Karnataka Infrastructure Development & Investment Plan

Infrastructure Development Strategy & Investment Plan Report

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SUBMITTED TO:

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Infrastructure Development Department, Government of Karnataka has engaged Infrastructure Development Corporation (Karnataka) Limited (iDeCK) to develop the Karnataka Infrastructure Development & Investment Plan (KIDIP) encompassing major infrastructure sectors. iDeCK has closely worked with several stakeholders in the development of this report. No part of this document may be replicated, quoted or printed without written confirmation of iDeCK.

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ABBREVIATIONS

AAI	Airport Authority of India
ADB	Asian Development Bank
AERA	Airports Economic Regulatory Authority
AMTS	Ahmedabad Municipal Transport Services
APMC	Agricultural Produce Market Committee
ATM	Air Traffic Management
BARL	Bangalore Airport Rail Link limited
BBMP	Bruhat Bengaluru Mahanagara Palike
BCAS	Bureau of Civil Aviation Security
BCM	Billion Cubic Meters
BESCOM	Bangalore ESCOM
BEST	Brihanmumbai Electricity Supply and Transport
BG	Broad Gauge
BMRCL	Bangalore Metro Rail Corporation Limited
BMTC	Bangalore Metropolitan Transport Corporation
BOT	Build-Operate-Transfer
BRTS	Bus Rapid Transit System
BWSSB	Bengaluru Water & Sewerage Sanitary Board
C&B	Communication and Buildings
CAGR	Compound Annual Growth Rate
CBD	Central business Districts
CEA	Central Electrical Authority
CESCOM	Chamundeshwari ESCOM
CFS	Container Freight Station
CKM	Circuit kilometers
CNNL	Cauvery Neeravari Nigam Limited
CPSUs	Central Public Sector Undertakings
CSTC	Calcutta State Transport Corporation
CSTF	City Sanitation Task Force
CTC	Chandigarh Transport Undertakings
CTTS	City Traffic and Transportation Study
CWC	Central Warehousing Corporation
DBFOT	Design, Build, Finance, Operate and Transfer
DDUTTL	D. Devaraj Urs Truck Terminal Limited
DFID	Department for International Development
DGCA	Directorate General of Civil Aviation
DMA	Directorate of Municipal Administration
DoT	Department of Tourism
DTC	Delhi Transport Corporation
DULT	Directorate of Urban Land Transport

EPC	Engineering, Procurement and Construction
ESCOM	Electric Supply Company
EWS	Economically Weaker Sections
FCI	Food Corporation of India
FKL	Food Karnataka Limited
GAIL	Gas Authority of India Limited
GBWASP	Greater Bengaluru Water and Sanitation Program
GC	Gauge Conversion
GEF	Global Environment Facility
GESCOM	Gulbarga ESCOM
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoI	Government of India
GoK	Government of Karnataka
GW	Gigawatts
HESCOM	Hubballi ESCOM
HMRDC	Hassan Mangalore Rail Development Company Limited
ICD	Inland Container Depot
IDD	Infrastructure Development Department
IEC	Information- Education- Communication
ILCS	Integrated Low Cost Sanitation Scheme
IPT	Intermediate Public Transport
IT	Information Technology
ITeS	Information Technology Enabled Services
ITS	Intelligent Transport System
IWT	Inland Water Transport
JLR	Jungle Lodges & Resorts Ltd.
JNNSM	Jawaharlal Nehru National Solar Mission
KAPPEC	Karnataka State Agricultural Produce Processing and Export Corporation Limited
KBJNL	Krishna Bhagya Jala Nigam Limited
KEA	Karnataka Exhibition Authority, Mysuru
KERC	Karnataka Electricity Regulatory Commission
KIADB	Karnataka Industrial Areas Development Board
Km	Kilometer
KMRP	Karnataka Municipal Reforms Project
KNNL	Karnataka Neeravari Nigam Limited
KPCL	Karnataka Power Corporation Limited
KPI	Key Performance Indicators
KPTCL	Karnataka Power Transmission Corporation Limited
KRCL	Konkan Railway Corporation Limited
KRDCL	Karnataka Road Development Corporation Limited
K-RIDE	Karnataka Rail Infrastructure Development Corporation Limited
KSCB	Karnataka Slum Clearance Board
KSHIP	Karnataka State Highways Improvement Project

KSRTC	Karnataka State Road Transport Corporation
KSTDC	Karnataka State Tourism Development Corporation
KSWC	Karnataka State Warehousing Corporation
KTIL	Karnataka Tourism Infrastructure Limited
KTVG	Karnataka Tourism Vision Group
KUDCEMP	Karnataka Urban Development and Coastal Environmental Management Project
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation
KUIDP	Karnataka Urban Infrastructure Development Project
KUWASIP	Karnataka Urban Water Sector Improvement Project
KUWASMP	Karnataka Urban Water Supply Modernization Project
KUWSDB	Karnataka Urban Water Supply and Drainage Board
MDR	Major District Road
MESCOM	Mangalore ESCOM
MG	Meter Gauge
MNRE	Ministry for Non Renewable Energy
MoCA	Ministry of Civil Aviation
MoHUPA	Ministry of Housing & Urban Poverty Alleviation
MoR	Ministry of Railways
MoSRTH	Ministry of Shipping, Road Transport and Highways
MoUD	Ministry of Urban Development
MSW	Municipal Solid Waste
MT	Metric Tonne
MTC	Metropolitan Transport Corporation of Chennai
MTOE	million tonnes of oil equivalent
Mts	Meters
MU	Million Units
MW	Megawatts
NABARD	National Bank for Agriculture and Rural Development
NEKRTC	North East Karnataka Road Transport Corporation
NG	Narrow Gauge
NGO	Non-Governmental organization
NH	National Highway
NKUSIP	North Karnataka Urban Sector Improvement Project
NL	New Line
NMT	Non-motorized Transport
NWKRTC	North West Karnataka Road Transport Corporation
NWP	National Water Policy
OMT	Operate, Maintain & Transfer
OYWS	Own Your Wagon Scheme
PCKL	Power Company of Karnataka Limited
PH	Plan Head
POL	Petroleum Oil and Liquid Products
PPP	Public Private Partnership

PRAMC	Planning and Road Asset Management Company
PWD	Public Works Department
PWP&IWTD	Public Works Ports & Inland Water Transport Department
REC	Renewable Energy Certificates
ROB	Road Over Bridge
RoW	Right of Way
RPO	Renewable Purchase Obligation
RUB	Road Under Bridge
SBM	Swatch Bharat Mission
SH	State Highway
SHDP	State Highway Development Project
SHP	Small Hydro Power
SPV	Special Purpose Vehicle
SPARC	Society for Promotion of Area Resource Centres
Sq.Km	Square Kilometers
SWR	South Western Railways
TERI	The Energy and Resources Institute
TMC	Thousand million cubic feet
TPD	Tonnes per day
TTMC	Traffic and transit management centers
UDD	Urban Development Department
UGD	Underground Drainage
ULB	Urban local body
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VGF	Viability Gap Funding
WASHi	Water, Sanitation and Hygiene Institute
WB	World Bank
WHO	World Health Organization
WTTC	World Travel and Tourism Council
WTERT	Waste-to-Energy Research and Technology Council

CONTEXT SETTING

Infrastructure is a pre-requisite for economic development of any country. Roads, railways, ports, airports, logistics urban infrastructure, energy, tourism infrastructure, etc. are an integral part of human existence today and life without these infrastructure facilities is hard to imagine. National and sub-national Governments across the world have realized the significance of infrastructure development as a precursor to increased investments and economic development in the region.

Infrastructure Development Department (IDD), Government of Karnataka (GoK) is the nodal agency for development of infrastructure in the State of Karnataka. IDD intends to document the progress of infrastructure development in the State and formulate a strategy plan for infrastructure development in future. In this regard, Infrastructure Development Corporation (Karnataka) Limited (iDeCK) has been appointed by IDD to develop the Karnataka Infrastructure Development & Investment Plan (KIDIP).

The Karnataka Infrastructure Development & Investment Plan (KIDIP) would set out an account of infrastructure development and future development plans, across the following major infrastructure sectors;

- Railways
- Ports & Inland Water Transport
- Airports & Regional Air Connectivity
- Roads
- Tourism Infrastructure
- Logistics
- Energy
- Urban Infrastructure (Water, Sewerage, Solid Waste Management and Urban Transport)
- Infrastructure in Bengaluru City

The objective of the plan would be to provide details about the current status of infrastructure in the State, assess the proposed development plans (shelf of projects), estimate investments for and prioritise proposed developments. The plan would eventually provide the reader with the following information:

- Current status of infrastructure
- Key issues and challenges in the sector
- Proposed developments in future – shelf of projects

The following deliverables would be submitted to IDD during the course of the development of the plan;

- **Diagnostic Study Report** - sets an account of the existing status of infrastructure in each of sectors. This would involve meeting stakeholders in the sector, identifying the key projects that are executed and the current service levels in the sector, if any.
- **Infrastructure Development Strategy & Investment Plan Report** – would involve an assessment of gaps in the infrastructure requirement in the sector, avenues for bridging the gaps, listing out projects that are proposed for development in the sector, estimation of capital investment that is required in each of the sector and phasing out of projects over a period of time where applicable.

This report sets out the Infrastructure Development Strategy an Investment Plan for infrastructure sector in the State and provides an account of the current status of infrastructure and assesses the gaps. The development strategy for each sector resulting in shelf of projects for development and investments estimated for each of the above mentioned infrastructure sectors would be presented in this report.

The final plan would consolidate the entire exercise thus, providing the reader an account of the current status, proposed developments, shelf of projects and estimated investments in each of the infrastructure sector.

EXECUTIVE SUMMARY

Karnataka is on a growth trajectory which is evident by the GDP growth in 2014–15 which was 7.4%[1] combined with increased urbanization of around 38.57% as of 2011[2]. Given this scenario, there has been a lot of stress on the existing infrastructure in the State combined with a greater pressure on development of new infrastructure to address the rising needs of urbanization and economic development. The following is a Map of Karnataka along with the list list of Districts and their corresponding population.

	District	Population
1.	Bagalkot	18,89,752
2.	Bengaluru Urban	96,21,551
3.	Bengaluru Rural	9,90,923
4.	Belagavi	47,79,661
5.	Bellary	24,52,595
6.	Bidar	17,03,300
7.	Vijayapura	21,77,331
8.	Chamarajanagar	10,20,791
9.	Chikballapur	12,55,104
10.	Chikkamagaluru	11,37,961
11.	Chitradurga	16,59,456
12.	Dakshina Kannada	20,89,649
13.	Davanagere	19,45,497
14.	Dharwad	18,47,023
15.	Gadag	10,64,570
16.	Kalaburagi	25,66,326
17.	Hassan	17,76,421
18.	Haveri	15,97,668
19.	Kodagu	5,54,519
20.	Kolar	15,36,401
21.	Koppal	13,89,920
22.	Mandya	18,05,769
23.	Mysuru	30,01,127
24.	Raichur	19,28,812
25.	Ramanagara	10,82,636
26.	Shivamogga	17,52,753
27.	Tumakuru	26,78,980
28.	Udupi	11,77,361
29.	Uttara Kannada	14,37,169
30.	Yadgir	11,74,271

[1] The World Bank, http://data.worldbank.org/
[2] Census 2011

Infrastructure development has been widely acclaimed as a precursor for industrial development, urbanization and resultant economic development. Over the years, Government of Karnataka (GoK) has also been focusing upon development of infrastructure in the State across sectors such as roads, railways, ports, airports, logistics, power, etc.

Realising the significance of infrastructure development and the multiplier effect it demonstrates, GoK has been one of the first States in the country to have constituted a separate department for infrastructure development. With increasing emphasis on private sector investments and participation in infrastructure development; a Public Private Partnership (PPP) Cell was also constituted within the Infrastructure Development Department (IDD) of the State. Over the years, the Department has also carried out several capacity building programmes in the domain of PPPs and infrastructure development. It has also introduced the Karnataka Infrastructure Policy, 2007 amended up to 2015 that sets out incentives and concessions for infrastructure projects.

Karnataka has been a pioneer in the development of infrastructure projects under innovative project structures/ implementation frameworks. The structures have had a good thrust on private and community participation. Given below are a few examples of such developments;

- Development (including capacity enhancement) of over 7,800 km of state highways in the State (PPP – BOT, OMT and otherwise) under the aegis of Karnataka Road Development Corporation Limited (KRDCL) and Karnataka State Highways Improvement Project (KSHIP).
- Constitution of a special purpose vehicle, viz. Karnataka Rail Infrastructure Development Corporation (K-RIDE) with an objective of developing and implementing rail infrastructure projects in Karnataka. K-RIDE then constituted Hassan-Mangalore Rail Development Corporation (HMRDC) which was involved in the development of Hassan- Mangaluru railways line under a commercial framework.
- Development of the first green-field international airport at Devanahalli, Bengaluru under PPP framework. Also, development of several non-major airports in Karnataka under PPP framework.
- Development of industrial clusters, industrial parks and special economic zones across the State and emergence of Bengaluru in Karnataka as an Information Technology/ Bio Technology (IT/BT) hub of the country.
- Development of several tourism (hotels & wayside) properties across Karnataka under suitable PPP frameworks.
- Development of 24/7 water supply systems under Performance Based Deferred Payment System (PBDPS) framework in the towns of Hubballi-Dharwad, Kalaburagi and Belagavi.

Albeit several milestones are achieved; there exists tremendous scope for improvement and enhancement in the infrastructure provision and service levels, across sectors. The current infrastructure indices/ metrics for the State across core infrastructure sectors are provided in the table below:

Table 1: Key Infrastructure Indices/ Metrics

Sector	Index	As in 2014
Roads	Per Lakh Population	386.5[3]
	Per 100 sq. km area	120.9
Railways	Route km/1000 sq.km	18.2[4]
	Route km/million population	57.1[5]
Airports	No./10000 sq.km	0.26

[3] Economic Survey Report, Directorate of Economics and Statistics, GoK
[4] Based on data collected from South Western Railways
[5] Based on data collected from South Western Railways

	No./million population	0.098
Ports	No. of Major ports	1
	No. of Minor Ports	12
Energy	KWH/Capita	766.48[6]
Tourism	Domestic Tourist Arrivals	118 million
	Foreign Tourist Arrivals	56 lakhs
Logistics	Storage warehousing capacity	17.57 lakh MT[7]

Source: iDeCK assessment

An account of the current status, existing gap and future potential for development of core infrastructure sectors in the State viz transport (airports, ports, roads, railways, inland water ways, regional air connectivity), energy, urban sectors (water and sewerage, solid waste management and urban transport) logistics and tourism infrastructure; is presented in this report. Infrastructure in the capital city of Bengaluru has also been discussed as a separate chapter in the report. Wherever necessary, certain references in the report are also made to other sectors such as agri-infrastructure, rural infrastructure and industrial infrastructure to clarify the context. However the primary focus of the report is on development of core infrastructure sectors which would result in good quality of life and provide the necessary fillip to development of industries and commerce in the State.

The summary of findings of each of the infrastructure sector is set out below;

Railways

Railways in Karnataka is under the jurisdiction of four divisions; viz. South Western, Central, Southern and Konkan Railways. The total railway route length in the State is about 3492 km. Karnataka is also one of the pioneer States in the country that initiated sharing of costs with the Ministry of Railways, Government of India in development of railway projects; primarily to expedite the progress of railway projects in the State. Over the last five years (2009-14), about 277 km of rail length has been added in the State and the cumulative growth rate of railway lines during the period is 3.2% which is higher than the national average of 0.6%. Possible interventions in the sector include new line development, doubling and electrification. The new lines proposed mostly connect Hyderabad-Karnataka region to the rest of the country and hinterland to west coast connectivity in the State. With only 10% of the existing railway lines in the State being electrified, there exists tremendous scope for investments in this regard. About 14 lines are under construction of which 9 are under cost sharing framework, and the likely investments in the sector is to the tune of Rs. 39,173 Crores.

Ports & Inland Water Transport

Karnataka is home to one major port, New Mangalore Port Trust, at Mangaluru and 12 minor ports located along its 320 km of coastline. The major port lies in the southern coastline and is in proximity to the State of Kerala; in 2014-15, the port handled about 36.5 million MT of cargo which is 50 percent of its optimal capacity. The other port in the State where significant movement of cargo is witnessed is located in Karwar along the northern coastline of Karnataka. In 2014-15, the port handled about 0.6 million MT of cargo. Until, the ban on iron ore mining in the State in 2011, Belekeri port also was instrumental in movement of iron ore cargo through barge loading facilities; it handled cargo to the tune of 6 million MT in 2007-08. A need has been felt for development of an all –weather, state-of-the-art port along the northern coastline of the State below Karwar. The Government of Karnataka is also striving to strengthen the rail and road connectivity from hinterland to coast to complement/ support the proposed port

[6] Based on data from Economic Survey of Karnataka 2014-2015
[7] Includes government owned central and state warehousing capacity

development. Possible locations for port development are Karwar, Tadadi, Belekeri, Pavinkurve, and Padubidiri. Several studies have been carried out assessing development of ports in each of these locations. The likely investment in the sector is to the tune of Rs.7,395 crores.

The rivers in the State are categorized into west flowing and east flowing rivers. Although Karnataka has a total river length of 184 km only 29 km of the total length is navigable. Inland water transport in the State is almost negligible primarily due to the non-conducive physical features of the rivers. Inland Waterways Authority of India has identified seven rivers in the State as National Waterways. Likely investment in the sector is to the tune of Rs.79.5 crores.

Airports

Karnataka has five operational airports of which two are international airports located in Bengaluru and Mangaluru. The other airports are located in Mysuru, Belagavi and Hubballi. The international airport located in Bengaluru is the first green-field airport to be developed under Public Private Partnership (PPP) in the country. With a view to promote regional air connectivity and coverage; Government of Karnataka has been proposing development of five minor airports at Shivamogga, Vijayapura, Kalaburagi, Hassan and Ballari. With development of these airports; the entire State would have access to an airport located at a distance of less than or about 150 km. In addition, the Government is also keen on development of air strips and helipads across the length and breadth of the State so as to propel air travel and connectivity. The likely investment in the sector is to the tune of Rs.1405 Crores.

Roads

The State has a good mix of National Highways (NH), State Highways (SH), Major District Roads (MDR) and other roads. Karnataka stands among the top five States in terms of its road network coverage as against the total geographical area and total population. The State has 4688 km of NH, 20572 km of SH and 49959 MDRs. Programmatic approach has been adopted by the State in development of roads under PPP framework. Specific agencies have been created such as Karnataka Road Development Corporation Limited (KRDCL) and Karnataka State Highways Improvement Project (KSHIP) to undertake road development in the State. KSHIP has identified nine east-west and north-south corridors for development across the State. In addition to the above, there is also need to strengthen the existing roads and augment capacities. The likely investment in the sector is to the tune of Rs.21,550 Crores.

Tourism Infrastructure

Development of tourism infrastructure is quintessential in development of tourism in the State. As in 2014, Karnataka stood third and ninth in the list of States with the highest domestic tourist and foreign tourist arrivals categories respectively. The State is also home to three of the UNESCO World Heritage sites and has a wide range of product offerings to tourists. Over the years the Department of Tourism, Government of Karnataka has been actively engaged in development and promotion of tourism in the State. Karnataka State Tourism Development Corporation (KSTDC) and Jungle Lodges and Resorts Limited (JLR) were constituted to undertake property development and management across the State at tourist destinations. The Department also has introduced a new policy for tourism in the State viz. Karnataka Tourism Policy, 2015-2020 which lists out all the incentives and concessions that are applicable for the project development in the sector. Karnataka Tourism Vision Group constituted by the Government has offered its recommendations for improvements in the sector; a special purpose vehicle viz. Karnataka Tourism Infrastructure Limited is also constituted to undertake tourism infrastructure development projects. Several reforms

and development initiatives have surfaced in the sector. Investments in the sector are categorized as two heads; one which provides for basic physical infrastructure at tourist destinations and the other which includes investments towards specific project developments. Improvement of tourism soft touch points is not discussed in the report as the focus has been on development of hard/ physical infrastructure. The likely investment in the sector is to the tune of Rs. 1675 Crores.

Energy

The energy demand in the State grew at a cumulative annual growth rate of 8% during 2006-14, while the supply grew by only 6%. As in April 2015, the total installed capacity in the State is about 15,052 MW which includes both renewable and non-renewable sources of energy. Karnataka stands among the top five States in the country with respect to the total untapped renewable energy resources. There is tremendous scope for development of energy projects in the renewable energy sector. The State has already bid out development of 500 MW solar power projects in the State; the Karnataka Renewable Energy Policy, 2009-14, provides for incentives and concessions for investments in the sector. The work involved in development of the gas pipeline from Dhabol in Maharashtra to Bengaluru has already been completed and the pipeline is now supplying natural gas to many industries along its alignment. Likely interventions along the value chain lies in generation of power, especially in the renewable energy sector and the estimated investment in the sector is to the tune of Rs.1,23,218 Crores.

Logistics

Logistics in the State is very complicated and challenging to assess owing to it being a dis-organised sector. There is not particular department within the State for development of logistics sector. Logistics includes the entire chain of activities that is involved in movement of goods from the origin to destination. Logistics has a role to play across all sectors – industries, agriculture, etc. Most of the industrial establishments (manufacturing sectors) have put in place their supply chains to address movement of goods from point of manufacture to point of sale. It is the agriculture sector that logistics play a crucial role owing to the nature of commodity (lesser shelf life/ perishable; price volatility; less bargaining power of farmers, etc.). The report mostly focuses on the agri-logistics sector. Karnataka currently has 16.2 lakh MT of publically developed storage infrastructure. It has 5 cold chain facilities for storage of agri-produce. The State has also developed 4 Food Parks at different locations in the State as a single point contact for agri-processing and post-harvest facilities. In addition, 3 truck terminals are proposed for development to accommodate the long haul vehicles that transit goods across the State. Likely interventions are in the fields of storage and distribution infrastructure creation and the estimated investment in the sector is to the tune of Rs.1421 Crores.

Urban Infrastructure

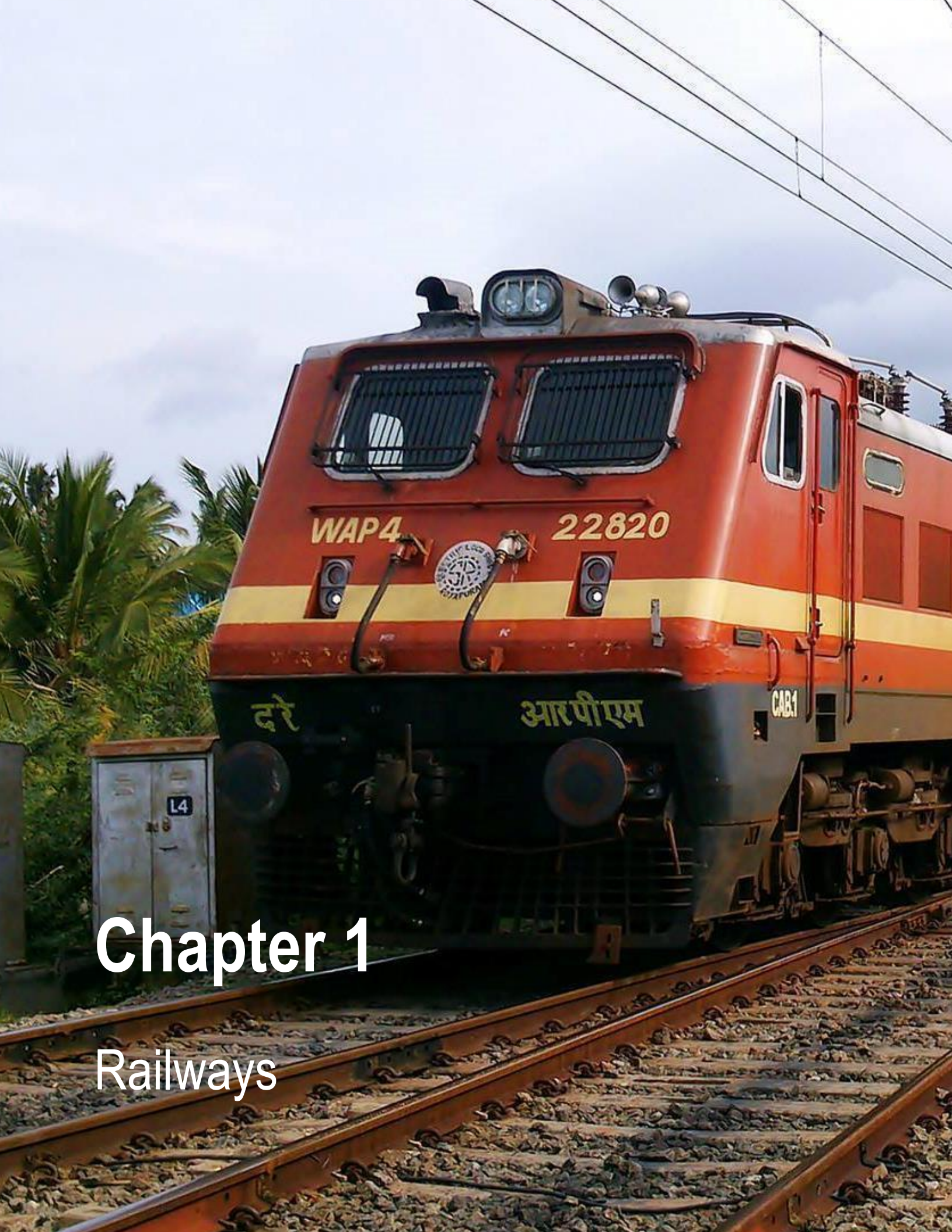
With the Ministry for Urban Development, Government of India introducing several reforms such as the Swachh Bharat Mission (SBM) and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) for development of urban infrastructure across the country; Karnataka has also played its role in enhancing the urban infrastructure service delivery across the State. Urban infrastructure includes water supply, sanitation & sewerage, solid waste management, urban amenities and urban transport. The urban infrastructure assessment has been carried out for the twenty six cities identified under AMRUT scheme within the State. Likely investments in the sector are to the tune of Rs.13,220 Crores.

Bengaluru City

Bengaluru, the capital city of Karnataka has been growing at a rapid pace owing to increased urbanization over the last years. The population of the city has increased from 51 lakhs in 2001 to 84 lakhs in 2011. With burgeoning population, the administration is looking at ways to provide for urban services to the entire population. Several urban infrastructure reforms were carried out in the city under the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) until 2012. With the formation of Bruhat Bengaluru Mahanagara Palike in 2007, the primary concern of the urban local body has been to provide the urban services to the newly added areas of the city. The entire metropolitan area is yet to be completely covered with water supply and drainage network; there are interventions required in the management of municipal solid waste as well. Mass rapid transit system such as Namma Metro (Bengaluru Metro) is already operating along few stretches and work is underway for the complete network development. Other urban transport initiatives such as development of Light Rail Transit System, promoting non-motorised transport, development of peripheral ring road, etc. are being considered for the city. The possibility for investment in the city is huge and about Rs. 75,270 Crores of investment is envisaged for Bengaluru city.

Several departments and agencies are instrumental in provision of infrastructure in the State. The overall investment estimated for development of infrastructure in the State is to the tune of Rs. 2,84,046 Crores. The projects which are identified under each of the sector are at different stages of development and would accordingly take different timelines to be executed.

The Government may look at innovative implementation framework options which could involve private sector participation and investments in development of identified projects. Development of projects under PPP framework wherever possible must be explored so as to meet the huge investment requirements of the sector; due regard must also be given for timely execution and completion of projects.



Chapter 1

Railways

1.1. RAILWAYS IN INDIA

Railways are one of the convenient and widely used means of travel in India. It is also widely used to transport freight across the length and breadth of the country. Indian Railways is the fourth largest railway network in the world with a route length of 65,808 km and a track length of 1,16,765 km.[8] In 2013 -14, Indian Railways transported around 8,397 million passengers and 1051.64 - million tonnes of freight across the country[9]. Railway infrastructure plays a crucial role in the economic development of the country. Improving connectivity through railways goes a long way in ensuring quick access of goods, resources and amenities to various quarters of the country.

The Ministry of Railways is the nodal authority for the development and maintenance of rail transport and the Indian railway network is controlled by the Railway Board through its 18 zonal offices. There are 14 Public Sector Units (PSUs) which perform railway-related function that are also under the control of Railway Boards.

Development of railway infrastructure consists of the following components;

- developing new lines,
- gauge conversion,
- doubling of lines,
- electrification,
- track renewal,
- modernization of station infrastructure,
- computerization and upgrading technology for ticketing.

This section would focus on the first four components of development of railway infrastructure (viz. developing of new lines, gauge conversion, electrification and doubling of lines).

Indian Railways Fact Sheet

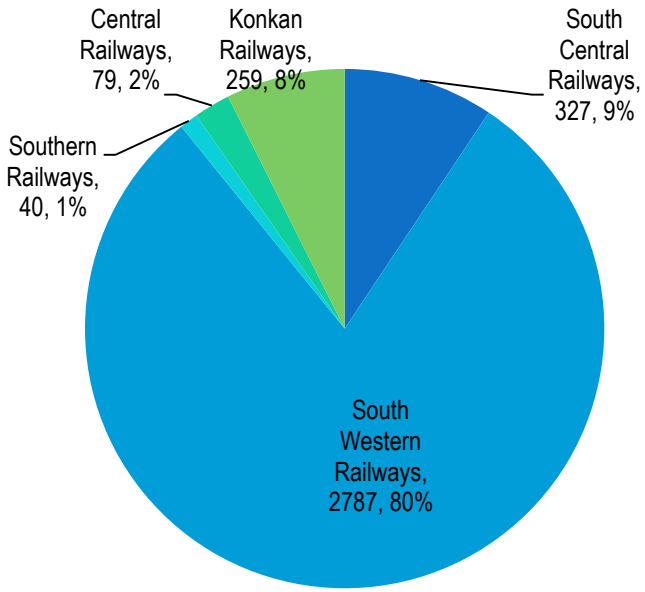
- Figures among the world's five largest networks along with the US, Russia, China and Canada
- Operations span nearly 170 years First train operated from Mumbai to Thane on April 16, 1843.
- Indian Railways has over 239,281 freight wagons, 59,713 passenger coaches and 9,549 locomotives.
- The network has 7,083 stations
- Seventh largest employer in the world comes after the US defense department, the Chinese army, Wal-Mart, China National Petroleum, State Grid of China and British health services
- Has 1.4 million employees on its rolls
- Has an annual revenue base of Rs.1,06,000 crore ($19 billion)

[8] Indian Railways Yearbook 2013-14
[9] Indian Railways Yearbook 2013 -14

1.2. RAILWAYS IN KARNATAKA

Railway infrastructure in Karnataka falls under five zonal offices i.e. South Western Railways, Konkan Railways, South Central Railways, Central Railways and Southern Railways. Among the five zones most part of Karnataka comes under the jurisdiction of South Western Railways which manages around 80% the total railway network in the State. At present, Karnataka has a route length (route kilometer) of 3492 km [10] which accounts for 5% of the total route length of railways in the country. The following figure highlights the various railway zones in Karnataka and route length of each railway zone that falls within Karnataka.

Figure 1: Zone-wise rail route length and percentage contribution in Karnataka (2014)



Source: South Central Railways, South Western Railways, Southern Railways, Central Railways and Konkan Railways

Over the last decade in Karnataka, several gauge conversion projects and new line constructions were successfully completed. At present, the Kolar – Chikaballapur line is undergoing gauge conversion, after completion of which all railway lines in the State would be broad gauge.

The key railway statistics of the State is set out in the table on the right;

Table 2: Key Railway Statistics for Karnataka (2013 - 2014)

Key Railway Network for Karnataka (2013 - 2014)	
Route Length [11]	3492
Running Track Kilometres[12]	3983
Total Track Kilometres[13]	4970
Rail Density (Route km/1 mn population) [14]	57.12
Rail Density (Route km/1000 sq. km.) [15]	18.21
Electrification Percentage[16]	10%
Number of Unmanned Railway Crossings (2012) [17]	585

Note: The route length refers to the total length of the network without taking into consideration double lines or railway sidings. 'Running Track Kilometre' is total length of the running rails of the railway while 'Total Track-km' is the total of the entire track of the railway, including that of railway sidings in yards, depots, stations, etc.

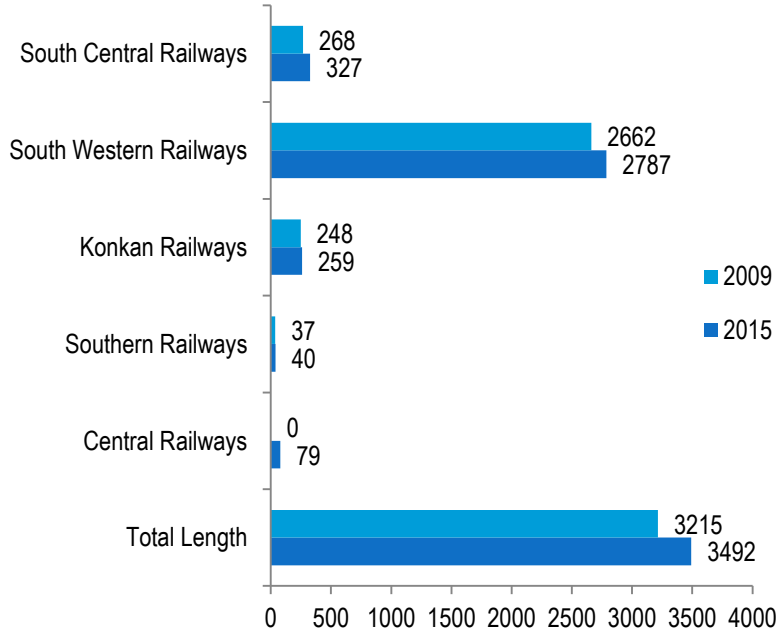
[10] Indian Railways Website

[11] The route length for Karnataka is calculated from the 5 railway zones that Karnataka falls under. Please note that for all comparative analysis with other states the route kilometers for other states are taken from the India Railways Year Book Data.
[12] Indian Railways Yearbook 2013 -2014
[13] Indian Railways Yearbook 2013 – 2014
[14] Calculated based on data from Census 2011
[15] Calculated based on data from Census 2011
[16] Indiastat.com
[17] Data from indiastat.com

There have been concerted efforts over the last five years to improve the railway connectivity in the State by overcoming the geographical and financial limitations. In the last five years, the railway network has been augmented and an additional 277 route km has been added which translates to an annual increment of approximately 40 – 50 route km per year. This is a significant increment in comparison to 32.9 route km per year added during the period from 2002 to 2009[18].

The figure below shows the increase in zone-wise route length of railway network in Karnataka in 2009 and in 2015 respectively.

Figure 2: Increase in Route Length of Railway Network in Karnataka (in route km)



Source: South Central Railways, South Western Railways, Southern Railways, Central Railways & Konkan Railways

[18] Calculated based on data from Indian Railways Yearbook 2002- 2003 & Indian Railways Yearbook 2008- 2009

1.3. COMPARATIVE PERFORMANCE

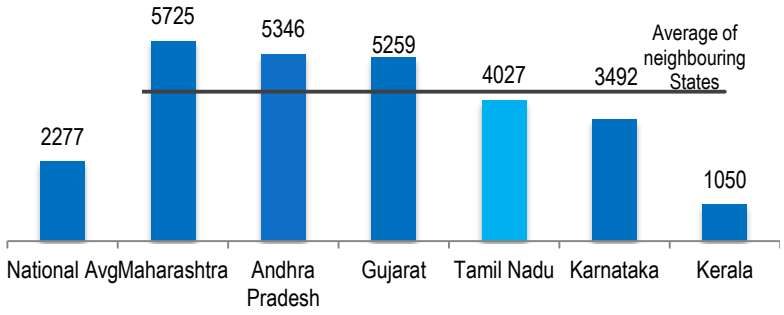
The railway infrastructure in the State has been compared with the railway infrastructure in other States of the country on the basis of the following parameters;

- Route length of existing railway lines
- Route length per unit area and unit population
- Electrified route length

The figure given below indicates the route length (in km) of railways in Karnataka and other Neighbouring States[19], respectively.

Karnataka ranks 10th in terms of total route length while its neighbouring States such as Maharashtra, Andhra Pradesh and Tamil Nadu rank 3rd, 4th and 8th respectively in the terms of total route length.

Figure 3: Comparison of Route length with neighbouring States in km (2013 – 2014)



Source: Indian Railways Year Book 2013 – 14

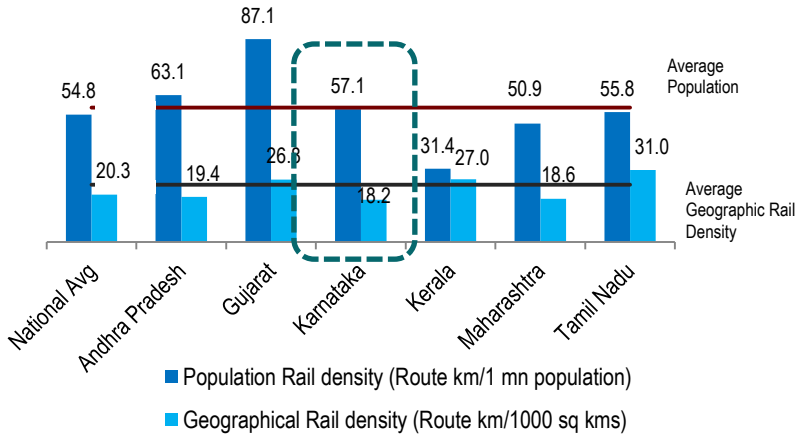
The figure given below comparison of Railway indicates the route length (in km) of railways in Karnataka and other neighbouring States, respectively.

In order to get a better understanding of Karnataka's railway network infrastructure a comparative analysis of rail density is carried out. The following figure compares the rail density of Karnataka with its neighbouring States on the following two parameters:

- **Population Rail Density** in terms of existing route km per 1000 sq. km. of area
- **Geographical Rail Density** in term of existing route km per 1 million (mn) population

In the sector, Karnataka performs close to the national average rail density when compared with other States however; it has the lowest rail density in terms of area Karnataka ranks 10th in terms of route length/million population.

Figure 4: Comparison of Rail Density

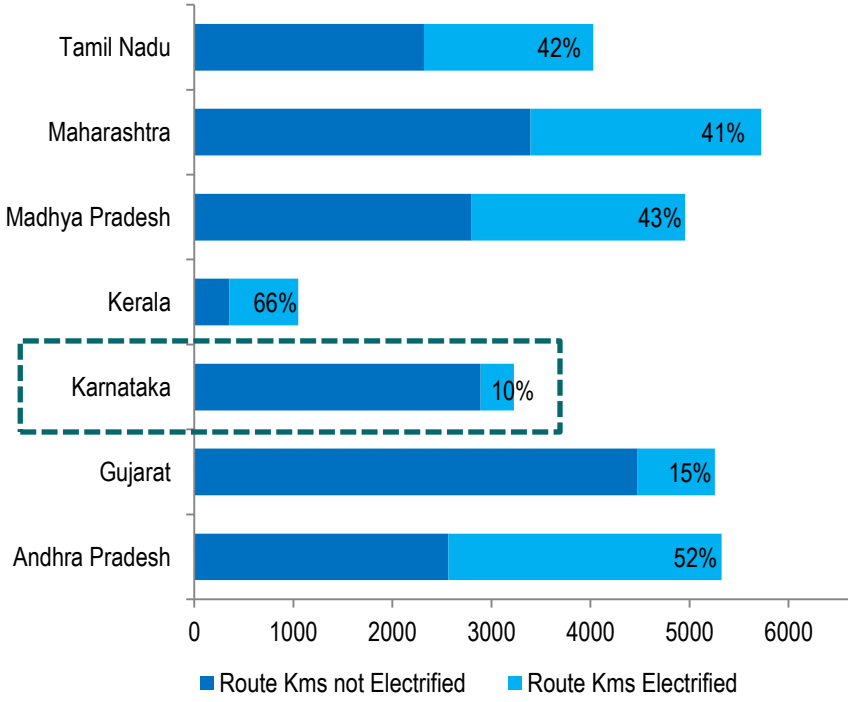


Source: Indian Railways Year Book 2013 -14

19 Note: Gujarat is included in the list of neighbouring states as it is in close proximity to Karnataka and is of similar size. **Average of neigbouring states is taken excluding Karnataka**

As of 2014, only 10% of the rail network in the State was electrified while most of the neighbouring States of Karnataka have around 40% of its railways lines electrified. The same is set out in the figure below.

Figure 5: Comparison of States in terms of electrification (2014)



Source: www.indiastat.com

The above analysis indicates that there is a huge potential for development of new railways lines (increased coverage), capacity augmentation (doubling) of existing lines and electrification of most travelled lines in the State; so as to atleast meet the national railway infrastructure average.

1.4. PROJECTS IN THE SECTOR

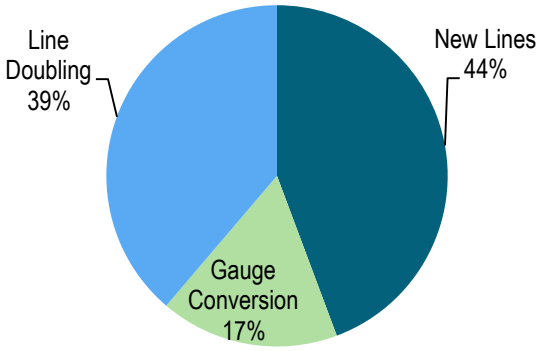
Railway projects have been taken up in the State through several innovative implementation frameworks such as on cost sharing (between State and Central Government) basis and through the Special Purpose Vehicle (SPV) format, for expedited project implementation. About 30 projects have been completed since 2002 that include construction of new lines, gauge conversion and doubling.

A breakdown of Government of Karnataka (GoK) spending in the railway sector for last 10 years (2004-2014) is provided in ***Annexure 1A.***

Funds for completed and ongoing projects were sourced from Ministry of Railways (MoR)/ South Western Railways (SWR) and GoK. Currently, 11 ongoing projects including new line construction, doubling and gauge conversion are being implemented on cost sharing basis with GoK contributing 50% of the funds required and in certain cases GoK has also provided land free of cost for the proposed development. Additionally some projects are being funded through the Extra Budgetary Resource (Institutional Financing) i.e. EBR(IF) scheme.[20]

The pattern of funds released towards construction of new lines, gauge conversion and line doubling is shown in the figure below.

Figure 6: Spending Pattern across Segments (5 years average 2009-14)



Source: South Western Railways and Infrastructure Development Department, Government of Karnataka

Key Highlights of Development of Railway Projects[21]

New lines: 17 works have been completed since 2005 and there are 14 new lines which under construction

Gauge conversion: 12 works have been completed since 2005

Doubling: 33 works have been completed since 2005 and presently there are 7 line doubling works that are ongoing and 1 line undergoing quadrupling under SWR

Electrification: 7 works of electrification have been completed since 2005 while 2 electrification works are being carried out

[20] EBR(IF) allocations would be utilized for priority works. An MoU between MoR and LIC was signed in which LIC has committed funding assistance to a tune of Rs. 1,50,000 Crore over 5 year period. Other institutions can also fund via this scheme

[21] Source : South Western Railways

1.4.1. DEVELOPMENT OF NEW LINES

One of the key focuses of the Indian Railways in development of new lines, for increased geographical railway coverage and provide rail accessibility to maximum population. The table below lists out all the new lines that have been constructed in Karnataka during the period, 2005-2015;

Table 3: New Line Projects Completed (2005 – 2015)

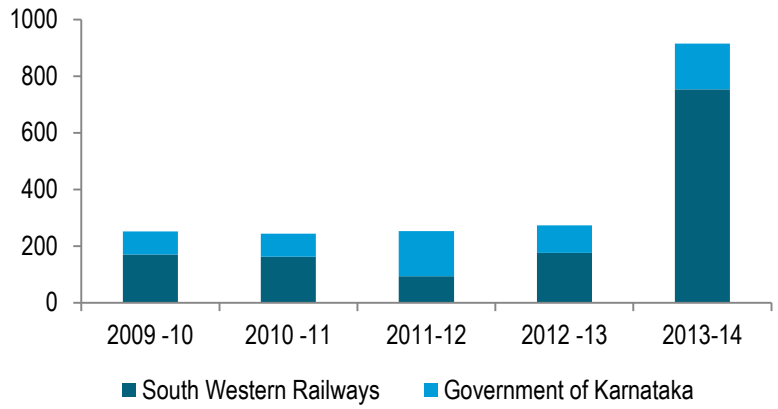
No.	Particulars	Length (km)	Year
1.	Hassan-Shravanabelagola (Hassan – Mangaluru)	42	2005-06
2.	Kadur-Sakryapatna (Kadur – Chikkamagaluru)	17	2010-11
3.	Chickbanavar –Nelamangala (Hassan – Mangaluru)	14	2010-11
4.	Sakryapatna-Kannivehalli (Kadur – Chikkamagaluru)	15	2011-12
5.	Kannivehalli-Chikkamagaluru (part) (Kadur – Chikkamagaluru)	3	2011-12
6.	Kannivehalli-Chikkamagaluru (part) (Kadur – Chikkamagaluru)	12	2012-13
7.	Hirisave-Shravanabelagola (Hassan – Mangaluru)	16	2012-13
8.	Ginigera-Budagumpa (Munirabad-Mehaboobanagar)	4	2013-14
9.	Bagalkot-Kerkalamatti (Bagalkote – Kudachi)	10	2013-14
10.	Nelamangala-Solur (Hassan – Mangaluru)	16	2013-14
11.	B.G.Nagar-Hirisave (Hassan – Mangaluru)	14	2013-14
12.	Kottur-Harihar	65	2013-14
13.	B.G.Nagar-Yediyur (Hassan – Mangaluru)	16	2014-15
14.	Yediyur-Kunigal (Hassan – Mangaluru)	17	2014-15
15.	Vedavathy-Kalyanadurga (balance) (Tumakuru – Rayadurga)	8	2014-15
16.	Ginigera-Budagumpa(balance) (Munirabad-Mehaboobanagar)	10	2014-15
17.	Khanapur – Homnabad (Bidar-Kalaburagi)	38	2013-14
	Total	**279**	

Source: IDD, GoK and South Western Railways

Development of new railway lines results in connecting new regions to the existing railway network. The foremost step in the development of new lines is the survey of the line to determine the feasibility (alignment, technical, socio-economic, environmental, rehabilitation and resettlement, financial, etc.). An in-principle environmental clearance from the Ministry of Environment and Forests is necessary to commence the survey and upon completion of the survey approval and clearance of the Ministry of Environment and Forests is necessary to commence construction of the new line.

During the period 2005 to 2015, 17 works involving development of new lines were completed (details have been set out in the table on the left). At present, 14 new lines are being constructed and 10 new lines are being surveyed. The surveys for 18 new railway lines have been completed and are awaiting clearances/ cabinet approval for commencement of construction. Two lines, Hubballi- Ankola and Honnavar – Talaguppa upon completion would connect the ports to the hinterland.

Figure 7: Funds Released for New Line Project (2009 – 2014) – in Rs. Crores



The figure on the left indicates the funds released for development of new lines by SWR and GoK over the last five years.

Source: South Western Railways

Given below is the list of new survey lines, lines for which surveys have been completed and those that are under construction.

