Government	Entry 6 of List II
Urban forestry, protection of the environment and promotion of ecological aspects	Deputy Conservatory of Forests (Urban), Bangalore. Forest Department	State Government	Entry 17 of List III
Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded	Department of Social Welfare, Directorates	State Government	Entry 9 of List II Entry 16 of List m
Slum improvement and upgradation	KSCB, BDA, BBMP	State Government, Board, BBMP	Entry 6 of List II
Urban poverty alleviation	DMA, BBMP	State Government, BBMP	Entry 11 of List III
Provision of urban amenities and facilities such as parks, gardens, playgrounds	BBMP, BDA (New Layouts)	BBMP, State Government	Entry 18 of List II Entry 20 of List III
Promotion of cultural, educational and aesthetic aspects	Department of Kannada & Culture, Department of Education	State Government	Entries 12, 33 Of List II Entry 25 of List III
Burials and burial grounds, cremations, cremation grounds and electrical crematoriums	BBMP	BBMP	Entry 10 of List II
Cattle pounds: prevention of cruelty to animals.	BBMP	BBMP	Entry 15 of List n Entry 17 of List III

Functions	Agency	Accountability structure	Entries in the Lists II and III of the Seventh Schedule
Vital statistics including registration of births and deaths.	BBMP	BBMP	Entry 30 of List III
Public amenities including street lighting parking lots, bus stops and public conveniences.	BBMP, BDA (New Layouts)	BBMP, State Government, Board	Entry 5 of List II Entry 20 of List III
Regulation of slaughter houses and tanneries.	KAMPCO, BBMP	BBMP, State Government, Company	Entry 15 of List II

2.1. Issues Arising from Functional Overlaps

Following the discussion on functional areas in the previous section, the issues related to overlaps and lack of clarity are presented in the following:

- Slums-The improvement and clearance of slums is governed by the Karnataka Slums (Improvement & Clearance) Act 1973. In Bangalore, there are three organizations dealing with this matter - the BBMP, the KSCB, and the BDA. Though each of them is expected to take care of the slums coming under its jurisdiction, this arrangement has led to confusion, particularly in areas of doubtful jurisdiction.
- Street Lighting-In respect of street lighting, while the BBMP carries out the obligatory functions to meet the related expenditure, the functioning of lights and supply of power is with the BESCOM, which leads to divided responsibility.
- Traffic Management-The area of traffic management, which is a problem in the city, is with the Traffic Police department. However, the funds for installation of traffic signals, lane marking, etc., are provided by the BBMP.
- Road Maintenance: Maintenance of roads is the responsibility of BBMP, BDA, or PWD, depending on the location/ jurisdiction.
- Special Institutions-The managerial responsibility in "special areas" that were formed for specific purposes is also an area of concern. For instance, the HAL Sanitary Board and the ITI Notified Area Committee are two non-elected bodies constituted under the Karnataka Municipalities Act 1964. Technically, they function outside the jurisdiction of the BBMP, and were meant to take care of the civic needs of the industrial areas. However, today there is a considerable non-industrial load, and a number of unauthorized constructions coming up because of the weak monitoring and enforcement ability of these bodies.
- Management of Fringe Areas-There are several legal complexities in the management of fringe areas. Several laws operate here - the Land Revenue Act, the Land Reforms Act, and the KTCP Act. Enforcement of these laws is done by different authorities like the Revenue Department, the Special Deputy Commissioner, and the BDA. While the citizen is put to hardship to obtain approvals from these Authorities, the Authorities also face problems in complying with the many legal provisions, particularly against those who transgress the law.

2.2. Options for Addressing Functional Issues

In the context of these inconsistencies, overlaps, organizational conflicts, managerial voids, and legal complications, there are several options that are being considered:

- Redefining the roles of the major urban authorities in the Bangalore Metropolitan Area, with particular reference to the BBMP, BDA, and BMRDA, to meet the challenges of future metropolitan management
- Tackling the managerial voids in the peri-urban/ suburban areas of Bangalore
- Introducing necessary legal reforms to meet the new planning and developmental needs of the Bangalore Metropolitan Region
- Ensuring transparent processes, with citizen participation, in the City's planning & governance.

The details of some of these options are discussed in the subsequent chapter.

3. Metropolitan Governance

The term Local Self Government implies an important role for people in governing their local affairs. However, as the City has grown, so has the authority of the Government/ Statutory Agencies. The citizen is thus at a distance from the governing bodies. It is also true that local governance has become more complex, and that Governmental agencies may not be in a position to find solutions for all local problems. Hence, there is a need for initiatives from people, and non-Governmental Organizations.

