CHAPTER – 1

INTRODUCTION

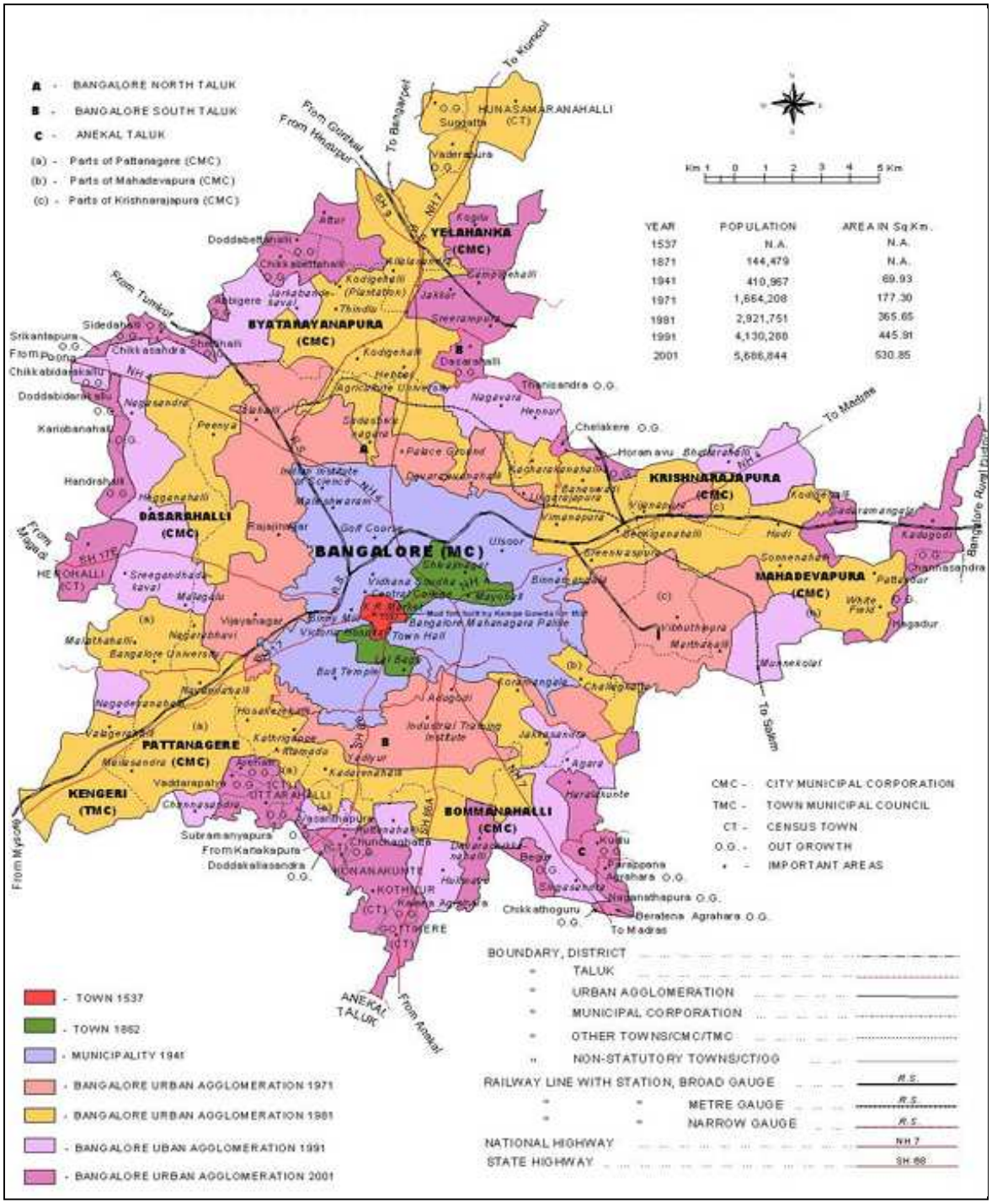
1.1 GENERAL BACKGROUND

1.1.1 Bangalore is the fifth largest metropolis (6.5 m in 2004) in India and is one of the fastest growing cities in Asia. It is also the capital of State of Karnataka. The name Bangalore is an anglicised version of the city's name in the Kannada language, Bengaluru. It is globally recognized as IT capital of India and also as a well developed industrial city.

1.1.2 Bangalore city was built in 1537 by Kempegowda. During the British Raj, Bangalore developed as a centre for colonial rule in South India. The establishment of the Bangalore Cantonment brought in large numbers of migrant Tamil Nadu and Andhra Pradesh and North Indian workers for developing and maintaining the infrastructure of the cantonment. New extensions were added to the old town by creating Chamarajpet, Seshadripuram, Nagasandra, Yediyur, Basavanagudi, Malleswaram, Kalasipalyam and Gandhinagar upto 1931. During the post independence period Kumara Park and Jayanagar came into existence. The cantonment area covers nearly dozen revenue villages, which included Binnamangala, Domlur, Neelasandra and Ulsoor to name a few. In 1960, at Binnamangala, new extension named Indiranagar was created. The defence establishments and residential complexes are in part of the core area. It is a radial pattern city growing in all directions. The Bangalore city which was 28.85 sq. Km. in 1901 increased to 174.7 sqkm in 1971 to 272 sqkm in 1986 and presently it has expanded to nearly 437 sqkm. **Figure 1.1** shows the physical growth of Bangalore during the last five centuries. This indicates that the city has a long history and the transport system has grown organically with its inherent problems to meet the requirements of changing times.

1.1.3 The city which was originally developed as a Garden City has slowly transformed into an industrial and software hub of India. The establishment of the Silicon Park on the outskirts of the city has converted the city and its surroundings into Silicon Valley of the country. It has also caused an urban sprawl around, to some extent lop sided towards south and east. It has become a commercial, administrative and military centre for the region because of its salubrious climate and cosmopolitan nature of people. It is also known as pensioner's paradise with well developed residential areas, roads with well grown trees, good commercial establishments, shopping malls etc. Despite such growth it is trying to maintain its character of garden city.

Figure 1.1 Physical Growth of Bangalore during the Last Five Centuries



1.2 PHYSICAL CHARACTERISTICS

1.2.1 Bangalore is located in the south east of Karnataka. It is located in the heart of the Mysore Plateau at an average elevation of 920 m (3,018 feet) above mean sea level. It is positioned at 12.97° N 77.56° E. Bangalore 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 neighbouring state of Tamil Nadu in the southeast.

1.2.2 The topography of Bangalore can be classified as a plateau, with a central ridge running NNE–SSW and land sloping gently on either side and longitudinally. The highest point is Doddabettahalli, which is 962 m and lies on this ridge. The roads generally have gentle to medium gradients. No major rivers run through the city, but the Arkavathi and South Pennar cross paths at the Nandi Hills, 60 km to the north. River Vrishabhavathi, a minor tributary of Arkavathi, originates within the city at Basavanagudi and flows through the city. Bangalore has a number of fresh water lakes and water tanks, the largest of which are Madiwala Tank, Hebbal Lake, Ulsoor Lake and Sankey Tank. The soil is predominantly of red soil interspersed with rock helping quicker drainage.