New Survey Lines

- Mysore-K R Nagar - Madikeri (110 km)
- Belur - Sringeri (70 km)
- Chamarajnagar - Krishnagiri(170 km)
- Subramanya - Byndoor (60 km)
- Shivamogga-Shringeri-Mangaluru (220 km)
- Gadag - Harapanahalli (93 km)
- Challekere -Channarayanapatna (195 km)
- Gabbur - Ballari (170 km)
- Ballari - Lingasugar (145 km)
- Talaguppa- Siddapura(

Completed Survey Lines

- Bidadi - Anekal (48 km)
- Vijayapura - Shedbul(112 km)
- Chitradurga - Kottur (78 km)
- Hubballi/Dharwad - Belagavi (91 km)
- Haveri - Gadag (53 km)
- Honnavar - Talaguppa (82)
- Kolar - Chitoor (166 km)
- Koppal - Alamatti (125 km)
- Kuppagal- Alamatti (180 km)
- Raichur - Belagavi via Bagalkote (345 km)
- Shahbad - Vijayapura (156 km)
- Shivamogga - Rannibennur (89 km)
- Yadgir - Alamatti (162 km)
- Hubblli-Ankola (30 km)
- Koppal-Sindhanur (88 km)
- Tumakuru- Chamarajanagar (181 km)
- Haveri-Sirsi (80 km)
- Madhugiri-Gauribidanaur (38 km)

Lines Under Consutruction

- Bengaluru - Chamaraj Nagar (162 km)
- Bengaluru– Hassan (166 km)
- Bidar – Kalaguragi (107 km)
- Kudachi-Bagalkot (144.05 km)
- Munirabad – Mehaboobnagar (Raichur)(170 km)
- Sakaleshpura – Chikmagalur (46 km)
- Tumakuru – Rayadurga (102 km)
- Gadag – Wadi (252.5 km)
- Chikaballapur –Gowribidanur (44 km)
- Chikaballapur – Srinilayam (103 km)
- Srinivasapura – Madanapalli (75 km)
- Shivamogga - Davangere / Harihara (79 km)
- Tumakuru – Davangere (200 km)
- Whitefield - Kolar (52 km)

Figure 8: Railway map of Karnataka - lines under construction, lines surveyed & new survey lines

The following table provides details and current status of all the Newline projects that are under construction

Table 4: New Line Projects under Construction (as of 2015)

Sr. No	Railway Line	Zone	Length (km)	Estimated Project Cost in Rs. crores	Mode of Investment	Current Status
1.	Bengaluru - Chamaraj Nagar (Broad Gauge conversion and new line)	SWR	162	1254.71	Cost Sharing 50/50 with land free of cost	Administrative approval given. Till now Rs. 10 crores has been accorded
2.	Bengaluru– Hassan	SWR	166 (88) = 78	1289.92	Cost Sharing 50/50	Around 88 km have been completed and 78 km are to be constructed. Targeted completion is in March 2016
3.	Bidar – Kalaburagi	SCR	107 (38 =69	843.00	Cost Sharing 50/50	Around 38 km have been completed. Around 69 km remaining.
4.	Kudachi-Bagalkot	SWR	144	816.14	Cost Sharing 50/50	Land acquisition in progress. Rs. 121.67 crores is released for land acquisition
5.	Munirabad – Mehaboobnagar (upto Raichur)	SCR	170	1350.91	Cost Sharing 50/50	1095 acres of land has been handed over for construction. Earth work and bridges are in progress
6.	Sakaleshpura – Chikkamagaluru (portion of Kadur – Chikkamagaluru)	SWR	46	657.80	Cost Sharing 50/50 with land free of cost	Land acquisition in progress. Rs. 15.49 crores released for land acquisition
7.	Tumakuru – Rayadurga	SWR	102	479.59	Cost Sharing 50/50	Construction work for 65 km is in progress there was delay due land acquisition
8.	Gadag – Wadi	SWR	252.5	1922.14	Cost Sharing 50/50 with land free of cost	Administrative approval given. Rs 15.38 crores has been released
9.	Chikkaballapur – Gowribidanur	SWR	44	368	-	Capital outlay has been set aside by MoR.
10.	Chikkaballapur – Srinilayam (1/3rd lies in Karnataka)	SWR	103 34 (1/3)	692 231 (1/3)	-	Expected to be taken up on taken up on cost sharing basis. However cost structure has not been finalized
11.	Srinivasapura – Madanapalli (½ lies in Karnataka)	SWR	75 37.5 (1/2)	296 148 (1/2)	-	Expected to be taken up on taken up on cost sharing basis. However cost structure has not been finalized
12.	Shivamogga - Davangere / Harihara	SWR	79	729.62	Cost Sharing 50/50 with land free of cost	Release of funds not started
13.	Tumakuru – Davangere	SWR	200	1801	Cost Sharing 50/50 with land free of cost	Release of funds not started
14.	Whitefield (Bengaluru) - Kolar	SWR	52	530	Cost Sharing 50/50 with land free of cost	Release of funds not started
	Total		**1439**			**Rs. 12421.83 crores**

Projects highlighted have already started construction and are under way. It is expected that these projects will complete within the next years and augment the route length. The projects that are not highlighted are about to begin physical construction and the timeframe for completion is expected to be around 10 years.

1.4.2. GAUGE CONVERSION PROJECTS

Gauge conversion is another key development undertaken by the Indian Railways. Over the years, all the meter gauge and narrow gauge railway lines in the State have been converted into broad gauge. During the period, 2002 to 2014, 12 works involving gauge conversion were completed, the details of which are given in the table below.

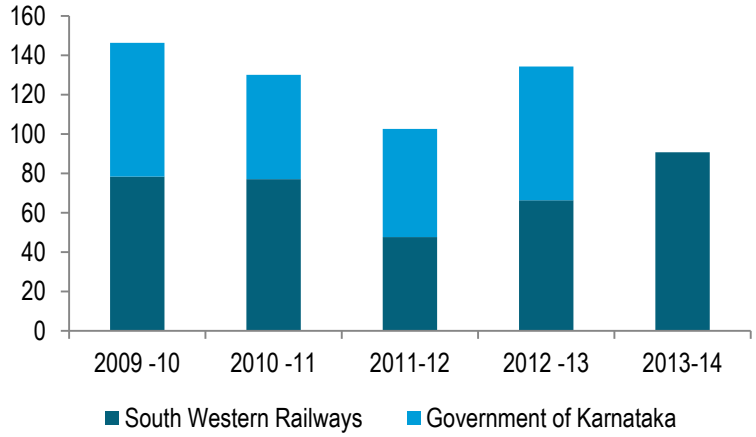
At present, there are no ongoing projects in gauge conversion. The figure on the left shows the funds released for gauge conversion projects by MoR and GoK over the last five years.

Table 5: Gauge Conversion Projects Completed (2005 – 2014)

No.	Particulars	Length (km)	Year
1.	Kabakaputtur-Subramanya Road	42	2005-06
2.	Vijayapura-Basavanabagewadi-Bagalkot	98	2006-07
3.	Sakleshpur-Subramanya Road	55	2006-07
4.	Mysuru-Nanjangud	26	2007-08
5.	Nanjangud-Chamarajanagar	36	2008-09
6.	Bagalkot-Gadag	93	2008-09
7.	Shivamogga-Anandapuram	57	2010-11
8.	Anandapuram- Talguppa	42	2011- 2
9.	Kolar-Chintamani	45	2011-12
10.	Chikkaballapur -Siddlaghatta	16	2011-12
11.	Chintamani-Siddlaghatta	27	2012-13
12.	Kolar - Chickballapura	97	2013-14
	Total	**634**	

Source: South Western Railways & IDD, GoK

Figure 9: Funds Released for Gauge Conversion Projects (2009 – 2014) in Rs. Crores



Source: South Western Railways

1.4.3. LINE DOUBLING PROJECTS

Doubling of lines is necessary for increased movement of trains between any two destinations. Doubling of lines are proposed when the traffic in any given line increases to the extent that it makes doubling inevitable so as to carry out capacity enhancement through doubling in order to operate more trains. During the period, 2002 to 2014, 33 works involving doubling of lines were completed. Details of line doubling projects are set out in the table below.

Table 6: Line Doubling Projects Completed (2005 – 2014)

No.	Particulars	Length (km)	Year
1.	Bayaluvoddigere- Tornagallu	14	2006-07
2.	Bengaluru-Kengeri	12	2006-07
3.	Kengeri-Bidadi	18	2007-08
4.	Yeshwantpur -Golhalli	22	2007-08
5.	Kariganuru-Byalavoddigeri	18	2007-08
6.	Bidadi-Ramanagaram	18	2008-09
7.	Golhalli-Tumakuru	44	2008-09
8.	Byalavoddigeri-Hosapete	18	2008-09
9.	Hubballi-Hebsur Doubling	19	2009-10
10.	Dharwad-Mugad	16	2009-10
11.	Ramanagaram-Chennapatna	12	2010-11
12.	Mysuru-Naganahalli	9	2010-11
13.	Mugad-Kambarganvi	15	2010-11
14.	Arsikere-Devanur	22	2010-11
15.	Devanur-Ballakere	12	2010-11
16.	Maddur-Hanakere	10	2011-12
17.	Ballakere-Birur	11	2011-12
18.	Birur-Nagavangala	9	2011-12
19.	Channapatna-Settihalli	7	2012-13
20.	Mandya-Yeliyur	8	2012-13
21.	Hanakere-Mandya	10	2012-13
22.	Nagavangala-Ajjampur	9	2012-13
23.	Ajjampur-Shivani	11	2012-13
24.	Settihalli-Maddur	11	2013-14
25.	Byadarahalli-Pandavapura	9	2013-14
26.	Shivani-Hosadurga		
27.	Hosadurga-Ramagiri		
28.	Yeshwantpur- Yelahanka		
29.	Yelahanka-Chennasandra		
30.	Naganahalli-Srirangapatna - Pandavapura		
31.	Yeliyur-Byadarahalli		
32.	Ramagiri-Holalkere		
33.	Holalkere-Chikjajur		
	Total		

Source: IDD, GoK and South Western Railways

Yeshwantpur - Yelahanka, Yelahanka – Chennasandra and Hosadurga - Ramgiri Holalkere – Chickjajur have been implemented through the EBR-IF

Presently, line doubling of the Ramanagaram - Mysuru (93 km) line is underway and is being carried out through cost sharing basis. Electrification of this line is being carried out simultaneously. The Bengaluru-Whitefield-Bengaluru City-Krishnarajapuram (23.08 km) line is undergoing quadrupling.

The following lines are being doubled.

- Hotagi-Kudgi-Gadag (284km)
- Hosapet-Huballi-Londa-Vasco-da-gama (352.58 km)

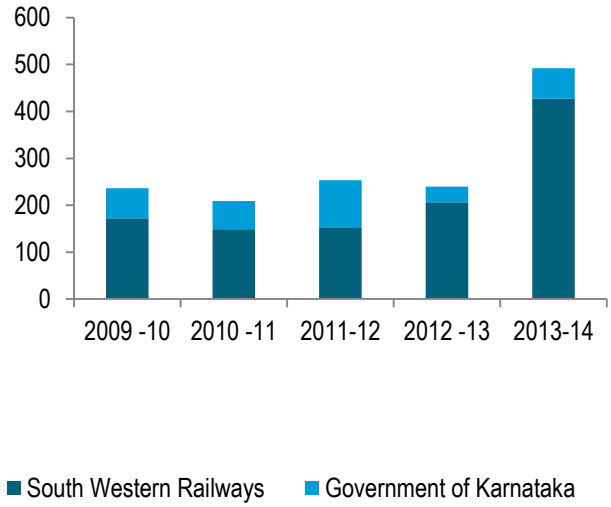
The following lines have been proposed for doubling

- Yelahanka-Penukonda (120.55 km)
- Huballi-Chikjajur(190 km)

- Arsikere – Tumakuru (96 km)
- Birur-Shivamogga

The figure below sets out the funds released for line doubling projects by MoR and GoK over the last five years.

Figure 10: Funds Released for Line Doubling Projects (2009 – 2014) in Rs. Crores



Source: South Western Railways

1.4.4. ELECTRIFICATION PROJECTS

Electrification is another aspect of railway infrastructure development. At present only 10% (338 route km[22]) of the route length in Karnataka are electrified which is much lower than the national average of 36%. South Western Railways under which most railways of Karnataka falls under has an electrified route km of 226; the details of the length of electrified route km in Karnataka that fall under the South Western Railways are provided in the table below.

Presently, there are no new proposed projects for electrification by South Western Railways. The electrification of the Bengaluru – Dharmavaram line (178 kms) and the Ramanagaram – Mysuru line (93 kms) is ongoing.

Table 7: Current status of Electrification of Lines of South Western Railways (as of 2014)

No.	Particulars	Electrified Route (kms)
1.	Jolarpet - Bengaluru	140.3
2.	Baiyyappanahalli- Yelhanka	15.7
3.	Krishnarajapuram -Chennasandra	0.8
4.	Bengaluru - Kengeri	63.5
5.	Baiyyappanahalli - Banaswadi	3.54
6.	Banaswadi - Yeswanthpur	15.8
7.	Bangarpet - Marikuppam	16.4
	Total	**225**

Source: South Western Railways

[22] indiastat.com

The regulatory framework for Railways is as shown below in the table:

Table 8: Regulatory framework for Railways

Sl.no	Regulatory Framework	Details
1.	The Railways Act, 1890	Act for railway administration, commissioners of railway safety, construction and maintenance of works, opening railways, fixation of rates, railway s rates tribunal, carriage of passengers, carriage of goods. The act was consolidated and amended in 1989
2.	The Indian Railway Board Act, 1905	Act to provide Railway Board with certain powers for functioning under the Indian Railway Act,1989
3.	The Metro Railways (Construction of Works) Act, 1978	Act of the Parliament of India that governs the construction of works relating to metro railways in metropolitan cities in the country. The act was amended for a second time in 2009
4	Railway Development Authority	To work within the parameters of the Railway Act, 1989 responsible for traffic determination, ensuring fair play, setting standards
5.	Associated offices	• Ministry of railways • Railway Board • Indian Railway Stations Development Corporation Limited (IRSDC)

1.5. GAP ANALYSIS

Karnataka has as a route length of 3492 km of which 10% of the network is electrified. The Population Rail Density and the Geographic Rail Density in Karnataka is 57.1 route km per million persons of 18.2 route km per 1000 sq km respectively.

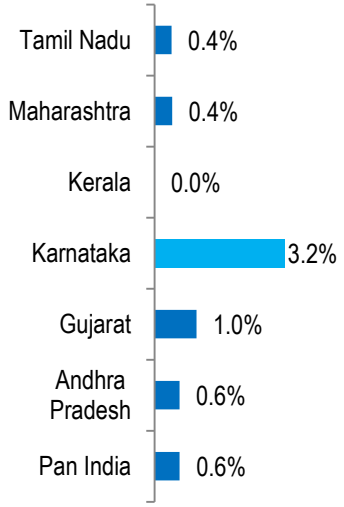
The average route length across Indian States is around 2277 km while the national average for **Population Rail Density** and **Geographic Rail Density** are 54.8 and 20.3 respectively. Thus, Karnataka lies around the national averages in terms of route length and rail density parameters. However, the comparative analysis carried out with neighbouring States such as Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Kerala show that among the southern States, Karnataka is below average across all parameters.

The average route length, Population Rail Density and Geographic Rail Density among neighbouring States is 4281 km, 57.7 km per million persons, 24.6 km per 1000 sq km respectively. Presently, there is a gap of around 790 route km that needs to be bridged for Karnataka to reach the average route length of its neighbours.

Considerable infrastructure investment in railways has been carried out in the State in the last five years. An additional 277 route km have been added during the period of 2009 - 2014 which translates to an annual increment of about 40 to 50 route km per year at a cumulative growth of 3.2%. In comparison to the average national growth in railway network of 0.6 %, Karnataka's development in railways is significantly high.

The figure below depicts the growth rate in route length of neighbouring States;

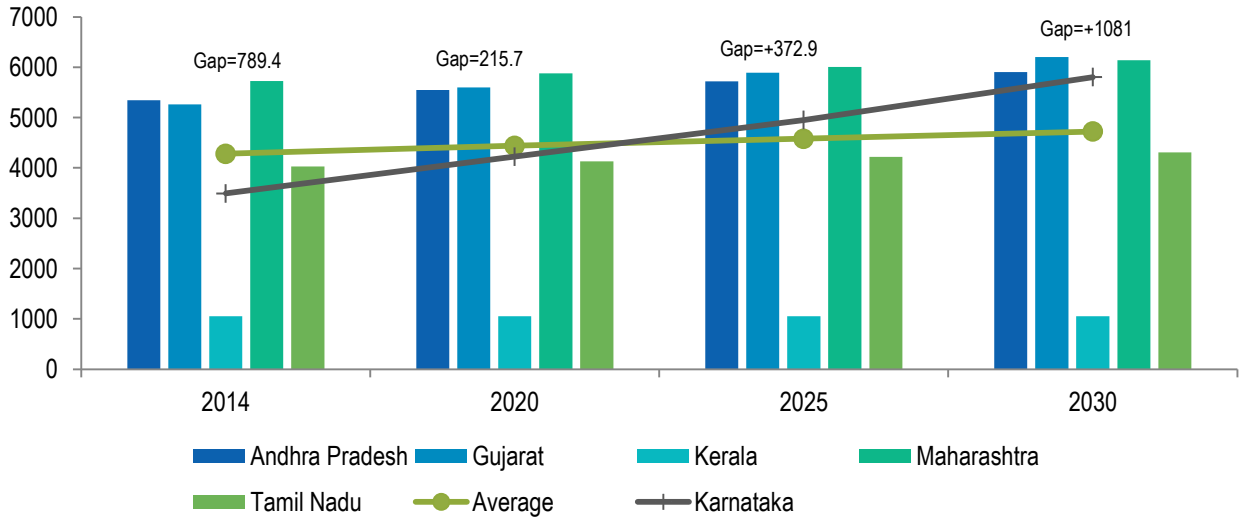
Figure 11: CAGR of Railway Network (route km) over last five years (2009-2014



Source: iDeCK Analysis

Based on the above growth rates, by 2020 the projected route length for the above States is as follows

Figure 12: Projection of Route Length for neighbouring States and Gap Analysis for Karnataka



Source: iDeCK Analysis

From the figure above, it is clear that by steadily augmenting the railway network of the State at the rate of 3.2% each year, Karnataka would be able to catch up to the existing average route length (790 km) of its neighbouring States by 2022.

For Karnataka to cover the existing gap of 790 km by 2020, for the next five years (2015-2020) it needs to expand its railway network at the rate of 5% every year. This translates to an addition of 158 km of new railway line development each year and a total of about 948 route km by 2020.

Presently, 14 projects are under various stages of construction and on completion will augment the rail network by 1439 route km. Of these 14 projects, four projects have commenced construction (refer to table 3). These four projects are expected to complete within five years and will augment the network by around 419 km (that translates to a growth rate of 2.4% which is less than the CAGR of route km added in Karnataka over the last five years). Based on the current trend, it seems like the railways in Karnataka will achieve a route length of 3911 km by 2020. It is imperative therefore that projects that are yet to commence physical construction require to be fast tracked and completed within 5 years.

Based on past performance, the State needs to add at least 559 km (corresponds to 3.2 % CAGR) of route length by 2020.

The following table provides brief details on the project pipeline (new lines) in the State.

Table 9: Project Pipeline

Projects	Total route km	Expected Investment (Rs. Crores)	Possible Timeframe for Implementation	Projected Route Length
Projects under construction(physical)	419	12,421.83	5 years	3911
Projects under construction (about to commence construction)	1020		10 years	4931
Projects that have completed survey (considered for project shelf)	2022	17,192.50	15 years	6953
Projects with on-going survey	1233	-	20 years	8186

Source: Calculated based on information from IDD and SWR

From the table above, it is clear that there are several projects and proposals that are being considered for augmenting the railway network. Thus, focus should be on efficient implementation and innovative financing in order to complete the existing projects. Additionally, some projects will need to be fast tracked in order to close the gap.

The map on the following page provides a graphic representation of all the new line projects that are either under construction (blue or purple colour), where survey has been completed (green in colour) and where the survey is ongoing (orange colour).

The gap analysis for the sector is carried out taking into account the following

- Connectivity to Ports
- Connectivity to Proposed Industrial Corridors and NIMZ
- Connectivity of regions in Hyderabad Karnataka Zone

Figure 13: Railway map of Karnataka - lines under construction, lines surveyed & new survey lines

1.5.1. CONNECTIVITY TO PORTS

Presently, Karnataka has only one railway line that provides hinterland to coast connectivity viz. Hassan- Mangaluru Railway Line. There is no hinterland connectivity via railway line to any of the ports in the north. This makes it imperative to fast track and complete the Hubballi –Ankola and Honnavar –Tallaguppa lines. Development of these lines especially Hubballi-Ankola will additionally allow movement of goods from the Bengaluru –Mumbai Economic Corridor towards ports in the northern part of the coast line.

The State is also looking at developing the Byandoor- Padubidri line and the Shivamogga- Mangaluru for which surveys are presently underway. The strategy is to first to provide hinterland to port rail connectivity to the north and north eastern districts of Karnataka in the next 5 years. Later, in the long term i.e. next ten years there can be focus on capacity augmentation and development of new feeder lines to the existing Hassan-Mangaluru line.

1.5.2. CONNECTIVITY TO PROPOSED INDUSTRIAL CORRIDORS AND NIMZS

There are several industrial developments that are proposed in the State viz.

- the Bengaluru-Mumbai Economic Corridor (BMEC),
- Suvarna Karnataka Development Corridor (SKDC) and
- Chennai–Bengaluru-Chitradurga Industrial Corridor (CBCIC).

As part of these industrial corridors several industrial centres/ megacities have been identified such as Tumakuru, Chitradurga, Davangere, Hubballi, Belagavi and Hassan. All the three corridors are aligned along the NH-4. The Suvarna Karnataka Corridor additionally has a spur going towards Bidar and Kalaburagi located on Hyderabad-Karnataka Region.

In order to facilitate corridor development it is important that the NH-4 which is the backbone for the corridors is well connected via railways in addition to NH-4. In this regards the following lines need to be prioritized

- Hubballi – Belagavi
- Gadag – Haveri
- Davangere – Tumakuru
- Bengaluru – Hassan
- Gadag - Harpannahalli

Additionally there are four NIMZs which have been proposed for Karnataka viz. located in Bidar, Kalaburagi, Tumakuru and Kolar. The NIMZs located in Bidar and Kalaburagi will been part of the Hyderabad – Karnataka Zone and connectivity to these two NIMZs will be discussed in the next section that will address connectivity of the Hyderabad- Karnataka Region. NIMZ located in Tumakuru will be a part of the Bengaluru – Mumbai Corridor which covered in the previous section. For providing connectivity to NIMZ located in Kolar, the Whitefield – Kolar line will be important.

1.5.3. CONNECTIVITY TO HYDERABAD – KARNATAKA REGION

The Hyderabad – Karnataka Region lies in the north – eastern part of Karnataka. Major cities in this region such as Bidar, Kalaburagi, Raichur, Vijayapura are not well connected via railway lines to rest of Karnataka.

Cities like Kalaburagi and Bidar are better connected to Andhra Pradesh than to Central Karnataka or to ports in the State. Most of the districts that lie in the region are economically backward (as identified by the

Nanjundappa Committee Report 2002) but have enormous potential for industrial and manufacturing sector. Goods such as Engineering Products, Automobiles, Agriculture and Horticulture commodities, Electricals, Electronics, Chemicals, Plastics, and Ready-made Garments are manufactured in this region and are typically exported via ports outside Karnataka as the connectivity to central and coastal Karnataka via railways is poor. Therefore Government of Karnataka has laid emphasis on developing the economy and infrastructure for the region.

As seen in map (Figure 13) earlier several surveys have been conducted for newlines in the Hyderabad Karnataka region. A quick analysis shows that most of the lines under construction (blue/purple coloured) are in central and southern part of Karnataka while most of the completed survey lines (green lines) are in Hyderabad Karnataka – region. The Gadag –Wadi line and Koppal -Raichur (Munirabad- Mehaboobanagar) lines are the only two new lines that are under construction that provide connectivity to Hyderabad Karnataka region. Given the lack of connectivity it is recommended that new line developments that are important for the progress and infrastructure of the region be fast tracked.

The following completed survey lines would ideally need to be fast tracked

- Vijayapura - Shedbul
- Koppal - Alamatti
- Kuppagal- Alamatti
- Raichur - Belagavi via Bagalkote
- Shahbad - Vijayapura
- Yadgir - Alamatti
- Koppal-Sindhanur
- Gabbur- Ballari
- Ballari - Lingasugar

1.6. SHELF OF PROJECTS

On the basis of the above gap analysis, it is clear that there is a need for increased railway coverage and capacity enhancement in the sector. The table below provides shelf of projects in the sector; these include those lines wherein the survey has been completed and environmental clearances and other approvals are being awaited for commencement of construction. The estimated investments in developing the shelf of projects is to the tune of Rs.17,200 Crores.

Table 10: Project Shelf for Railways

Sr. No	Railway Line	Length (km)	Estimated Project Cost in Rs. crores	Mode of Investment	Remarks
New Line Projects under construction					
1.	Bengaluru– Hassan	166 (88) = 78	1289.92	Cost Sharing 50/50	Around 88 km have been completed and 78 km are to be constructed. Targeted completion is in March 2016
2.	Bidar – Kalaburagi	107 (38 =69	843.00	Cost Sharing 50/50	Around 38 km have been completed. Around 69 km remaining.
3.	Munirabad – Mehaboobnagar (upto Raichur)	170	1350.91	Cost Sharing 50/50	1095 acres of land has been handed over for construction. Earth work and bridges are in progress
4.	Tumakuru – Rayadurga	102	479.59	Cost Sharing 50/50	Construction work for 65 km is in progress there was delay due land acquisition
5.	Bengaluru - Chamaraj Nagar (Broad Gauge conversion and new line)	162	1254.71	Cost Sharing 50/50 with land free of cost	Administrative approval given. Till now Rs. 10 crores has been accorded
6.	Kudachi-Bagalkot	144	816.14	Cost Sharing 50/50	Land acquisition in progress. Rs. 121.67 crores is released for land acquisition
7.	Sakaleshpura – Chikkamagaluru (portion of Kadur – Chikkamagaluru)	46	657.80	Cost Sharing 50/50 with land free of cost	Land acquisition in progress. Rs. 15.49 crores released for land acquisition
8.	Gadag – Wadi	252.5	1922.14	Cost Sharing 50/50 with land free of cost	Administrative approval given. Rs 15.38 crores has been released
9.	Chikkaballapur – Gowribidanur	44	368.00	Not proposed	Capital outlay has been set aside by MoR.
10.	Chikkaballapur – Srinilayam (1/3rd lies in Karnataka)	103 34 (1/3)	692.00 23.001 (1/3)	Not proposed	Expected to be taken up on taken up on cost sharing basis. However cost structure has not been finalized
11.	Srinivasapura – Madanapalli (½ lies in Karnataka)	75 37.5 (1/2)	296.00 148.00 (1/2)	Not proposed	Expected to be taken up on taken up on cost sharing basis. However cost structure has not been finalized

Sr. No	Railway Line	Length (km)	Estimated Project Cost in Rs. crores	Mode of Investment	Remarks
12.	Shivamogga - Davangere / Harihara	79	729.62	Cost Sharing 50/50 with land free of cost	Release of funds not started
13.	Tumakuru – Davangere	200	1801.00	Cost Sharing 50/50 with land free of cost	Release of funds not started
14.	Whitefield (Bengaluru) - Kolar	52	530.00	Cost Sharing 50/50 with land free of cost	Release of funds not started
New Line Projects where Survey has been completed					
15.	Bidadi - Anekal	48	426.00	Not proposed	2012- However Survey was completed in 2011 but there was delay in submitting to board
16.	Vijayapura - Shedbul	112	810.00	Not proposed	Submitted to railway boards in 2012
17.	Chitradurga - Kottur	78	555.00	Not proposed	Submitted to railway boards in 2014
18.	Hubballi - Belagavi	91	1657.00	SPV	Survey completed in 2013 however to be submitted to board. It is proposed to take project up through SPV
19.	Haveri - Gadag	53.46	300.00	Not proposed	Submitted to railway boards in 2012
20.	Honnavar - Talaguppa	82	1511.00	Not proposed	Submitted to railway boards in 2010
21.	Kolar – Chitoor (Half the lie lies within Karnataka) Expected lenth and cost in Karnataka	166 83	1247.00 623.00	Not proposed	Submitted to railway boards in 2012
22.	Koppal – Alamatti	125	904.00	Not proposed	Submitted to railway boards in 2012
23.	Kuppagal- Alamatti	180	1092.00	Not proposed	Submitted to railway boards in 2012
24.	Raichur - Belagavi via Bagalkote	345	2227.00	Not proposed	Submitted to railway boards in 2012
25.	Shahbad - Vijayapura	156	924.00	Not proposed	Submitted to railway boards in 2012
26.	Shivamogga - Rannibennur	89.47	938.00	Not proposed	In process for clearance via board
27.	Yadgir - Alamatti	162	1369.00	Not proposed	Submitted to railway boards in 2012
28.	Hubballi-Ankola	30	286.00	Not proposed	Submitted to board in 2014. A second survey was carried out in 2013.
29.	Koppal-Sindhanur	88	673.00	Not proposed	Submitted to railway boards in 2014
30.	Tumakuru-Chamarajanagar	181	1667.00	Not proposed	Awaiting submission to board. Survey is completed
31.	Haveri-Sirsi	80	900.00	Not proposed	Awaiting submission to board. Survey is completed

Sr. No	Railway Line	Length (km)	Estimated Project Cost in Rs. crores	Mode of Investment	Remarks
32.	Madhugiri-Gauribidanaur	38	330.00	Not proposed	Awaiting submission to board. Survey is completed
New Line Projects where Survey is Ongoing					
33.	Mysore-K R Nagar - Madikeri	110	TBA[23]	SPV	It is proposed to take project up through SPV
34.	Belur - Sringeri	70	TBA	Not proposed	-
35.	Chamarajnagar - Krishnagiri	170	TBA	Not proposed	-
36.	Subramanya - Byndoor	60	TBA	Not proposed	-
37.	Shivamogga-Shringeri-Mangaluru	220	TBA	Not proposed	-
38.	Gadag - Harapanahalli	93	TBA	Not proposed	-
39.	Challekere - Channarayanapatna	195	TBA	Not proposed	-
40.	Gabbur - Ballari	170	TBA	Not proposed	-
41.	Ballari - Lingasugar	145	TBA	Not proposed	-
42.	Talaguppa- Siddapura	17	TBA	Special Purpose Vehicle	It is proposed to take project up through SPV
Doubling and Electrification Projects					
43.	Ramanagaram – Mysuru (Doubling and electrification)	93	381.00	Cost Sharing 50/50 with land free of cost along with EBR(IF)	110 km already commissioned. 1 km in Shrirangapatna remains.
44.	Bengaluru-Whitefield-Bengaluru City-Krishnarajapuram (Quadrupling)	23	TBA	Not proposed	Sanctioned in 1997-98.Project is kept under abeyance as directed by Board as commuter rail service issues and cost sharing issues needed to be resolved. In 2013-14 survey intermodal transport system was sanctioned and completed by RITES
45.	Hotagi-Kudgi-Gadag	284	1617.00	EBR(IF)	Project sanctioned in 2014-15. Final Location survey in progress
46.	Hosapet-Huballi-Londa-Vasco-da-gama	353	4203.00	MoR, EBR(IF)	Sanctioned in 2010-11. Work being executed by RVNL.EBR(IF) used for sections outside of Karnataka
47.	Yelahanka-Penukonda	121	958.00	EBR(IF)	Project Sanctioned in 2015-16
48.	Huballi-Chikjajur	190	1900.00	EBR(IF)	Project Sanctioned in 2015-16
49.	Arsikere – Tumakuru	96	TBA	EBR(IF)	Project Sanctioned in 2015-16
50.	Bengaluru – Dharmavaram (electrification)	178	TBA	MoR	Rail Vikas Nigam Ltd. (RVNL), which is executing the project since 2011–12
51.	Birur- Shivamogga	60	500.00	EBR(IF)	Proposed for 2016-17
	Total				**39172.83**

[23] To be assessed

As seen in the table above mode of investment has not been proposed for several newline projects. These lines could be considered for developed through K-RIDE. It is suggested that a feasibility study be carried out for all such lines. Three lines have been proposed to be taken up on SPV format and therefore on a priority basis feasibility studies should be carried out for these 3 lines i.e. Hubballi- Belagavi, Talaguppa-Siddapura and Mysore-K R Nagar – Madikeri.

1.7. CONCLUSION

Railways being a Central subject mean that GoK must emphasise upon the Ministry of Railways as to the pressing need for increased railways coverage and hinterland to port connectivity in the State. GoK has been the fore runner in demonstrating innovative means of development of railway projects (by way of forming SPV such as K-RIDE and HMRDC and development of railway lines through cost sharing format with Ministry of Railways). Keeping in view the need for enhanced hinterland to port connectivity in the State, connectivity to industrial corridors and the Hyderabad Karnataka region; it is imperative for GoK to continue to look at innovative means to structure the projects so as to fast track these critical projects that are of high economic interest to the State.

Addition of railway lines in the State over the past five years has been at a promising rate of 3.2% which is much higher than the national average of 0.6% per annum. Assuming a similar growth rate in the future would mean that by 2020, Karnataka would add to its railway route length another 559 km.

ANNEXURE 1A: BUDGET ALLOTTED & SPENT ON RAILWAY PROJECTS (IN RS.LAKHS)

No.	Name of Scheme	2004-05		2005-06		2006-07		2007-08		2008-09		2009-10		2010-11		2011-12		2012-13	
		Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent	Allotted	Spent
1	K-RIDE investment			-	-		-	-	-	-	-	-	-	500	-	1	-	1	-
2	Hassan-Mangaluru guage conversion project	500	500	1500	1500	1500	1500	1	-	1.00	-	900	819 (by re-appn)	900	54	100	66	-	-
3	Sholapur-Gadag guage conversion project	300	300	800	800	-	-	800	800	100.00	4000 (by re-appn)	2800	2214 (by re-appn)	2800	926	500	300	1	-
4	K-RIDE - RoB/ RuB project	100	100	2000	2000	3000	1615	2600	1828	3000	2037	3000	2999 (by re-appn)	3000	2987	2149	2149	4000	2545
5	New Cost Sharing project	-	-	2000	2000	3500	7474 (by re-appn)	10000	6304	10000	10000	10000	9711	27250	26765	25652	24950	11075	11075
6	Commuter Rail Service for Banglore.	-	-	200	150	1000	1000	1000	810	100	10.00	100.00	-	100	-	500	273	500	-
7	Cost sharing Ramanagaram-Mysuru Railway Doubling	-	-	-	-	2500	0	2000	1615	3000	5200 (by re-appn)	2500	2419	2500	2500	2500	2500	7663	3280
8	Land for railway cargo complex.	-	-	-	-	500	500	1	-	1	-	1	-	1	-	1	-	-	-
9	Cost sharing- Bidar - Kalaburagi New Railway line.	-	-	-	-	1000	500	2000	2000	4200	2000	5000	5000 (by re-appn)	4250	4250	3910	2100	5000	5000
10	Hubballi Ankola Railway project	-	-	-	-	-	-	-		500	-	1	-	1	-	1.00	-	500	-
Total				**6500**	**6450**	**13000**	**12589**	**18402**	**13357**	**20902**	**23247**	**24302**	**23162**	**41302**	**37483**	**35314**	**32338**	**28740**	**21900**

Chapter 2

Ports & Inland Water Transport

2.1. PORTS IN INDIA

Ports have been considered as the gateways of trade and commerce since time immemorial. Ports are one of the primary components of the general transportation sector and are nowadays linked to the expanding world economy. Moreover, sea conveyance is the cheapest form of transportation in terms of fuel consumption and investment. Transportation through sea provides the opportunity to trade with other countries and with the movement of goods enhances the economy of the nation[24].

Mainland India, excluding Andaman, Nicobar and Lakshadweep islands is has a coatline of about 6100 km. The nine coastal Indian States are Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal that are home to all major and minor ports of India. The long coastline of India forms one of the biggest peninsular regions in the world. All ports that are publically owned in India are either classified as major or minor ports. There are thirteen major sea ports in India under the control of the Central Government. The following are the major ports of country

- Kandla in Gujarat
- Mumbai and Jawaharlal Nehru Port in Maharashtra
- Mormugao in Goa
- New Mangalore Port in Karnataka
- Cochin in Kerala
- Tuticorin, Ennore and Chennai in Tamil Nadu
- Vishakapatnam in Andra Pradesh
- Paradip in Odisha
- Haldia Dock Complex and Kolkata Dock System in West Bengal

There are 215 minor ports in India which are located in the 9 maritime States of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal. However, only 69 minor ports in the country handled cargo traffic in the year 2013-14. The minor ports are mostly used for the purpose of fishing and allied activities. In addition, to major and minor ports there are privately owned ports such as the ones located in Mundra, Pipavav, Gangavaram, Ennore, Krishnapatnam and Dhamra.

Distinction between Major and Minor Ports

India has 13 major ports and 200 non major ports (minor and intermediate ports) spread across nine (coastal) maritime States. Ports are under the concurrent list of the Indian Constitution. The key difference between major and minor ports is in jurisdiction. Major ports are under the jurisdiction of the Union Govt., managed by the Port Trust of India while minor ports are under the jurisdiction of the respective State Governments. However all Indian ports are regulated under the Indian Ports Act, 1908

Source: The Port Sector, Department of Economic Affairs, Government of India

[24] Role of ports in the economic development of the country, 39th European Congress of the Regional Science Association, August 23-27, 1999, Dublin, Ireland

SAGAR MALA PROJECT:

Sagar Mala project is a strategic and customer-oriented initiative of the Government of India to modernize ports so that port-led development can be augmented and coastlines can be developed to contribute in India's growth. It looks towards transforming the existing Ports into modern world class Ports and integrate the development of the Ports, the Industrial clusters and hinterland and efficient evacuation systems through road, rail, inland and coastal waterways resulting in Ports becoming the drivers of economic activity in coastal areas. The programme aims to promote port-led development in the country by harnessing India's 7,500-km long coastline, 14,500-km of potentially navigable waterways and strategic location on key international maritime trade routes

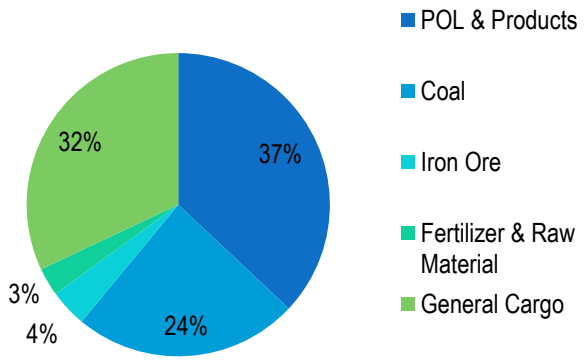
Six megaports are planned in Sagarmala project and provided in the table below.

S.No	Megaport	State
1.	Sagar Island	West Bengal
2.	Paradip	Odisha
3.	Sirkhazi	Tamil Nadu
4.	Enayam	Tamil Nadu
5.	Belikeri	Karnataka
6.	Vadhavan	Maharashtra

2.2. COMPARATIVE PERFORMANCE

The Indian ports handled a total cargo of 1051.99 MT in 2014-15. The major ports handled 55% of the total cargo which amounted to 4.7% growth when compared to the previous year. The remaining cargo is handled through minor ports which attained a growth rate of 12.8% as compared to the previous year. The types of commodities that are handled in the major and minor ports are given in the chart below:

Figure 14: Type of Cargo handled by Indian Ports



Source: Port Statistics, Ministry of Shipping, GoI

The table below presents the cargo handled at each of the major ports across India

Table 11: Major Ports in India during 2013-14 in million tonnes (MT)

S. No	Major Ports	Total cargo handled in 2013-14	Total cargo handled in 2014-15
1.	Kandla	87.00	92.50
2.	Mumbai	59.19	61.66
3.	Jawaharlal Nehru Port	62.33	63.80
4.	Mormugao	11.74	14.71
5.	New Mangalore Port	39.37	36.57
6.	Cochin	20.89	21.60
7.	Tuticorin	28.64	32.41
8.	Ennore	27.34	30.25
9.	Chennai	51.10	52.54
10.	Vishakapatnam	58.50	58.00
11.	Paradip	68.00	71.01
12.	Kolkata (Haldia Dock Complex and Kolkata Dock System)	41.39	46.29
	Total	**555.49**	**581.34**

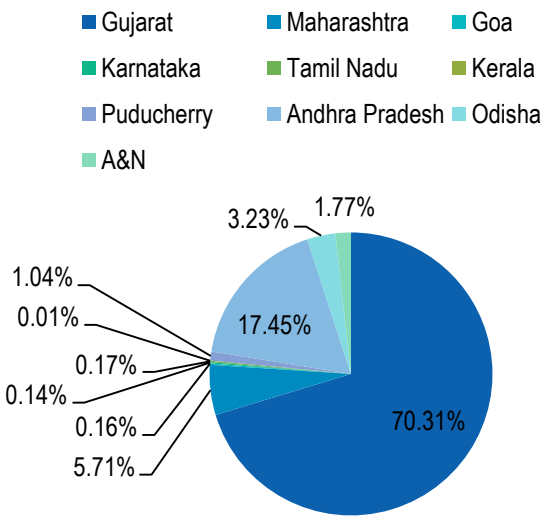
Source: E-Magazine, Indian Ports Association

As seen in the table on Major Ports in India, Kandla port handles the highest amount of cargo in India. All major ports expect New Mangalore Port and Vishakapatnam have seen an increase in cargo traffic from 2013-14 to 2014-15. In terms of percentage Mangaluru Port handles around 6.3% of the total cargo handled of the major ports in India. Each of the major ports handles on average 48.45 MT each year and New Mangalore Port handles around 36.57 MT which is close to the average.

Over the years minor ports have been gaining prominence and the growth rate of cargo handled at minor ports has been steadily increasing. In India there are around 215 minor ports spread across the nine maritime States

The figure given below indicates the percentage of cargo handled by the minor ports across the maritime States as well as the Andaman's and Puducherry during the year 2014- 15

Figure 15: Percentage of cargo handled in minor ports across maritime States in India in 2014-15



Source: Port Statistics, Ministry of Shipping

As seen in the figure above Gujarat handles a huge portion of non- major port traffic and it corresponds to around 336.09 MT which is more than three times the cargo handled at Kandla major port (92.50 MT). Thus Gujarat's prominence as a maritime State comes not only from the cargo traffic at its major port but from the 41 minor ports that are located along its coastline. Karnataka has a very small share of 0.14% of non-major port cargo. The total cargo handled by all ports in the maritime States is provided in the below table:

Table 12: Total Cargo handled by maritime States in India in 2014-15

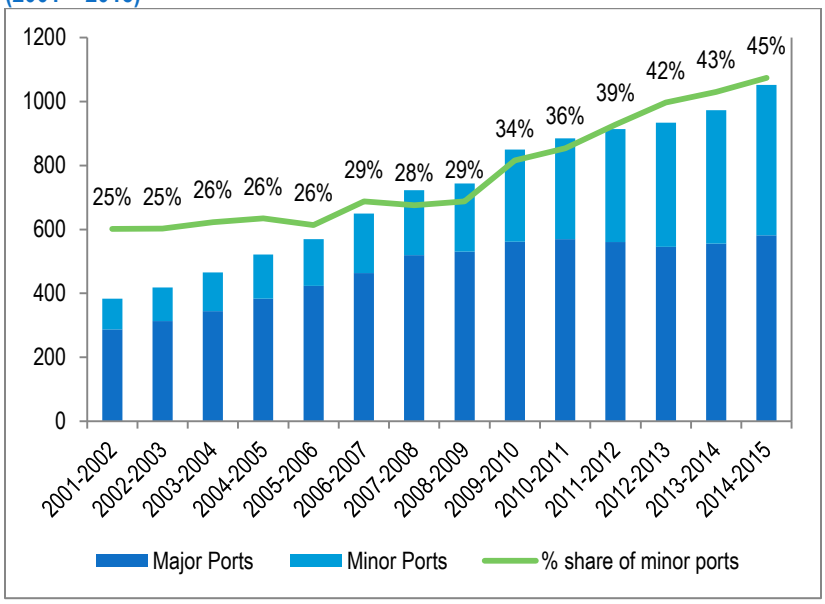
No	Name of the State	Major Ports (MT)	Minor Ports (MT)	Total (MT)	No. of minor ports
1.	Gujarat	92.5	336.09	428.59	41
2.	Maharashtra	125.46	27.3	152.76	48
3.	Goa	14.71	0.78	15.49	5
4.	Karnataka	36.57	0.65	37.22	12
5.	Kerala	21.6	0.01	21.61	17
6.	Tamil Nadu	115.2	0.83	116.03	15
7.	Andhra Pradesh	58	83.42	141.42	12
8.	Odisha	71.01	15.45	86.46	13
9.	West Bengal	46.29	0	46.29	1
10.	Others *	0	6.12	6.12	37
	Total	581.34	470.65	1051.99	215

**others include Andaman and Nicobar Islands and Puducherry*
Source: Port Statistics, Ministry of Shipping, GoI

Gujarat State handles the highest cargo traffic through the minor ports among the maritime States in the country. Almost 70.31% of the entire cargo handled through minor ports in the country is from Gujarat. This is followed by Andhra Pradesh, Maharashtra and Orissa. The other maritime States contribute negligible volume of traffic to the overall cargo handled through minor ports in the country.

The maritime States have recognized the importance of the minor ports in trade and commerce and have taken up several initiatives in developing minor ports. With the advent of private sector participation in development of major ports, the maritime States (especially Gujarat and Andhra Pradesh) leveraged the opportunity to allow participation of private sector in the development of minor ports. The figure below shows the year-wise traffic handled at major and non-major ports across India.

Figure 16: Year-wise traffic handled at major and non-major ports in India (2001 – 2015)



Source: E-Magazine, Indian Ports Association

The total traffic volumes of non-major ports have continued their upward trajectory with 44.74% share in traffic handles in 2014 -2015. There has been a phenomenal increase in the share of non- major ports in import and export activities. In the last 5 years the share of non- major ports has gone up by 11%. It is imperative that a clear strategy is developed in order to better leverage the potential of minor ports within Karnataka.

Need for Maritime Boards in Development of Ports

Currently, the minor ports in Karnataka are administered by Directorate of Ports and Inland Water Transport with Public Works Department as the nodal agency. As a result, the policy matters and regulations with regard to development of ports in the State are determined by the Public Works Department. The Directorate of Ports and IWT only act as an implementing agency. Karnataka having 12 minor ports under the State control need to have a single distinct set up which formulate plans as well as does the implementation. This will reduce the gap in coordinating the various activities towards the execution of the policies and regulations.

In order to show case the advantage of setting up a maritime board for the State, the functions and objectives of the maritime board across the maritime States in the country has been compared and assessed in ***Annexure 2A***

2.3. PORTS IN KARNATAKA

Karnataka is endowed with a long coastline of around 320 km between Karwar (in the North) and Mangaluru in the South) and running across the districts of Uttara Kannada, Udupi and Dakshina Kannada. The entire coastal belt as well as the adjacent districts are rich in mineral and natural resources and hence offer good scope for industrial investment. This section provides details of infrastructure and activities at each of the ports in the State.

At present, there is only one major port in Karnataka viz., The New Mangalore Port (NMP) This is located at the southern end of the coastline and hence is predominantly being utilized by the southern districts of the State. The New Mangalore Port handles most of the exports from the State. Presently, New Mangalore Port has a port capacity of 77.77 million tonnes per annum. The port handled total traffic of 39.4 million tonnes during 2013-14 and 36.5 million tonnes in 2014-15.That means the port is using around 50 per cent of its optimal capacity. The port is in the process of increasing its capacity to 100 million tonnes by 2020. The key commodities/products being exported from NMP are petroleum & petroleum products, coal, iron ore and granites, chemicals and pharmaceuticals, coffee, cashew, marine, and agricultural produce and processed food. The table below indicates the share and quantity of the key commodities being exported out of NMP.

Table 13: Commodity-wise cargo handled at NMP

Name of Commodity	2014-15 in lakh tonnes	% share of total
POL Crude (MRPL)	144.02	39.4%
POL Products	67.58	18.5%
Coal (UPCL)	27.25	7.5%
Coal - Others	54.17	14.8%
Edible Oil	6.83	1.9%
Maize	0.06	0.0%
Cement	3.36	0.9%
Iron Ore	13.18	3.6%
LPG	15.63	4.3%
Other Cargo	33.58	9.2%
Total	**358.83**	
Rly. Traffic (in lakh tonnes)	70	
Containerized Cargo (TEU)	50,126	
Port Capacity (MPTA)	77.77	

Source: NMPT website

In addition to the major port located in Mangaluru, there are twelve minor ports in the State. The major activities carried out in each of the ports are set out in the table below;

Table 14: Major Activities in the Ports of Karnataka

No.	Port	Activity
1.	Karwar	Cargo
2.	Belekeri	Cargo
3.	Tadadi	Marginal Cargo and Fishing
4.	Honnavar	Marginal Cargo and Fishing
5.	Pavinakurve	Fishing
6.	Manki	Fishing
7.	Bhatkal	Fishing
8.	Kundapur	Marginal Cargo and Fishing
9.	Hangarkatta	Fishing
10.	Malpe	Fishing
11.	Padubiri	Marginal Cargo
12.	Old Mangaluru Port	Cargo
13.	New Mangaluru Port	Cargo

Source: Public Works, Ports & Inland Water Transport Department, GoK

Although there are twelve minor ports, only four ports handle cargo traffic in the State. During the year 2015-16 the cargo handled by all minor ports in the

State was 0.84 MTPA against 0.64 MTPA in the year 2014-15. All the minor ports are under the administrative control of the State Ports and Inland Water Transport (IWT) Department.

The port-wise cargo handled by the four minor ports in the State is given in the table below;

Table 15: Port-wise cargo in Karnataka (MT)

Port	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Karwar Port	2.61	2.47	2.38	2.72	2.96	2.2	1.13	0.5	0.44	0.38	0.53
Belekeri Port	0.81	1.55	4.08	6.09	1.91	6.27	1.83	0	0	0.13	0
Malpe Port	0.01	0.02	0.01	0.01	0.01	0.03	0	0	0	0	0
Old Mangaluru Port	0.08	0.08	0.09	0.08	0.09	0.08	0.14	0.09	0.16	0	0.11
Total	**3.51**	**4.12**	**6.56**	**8.9**	**4.97**	**8.58**	**3.1**	**0.59**	**0.61**	**0.51**	**0.64**

Source: Public Works, Ports & Inland Water Transport Department, GoK

From the above table it can be inferred that, only Karwar and Belekeri port handled considerable volume of traffic over the decade. Belekeri port which was handling iron ore did not carry any traffic after the year 2010-11 owing to the ban on iron ore mining in the State. As a result, there has been a significant drop in the volume of traffic in these ports.

The commodity wise traffic handled by the minor ports in the State is given in the table below.