The cities are managed by Local Self Government historically. At the time of 74th CA, many out of 18 services were being delivered by para-statals such as boards, authorities, companies, and State departments. These para-statals, which were created for efficient service delivery, do not have local elected representatives at board level for consultations and decision-making. This arrangement has resulted in a peculiar accountability structure where local representatives of the City Corporation along with Corporation Administration stand accountable to the user citizens for the services offered by para-statals - in which they have no role to play.

In India, traditionally, the Municipal Acts listed the functions of ULBs under two categories, namely, "Obligatory Functions" and "Discretionary Functions." The 74th CAA, however, has listed 18 (illustrative) functions and proposed that the State Legislatures may specify, by law, those which they choose to include in their respective municipal enactments. The Twelfth Schedule of 74th CAA provides the basis for State Legislatures to assign functions to the municipalities in their respective States.

Managing a modern metropolis and "mega-city" is an extremely complex function. The structure of the Government in metropolitan cities envisages an entirely new scheme of things, and may need a comprehensive legislative basis under the 74th CAA. This could be a separate legislation in respect of Bangalore, which can incorporate all aspects of municipal government, the political and administrative structure, the functional domain, and the fiscal arrangements.

3.1. The Planning Needs of Metropolitan Region

The City Development Plans (Master plan) exercises of planning bodies such as BDA and BMRDA are related largely to land-use plans. In future, the objective should be to achieve integration of spatial, economic, social, transportation, and ecological planning. It should include new concepts relating to town planning, land-use controls, and management of urban fringes:

- The KTCP is nearly 30 years old and is out of tune with modern developments, to meet the future needs of urban growth. It is, therefore, necessary to have a single comprehensive legislation which deals with all aspects of urban planning including regional planning.
- The hierarchical relationships between various institutions (municipal and non-municipal) should be brought out with a view to eliminating overlapping jurisdictions and conflicts.
- Necessary legal support must also be provided to implement the new strategy proposed to overcome the deficits in economic, social, and civic infrastructure. This would involve amendments to certain existing laws like the Land Acquisition Act.
- Management of ecology/environment should also form part of planning a metropolis. Although there are separate central laws to deal with pollution air, water, and environment it would be useful to include suitable provisions in the State Planning Act, as it would make the implementation of these laws more effective.
- Similarly, policies relating to industrial location, including phasing out obsolete industries, and recycling of industrial lands, must form part of planning legislation.

The aim is to integrate these fragmented components, into the urban planning process, so that there is a unified approach to planning of the Bangalore Metropolitan Region.

4. Linkage of Reforms to Projects

For Bangalore, the funding structure under JNNURM is 35% from GoI, 15% from State Government, and 50% from ULB/para-statal own sources or from commercial capital/ borrowings. There is a clear connection between the aspect of reform and the ability to raise commercial finances and deliver infrastructure services. While the details of JNNURM specific reforms are discussed in the subsequent chapter, some of the linkages are outlined here.

Creation of Decentralized Capacity

The unique challenge for the Urban Sector stems from the capacity required at the decentralized levels to successfully implement projects and provide the services. As extensively discussed in the vast body of literature on decentralization and economies of scale, administrative convenience often has veered towards centralized administration, as it is easier to create capacity. However, with the real requirement being at the local government level, the challenge is to create capacity at the zonal level.

Automation of Municipal Functions & E-Governance

To improve management, it is useful to design operational manuals on municipal functions such as administration and engineering (apart from accounts and computer applications), defined systems and provided software support in certain core areas:

- Birth and Death registration
- Building Plan Registration/Approval
- Licenses
- Financial Management: Financial Accounting System, Inventory Control, Movable Property, Vehicle Inventory, Immovable Property
- Revenue Management: Non-Tax, Professional Tax, Water Charges, Property Tax
- Others: Census, Personal Management System, Electoral rolls, Family Enumeration, Solid Waste management, Hospital Information
- Engineering applications.

Once these systems are in place at the para-statal agencies' level, the public can access them for direct queries and services, over a suitable e-governance platform.

Continuing Stakeholder Interactions

The consultation process with stakeholders has to be institutionalized and kept as an ongoing exercise.