1.2.3 Due to its elevation, Bangalore enjoys a pleasant and equable climate throughout the year. The highest temperature recorded is 41°C and the lowest is 7.8°C. Winter temperatures rarely drop below 12°C and summer temperatures seldom exceed 38°C. Monsoons commence sometime around mid April. The wettest months are August, September and October, in that order. The summer heat is moderated by fairly frequent thunderstorms. Bangalore, receives both incoming and outgoing monsoons because of its geographic location. The city receives rainfall of about 860mm from the North-East and South-West monsoons.

1.3 DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

1.3.1 Population of Bangalore has been growing @ over 3% per annum since independence as shown in **Table 1.1**. The city, which had a population of 1.6 lakh in 1901 reached nearly 61 lakh in 2001. With a decadal growth rate of 49%, Bangalore was one of the fastest-growing indian metropolis for the decade 1991-2001. It has an average density of about147.97 people/hectare. Currently the Bangalore Metropolitan Area (BMA) is estimated to have population of about 70 lakh and is expected to be 80 lakh by 2011 and 88.40 lakh by 2015 as per Master Plan, 2015. By 2025, population of BMA is expected to be 122.52 lakh as indicated in **Table 1.1**.

Table 1.1 Growth of Population in Bangalore

YEAR	Population (lakh)	Decadal Growth (%)	Annual Growth
1901	1.63	-9.58	-1.00%
1911	1.89	16.18	1.51%
1921	2.40	26.69	2.39%
1931	3.10	29.05	2.58%
1941	4.11	32.66	2.87%
1951	7.86	91.34	6.70%
1961	12.07	53.49	4.38%
1971	16.64	37.88	3.26%
1981	29.22	75.56	5.79%
1991	41.30	41.36	3.52%
2001	61.70*	49.39	4.10%
2011	80.15*	29.90	2.65%
2015	88.00*		
2025	122.52**		3.07%

(* -Revised Master Plan, 2015 for BMA, ** -projected for BMA)

1.3.2 Bangalore has the second highest literacy rate (83%) for an Indian metropolis, after Mumbai. The city's workforce structure is predominantly non-agrarian, with only 6% of Bangalore's workforce being engaged in agriculture-related activities. Roughly 10% of Bangalore's population lives in slums - a relatively low proportion when compared to other cities in the developing world.

1.3.3 Bangalore's Rs. 26000 crore economy makes it a major economic centre in India. Indeed, Bangalore is India's fourth largest and fastest growing market. Bangalore's per capita income of Rs.49,000 is one of the highest for any Indian city. The city is the third largest hub for high net worth individuals after Mumbai and Delhi.

1.3.4 In the 1940s industrial visionaries such as Sir Mirza Ismail and Sir Mokshagundam Visvesvaraya played an important role in the development of Bangalore's strong manufacturing and industrial base. 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 Limited, Bharat Earth Movers Limited (BEML) and Hindustan Machine Tools (HMT). In 1972 the Indian Space Research Organisation (ISRO) was established under the Department of Space and headquartered in the city. Globalisation has seen the city's potential to grow as an IT capital of the country so much so that foreign visitors to the country including many Heads of Governments make it appoint to visit the city during their visit to the country. Bangalore is also called the "Silicon Valley of India" because of the large number of Information Technology companies located in the

city which contribute 38% of India's IT and software export market. As headquarters to many IT companies, Bangalore's place in the global IT map is prominent. Bangalore's IT industry is divided into three main clusters — Software Technology Parks of India, Bangalore (STPI); International Technology Park Bangalore (ITPB), formerly International Technology Park Ltd. (ITPL); and Electronics City. Infosys and Wipro, India's largest software companies, have big campuses in Electronics City. If the growth of Information Technology has presented the city with unique challenges, Biotechnology has now become another rapidly expanding field in the city. Bangalore accounts for 47% or 127 of the approximately 265 biotechnology companies in India. The Bangalore Stock Exchange is the largest in South India. **Figure 1.2** shows the major activity centres along with the transport network in Bangalore.

1.3.5 With the growth of population and industries, the number of educational institutions has also grown up in the city and BMA. Numerous educational institutions up to High School and Colleges have come up in almost all the developing residential localities and extensions. Most of the institutions for higher learning like engineering colleges and medical colleges are located on the outskirts of Bangalore Corporation area. There are a few institutions of higher learning and special requirements like Government Educational Institutions are spread all over the city. Bangalore also has internationally acclaimed educational institutions like Indian Institute of Management (IIM), National Law College (NLC) and Indian Institute of Science (IISc).

1.3.6 In the planned growth over the last 2 decades, the primary and secondary educational institutions have been provided in each of the residential locality and to this extent the educational requirement of the younger people is satisfied by and large locally. It is for the higher and selective learning, that the people have to make longer trips requiring vehicular journeys.

1.4 TRANSPORT NETWORK

1.4.1 Road Network Characteristics

Bangalore is endowed with a radial pattern of road network converging in the core area of the city. The total road network of the city is about 4000 km of which arterial/sub-arterial roads account for about 350 km. The road network is shown in **Figure 1.2**. The road network in the central parts of the city has developed organically over the last few centuries and has inadequate right-of-way. There is also a ring road (Outer Ring Road of about 62 km) which cuts across the various radial roads. An intermediate ring road has been constructed in fragments e.g. at south-east between Koramangala and Airport Road. The National Highways which pass through Bangalore include:

Figure 1.2 Major Activity Centres along with the Transport Network in Bangalore

- NH – 4 connecting to Pune and Chennai
- NH – 7 connecting to Varanasi and Capecamorin
- NH – 209 connecting Dindigul / Pollachi

The following are the State Highways in Bangalore:

- SH – 17 connecting Mysore & Gundlupet
- SH – 17E connecting T G Halli
- SH – 19 connecting Hindupur via Yelahanka and Doddaballapur
- SH – 86 connecting Mysore via Kanakapura

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 as shown in **Table 1.2**. Length of roads with carriageway of 4 lanes and above is only 290 km. The roads indicating carriageway widths are shown in **Figure 1.3**. 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 5 legs. This adds to traffic delays.

Table 1.2 Distributions of Roads with Carriageway Widths in Bangalore

Type of Road	Length (Km)	%
Two Lane Undivided One Way	62.3	3.53
Two Lane Undivided Two Way	1379.2	78.21
Three Lane	31.6	1.79
Four Lane Undivided One Way	10.3	0.59
Four Lane Undivided Two Way	49.7	2.82
Four Lane Divided Two Way	198.5	11.25
Six Lane Divided	31.4	1.78
Six Lane Undivided One Way	0.5	0.03
Total	**1763.5**	**100.00**

The available right-of-way of major roads are generally inadequate to allow for their major widening as given in **Table 1.3**. This is a major issue in augmenting the capacity of transport system in Bangalore. This indicates public transport system will have to play a very major role in satisfying the mobility requirements of people of Bangalore as they are the most economic users of the road space.

Figure 1.3 Carriageway Widths of the Roads

Table 1.3 Distribution of Roads with available ROW in Bangalore

Road ROW (m)	Length of Major Roads (%)
Less than 20	40.7
20-30	40.0
More than 30	19.3
Total	**100.0**

1.4.2 Rail Network

Bangalore is served by 5 radial rail corridors (shown in **Figure 1.2**), which are listed below.