Table 16: Commodity-wise cargo handled in minor ports in Karnataka (MT)

Port	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
POL & Products	0.15	0.11	0.10	0.14	0.05	0.02	0.04	0.03	-	0.04	0.04
Granite	0.23	0.27	0.25	0.34	0.31	0.44	0.34	0.36	0.23	0.05	0.00
Fertilizer & FRM	0.02	0.02	0.03	0.10	0.04	0.03	-	0.02	0.03	0.05	0.00
Salt	0.05	0.06	0.10	0.07	0.08	0.07	0.08	0.03	0.06	0.05	0.00
Iron Ore	0.49	2.72	3.40	5.77	8.04	4.28	7.84	2.32	-	-	-
Others	0.19	0.32	0.24	0.14	0.38	0.13	0.22	0.31	0.27	0.42	0.40
Total	**1.17**	**3.51**	**4.12**	**6.56**	**8.90**	**4.97**	**8.58**	**3.10**	**0.59**	**0.61**	**0.51**

Source: Port Statistics, Ministry of Shipping

A brief overview of the current status of the minor ports in the State, connectivity to ports and, the development activities that have been initiated at these ports are discussed below.

2.3.1. KARWAR PORT

Karwar port is located in Uttara Kannada District. It is the northern most port in Karnataka and the nearest port to Karwar is Belekeri which is 32 km to the south of Karwar. Karwar is the only minor port that has reasonable infrastructure facilities in terms of berthing the ships and cargo handling when compared to other minor ports in the State. A variety of commodities are handled at the port through excavators, dumpers and loaders within the port area. The existing storage area within the port limit is limited and it cannot stack huge volumes of cargo.

The location map of the port is presented below

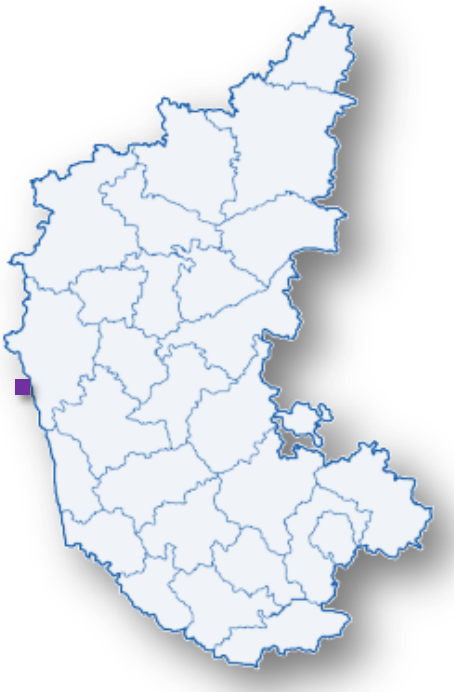
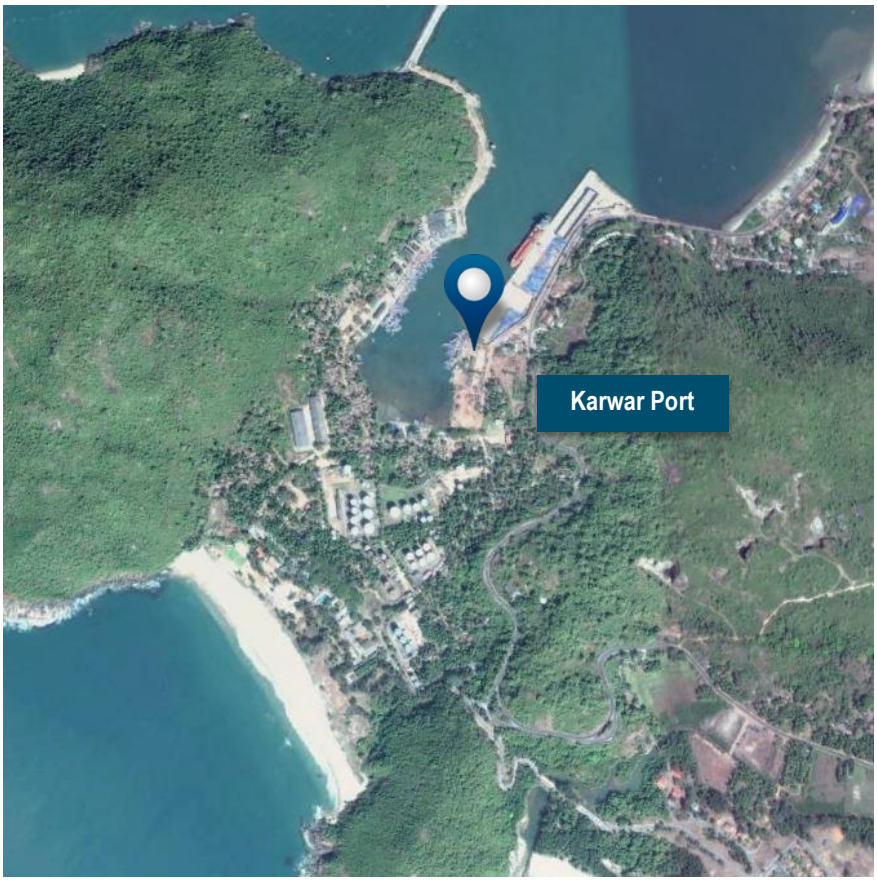


Figure 17: Location Map of Karwar Port



Karwar Port – Fact Sheet

District: Uttara Kannada

Key Activities: Cargo and Fishing

Road Connectivity: NH-66 (NH-17), SH-6, SH-34

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 9

Cargo Handled (in MTPA): 0.72

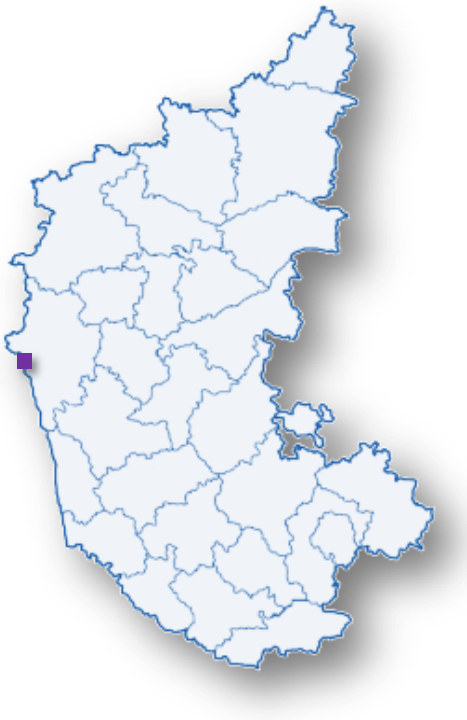
Type of cargo: Iron ore, manganese ore, granite, coal, POL and Products, Limestone, Agricultural Products

Existing Facilities: Break water of length 250 m, 516 meters wharf accommodating 3 ships with other matching facilties, warehouse and transit sheds

Extent of land area: 200 acres

Source: Google Maps

2.3.2. BELEKERI PORT



Belekeri port is located in Uttara Kannada District. It I located between Karwar port to the north and Tadri port to the south. The nearest port to Belekeri is Karwar port which is at a distance of 32 km. The port location has Kantrivada Hills (elevation of 257m) as the northern boundary, Ipati Hills (194 m) on the west and the tidal marsh with low relief towards north. Eastern part is a narrow sand acute coastal strip that extends southwest forming the eastern rim of the Belekeri bay. The proximity of the port to the ore rich areas of Ballari/ Hosapete and good connectivity gave importance to this port. During the peak in exports of iron ore, the area and facilities were leased out to various companies to facilitate the export of iron ore. The ore was transported from the mines in trucks and loaded on to barges for mid-sea loading onto vessels. This continued till 2010, and the exports of iron ore dropped significantly, following the ban on iron ore extraction.

The location map of the port is presented below

Figure 18: Location Map of Belekeri Port

Source: Google Maps

Belekeri Port – Fact Sheet

District: Uttara Kannada

Key Activities: Cargo and Fishing

Road Connectivity: NH-66 (NH-17), SH-6, NH-63

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 3

Cargo Handled (in MTPA): Nil. Due to iron ore ban cargo handled at port has reduced drastically

Type of cargo: Iron ore and Container cargo

Existing Facilities: Stone masonry jetty of 250 m

Extent of land area: 130 acres

2.3.3. TADADI PORT

Tadadi port is located in Uttara Kannada District. It is located between Belekeri port to the north and Honnavar port to the south. The nearest port to Tadadi is Belekeri port which is at a distance of 35 km. It is located on the mouth of the river Aghnashini. The river forms a large estuarine expanse which is 13 km long and 2 to 6 km wide in the coastal taluk of Kumta. The estuary has its outlet into the sea between the villages of Aghanashini in the south and Tadadi in the north. The port is fair weather lighterage and is currently classified as a fishing harbour.

The location map of the port is presented below

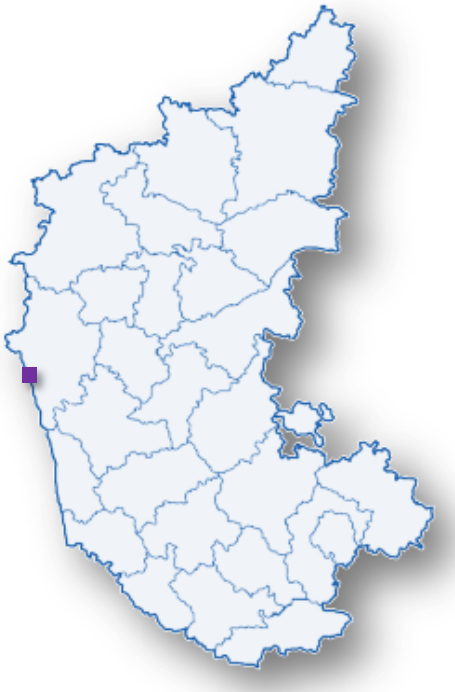


Figure 19: Location Map of Tadadi Port

Source: Google Maps

Tadadi Port – Fact Sheet

District: Uttara Kannada

Key Activities: Cargo and Fishing

Road Connectivity: NH-66(NH-17), NH-63, SH-69, SH-48, SH-142 (SH – 69 becomes SH-142)

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 2.5 m

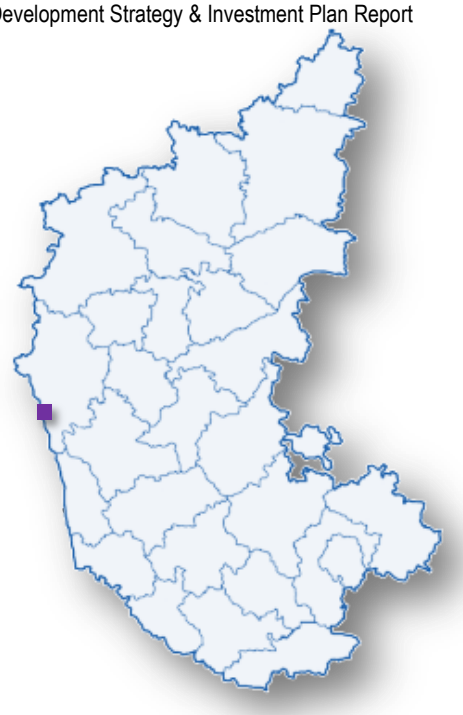
Cargo Handled (in MTPA): Nil. No commercial operations

Type of cargo: No commercial cargo is being handled. Primarily a fishing harbour

Existing Facilities: RCC jetty 200, auction hall 1400 sq. m, transit shed, dry fish godown, ice plant, freezing plant and cold storage.

Extent of land area: 1684 acres

2.3.4. PAVINKURVE PORT

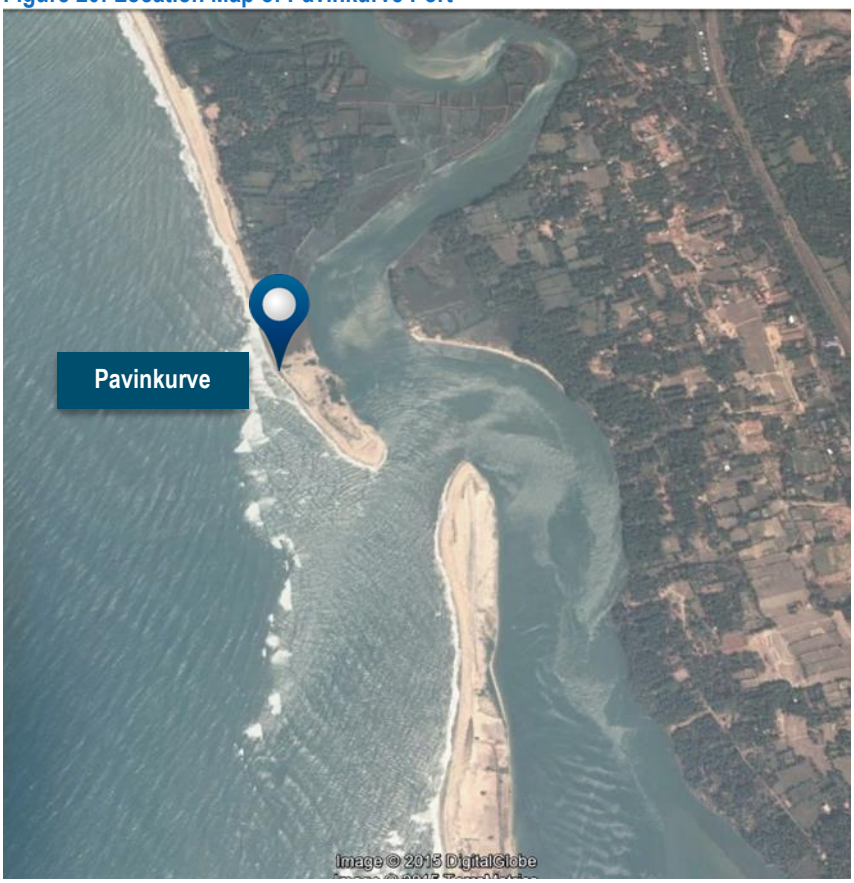


Pavinkurve port is located in Uttara Kannada District. It is located between Tadadi port to the north and Honnavar port to the south. The nearest port to Pavinkurve is Honnavar port which is at a distance of 16 km. The port is situated along the coast on the northern side of the creek where the river Badgani and Sharavathi meet.

Government of Karnataka has notified the new port to develop under PPP mode. The proposal for the development of the port under Swiss challenge. IT is planned to develop port infrastructure to handle 5 MTPA initially at an estimated amount of Rs.544 Cr

The location map of the port is presented below

Figure 20: Location Map of Pavinkurve Port



Source: Google Maps

Pavinkurve Port – Fact Sheet

District: Uttara Kannada

Key Activities: Cargo

Road Connectivity: NH-66(NH-17), NH-206

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): NA

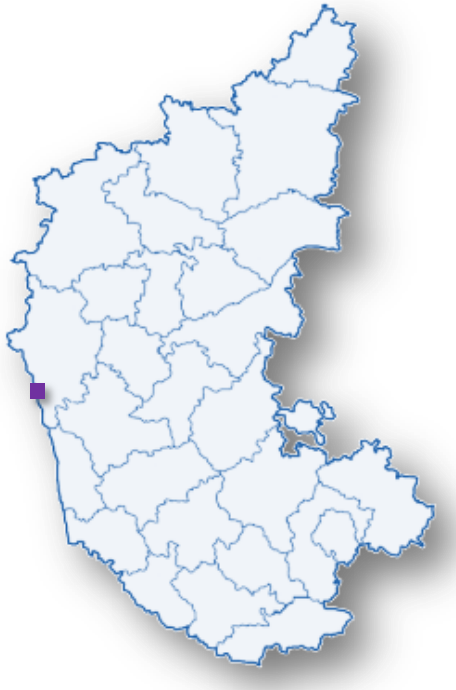
Cargo Handled (in MTPA): Nil. No commercial operations

Type of cargo: No commercial cargo is being handled. However coal, limestone, and steel products can be handled at the port

Existing Facilities: No existing facilities

Extent of land area: 74.1 acres

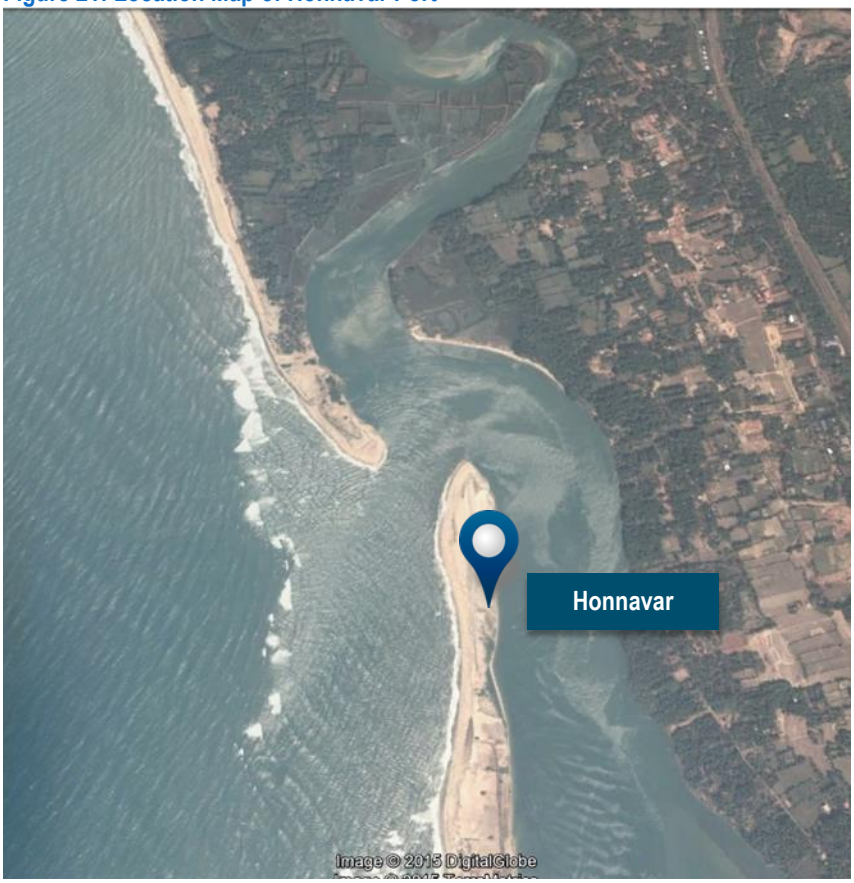
2.3.5. HONNAVAR PORT



Honnavar port is located in Uttara Kannada District. It is located between Tadadi port to the north and Pavinkurve port to the south. The nearest port to Honnavar is Pavinkurve port which is at a distance of 16 km. The port is situated on the banks of the River Sharavathi. Before draining into Arabian Sea, the Sharavathi joins with Badgani which flows in from the opposite direction. As a result, it forms a creek like structure which acts as natural breakwater and approach channel to the port. This western side of the river is called as Kasarkod and the eastern side of the river is called as Honnavar. The northern side of the creek where the river Badgani flows is where Pavinkurve port is located.

The location map of the port is presented below

Figure 21: Location Map of Honnavar Port



Source: Google Maps

Honnavar Port – Fact Sheet

District: Uttara Kannada

Key Activities: Fishing

Road Connectivity: NH-66(NH-17), NH-206

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 2.5 m

Cargo Handled (in MTPA): Nil. No commercial operations

Type of cargo: No commercial cargo is being handled.

Existing Facilities: Wharf of 120 m and stacking area of 6400 sq. m on eastern side, wharf of 170 m and stacking of 27,870 on the western side

Extent of land area: 197.6 acres

2.3.6. MANKI PORT

Manki, is a village located along the shore of the Arabian Sea, is located in the Honnavar taluk. It is at a distance of about 103 km from Karwar. It is located between Honnavar port to the north and Bhatkal. The nearest port to Manki is Honnavar port which is at a distance of 14 kms. The port in case to be developed here would be a complete green field development. Currently, there are no commercial activities taking place at Manki except some fishing. However, there are discussions held on propositions of developing a port at Manki towards the mouth of River Manki.

The location map of the port is presented below

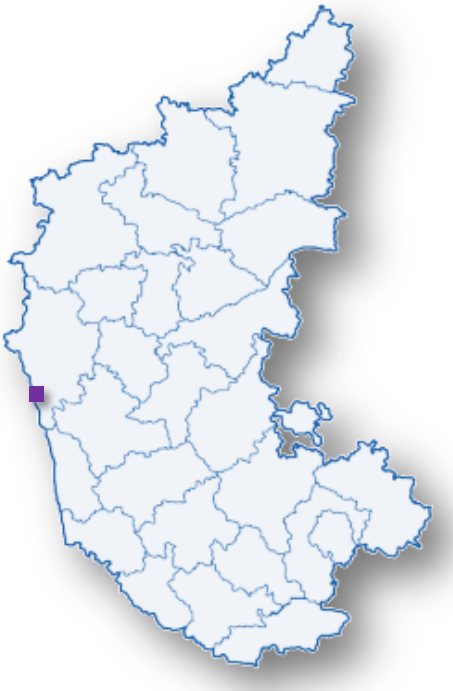
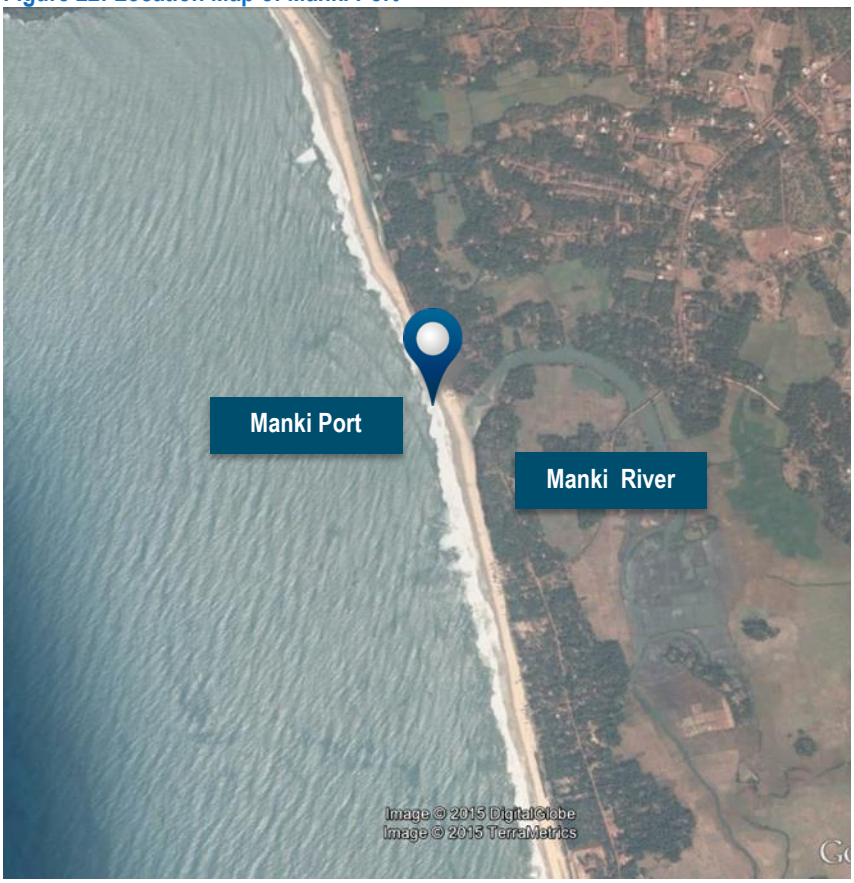


Figure 22: Location Map of Manki Port



Source: Google Maps

Manki Port – Fact Sheet

District: Uttara Kannada

Key Activities: Fishing

Road Connectivity: NH-66(NH-17), NH-206

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): NA

Cargo Handled (in MTPA): Nil. No commercial operations

Type of cargo: No commercial cargo is being handled.

Existing Facilities: No existing infrastructure

Extent of land area: Not Available

2.3.7. BHATKAL PORT

Bhatkal port is located in Uttara Kannada District. It is located between Manki port to the north and Kundapura port to the south. The nearest port to Bhatkal is Manki port which is at a distance of 29 km. It is equidistant from Karwar and Mangaluru which is 150 km. The port is located on the banks of River Chowtani.

The location map of the port is presented below

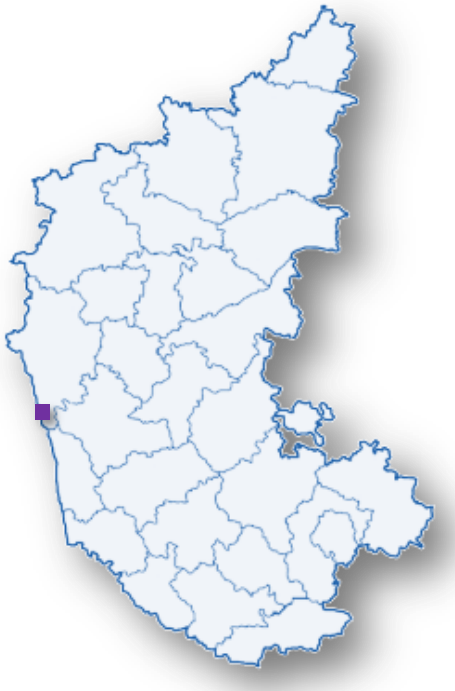
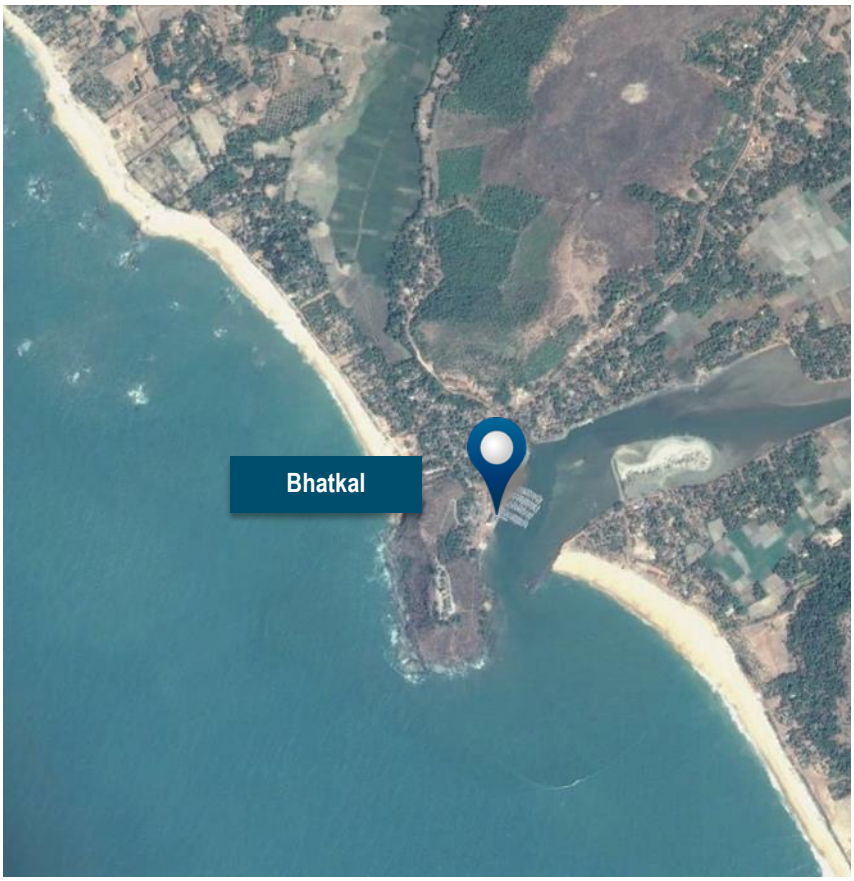


Figure 23: Location Map of Bhatkal Port



Source: Google Maps

Bhatkal Port – Fact Sheet

District: Uttara Kannada

Key Activities: Fishing

Road Connectivity: NH-66(NH-17), SH-50

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 2.5 m

Cargo Handled (in MTPA): Nil. No commercial operations

Type of cargo: No commercial cargo is being handled.

Existing Facilities: Wharf of 186 m and stacking area of 15,888 sq. m

Extent of land area: Not Available

2.3.8. KUNDAPURA PORT

Kundapura port is located in Udupi District. It is located between Bhatkal port to the north and Hangarkatta port to the south. The nearest port to Kundapura is Bhatkal port which is at a distance of 49 kms. The port is situation on the banks of the river Panchagangavali. It is a fishing hamlet and no port operations take place. The port is exactly 100 km from the New Mangalore Port. The river forms an estuary before entering into the Arabian Sea thereby creating creek like structure acting as natural breakwater to the port. However, due to this creek formation, the port cannot accommodate larger vessels and only barge type vessels could be operated in the port.

The location map of the port is presented below

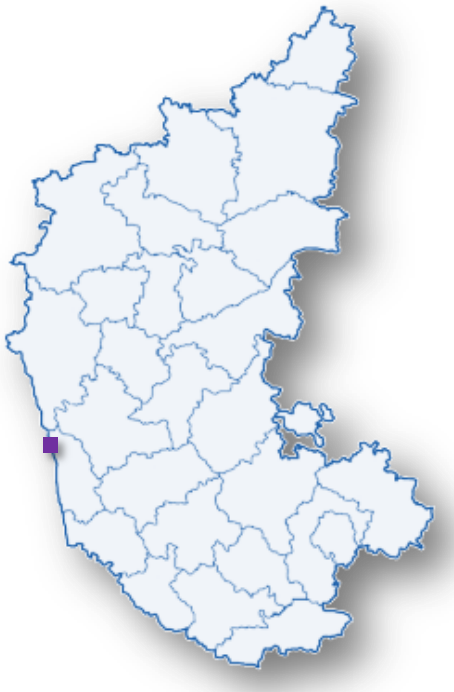
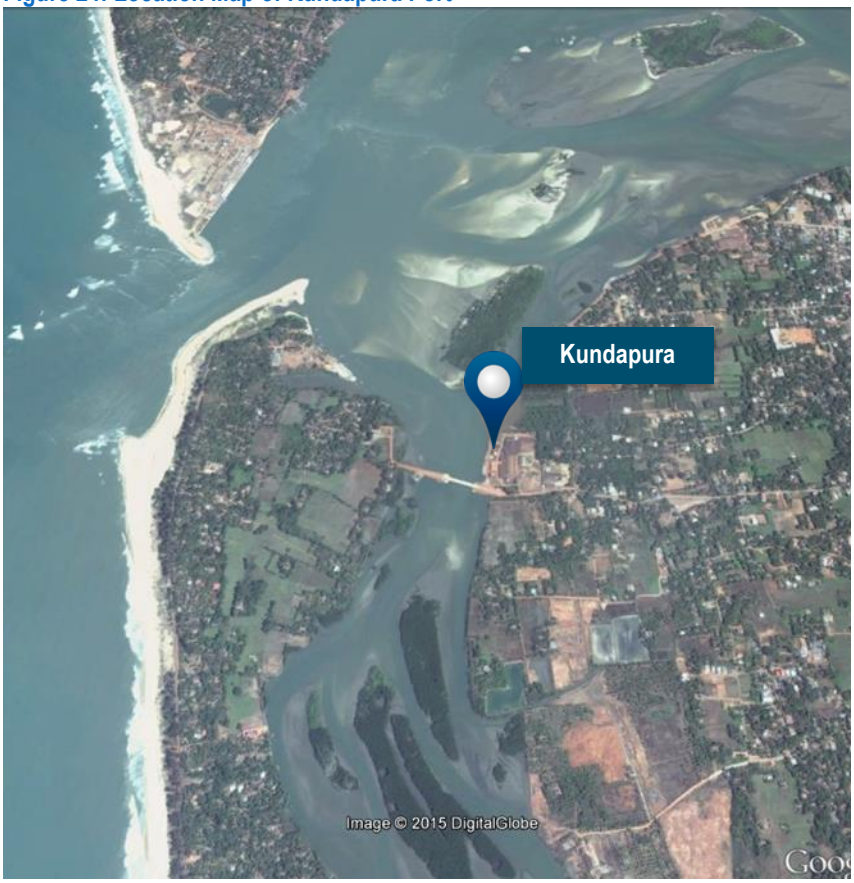


Figure 24: Location Map of Kundapura Port



Source: Google Maps

Kundapura Port – Fact Sheet

District: Udupi

Key Activities: Fishing

Road Connectivity: NH-66(NH-17), SH-52

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 1.5 m

Cargo Handled (in MTPA): Nil. No commercial operations

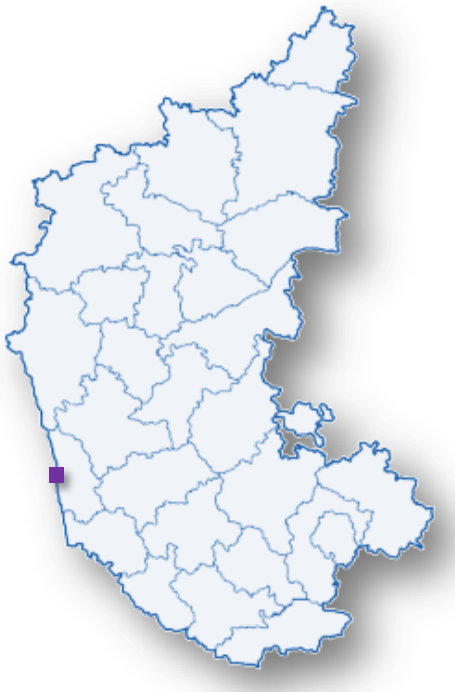
Type of cargo: No commercial cargo is being handled.

Existing Facilities: Length of berth : 216 m, auction hall 1680 sq. m., ice plant, net mending facility and administrative building

Extent of land area: Not Available

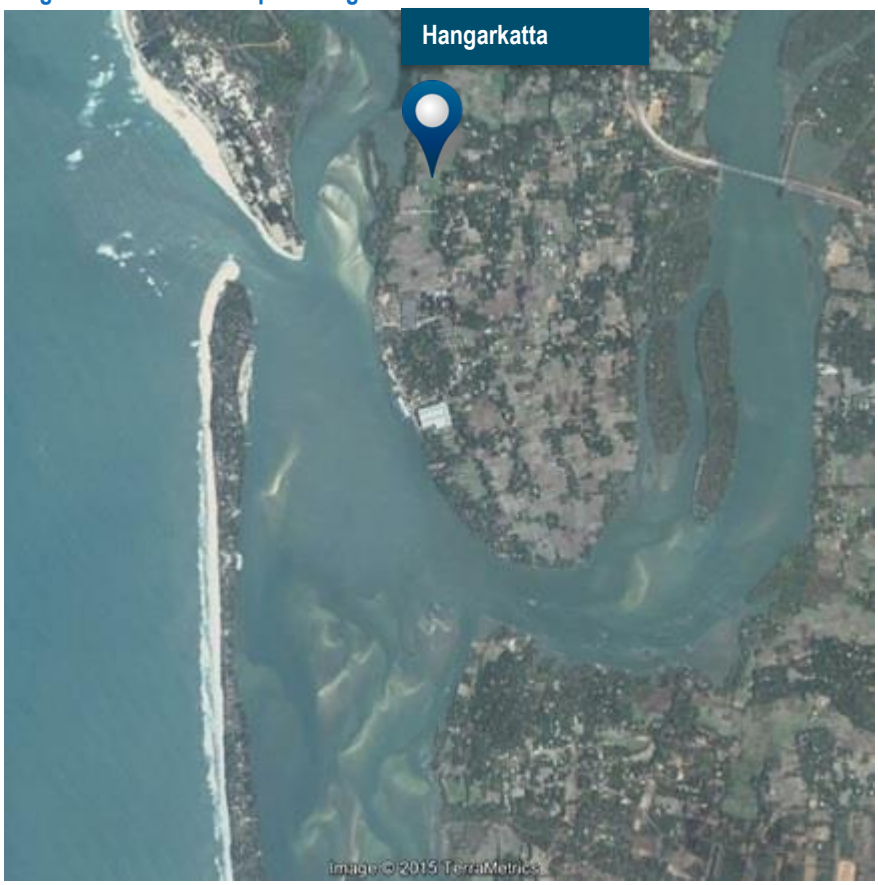
2.3.9. HANGARKATTA PORT

Hangarkatta port is located in Udupi District. It is located between Kundapura port to the north and Malpe port to the south. The nearest port to Kundapura is Malpe port which is at a distance of 21 km. Hangarkatta Port is located at the mouth of the Sita River in Udupi District. It serves as a fishing harbour and currently no port operation take place. The river flowing into the sea creates a sand bar and shallow creek structure which does not favour the movement of large vessels. Heavy sedimentation occurs at the mouth of the river, thereby creating a shallow draft. The Hangarkatta port is at distance of 67 km from the New Mangalore Port. Ship building and ship repair activitiesare utilizing the facilities of the Port.



The location map of the port is presented below

Figure 25: Location Map of Hangarkatta Port



Source: Google Maps

Hangarkatta Port – Fact Sheet

District: Udupi

Key Activities: Fishing

Road Connectivity: NH-66(NH-17), NH-169A

Rail Connectivity: Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 2.00 m

Cargo Handled (in MTPA): Nil. No commercial operations 1165

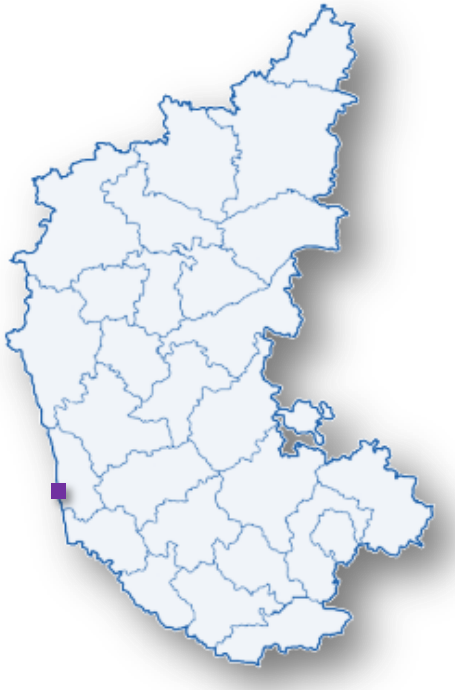
Type of cargo: No commercial cargo is being handled.

Existing Facilities: 150 m Wharf and wooden jetties

Extent of land area: 0.41 acre

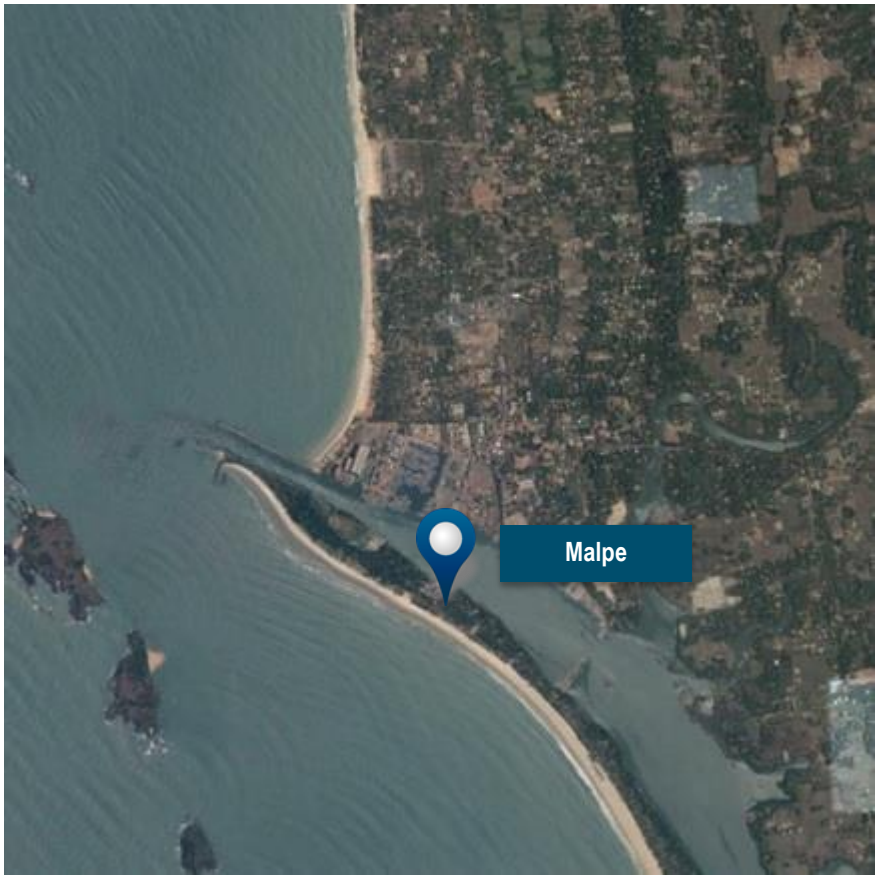
2.3.10. MALPE PORT

Malpe port is located in Udupi District. It is located between Hangarkatta port to the north and Padubidri port to the south. The nearest port to Malpe is Hangarkatta port which is at a distance of 21 km. Malpe is a natural port and the area is highly populated. The port is located at the northern bank of the river Malpe. The port is at a distance of 52 km from the New Mangalore Port. Malpe is a major fishing harbour which has been provided with the break water for guiding the river flow and is working as an efficient harbour.



The location map of the port is presented below

Figure 26: Location Map of Malpe Port



Malpe Port – Fact Sheet

District: Udupi

Key Activities: Fishing

Road Connectivity: NH-66)NH-17), NH-169A, SH-67, SH-37

Rail Connectivity:
Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 2 m

Cargo Handled (in MTPA):
Marginal cargo operations

Type of cargo:
No commercial cargo is being handled.

Existing Facilities:
Quay of 810.05 m, net mending facility and boat repair shed

Extent of land area: Not Available

Source: Google Maps

2.3.11. PADUBIDRI PORT

Padubidri port is located in Udupi District. It is located between Malpe port to the north and Old Mangalore Port to the south. The nearest port to Padubidiri is Old Mangalore Port which is at a distance of 24 km.

The location map of the port is presented below

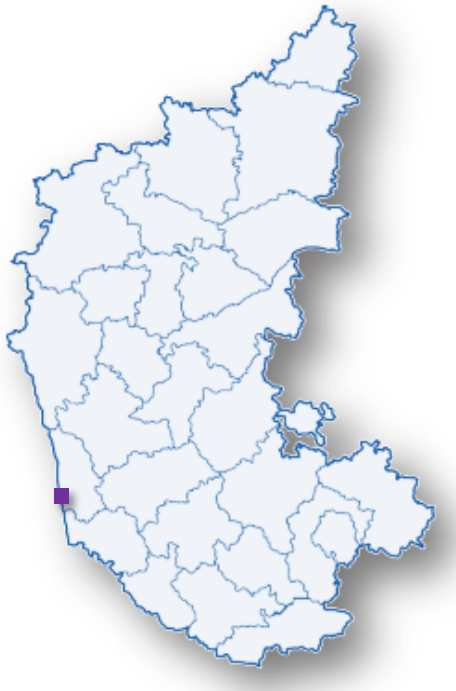


Figure 27: Location Map of Padubidiri Port

Padubidiri Port – Fact Sheet

District: Udupi

Key Activities: Cargo

Road Connectivity: NH-66 (NH-17), NH-50 (NH-13), NH-169A,NH-234, SH-1,SH-70

Rail Connectivity:
Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): NA

Cargo Handled (in MTPA):
Nil. No commercial operations

Type of cargo:
No commercial cargo is being handled.

Existing Facilities:
No existing facilities

Extent of land area: Not Available

Source: Google Maps

2.3.12. OLD MANGALORE PORT

Old Mangalore Port is the southern-most minor port in Karnataka. The port is located in Dakshina Kannada District. Padubidiri Port lies to the north of the port and it is located approximately 10 km from the New Mangalore Port in the Dakshina Kannada District. The port is situation on the bank where the river Gurupur and Netravathi confluence before entering the Arabian Sea. The port is a fair weather port and is operational only during September to May. Old Mangalore Port is now used as a fishing harbour and during 2013-14 no port operation took place. The port is mainly used for coastal shipping along Karnataka coast and to Lakshadweep.

The location map of the port is presented below

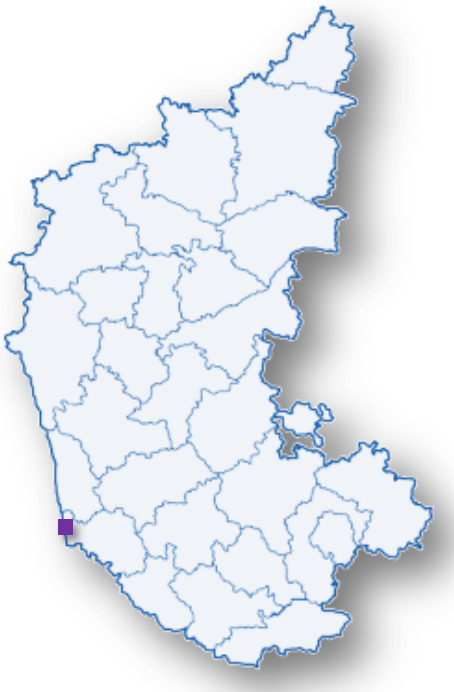
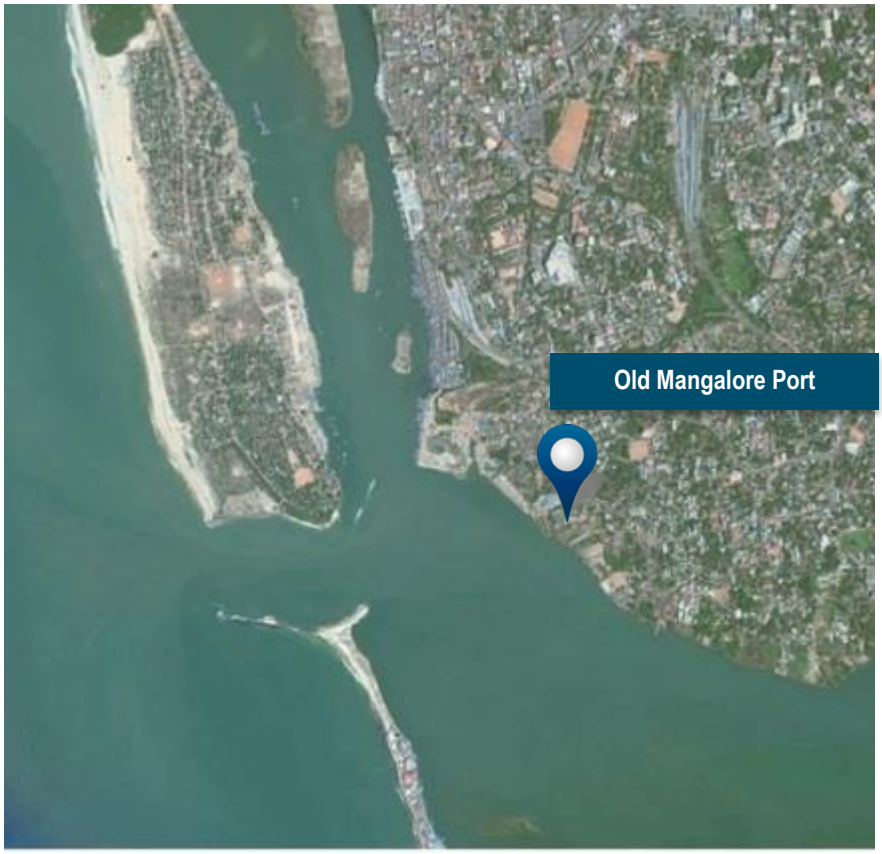


Figure 28: Location Map of Old Mangalore Port



Old Mangalore Port – Fact Sheet

District: Dakshina Kannada

Key Activities: Cargo and Fishing

Road Connectivity: NH-66, NH-50, SH-67, SH-101, NH-234, NH-48

Rail Connectivity:

Konkan Railway and no direct connection to Hinterland

Existing Draft (in m): 3 m

Cargo Handled (in MTPA): 1, 15,894 MT

Type of cargo: Transportation of cargo to Lakshadweep

Existing Facilities: Wharf 583 m, auction halls, ice plants, diesel bunk.

Extent of land area: Not Available

Source: Google Maps

The regulatory framework for ports is as shown below in the table:

Table 17: Regulatory framework for Ports

Sl.no	Regulatory Framework	Details
1.	Indian Ports Act,1908	An Act to provide for the development, maintenance and management of Indian Ports. The aim of this act is to consolidate the enactments relating to ports and port-charge.
2.	The Major Port Trusts Act, 1963	An Act to provide for the development, maintenance and management of National Highways. Established in 1995.
3.	Associated Offices - Central	• Border Roads Organization • Indian Road Construction Corporation Limited • National Institute of Training For Highways Engineers • Indian Roads Congress (IRC) • Indian National Group of the International Association for Bridge and Structural Engineering (IABSE)
4.	Karnataka Ports (Landing and Shipping Fees) Act, 1961	An Act to provide for the levy of fees on landing, shipping and storage of goods, and on passengers embarking and disembarking within the ports of the State of Karnataka and for certain other purposes
5.	Karnataka Minor Ports Development Policy of 2014	To increase the share of Karnataka State in the Export and Import sector, in National and International Trade and Commerce.
7.	Associated Offices - State	Public Works Department - Karnataka Ports and IWT

GAP ANALYSIS

Priority of customers to call up on a port depends on several factors such as - time and cost associated with movement of cargo from origin to ports (hinterland connectivity); turnaround time at ports (port efficiency in docking of ships and handling cargo) and the distance from port to destination (countries where cargo is to be exported to - for instance, it is convenient to export cargo to the Pacific and eastern countries through the ports located on the eastern coastline). Through the coastline of Karnataka, it is only NMP which handled about 98.27% of the total cargo movement (37.14 million tonnes[25] in 2014-15). All minor ports put together handled the balance 1.73% of the total cargo.