- Periodic stakeholder meetings with the officers/ elected representatives, to review the progress of various initiatives and to iron out any wrinkles need to be conducted.
- Interactions could be organized by specific NGO's with the Urban Poor; and
- Developing a process of periodic reports/ feedback/ score-card on key performance parameters.

Transparency and Accountability

Karnataka State has always been ahead in terms of setting in place processes to ensure transparency in public dealings. The Karnataka Transparency in Public Procurements Act 1999, and the Karnataka Right to Information Act 2000, form the cornerstone of the legal framework under which Government departments and agencies have to operate. Karnataka also has the Fiscal Responsibility Act, to encourage planning and prudence in the process of budgeting.

However, it is clear that going forward, the objective is not to have mandated transparency, but to have open and participative governance. This can be set in place only through an institutionalized and sustained process of interaction, as mentioned in the previous section.

PPP Infrastructure Projects

Karnataka has encouraged private sector participation in projects in the infrastructure areas, with first-time projects in the country illustrated by the Bangalore International Airport Project, and the Hassan – Mangalore railway line. In projects such as KUWASIP, Karnataka has also amended rules of employment to enable employees to proceed on deputation to the private sector. In addition, Karnataka has pioneered an innovative

public private partnership initiative, which involves setting up of a citywide task force in Bangalore for effective delivery of urban Infrastructure services.

Land-use and Planning

BDA prepares a Comprehensive Development Plan for the city, at an interval of 10 years, while BMRDA prepares a "Structure Plan." Based on these plans, the development regulation is done by way of plan approvals and land-use. However, given the rate of urbanization, 10 years is a long time frame, and this leads to the issue of periodic land-use reclassification and the concomitant problems and issues. It is therefore imperative to:

- Review the master plan periodically, to incorporate demographic and economic changes as they occur
- Have a realistic and flexible master plan, where the emphasis is on a zone and sector, rather than on the exact use of a particular lot of land
- Resolve the function/ organization overlap/ conflict issues that have been discussed in the previous sections

Asset management

Government and its agencies have been generally efficient in asset creation, but the real issues arise in maintenance of these assets. This leads to situations where the facility does not perform its intended function properly. Potholed roads, leaking water systems, non-functional sewage treatment plants – many of these situations occur because:

- Poor construction quality, leading to higher maintenance requirements
- The life-cycle aspect of the infrastructure asset is not considered
- The contracting entity that constructs the facility has no stake in ensuring that it functions
- Finances for operation and maintenance are not earmarked/available
- The capacity of the staff engaged in the maintenance is generally lower
- Ensure construction quality requirements
- Consider life-cycle aspect of the infrastructure asset
- Tie-in the contracting entity to a longer maintenance, or back-ended payment structures, to ensure that it has a stake in the functioning of the asset
- Include costs for operation and maintenance, and keep aside in an ear marked fund
- Build up capacity/ training of the staff engaged in the maintenance.

Chapter 14: Governance Structures & Reform Agenda

1. Options for Institutional Reorganization

To manage the diversity of institutional issues that come up in managing a metropolis, a new perspective is needed for the metropolitan management of Bangalore. While the general imperatives for the City – in terms of requirement and service delivery are simple to outline, assess, and debate – the fundamental issue is that of setting up the organizational set-up for ensuring that these objectives can be met.

Various governance structures which had been mooted and debated in the original CDP, are outlined in the following sections. The actual framework for implementing the Greater Bangalore concept and structure had been debated at all levels, and decided at the highest political and administrative levels. The following sections set forth four different options for institutional reorganization.

1.1. Option 1 Greater Bangalore Concept

GoK had proposed the concept of "Greater Bangalore" – and the Bill in this regard was passed in the Legislature. The BBMP area and the 110 villages around Bangalore are part of the new Authority, which will have wide powers in matters pertaining to development and maintenance of infrastructure. It will have about 150 wards under it.

The concept of Greater Bangalore is a step forward in addressing the issue of integrated development of the fringe areas, and ensuring a unified governance approach. It also offers an opportunity to clear functional and jurisdictional overlaps in the BBMP and BDA areas, since the Greater Bangalore geographical jurisdiction is virtually the BDA area, and this would bring in the participation of elected representatives.

The issue of the integrated development of the Bangalore Metropolitan Region, in its entirety, would still not be addressed completely. For instance, the planning authority for the new international airport – BIAAPA, would not be part of this development. An added issue is that the functional jurisdiction may become too big, and there are therefore proposals to separate the area into two or three functional jurisdictions. The above limitation notwithstanding, this is a clear step forward in recognizing the growth of the city, and the fact that the fringe areas need to be systematically integrated.