- B.G. line from Chennai on east
- B.G. line from Mumbai-Pune on north-west
- B.G. line from Guntakal on the north
- B.G. line from Salem / Trivandrum from east
- B.G. line from Mysore from south-west

Though at present these rail corridors serve only intercity traffic, a small number of conventional short distance passenger trains are run in morning and evening hours to nearby (satellite) towns like Tumkur, Chikballapur, Bangarapet, Hosur and Mandya to serve the commuters. Its layout is conducive to convert them as "Commuter Rail System" (CRS), to provide viable commuter services to suburbs and also some nodes in the Bangalore.

1.4.3 Airport

The Bangalore Airport located about 11 km from city centre towards the east of the city and adjacent to the Hidusthan Aircrafts Ltd (location of Airport in shown in **Figure 1.2**), was opened to passenger traffic in 1947. Direct flights from Bangalore fly to destinations in Asia, the Middle East and Europe. The liberalisation of India's economic policies has led to increase in the number of domestic carriers within India, with several carriers such as Indian, SpiceJet, Kingfisher Airlines, Jet Airways, Air Deccan, Paramount and Go Air servicing the city. Unlike most airports in the country which are controlled by the Airports Authority of India, the quasi government-owned Hindustan Aeronautics Limited owns and operates Bangalore's HAL Airport. This airport at present serves both domestic and international passengers. Due to its limited capacity and shorter runway, it has not been able to satisfy the growing demand for air traffic. A new international airport (catering to both domestic and international passengers) is being constructed at Devanahalli and is expected to become operational in early 2008. As part of its planning there are proposals to provide a dedicated rail line and an expressway connecting the city to the airport.

1.5 GROWTH OF MOTOR VEHICLES

1.5.1 Vehicle Growth and Composition

The vehicle population in all cities in India started growing rapidly since later part of 1980s. Bangalore is no exception. It has always had a reputation of having more two wheeler users. The liberalization policy of the country made availability of not only vehicles but also loans for buying vehicles. With the rapid growth of IT sector in Bangalore, the affordability of larger segment of employees increased for ownership of vehicles, more specially two wheelers. Coupled with inadequacy of comfortable and convenient public transport gave an impetus to more and more commuters shifting to cars and two wheelers for their commuting in Bangalore. Growth of motor vehicles is shown in **Table 1.4**. The number of registered motor vehicles has crossed 2.5 million and is growing at a rate of over 12% per annum. The two wheelers, which constitute about 72% of the total registered vehicles, are growing at a rate of about 13% per annum. Lately, cars have been growing even faster than two wheelers. Vehicle ownership has grown from 58 to 365 per 1000 population from 1981 to 2006. The trend is likely to continue. This will result in higher use of personalised modes of transport particularly cars unless extensive and convenient public transport system is provided.

Table 1.4 Growth of Motor Vehicles in Bangalore (in lakh)

Year	2-Wheelers	M/Cars	A/R, Cabs	Others	Total
1980	0.97	0.30	0.10	0.31	1.68
1985	1.89	0.47	0.11	0.30	2.77
1990	4.01	0.71	0.15	1.41	6.28
1995	5.94	1.07	0.34	0.62	7.97
1996	6.69	1.21	0.39	0.71	9.00
1997	7.58	1.38	0.47	0.80	10.23
1998	8.39	1.52	0.54	0.84	11.29
1999	9.10	1.64	0.55	0.94	12.23
2000	9.94	1.84	0.58	1.01	13.37
2001	10.92	2.07	0.62	1.12	14.73
2002	11.83	2.26	0.64	1.23	15.96
2003	13.23	2.53	0.69	1.37	17.83
2004	14.44	2.77	0.76	1.53	19.50
2005	16.71	3.51	0.81	1.69	22.72
2006	18.96	4.06	0.82	1.73	25.57

Source: Bangalore Traffic Police Web Site and RTO, Bangalore

1.5.2 Intermediate Public Transport

Autorickshaws (popularly known as autos) and taxis are the IPT facility available in Bangalore. Autos are the popular form of transport and can be called common man's taxi in Indian cities and towns. It is a hybrid three wheel, three-seater (in addition to driver) low floor vehicle, which is easily maneuverable and at the same time provides a fast service. Priced much lower than a car, majority of autos are owned by the driver himself. Apart from thee autos, regular small cars (Maruti Omni vans and Indica diesel cars) as taxis are provided by several operators commonly referred to as City Taxis or call Taxis. The number of autos and call taxis registered in Bangalore is about 82000 and they are growing at the rate of 5-6 % p.a. The autos are used more for education and other trips and to a large extent by the visitors to the city. The drivers tend to take advantage of the vehicle's size and maneuverability and criss cross in traffic contributing a lot to accidents and traffic indiscipline and delays to overall traffic flow.

1.5.3 Public Transportation System

Buses are the predominant public transport system in all Indian cities except Mumbai. While four other metropolises Mumbai, Kolkata, Chennai, Delhi and even Hyderabad have one or more forms of rail transport systems to cater to varying extents for commuters, Bangalore has only bus as its public transport system. The city has one of the better run city bus transport systems in the country. It is operated in the Public Sector by Bangalore Metropolitan Transport Corporation (BMTC), a wholly owned company of the State Government. BMTC at present operates services on 1726 routes by utilizing 4100 buses with 3953 schedules. BMTC has 24 depots in and around Bangalore city. The corporation has 18500 employees to man its operation. It has established state of the art commuter friendly modernized bus stations at Shivaji Nagar and Shanti Nagar. The Kempegowda bus station at Subhash Nagar is also modernized with improved commuter amenities. In addition to this, sub nodal stations at different parts of the city have been constructed for the benefits of commuters. The corporation is operating more than 60,000 trips and carrying about 35 lakh passengers every day. Its patronage has started having significant growth since 2002-03. In order to increase the frequency of services and to provide direction-oriented services in place of the present destination oriented services, 27 high density trunk corridors (grid routes) have been started. These grid routes have been shown in **Figure 1.4**. The progress of BMTC during the last few years is briefly given in the **Table 1.5** below.

Table 1.5 Operational statistics of Bangalore Metropolitan Transport Corporation

Sl. No.	Factor	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
1.	Operations	1924	1960	2017	2190	2253	2302	2581	3199	3531
2.	Schedules	1934	2030	2121	2376	2535	2932	3291	3827	3957
3.	Fleet	2098	2160	2285	2473	2658	3036	3460	3925	4106
4.	Daily Average Scheduled Km (in lakh)	4.43	4.44	4.86	5.15	5.77	6.19	7.18	9.02	9.33
5.	Routes	1036	1048	1063	1147	1212	1345	1523	1690	1726
6.	City Services	740	783	789	798	817	988	1029	1131	1102
7.	Suburban Services	925	983	1065	1282	1412	1647	1985	2382	2542
8.	Pushpak Services	269	264	267	296	306	297	287	314	313
9.	Passengers carried per day (in Lakh)	24.50	25.00	25.50	25.75	26.25	26.75	30.35	32.07	34.78
10.	Accidents per Lakh Km	0.32	0.29	0.26	0.26	0.22	0.22	0.23	0.18	0.16

Source: BMTC

BMTC has plans to add new fleet through inducting new types of buses. It also has plans of adding new depots, new bus stations, commuter amenity centres, bus shelters, GPS system etc.