The quantum of cargo handled across minor and major ports during the year 2014-15 is provided in the following table:

Table 18: Cargo handled across minor ports in Karnataka

Port	Cargo Handled (MT) (2014 -15)	% of cargo handled
Major Port- New Mangalore Port	36,500,000	98.27%
Minor Ports		
Karwar	5,25,070	1.41%
Belekeri	-	-
Old Mangalore Port	1,15,894	0.32%
Hangarkatta	1,142	negligible
Kundapura	1,165	negligible
Tadri, Honnavar, Bhatkal, Padubidri	-	-
Total cargo at Minor ports	6,43,271	1.73%
Total cargo across all ports	3,71,43,271	

Source: Public Works, Ports & Inland Water Transport Department, GoK

Belekeri Port – Iron Exports

Prior to 2010, Belekeri port handled iron ore bulk cargo of around 6 million tonnes in 2009. However, in 2010 due the blanket ban on iron ore there have been no exports through this port. Belekeri port has no presence of berths; most of the cargo handled at Belekeri is through barge loading.

Currently, NMP is the only port in Karnataka that has requisite state of the art infrastructure for movement of cargo and being a major port, it is under the jurisdiction of the Major Ports Trust, Government of India. The only other port along Karnataka's coastline that has basic infrastructure for movement of cargo is located at Karwar.

It is to be noted that the total exports from Karnataka are much more than what are handled at the ports in NMP and Karwar. This means that there certainly are goods/ cargo which are moved through ports located in Goa or those on the eastern coastline.

The customer base in districts along the western coastline (Uttara Kannada, Dakshina Kannada and Udupi) and those located in the central and southern part of Karnataka (Mysuru, Bengaluru, Hassan, Chamrajnagar, Madikeri, Chitradurga, Shivamogga, and Tumakuru) are well connected to NMP via road (NH 66) and rail (HMRDC & Konkan) networks; and as such opt NMP for their imports/ exports.

The key commodities/products being exported from NMP are petroleum & petroleum products, coal, iron ore and granites, chemicals and pharmaceuticals, coffee, cashew, marine, and agricultural produce and processed food. However, the State also exports significant volumes of automobiles, engineering products, textiles, readymade garments, handicrafts and plastic; most of

[25] Source: Calculated based on data from NMPT website

these commodities are produced in the northern and north eastern districts of Karnataka (Bidar, Kalaburagi, Yadgir, Raichur, Vijayapura, Bagalkote, Koppal, Ballari, Gadag and Dharwad). These districts being in proximity to and well connected to the ports located in other States prefer to move their cargo through those ports. The following are the key exports from these districts that can be potentially exported via a minor port in Karnataka.

Table 19: Potential exports from north and north-eastern Karnataka

District	Products Exported
Bagalkot	Agriculture and horticulture commodities, minerals and mineral based products, engineering product
Ballari	Engineering products, textiles, electrical, minerals, Automobiles, agriculture products
Bidar	Handicrafts, engineering products, agriculture and horticulture commodities, processed food
Dharwad	Engineering products, automobiles, agriculture and horticulture commodities, electrical, electronics, chemicals, plastics, readymade garments
Gadag	Agriculture and horticulture commodities, automobiles, engineering, textiles
Kalaburagi	Agriculture and horticulture commodities, minerals and mineral based Products(Fullers earth and allied products)
Koppal	Agriculture and horticulture commodities, minerals, processed food, engineering
Raichur	Agriculture commodities, precision engineering, processed food
Vijayapura	Engineering products, automobiles, textiles, agriculture and horticulture commodities
Yadgir	Agriculture and horticulture commodities, energy, textile, readymade garments, pharmaceutical

Source: Visvesvaraya Trade Promotion Centre, GoK

Development of an all-weather state of the art sea port in the northern part of the State's coastline along with improved connectivity to hinterland; could possibly tap the existing and growing customer (industry/ manufacturing) base in the State. It would not only provide a much needed alternative to NMP but also reduce dependence of the customer base in Karnataka on movement of its cargo through other ports that lie outside Karnataka.

2.4.1. EXISTING & PROPOSED INDUSTRIAL GROWTH IN KARNATAKA

There are several industrial developments that are proposed in the State viz. the Bengaluru-Mumbai Economic Corridor (BMEC), Suvarna Karnataka Development Corridor (SKDC) and Chennai–Bengaluru-Chitradurga Industrial Corridor (CBCIC). All these corridors overlap with each other and are aligned along NH 4. Several industrial clusters / industrial centres have been identified as part of these corridors. Implementation of the proposed projects along the corridors would contribute to increased imports and exports through the State.

Bengaluru-Mumbai Economic Corridor (BMEC)

The BMEC corridor is envisaged to pass through the following cities - Pune, Satara, Kolhapur, Belagavi, Dharwad, Davangere, Haveri, Chitradurga and Tumakuru. Industrial nodes cum mega-cities are proposed for development as part of BMEC at Belagavi, Dharwad, Haveri, Ballari, Hassan, Davangere, Chitradurga, Tumakuru and Bengaluru. All the cities except Hassan lie along NH-4. Additionally, three large National Investment Manufacturing Zones planned for development in Bidar Kalaburagi and Tumakuru and two logistics hubs are proposed for development at Dharwad and Hassan.

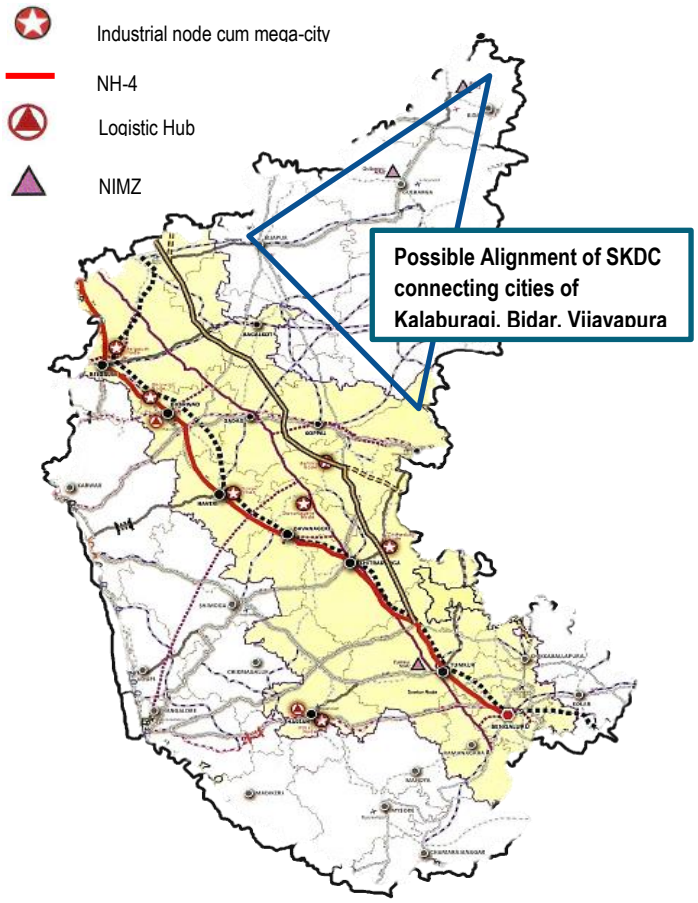
Development of BMEC is also expected to generate exports worth USD 86,000 million. The focus sectors are as follows

- Heavy Engineering
- Precision Engineering
- Automobiles
- Aerospace and Defence
- Pharmaceuticals
- Electronics
- Cement

- Robotics
- Solar PV
- Base Metals
- Agro Processing
- Textiles

Given below is the proposed alignment of BMEC along with the proposed alignment of SKDC.

Figure 29: Bengaluru-Mumbai Economic Corridor and Suvarna Karnataka Development Corridor



Source: KSIIDC, GoK

The Suvarna Karnataka Development Corridor (SKDC)

SKDC is a Government of Karnataka initiative for industrial development across the State. It is aligned along the NH-4 and proposes development of major cities which are also part of the BMEC. In addition to BMEC, SKDC proposes development of industrial hubs at Bidar, Kalaburagi and Vijayapura. The thrust is also in improving road and rail connectivity to these centres.

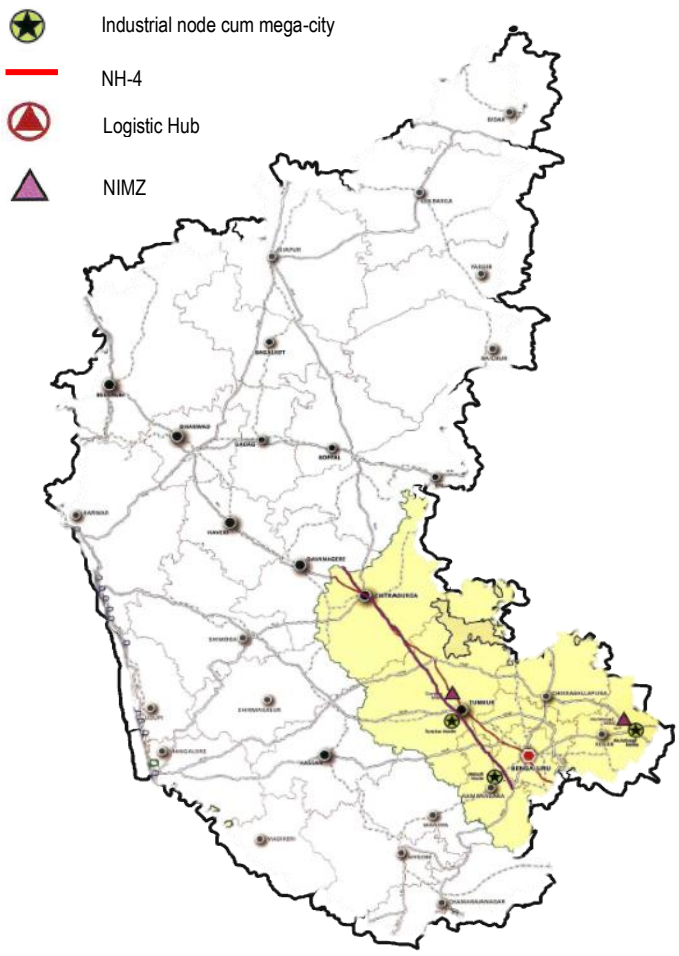
The Chennai–Bengaluru-Chitradurga Industrial Corridor (CBCIC)

CBCIC is also proposed for development along NH-4 and proposed industrial nodes cum mega-cities under this corridor are at Ramanagara and Tumakuru. It also proposes development of a National Investment Manufacturing Zone (NIMZ) at Mulabagal.

CBCIC development aims to provide thrust to economic growth and increase the contribution of manufacturing sector to 25% of GDP. The focus sectors are computer, electronics and optical products, automobiles, machinery and engineering, pharmaceuticals, agro-processing, textiles and apparels.

CBCIC corridor alignment is set out in the map below.

Figure 30: Chennai-Bengaluru-Chitradurga Industrial Corridor



Source: KSIIDC, GoK

The existing industrial base and the proposed industrial development in the State would eventually result in increased exports from the State. With improved connectivity by road and rail to the existing ports (NMP and Karwar) in the State and development of an all-weather sea port in the State; it could be possible to divert export of goods produced in Karnataka through the ports located in the State.

2.4.2. CONNECTIVITY TO PORTS

Connectivity to ports is analysed by looking at connectivity of entire hinterland of Karnataka to ports in Karnataka and connectivity of proposed key industrial corridor to ports through rail and road network.

Rail Connectivity to Ports

The only railway line that connects the coastline with the hinterland in the State is the Hassan – Mangaluru railway line which is down in the south. This railway line connects Bengaluru with Mangaluru. There is no such railway connectivity from the hinterland to the northern coastline of Karnataka. Therefore the hinterland districts of northern, north-eastern and north-western Karnataka such as Bidar, Kalaburagi, Yadgir, Raichur, Vijayapura, Bagalkote, Koppal, Ballari, Koppal, Gadag and Dharwad find it a challenge to export goods manufactured through the NMP or Karwar owing to inadequate rail connectivity.

In addition to the Hassan Mangalore railway line, there exists the Konkan railway which connects all the coastal districts of the State to NMP. The customer base located in the coastal districts of the State use the Konkan railways for movement of goods to NMP and Karwar.

The map given below sets out the rail connectivity (existing and proposed) from hinterland and industrial corridor to the coastline of Karnataka.

Figure 31: Rail Connectivity: Hinterland to coast and connectivity to industrial corridors

The Ministry of Railways, Government of India is in the process of developing the Hubballi - Ankola and Honnavar-Talaguppa railway lines. The surveys for development of railway lines along both the alignments are complete and are awaiting environmental clearances. In addition, surveys are being carried out for a railway line that connects Byndoor and Padubidiri to Hassan–Mangaluru railway line.

The Hubballi-Ankola Line is to originate from the city of Hubballi which is along the NH-4 and also a prosposed insustrial megacity as part of the BMEC. It would culminate at Ankola which is located between Karwar and Honnavar. The line would facilitate direct movement of goods from the industrial corridor towards ports located in the northern part of Karnataka.The Hubballi-Ankola line is critical to providing connectivity between industrial corridors and ports as it links NH-4, which is the backbone for all the three industrial corridors (BMEC, SKDC and CBCIC) to the coast. Simlarly, the proposed Honnavar- Talaguppa line would also facilitate movement of goods from Honnavar port to cities such as Davanagere and Chitradurga which are part of the BMEC corridor.

Development of a port in the northern part of Karnataka coastline would serve the following purpose;

- Cater to the existing exports from industries located in the hinterland (north and northern-eastern districts) of Karnataka.
- Cater to future exports from industries proposed along industrial corridors (BMEC, SKDC & CBCIC)

Keeping in view the proposed rail connectivity to the coastline; Karwar, Belekeri, Tadadi or Honnavar; could be considered as an optimum location for development of an all-weather sea-port.

Road Connectivity to Ports

Roads are another major mode of connectivity to ports. Currently, there are seven national highways in Karnataka that provide hinterland to coast connectivity to ports which are; NH-66 (NH-17), NH-63 NH-206, NH-50 (NH-13), NH-234, NH-48, NH-169A. Of all the highways, NH-66(NH-17) is the main highway that runs along the coast line of Karnataka and connects all the ports and intersects all the other national highways mentioned above. NH 66 runs almost parallel to the Konkan railway in Karnataka. The following table provides details of the 6 national

highways that provide hinterland to coast connectivity;

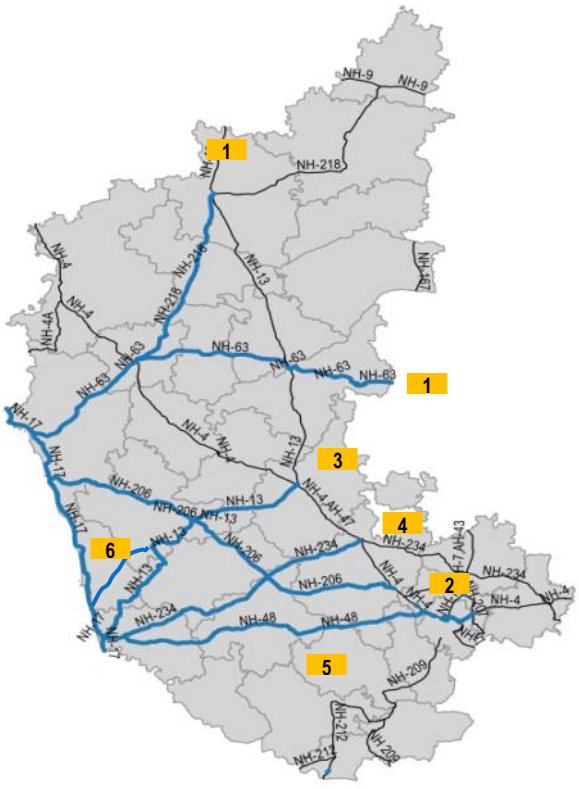
Table 20: Details on National Highways that provide Hinterland – Coast

No.	National Highway	Ports that are in close proximity	Intersection with NH-4	Intersection with NH-66
1.	NH-63	Belekeri, Tadadi	Hubballi	Ankola
2.	NH-206	Honnavar, Pavinakurve, Manki	Tumakuru	Honnavar
3.	NH-50(NH-13)	Padubidiri, Old Managlore Port	Chitradurga	Mangaluru
4.	NH-234	Padubidiri, Old Managlore Port	Sira (north of Tumakuru)	Mangaluru
5.	NH-48	Padubidiri, Old Managlore Port	Outskirts of Bengaluru	Mangaluru
6.	NH-169A	Hangarkatta, Malpe	Connects to NH-50(NH-13) at Thirthahalli	Malpe

Source: iDeCK Analysis based on Google Maps

Given below is the map depicting the NH connectivity to coastline of Karnataka.

Figure 32: Road Connectivity: Hinterland to coast via National Highways



Source: KRSAC and iDeCK Analysis

NH Connectivity

In the north NH-63 and NH-206 are the only national highways that connect the coast to the hinterland. Thus the exports of northern and north-eastern districts of Karnataka which are well connected to the ports located on the eastern coastline of the country in Tamil Nadu and Andhra Pradesh are typically not exported out of ports in Karnataka. The New Mangalore Port is connected to the hinterland via NH-50 (erstwhile NH-13), NH-48 and NH-234. However these three highways connect mainly the southern hinterland of Karnataka.

SH Connectivity

In the north SH-6,SH-34,SH-69 and SH-48 connect ports such as Karwar, Belekeri, Tadadi, Honnavar and Pavinkurve. These ports have poor connectivity via national highways and are primarily dependent on State highways for connectivity. Bhatkal and Kundapura are connected via SH-50 and SH-52 respectively while Manki and Hangarkatta have no connectivity via State highways. Malpe, Padubidiri and Mangaluru Port are well connected and there are several option for goods to move towards these ports via road such as SH-67,SH-37,SH-1,SH-70, and SH-101.

There are several State highways that provide connectivity to the ports as well. Most of them connect finally lead to NH-66. The following table provides details of all the State highways that provide connectivity to ports.

Table 21: Details on State Highways that provide connectivity to ports

No.	State Highway	Ports that are in close proximity	Intersection with NH-4	Intersection with NH-66(NH-17)
1.	SH-6	Karwar, Belekeri	Bankapur (North of Haveri)	Karwar
2.	SH-34	Karwar	NA. Goes to Londa near Hubballi	Slightly north of Karwar
3.	SH-69 + SH-142	Tadadi	Goes to Tadas near NH-4 south of Hubballi	Kumta
4.	SH-48	Tadadi could also serve Pavinkurve and Honnavar	Chitradurga	Kumta
5.	SH-50	Bhatkal	NA	Bhatkal
6.	SH-52	Kundapura	NA. Goes to Harihara near Davanagere	Kundapura
7.	SH-67	Malpe	NA. Goes towards Mangaluru	Udupi
8.	SH-37	Malpe	NA. Goes south towards Madikere	Udupi
9.	SH-1	Padubidiri	NA. Goes towards Karkala	Padubidiri
10.	SH-70	Padubidiri	NA. Goes to Belthangady	Hejmadi
11.	SH-67	Old Mangalore Port	Connects to Udupi	Mangaluru
12.	SH-101	Old Mangalore Port	Goes to Bantwal	Mangaluru

Source: iDeCK Analysis based on Google Maps

2.4.3. ANCILLARY INFRASTRUCTURE DEVELOPMENT

It is interesting to note that at all the minor ports in the State including those that are not commercially operational, fishing activities are prevalent. These locations are also known for their fishing harbours and large scale marine fishing activities. Basic facilities such as break water and jetty for landing of small vessels are provided at all minor port locations except in Manki where presently there are no facilities. All minor port locations also serve as harbours for vessels.

Specific infrastructure available at each of the port locations has already been set out in the respective sections on minor ports - Fact Sheet; this section highlights the development of fisheries related activities at port locations. Development of fishing related infrastructure, including development of harbours is carried out by the the Karnataka State Fisheries Department.

The State has 27,000 sq. km of continental shelf area, rich in pelagic fishery resources. Traditionally, the Karnataka coast was known as the "Mackerel Coast". There are about 9.61 lakh fishermen in the State of which 3.28 lakh fishermen are involved in marine fishing. During the year 2013-14, the total fish production of the State is 5.55 lakh tonnes which contributed to 5.8% of the national fish production. Karnataka has significant potential in the marine fishing sector. Currently fishing activities are being carried out at Karwar, Belekeri, Tadadi and Old Mangalore Port alongside commercial cargo handling activities. Minor ports such as Pavinkurve, Honnavar, Manki, Bhatkal, Kundapura, Hangarkatta and Malpe serve mainly as harbours were fishing activities and commercial cargo handling operations are low to non-existent. Padubidri is the only port where there is no fishing activity is carried out; it is intended to be utilized only for cargo handling activities.

Given that there are already harbours developed at all minor port locations it makes iminent sense to improve/complement the existing infrastructure at harbours. One of the large scale projects in this regard, is development of a marine sea food logistics hub along the coastline which would provide an end-to-end logistics value chain support in processing and export of sea food. To this effect, Infrastructure Development Department, Government of Karnataka has already carried out a pre- feasibility study. The study identified Malpe, Mangaluru, Bhatkal and Honnavar to be suitable locations for the proposed development. Of the several locations proposed for development; Malpe which currently houses the largest fishing harbour seems to be the best possible option for development of the marine seafood logistics hub. The estimated project cost for development of logistics hub has been estimated at around Rs.70 crores.

Marine Food Logistics Hub Concept

The concept of Marine Food Logistics Hub is essentially a strategically located multi-modal logistics platform; allowing efficient marine operations by incorporating reefer van logistic facilities, weigh bridges, frozen plant / cold storage, freezing plant, canning plant, grading & batching, and other value added services. The hub addresses these issues effectively as they would enable the supply chain/ logistics to function more efficiently by removing the bottlenecks in the transit related activities. Integration of such facilities helps in shortening the supply chain for the producers who have to traverse a long marketing channel to reach the market due to unavailability of the necessary infrastructure.

In addition to the above, another avenue for development across the ports are in the domain of cruise tourism. NMP already has a cruise terminal developed to cater to the requirements of cruise liners. Basic jetty facilities at other ports and a few cruise lounges at port locations such as Malpe, Bhatkal and Karwar would enable day cruises to operate along the coastline.

2.4. INLAND WATER TRANSPORT

Inland water transport (IWT) sector in the State is in its nascent stage of development. The rivers in Karnataka are rain fed during the monsoon period and hence are seasonally navigable. The Western Ghats in Karnataka is the source of major rivers and all the rivers in the State can be classified as east flowing and west flowing rivers. The west flowing rivers drain into the Arabian Sea and carry some amount of water that may suit navigation for smaller boats. However, east flowing rivers in the peninsular plateau traverses through creeks and gorges and unlike the plains in North India are shallow in nature and hence not suitable for navigation for longer distance.

The total length of rivers in Karnataka is approximately 2862 km. The navigable length of the rivers in the State is 1215 km. The major rivers in the State, their lengths and navigable length are given in below table.

Table 22: Navigable length of the rivers in Karnataka

River	Total Length of the river (in km)	Navigable length (in km)
Sharavathi	80	27
Tungabhadra	375	375
Malaprabha	230	230
Ghataprabha	160	160
Krishna	325	125
Cauvery	270	34
Kabini	117	30
Gurupur	80	20
Gangolli	48	20
Bheema	860	125
Udyavara	37	14
Netravathi	96	26
Kali	184	29

Source: IWT Statistics, Ministry of Shipping

The inland water transport in Karnataka is mainly concentrated on the west flowing rivers due to availability of water throughout the year. However, the transport is primarily for passenger movement across the river, with few instances in the rural areas of short distance transport along the river.

The total number of passengers transported through IWT in the State was 2.1 million during the year 2013-14 [26]. The cargo moved along the river in the State was 2700 tonnes in the same period. The inland water transport system in the State does not have any major infrastructure and are provided with only wooden or concrete jetty.

The IWT in the State is administered through Director of Ports and Inland Water Transport under the Public Works Department. In order to develop the inland water transport in the State, Director of Ports and Inland Water Transport had undertaken preparation of DPRs for select rivers.

The details of the DPRs prepared are given in the table below.

[26] IWT Statistics, Ministry of Shipping

Table 23: Details of Project Report of Waterways in Karnataka

S. No	River/Waterway	Details of Project Report of Waterways	Total Estimated Project Cost (in Rs. Crore)
1.	Kali	Kodibag to Kadra along Kali river coast of Karwar Taluka, Uttara Kannada, District.	5.16
2.	Gangolli	Inland Water ways along the Gangolli (Pancha Gangaovali) rivers of Kundapura Taluka of Udupi District	8.27
3.	Netravathi	Old Mangaluru coast to Gurupur Netravati river coastal area of Mangaluru taluka of Mangaluru District.	6.87
4.	Krishna	Waterways in Back-water area created by construction Almatti dam across Krishna river in Bagalkot taluk of Bagalkot District.	12.12
5.	Kabini	Anandagiri in Beedarhalli, Hooballi to Beeramballi of Back water area of Kobini river reservoir in Hegda Devanakote Taluka of Mysuru District.	4.30
6.	Udayavara	Inland Water ways along Udyavar river upto Malpe Port in Udupi taluk of Udupi District.	10.32
7.	Sharavati	Along Sharavati river coast from Honnavar to Gerasoppa in Honnavar taluka of Uttara Kannada District.	19.25
8.	Gurpur	Mangaluru port to other places situated on the banks of the Gurpur River	13.16
	Total		**79.45**

Source: Director of Ports and IWT, Karnataka

The potential for IWT solely depends on the navigable length of the rivers. Inland Waterways Authority of India (IWAI), the nodal agency for IWT in India is focused on developing transport through rivers as is it is one of the greener operations and could be integrated with road, rail and port. Most of the navigable rivers in the State are west flowing and have short navigable lengths. The physical geography of the State does not support development/ promotion of IWT in a big way. Although DPRs have been prepared for IWT development, implementation of the same remains a challenge as it requires the commitment of all stakeholders to use the infrastructure created.

Recently, the Central Government declared 101 waterways as National Waterways of which 7 rivers belong to Karnataka; viz. Bheema, Ghataprabha, Kali, Netravathi, Kaveri, Malaprabha and Tungabhadra. Henceforth, these rivers would come under the purview of IWAI for development and implementation and GoK could focus on development of IWT along other navigable rivers.

2.5. SHELF OF PROJECTS

On the basis of the gap analysis, the following projects have been identified for development in Karnataka over a span of the next 10 years. Given below is the table listing out the projects in the port and IWT sector proposed for development and investment;

Table 24: Shelf of Projects in Ports Sector

No.	Port	Project	Mode of Investment	Investment (in Rs. Crores)
1.	Karwar	• Development of 5 berths for bulk cargo • Dredging, Reclamation, Breakwater Construction	PPP	1930.00
2.	Belekeri	• Development of two multipurpose berths • Development of free trade warehouse zone (FTWZ) • Dredging, Breakwater Construction	PPP	1500.00
3.	Tadadi	• Development of 7 berths (4 – dry bulk, 3 - multipurpose) • Dredging Reclamation	PPP	3000.00
4.	Pavinakurve	• Development of two berths • Dredging, Reclamation, Breakwater Construction	Captive	515.00
5.	Malpe	Development of a marine sea food logistics hub	PPP	67.20
6.	Padubidiri	Basic Infrastructure Development*	GoK	100.00
7.	Honnavar	Construction of jetty, breakwaters and dredging	PPP	511.00
8.	Manki	Construction of captive jetty, dredging, breakwaters,	PPP	50.00
9.	Inland Water Transports	Development of 8 inland water ways in Karnataka	GoK	79.45
	Total Investment			**7475.32**

Source: PWD, Government of Karnataka

* Basic infrastructure development includes modernise/ development of jetties, create atleast 3m draft along the berth, storage/ warehouses, etc.
# Estimated Project Cost

In addition to the physical infrastructure development there is also a need for introducing policy and institutional reforms in the ports sector; most important of all is with respect to setting up of a Maritime Board in the State to govern its maritime activities. Refer Annexure 2A for analysis of the functions of the Maritime Boards.

2.6. CONCLUSION

Ports in Karnataka face stiff competition from ports located in other peninsular States of the country. NMP is the only major port located in the State. The port at Karwar could increase its berth capacity to nine but owing to the naval project; Seabird – further development in the port is a challenge.

Keeping in the view the current and future industrial growth; there seems to be a potential for development of an all-weather sea port in the northern part of the State's coastline so as to cater to export of cargo from Karnataka. The presence of the great Western Ghats adjacent to the coastline has mostly hindered development of better road and rail network, connecting the ports to the hinterland. There is a pressing need for development of road and rail network, strengthening the hinterland connectivity to ports in the State. Fishing being one of the key occupations in the coastal districts; development of basic harbours/ jetties at ports would go a long way in benefitting the local population.

With respect to not so conducive physical features of rivers in the State, the development of inland water transport, there is currently not much movement of men and material through the inland waterways. However, the DPRs prepared by PWD for development inland waterways could provide a shelf of projects in the sector for development.

ANNEXURE 2A: ANALYSIS OF MARITIME BOARDS

	Gujarat Maritime Board	Maharashtra Maritime Board	Tamil Nadu Maritime Board
Year Established	1982	1990	1995
Functions & Objectives	• To maximize coastal benefits and strategic advantages of Gujarat Ports • To capture maximum traffic at Gujarat Ports and enhance container traffic at GMB Ports • To further strengthen its role in liquid and bulk cargo container traffic at GMB Ports • To develop Gujarat as a Shipbuilding/Repair Hub • To promote various other port led development as Ro-Ro Ferry Terminal services, Jetty Services, Marine Tourism, Logistic Parks • To provide services, property and infrastructure support that will promote private investment • To ensure and protect ecological balance and safeguard social and environmental issues • To bring innovation and implement latest technology at all ports • To ensure safety and security at all levels of operation	• Development of minor ports and harbours for promoting cargo movement with a view to boost the economic activity along the coastline and State's hinterland. • Enforcement of Maritime Rules & Regulations for administration and conservancy of ports, for regulating traffic and tariff structure and licensing of crafts etc. • Development of Inland Water Transport for cargo as well as for passenger movement in the inland waterways within the State. • To carry out hydrographic surveys and other allied investigations along the west coast of Maharashtra in the creeks as well as in the rivers of the Konkan region. • To carry out various functions assigned to it by the GOM from time to time.	• To satisfy the major requirements and effectively render the performance of the proposed minor or private ports in a more efficient manner • To increase the share of Tamil Nadu State in the Export and Import sector, in National and International Trade and Commerce, in the post-liberalisation and globalization era • To decongest the major ports at Ennore, Chennai and Tuticorin in order to improve their productivity • To cater to the needs of increasing traffic of Southern States by providing efficient facilities and services and to support the country's domestic and international trade • To create sufficient infrastructure facilities to handle 25% of India's total cargo in Tamil Nadu Maritime waters • To provide port facilities to promote export oriented industries and port based industries along the coastal districts of Tamil Nadu • To promote port based thermal power plants by providing exclusive port facilities to import different kinds of fuels • To decongest highways by providing facilities for coastal shipping of passengers and cargo traffic along the east coast of nearly 1000 Kms

	Gujarat Maritime Board	Maharashtra Maritime Board	Tamil Nadu Maritime Board
			• To promote tourism by providing facilities for leisure and water sports activities along the coast line • To provide facilities to encourage ship building, repairing, breaking and manufacture of cranes and floating crafts • To facilitate optimum utilization of the port infrastructure developed in the State
Development Activities	• GMB owned ports • Greenfield ports • Captive Jetties • Private Jetties • Shipyards • Ship Recycling yards • Last Mile connectivity • Strategic projects	• Port Projects • Multipurpose Terminals • Captive Jetties • Shipyards • IWT • Marina • Water sports	
Tariff fixation	Fixation is on the mode of implementation	Fixation is on the mode of implementation	Fixation is on the mode of implementation

Chapter 3

Airports

3.1. AVIATION SECTOR IN INDIA

The aviation sector in India has achieved a significant transformation from an over regulated and under managed sector to a more open, liberal and investment friendly sector since 2004. Adoption of global standards has made air travel safer. Strong Government support, enabling policy framework coupled with favourable business environment has positioned India as an attractive investment destination in the sector on the world map.

However, air travel penetration in India remains among the lowest in the world. In fact, air travel penetration in India is less than half of that in China where people take 0.2 trips per person per year, indicating high long term growth potential. A comparative statistic in United States, the world's largest domestic aviation market stands at 2 trips per person per year.

Traditionally, investments in airports came in only from the public sector with the Airport Authority of India (AAI) being the sole project implementing agency. Until 2005-06, almost all the airports were under the control of the AAI, which carried out the improvement works on its own or by sub-contracting them to construction contractors. The first airport to be developed through the public-private partnership (PPP) format was the Cochin airport which started operations in 1999. The international airport at Devanhalli, Bengaluru is the first greenfield airport in the country to be developed under BOT framework.

Over the past decade, development of airports at metro/major cities has managed to attract the participation of the private sector. There are four privately managed international airports in the country today – brownfield airports at Delhi and Mumbai which are managed by joint venture companies, Delhi International Airport Limited (DIAL) and Mumbai International Airport Limited (MIAL) respectively; and two greenfield airports at Bengaluru and Hyderabad managed by Bangalore International Airport Limited (BIAL) and GMR Hyderabad International Airport Limited (HIAL) respectively. These airport projects have been undertaken on a PPP framework wherein a special purpose vehicle (SPV) was formed by a consortium of private developers. The modernization of existing airports at Kolkata and Chennai is however, being taken up by AAI.

Airport Infrastructure

Airport Infrastructure in India is largely developed by the Airports Authority of India (AAI). There are 454 airports and airstrips in the country which includes operational, non-operational, under-utilized and abandoned airports. AAI manages a total of 125 airports, which include 11 International Airports, 8 Customs Airports, 81 Domestic Airports and 25 Civil Enclaves at Defence Airfields. AAI also provides Air Traffic Management (ATM) Services over the entire Indian air space. The six metro airports at Delhi, Mumbai, Chennai, Kolkata, Hyderabad and Bengaluru account for 67.2% of the total passenger traffic handled at all airports in India during the year 2013-14; whereas the Delhi and Mumbai airports together account for about 42% of the total traffic. In terms of freight, the six metros handle more than about 90% of the total freight traffic.

Source: Airports Authority of India

3.2. COMPARATIVE PERFORMANCE

India has 251 airports with paved runways and 101 airports with unpaved runways. The unpaved runways cater only to lighter aircrafts. The table below provides the number of airports in each State managed by AAI;

Table 25: State-wise number of Airports managed by AAI

S.No.	State	Airport	Geographical area in sq.km	Runway/10000 sq.km	Population as per 2011 census in million	million population per airport
1.	Andhra Pradesh	7	160205	0.44	49.38	7.05
2.	Karnataka	5	191791	0.26	61.13	12.23
3.	Kerala	2	38852	0.51	33.39	16.69
4.	Tamil Nadu	8	130060	0.62	72.14	9.02
5.	Telangana	2	114840	0.17	35.29	17.64
6.	Arunachal Pradesh	3	83743	0.36	1.38	0.46
7.	Assam	7	78438	0.89	31.17	4.45
8.	Manipur	1	22327	0.45	2.72	2.72
9.	Meghalaya	2	22429	0.89	2.96	1.48
10.	Mizoram	1	21081	0.47	1.09	1.09
11.	Nagaland	1	16579	0.60	1.98	1.98
12.	Tripura	4	10486	3.81	3.67	0.92
13.	Bihar	5	94163	0.53	103.80	20.76
14.	Chattisgarh	2	135192	0.15	25.54	12.77
15.	Jharkhand	3	79716	0.38	32.97	10.99
16.	Odhisa	2	155707	0.13	41.95	20.97
17.	West Bengal	7	88752	0.79	91.35	13.05
18.	Delhi	2	1483	13.49	16.75	8.38
19.	Himachal Pradesh	3	55673	0.54	6.86	2.29
20.	Jammu & Kashmir	3	222236	0.13	12.55	4.18
21.	Madhya Pradesh	8	308252	0.26	72.60	9.07
22.	Punjab	4	50362	0.79	27.70	6.93
23.	Rajasthan	7	342239	0.20	68.62	9.80
24.	Uttar Pradesh	8	240928	0.33	199.58	24.95
25.	Uttarkhand	2	53483	0.37	10.12	5.06
26.	Goa	1	3702	2.70	1.46	1.46
27.	Gujarat	11	196244	0.56	60.38	5.49
28.	Maharashtra	10	307713	0.32	112.37	11.24
29.	Union Territories	3	-	-	-	-
30.	Andaman & Nicobar Islands	1	-	-	-	-
	Total	125				

Source: Airport Authority of India

Gujarat State has the highest number of airports that are managed by AAI. In terms of runway per 10000 sq. km, the ratio is 0.26 for Karnataka. This is comparatively less when compared to the States of similar geographical extent such as Andhra Pradesh, Gujarat, Maharashtra, Uttar Pradesh and Tamil Nadu. The existing number of runways in Karnataka is also less than the national average in terms of runway per 10,000 sq. km which is 1.07. The above table also shows the population that each airport in the State caters to. Hence, in terms of population, in Karnataka the average is 12 million persons per airport, whereas in Gujarat each airport caters to the need of a population of 5.5 million. Maharashtra which is the highest contributor to the GDP has 10 airports that are managed by AAI and the average is around 11.23 million persons per airport in the state. In Maharashtra, the State Government manages 5 airports in addition to the airports managed by AAI. Including the state run airports, in Maharashtra the average is 7.5 million persons per airport.

The aviation infrastructure in Karnataka has also been compared with the aviation infrastructure in other countries of similar geographical area. For instance, Nepal and Sri Lanka have 11[27] and 14[28] paved runways respectively which when converted to runway/10000 sq.km comes to 0.74 and 2.16 respectively. The figure given below sets out clearly the status of aviation infrastructure (in terms of availability of runways per 10,000 sq. km) in Karnataka vis-à-vis other countries.

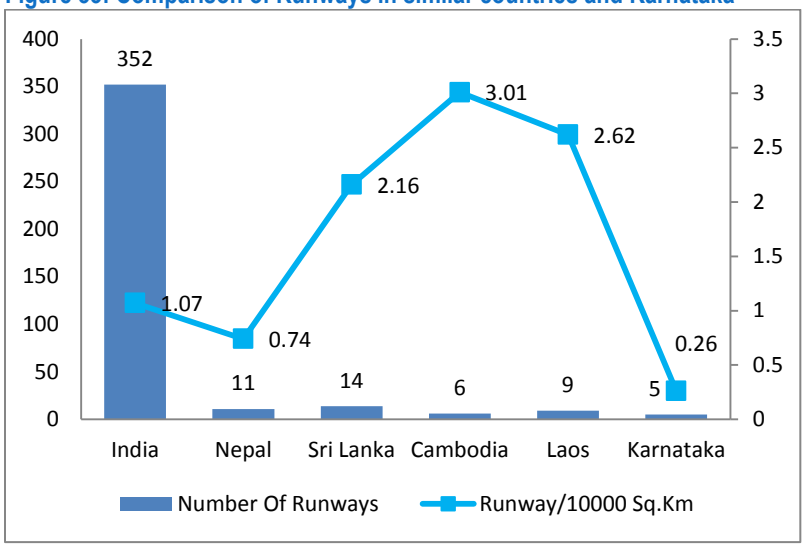
Table 26: Comparison of Runways with Similar Countries

No	Country/State	Total Land Area In Sq. Km	Number of Operational Runways	Runway/10000 Sq. Km	Population as on 2014 in million	Million population per runway
1.	India	32,87,240	352	1.07	1267.4	3.60
2.	Nepal	1,47,181	11	0.74	28.1	2.55
3.	Sri Lanka	64,740	14	2.16	21.4	1.53
4.	Cambodia	1,81,035	6	3.01	15.4	2.57
5.	Laos	2,36,800	9	2.62	6.8	0.76
6.	Karnataka	1,91,791	5	0.26	64.1	12.82

Source: www.indexmundi.com and ideck analysis

[27] Indexmundi website
[28] Indexmundi website

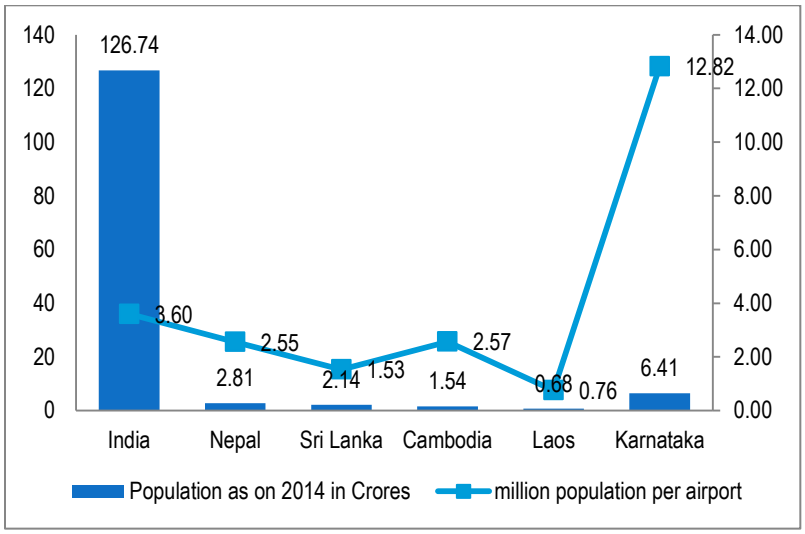
Figure 33: Comparison of Runways in similar countries and Karnataka



The figure indicates the number of runways and runway/10000sq km in India, Karnataka and in other countries of similar geographical area.

Source: www.indexmundi.com and ideck analysis

Figure 34: Comparison of million population per airport with similar countries



The figure indicates the population and million population per airport in India, Karnataka and in other countries of similar geographical area as that of Karnataka and the million population per airport.

The countries having area equivalent to Karnataka fare better in terms of airport infrastructure and also in terms of coverage of population with respect to Karnataka.

Source: www.indexmundi.com and ideck analysis

3.3. AIRPORTS IN KARNATAKA

Karnataka has five operational airports located at Bengaluru, Mangaluru, Mysuru, Hubballi and Belagavi. Currently, Bengaluru and Mangaluru airports cater to domestic as well as international passengers while the rest of the airports cater to domestic passengers. The details of the operational airports in Karnataka are given in the table below:

Table 27: Details of existing Airports in Karnataka

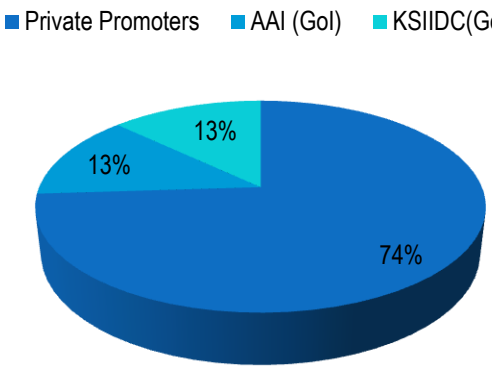
Sl. No	Airport	Airport Type	Area (acres)	Aircraft Movement during (No of flights) 2013-14	Passenger Traffic in 2013-14 (in million)	Runway Length (in Km)
1	Bengaluru	International	4300	117728	12.80	4.0
2	Mangaluru	International	584	12776	1.25	2.5
3	Mysuru	Domestic	425	442	0.01	1.9
4	Hubballi	Domestic	369	1380	0.08	1.6
5	Belagavi	Domestic	440	815	0.04	1.8

Source: Airports Authority of India

3.3.1. KEMPEGOWDA INTERNATIONAL AIRPORT LIMITED

Bangalore International Airport now rechristened as Kempegowda International Airport Bengaluru, has the distinction of being the first greenfield airport in India, developed through a public private partnership framework. The airport is located 34 km from the city and covers an area of about 4300 acres. The concession agreement with the private developer was signed in 2004 and the airport commenced its operations in 2008. The agreement allows the concessionaire to develop, construct, operate and maintain the Kempegowda International Airport for a period of 30 years, extendable at the sole option of GoK for another 30 years (i.e. total 60 years). The land for the same is leased out by the State Government. The airport handled around 15 million passengers in the year 2014-15 and the number of passengers is expected to go up to 20 million by year 2020. The ratio of domestic-international passenger stands at 86.5:13.5. Totally, 39 airlines currently operate from this airport, of which 29 are international airlines.

Figure 35: Shareholding pattern of Kempegowda International Airport



Source: BIAL

Figure 36: Kempegowda International Airport

3.3.2. MYSURU AIRPORT

Mysuru airport also known as Mandakalli airport is spread over 425 acres. The dimension of the runway is 1740×30 m. This runway is adequate to operate the 78-seater aircraft. The airport is located at a distance of 11 kms away from the city. The airport was commissioned for operation in 2010.

Figure 37: Mysuru Airport

3.3.3. MANGALURU INTERNATIONAL AIRPORT

Mangaluru International Airport also known as Bajpe airport is located 20 km from the Mangaluru city. The airport is operated and managed by AAI. The total area is 584 acres. The airport started its international operations in 2006 and it was a customs airport until 2012. The airport has 2 runways and was the first airport in Karnataka to have such a facility. The dimension of the second runway is 2450×45 m and was constructed to cater to the bigger aircrafts. The airport has witnessed a significant growth in the passenger traffic. The terminal handled 1.25 million passengers in 2013-14 against 1.03 million passengers in 2012-13. Air India Express and Jet Airways connect Mangaluru International Airport with many destinations in the Gulf region.

Figure 38: Mangaluru International Airport

3.3.4. HUBBALLI AIRPORT

Hubballi Airport is located 8 km from the city. The airport is spread over an area of 369 acres, managed and operated by AAI. The dimension of the runway at the airport is 1674 ×30 m. The terminal handled 0.077 Imillion passengers in the year 2013-14. During early 2007, in order to cater to the growing demand, Air Deccan had operated 2 flights each to Mumbai and Bengaluru from Hubballi on a daily basis, before it was acquired by Kingfisher Airlines which has closed down all operations. Spicejet has a service in 2012 which has been discontinued. Presently Air Pegasus has commenced operations at Hubballi Airport.

Figure 39: Hubballi Airport

3.3.5. BELAGAVI AIRPORT

The Airport is spread over 440 acres with a runway length measuring about 1830 × 45 m. In the year 2013-14, the total passenger traffic handled in the terminal was 0.036 lakh million. In order to expand its domestic network, SpiceJet, had announced the commencement of flight operations on the Bengaluru-Belagavi route in November 2012. The airline uses 78 seater aircraft on this route. It currently operates 2 flights per day (one from Bengaluru to Belagavi and the other from Belagavi to Bengaluru). Belagavi Airport is located at around 101 km from Hubbali Airport (via road).

Figure 40: Belagavi Airport

The regulatory framework for Airport is as shown below in the table:

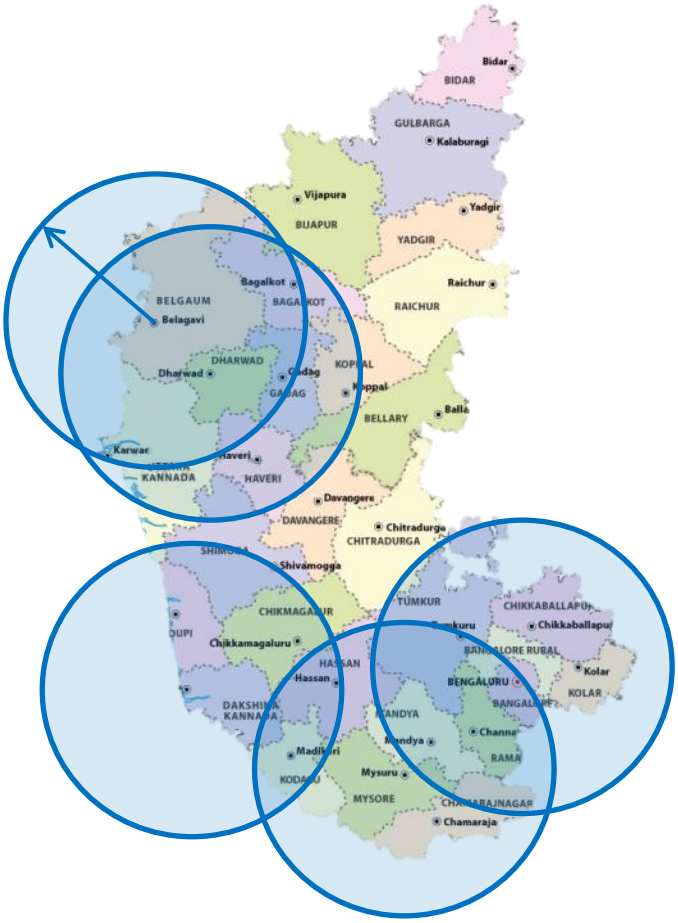
Table 28: Regulatory framework for Airports

Sl.no	Regulatory Framework	Details
1.	The Airports Authority Of India Act, 1994	An Act to provide for the constitution of the airports Authority of India and for the transfer and vesting of the undertakings of the International Airports Authority of India and the National Airports Authority
2.	The Airports Economic Regulatory Authority Of India Act, 2008	An act to provide for the establishment of an Airports Economic Regulatory Authority to regulate tariff and other charges for the aeronautical services rendered
3.	Associated offices - Central	• Airports Authority of India • Airports Economic Regulatory Authority • Directorate General of Civil Aviation , GOI
4.	Directorate General of Civil Aviation	The Directorate General of Civil Aviation is the regulatory body in the field of Civil Aviation primarily dealing with safety issues. It is responsible for regulation of air transport services to/from/within India and for enforcement of civil air regulations, air safety and airworthiness standards. It also co-ordinates all regulatory functions with International Civil Aviation Organisation
5.	Associated offices - State	• Bangalore International Airport Limited

3.4. GAP ANALYSIS

The below map indicates the location of the existing airport in the State.