1.2. Option 2 Greater Bangalore Metropolitan Council

A proposal has been mooted to set up a Greater Bangalore Metropolitan Council (GBMC) with the Chief Minister as Chairman, and functional/political heads of civic bodies (the BBMP), and service agencies such as BDA, BWSSB, BMTC, as members. Representatives from the Government of India, Ministry of Urban Development, and representatives of civil society, the industry, and academia, would also be on the Council. A very senior officer would be the Secretary of GBMC.

The GBMC's functions would include overall development of the metropolitan region including its economy, city/regional planning, capital budgeting, including sanction of large-scale infrastructure projects, coordination and monitoring. Each of the local

authorities will continue to perform its assigned functions, while inter-agency issues will be resolved by the GBMC. There would actually be decentralization to the City Corporation and agencies, making them more effective and accountable. The ward committees would be strengthened to enable effective public participation. The institutional framework proposed would achieve three objectives:

1. Provide an apex body, with appropriate political and administrative backing, which will act as a planning, coordinating, and monitoring authority for all operating urban agencies and activities in the entire Bangalore metropolitan area
2. Promote decentralization and public participation in management of civic affairs
3. Involve both the state and central governments in city development

The proposed structure for City Government needs to be established in stages. The existing boards of para-statals such as BWSSB, BDA, BMRDA, may need to be abolished. The state government officers on the existing boards may not continue to be members of the City board. This is necessary to separate the City board from the state and central government following the spirit of 74th CA. Once the City Council starts working on the functions assigned under the 74th CA, the State Government may relinquish its powers under the Municipal Act to the Council, and make it a true third tier Government.

1.3. Option 3 Replicating Rural Governance Structures

One other possibility is to replicate the rural governance structure, set in place under the 73rd CA, 1992. The salient features of the Act are to:

- Provide 3-tier system of Panchayat Raj for all States having population of over 20 lakh;
- Hold Panchayat elections regularly every 5 years;
- Provide reservation of seats for Scheduled Castes, Scheduled Tribes and women (not less than 33%);
- Appoint State Finance Commission to make recommendations as regards the financial powers of the Panchayats; and
- Constitute District Planning Committee to prepare draft development plan for the district as a whole.

Janaagraha Centre for Citizenship & Democracy has mooted a similar three-tier structure for urban areas: Area Sabha (Gram-sabha equivalent), Ward Committee, and the ULB. The construct is for giving citizens a greater say in urban governance. The construct would necessarily have to be accompanied by urban decentralization and a credible coordination mechanism between civic agencies. The following are in brief, are some of the action items for this framework:

- Permanent Metropolitan Planning Committee with coordination powers
  - Constitution with Elected Representatives and Experts
  - Master Planning Procedures and Technical Groups
  - Completely revamped Municipality Law
- City Government stands as a guarantor.
  - Direct Election to Mayor
  - 3-tier structure of Municipality/ Ward Committee/Area Sabha
  - Formal Citizen Participation in Municipal affairs
  - Mandatory quarterly disclosure of performance

- Co-ordination mechanisms on all Municipal Services as per Schedule XII (and Schedule XI) of the Amendment to the Constitution of India
  Alignment of Jurisdictions based on Ward Boundaries
  Joint Budgeting/ Reporting cycles

2. Linking Reform under JNNURM to Development Projects

Development of projects has a strong linkage to reform in governance.

- An assessment of ULBs/ para-statal agencies' current financial situation will illustrate that unless there are key financial reforms, it may not be in a position to raise budget surpluses, and use those surpluses in implementing its CIP.
- Further, even if the financial situation improves, the size, number, and type of projects that need to be implemented, will place a significant strain on the capacity of the ULBs/ para-statal agencies staff, and on the governance system as a whole. For instance, even small urban transport projects like the High Capacity Bus, need a very high skill level to implement and administer.
- Finally, if private or commercial finance is required to be brought in, the legal and financial capacity required to handle such transactions, has also to be created.

There is a clear and imperative need to ensure those reforms on the financial and capacity aspects of ULBs/ para-statal agencies and the other stakeholders, moves in tandem to the project development process.