1.6 THE BANGALORE METROPOLITAN REGION :

1.6.1 The Bangalore Metropolitan Region Development Authority (BMRDA) has been given the responsibility of planning the 8,000 sq km of Bangalore Metropolitan Region (BMR) consisting of 2191 sq km in the Urban Districts and 5814 sq km in the Rural Districts. The planning areas falling in the BMR are indicated in the **Figure 1.5** and **Table 1.6.**

Figure 1.4 Grid Routes of BMTC

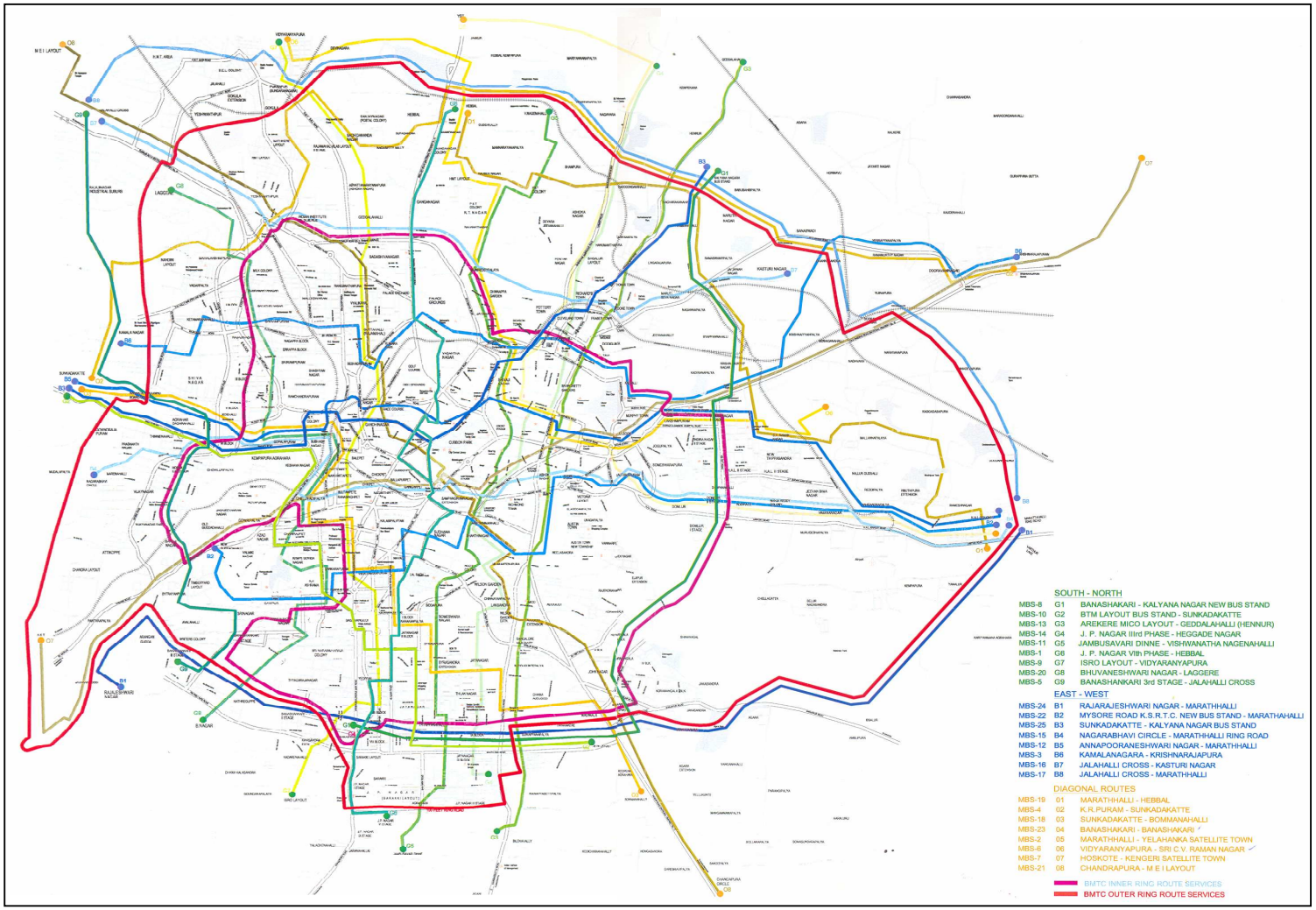


Table 1.6 Bangalore Metropolitan Region

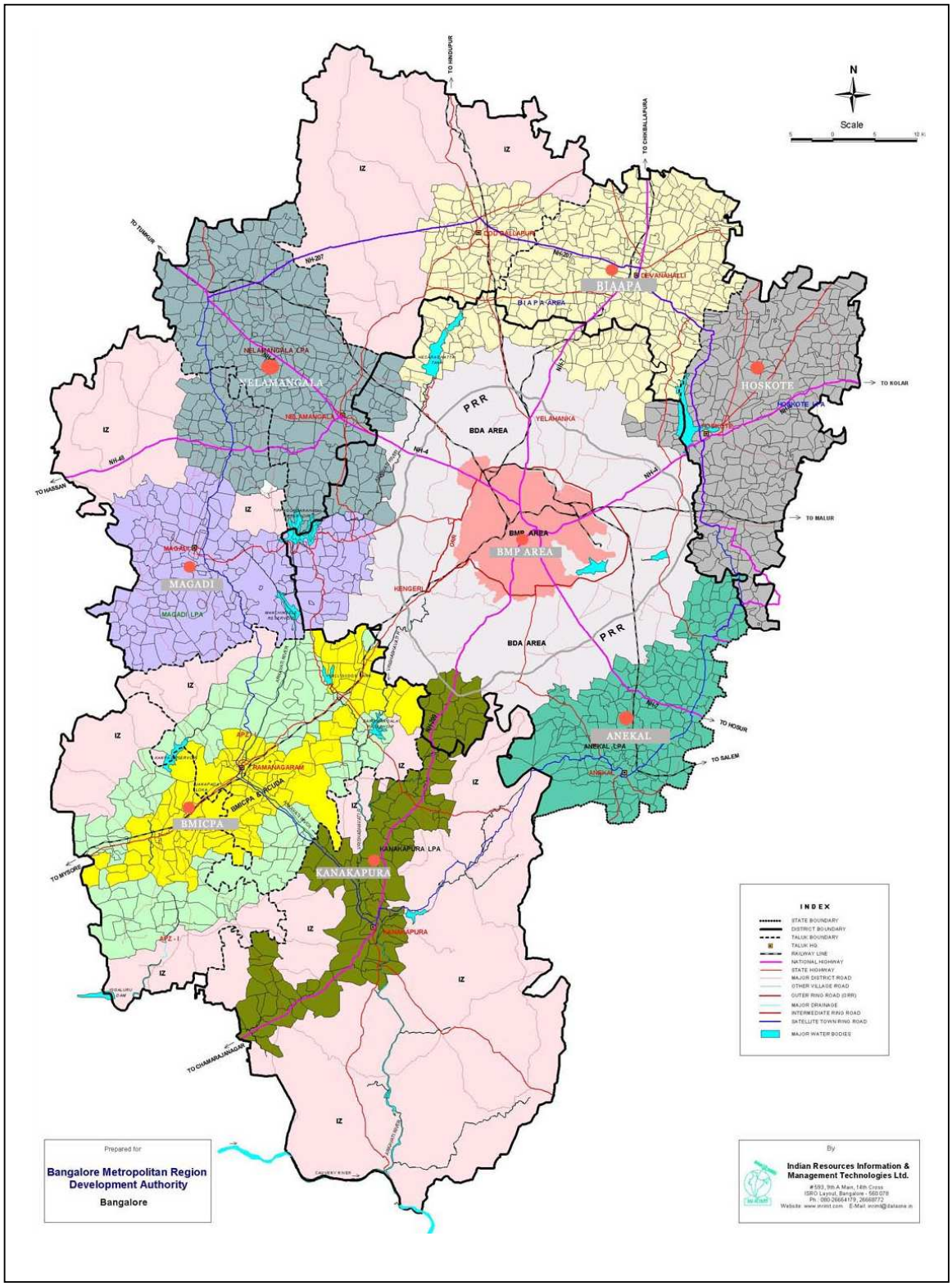
Sl. No.	Area		Area Sq. Kms
1	B M A		1240.69
2	BMICAPA (within BMA)	65.31	
3	BMICAPA (outside BMA but within BMR)	338.74	404.05
4	Ramanagaram Taluk		200.25
5	Channapatna Taluk		110.60
6	Bangalore South Taluk		27.89
7	Anekal LPA		406.00
8	Nelamangala LPA		750.00
9	Magadi LPA		501.00
10	Hoskote LPA		591.00
11	Kanakapura LPA		879.00
12	BIAAPA LPA		985.00
13	RCUDA LPA		62.50
14	APZ-1 (excl. RCUDA)		462.50
15	Industrial Zones in B.M.R		1723.26
	Total		**8005.00**