Figure 41: Map showing the existing airports in the State



The circles in the figure represent the 150 km radius, the airport being the centre of the circle. It is assumed that that the airport caters to the 150 kms. The circles marked in the map shows the extent to which the existing airports in the State provide access for air traffic. The other areas which are not covered within the 150 km radius have to depend on either rail or road transport. This increases the travel time to the capital city from various regions in the State. It is inferred that there is need for better air connectivity and creation of airport infrastructure in the north eastern as well as in the central region. Natural barriers such as Western Ghats in the western region of the State hinder access to the air passengers, although the existing airports are within 150 km range. The international airport in Bengaluru and Mangaluru and the airport in Mysuru cater to the southern region of the State. The airports in Belagavi and Hubballi cater to the northern coastal districts and the north western region of Karnataka. There is no air connectivity from north eastern districts of the State such as Bidar, Kalaburagi and Raichur circle within the radius of 150 km. A detailed analysis has been carried out to indicate accessibility of district headquarters to Airports. The table below sets out the distance of district headquarters to the nearest domestic and international airport.

Table 29: Air Connectivity of District Headquarters

S. No.	District Head Quarters	Nearest Airport (Domestic/international)	Distance to nearest airport (Km)	Travel time - Road (mins)	Nearest international Airport	Distance to International airport (Km)	Travel time - Road
1	Bagalkot	Belgaum Airport	127	2 hr 8 mins	Goa International Airport	267	5 hr 26 mins
2	Belagavi	Belgaum Airport	16.4	0 hr 35 mins	Goa International Airport	138	3 hr 2 mins
3	Ballari	Vidyanagar Airport	36	0 hr 54 mins	Bengaluru International Airport	287	4 hrs 25 mins
4	Bengaluru	Bengaluru International Airport	25.6	0 hr 29 mins	Bengaluru International Airport	25.6	0 hr 29 mins
5	Bengaluru	Bengaluru International Airport	41.7	0 hr 58 mins	Bengaluru International Airport	41.7	0 hr 58 mins
6	Bidar	Rajiv Gandhi International Airport,Hyderabad	151	2 hrs 48 mins	Rajiv Gandhi International Airport,Hyderabad	151	2 hrs 48 mins
7	Chamarajanagar	Mysore Airport	51.3	1 hr 17 mins	Coimbatore International Airport	132	3 hr 0 mins
8	Chikballapur	Bengaluru International Airport	33.7	0 hr 39 mins	Bengaluru International Airport	33.7	0 hr 39 mins
9	Chikkamagaluru	Mangaluru International Airport	158	3 hr 58 mins	Mangaluru International Airport	158	3 hr 58 mins
10	Chitradurga	Bengaluru International Airport	212	3 hr 16 mins	Bengaluru International Airport	212	3 hr 16 mins
11	Mangaluru	Mangalore International Airport	7	0hr 13 mins	Mangalore International Airport	7	0hr 13 mins
12	Davanagere	Vidyanagar Airport	134	3 hr 3 mins	Mangaluru International Airport	266	5 hr 47 mins
13	Dharwad	Hubli Airport	18.9	0 hr 28 mins	Goa International Airport	164	3 hr 37 mins
14	Gadag	Hubli Airport	63.4	1 hr 22 mins	Goa International Airport	246	5 hr 3 mins
15	Hassan	Mysore Airport	134	2 hr 40 mins	Mangaluru International Airport	177	4 hr 1 min
16	Haveri	Hubli Airport	84.7	1 hr 12 mins	Goa International Airport	255	4hr 48 mins
17	Kalaburagi	Rajiv Gandhi International Airport,Hyderabad	204	3 hr 31 mins	Rajiv Gandhi International Airport,Hyderabad	204	3 hr 31 mins
18	Madikeri	Mysore Airport	131	2 hr 41 mins	Mangaluru International Airport	144	3 hr 10 mins

S. No.	District Head Quarters	Nearest Airport (Domestic/international)	Distance to nearest airport (Km)	Travel time - Road (mins)	Nearest international Airport	Distance to International airport (Km)	Travel time - Road
19	Kolar	Bengaluru International Airport	65.3	1 hr 28 mins	Bengaluru International Airport	65.3	1 hr 28 mins
20	Koppal	Hubli Airport	123	2 hr 18 mins	Goa International Airport	306	5 hr 58 mins
21	Mandya	Mysore Airport	57.8	1 hr 6 mins	Bengaluru International Airport	140	2 hr 41 mins
22	Mysuru	Mysore Airport	10.5	0 hr 27 mins	Bengaluru International Airport	180	3 hr 31 mins
23	Raichur	Rajiv Gandhi International Airport,Hyderabad	198	3 hr 27 mins	Rajiv Gandhi International Airport,Hyderabad	198	3 hr 27 mins
24	Ramanagara	Bengaluru International Airport	89.6	1 hr 50 mins	Bengaluru International Airport	89.6	1 hr 50 mins
25	Shivamogga	Mangalore International Airport	189	4 hr 3 mins	Mangalore International Airport	189	4 hr 3 mins
26	Tumakuru	Bengaluru International Airport	86.8	1 hr 45 mins	Bengaluru International Airport	86.8	1 hr 45 mins
27	Udupi	Mangalore International Airport	59.7	1 hr 14 mins	Mangalore International Airport	59.7	1 hr 14 mins
28	Karwar	Goa International Airport	95.8	2 hr 18 mins	Goa International Airport	95.8	2 hr 18 mins
29	Vijayapura	Bengaluru International Airport	24.4	0 hr 31 mins	Bengaluru International Airport	24.4	0 hr 31 mins
30	Yadgir	Rajiv Gandhi International Airport,Hyderabad	187	3 hr 14 mins	Rajiv Gandhi International Airport,Hyderabad	187	3 hr 14 mins

It is observed from the table above that several district headquarters are at a distance greater than 100 k.m. from a domestic airport. Chitradurga, Kalaburagi, Raichur, Shivamogga, Yadgir, Chikkamagaluru and Bidar are at distances greater than 150 km from a domestic airport. Additionally, Koppal, Ballari, Bagalkot, Davanagere, Haveri, Gadag, Chitradurga, Kalaburagi and Raichur are further than 200 km from an international airport. Clearly some district headquarters such as Kalaburagi, Raichur Bidar and Chitradurga are poorly connected to either domestic or international airports. The average distance of a district headquarter to a domestic airport is around 94 km while to an international airport is around 151 km. There is clearly scope of developing airports in the state in order to improve air connectivity as well as provide more equitable access to air transportation across the state.

With the State GDP poised to be in growth trajectory, there will be an increase in economic activity in the State. Therefore, for the trade and commerce to flourish in the State, it is not only sufficient to create industrial infrastructure such as industrial areas, clusters and NIMZs, it is imperative that rapid means of transport for both passengers and the cargo should be established in order to keep pace with the economic activity and development. Setting up of adequate infrastructure in place will also bolster the growth prospects in the State.

There is need for development of additional airport infrastructure in the State to enable seamless and swift transport.

GoK took the initiative of developing minor airports through PPP in the State in 2008, following the success of BIAL. In order to improve the air-connectivity within the State and to give a fillip to the economic development, GoK has initiated development of five green-field airports at Shivamogga, Kalaburgi, Vijayapura, Ballari and Hassan on a PPP framework.

The status of these minor airports is as set out in the table below:

Table 30: New Minor Airports in Karnataka

No.	Airport	Land Extent (acres)	Current Status
1.	Shivamogga	662	• Project stalled • Land allotment to the developer is annulled • AAI inspected the site and report is awaited • Cabinet gave approval for developing the airport under PPP
2.	Kalaburagi	567	• Project stalled • Land allotment to the developer is annulled • AAI inspected the land and did not express interest in developing the airport • Land has been handed over to PWD for construction of airport • RITES has been appointed as the third party agency for inspection
3.	Ballari	727	• Land acquisition completed • Survey work has been completed • Owing to the non-performance of the developer as per PDA, the performance security has been forfeited
4.	Hassan	536	• Construction not started • AAI inspected the site and report is awaited
5.	Vijayapura	727	• PDA was terminated since the developers expressed their inability to continue the project • KSIIDC to develop the airport

Source: IDD, GoK and iDeCK assessment

3.5. INVESTMENT STRATEGY - MINOR AIRPORTS

The development strategy and the implementation for creating airport infrastructure have been divided into two parts viz. development of minor airports and development of airstrips and helipads.

The immediate focus will be on meeting the requirement of creating and providing airport infrastructure in the districts or locations which are not connected within the 150 km of the existing airports. It is also taken into consideration that the major industrial districts in the State are provided with all modes of transport infrastructure for swift movement from one region to other region. With these factors, it is recommended to develop 5 minor airports in the State that will provide complete coverage ib
the State. The prospective locations are as follows:

1. Shivamogga
2. Vijayapura
3. Ballari
4. Hassan
5. Kalaburagi

3.5.1. SHIVAMOGGA

Shivamogga is the ninth largest district in Karnataka State covering an area of 8,478 square kms which constitute 4.41 % area of the State. It lies between 14.00° North Latitude and 75.28° East Longitude. The district's population is 17.52 lakhs as per the 2011 census which, constitutes 2.87% of the total population of the State. Population of the Shivamogga city is 3.22 lakhs.

Shivamogga is connected by broad-gauge rail line to Bengaluru, Mysuru and Hubballi and Hyderabad. Shivamogga is connected by two National Highways namely NH-13 (Solapur-Chitradurga-Shivamogga-Mangaluru) and NH -206 (Tumakuru –Honnavar). The city is located at a distance of 274 kms from the State capital Bengaluru. Shivamogga has been on the industrial map of Karnataka right from 1920s. It had over 14,711 industrial units with an investment of Rs. 268.78 crores as on 2010-11. Apart from small scale industries, Shivamogga has large scale industrial facilities such as food and beverages, textile, automobile, artisans, rubber and plastic industries. Major industries located in Shivamogga district are Visweswaraiah Iron and Steel Limited (VISL), Bhadravathi, Mysore Paper Mills Limited (MPM), Bhadravathi, M/s Pealite Liners Pvt. Ltd. etc. GoK has also been facilitating investments from automobile companies to set up their manufacturing units at Shivamogga. Growing industrial development coupled with religious and domestic tourist destinations in and around Shivamogga has augmented the need for an airport. The development of airport will provide connectivity to the capital city and other major districts in the State. GoK has identified around 662 acres of land at Sogane near Shivamogga for the development of greenfield airport.

3.5.2. VIJAYAPURA

Vijayapura is one of the largest districts in Karnataka and has an area of 10,541 sq. km, which accounts for 5.49% of the area of the Karnataka State. It lies between 16.82° North Latitude and 75.72° East Longitude. The district's population is 21.77 lakhs as per the 2011 census which constitutes 3.56% of the total population of the State. Population of the city is 3.27 lakhs. The city is accessible by both highways and rail. Vijayapura is connected to major cities like Bengaluru, Mumbai, Pune and Hyderabad by rail line. The rail connecting Solapur in Maharashtra and Hubballi passes through the Vijayapura

city. Vijayapura city is connected by two National Highways namely NH-13 (Solapur-Chitradurga-Shivamogga-Mangaluru) and NH -218 (Hubballi – Vijayapura). Vijayapura city is located at a distance of around 580 kms from the State capital Bengaluru. The district has 3 developed industrial areas covering an area of 583 acres and 3 industrial estates covering an area of 46 acres. There were 56,324 registered industrial units in the district as on 2011-12 with the total investment of Rs. 40.16 crores. Food and agro industry are the prominent industries in the district followed by engineering and leather based industry.

Vijayapura is also well known for its historical buildings of architectural importance. The most prominent tourist attractions are Gol Gumbaz, Ibrahim Roza, Malik-e-Maidan and Barakaman.

Tourism is one of the most important economic activities in this region. For providing easy access to this tourism centre and to promote overall development in the North Karnataka region, GoK has proposed to develop a greenfield airport at Vijayapura. GoK has identified around 457 acres of Government land and about 500 acres of private land in Burnapur for the proposed greenfield airport development.

3.5.3. BALLARI

Ballari district is located at a distance of approximately 300 kms from Bengaluru in its north east direction and adjoining the neighbouring State Telangana. The geographical area is 8447 sq. km. and lies between15° 30' - 15° 50' north latitude and 75° 40' - 77° 11' east longitude. The district's population was 24.52 lakhs as per the 2011 census which constitutes 4.01% of the total population of the State. Population of the city is 4.10 lakhs. Ballari is well connected via rail and most of the iron ore exports happen through rail network. Ballari district has 25% of India's iron ore reserves. There are large and small mining units in the district. JSW Steel Ltd has set up its steel plant in the district. The other notable industries in the district are textile and garments. The district has 5 developed industrial areas covering an extent of 200.94 hectares. There were 16,620 small scale industries, 109 medium and large scale industries and 13 mega industries as on 2012 with total investments amounting to 2845 crores. Ballari showcases tremendous tourism potential and is one of the most visited districts for tourism within Karnataka; due to the UNESCO World Heritage Site located at Hampi in Ballari. Apart from Hampi, Ballari has many other destinations which have tourism potential such as the Daroji Bear Sanctuary, Tungabhadra Dam, Ubalagundi etc. Industries and tourism are the most important economic activities that support the district's economy. For providing easy access to all the important destinations for business and tourism purpose there is an increased need of an airport in Ballari.

3.5.4. HASSAN

Hassan district located in the southern part of Karnataka is located at a distance of 185 kms from the capital city Bengaluru. The geographic area of the district of Hassan is 6845 sq. km. and is between 12° 13´ and 13° 33´ north latitudes and 75° 33´ and 76 ° 38´ east longitudes. The district's population was 17.76 lakhs as per the 2011 census which constitutes 2.91% of the total population of the State. Total urban population in the Hassan district is 3.76 lakhs. Hassan is well connected via both road and rail. NH-48 connects Hassan to both Mangaluru in the west and Bengaluru in the east. There is also rail connectivity from Bengaluru to Mangaluru via Hassan. Hassan district is covered by metamorphic and igneous rocks and is famous for granite mining and is also rich in minerals. Agro based industry such as coffee plantation; potato, coir industry, etc. are the prominent growth drivers in the district. Other notable industries established in the district are mineral based, textile and wooden industries. The district has one Special Economic Zone (SEZ), 4 industrial areas covering a total area of 2549

acres. The district also has established 7 industrial estates measuring about 69 acres. The total number of industrial units in the district was 12,503 as on 2010-11. The district is also famous for tourism. The world famous sculptural wonders of Halebeedu, Belur and Shravanabelagola are located in the district. With the base for economic activity already available in the district which is set to increase in future, the district has to be complemented by enabling swift and direct connectivity to all regions within and beyond the State. GoK is looking at developing an airport in Hassan district, which may be an added advantage in the medium and long term. The map below indicates the vicinity of airport that it can cover.

GoK has identified about 567 acres of land, located at a distance of 15 Kms from Kalaburagi city and 9 Kms from the University campus on Sedan road for the development of the greenfield airport. The development of airport will provide direct air connectivity from the northern to the southern region in the State

3.5.5. KALABURAGI

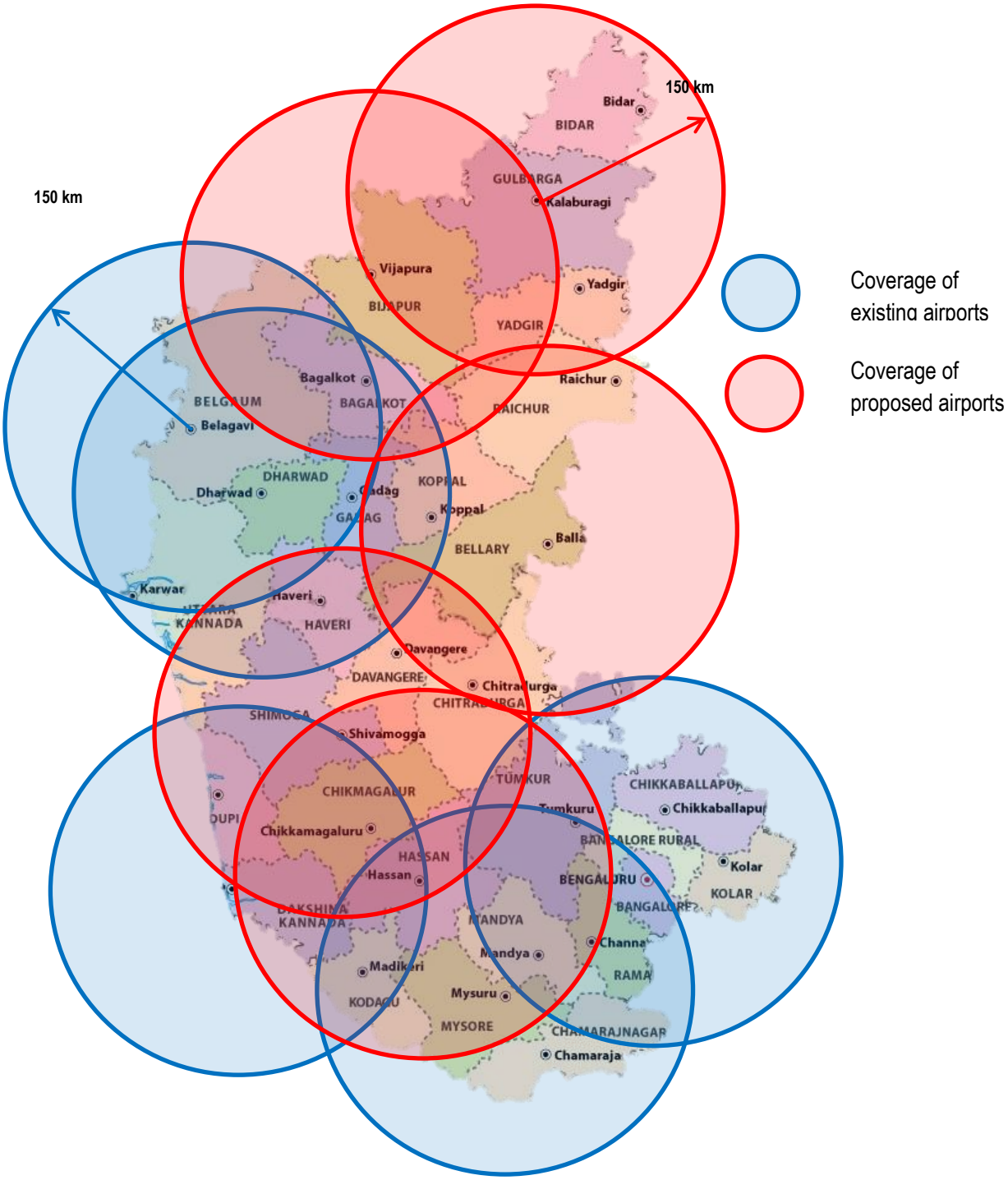
Kalaburagi district also known as the 'tur bowl' of Karnataka is located in the northern part of the State. It is the largest district in the State covering an area of 10,954 square kms which constitute 5.71 % area of the State. It lies between 17.33° north Latitude and 76.83° east Longitude.

The district's population was 25.66 lakhs as per the 2011 census which constitutes 4.20% of the total population of the State. Population of the Kalaburagi city is 5.43 lakhs. Kalaburagi city is well connected by rail line to major cities like Bengaluru, Mumbai, Pune and Hyderabad. It is also connected by State Highways and Major District roads to major towns in Karnataka and the neighbouring States. Kalaburagi city is located at a distance of nearly 663 Kms by road from the State capital Bengaluru. Kalaburagi is an industrially developing district with sizeable presence of cement, textile, leather and chemical industries. To promote industrial investment in the region, GoK has earmarked 105 acres of land for setting up special economic zone for food processing. Kalaburagi district has 4 established industrial areas measuring about 957 acres and 7 industrial estates which measures around 126 acres. The district also has 16,883 registered industrial units.

The map indicating the locations of the existing airports and the airports that are proposed to be developed is shown below.

The 5 proposed minor airports will provide a comprehensive coverage in the State in terms of having airport infrastructure thereby providing a foundation for ensuring air connectivity to and from various regions of the district seamlessly. The map here gives an overall coverage in the State after implementation of all 5 minor airport projects.

Figure 42: Map showing coverage of existing airports and proposed Airports



3.6. INVESTMENT STRATEGY - AIRSTRIPS & HELIPADS

The Government can look for development of airstrips and helipads in addition to minor airports. The main reason for development of airstrip and helipads is basically to cover all districts and ensure air connectivity in the long term. This will primarily focus on the operation for chartered, unscheduled and private airlines. The airstrips will also act as a training and development centre for aircraft operations and for adventure sports activities. GoK has initiated development of helipads in every district and tourist destinations, and air strips in multiple locations. The table sets out few of the location identified for development of airstrips in the State. The map below sets out the location of the proposed airstrips and helipads in the State.

Table 31: Location of Airstrips and Helipads in Karnataka

No.	Airstrips	No.	Helipads
1.	Bagalkot	1.	Badami
2.	Raichur	2.	Vijayapura
3.	Chitradurga	3.	Hampi
4.	Davangere	4.	Aihole
5.	Karwar	5.	Pattadakal
6.	Gadag	6.	Coorg
7.	Haveri	7.	Belur
8.	Udupi	8.	Chikkamagaluru
9.	Chikkamagaluru	9.	Udupi
10.	Kollegal	10.	Dharmasthala
11.	Madikeri	11.	Hornadu
		12.	Kolar
		13.	Jog Falls
		14.	Murudeshwar
		15.	Gokarna
		16.	Karwar
		17.	Kukke Subramanya
		18.	Moodubidiri
		19.	Sringeri

**List is based on iDeCK study. Development of Regional Air connectivity in the state of Karnataka, 2013.*

The location for the airstrips and helipads is based on analysis carried out by iDeCK in 2013. Helipads are predominately located in destinations that are of tourist interest. The proposed helipads encompass tourist circuits such as costal circuit, pilgrim circuit, heritage circuited, etc. that have been developed for tourism. The idea is to develop a hop-on-hop-off service between these destinations within a circuit. In addition to providing connectivity for tourists these helipads can also be leveraged to provide connectivity for the state as a whole.

Figure 43: Map showing proposed airstrips and helipads


Bidar
BIDAR
GULBARGA
Kalaburagi
Vijapura
BIJAPUR
Yadgir
YADGIR
Bagalkot
BAGALKOT
Raichur
RAICHUR
BELGAUM
Belagavi
DHARWAD
Dharwad
GADAG
KOPPAL
Koppal
BELLARY
Balla
Haveri
HAVERI
UTTARA KANNADA
Davangere
DAVANGERE
Chitradurga
CHITRADURGA
SHIMOGA
Shivamogga
TUMKUR
CHIKKABALLAPU
Chikkaballapur
CHIKMAGALUR
Tumkuru
Chikkamagaluru
BANGALORE RURAL
HASSAN
Hassan
Kolar
BENGALURU
KOLAR
BANGALORE
DAKSHINA KANNA
MANDYA
Mandya
Channa
Madikeri
RAMA
KODAGU
Mysuru
MYSORE
CHAMARAJNAGAR
Chamaraja
Airstrips
Helipads

3.7. SHELF OF PROJECTS

GoK is in the course of development of 5 minor airports that cover the entire State with the much needed air connectivity. In addition, airstrips and helipad are also planned for development to provide air connectivity to the remote locations of the State. The table below indicates the investment estimates for the shelf of projects that are identified and proposed to be developed in the State:

Hence a total investment of Rs. 1315 Crores is estimated for development of airport infrastructure in the state.

Table 32: Shelf of Projects and Investment Estimates

Project	Details	Investments INR Crores
Development of minor airport at Shivamogga*	Runway, Terminal Building, Taxi Track, Apron, Air traffic control tower , radio and navigation aids, safety and fire services, security services, lighting.	288
Development of minor airport at Vijayapura*	Runway, Terminal Building, Taxi Track, Apron, Air traffic control tower , radio and navigation aids, safety and fire services, security services, lighting.	100
Development of minor airport at Ballari*	Runway, Terminal Building, Taxi Track, Apron, Air traffic control tower , radio and navigation aids, safety and fire services, security services, lighting.	110
Development of minor airport at Hassan*	Runway, Terminal Building, Taxi Track, Apron, Air traffic control tower , radio and navigation aids, safety and fire services, security services, lighting.	150
Development of minor airport at Kalaburagi*	Runway, Terminal Building, Taxi Track, Apron, Air traffic control tower , radio and navigation aids, safety and fire services, security services, lighting.	186
Development of 11 airstrips#	Runway, terminal building, radio and navigation aids, security services.	462
Development of 19 helipads^		19
Total Investment		**1315**

**Estimates based on DPRs prepared*
 # Cost per airstrip estimated at Rs. 42 crores
^ Cost per helipad estimated at Rs. 1 crore

3.8. CONCLUSION

Presently there are 2 international and 3 domestic airports that are operational in the State. 5 minor airports have been proposed for development. The development of these minor airports in Kalaburagi, Vijayapura, Shivamogga, Hassan and Ballari will enable the rest of Karnataka access to airports and air connectivity. Alongside development of minor airports it is also proposed to develop airstrips and helipads which will aid regional air connectivity for emergency services and medical evacuations. The table below indicates the district-wise existing and proposed infrastructure for air connectivity.

Table 33: District-wise existing and proposed infrastructure

District	Head Quarters	International Airport	Domestic Airport	Minor Airport	Airstrip	Heli-pad	Total
Bagalkot	Bagalkot				1	3	4
Belagavi	Belagavi		1				1
Ballari	Ballari			1		1	2
Bengaluru Rural	Bengaluru						
Bengaluru Urban	Bengaluru	1					1
Bidar	Bidar						
Chamarajanagar	Chamarajanagar						
Chickballapura	Chickballapura						
Chikkamagaluru	Chikkamagaluru				1	3	4
Chitradurga	Chitradurga				1		1
Dakshina Kannada	Mangaluru	1				3	4
Davangere	Davangere				1		1
Dharwad	Dharwad		1				1
Gadag	Gadag				1		1
Hassan	Hassan			1		1	2
Haveri	Haveri				1		1
Kalaburagi	Kalaburagi			1			1
Kodagu	Madikeri				1	1	2
Kolar	Kolar					1	1
Koppal	Koppal						
Mandya	Mandya						
Mysuru	Mysuru		1		1		2
Raichur	Raichur				1		1
Ramanagaram	Channarayapatna						
Shivamogga	Shivamogga			1			1
Tumakuru	Tumakuru						
Udupi	Udupi				1	1	2
Uttara Kannada	Karwar				1	4	5
Vijayapura	Vijayapura			1		1	2
Yadgiri	Yadgiri						

From the table above it is clear that even if all proposed projects are implemented 8 districts will not have access to air connectivity infrastructure of any kind (airport, minor airport, airstrip or helipad). It is there recommended that airstrips be developed in these eight location i.e. Bidar, Chamarajanagar, Chickballapura, Koppal, Mandya, Ramanagaram, Tumakuru and Yadgiri. Providing airstrips in these 4 locations will cost around Rs. 336 crores based on the estimate of Rs. 42 crore per airstrip. This will result in an increase of the project shelf from Rs. 1315 crores to Rs. 1651 crores.

As indicated in the table above there is a need to augment the current project shelf but is also import that projects get implemented on time. Timely implementation of projects and competition in developing the minor airports is the key to the sector. It is important to revive and revitalize current projects. Further, in order to promote regional air connectivity it is important to promote private players to operate flights across the State. Aviation Development Cell constituted under KSIIDC, Government of Karnataka is a step in this regard.

Chapter 4

Roads

4.1. ROADS IN INDIA

This chapter gives an account of the development of road infrastructure in Karnataka, identifying the road infrastructure requirement and estimate the investment to be made available for efficient and effective network of road connectivity impacting on the economic development in the State.

Road network is vital for sustained and inclusive growth of the economy. It not only facilitates the movement of passengers and freight across the region, it also promotes efficiency in the economy by minimizing total transportation cost in terms of economies of production, distribution and consumption. The role of road transport among the different modes of transport is dominant because of its last mile connectivity or feeder service. In comparison to other modes of transport, the movement of passenger and freight in India over the years has increasingly shifted towards road transport sector. According to MoSRTH (Ministry of Shipping, Road transport and Highways), in 2011-12, the road network in the country carried about 86 per cent of the total passenger movement by roads and railways put together. The corresponding figure for freight movement by roads was 64.5 per cent.

As per the analysis of MoSRTH, the growth in motor vehicle population during 2001 to 2011 of around 10% has outstripped the modest growth in the roads network of 3.3%. This has resulted in the saturation of road capacities on many stretches. Rehabilitation and construction of new roads are essential to provide sufficient, safe and efficient transportation for passenger and goods and are vital for making the economy competitive and for sustaining a high rate of growth. The need to promote road connectivity across the country and maintain road infrastructure poses an enormous challenge.

GoK has recognized development of roads as one of the most critical enabler for economic development in the State and has over the years initiated development of roads through several programmes/ projects/agencies and through various Government agencies.

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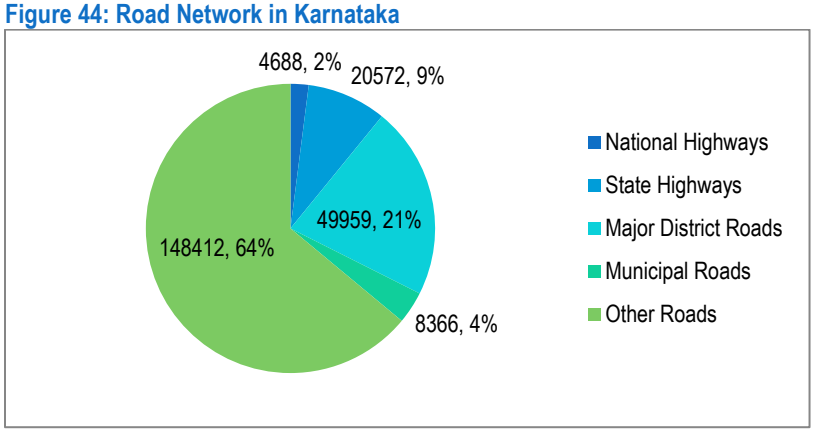
4.2. ROADS IN KARNATAKA

Karnataka has total road network of 2.3 lakh kilometers comprising of National Highways (NH), State Highways (SH), Major District Roads (MDR), Municipal Roads (MR) and Other Roads (OR). Village Roads are typically classified under other roads. As seen in the figure below 64% of roads in the state are other roads i.e. village roads. NHs and SHs together contribute to only around 11% of the state existing roads. There are around 4688 km of national highways and 20,572 km of state highways.

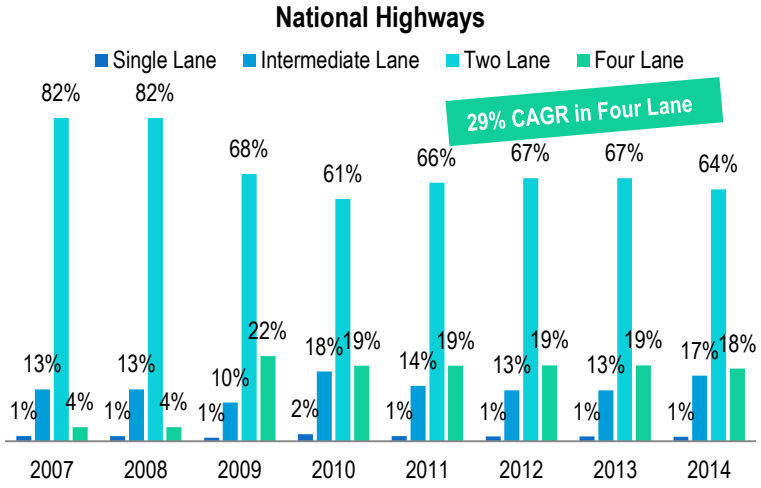
Figure 44: Road Network in Karnataka



In Karnataka, Public Works, Ports & Inland Water Transport Department (PWP&IWTD) is the principal Government department administrating development and maintenance of NHs, SHs and MDRs for further details on the institutional framework see ***Annexure 4A***.

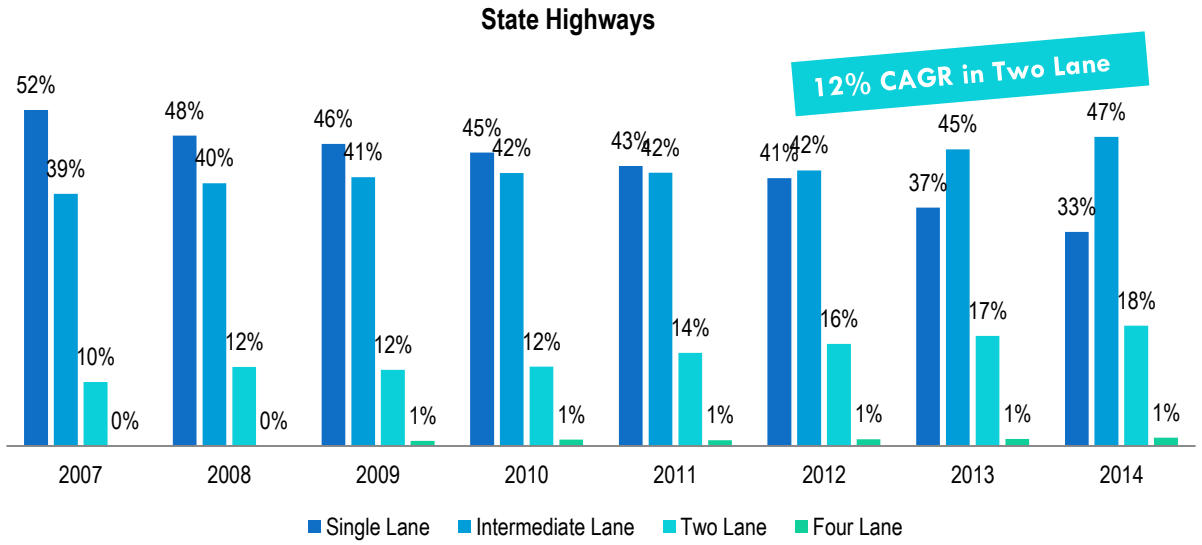
4.2.1. LANE DISTRIBUTION

Figure 45: Lane Distribution of National Highway in Karnataka



In Karnataka, as on 31st March 2014, 64% i.e. approximately 3000 kms out of 4688 km of NH has been augmented to two lanes capacity and 864 km i.e. approximately 18% has been augmented to four lanes capacity. During the years from 2007 to 2014, capacity augmentation of NH has recorded a compounded annual growth rate of 29% in the State.

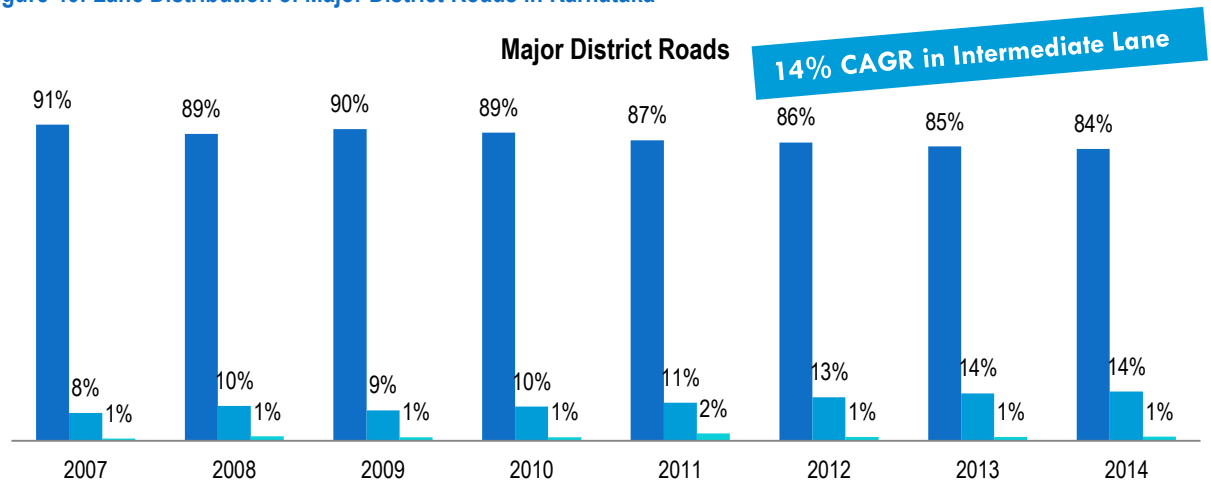
For development and maintenance of SH and MDR, GoK had established multiple organizations such as Karnataka Road Development Corporation Limited (KRDCL), Karnataka State Highways Improvement Project (KSHIP) and State Highway Development Project (SHDP). As on 31st March 2014, less than 20% length of SH in the State were of two or four lane capacity. It is considered that expanded road development programs in the State has made an effect in providing opportunities for less developed areas and continue to support development of places. Over the period from 2007 to 2014, 12% compounded annual growth rate was recorded for augmenting the capacity of SH from intermediate to two lanes.



More than 80% of Major District Roads in Karnataka are of intermediate lane capacity. Karnataka has achieved and accomplish one of the objective "To promote socio-economic development in the interior and remote areas of the State by ensuring connectivity to the closest MDR for all villages having a population greater than 500, so that an all-weather two-lane road will be available within three kilometers of every such village" of Karnataka Road Sector Policy 2009.

During the period 2007 to 2014, capacity augmentation of Major District Road from single lane to intermediate lane has recorded a compounded annual growth rate of 14%. Major District Roads will go a long way in promoting potential industrial and tourist destinations in the State. Considering, industrial activity in future and prospective foreign investment in developing industrial zones, Major District Roads will play a significant role by sharing the load of State Highways.

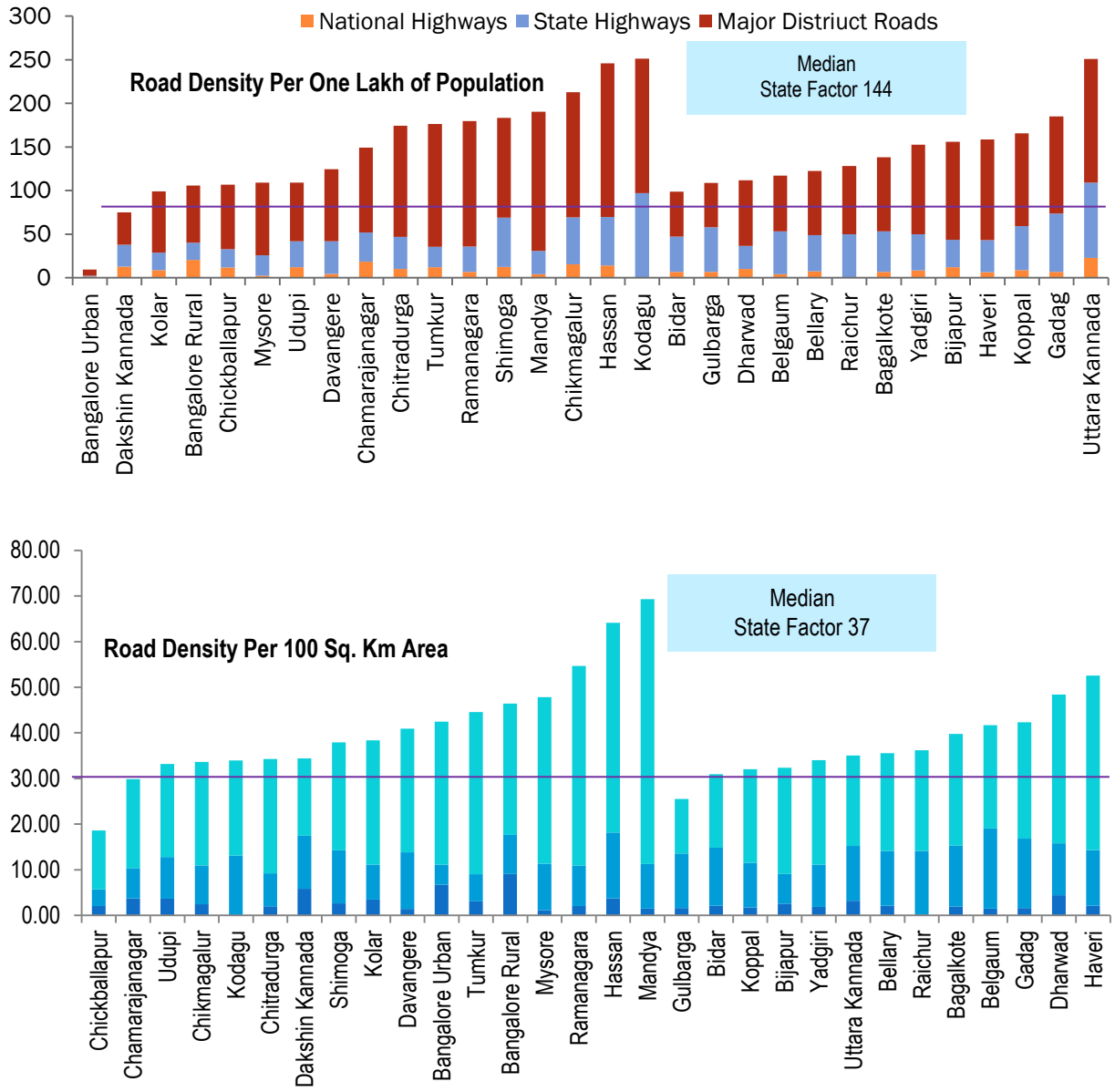
Figure 46: Lane Distribution of Major District Roads in Karnataka



4.2.2. DISTRICT WISE ROAD DEVELOPMENT

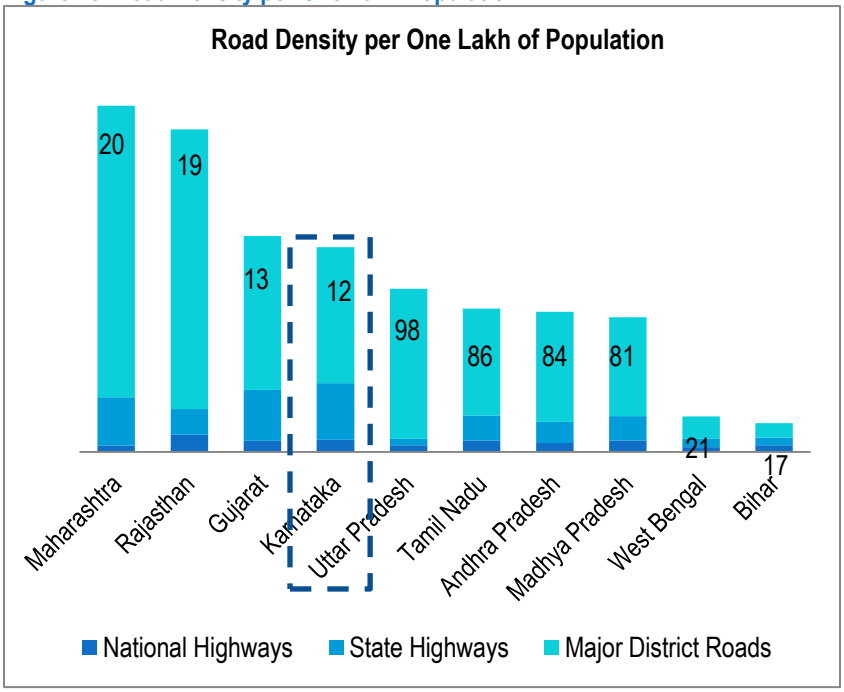
Roads are perceived as an intervention to support mobility in any dedicated region. Main objective of the road network is to provide access composed and mobility i.e. ease of movement and proximity or availability to the user. Karnataka has road network of just over 75,000 kms comprising of NH, SH and MDR spread across 30 districts. Road density based on area and population varies across the districts.

Figure 47: District-wise Road Density



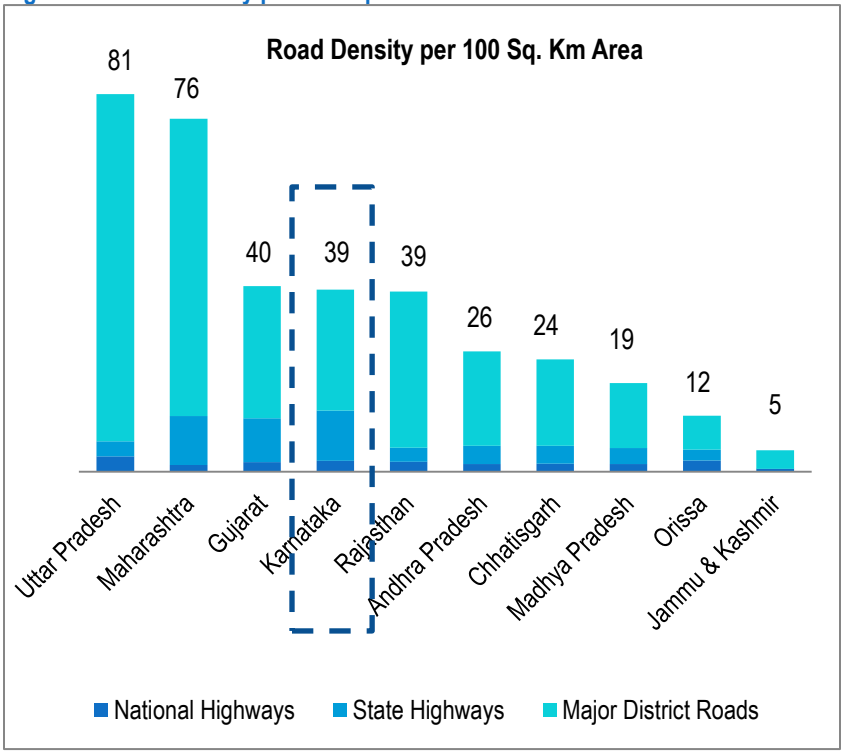
4.3. COMPARATIVE ANALYSIS

Figure 48: Road Density per One Lakh Population



Karnataka has developed a very reliable road network providing accessibility to users. One of the indicators used to measure road development is Road Density. Road density can be calculated based on geographical density or population density. As per 2011 statistics of 28 States released by MoSRTH, Karnataka stands at 13th position in road density per lac population and at 11th position in road density per 100 sq. km area.

Figure 49: Road Density per 100 Sq. K areas



As seen from the figures to the left, Karnataka has a road density per one lakh population and road density per 100 sq. kms of 12 and 39 respectively.

The regulatory framework for Roads is as shown below in the table:

Table 34: Regulatory framework for Roads

Sl.no	Regulatory Framework	Details
1.	National Highways Authority of India Act, 1988	Responsible for the development, maintenance and management of National Highways. Established in 1995.
2.	NHAI rules , 1997	These rules may be called the National Highways (Collection of Fees by any Person for the Use of Section of National Highways/Permanent Bridge/ Temporary Bridge on National Highways) Rules.
3.	Associated Offices	• Border Roads Organization • Indian Road Construction Corporation Limited • National Institute of Training For Highways Engineers • Indian Roads Congress (IRC) • Indian National Group of the International Association for Bridge and Structural Engineering (IABSE)
4.	Karnataka Highway Act, 1964	An Act to provide for the restriction of ribbon development along highways, for the prevention and removal of encroachment thereon, for the construction, maintenance and development of highways, for the levy of betterment charges
5.	Road Development policy, 1998-2012	The road development policy is aimed at providing an efficient, sustainable road network across the state
6.	Associated Offices in the State	Public Works Department as a nodal agency - KRDCL - KSHIP - SHDP

4.4. GAP ANALYSIS

According to 2010 published ADB TA 7324 – IND: Karnataka State Highway Network Improvement Strategy- Final Report, 27% of SH and 21% of MDR were considered to be in good condition, while 14% of SH and 20% of MDR were in poor condition. And it was reported that more than 13000 km of SH were already experiencing congestion of various degree, with more than 7800 kms were operating at the capacity limit. Due to the congestion and poor condition of road network, passenger and commodity vehicular traffic faces financial losses.

In Karnataka, road network comprising of NH, SH, and MDR grew at a CAGR of 4% in the period 2007 to 2014 recording increase in road length from 57000 kms to 75,000 kms.[29] The growth in the road sector had demonstrated multiplier effect resulting in CAGR of 10% for Karnataka's Gross State Domestic Product (GSDP) which crossed over US $ 100 billion in the same period.

Even with higher growth rate, lane distribution pattern indicates that single lane is predominant in the State. More than 93% of combined length of SH and MDR is comprised of single lane or intermediate lane capacity. It is important to upgrade MDRs from single lane to intermediate and all SH in State to at least intermediate or double lane capacity.

Key Statistics of the road network highlights that 98% of the length of MDR in the State have single lane or intermediate lane capacity which in turn transfers more vehicular load on the 20% of the SH augmented to two lane or more lane capacity.