2.1. Implementation, Sequencing and Prioritization of Reform

Some of the key reform areas lie in the purview of the State Government, while some of them are in the jurisdiction of the City. Issues such as determining Stamp Duty are clearly in the State's purview, while introduction of accrual-based double-entry systems are in the domain of ULBs/ para-statal agencies. At the next level, there are also issues where the ULBs/ para-statal agencies have to depend on the discretion of Government of Karnataka. The devolution of State grant to a particular ULB is a matter of such discretion. Finally, in situations such as the JNNURM, the Central Government is also a key participant.

- The important aspect of urban infrastructure is that the objectives will be met only if all the tiers of Government work in concert. The JNNURM guidelines therefore rightly envisage a tri-partite agreement between the Central Government, the State Government, and the ULB.
  Many of the mandatory & optional reforms are in the jurisdiction of the State's legal and administrative domain, and would be committed at the State level.
  The role of ULBs/ para-statal agencies and Government of Karnataka, vis-à-vis the reform process that is agreed upon, will be set out in such an agreement, and will determine the duties/ responsibilities that each party has to perform, to make a reality of the vision envisaged in this CDP.
- Public Sector Undertakings and Defense Authorities have significant land in the core area of Bangalore City. A platform could be created to enable consultations with such authorities.
- Various initiatives have been taken in past by urban local bodies to improve the quality of life of the citizens. The service delivery levels even after implementation of such projects have been suboptimal primarily due to lacunae in implementation

and operation maintenance. A Project Implementation Unit/ Project Management Unit could be set up to facilitate implementation of projects.

- To address this specific issue, there is discussion on the possibility of setting up a separate SPV for implementing and maintaining infrastructure projects in the City

2.2. Reforms already underway

In order to efficiently manage and implement the infrastructure projects, a primary requirement is capacity building and instituting reforms. In concurrence with the above, the stakeholders of Bangalore are in consensus that reform in urban governance and service delivery is a must. These would help in cost efficient delivery of infrastructure projects.

The question in debate is the form and time-scale required to achieve these reforms. JNNURM has specified certain mandatory and optional reforms and the State Government and ULBs of Bangalore have expressed their commitment for achieving the same. These reforms have been categorized as Mandatory reforms and Optional reforms.

The following reforms, which have been mentioned in the JNNURM guidelines, have already been implemented by the Government of Karnataka. These are as follows:

- BBMP has adopted modern accrual-based double entry system of accounting, while other ULBs and para-statal agencies are in the process of implementing the same
- Introduction of a system of e-governance using IT applications, such GIS and MIS for various services has been implemented
- Local bodies have provisionally implemented internal earmarking, budgets for basic services to the urban poor
- Subsequent to the 74th Amendment to the Constitution of India, the Karnataka Municipal Corporations Act 1976 was amended (vide Karnataka Act No. 35 of 1994) on October 5, 1994
- Urban Land Ceiling Regulation Act has been repealed
- Rent Control Laws have been reformed/modified
- Reduction of Stamp Duty is being progressively done
- Rain-water harvesting is being promoted and has been made mandatory in certain structures
- The Government agencies are actively encouraging PPP in infrastructure.

In tandem with the JNNURM reforms, there are certain other structural and operational reforms, which also need to be implemented. Some of these are outlined as below:

- GIS mapping
- Reducing Non revenue water/unaccounted for water
- Preparation of best practice toolkits
- Preparation of action plans for revenue improvement
- Framework for benchmarking investments
- Analysis of new financing mechanisms
- Tariff rebasing mechanisms

2.3. JNNURM Reform Timelines

Table 95 and Table 96 indicate the timelines for carrying out the reforms under the JNNURM program.

Table 95: Timelines for Mandatory Reforms

Prerequisites for funding – mandatory Reforms (ULBs & PARA-STATAL Agencies)	Current Status	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Adoption of modern accrual based double entry system and accounting in Bangalore	Being implemented						
Introduction of the system of e-governance using IT applications, such as GIS and MIS for various services provided by Bangalore	Being implemented						
Reform of property tax with GIS so that collection efficiency reaches at least 85 percent within the next seven years.	Being implemented						
Levy of reasonable user charges by Bangalore with the objective that the full cost of O& M recurring cost in collected within the next seven years	To do						
Internal earmarking within local bodies, budgets for basic services to the urban poor	To do						
Provision of basic services to the urban poor including security of tenure at affordable prices, improved housing, water supply and sanitation	To do						

Table 96: Timelines for Optional Reforms

Prerequisites for funding– OPTIONAL Reforms	Current Status	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Revision of byelaws to streamline the approval process for construction of buildings, development of site, etc.	To do						

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