1.6.2 The regional plan while emphasizing on development of a regional transport network is also under taking the planning and development of 5 new township at Bidadi, Ramanagaram, Solur, Sathanur & Nandagudi covering a total area of 61,000 hectares on the outskirts of BMA. These townships are proposed to create the modern work and play environment in urban settlements within the areas as per **Table 1.7**.

Table 1.7 BMRDA TOWNSHIPS AREAS (Acres)

Township	Pvt. Land	Govt. Land	Total
Bidadi	6959	2725	9684
Ramnagar	3621	392	4013
Sathanur	5891	10341	16232
Solur	9661	2864	12525
Nandagudi	13762	4745	18507
Total	**39894**	**21067**	**60961**

Figure 1.5 Bangalore Metropolitan Region – Local Planning Areas



1.6.3 The following road network proposed by the BMRDA within the BMR consists of:

1)	Satellite Town Ring Road	-	204 km
2)	Intermediate Town Ring Road	-	130 km
3)	Radial Roads	-	180 km
4)	Town Ring roads	-	176 km

1.7 URBAN LAND USE STRUCTURE FOR BMA

1.7.1 Existing Situation

Bangalore city has spatially developed in a concentric manner. The economic activities have been growing at an unprecedented pace locating themselves in a sporadic manner with limited plan intervention covering an area of 1307 Sq. Kms. The existing landuse distribution of the BMA for 2003 & its comparison with the proposed Land use as per Revised Master Plan 2015 is given in the **Table 1.8**. The spatial distribution of existing land use is shown in **Figure 1.6**.

1.7.2 Revised Master Plan - 2015

Bangalore Development Authority (BDA) is responsible for preparing Master Plan for the BMA and guiding its development. Salient features of the Revised Master Plan-2015 are as follows:

a. Local planning area(LPA) or Bangalore Metropolitan Area (BMA) - 1307 sqkm (including BMICAPA area)
b. The city has to be planned for a population of 80 lakh by 2011 and 88 lakh by 2015.
c. Land Use Proposals: Keeping in view the rapid socio-economic development in Banglore and the development patterns in the BMR, the Master plan has evolved the following proposed land use for the Banglore Metropolitan Area as indicated in **Table 1.8** and **Figure 1.7**.
d. Economic activities & their spatial distribution: During the year 2003 approx. 6,30,000 Sq. Mts of office space was sold which consisted 5,00,000 Sq. Mts for suburban Hi-Tech firms and the balance 150,000 Sq. Mts for other businesses. For the year 2015 the Plan envisages following requirement of office spaces:

	Area in Sq. Mts		
Office Type	**Suburb**	**CBA**	**Total**
High-Tech	6,71,006	813,293	1484299
Non- High-Tech	234,093	585,394	819,487
Total	905,009	1,398,687	2,303,786