Considering the current status of the road network and the efforts made to upgrade the road network since year 2010, Government's aim to boost the industrialization and manufacturing sector in the State especially in North Karnataka where NIMZs have been proposed viz. located in Bidar and Kalaburagi will have an effect on the economy of the surrounding districts of Vijayapura, Yadgir, Bagalkot, Raichur, Kalaburagi and Ballari where currently road density based on population and area is below the State's average density. The above region which falls in the Hyderabad Karnataka Zone is expected to draw significant investments and development in the coming years as a manufacturing hub. It is suggested that a length of 200 to 400 kms with two lanes and above capacity is to be developed in Bidar, Kalaburagi, Dharwad, Belagavi, Ballari, Raichur and Bagalkot districts. Similarly, Kolar, Dakshin Kannada, Chickballapura, Mysuru, Udupi, Davangere, Chamarajanagar districts also have recorded density factors below the State average and demand road network development of 300 – 500 kms with two lane and above capacity to support economic and NIMZs development in Tumakuru and Kolar districts.

[29] Source:KPWD MIS

4.5. PROJECTS

To strengthen road network in order to support economic development across Karnataka, corridor development that will provide pan State connectivity is essential. A corridor either access controlled expressway or comprise of multiple sections of highway developed to provide accessibility for a longer stretch that attracts higher traffic due to reduced travel time and lower vehicular running cost. It is always beneficial for the State to have planned corridors to reduce user travel time and cost and also to reduce impact on environment.

Karnataka has so far developed small links between important destinations which acts as part of a corridor. If one link fails to deliver, the attractiveness of the corridor as a whole is affected, resulting in lower traffic demand. KSHIP under Asian Development Bank (ADB) assisted program conducted a prefeasibility study of 4400 kms, of Core Road Network identified earlier and prioritized roads to be developed under three priority segments as to be developed in one after the another as shown below;

Under Priority I: Identified roads stretches is planned to be developed by 2018-2019;

Table 35: Core Road Network identified as Priority I

Corridor	From	To	Road Length
			KMs
CEW 14	Kumta	Yekkambi	78.70
CNS 5	TN Pura	TN Border	118.80
CEW16	Chitradurga	A P Border	110.50
CEW 28	AP Border	Somwarpet	278.50
CNS 5	Bagalkot	Honnali	268.60
CNS 7	Before Uppin Bettageri	Kerala Border	506.7
Total			**1361.8**

For Priority I, KSHIP has appointed technical consultants for preparation of Detailed Project Report. It is expected that consultants will submit reports by April 2016.

Under Priority II: Road Stretches to be developed after completion of Priority I.

Table 36: Core Road Network identified as Priority II

Corridor	From	To	Road Length
			KMs
CNS 5	Honnali	Mysuru	271.30
CNS 13	Afzalpur	Karwar	436.30
Total			**707.60**

Under Priority III: Road stretches to be developed with or after Priority II are listed in the table below

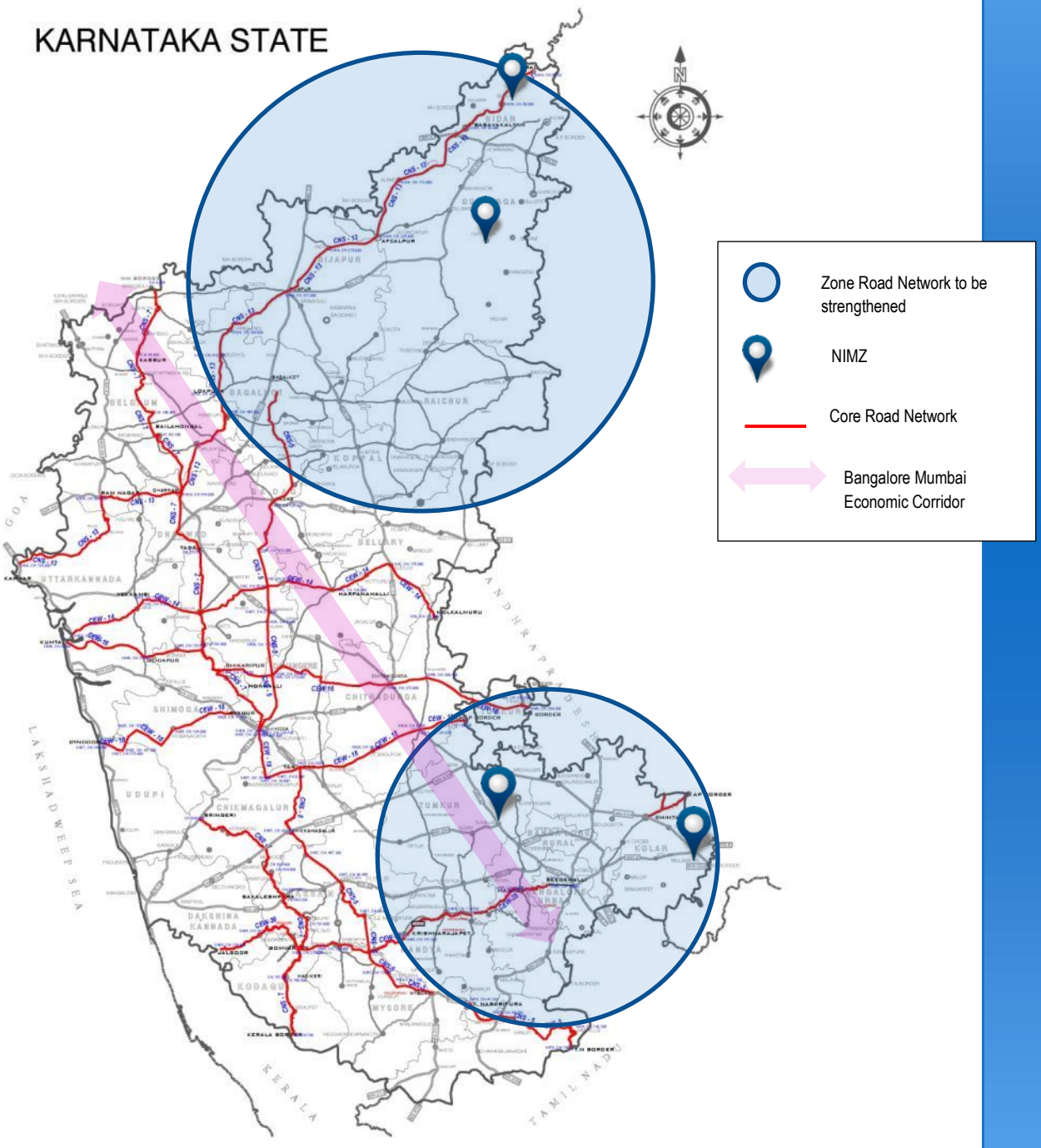
Table 37: Core Road Network identified as Priority III

Corridor	From	To	Road Length
			KMs
CEW 14	Yekkambi	Molakalmuru	251.00
CNS 7	MH Border	Before Uppin Bettageri	182.10
CEW 18	Byndoor	KA/AP Border	323.70
CEW 28	Somwarpet	Jalsoor	100.00
CNS 13	Aurad	Afzalpur	215.00
CEW 16	Kumta	Chitradurga	270.90

Development of corridors will not only provide connectivity but also improve the economic development in and around the project influence area. Slow development of corridors might hamper industrial growth in the State and might lead to increase in project development cost.

The corridor identified for development under KSHIP is set out in the map below;

Figure 50: Map of Core-Road Network



4.6. INVESTMENT

On the bases of the gap analysis and the proposed projects in the sector; the investments possible in the sector is identified. The development of road network identified and proposed are to be developed in the state in 3 different phases. The key investment heads would be the following;

- Development of corridors (strengthening of roads and new road development and
- Development of road network (to ensure equitable road development across the State)

The summary of investments is set out in the table below;

Table 38: Proposed Investment in Road Sector

Implementation Phase	Development Activities	Length in kms	Investments INR Crores
Phase-I	Development of SH and MDR in North and South Zone to increase density factor	900	4500
	Development of Priority I roads under KSHIP	1361	6805
Phase-II	Development of Priority II roads under KSHIP	707	3535
Phase-III	Development of Priority III roads under KSHIP	1342	6710
	Total	4310	21,550

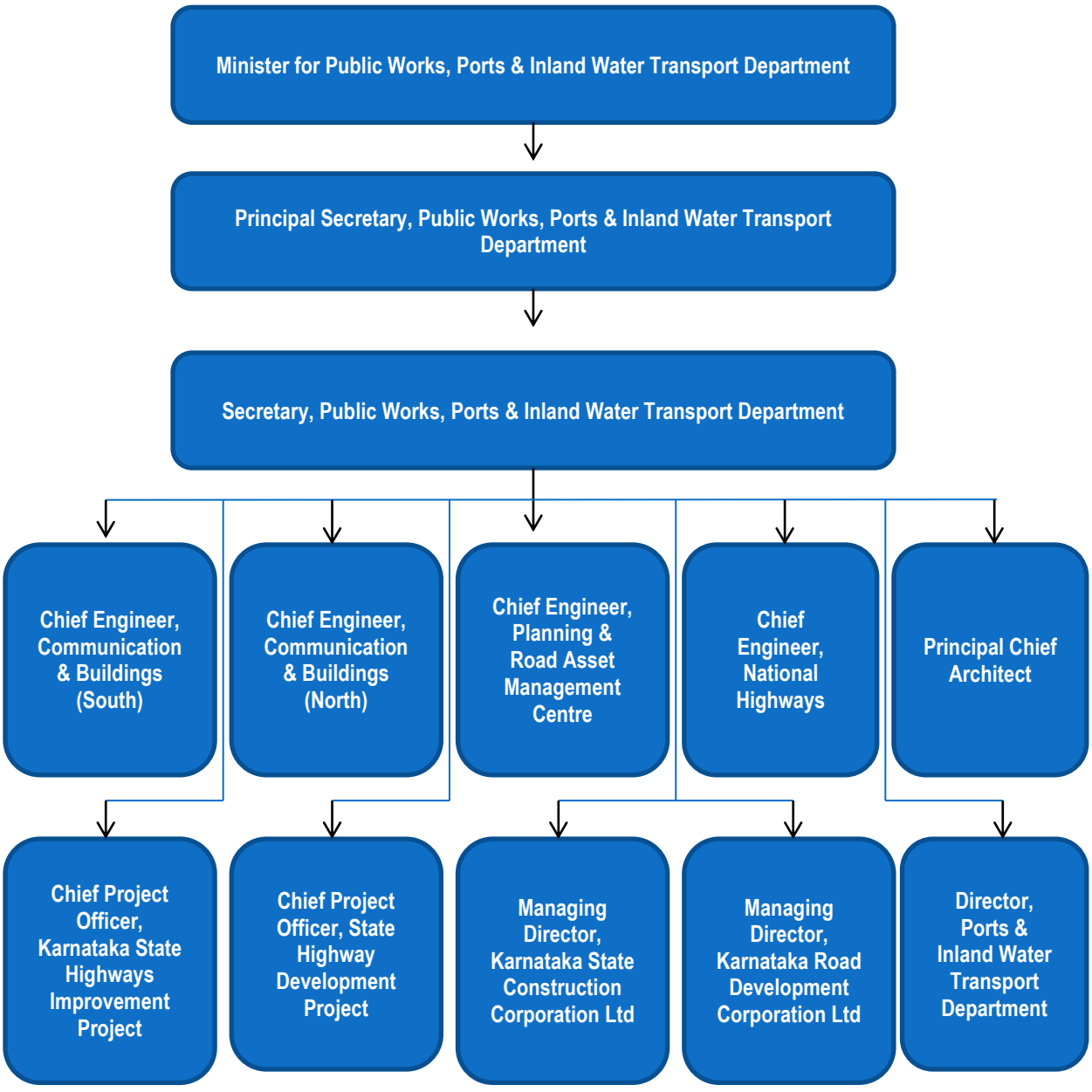
A total investment of about Rs. 22,000 crores is estimated for development of road infrastructure in the State in the coming years.

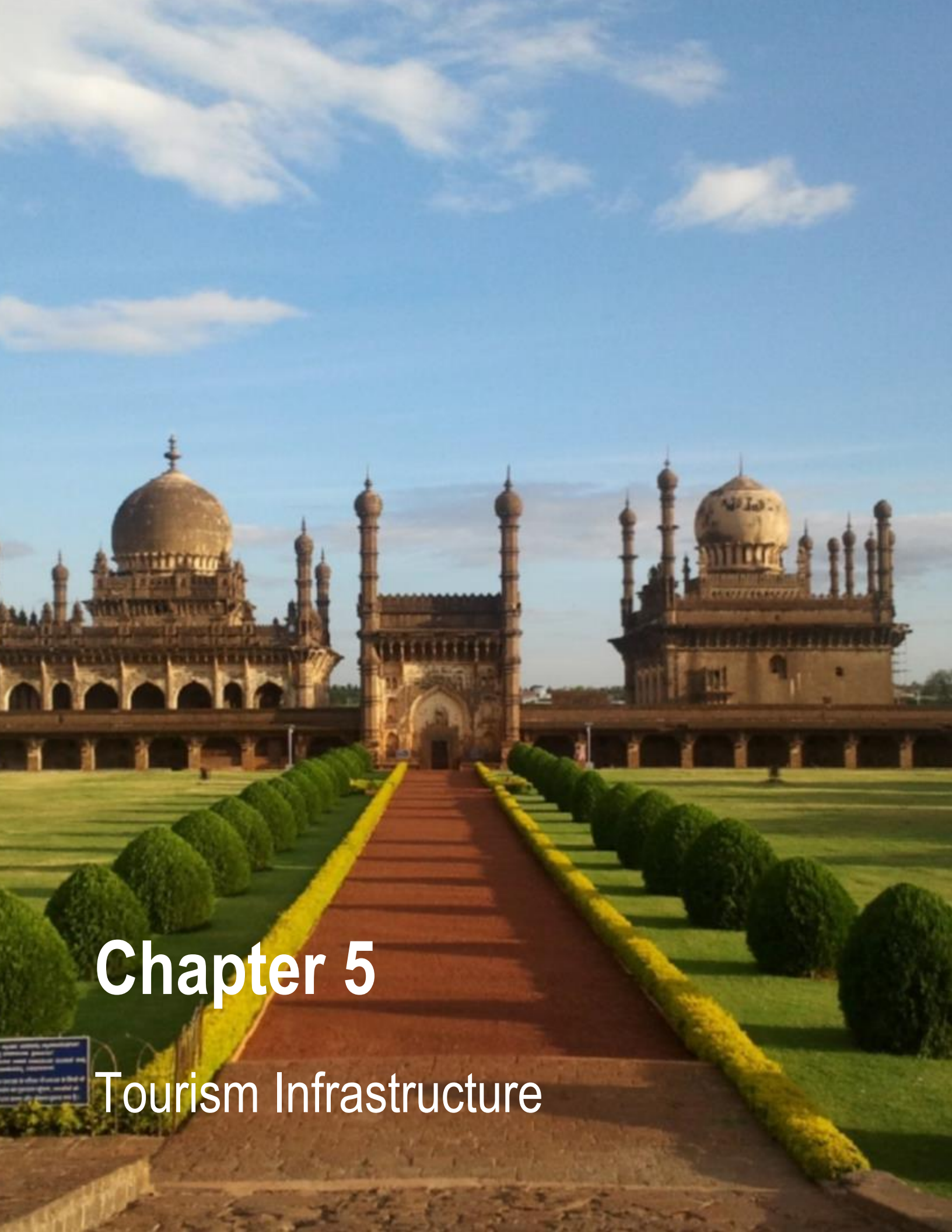
4.7. CONCLUSION

Over the years, it can been seen that road accessibility in the State has increased and almost the entire State is today accessible by road. The focus now is on augmenting the road capacity to keep pace with the increased vehicular growth. Highways development in the State has been taken up under programmatic approach by institutions such as KRDCL, KSHIP and PWD. KSHIP now has taken up development of east-west and north-south corridors that connect the length and breadth of the State. Large stretches of roads have been taken up under PPP models for development in the State. Although the sector has witnessed manifold development, there is possibility for much more so as to ensure equitable development across the State.

ANNEXURE 4A: INSTITUTIONAL FRAMEWORK

In Karnataka, PWP& IWTD is the principal Government department administrating development and maintenance of NHs, SHs and MDRs. At the secretariat the PWP&IWTD is headed by Principal Secretary and a Secretary. Department controls the entire development through three zones namely C&B South Zone, C&B North Zone and National Highways headed by respective Chief Engineers. Each zone is further divided into Circles and Divisions. Superintendent Engineers head the Circles and Executive Engineer are responsible for Divisions.





Chapter 5

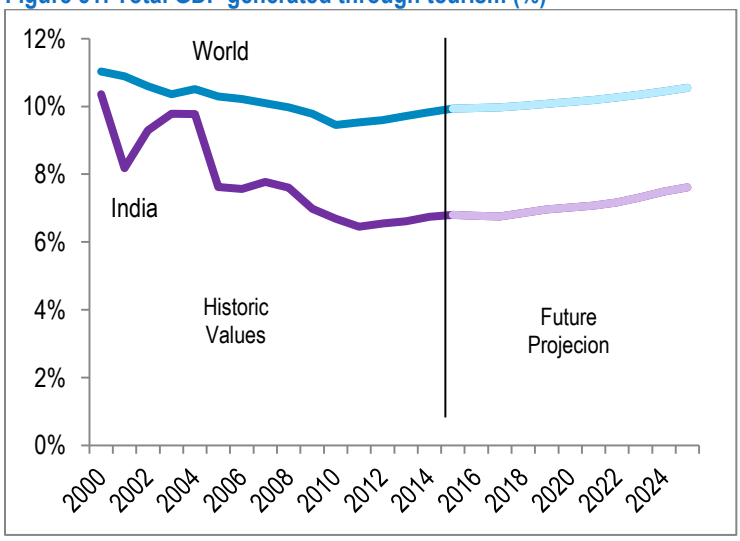
Tourism Infrastructure

5.1. TOURISM IN INDIA

Tourism plays a positive role in the social, cultural and economic development of countries. The key driving force of the sector is the human need to explore new places, gain new experiences and find varied outlets for entertainment. There are significant economic benefits that tourism can bring as it increases consumption expenditure and generates jobs at a local level creating a multiplier effect on the economy. The sector holds strategic importance in the Indian economy providing several socio-economic benefits. Income and employment generation, foreign exchange earnings, development or expansion of other industries such as agriculture, construction, handicrafts etc. are some of the important economic benefits provided by the tourism sector. In addition, investments in facilities such as transportation, accommodation and other tourism related services lead to an overall development of infrastructure in the economy.

The rise of travel and tourism has shown significant resilience globally. Despite slow economic growth in advanced economies and geopolitical tensions in some regions, the tourism sector still accounts for a large part of the global economy and employment, as the number of international travellers continues to increase. According to the World Travel and Tourism Council (WTTC) 2015, the tourism sector contributed 9.8% of the GDP of the world economy (US$ 7,580.9 bn) and accounted for 9.8% of the global employment in 2014. In absolute terms the industry accounted for 277 million direct and indirect jobs worldwide. The figure below depicts the GDP potential of the tourism industry.

Figure 51: Total GDP generated through tourism (%)



Source: UNWTO Tourism Highlights, 2015

Travel and tourism is the largest service industry in India. This industry provides heritage, cultural, medical, business and sports tourism. The creation of niche tourism products like heli-tourism, medical tourism, wellness tourism, adventure tourism, cruise tourism, and caravan tourism has served to widen the scope of this sector.

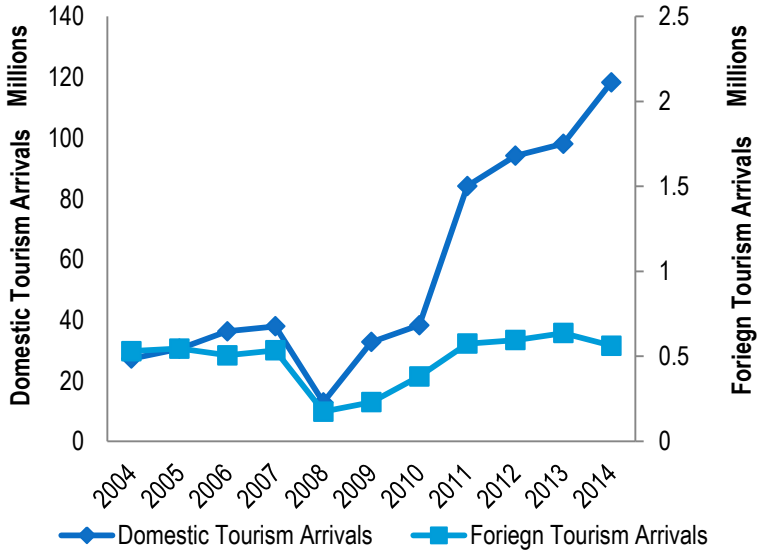
The total contribution of travel and tourism to the national GDP was Rs. 7,642.5 billion (6.7% of GDP) in 2014, and is forecast to, to rise by 7.3% pa to Rs. 16,587.2 billion (7.6% of GDP) in 2025. Further, the total contribution of travel and tourism to employment, including jobs indirectly supported by the industry, was 8.7% of total employment (36,695,500 jobs) in 2014. This is expected to rise by 2.0% pa to 45,566,000 jobs in 2025 (9.0% of total).

5.2. TOURISM IN KARNATAKA

Karnataka is home to several forts, architectural marvels and is blessed with a rich cultural heritage. The State also offers a variety of tourism products that cater to the demand from different visitor segments, such as, eco-tourism, wellness tourism and adventure tourism. The UNESCO World Heritage Sites at Hampi, Pattadakal and the Western Ghats, Gol Gumbaz with its whispering gallery at Vijayapura, a coastline of 320 km with beach resorts at Karwar, Ullal, Malpe and Maravanthe, the world-famous Brindavan Gardens at Krishnarajasagara, the monolithic statue of Gommateshwara at Sharavanabelagola, the wild life sanctuaries at Bandipur, Nagarhole and Dandeli, the Ranganathittu Bird Sanctuary near Srirangapatna, hill stations like Nandi Hills, Kemmannagundi and Mercara, the Jog falls and other waterfalls at Shivanasamudram, Magod, Satoddi, Unchelli (Lushington) and Lalguli and many other exotic places indicate the variety and richness of the attractions that Karnataka holds out to its visitors.

In 2014, Karnataka ranked third in terms of domestic tourist arrivals and ranks ninth in terms of foreign tourist arrivals in the country.[30].Around 1180 lakh domestic tourists and 5.6 lakh foreigners visited the State in 2014.[31] The domestic and foreign tourist arrivals in Karnataka are set out in the figure given below.

Figure 52: Domestic & Foreign Tourist Arrivals in Karnataka (in millions)



Source: India Tourism Statistics 2013, Ministry of Tourism, GoI

As depicted in the figure Karnataka has seen significant growth in domestic tourist arrivals in the last 5 years. There is a significant scope for developing tourism in the State. The Karnataka Tourism Policy 2015 -2020 aims at developing the State to be in the top two tourism destinations in India and top fifty in the world.

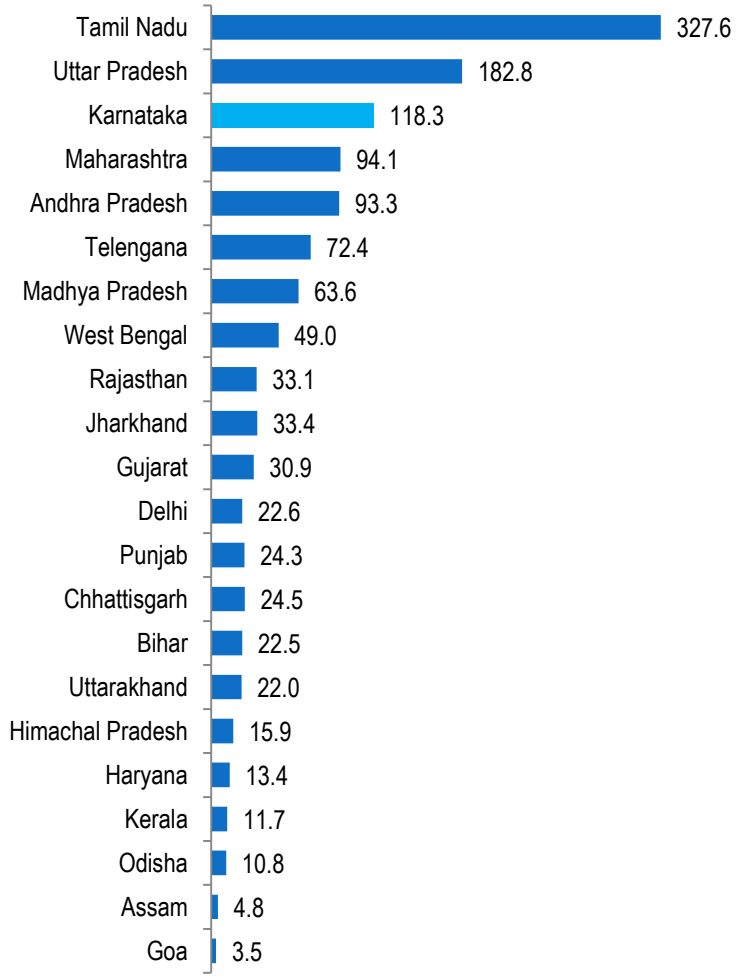
Presently in Karnataka, tourism development and promotion is carried out by Department of Tourism, Government of Karnataka, along with other Government undertakings like Karnataka State Tourism Development Corporation (KSTDC), Jungle Lodges and Resorts Ltd. (JLR) and Karnataka Exhibition Authority (KEA). Additionally, there are District Tourism Promotion Councils for each of the districts headed by the Deputy Commissioner of the respective districts. Department of Tourism (DoT) acts as the main catalyst for tourism development in the State. Further, each of these institutions is supported by the administrative and technical staff employed for carrying out routine activities.

[30] India Tourism Statistics 2013, Ministry of Tourism, GoI
[31] Department of Tourism, GoK

5.3. COMPARATIVE ANALYSIS

The tourism in the State has been compared to that of other States in India on the basis of tourist arrivals – both domestic and foreign for the year 2014.

Figure 53: Comparative analysis of Domestic Tourists Arrivals (in millions)

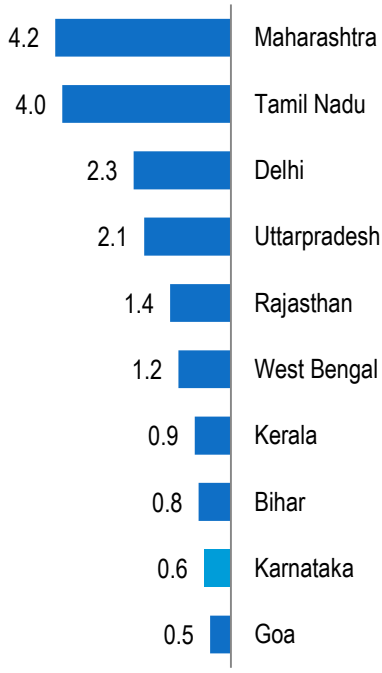


Source: indiastat.com

The bar chart above indicates that Karnataka is third in India among all States in terms of domestic tourist arrivals. Other states are not included in the figure as the domestic tourist arrivals in these States are negligible. Karnataka is a prominent destination for tourism in India and contributes significantly to the sector in the country.

In terms of foreign tourist arrivals Karnataka ranks ninth as indicated in the figure below:

Figure 54: Top 10 States in terms of Foreign Tourist Arrivals (2014)

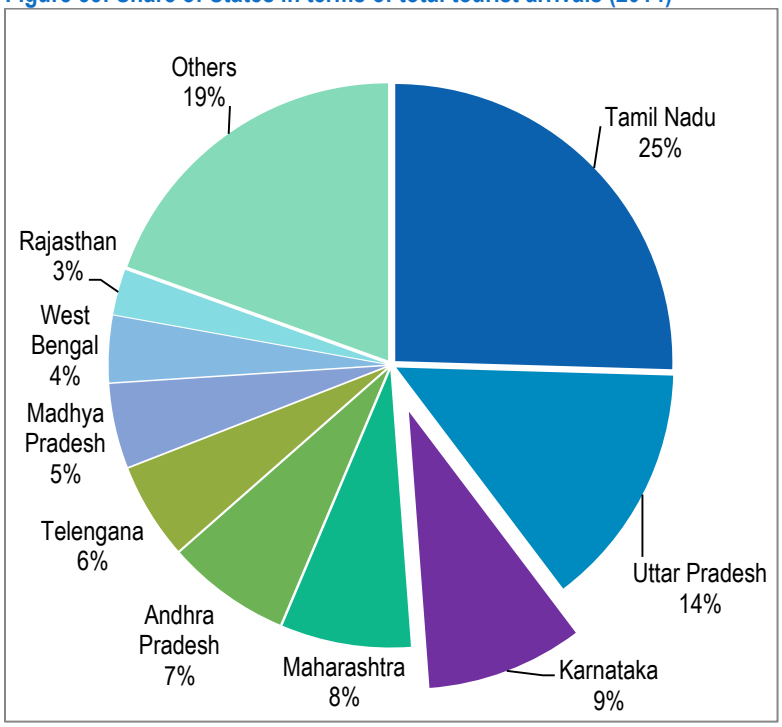


Source: indiastat.com

Thus, although Karnataka is able to attract domestic tourists it is not able to attract foreign tourist as much as in Tamil Nadu, Maharashtra, Rajasthan, Gujarat, Kerala, West Bengal and Bihar. This indicates that an improved branding strategy could possibly enable Karnataka to bring in more foreign tourists and foreign exchange.

As seen in the figure below, 9% of all tourist arrivals are attributed to Karnataka while Tamil Nadu and Uttar Pradesh contribute to 25% and 14% respectively.

Figure 55: Share of States in terms of total tourist arrivals (2014)



Source:Indiastat.com

Presently, Karnataka is also among the top States to attract investments in tourism. Karnataka ranked third, attracted around 14% of total investment in the sector.[32] Thus Karnataka is in a favorable position for developing tourism and can benefit significantly through the tourism sector.

[32] Associated Chambers of Commerce and Industry of India (Assocham), 2012

5.4. CURRENT STATUS

Investments in roads, ports, airports and urban amenities have a cascading effect creating a positive cycle of stimulating demand, production, employment, consumption surplus and more demand. However, the impact is the quickest and most far-reaching when investments are made in tourism.

The sector is well developed in the State however, it is vital to maintain and enhance tourism with a sustained strategy for further expansion and improving competitiveness given its potential to strengthen other economic sectors in rural and urban regions. The Department of Tourism, GoK has identified 298 tourism destinations across Karnataka to promote tourism.

The key components for tourism development are as follows:

- Improvement of basic infrastructure
- Development of offerings/ products of tourist interest
- Improvement of soft tourist touch point competencies

This report will largely deal with the development and improvement of hard infrastructure and tourism products/offerings such as facilities, utilities, transportation networks, etc. It is also important to realize that there is also a need to build soft tourist touch point competencies as well, such as promotion, content creation, information centres, website(s)/ mobile apps, destination narratives, human resources development (training guides, etc.) to support the tourism sector. The impact of soft tourist touch point has not been included in this report.

Soft Tourist Touch point Competencies

There is a necessity to focus on soft tourism touch point competencies along with hard infrastructure, which include content creation, information centres, website(s)/ mobile apps, destination narratives, human resources development (training guides, etc.) to support the tourism sector. Various media could be used for enhancing the tourist experience at various tourism destinations, such as signage, information panels, audio guides, and other audio-visual equipment. The most essential aspect in such media is the content creation, whereby a destination literature (narrative) is created to showcase a complete picture of the destination to the tourist. Similarly, tourist guides are also an essential aspect of all tourist destinations; it is important that they are suitably trained and well versed in major languages. Soft tourism competencies also include designing and maintaining a website and/or mobile application on various platforms, so as to provide tourists access to information related to tourism in the State. Such information could also be available in the form of brochures, etc. from various information centres, established not only in the State but across the country.

In order to analyse the current status of basic infrastructure, an assessment was carried out at each of the 298 destination based on the following parameters.

Table 39: Parameters for assessing Basic Tourism Infrastructure

1. Availability of Utilities	Drinking Water • Availability • Operational or not
	Restrooms • Availability • Operational or not
	Power • Availability of Connection • Number of hours of power • Backup Power
2. Connectivity and Parking	Availability of Parking
	Connectivity • Nearest NH/ SH • Distance from NH/ SH (km)
3. Safety	Signage
	Security Personnel

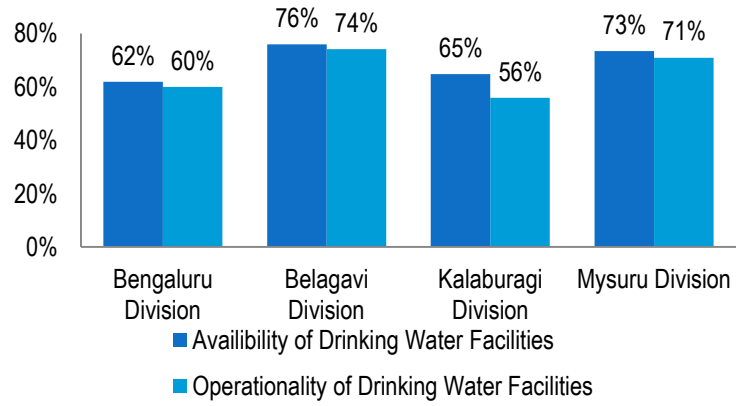
Source: iDeCK Research

5.4.1. AVAILABILITY OF UTILITIES

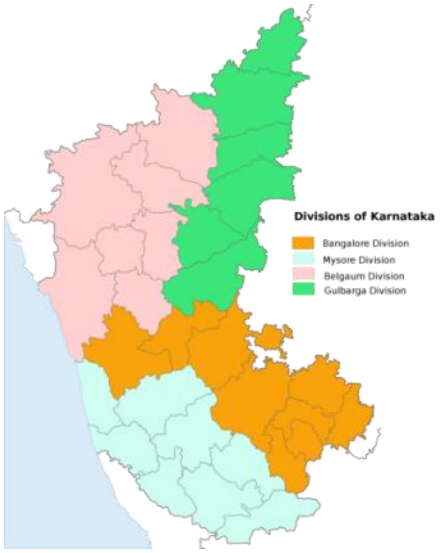
It is essential for all the tourist destinations to include utilities such as drinking water facilities, restrooms/ toilets, power availability, waste management and so on. In this section, the availability of utilities across tourist destinations in the State has been assessed.

The status of availability of drinking water facilities across the tourist destinations in the administrative divisions of the State is set out below.

Figure 56: Availability of Drinking Water Facilities (2015)



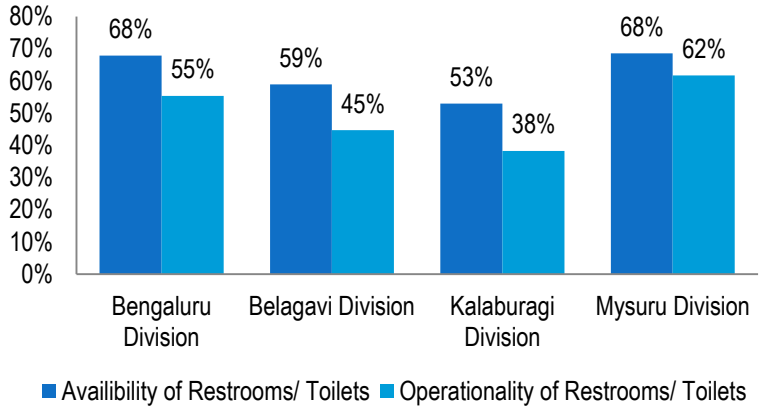
Source: iDeCK Analysis



The tourist destinations located in the Mysuru and Belagavi divisions fared better than those located in other parts of the State with respect to the availability of drinking water facilities. In all divisions there is at least 2% gap between availability of drinking facilities and operational facilities indicating that several facilities that are available are not maintained properly and have become unusable.

With respect to availability of restrooms/ toilets; the figure given below sets out the status of infrastructure in the administrative divisions;

Figure 57: Availability of Restrooms/ Toilets

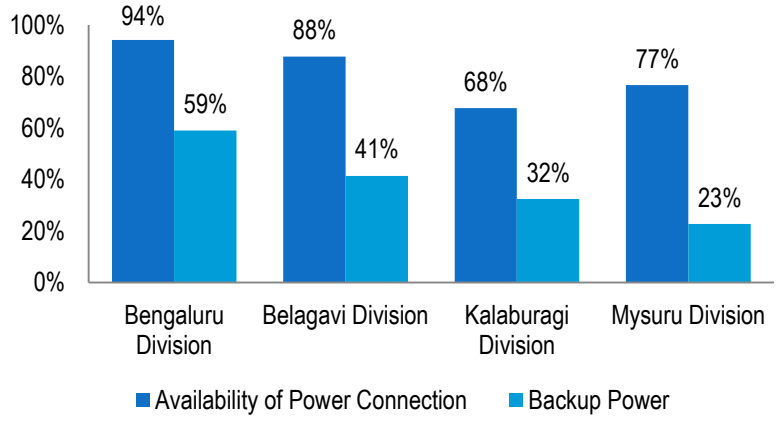


Source: iDeCK Analysis

As seen above, the tourist destinations located in Bengaluru and Mysuru divisions have the highest availability of restroom facilities. The tourist destinations located in Kalaburagi division lack this infrastructure when compared to those located in other divisions.

With respect to availability of power at tourist destinations, the findings are set out in the figure given below.

Figure 58: Availability of Power Connection



Source: iDeCK Analysis

On an average, power is available at all tourist destinations for 19 hours per day. About 94% of tourist destinations located in the Bengaluru division have power connections, while tourist destinations located in Kalaburagi division fare poorly on this front. However, with respect to availability of backup/ stand by power supply; it is not available at majority of the destinations.

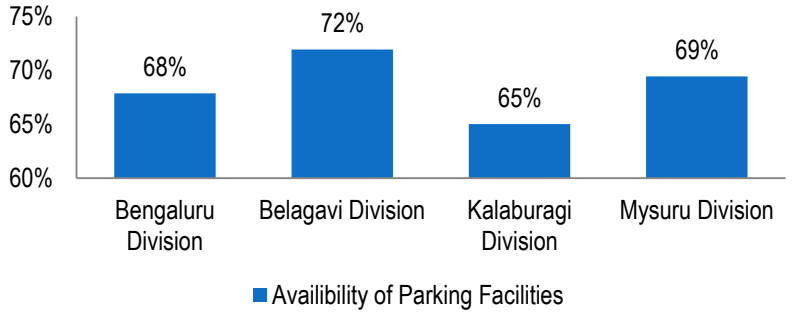
Thus in terms of utilities it is evident than Bengaluru Division and Mysuru Division are far ahead while Kalaburagi Division is lagging in all parameters and interventions are needed in destinations located in Kalaburagi Divisions on an urgent basis.

5.4.2. CONNECTIVITY & AVAILABILITY OF PARKING FACILITIES

End mile connectivity to tourist destinations largely impacts the number of tourist footfalls to the destination and its chances of being popular. The tourist destinations when assessed for connectivity to the nearest National of State Highway; were found to be located at an average distance of 4-6 km from the nearest National Highways/ State Highways.

Provision for parking facilities in and around tourist destination is a necessity so as to ensure smooth movement and prevent congestion of vehicles in the area. The following chart shows the percentage of tourist destinations in various administrative divisions of Karnataka having the facilities for parking. Of the tourist destinations located across the State, those located in the Belagavi division have better parking facilities.

Figure 59: Availability of Parking Facilities

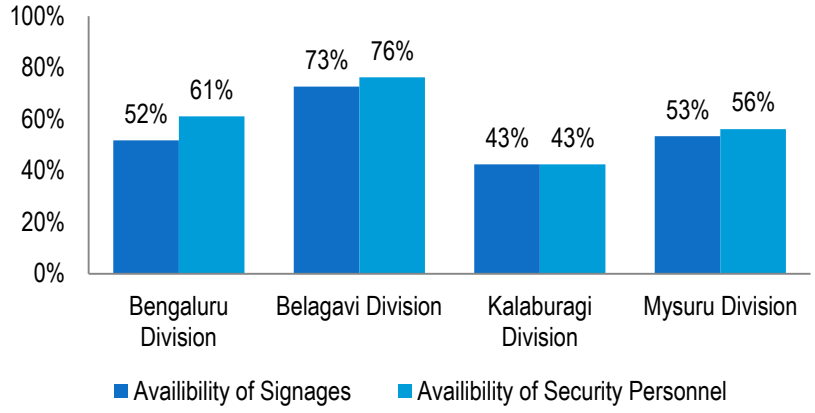


Source: iDeCK Analysis

5.4.3. SAFETY & SECURITY ASPECTS AT TOURIST DESTINATIONS

It has been observed that safety and security at any tourist destinations or in any foreign country is a key element considered by tourists before visiting any destination. It is the onus of the Government to ensure safety and security of tourists visiting any destination. Safety and security at tourist destination has been assessed on the basis of two parameters; viz. availability of signage and presence of security personnel at destinations. The figure given below sets out the availability of signage and security personnel at tourist destinations located in the four administrative divisions.

Figure 60: Availability of Signage & Security Personnel



Source: iDeCK Analysis

As seen above, there are many destinations where there is no signage or security personnel present. The same needs to be addressed.

5.4.4. DEVELOPMENT OF PRODUCTS AND OFFERINGS

In addition to basic infrastructure of tourist attractions; standalone projects, accommodation, etc. need to be developed to attract tourists. The Karnataka Tourism Policy 2015-2020 has set out the tourism products that are intended to be developed in the policy period. The following products that have been defined in the Policy are reproduced in the table below;

Table 40: Products / Offering as laid out in the Karnataka Tourism Policy

Project	Definition
Hotels & Resorts	**'Hotel'** is an establishment providing accommodation, meals, and other services for travellers and tourists, in tourist destinations of the State. **'Resort'** shall include a hotel and is a place used for relaxation, recreation, attracting visitors for vacations and/or tourism. The Hotels and Resorts shall provide accommodation facilities for tourists with at least 20 rentable rooms with attached bathrooms.
Caravan Parks	'**Caravan Park**' is a facility developed for parking of Caravans in allotted spaces and includes other amenities. The caravan park would need to be developed in an area of at least two acres and include at least five parking bays.
Museums & Galleries	'**Museum'** is an institution that cares for or conserves a collection of artifacts and other objects of scientific, artistic, cultural, or historical importance and makes them available for tourists viewing through exhibits. '**Galleries'** includes roofed premises in which paintings, sculptures and other art forms are exhibited for purposes of information dissemination/ sale and is accessible by the tourists..
Eco-Tourism Project	**Eco-Tourism** is broadly defined as tourism which is ecologically sustainable. The concept of ecological sustainability subsumes the environmental carrying capacity of a given area. Eco-tourism projects shall be governed by the following principles: The local community should be involved leading to the overall economic development of the area; The likely conflicts between resource use for eco-tourism and the livelihood of local inhabitants should be identified and attempts made to minimize the same; The type and scale of eco-tourism development should be compatible with the environment and socio-cultural characteristics of the local community, and; It should be planned as a part of the overall area development strategy, guided by an integrated land-use plan avoiding inter-sectoral conflicts and ensuring sectoral integration, associated with commensurate expansion of public services; The guidelines for eco-tourism are applicable to any protected areas, national parks, wildlife sanctuaries, community reserves; conservation reserves, sacred groves, or pilgrimage spots located within protected and/or forested areas.
Rural Tourism Project	**'Rural Tourism Project'** shall mean and include all of the following; (a) tourism that showcases the rural life, art, culture, craft, cuisine and heritage of rural locations in the State; (b) benefit the local community economically and socially; (c) enables interaction between the tourists and the locals for a more enriching tourism experience and (d) is essentially an activity which takes place in the countryside. The Project shall provide self-employment opportunities and shall have a training centre to impart training on local art and craft. The Project shall also have an information centre and a sales outlet providing the necessary backward and forward linkages.
Agri-Tourism	**'Agri-Tourism'** shall encourage active involvement in the activities of the farm or its operations. Agri-Tourism must include setting up within a working farm or any agricultural, horticultural, or agribusiness operations for the purpose of tourists/ travellers visiting for leisure, education and must include: (a) any one of the following components - horticulture orchard/garden/vineyard; fish pond; sericulture unit; apiculture unit; dairy farm; goat/piggery unit; (b) any two or more of the following activities / components - farm camping, hands on farming, picking fruits/ vegetables, feeding animals, interactions with farmers on farming – process from sowing to reaping, etc.
Cruise Tourism	'**Cruise Tourism'** is defined as leisure travel between tourist destinations along the coastline or major rivers in Karnataka on a ship/ cruise liner and also involves development of a cruise terminal;
Adventure Tourism	**'Adventure Tourism'** involves infrastructure and activities that provide the tourists with an opportunity to explore adventure and includes activities such as the following;

Project	Definition
	(a) Land based – mountaineering and trekking (b) Water based – river running, kayaking, river rafting, scuba diving, snorkelling, water skiing, jet skiing, boat based fishing, surfing, sail boarding and wind surfing (c) Air based – paragliding, parasailing and bungee jumping
Entertainment Park	**'Entertainment Park'** is an outdoor recreation park and shall mean either of the following - a theme park, an amusement park, a water park. An entertainment park offers relaxation and/ or recreation to visitors and includes amusement rides, games, entertainment options.
Wayside Amenity	**'Wayside Amenity'** is defined as a facility comprising resting areas, toilets, cafeteria, mini store/ pharmacy and an information / souvenir booth; located on National, State and District Highways; for the benefit of travellers/ tourists.
Yatri Niwas	**'Yatri Niwas'** is defined as a budget accommodation facility targeting families or group of individuals; located on National, State and District Highways; within a distance of at least 10 km from an existing tourist destination and includes at least (a) ten rentable rooms with attached toilets, (b) two dormitories with toilets(one each for men and women), each dormitory with at least ten beds; and (c) a cafeteria.
Dormitories / Youth Hostel (Yuva Vasatigraha)	**'Youth Hostel'** is defined as a facility which provides budget/ inexpensive overnight lodging, particularly for budget tourists who are unable to afford expensive hotels.
Wellness/ Holistic Health Centre	**'Wellness/ Holistic Health Centre'** is defined as a facility that provides specialised therapy to tourists through alternate system of medicine such as AYUSH (Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homoeopathy) through professionally qualified personnel.
Tourist Interpretation Centre	**'Tourist Interpretation Centre'** is a facility for dissemination of knowledge of natural or cultural heritage to tourists; it provides a visitor an interpretation of the place of interest through a variety of media, such as video displays and exhibitions of material.
Tourist Information Kiosk	**'Tourist Information Kiosk'** is a kiosk located at a public place or at transit points such as bus station, railway station, airport, sea port, etc.; providing basic information to tourists; including but not limited to the following; (a) Tourist maps of destinations (b) Nearest basic amenity such as hotel, restaurant, bus stop, railway station, etc. (c) Tourist destinations in the State (d) Emergency contact numbers - police, fire, hospital, etc. (e) Modes of transport and means to reach destinations
Tourist Information Centre	**'Tourist Information Centre'** is a facility located at a public place or at transit points such as bus station, railway station, airport, sea port, etc.; which in addition to providing basic information to tourists, also enables hassle free travel/ tour/ stay for tourists. It would provide services including but not limited to the following; (a) Plan and customize tour/ travel/ stay in the city/ State based on tourist requirements (b) Book accommodation in hotels/ home stays/ etc. (c) Book travel through taxi/ bus/ train/ flight/ ferry, etc.
Vocational Training Institutes (Training& HRD Infrastructure)	Institutions established for providing training and skill development courses for tour guides, tour operators and in areas such as culinary skills, hotel management, tourism facility management

Source: Karnataka Tourism Policy, 2015-2020

Apart from the above products, homestays have also been identified as an important tourism product. The above products focus on holistic development of tourism, including connectivity and information infrastructure. Soft activities such as skill development, film induced tourism is also covered under the Karnataka Tourism Policy 2015 -20. The Policy targets on positioning Karnataka as the most preferred tourist destination in the country through branding, marketing and promotional aspects, focusing on increased tourist visitations, duration of stay and time spend in the State.

5.4.5. INITIATIVES IN THE SECTOR

The Government of Karnataka has taken a number of initiatives to promote and accelerate the tourism sector in Karnataka. Some of the initiatives are unique and have been tried for the first time in the Country. In order to facilitate the development of tourism products and standalone projects Government has developed an enabling framework for streamlining and fastracking projects in the sector. The various initiatives in the sector in this regard are as follows.

1. **Karnataka Tourism Vision Group:** Government of Karnataka had set up a Tourism Vision group in October 2013 consisting of eminent citizens and domain specialists to advise the Government on the way ahead for the Tourism sector. The intent was to provide a road map for making Karnataka a tourist experience destination on par with International Standards. The recommendations of the group were detailed out in a report. The report lays emphasis on the development of various aspects of tourism in the State with an estimated investment of Rs. 73,000 crores (with 50% contribution by the private sector) by 2024. This is expected to generate additional employment of 43 lakh with revenues to the exchequer to the extent of Rs. 85,000 crores. Projects were identified by the group which would enhance the tourism appeal of the State. The list of projects identified by KTVG, in its phase I and the tentative list of projects identified for development in phase II will form part of the shelf of projects in the sector.

2. **Adopt a Destination Programme:** GoK has also introduced "Adopt a Destination" programme under which the Corporates are invited to adopt and maintain a tourist destination of their choice for a minimum period of 5 years as a part of their CSR activities.