Figure 1.6 Spatial Distribution of Existing Land Use

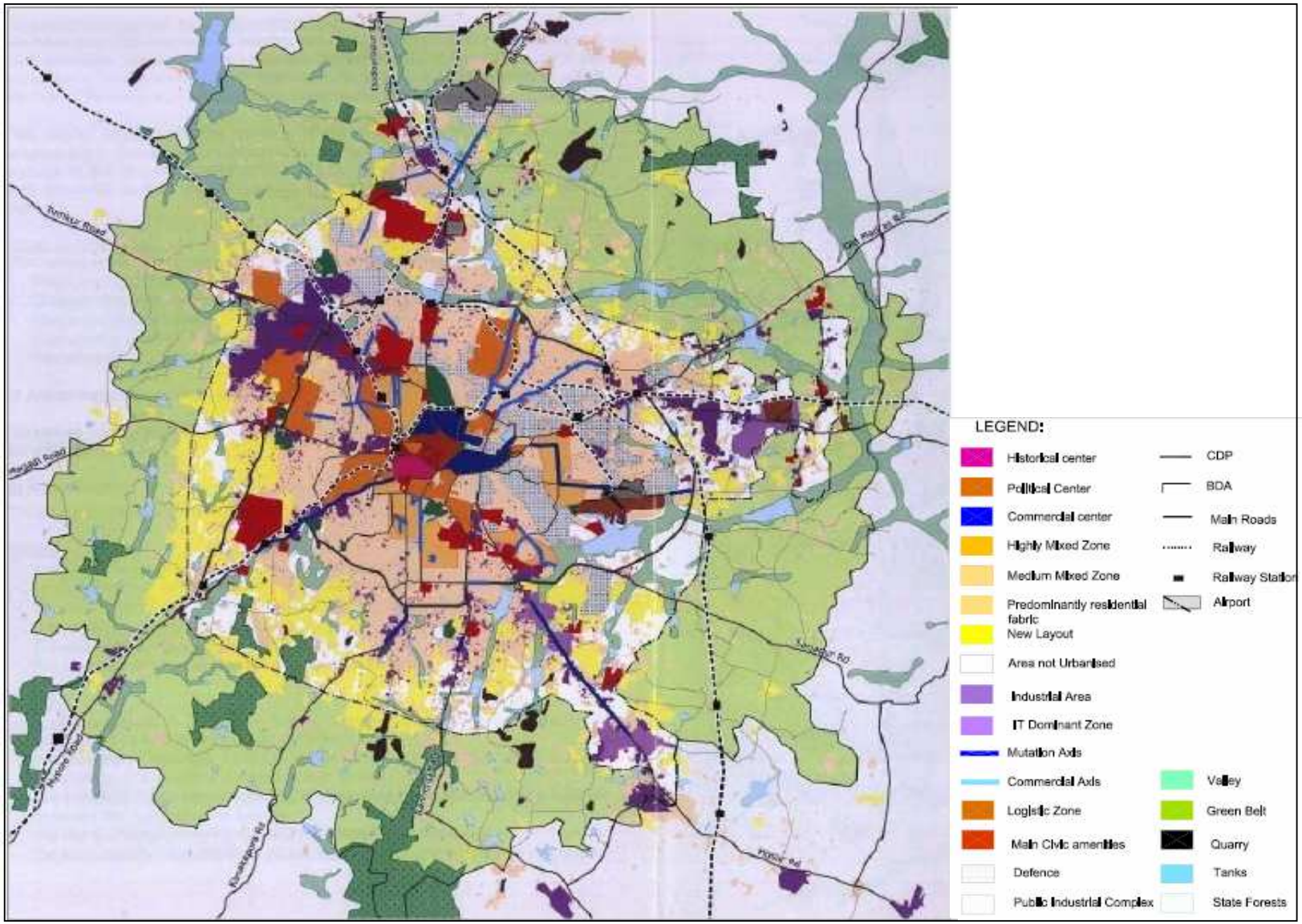


Figure 1.7 Proposed Land Use for the Bangalore Metropolitan Area

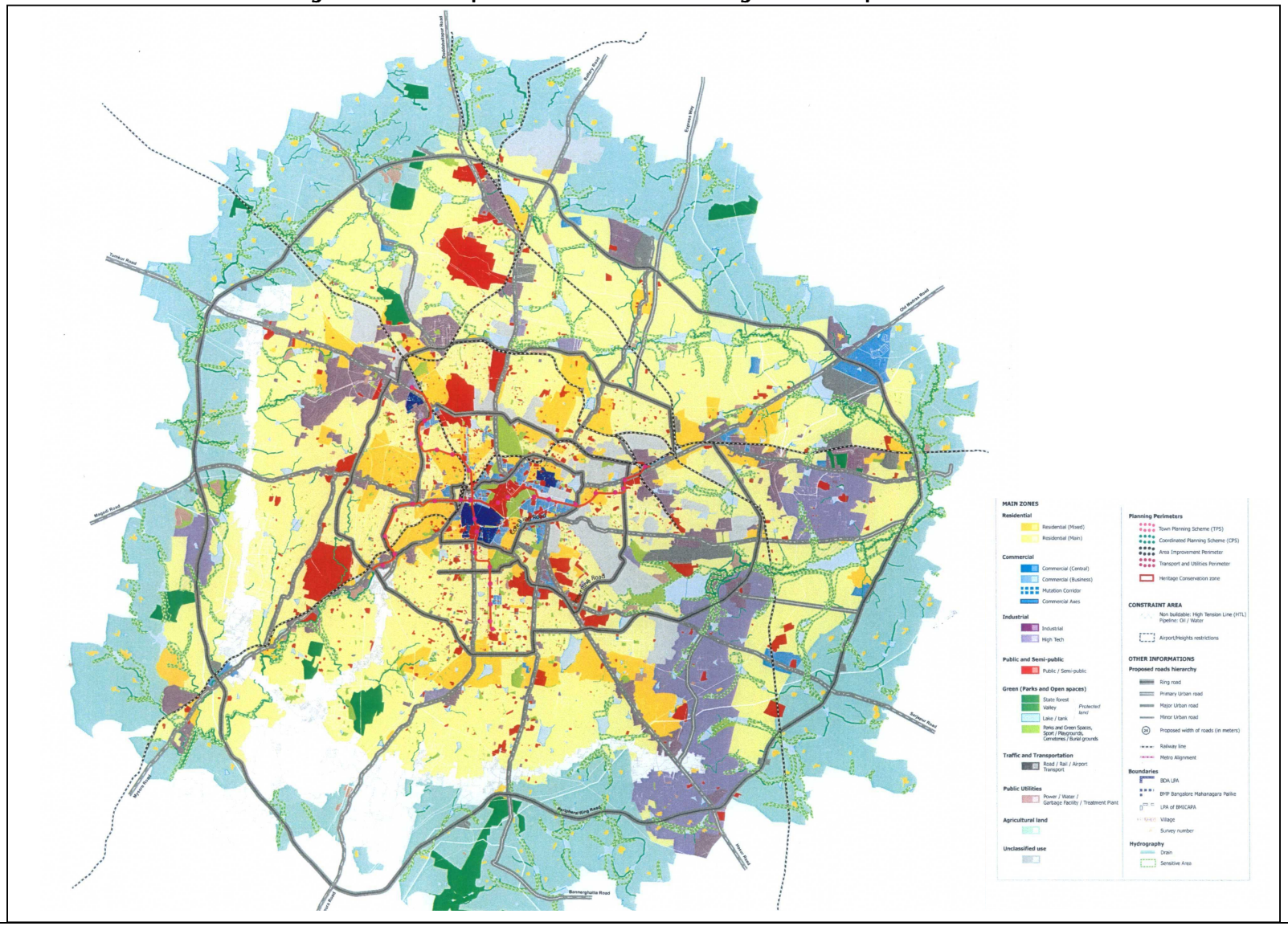


Table 1.8 Existing and Proposed Land Use for BMA

Land Use	2003		2011	
	Sq. Kms	% age distribution	Sq. Kms	% age Distribution
Residential	159.76	37.91	243.69	43.16
Commercial	12.83	3.04	16.43	2.91
Industrial	58.83	13.96	38.44	6.81
Open spaces	13.10	3.11	77.88	13.79
Publi & Semi-public	46.56	11.05	49.08	8.69
Public Utilities	2.49	0.59	-	0.00
Offices and Services	4.27	1.01	-	0.00
Traffic & Transportation	88.31	20.96	116.97	20.72
Un-classified	35.26	8.37	22.14	3.92
Total	421.41	100	564.63	100
Agriculture land	649.24			
Lakes & Tanks	39.02			
Quarry	9.61			
Vacant	187.72			
Total	**1307.00**		**564.63**	

Source- Revised Master Plan-2015

Keeping the above in view, the Master Plan has proposed the following development strategy:

i. In order to reap the benefits of the potential expected to be created by Multi-Modal Transport System at the transport Hub in the centre, Highest FAR is proposed in identified Central Business Area. FAR 2.5; Ground Coverage 75%. within the core area surrounded by the proposed Core Ring Road.
ii. Strengthening and extensions of employment areas along major roads and in clusters like Peenya, Bommasandra or Electronic City.
iii. Identifying new industrial areas. – 3 locations in the north accessible directly from PRR and the Radial Roads.
iv. High tech zone with FAR ranging between 2 to 3.25 – vacant area between Whitefield (ITPL) and Electronic City proposed as Hi-tech zone.