3. **Karnataka Tourism Infrastructure Limited:** The KTVG Report also recommended setting of Karnataka Tourism Infrastructure Limited (KTIL), to be the nodal agency for development and implementation of tourism infrastructure in the State. KTIL has been set up and aims at developing flagship, state-of-the-art tourism projects in the State. KTIL is setup to predominantly carry out pre development activities such as promote tourism and invest in development of tourism infrastructure, identify land, create land banks for tourism infrastructure and identify innovative concepts for promoting tourism in Karnataka.

4. **Rating of Tourism Products:** Rating of tourism facilities/ products is a novel concept in the whole country, which would help develop effective and impactful tourism initiatives in Karnataka. Government of Karnataka has identified about 18 tourism products as part of the Karnataka Tourism Policy 2015-20, which can avail incentives and concessions from the Government. These tourism products, if rated through a certified Rating Agency would have undergone rigorous assessment to ensure that they deliver a quality experience to tourists.

   The following Rating Agencies have been empanelled with the Government for rating tourism products across the State;
   - Brickwork Ratings India Private Limited
   - India Ratings and Research Private Limited
   - SMERA Ratings Limited
   - Credit Analysis and Research Limited

5. **Karnataka Tourism Trade Regulation and Facilitation Act:** Though Karnataka has many advantages in terms of diverse tourism attractions, factors like poor administration and management, lack of marketing, unhygienic

environment, lack of tourism facilities and infrastructure etc. overshadow its advantages. To overcome such shortcomings which are retracting growth of State tourism, the Government felt that a comprehensive legislation was needed which would not only facilitate and regulate tourism activities in the State but would also accelerate the growth of tourism trade and industry. The Government has introduced Karnataka Tourism Trade (Facilitation & Regulation) Act 2014 with an objective to promote State tourism and facilitate its growth. The Act focuses on streamlining registration process of tourism facilities & tour guides and provides mechanism for approval and disbursement of subsidies on tourism products. There are penal provisions to ensure safety and security of tourists.

6. **Tourism Dashboard:** In order to have a common management information system (MIS) of tourism related information of the entire State, the Department of Tourism is in the process of developing an online 'Dashboard'. The dashboard will be an online software that will be designed on the basis of information that is gathered at a district level by the tourism consultants who have be placed in each district. The dashboard will enable DoT officials to cull out tourism related data/information and analyse data in order to improve efficiency in delivery of services at destinations. The dashboard will also allow DoT to keep track of facilities, infrastructure and projects across all destinations.

The regulatory framework for Tourism is as shown below in the table:

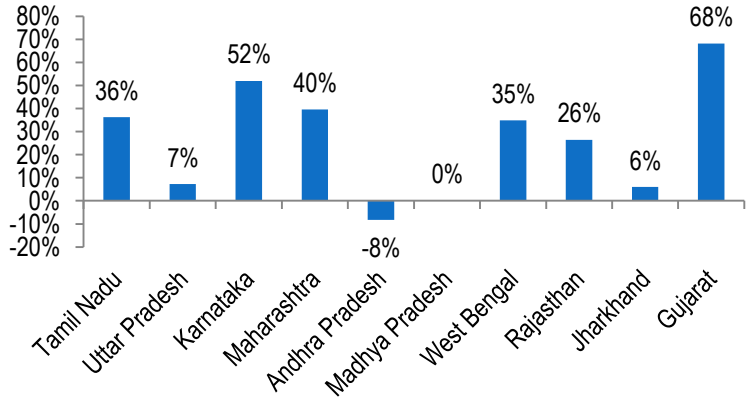
Table 41: Regulatory framework for Tourism

Sl.no	Regulatory Framework	Details
1.	Associated offices - Central	• Ministry of Tourism
2.	Karnataka Tourism Policy 2015-20	Mainly focuses on the following features: • Position Karnataka as a preferred destination • Institutional/ Governance Structures • Improve Tourism Products and Services • Human Resources Development & Capacity Enhancement • Streamlining Procedures • Incentives and Concessions
3.	Karnataka Tourism Trade (Facilitation and Regulation) Act 2014	Objective is to promote State tourism and facilitate its growth.
4.	Associted offices - State	• Department of Tourism • Karnataka State Tourism Development Corporation • Jungle Lodges and Resorts • Karnataka Exhibition Authority

5.5. GAP ANALYSIS

Karnataka has total tourist arrivals of around 119 million domestic and foreign tourists in 2014. In terms of domestic tourist arrivals, only Tamil Nadu and Uttar Pradesh attract higher footfalls that Karnataka viz. 332 million and 186 million respectively. The figure below indicates CAGR of total tourist arrivals over the last five year period (2009-14) for some of the most preferred States for tourism;

Figure 61: CAGR of total tourist arrival over last five years (2009-2014)



Source: iDeCK Analysis based on indiastat data

As seen in the figure above, tourist arrivals in Karnataka has increased by 52%. Most other States have registered an increase of around 30% to 40%. Only Gujarat has seen a higher growth in tourist arrivals than Karnataka. One of the key targets of the Karnataka Tourism Policy 2015-20 is to make the State one of the top two tourism destinations in India. Given that the State is already well positioned (ranked 3rd) and tourist arrivals have been growing phenomenally in the last five years vis-à-vis other States, Karnataka is definitely poised to achieve this target within the next 5 years. It is anticipated that the State is going to see significantly higher levels of domestic and international tourism and in order to address tourist needs it is imperative that both the quality and quantum of tourism infrastructure be improved. The gap analysis for tourism infrastructure is carried to determine the gaps in the existing tourism infrastructure in terms of:

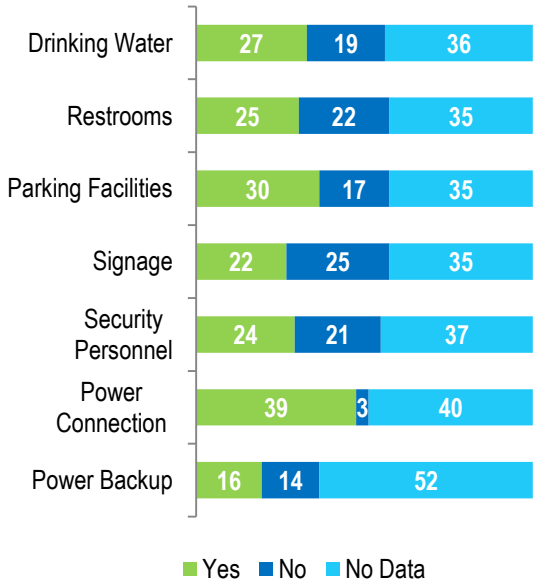
a. basic Infrastructure
b. infrastructure pertaining to offerings/ products of tourist interest

5.5.1. BASIC INFRASTRUCTURE AVAILABLE AT DESTINATIONS

Basic Infrastructure at destinations needs to be developed in order to improve the tourist experience. Basic infrastructure in the State has been assessed in the previous section. At a divisional level, it is observed that Kalaburagi division is faring poorly compared to all other divisions and destinations in this division require immediate interventions for tourists to avail even basic facilities such as toilets and drinking water. The figures below indicate the gaps in core infrastructure facilities in each of the divisions. The destinations have been assessed in terms of availability of the following:

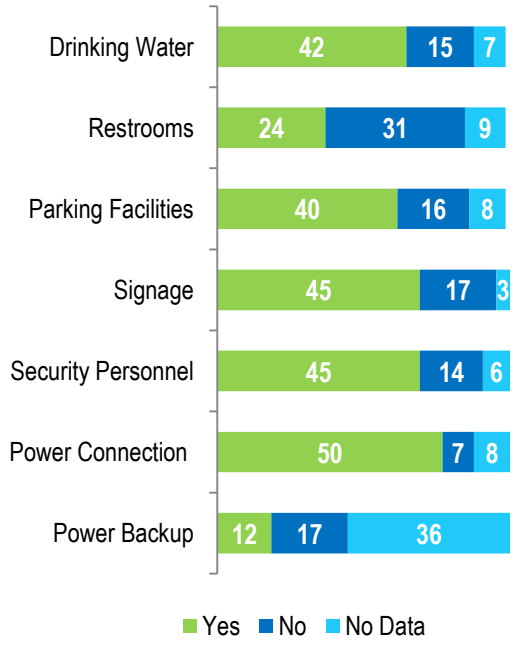
- Drinking Water
- Restrooms
- Parking Facilities
- Signage
- Security Personnel
- Power Connection
- Power Backup

Figure 62: Availability of Basic Infrastructure in Bengaluru Division (No. of destinations out of 80)



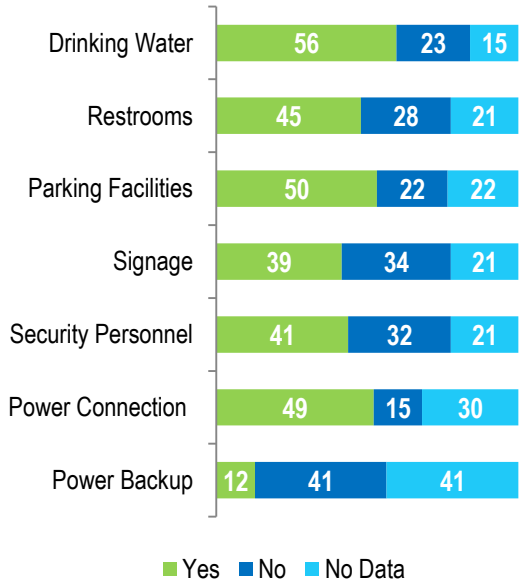
Source: iDeCK data

Figure 63: Availability of Basic Infrastructure in Belagavi Division (No. of destinations out of 65)



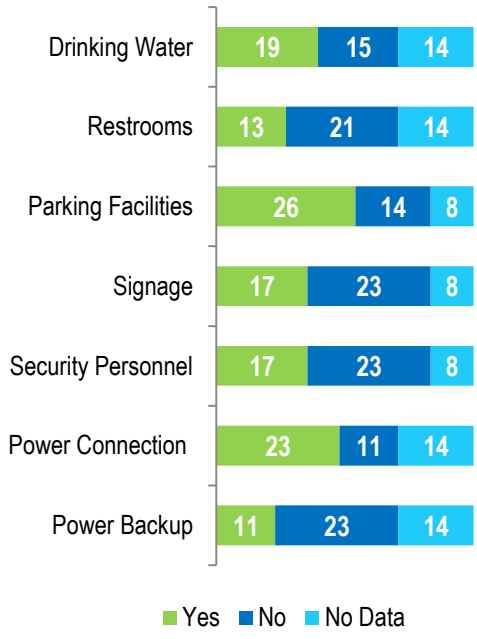
Source: iDeCK data

Figure 64: Availability of Basic Infrastructure in Mysuru Division (No. of destinations out of 94)



Source: iDeCK data

Figure 65: Availability of Basic Infrastructure in Kalaburagi Division (No. of destinations out of 48)



Source: iDeCK data

As depicted in the figures above, it is evident that most destinations are lacking in at least one core facility. Also in the destination if there is no data on a certain facility it is typically because there is no facility available that was located/ found by the surveyor. There are only 24 destinations predominately located in Udupi and Uttara Kannada districts where all seven core facilities are available. However, even in these locations the quality of the infrastructure is not up to standards therefore it is recommended that all 298 destinations in the State be provided basic infrastructure facilities based on the expected tourist footfall. Four infrastructure packages have been developed in order to cover the infrastructure needs of all destinations depending on their footfalls. The figure below provides details on the four packages that have been formulated. For further details regarding standards used for developing the packages and cost break up refer to ***Annexure 5A***.

Figure 66: Details of Packages for Basic Infrastructure

Low Footfall Destinations (72)

- Drinking water fountains: 2
- Toilets: WC (Female): 5, WC (Male): 4, Urinal: 6
- One time power connection cost
- Power Backup: Not Required
- Parking: 5 car parking lots
- Cubicle for Security Personnel: 1
- Signage to be placed: 10
- 1 Information Kiosk
- 1 food kiosk

Total Cost = Rs.0.13 crores

Medium Footfall Destinations (152)

- Drinking water fountains: 14
- Toilets: WC (Female): 5, WC (Male): 4, Urinal: 6
- One time power connection cost
- Power Backup: Required
- Number of Generators: 1
- Parking: 50 car parking lots
- Cubicle for Security Personnel: 1
- Signage to be placed: 15
- 1 Information Centre
- 1 Information Kiosk
- 1 restaurant with seating

Total Cost = Rs. 0.73 crores

High Footfall Destinations (59)

- Drinking water fountains: 42
- Toilets: WC (Female): 6, WC (Male): 5, Urinal: 8
- One time power connection cost
- Power Backup: Required
- Number of Generators: 3
- Parking: 150 car parking lots
- Cubicle for Security Personnel: 2
- Signage's to be placed: 20
- 1 Interpretation Centre
- 2 Information Kiosks
- 1 restaurant with indoor and outdoor seating

Total Cost = Rs. 2.03 crores

Very High Footfall Destinations (15)

- Drinking water fountains: 70
- Toilets: WC (Female): 7, WC (Male): 7, Urinal: 10
- One time power connection cost
- Power Backup: Required
- Number of Generators: 5
- Parking: 232 car parking lots
- Cubicle for Security Personnel: 2
- Signage's to be placed: 20
- 1 Interpretation Centre
- 3 Information Kiosks
- 2 restaurants with indoor and outdoor seating

Total Cost = Rs. 3.13 crores

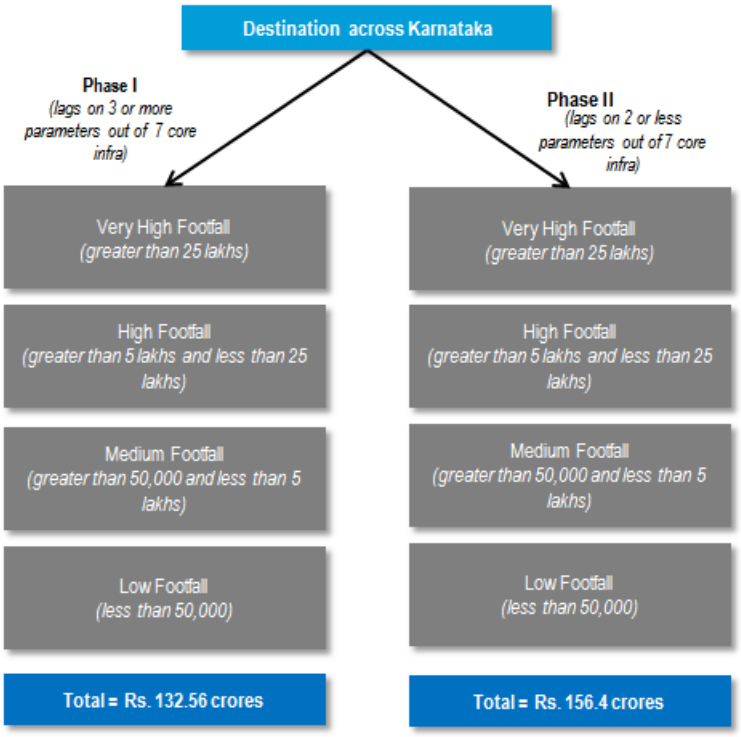
All the 298 destinations across Karnataka have been categorized based on their footfalls into

- Very High (exceeding 25 lakhs),
- High (greater than 5 lakhs and less than 25 lakhs),
- Medium (greater than 50 thousand lakhs and less than 5 lakhs) and
- Low (less than 50,000).
- Additionally, it is anticipated that investment for basic infrastructure can be carried out in 2 phases for better financial viability.

Phase I - will address destination that are severely lacking basic infrastructure across 3 or more core infrastructure parameters out of the 7 that have been assessed.
Phase II - will address destinations where at least 5 out of the 7 basic facilities are available.

The figure below depicts the phased approach to basic infrastructure development.

Figure 67: Structuring of Basic Infrastructure Development via a phased approach.



The investment required to develop all the destinations is estimated below.

Table 42: Phased investment required for Basic Infrastructure Development (in Rs. crores)

PHASE I	
Very High	
Number of Destinations	2
Cost	6.27
High	
Number of Destinations	18
Cost	36.67
Medium	
No of Destinations	110
Cost	80.86
Low	
No of Destinations	63
Cost	8.75
Total Phase I	**132.55**
PHASE II	
Very High	
Number of Destinations	13
Total Cost	40.74
High	
Number of Destinations	41
Total Cost	83.56
Medium	
No of Destinations	42
Total Cost	30.87
Low	
No of Destinations	9
Total Cost	125
Total Phase II	**156.42**
Rs. 288.97 crores	

Source: iDeCK Assessment

Thus, it is anticipated that to bridge the gap in basic tourism infrastructure around Rs. 289 crores would be required across the State of Karnataka.

5.5.2. DEVELOPMENT OF OFFERINGS/ PRODUCTS OF TOURIST INTEREST

The Karnataka Tourism Vision Group has identified the following projects for developing tourism in Karnataka.

Table 43: Investment through KTVG Projects (in Rs. Crore)

Proposed projects	Investment
Development of Old Mangaluru town – roads, art gallery, master plan	5.00
Srirangapatna town – roads, parking, lighting, signage, etc.	2.00
Kittur fort area improvement	2.00
Bengaluru Open Streets	1.00
Toilets in 50 tourist locations	5.00
Karwar region projects	4.98
Maulangi Falls Development	3.02
Coastal master plan	3.00
Feasibility reports – Circuits in Kaveri region, Vijayapura, Bidar and Kalaburagi – Deccan Sultanate routes; Interventions in Hampi, Patdadkal, Badami / Aihole	4.00
Developing a detailed Tourism brand and promotion strategy using an external consultant	1.50
Developing a web portal and mobile strategy for tourism information & promotion using an external consultant	2.00
Technical development and roll out of the web / mobile app based on the overall suggested approach including SEO using a technical agency	3.00
Destination Development - Chitradurga Fort	4.00
Crocodile Park, Dandeli	4.00
Old Bengaluru heritage trail / zone including Nandi heritage precinct (Swarna Vallaya Project)	5.00
Green Buses operated by KSTDC from Chamundi and Nandi Hills – viability gap	2.00
3D in Gol Gumbaz	5.00
Bannerghata National Park interpretation centre	2.00
Elephant camp Dubare	5.00
Promotional Literature for destinations	1.50
Total	65.00

The tourism Master plans have been prepared which provides a detailed list of projects and offerings required at each district. The following table summarizes the investment required at each district.

Table 44: Investments required as addressed in the Tourism Master Plan

Proposed projects / Scheme	Estimated project cost / Investment (in crores)
Bengaluru Rural	50.50
Chamraja Nagar	36.50
Chikballapur	99.75
Kolar	40.00
Mandya	13.18
Mysuru	41.62
Ramanagaram	20.96
Tumakuru	2.71
Chikmagulur	119.25
Chitradurga	63.00
Dakshina Kannada	148.50
Davangere	44.00
Hassan	23.00
Total	**1674.54**

Given that requirements for the State in terms of products and offerings has already been detailed out by the Karnataka Tourism Vision Group's recommendations and the Tourism Master Plan, the aim for the Government in the coming years should be to bridge the gaps that have already been identified.

5.6. SHELF OF PROJECTS

On the basis of the above gap analysis, it is clear that there is a need for improved basic infrastructure at tourism destinations as well as there is a need to invest in products / offerings that will attract tourists. The table below provides projects in the sector as against investments. The estimated investment in developing tourism infrastructure is to the tune of Rs.1674.54 crores.

Table 45: Project Shelf for Tourism Infrastructure

S. No	Railway Line	Investment (in Rs. crores)
1.	Basic Infrastructure Phase I	132.56
2.	Basic Infrastructure Phase II	156.44
3.	Projects as part of KTVG	65.00
4.	Projects as part of Tourism Master Plan	1385.54
	Total	**1674.54**

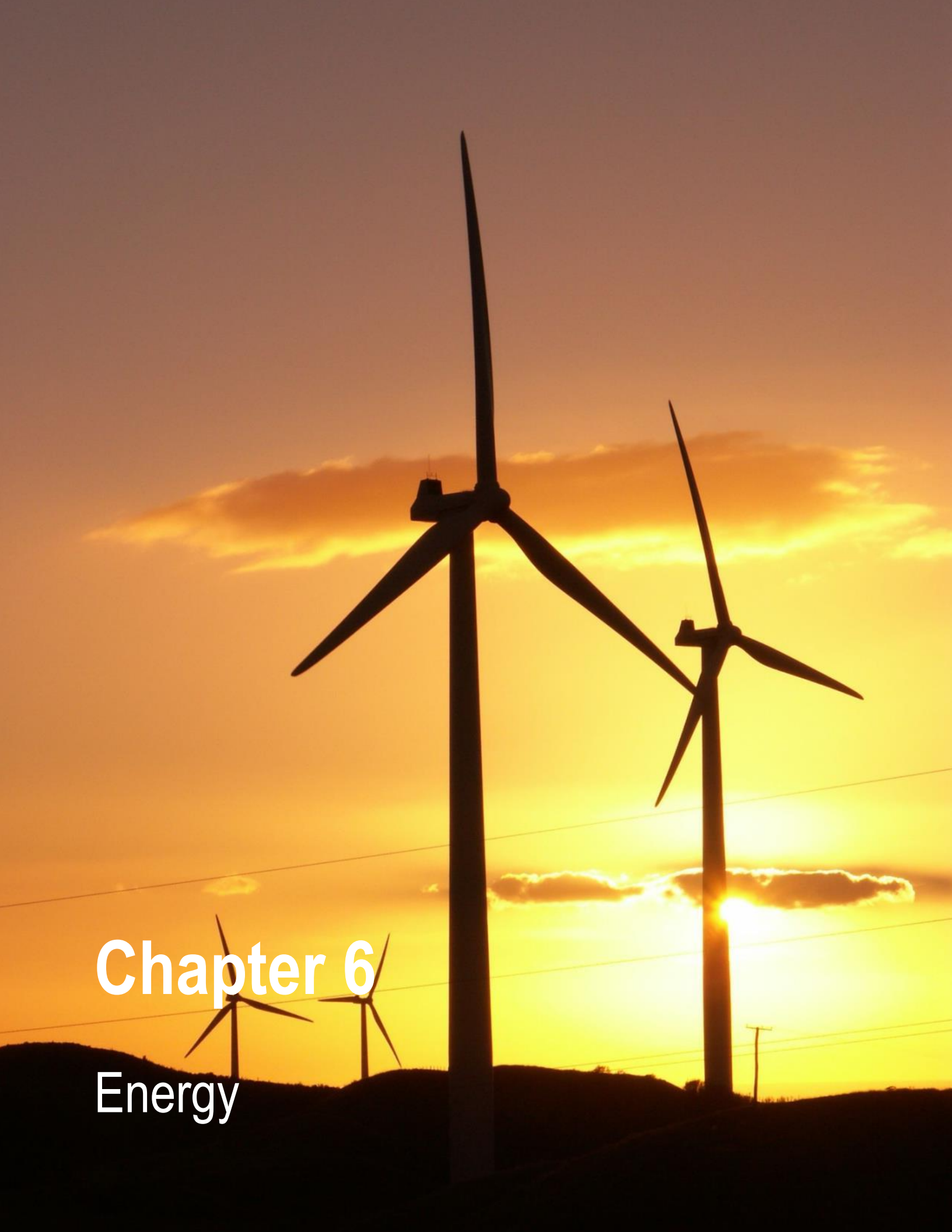
5.7. CONCLUSION

Tourism is a key sector that has the ability to bring in economic benefits at a local level. Tourism development can augment incomes at a community level and backward communities can significantly benefit by participating in tourism. Additionally, tourism is one of the key contributors for bring in foreign exchange to the country. Given Karnataka's immense potential due to varied landscape and unique heritage and culture there is significant scope for Karnataka to grow its tourist base to reap economic benefits. The State is already well positioned among other States in the country in its ability to bring tourist footfall. Investments in developing tourism infrastructure and upgrading the existing infrastructure will enable the State to attract more tourists. Infrastructure development in this sector will go a long way in improving tourist experience and place Karnataka among the top fifty tourist destinations in the world.

ANNEXURE 5A: ESTIMATION OF COST FOR BASIC INFRASTRUCTURE PACKAGES

	Facilities					Norms (UDPFI & NBC & KTP)	Costing				Assumptions		
Sl. No.	Facilities	Low (0 - 50000/ annum) =140/day	Medium (50001 - 500000 / annum) =1390/day	High (500001 - 2500000/ annum) =4170/day	Very High (>2500000/ annum) =6950/day		Low (0 - 50000/ annum) =140/day	Medium (50001 - 500000 / annum) =1390/day	High (500001 - 2500000/ annum) =4170/day	Very High (>2500000/ annum) =6950/day			Unit
1	**Availability of Drinking Water (Outdoor Drinking Water Fountain)**	2	14	42	70	1 Outdoor Drinkinkg Water Fountain for every 100 people (Bureau of Indian Standards)	100000	700000	2100000	3500000	Outdoor Drinking Water Fountain Cost=	50000	Rs.
2	**Availability of Restroom**	WC (Female): 5 WC (Male): 4 Urinal: 6	WC (Female): 5 WC (Male): 4 Urinal: 6	WC (Female): 6 WC (Male): 5 Urinal: 8	WC (Female): 7 WC (Male): 7 Urinal: 10 Provision for future expansion	4 WCs for first 1000 females and 1 for every subsequent 1000 persons or part thereof 5 for first 1000 males and 1 for every subsequent 2 000 persons or part thereof 6 Urinals for first 1000 persons and 1 for every subsequent 1000 persons or part thereto					Area Considered per WC =	15	Sft.
	Area Req (Sft)	225	225	285	360		405000	405000	513000	648000	Construction Cost considered=	1800	Rs./ Sft.
3	**Availability of Power**	Yes	Yes	Yes	Yes	One time connection cost	10000	10000	15000	15000			
4	**Availability of Power Backup**	0	1	3	5		0	200000	600000	1000000	Generator Cost =	200000	Rs.
5	**Parking Facility (4 Wheeler)**	5	50	150	232	2.0 ECS per 100 sqm of builtup area (Delhi that has about 115 cars per 1000 people allows 3 ECS/100 sqm in commercial areas. But Tokyo that has nearly 400 cars per 1000 persons allows 0.5 ECS/100 sqm in CBD – much less than Delhi. Cities do not increase parking indefinitely) Considering 1 car park/30 visitors							
		5	50	150	232	Considering the peak day traffic					Area Requirement for 1 car=	150	Sft.
	Area Req (Sft)	750	7500	22500	34800		450000	4500000	13500000	20880000	Construction Cost=	600	Rs./Sft.
	Parking Facility (Bus)	1	3	9	14	Considering 1 Bus parking per 500 persons					Area Requirement for 1 car=	540	Sft.
	Area Req (Sft)	540	1620	4860	7560		324000	972000	2916000	4536000	Construction Cost=	600	Rs./Sft.
6	**Availability of Signage**	Yes	Yes	Yes	Yes	Considering 10 Signages for Low, 15 for Medium, 20 for High and Very High	30000	45000	60000	60000	Cost of Signage=	3000	Rs./ Signage

		Facilities				Norms (UDPFI & NBC & KTP)	Costing				Assumptions		
Sl. No.	Facilities	Low (0 - 50000/ annum) =140/day	Medium (50001 - 500000 / annum) =1390/day	High (500001 - 2500000/ annum) =4170/day	Very High (>2500000/ annum) =6950/day		Low (0 - 50000/ annum) =140/day	Medium (50001 - 500000 / annum) =1390/day	High (500001 - 2500000/ annum) =4170/day	Very High (>2500000/ annum) =6950/day			Unit
7	**Availability of Security (Security Cubicle)**	1	1	2	2								
	Area Req (Sft)	40	40	80	80	Considering a minimum area of 4 Sqm.= 40 Sft./ security cubicle	40000	40000	80000	80000	Construction Cost=	1000	Rs./Sft.
8	**Availability of Interpretation Centre along with Guides**	0	0	1	1	Considering an area of Sqm.= 300 Sft./ Tourist Interpretation Centre (KTP 2015 - 2020)	0	0	540000	540000	Construction Cost=	1800	Rs./Sft.
9	**Availability of Information Kiosk along with Guides**	1	1	2	3	Considering an area of Sqm.= 16 Sft./ Tourist Information Kiosk (KTP 2015 - 2020)	28800	28800	57600	86400	Construction Cost=	1800	Rs./Sft.
10	**Availability of Information Centre along with Guides**	0	1	0	0	Considering an area of Sqm.= 250 Sft./ Tourist Information Centre (KTP 2015 - 2020)	0	450000	0	0	Construction Cost=	1800	Rs./Sft.
11	**Availability of Food Joint**	1	1	1	2	Considering a kiosk for the low bracket, Restaurant with seating for medium, Restaurant with outdoor sitting for the high bracket and 2 restaurants with ourdoor sitting for very high segment							
	Area Req (Sft)	40	1000	2000	5000		80000	2000000	4000000	10000000	Construction Cost=	2000	Rs./Sft.
						Total (Rs.)	1387800	7350800	20381600	31345400			



Chapter 6

Energy

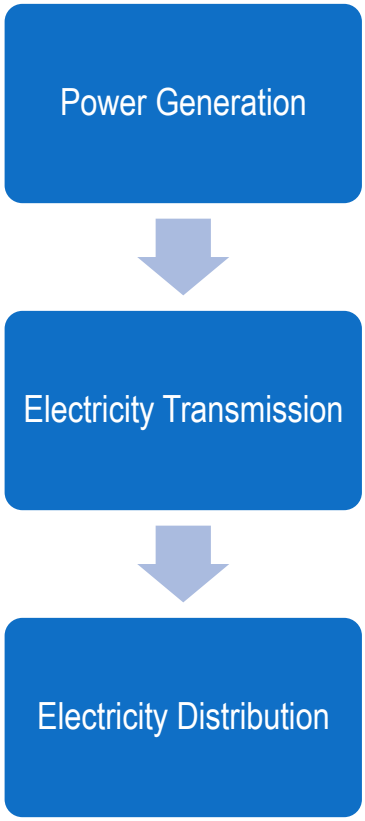
6.1. ENERGY INFRASTRUCTURE IN INDIA

Energy is a strategic commodity and any uncertainty or fluctuation about its supply can threaten the functioning of the country. Attaining energy security in this strategic sense is one of the fundamental goals not only to India's economic growth but also for the human development objectives that aim at alleviation of poverty, fighting unemployment and meeting the Millennium Development Goals (MDGs). Holistic planning along with quality data and statistics is need to address the issues related to energy demand, energy poverty and environmental effects of energy growth.

The Indian economy has experienced unprecedented economic growth over the last decade. With the growth, the country has become power hungry. India with a production of 1,006 terawatt hours (TWh), is the fifth largest producer and consumer of electricity in the world. In India, sources for power generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to other non-conventional sources such as wind, solar, and agriculture and domestic waste. The key components of power sector include non-renewable energy and renewable energy- wind energy and solar power. The 12th Five Year Plan expects total domestic energy production to reach 669.6 million tonnes of oil equivalent (MTOE) by 2016–17 and 844 MTOE by 2021–22. By 2030 – 35, energy demand in India is projected to be the highest among all countries according to the 2014 Energy Outlook report by British oil giant, British Petroleum.

The energy sector in India has evolved rapidly after the reforms introduced through Electricity Act 2003. The Electricity Act, 2003 introduced much needed reforms in the power sector such as unbundling of State Electricity Board's into separate generation, transmission and distribution entities, and removal of license for setting up generation unit by any individual or corporate along with other reforms in distribution and transmission sector respectively.

Figure 68: Existing value chain of energy sector in India



India had a total installed capacity of 284.3 GW at the end of December, 2015. India ranks third in countries with the highest installed power generating capacity. The details of installed capacity sector wise are given below.

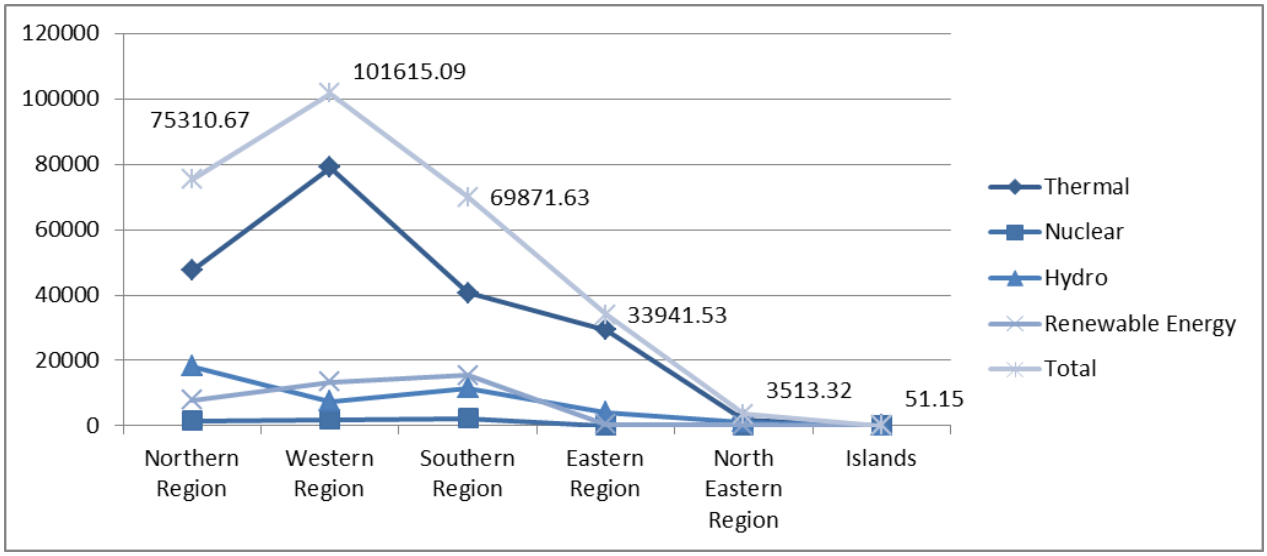
Table 46: All India installed capacity in MW (Sector wise) as on 31st Dec 2014

Sectors	Thermal	Nuclear	Hydro	Renewable Energy	Total
Central	56899.73	5780.00	11491.42	0.0	74171.15
State	67964.37	0.0	28012.00	1948.23	97924.60
Private	73620.34	0.0	3120.00	35467.30	112207.64
All India	198484.44	5780.00	42623.42	37415.53	284303.39

Source: CEA

The region wise detail of installed capacity of India is depicted by the graph below.

Figure 69: All India installed capacity in MW (region wise) as on 31st December 2015



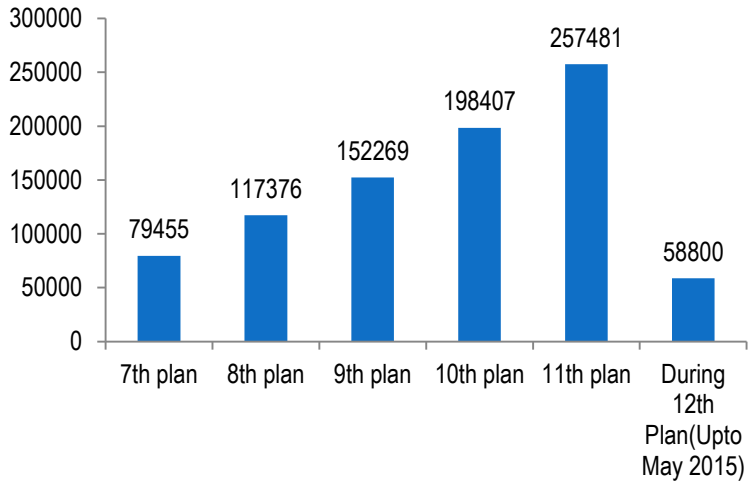
Source: http://www.cea.nic.in/reports/monthly/executivesummary/2015/exe_summary-12.pdf

Amongst the southern region, Karnataka lags behind only Tamil Nadu with an installed capacity of 15325.04 MW as on 31st December 2015. Overall, Karnataka is ranked 6th with respect to installed capacity. According to data from CEA, only Tamil Nadu, Uttar Pradesh, Maharashtra, Gujarat and Rajasthan lie ahead of Karnataka.

Distribution and retail supply is the most critical link in the electricity market, which interfaces with the end customers and provides revenue for the entire value chain. Indian electricity distribution caters to nearly 200 million consumers with a connected load of about 400 GW that places the country among the largest electricity consumer base in the world. With respect to distribution sector, Government of India provides assistance to States through centrally sponsored schemes such as Integrated Power Development Scheme (IPDS), Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Ujwal DISCOM Assurance Yojana (UDAY), National Electricity Fund (NEF) and Financial Restructuring Scheme (FRS).

With over 2, 80,000 circuit kilometers (or CKm), India's transmission network is one of the largest and most complicated in the world. The majority of the inter-state and inter-regional transmission is carried out by the Power Grid Corporation of India. The progress of transmission sector can be gauged by the increase in the length of transmission lines, depicted in the figure below.

Figure 70: Length of transmission lines in India (in CKm)



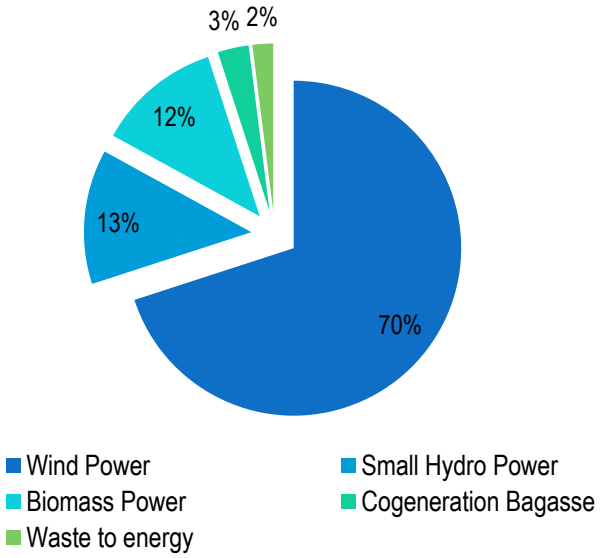
Source: http://powermin.nic.in/growth-transmission-sector

With increase in transmission and distribution losses and discrepancies in power purchases affecting the power sector, India is in dire need to match the increasing power demand across the country.

6.2. RENEWABLE ENERGY SECTOR

There is high potential for generation of renewable energy from various sources- wind, solar, biomass, small hydro and cogeneration bagasse. According to data from "Energy Statistics-2015" by Ministry of Statistics and Programme Implementation, total potential for renewable power generation in the country as on 31st March 2014 is estimated at 147615 MW. This includes wind power potential of 1, 02,772 MW (69.6%), SHP (small-hydro power) potential of 1,97,49 MW (13.38%), Biomass power potential of 1.7,538 MW (11.88%) and 5000 MW (3.39%) from bagasse-based cogeneration in sugar mills. The distribution is given in the figure below.

Figure 71: Source wise Estimated Potential of Renewable Power in India as on 31st March 2014



Source: Ministry of Statistics and Programme Implementation

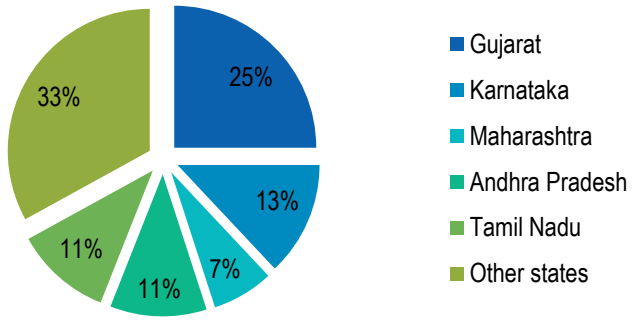
The geographic distribution of the estimated potential of renewable power as on 31st March 2014 reveals that Gujarat has the highest share of about 25.04% (36,956 MW), followed by Karnataka with 13.08% share (19,315 MW) and Tamil Nadu with 11.17% share (16,483 MW), mainly on account of wind power potential. The geographic distribution is given below.

MNRE Classification

MNRE classifies renewable energy as

- Grid interactive renewable power- This includes wind power, solar power, small hydro power, biomass power & gasification, bagasse cogeneration and waste to power
- Off grid/captive power- This includes waste to energy, biomass (non-bagasse) cogeneration, biomass gasifiers, aero-generators/Hybrid systems, spv systems, water mills/micro hydel, bio-gas based energy system.
- Other sources such as family biogas plants, solar water heating

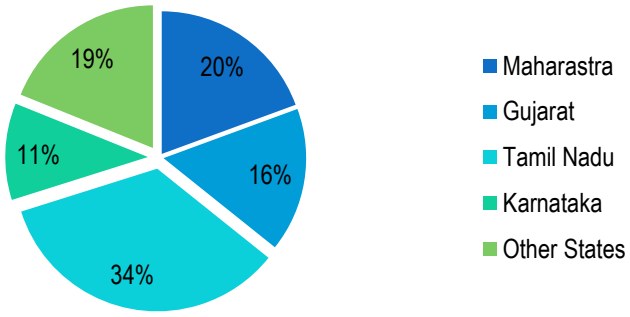
Figure 72: State wise Estimated Potential of Renewable Power in India as on 31st March 2014



Source: Ministry of Statistics and Programme Implementation

The total installed capacity of grid interactive renewable power, which was 28,067.26 MW as on 31st March 2013 had gone up to 31,692.18 MW as on 31st March 2014 indicating growth of 12.92% during the period. Out of the total installed generation capacity of renewable power as on 31st March 2014, wind power accounted for about 66.69%, followed by biomass power (12.66%) and small hydro power (12%). Tamil Nadu had the highest installed capacity of grid connected renewable power (8,070.26 MW) followed by Maharashtra (5,630.20 MW) and Gujarat (4,430.20 MW), mainly on account of wind power. The figure below gives state wise installed capacity of wind power in India.

Figure 73: State wise installed capacity of wind power in India as on 31st March 2014



Source: MNRE

With regards to biogas power, out of total number of biogas plants installed (47.52 lakh), maximum number of plants installed were in Maharashtra (8.56 lakh) followed by Andhra Pradesh, Karnataka, Uttar Pradesh and Gujarat each with more than 4 lakh biogas plants as on 31st March 2014.

6.2.1. SOLAR ENERGY

As of April 2015, India has slightly more than 3,000 MW in installed capacity for MW-scale, grid connected solar power plants. The Union Cabinet chaired by the Prime Minister has given its approval for stepping up of India's solar power capacity target under the Jawaharlal Nehru National Solar Mission (JNNSM) by five times, reaching 1,00,000 MW by 2022. The target will principally comprise of 40 GW rooftop and 60 GW through large and medium scale grid connected solar power projects. The total investment in setting up 100 GW will be around Rs. 6,00,000 crores. In the first phase, the Government of India is providing Rs.15,050 crore as capital subsidy to promote solar capacity addition in India [33].

[33] Press Information Bureau, GoI

India's total installed solar capacity stands at a little over 3 GW, including off-grid and rooftop solar plants. Gujarat and Rajasthan together accounted for over 50% of the total installed solar installed capacity, and along with Madhya Pradesh, Andhra Pradesh, Maharashtra and Tamil Nadu accounted for almost 90% of total. Thus, six States accounted for over 90% of total solar installations in India as of end 2014. The status of MW scale solar plants for different States and under the various policies, are given below.

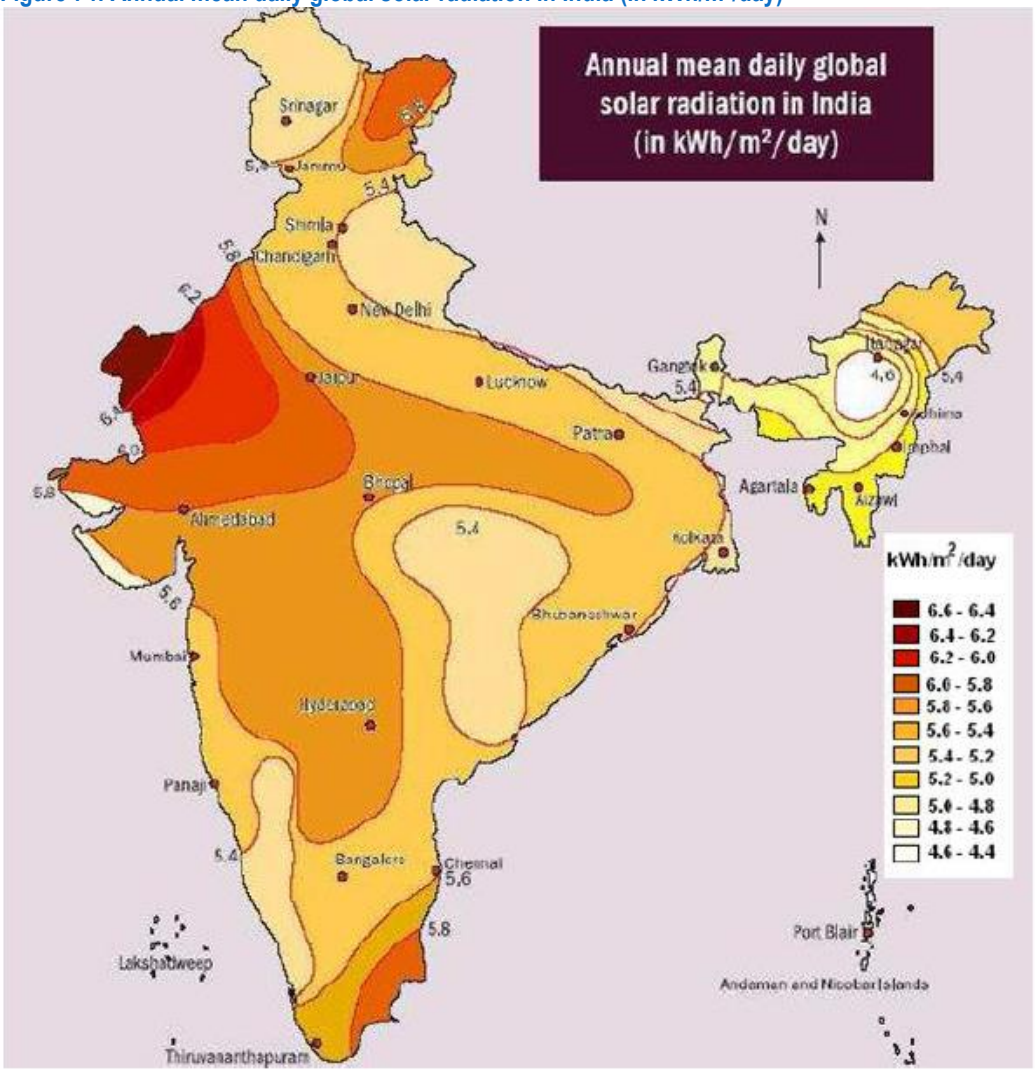
Table 47: State-Wise Status of MW Scale Solar Power Plants as of May 29, 2015 (MW)

State/UT	Total MNRE Projects	Under State Policy	REC Scheme	Total
Andhra Pradesh	94.75	115.01	37.7	247.46
Arunachal Pradesh	0.0025			0.0025
Chhattisgarh	4.00	1.68	4.6	10.28
Gujarat	20	974.05	6.00	1000.05
Haryana	7.80	5.0		12.8
Jharkhand	16.00			16
Karnataka	**5.00**	**73.22**		**78.22**
Kerala	0.0025			0.0025
Madhya Pradesh	185.25	297.55	80.78	563.58
Maharashtra	57.00	185.38	121.32	363.7
Odisha	12.00	15.42	4.50	31.92
Punjab	10.5	177.25	7.52	195.27
Rajasthan	789.1	65	193	1047.1
Tamil Nadu	16.00	33.82	98.16	147.98
Telangana		39.35	23.4	62.75
Uttar Pradesh	12.00	59.26		71.26
Uttarakhand	5.00			5
West Bengal	2.05	5.16		7.21
Andaman &Nicobar	0.10	5		5.1
Delhi	0.34	4.237	2.14	6.712
Lakshadweep	0.75			0.75
Puducherry	0.03			0.03
Chandigarh	4.5			4.5
Others	0.79			0.79
	1243	2056.387	584.12	3883.507

Source: MNRE

The map below gives solar radiation in India.

Figure 74: Annual mean daily global solar radiation in India (in kWh/m²/day)



Source: http://www.engrreview.com/Articles/higher-output-of-solar-installations-with-tracking-systems/734475/110250/45150

Other than radiation and associated environmental factors such as temperature, another key infrastructural element is critical in deciding whether a location is practically attractive – and that is the grid evacuation infrastructure. The grid infrastructure in many parts of India is not robust enough. As a result, while a location might have excellent radiation and other environmental characteristics, there might be no grid evacuation facilities in that location, and under these circumstances, the power generated by the solar power plant cannot be evacuated and supplied to the utility.

6.3. ENERGY INFRASTRUCTURE IN KARNATAKA

The energy demand in the State grew at a CAGR of around 8 % during 2006-2014, while the supply grew by only 6 %. Energy requirement of the State at the end of Tenth Five Year plan was 40,797 Million Units (MU) and it has increased to 62,643 MU in FY 2014-15. The State was able to progressively reduce the difference between energy requirement and availability by 10% in the last three financial years 2013-15 from 14% to 4% amounting to about 2694 MU. Peak demand which was 6,253 MW at the end of Tenth Five Year Plan (by 2007) increased to 9,940 MW in FY 2013-14. However, the State was able to meet only 9,223 MW during FY 2013-14 resulting in peak deficit of 717 MW[34] . In addition, there has been an increased dependence on short term power purchase by the distribution utilities (~19 % of total annual power purchase during FY 2012-13), the cost of which is 30 to 35 % higher than average power purchase cost. The State also depends pre-dominantly on conventional energy sources with a huge dependence on coal-based generation for meeting its current as well as rapidly growing energy and peak demand. Issues related to limited fossil fuel resources, coal linkages and environmental restrictions are hindering the capacity addition as well as increasing the dependence on imported coal.