e. Secondary Centres: 10 Secondary Sub Centers (administrative / education & health) to be located at places to be served by Public transport – near railway station and big rail road junction.
f. Compact City Development: Vacant areas in the City need to be occupied and spread of layouts needs to be minimised.
g. Protection of natural drainage and ground water sources.

h. Land values to be linked to market economy – built area density to be proportionate to land price and presence of transport infrastructure.
    i. Higher FAR for old bungalow and villa areas.
    ii. Review of the areas accompanied by Industries along the major Roads – Virtually extension of core area to the periphery – Mutation zones.
    iii. Redevelopment of derelict industrial areas – promotion of market (actual and creation of mini zones of activities public amenities & infrastructure and social housing.
    iv. Densification of low density area (< 200 ppha)
    v. Encourage mixed land use in core areas – the live work mixed use reduces commuting time and mix of different activities increases economic efficiency. For these areas action imperatives defined are:
        - Diversion of traffic in mixed land-use areas by introduction of "one way"
        - Enforcement of new parking regulations.
        - Ban on entry of heavy goods vehicles in such areas
        - Widening of Roads
        - Removal of encroachments.
        - Appropriate transport system for the commuters to reduce owner vehicle usage
        - Demarcation into transport and utility zones.
        - Maintenance of open spaces
        - Improvement of Civic services.

i. Development of a Structured Road Network : The emphasis being on:
    i. Core Ring Road
    ii. Supplementing Outer Ring Road
    iii. Organising transportation/Logistic facilities: Specific Areas strategically located to provide for storages facilities, garages, and heavy vehicles supported by personnel, technicians and offices as well as integrating various transport modes like road, railway and air.
    iv. Developing Multimodal Public Transport System: consisting of rail & road based systems i.e. Metro-Rail, Mono-Rail, Circular Rail and other proven MRT systems.

j. Local Planning Area: The entire local planning area of Bangalore has been categorised into three major areas for application of Zonal Regulations and consist of:
    1. Main Areas : Comprising
        i. Old Urban Areas including the Petta Zone & Traditional Area Zone

ii. Urban Redevelopment Areas M.G. Road Area Zone, CBD Zone, CBD Areas, CD Precinct Zone, Transformation / Development Zone and Mutation Corridor Zone

iii. Residential Areas including mixed residential area, mainly residential area, and Commercial Axis Zone.

iv. Industrial / Activities Areas including Industrial, High Tech and Logistics/ Transport Zone

v. Green Areas including Protected Land, Restricted Development, and Agriculture Land Zones.

2. Specific Areas: Areas not covered by main areas and comprise large public and semi-public infrastructure; large transport structures, dedicated land uses, scheme areas & heritage conservation areas.

3. Constraint Areas: Areas having restrictions on type of development with its internal technical rules determining regulations within the site and around.

k. Based on the ward boundaries, existing physical features, and the analysis of the existing development trends within the City, 47 Planning Districts (PDs) have been delineated to implement the Master Plan. The planning districts are organized in three rings :

1st Ring: The Core area PDs 1.01 to 1.07

2nd Ring: The development urban areas surrounding the core are PDs 2.01 to 2.18

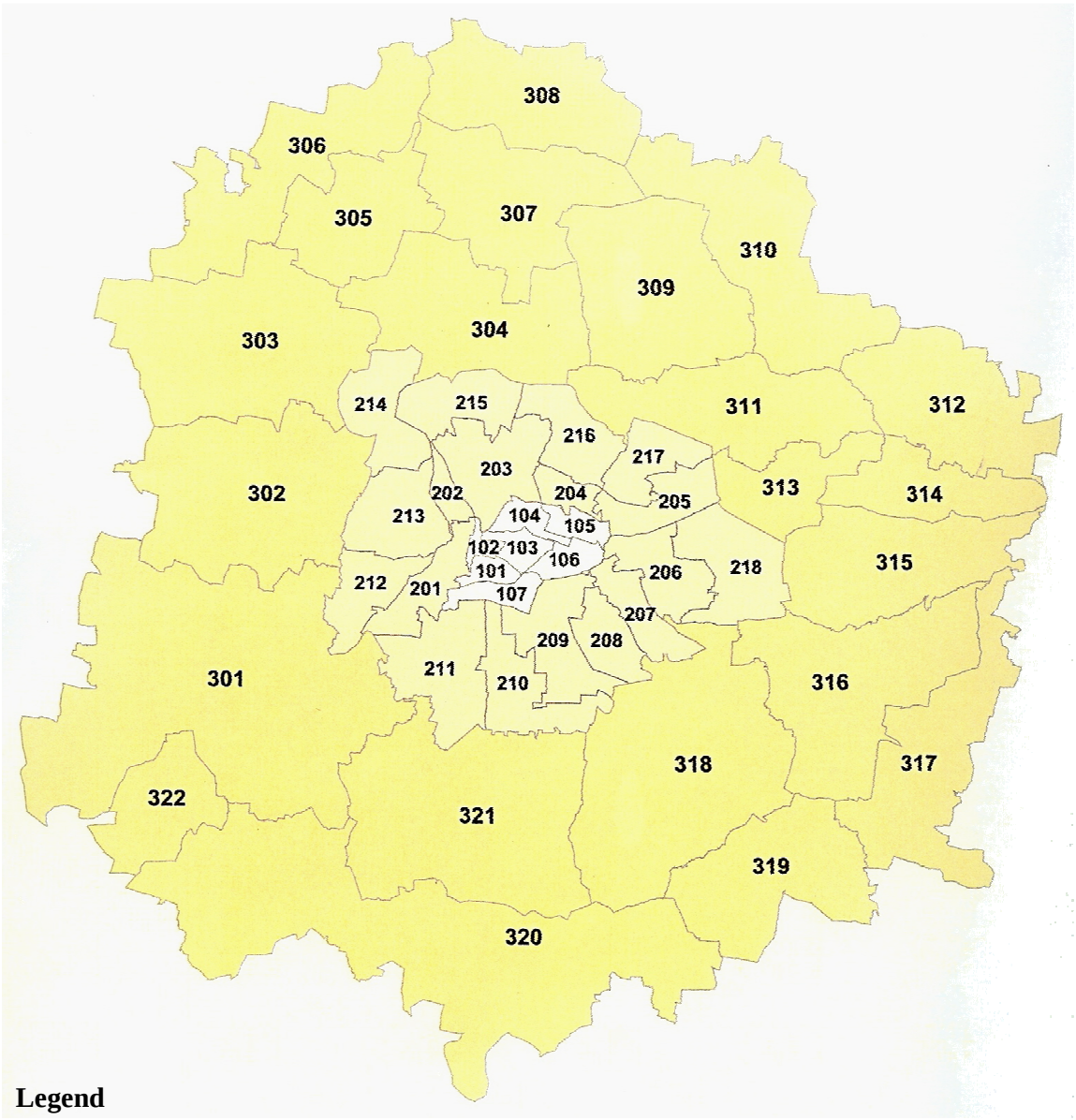
3rd Ring: The urban extension areas in the City's outskirts PDs 3.01 to 3.22

These planning district boundaries are indicated in the **Figure 1.8**

1.8 BANGALORE MYSORE INFRASTRUCTURE CORRIDOR AREA PLANNING AUTHROITY (BMICAPA)

The BMICAPA Planning Area comprises of BMIC Project Area and its environs. The total area is 701.01 Sq.kms. The BMICP comprises five self sustainable new townships viz., Corporate Township, Commercial Township, Industrial Township, Heritage Township & Eco-Tourism Township, 111 kms. of Expressway between Bangalore & Mysore, 41 kms. of Peripheral Road connecting NH 4 and NH 7 on the southern segment of Bangalore and about 9 kms. of Link Road connecting west of Chord Road/Mysore Road junction and "O'' point of the Expressway. It also includes interchanges at the junction of main, arterial and major roads.

Figure 1.8 Planning Districts in the Bangalore Metropolitan Region



101	Petta	210	Jayanagar	308	Bettaalasuru
102	Majestic	211	Banashankari	309	Tanisandra
103	Gandhi Nagar	212	Vijaya Nagar	310	Bagaluru
104	Vasantnagar	213	Rajaji Nagar	311	Horamavu
105	Shivaji Nagar	214	Peenya	312	Avalahalli
106	Richmond Town	215	Mathikere	313	K R Puram
107	Chamarajpet	216	Kaval Byrasandra	314	Sadara Mangala
		217	Kammanahalli	315	Whitefield
201	Kempapura Agrahara	218	C.V. Raman Nagar	316	Varthur
202	Srirampuram			317	Dommasandra
203	Malleswaram	301	Kengeri	318	Begur
204	Jayanagar	302	Herohalli	319	Electronic City
205	Baiyyappanahalli	303	Makali	320	Bannerghatta
206	Indiranagar	304	Byatarayanapura	321	Anjanapura
207	Unclassified	305	Bavalakere	322	Kumbalagodu
208	Koramangala	306	Hesarghatta		
209	Shanti Nagar	307	Yelahanka		

The BMICP Planning area (64 sq km in BMA) within which the 41 kms. of Peripheral Road connecting NH 4 and NH 7 on the southern segment of Bangalore and the link road are located has been planned for various land uses as under:

Table 1.9 Proposed Land Use of BMICAPA in BMA

Land Use	Area (Ha.)	% age
Residential	4882	8
Commercial	2174	3
Industrial	708	1
Public & Semi-Public	415	1
Parks & Open Spaces	1052	2
Traffic & Trans.	3230	5
Sub Total	**12461**	**19**
Agriculture Land	51875	81
Total	**64336**	**100**

Assuming a normal residential density of 350 pph & overall density of 150 pph this corridor will be able to accommodate between 17 to 18 lakh of population.

1.9 EARLIER STUDIES

1.9.1 The first committee to work on a planned development of Bangalore was Bangalore Development Committee (BDC) constituted in 1952. Subsequently in 1961, the Bangalore Metropolitan Planning Board was constituted for bringing out a Master Plan for Bangalore. The BMPB prepared an outline development plan for BMPA.

1.9.2 The Town and Country Planning Act came into force from 1965 and a City Planning Authority was constituted in August 1967. A Comprehensive

Development Plan (CDP) was prepared by the City Planning Authority for the year 2001 with an estimated population of 38 lakh.

1.9.3 In order to implement CDP, the Bangalore Development Authority (BDA) came into existence in 1976 with the authority to control the land-use in the metropolitan area. The result of 1981census, however, threw over board the assumptions of CDP. As the population anticipated for 1991 was reached in 1981 itself, the CDP had to be revised drastically and the population projections were revised in view of the recent trends. A plan was prepared and approved in 1984, then revised 10 years later and approved in 1995 for a population of 45 lakhs in 1991 and 70 lakhs for the year 2001. This plan is merely a zoning document with rough location of the road network. This has now been updated by BDA and French Consultants using satellites imagery and digital area maps and Revised Master Plan – 2015 published.

1.9.4 However, rapid growth in population and economic activities after independence brought to the fore increasing traffic and transportation problems due to the gap between demand and supply of transport system. In order to look for solutions to the traffic problems, several studies have been conducted in the past. Some of these major traffic studies are described briefly below.

1.9.5 The first Comprehensive Traffic and Transportation Plan was prepared in 1963 – 64 by CRRI, New Delhi. The plan was based on the population, land use and area projections made in the Outline Development Plan for Bangalore Metropolitan Region prepared by the Town Planning Department.

1.9.6 An effort to refresh the data and update the proposals was made by the Town Planning Department in 1977. One of its recommendations was to look into a Mass Rapid Transit Project i.e. a metro for Bangalore in 1981. Based on Lynne Committee's recommendations, Southern Railway team recommended a 2-corridor metro of 24 km, 3 commuter rail lines, and a 58 km ring railway at a cost of Rs.6500 million in 1983 terms and to be completed over a period of 25 years.

1.9.7 In 1988 under World Bank funding, RITES Ltd was commissioned to carryout another transport study with broad coverage of roads, traffic and mass transit. The study was completed proposing various roads and traffic improvements, as also commuter rail lines but again without much follow up.

1.9.8 In 1993, State of Karnataka established a committee to look into MRTS, which recommended the same metro project put forward by Southern Railway in 1983 and the same circular railway.

1.9.9 In 1994, the Government of Karnataka created BMRTL to seek public/private partnership of MRTS project. BMRTL commissioned a feasibility study, which pointed out to develop LRT based 96 km long MRTS network.

1.9.10 A study was carried out in 1999 proposing a large and varied road improvement program, including 45 multi-grade intersections, 25 pedestrian underpasses and various corridor improvements. In the process, grade separators were reduced to 19 with 9 to be done in the first phase.

1.9.11 In 2001, the State Government along with railways commissioned RITES to study introduction of commuter rail facility. The report is still under active consideration of the State Government.

1.9.12 In 2003, Government of Karnataka, commissioned Delhi Metro Rail Corporation (DMRC), to carry out a Detailed Project Report for metro in Bangalore. The study recommended 2 line metro, 18 km and 15 km in length, cross shaped. The lines intersect at the Bangalore city railway station and Bus station.

1.10 NEED FOR THE COMPREHENSIVE TRAFIC AND TRANSPORTATION PLAN

1.10.1 Thus several studies have been carried out for the city to improve transportation system in Bangalore. As short-term measures, road widening, flyovers, junction improvements were suggested and some of them have been implemented also. As long term solution, versatile and comfortable Mass Rail Transit System and commuter rail services have been recommended. However, the traffic and transportation scenario continues to be worsening. The BDA has recently got prepared a comprehensive development plan (Revised master Plan-2015). This plan has considered the first phase of Bangalore Metro Rail Project as well as network augmentation of Bangalore Metropolitan Transport Corporation. It, however, does not cover the urban transportation needs of the city fully. Therefore, it was felt by the Government of Karnataka to take a stock of the prevailing situation and prepare a comprehensive traffic and transportation plan which will not only cover short term requirements but also medium and long transport system requirements upto 2025. It should also provide for proper inter-modal transport integration.

1.10.2 It is in this context that Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) has initiated this study for preparing a Comprehensive Traffic and Transportation Plan for Bangalore and engaged RITES Ltd, a Government of India Undertaking, to carry out this study.