The details about energy sector in Karnataka are set out in the table below.

Table 48: Energy sector at a glance (as on 30th April 2015)

Energy sector at a glance	
Installed Capacity	
KPC Hydro and Thermal (MW)	6615.00
CGS(Karnataka Share) (MW)	2169.00
NCE,IPPs and Others(MW)	6268.00
Total Installed Capacity (MW)	15052.00
Number of Consumers (Crs)	2.09
Length of Transmission Lines (length in Circuit Kms)	41927.494
Number of stations	1399
Number of DTCs	552834
HT Lines (length in Circuit KMs)	271836.299
LT Lines (length in Circuit KMs)	505661.027

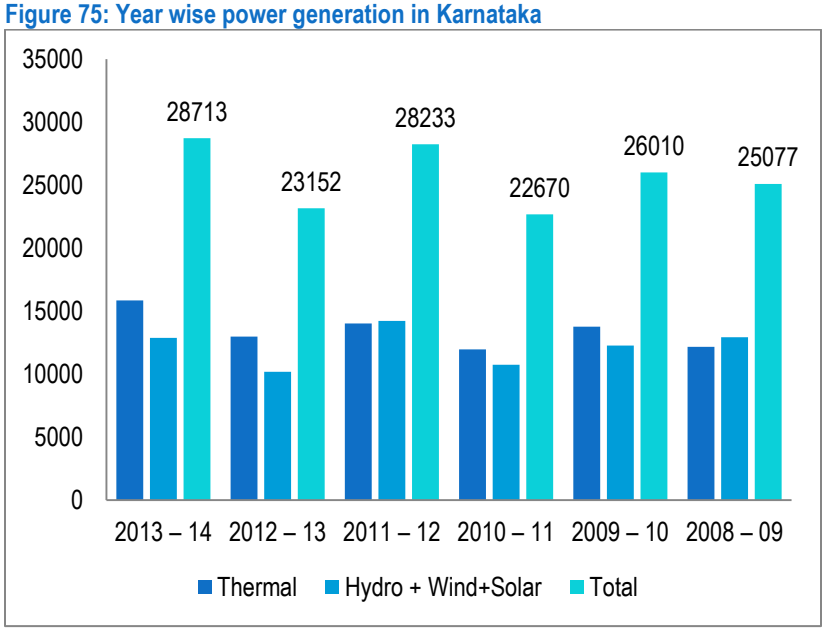
Source: Karnataka Power Transmission Corporation Limited (KPTCL)

6.3.1. POWER GENERATION PERFORMANCE

The State has witnessed a 30.3% growth in thermal power generation since 2008-09. Consequently, the generation from hydro, wind and solar has witnessed a reduction of 0.4% in the same period. Thus, the total power generation has increased to about 14.5% since 2008-09. The details are given in the figure below.

[34] Load generation Balance Report by CEA

Figure 75: Year wise power generation in Karnataka



Source: KPCL

6.3.2. TRANSMISSION AND DISTRIBUTION SYSTEM IN KARNATAKA

The State has 1025 stations and 32,471 km of transmission line. An overview of the State Transmission system as on 31st March 2014 is indicated in the table below:

Table 49: Transmission system (as on 31st March 2014)

Voltage Level in KV	No. of stations	Transmission line in Circuit Km
400	4	2650
220	93	10052
110	359	9703
66	569	10066
Total	**1025**	**32471**

Source: KPTCL

KPTCL has added 26 stations and 609 circuit kilometers of line during the year 2013-14 and has handled a peak load of 9,223 MW on 13th February 2014.

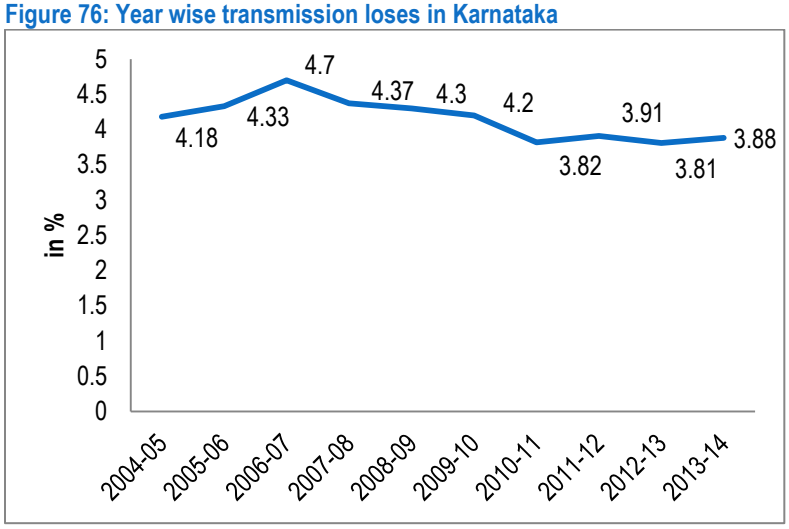
The State has experienced reduction in transmission losses from 4.18% in 2008-09 to 3.88% in 2013-14. The data given below indicates the transmission losses in Karnataka from 2008-09 to 2013-14.

Dabhol-Bengaluru Gas Pipeline

Inaugurated in February, 2013, the pipeline, built at a cost of Rs. 4, 500 crore, has a total capacity of 16 million metric standard cubic metres per day (mmscmd). The first recipient of the gas was Toyota Kirloskar Auto Parts, which utilised the fuel for its captive 6.5 MW power plant. GAIL has also signed a gas transmission agreement with Karnataka Power Corporation Ltd. (KPCL) for the supply of 2.1 mmscmd of natural gas for its 700 MW power plant at Bidadi in 30 months. The project is expected to produce 3000 MW of clean energy.

The pipeline starts at Dabhol in Maharashtra and passes through Belagavi, Dharwad, Gadag, Ballari, Davangere, Chitradurga, Tumakuru, Ramanagaram, Bengaluru Rural and Bengaluru Urban districts. It traverses 18 National Highways, 382 roads, 20 railway tracks, 11 major rivers and 276 water bodies, including Asia's largest river crossing in the rocky terrain at Ghatprabha.

Figure 76: Year wise transmission loses in Karnataka



Source: KPTCL (Transmission losses for FY13 & FY14 are excluding Southern Region losses.)

Electricity Supply Companies (ESCOM)s purchase power from generators and the energy of such purchases is measured at the interface of generating stations with the transmission system termed as energy at ex-bus generation. KPTCL transmits this energy from ex-bus generation to the interface points with the ESCOMs through its transmission system. The ESCOMs supply this energy to their consumers through their distribution network. In the process, technical energy losses are incurred both in the transmission and the distribution system. Further, in the distribution system, losses are also incurred due to commercial reasons like theft / pilferage of energy, errors in metering and billing etc.

The trajectories of distribution losses of the ESCOMs in the past five years are as follows:

Table 50: Distribution losses of ESCOM (All figures in %)

Name of the ESCOM	FY09	FY10	FY11	FY12	FY13	FY14
BESCOM	16.70	15.09	14.48	14.46	14.20	13.95
MESCOM	12.95	12.64	13.07	12.09	11.88	11.93
CESCOM	17.35	16.42	15.48	16.20	15.07	14.73
HESCOM	25.15	20.86	19.85	19.99	19.88	18.05
GESCOM	26.01	25.53	22.06	21.71	18.97	21.90
Hukeri RECS	15.38	15.19	15.15	15.30	14.91	14.53

Source: KERC (Transmission loss for FY 14 is provisional data)

6.4. RENEWABLE ENERGY IN KARNATAKA

According to a tentative State-wise break-up of renewable power target by Ministry of New and Renewal Energy (MNRE), the southern States of Andhra Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu and Puducherry are expected to generate 59018 MW of renewable power by year 2022. The State of Karnataka is expected to achieve the following targets by year 2022:

1. Solar Power -5697 MW
2. Wind Power – 6200 MW
3. Small Hydro Power -1500 MW
4. Biomass Power – 1420 MW

Karnataka Renewable Energy Development Limited (KREDL) is a facilitating agency for implementation of renewable energy sources. The developer develops the project and on commission will connect the capacity to the grid. Thereby the energy is distributed by KPTCL to ESCOMs through PPA and also for third party sale through wheeling and banking. According to data from KREDL, following is the distribution of renewable energy sources as of May 2015.

Table 51: Distribution of renewable energy sources as of May 2015

District	Capacity Allotted	Capacity Commissioned	Capacity Cancelled	Balance allotted to be commissioned
Wind	13071.72	2685.44	2808.00	7578.28
Small Hydro	2989.61	785.21	460.00	1744.40
Solar Grid	1100.00	84.00	70.00	946.00
Cogeneration	1727.35	1191.05	0.00	536.30
Biomass	369.98	113.03	0.00	256.95
Municipal solid waste	25.50	0.00	0.00	25.50
Total	19284.15	4858.73	3338.00	11087.43

Source: KREDL

With introduction of the "Karnataka Renewable Energy Policy 2009–14", the State Government had articulated its vision to harness green and clean renewable energy sources in the State for environment benefits and energy security and to initiate energy efficiency measures in all sectors for sustainable growth." The goals of this comprehensive Policy range from utilizing renewable energy resources based utility–scale power generation for energy security to renewable energy-based village energization; from effective use of renewable energy technologies (RET) for socio-economic development of its rural and peri-urban populace to manufacturing RETs for propelling the State's economic growth.

6.4.1. SOLAR ENERGY

Karnataka is rich in solar resources and solar energy will complement the conventional sources of energy in a large way. The State of Karnataka is blessed with 240 to 300 sunny days with good solar radiation of 5.4 to 6.2 kWh/m^2/day. Karnataka was the first southern State to notify its Solar Policy in 2011 and was the first State to commission utility scale solar project in India. According to estimates by the Government solar potential in Karnataka is 20 GW. However, considering different factors like availability of waste lands, evacuation infrastructure, etc. the moderated potential may be around 10 GW. Karnataka has the potential to evolve as a solar generation hub in India due to a host of factors. Karnataka's Solar Policy was released in 2014; operative till 2021, and targets setting up of 1,600 MW of ground mounted plants.

Highlights of the Policy are given below:

- To add solar generation of minimum 2000 MW till 2021 in a phased manner by creating favourable industrial atmosphere
- To promote solar roof top generation and technologies
- To encourage decentralized generation and distribution of energy where access to grid is difficult

GoK in its endeavour to achieve minimum of 3% solar energy out of total projected consumption, has proposed to install 2000 MW till 2021 as given below:

Table 52: Program targets under solar policy

Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
% of solar total consumption of energy	1.5	1.75	2.0	2.25	2.5	2.75	3.0

Source: Karnataka Solar Policy 2014-21

It is proposed to meet the solar targets under different segment as below:

1. **Grid connected plants**
   It is proposed to achieve minimum 1,600 MW of grid connected utility scale solar power generation projects for sale of power to State Electricity supply companies (ESCOMs), third party sale and captive consumption[35].
2. **Grid connected roof top projects**
   It is proposed to achieve minimum 400 MW of grid connected roof top solar generation projects in the State by 2018.[36]

Table 53: Minimum targets proposed

Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Utility scale projects	350	150	150	150	200	200	200
Roof top solar PV project (grid connected and off grid)	100	100	100	100	-	-	-

Source: Karnataka Solar Policy 2014-21

An RFP was released in June 2014 for 500 MW for grid connected projects under the category of projects more than 3 MW through competitive bidding process.

- 8 out of 30 bidders won the allocation for 500 MW
- Lowest winning bid was Rs. 6.71/kWh (20 MW) and highest was Rs. 7.12/kWh (10 MW).
- The Power Purchase Agreement (PPA) was for 25 years.

The following incentives were granted under the Policy for sale to third parties or captive consumption until 2021:

- Tax concessions – For entry tax, stamp duty, and registration charges as per Industrial Policy
- Contract demand – Industrial consumers buying solar power will be allowed pro-rata deduction in contract demand
- Wheeling, Banking, Cross Subsidy charges – Fully exempt for 10 years from commissioning of plant, for plants commissioned between 01.04.2013 and 31.03.2018. This exemption does not apply to captive plants availing Renewable Energy Certificates (RECs).

Other Initiatives

1. Solar Park: Development of solar parks helps to utilize uneven waste land for power generation; understand appropriate technology usage to achieve optimum efficiency, mitigate issues like watch & ward facilities by way of common infrastructure etc. The experience will be used to

[35] Karnataka Solar Policy 2014-21
[36] Karnataka Solar Policy 2014-21

decide further development of solar parks in the State. The Policy encourages:

i) Promotion of distributed generation through small solar parks. The GoK contemplates to provide financial assistance of Rupees 1 Crore for development of each solar park with area not less than 100 acres through a viable model (PPP or other) in the backward districts identified as per the recommendations of Nanjundappa Committee.

ii) Promotion of integrated solar parks. Private participation by providing "plug and play" options for developers. The promoters of the park may facilitate with additional support like EPC services, assistance in financial closure and skill development programs etc.

2. GoK contemplates to create private land banks owned by individual farmers / group of farmers / associations for development of solar projects on long term lease basis up-to 30 years (subject to renewal after lease period) at lease rates fixed by GoK from time to time, in co-ordination with Revenue Department.
3. Grid tied canal corridor projects. GoK supports deployment of grid connected projects on canal corridor by water resources department on pilot basis subject to purchase of energy by ESCOMs.
4. Grid connected solar with other renewable hybrid projects. GoK encourages projects that can benefit from existing project infrastructure. In this regard, solar with other renewable hybrid projects having minimum 25% of overall generation coming from respective generation sources shall be promoted through this policy. The tariff will be at a mutually agreed rate with due approval of Karnataka Electricity Regulation Commission (KERC).

In addition, a new scheme, Surya Raitha Scheme has been introduced in 2014. This scheme was launched to encourage famers to install solar panels for their irrigation pumps. Farmers can sell excess electricity produced back to the grid. Tariffs offered for electricity are the same as that of solar rooftop plants; however Central subsidies of up to 90% are available for irrigation pump sets.

6.4.2. WIND POWER

Karnataka was one of the first States to install wind power in the year 1995-96. Located in Gadag district, the Kappatagudda Project was the first Wind Energy project in Karnataka. 9 units of 225 KW each were installed during 1995 – 96. As part of its expansion plans, 11 more units of 230 KW each was added during 2002 – 03 to increase the total installed capacity to 4.555 MW (20 units).

The total annual energy benefit from Kappatagudda is 12 MU. The table below gives a brief snapshot of wind resources in Karnataka.

Table 54: Wind resources in Karnataka (as of 31st December 2014)

Total number of established Wind Monitoring stations	72
Number of operational wind monitoring stations	13
Stations with recorded Annual Average Wind Power Density > 200 W/sq m at 50 m height	19
Wind belts	Sogi, Kappathgudda, Jogimatti, BB Hills
Windy Districts	Tumakuru, Ballari, Davangere, Gadag, Shivamogga, Belagavi, Hassan, Madkari, Raichur, Chitradurga

Source: indianwindpower.com

So far about 7,000 MW capacity wind power projects are under implementation at different stages and about 25,877.635MW have been commissioned. The district wise detail for wind power capacity is given below.

Table 55: District wise details of wind power projects in Karnataka

District	Capacity Allotted (MW)	Capacity Commissioned (MW)	Capacity Cancelled (MW)	Capacity facilitate (MW)
Bagalkot	393.2	0	12	0
Bengaluru Rural	180.13	0	113.38	0
Belagavi	1912.25	319.3	297.95	20
Ballari	588.5	136.8	31.35	192.6
Bidar	79.5	0	15	45
Vijayapura	1184.85	223.6	0	198
Chamarajanagar	92.5	0	0	0
Chickballapura	10.5	0	0	0
Chikkamagaluru	858.4	0	245.25	25
Chitradurga	1508.66	565.94	130.22	137
Dakshina Kannada	107	0	0	0
Davangere	1064.95	218.55	56.8	72.9
Dharwad	327	22.9	46.25	241
Gadag	1110.775	568.505	38.13	49
Kalaburagi	245.9	0	33.75	0
Hassan	421.42	143.9	187.02	0
Haveri	369.23	235.9	0	132
Kodagu	91.95	0.55	15	0
Kolar	297.46	0	254.56	0
Koppal	158.65	6.92	0	12
Mandya	65.8	0	29.8	0
Mysuru	249.3	0	28.95	0
Raichur	365.8	39.725	0	0
Shivamogga	606.98	150.65	268.83	15
Tumakuru	441	52.2	255.6	169
Uttara Kannada	43.1	0	26.4	0
Yadgir	100	0	0	143
Grand Total	**12961.805**	**2685.440**	**2086.24**	**1451.5**

Source: KREDL

Based on estimates of KREDL, the total wind power potential in Karnataka is 13,236 MW, with the highest wind power expected from the district of Belagavi.

Table 56: District wise details of wind power potential in Karnataka

District	Total wind power potential in MW
Bagalkot	643.78
Bengaluru Rural	205.35
Belagavi	1413.94
Ballari	700.85
Bidar	80.85
Vijayapura	794.97
Chamarajanagar	67.58
Chikkamagaluru	702.35
Chitradurga	1300
Dakshina Kannada	221.1
Davangere	544.4
Dharwad	450.7
Gadag	1102.28
Kalaburagi	400.2
Hassan	650.53
Haveri	685.27
Karwar	367.8
Kolar	300.56
Koppal	474.72
Mandya	70.6
Mysuru	300.65
Raichur	408.36
Shivamogga	700.36
Tumakuru	500.47
Udupi	47.38
Grand Total	**13236**

Source: KREDL

India Infrastructure Research in its Report on 'Wind Power in India 2014-15' issued in January 2015 has analysed the capital cost of some of the completed wind power projects in the country including in Karnataka during 2012-13, 2013-14 and 2014-15. This market analysis indicates the average capital cost for the last three years i.e., FY13-FY15 at Rs.612 Lakhs/MW with the capital cost varying from Rs.520 lakhs to Rs.706 lakhs/MW. The report also indicates that the average cost has not changed substantially in these years.

6.4.3. SMALL HYDRO POWER

Small hydro is the development of hydroelectric power on a scale serving a small community or industrial plant. The definition of a small hydro project varies but a generating capacity of up to 25 MW is generally accepted as the upper limit of what can be termed small hydro.

Karnataka is the first State in the country to set up a professionally managed corporation to plan, construct operate and maintain power generation projects. According to Karnataka Renewable Energy Policy 2009-14, it was targeted to harness 600 MW of power through mini hydro projects involving Rs. 2,700 crores of investment. The mini hydro project proposals which do not involve diversion of the water flow resulting in drying up the stream/river stretch were considered for development. Keeping in view the environmental issues, the mini hydro projects in the Western Ghats' districts/forest areas were restricted to maximum 5.00 MW and preferably run of the river (ROR) projects were encouraged.

According to KREDL, the total installed generating capacity of the State has been 4,118 MW of which hydro contributed 2,913 MW. Karnataka State is endowed with hydro power potential estimated at about 7,000 MW, of which only 40% of the estimated potential has been harnessed so far.

As of March 2015, total capacity allotted to be commissioned for small hydro projects is 1,715 MW and commissioned capacity is 7,85 MW in Karnataka.

Table 57: District wise details of capacity for small hydro projects

District	Capacity Allotted to be commissioned (MW)	Commissioned Capacity (MW)
Bagalkot	33	
Bengaluru Rural	88	11.75
Belagavi	26	23.95
Ballari	5.5	30.2
Vijayapura	2	22.1
Chamarajanagar	94.25	31
Chikkamagaluru	126.05	6
Dakshina Kannada	275	115.3
Davanagere	17.6	
Gadag	2	
Kalaburagi	17.75	1.25
Hassan	160.6	80
Kodagu	116	25
Koppal	17.85	18
Mandya	274.87	112.7
Mysuru	19	49
Raichur	90.93	23.058
Ramanagara	9.4	2
Shivamogga	32.43	55.8
Udupi	105.2	64.5
Uttara Kannada	109.4	
Yadgir	92.15	113.6
Grand Total	**1714.98**	**785.208**

Source: KREDL

6.4.4. COGENERATION, BIOMASS AND WASTE TO ENERGY

Cogeneration, biomass and waste to energy contribute less than 10% to the State's energy.

Cogeneration (also combined heat and power, CHP) is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. For a cogeneration project, the developer shall obtain all the statutory clearances from departments such as Irrigation, Environment and Forests, Pollution Control, KPTCL/ESCOMS etc., and submit monthly progress report to KREDL. Following is the timeline for project implementation of a cogeneration project.

Table 58: Time limit for implementation for cogeneration project

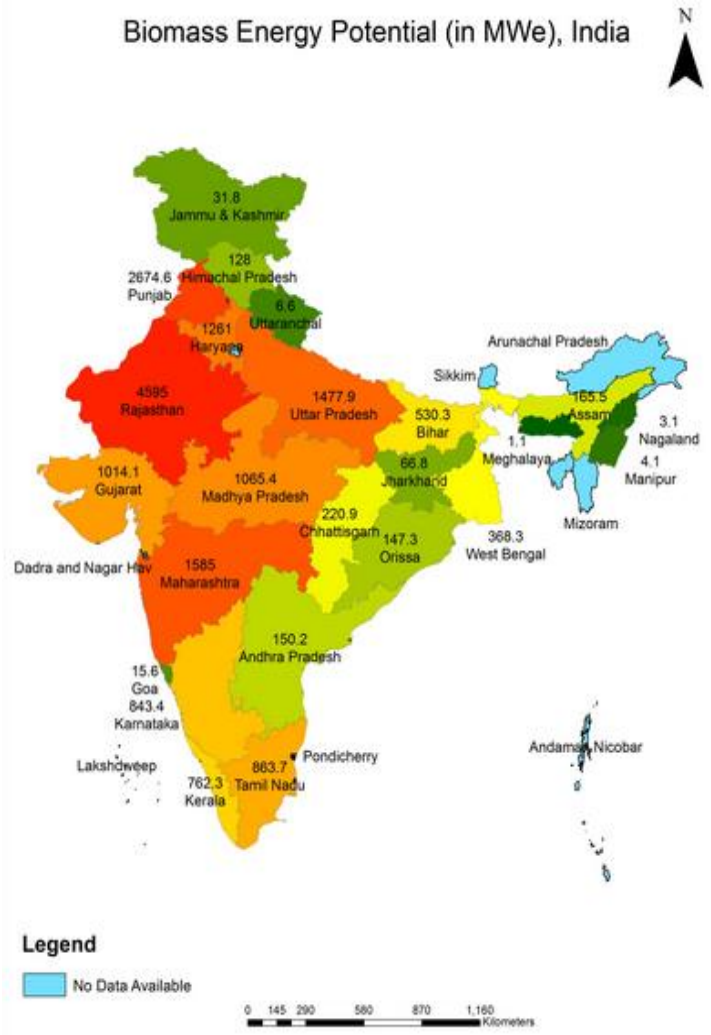
Milestone	Time Limit
Obtaining Statutory clearances from other related departments	6 Months
Approval to DPR & Technical Clearances	2 Months
Financial Closure	3 Months
Project implementation	10 Months
CEI Approval, Synchronisation Approval	3 Months

According to data from KREDL, there are 23 cogeneration projects pending with an allotted

capacity of 1868.8 MW in Karnataka. There are 54 cogeneration projects commissioned with an overall capacity of 1188 MW.

Biomass is produced by green energy plants through photosynthesis using sunlight. Biomass contains organic matter which can be converted to energy. The figure below gives the biomass energy potential of all the States in India.

Figure 77: State wise biomass energy potential in India



Source: MNRE

According to data from KREDL, there are 37 biomass energy projects that have been allotted that is pending with an overall capacity of 238.5 MW in Karnataka. There are 16 biomass energy projects commissioned with an overall capacity of 113.03 MW.

Waste to Energy: Every year, about 55 million tonnes of municipal solid waste (MSW) and 38 billion litres of sewage are generated in the urban areas of India. In addition, large quantities of solid and liquid wastes are generated by industries. Waste generation in India is expected to increase rapidly in the future. As more people migrate to urban areas and as incomes increase, consumption levels are likely to rise, as are rates of waste generation. According to the MNRE, there exists a potential of about 1,700 MW from urban waste (1,500 from MSW and 225 MW from sewage) and about 1,300 MW from industrial waste. The Ministry is also actively promoting the generation of energy from waste, by providing subsidies and incentives for the projects.

According to data from KREDL, there are 3 waste to energy projects allotted (2 in Bengaluru and 1 in Ballari) pending with an overall capacity of 23.09 MW in Karnataka.

6.5. PROJECTS AND INVESTMENTS

The currently ongoing projects have a capacity of 2,325 MW while the capacity of proposed projects is 3,895 MW. The details of projects are given below.

Table 59: KPCL Power projects in Karnataka

Sl.No	Power Stations	Units x MW	Installed capacity (MW)
A. HYDRO PROJECTS			
	Cauvery River Basin		
1	Sir Sheshadri Iyer Hydro Electric Station (Shivanasamudram)	4 x6 6 x3	42
2	Shimsha Hydro Electric Station	2x8.6	17.20
Total			**59.20**
	Sharavathy valley Project		
3	Linganamakki Dam Power House	2x27.5	55.00
4	Mahatma Gandhi Hydro Electric Station	4x21.6 4x21.6	139.20
5	Sharavathi Generating Station	10x103.5	1035.00
Total			**1229.20**
	Gerusoppa Hydro Electric Project		
6	Gerusoppa Dam Powerhouse	4x60	240.00
	Kali Hydro Electric Project		
7	Supa Dam Powerhouse	2x50	100.00
8	Nagjari Powerhouse	5x150+1x135	885.00
9	Kadra Dam Powerhouse : 3 x 50 =150	3x50	150.00
10	Kodasalli Dam Powerhouse : 3 x 40=120	3x40	120.00
Total			**1255.00**
	Varahi Hydro Electric Project		
11	Mani Dam Powerhouse	2x4.5	9.00
12	Varahi UGPH :4 x 115 =460	4x115	460.00
Total			**469.00**
	Krishna Basin Project		
13	Almatti Dam Power House	1x15 5x55	290.00
	Mini Hydro Electric Project		
	Bhadra Project		
14	Bhadra Right Bank Canal Powerhouse	1x7.2 1x6	13.20
15	Bhadra Left Bank Canal Powerhouse	2x12 1x2	26.00
16	Munirabad Power House(Thunga Bhadra Basin)	2x9 1x10	28.00
17	Ghataprabha Dam Powerhouse	2x16	32.00

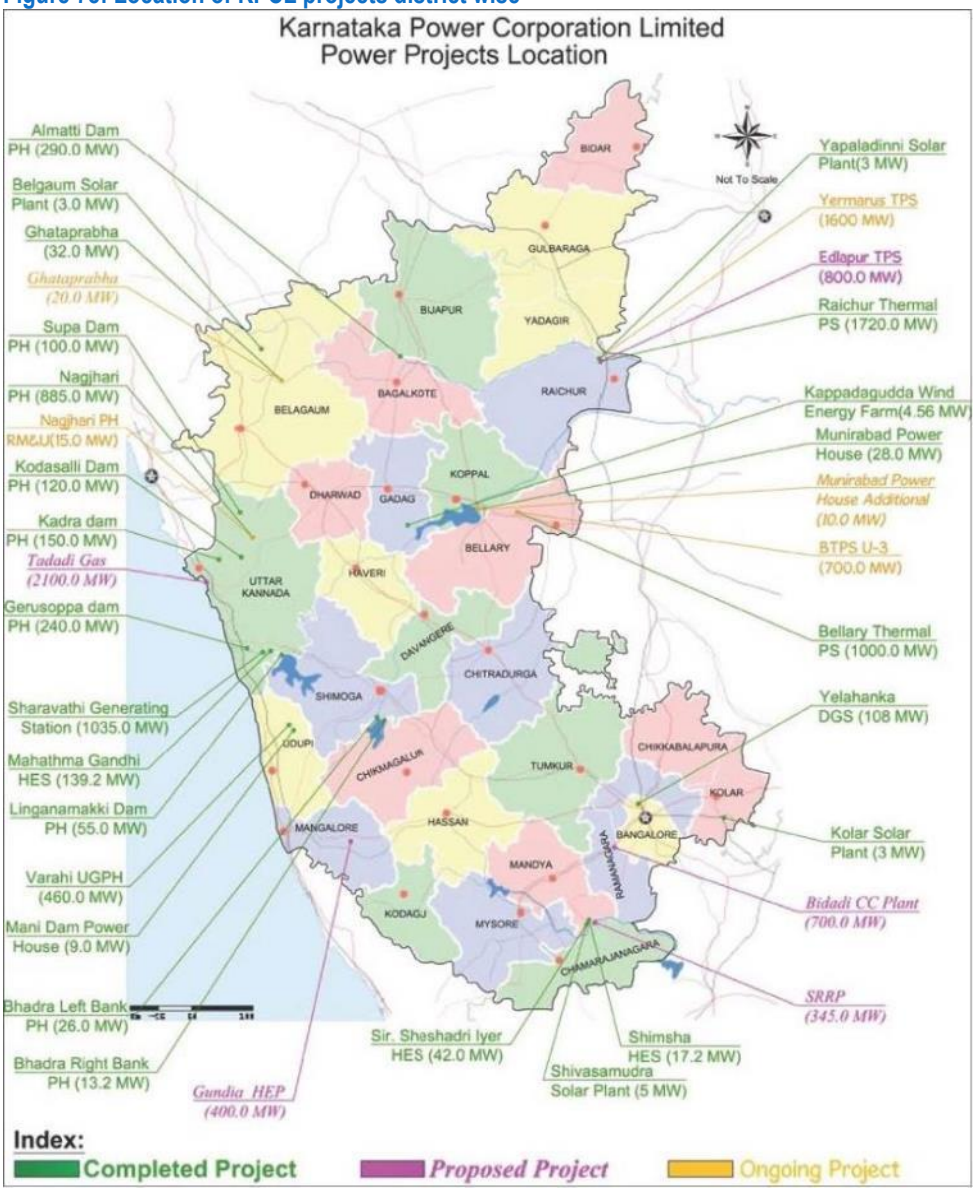
Sl.No	Power Stations	Units x MW	Installed capacity (MW)
18	Mallapur Mini Hydel Scheme	2x4.5	9.00
19	Sirwar Mini Hydel Scheme	1x1	1.00
20	Kalmala Mini Hydel Scheme	1x0.40	0.40
21	Ganekal Mini Hydel Scheme	1x0.35	0.35
Total Hydro			**3652.35**
B. THERMAL STATIONS			
22	Raichur Thermal Power Station 1 to 7 Unit	7x210	1470.00
23	Raichur Thermal Power Station Unit-8	1x250	250.00
24	Ballari Thermal Power Station Unit-I	1x500	500.00
25	Ballari Thermal Power Station- Unit-II	1x500	500.00
Total Thermal			**2720.00**
C. DIESEL GENERATION STATION			
26	Yelahanka Diesel Generating Station	6x18	**108.00**
D. WIND POWER STATION			
27	Kappadagudda Wind Farm 4.56	9 x 0.225 +11x0.230	**4.56**
E. SOLAR ENERGY			
28	Yelesandra Solar PV Plant, Kolar District		3.00
29	Itnal Solar PV Plant, Belagavi District		3.00
30	Yapaldinni Solar PV Plant, Raichur District		3.00
31	Simsha Solar PV Plant, Shimshapur, Mandya District		5.00
Sub Total Solar			**14.00**
GRAND TOTAL			**6498.91**
F. KPCL Ongoing Projects			
32	Ballari Thermal Power Station Unit-III	1x700	700.00
33	Yermaras Thermal Power Station	2x800	1600.00
34	Munirabad Hydro power station	1x10	10.00
35	R M & U of NPH. Unit-6	1x15	15.00
GRAND TOTAL			**2325.00**
G. KPCL New Projects(Capacity in MW)			
36	Bidadi Gas Based Combined Cycle Power Plant	1x700	700.00
37	Godhna Thermal Power Station Chhattisgarh Thermal Plant(Pit Head)	2x800	1600.00
38	Edlapur Thermal Power Station	1x800	800.00
39	Ghataprabha		20.00
GRAND TOTAL			**3120.00**
H. KPCL Proposed New Projects(Capacity in MW)			
Hydro Projects			
40	Shivanasamudram Seasonal Scheme	3x100+1x45	345.00
41	Gundia Hydel Project	2x200	400.00
Gas Based Projects			
42	Bidadi 2nd Stage		700.00
43	Yelahanka		350.00

Sl.No	Power Stations	Units x MW	Installed capacity (MW)
44	Tadadi Gas Based Project		2100.00
Total			**3895.00**

Source: KPCL

The location of all the projects district wise is given below.

Figure 78: Location of KPCL projects district wise



Source: KPCL

The regulatory framework for Energy is as shown below in the table:

Table 60: Regulatory framework for Energy

Sl.no	Regulatory Framework	Details
1.	National Renewable Energy Act 2015	The purpose of this Act is to promote the production of energy through the use of renewable energy sources in accordance with climate, environment and macroeconomic considerations in order to reduce dependence on fossil fuels, ensure security of supply and reduce emissions of CO2 and other greenhouse gases.
2.	The Electricity Act, 2003	The purpose of this Act is to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity.
3.	Electricity Regulatory Commissions Act, 1998	The purpose of this Act is to provide for the establishment of a Central Electricity Regulatory Commission and State Electricity Regulatory Commissions, rationalization of electricity tariff, transparent policies regarding subsidies, promotion of efficient and environmentally benign policies
4.	Associated offices - Central	• Central Electricity Regulatory Commission
5.	Karnataka Renewable Energy Policy 2009-14	Policy to harness green and clean Renewable Energy Sources in the state for environment benefits and Energy Security. To initiate energy efficiency measures in all sectors for sustainable growth.
6.	Solar Policy, 2014 - 2021	Policy to harness the solar resources in the state
5.	Associated offices - State	• Karnataka Electricity Regulatory Commission (KERC) • The Karnataka Power Transmission Corporation Limited • Karnataka Renewable Energy Development Limited

6.6. INVESTMENT OPPORTUNITIES AND PROJECT SHELF

The energy sector in the State is at the cusp moving into a surplus situation with the gap between demand and availability nearing 0%. However, other technical areas are to be addressed in order to gradually move into a 24X7 regime without any power cuts. This will require significant increase in the generation capacity so that any maintenance works at the thermal stations do not affect the power situation in the State. Further, the transmission and distribution networks are to be adequately strengthened so that energy generated is not lost due to weak infrastructure. Such enhancement would also be made by strategic utilization of IT in the process.

The areas of investments in the sector are listed below.

6.6.1. GENERATION

Much of the investments in generation would be in the renewable energy sector. The identified areas are:

Table 61: Investment requirement in generation

Sl. No	Source	Projects	Investment in Rs. crore
1.	Solar	Karnataka Solar Power Development Corporation Private Limited (KSPDCPL) is developing a 2000 MW solar park. Of this 1200 MW is currently in the bid stage. • NTPC will bid out the balance capacity at the solar park	12,000
2.	Solar	Other grid-tied solar power projects- with a total potential >5000 MW, of which about 122 MW is installed (FY 15), investors have ample investment opportunities for open access customers- considering that ~11% of the consumption is by the industrial & commercial sectors.	29,268
3.	Solar	Rooftop solar- target of 400 MW by FY 18 • This target does not address all the rooftops in the state. Could be achieved by the Government Buildings alone • The net-metering policy in Karnataka being the best in the country, makes it very attractive for private investment on a BOO model.	3,200
4.	Wind	Potential of 2600 MW available for private investments	15,600
5.	Wind	Repowering of old wind mills for enhancing the existing capacity will be taken up in the state in a pro-active manner for more than 1,500 MW of old wind power.	9,000
6.	Small Hydro	Potential of 600 MW available for private investments	3,600
7.	Hydro	Harnessing the 7.9 GW potential of pumped storage based hydro power in the state and implementing such projects through private sector participation through competitive bidding route.	31,600
8.	Biomass/ Cogeneration	Potential of 400 MW available for private investments	2,000
9.	WTE	3 plants proposed in Bengaluru, addressing a total of ~3000 TPD. The total estimated generation potential is about 30 MW	750
10.	WTE	WTE policy is proposed for the State where all ULBs would look at WTE as an alternate solution to address solid waste issues.	-
11.	Thermal Power	700 MW gas based power plant in Bidadi- way forward pending Hon'ble High Court's decision on the project	2,800

Sl. No	Source	Projects	Investment in Rs. crore
12.	Thermal Power	350 MW gas plant being developed in Yelahanka.	1400
13.	Thermal Power	3 power plants proposed along the tap-off points on the gas pipeline laid between Dabhol and Bengaluru.	12,000
	Total		**1,23,218**

6.6.2. *TRANSMISSION*

All transmission related projects are taken up by the State owned entity Karnataka Power Transmission Corporation Limited (KPTCL). While private contractors are appointed for implementation of projects, there are no PPP projects proposed to be undertaken.

All the planning and development process is also undertaken by KPTCL internally.

6.6.3. *DISTRIBUTION*

The possible investment areas in the distribution sector are:

1) Implementation of Smart Grid projects in all ESCOMs in the State.
   Pilot project being undertaken by BESCOM in the Indiranagar Division which will involve Advance Metering Infrastructure; Peak Load Management and Solar Rooftop PV Systems (RTPV).

2) Implementation of distribution franchisee model through PPPs across the state

6.7. CONCLUSION

In India, power is a concurrent subject, i.e., a subject under the jurisdiction of both the Central and State Governments; policy direction has therefore been allowed both from the Central Government and State-Government through its Energy Department.

The Government has taken many progressive steps by way of policies in order to attract much private investment in power generation. With increasing demand, the State is also working towards bringing the private sector expertise in distribution so as to provide the consumers with uninterrupted supply of power going forward.

Chapter 7

Logistics

7.1. INTRODUCTION

Originally, logistics originated out of requirements of military services and was developed to procure, maintain and transport material, personnel and facilities. It is the process of planning, implementing, and controlling the effective and efficient flow of goods and services from the point of origin to the point of consumption.

Logistics comprise of two components, viz. a) Inbound Logistics which is concerned with purchasing and arranging the inbound movement of materials, parts, and/or finished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores and, b) Outbound Logistics which is related to the storage and movement of the final product and the related information flows from the end of the production line to the end user.

The logistics industry in India is evolving rapidly and it is the interplay of infrastructure, technology and new types of service providers that will define whether the industry is able to help its customers reduce their logistics costs and provide effective services. Despite weak economic sentiments, the logistics and warehousing industry continued to witness growth largely due to growth in retail, e-commerce and manufacturing sectors. The Global Logistics sector is expected to grow at around 10-15% in the period 2013-14.[37] With this forward looking attitude and a promise of growth and improvements, the service oriented logistics industry is all set to expand beyond the horizons in the latter half of this decade, utilizing this fiscal year as its launch pad.

The logistics sector in Karnataka is witnessing a paradigm shift and is receiving impetus from the rising exports, Government investment on infrastructure and the entry of private players. Typically, the major elements of logistics costs for industries include transportation, warehousing, inventory management and other value-added services such as packaging. In the logistics value chain, transportation and inventories account for 35 % and 25 % of logistics cost respectively. With the market becoming more competitive, especially for the manufacturing sector, outsourcing of logistics activities is actively becoming a preferred option.

Logistics comprises of transportation, storage and distribution of goods and materials. The transportation aspects of logistics are usually addressed by the existing road and rail networks in the State.

[37] Indian Logisticsd Industry: A Report on the Performance and Emerging Trends in the Indian Logistics Industry, IBEF, November 2013

7.2. LOGISTICS IN KARNATAKA

Logistics play a very significant role in the context of exports from and imports into any State. The creation of logistics infrastructure in the State would ideally be correlated to the value of exports from the State. Karnataka exports a wide variety of goods both agricultural and industrial covering silk, sandalwood oil, handicrafts, readymade garments, coffee, iron ore, sophisticated machine tools, electronic products, computer hardware and software etc. In the last two decades the State has emerged as a major player in the export of engineering goods, readymade garments, leather goods, chemicals, minerals and ores etc. Since the second half of the 1990's, Karnataka has carved out a niche for itself in the global market place as the knowledge and technology hub of India. The table below sets out the top export items of Karnataka.

Table 62: Top Export Commodities of Karnataka in Rs. Crores

Commodity	2013-14	2014-15
Electronics & Computer Software	178000	194020
Readymade Garments	8900	9821
Petroleum & Petroleum Products	35392	40882
Engineering	17978	20958
Iron Ores & Minerals(including granites)	739	749
Silk Products	650	554
Coffee Products	3598	4973
Basic Chemicals, Pharmaceuticals & Cosmetics	8300	5896
Agriculture and Processed Food Products	1300	1383
Gem and Jewellery	24175	21998
Cashew and Cashew Kernels	1200	1505
Handicrafts	516	548
Leather Products	450	543
Chemicals and Allied Products	562	955
Marine Products	1067	1313
Plastic Goods	700	376
Spices	1150	1126
Wool & Woollen Products	176	191
Miscellaneous and Others	5565	5777
Total	**290418**	**313570**

Source: VTPC , GoK

Mining, Transportation & Export of Minerals in Karnataka

Karnataka is a major producer of Gold, Felsite, Iron ore, Chromite, Manganese ore , limestone and Dunite which account for approximately 98.92% of the total value of mineral production in the State. The mineral resources are concentrated in Ballari, Chitradurga and Tumakuru districts. Ballari - Hosapete region in the State accounts for almost 88% of the iron ore in the State. Tumakuru, Bagalkot and Chitradurga districts account for the rest. Karnataka in the year 2008–09 produced iron ore to the tune of 47.35 MT, out of which the Ballari - Hosapete region contributed to approximately 35.70 MT. In the year, 2009-10 when iron ore comprised the major export component in the State; New Mangalore Port handled export of iron ore to the extent of 50 MT; whereas the ports in Karwar and Belekeri handled exports to the tune of 2MT and 6MT respectively. However, in 2010 a blanket ban was imposed on the mining and export of certain minerals. As a result, the iron ore and mineral exports from Karnataka which were Rs. 3,809 crores in 2007-08 witnessed a drop of 13% to Rs. 3,302 crores in 2011-12. The major destination countries of iron ore and mineral exports from Karnataka included China, Japan, Netherlands, Korea etc.

Electronics and Computer software constitutes about 60% of the total value in exports, followed by petroleum, petroleum products, gems and jewelry which constitute about 13% and 9% respectively. Of the top export items, petroleum and petroleum products are exported mostly through the New Mangalore Port Trust located in Mangaluru. Gems and jewelry are low volume and high value items; the logistics of which are managed by the private players. Even in case of readymade garments, engineering goods, chemicals; the logistics network is well spread and in most cases are privately owned and managed.

7.2.1. AGRI-LOGISTICS IN KARNATAKA

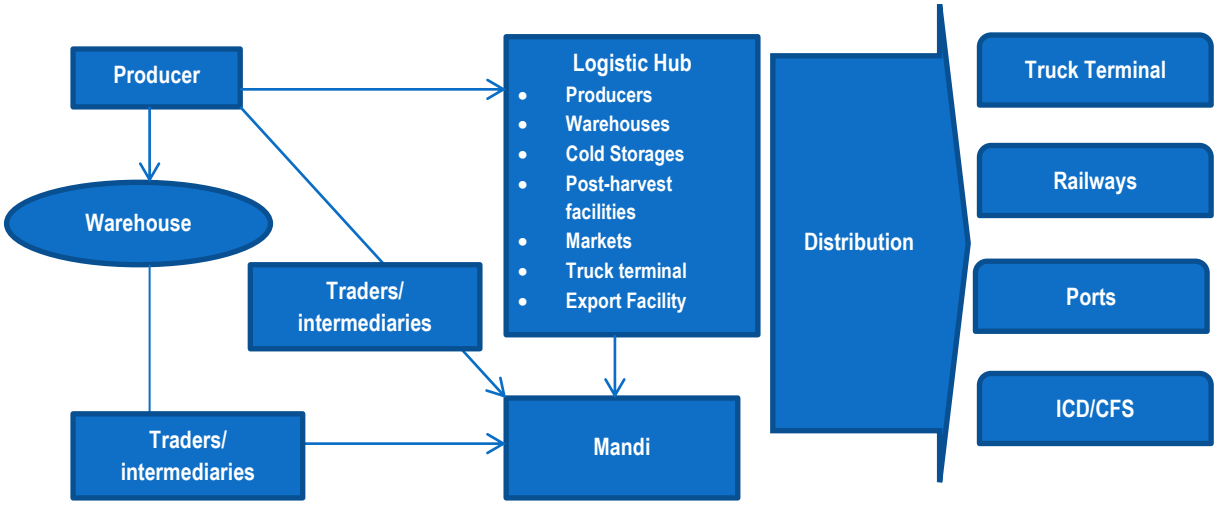
Agriculture produce is one such item which is produced in high volume, but has a short shelf life, most of the time it is easily perishable unless processed or refrigerated and the prices of which are highly volatile. Over the years, GoK has realized the significance of creating quality logistics infrastructure for agriculture produce.

Karnataka accounts for 8.4% of total fruits and 6.2% of total vegetables produced in the country. With 64% of its geographical area under agricultural cultivation, the State has a strong input base and is a major producer of agricultural and processed food products. Karnataka's agricultural and processed food product exports contribute an average 1.5% towards India's total agriculture and processed food products. The major destination countries of agricultural and processed food exports from Karnataka include UK, US, UAE etc. and this section sets out the status of agri-logistic infrastructure in the State.

The agri logistics chain involves several components including producers, markets, cold storages, post-harvest facilities and transport logistics such as truck terminals, railways, ports and ICD/CFS. Typically, producers sell their produce at the farm level or store in warehouse within the local area. The produce goes to local mandi without processing in most cases. In some cases, the produce arrives at a logistic hub which brings together producers, warehouse, cold storages, post- harvesting facilities, transportation and markets. In the State, typically Agricultural Produce Market Committee's (APMC) wholesale market yard mostly serves the function of the logistic hub for agriculture produce. In addition to the wholesale market yards, there are food parks and cold chain facilities under Karnataka State Agricultural Produce Processing and Export Corporation Limited (KAPPEC) serve the needs of post-harvest and processing of agriculture produce.

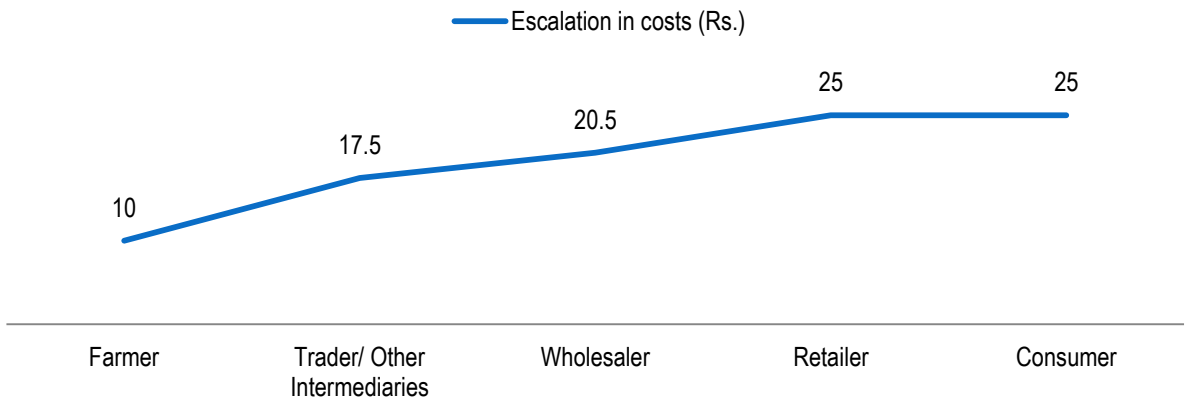
The diagram below depicts the agri-logistic chain prevalent in the State today.

Figure 79: Agri-logistics Chain



According to a study on horticultural products by GoK, 75% of the farmers in the State sell their produce at the farm level. They cannot afford to go to distant mandis on account of lack of facilities, expensive transportation and malpractices in assembling markets. This has resulted in formation of long marketing channels, which has also proved to be detrimental to the quality and safety of the perishable products. Moreover, the long chain of intermediaries between the farmer and the market, adds cost but no value to the product. The escalation in the cost of the produce is to an extent of 250%[38] of the cost of production at the farm level and same is set out in the figure below.

Figure 80: Existing Agro-Market Supply Chain – Escalation in costs (Rs.)



Source: Report on Marketing Reforms and Enhancing Competitiveness, Government of India

[38] Report on Marketing Reforms and Enhancing Competitiveness, Government of India

The escalation in price is not always accompanied with better quality, in many cases cost escalation comes with deteriorated quality as well. This is primarily due several constraints in the current system, a few of which are mentioned below:

- High level of wastages due to lack of proper handling, storage and transport infrastructure.
- Lack of grading facilities based on the quality.
- Long and inefficient value chain with many intermediaries.
- Lack of packaging facilities.
- Lack of price-sharing mechanism.
- Lack of efficient prices discovery mechanism.
- Inefficient linkages between the producers and the off-takers (retailers/ institutional off-takers/consumers).

Therefore presence of storage and warehousing logistics are critical with respect to agriculture and horticulture produce.

7.3. PROJECTS IN THE SECTOR

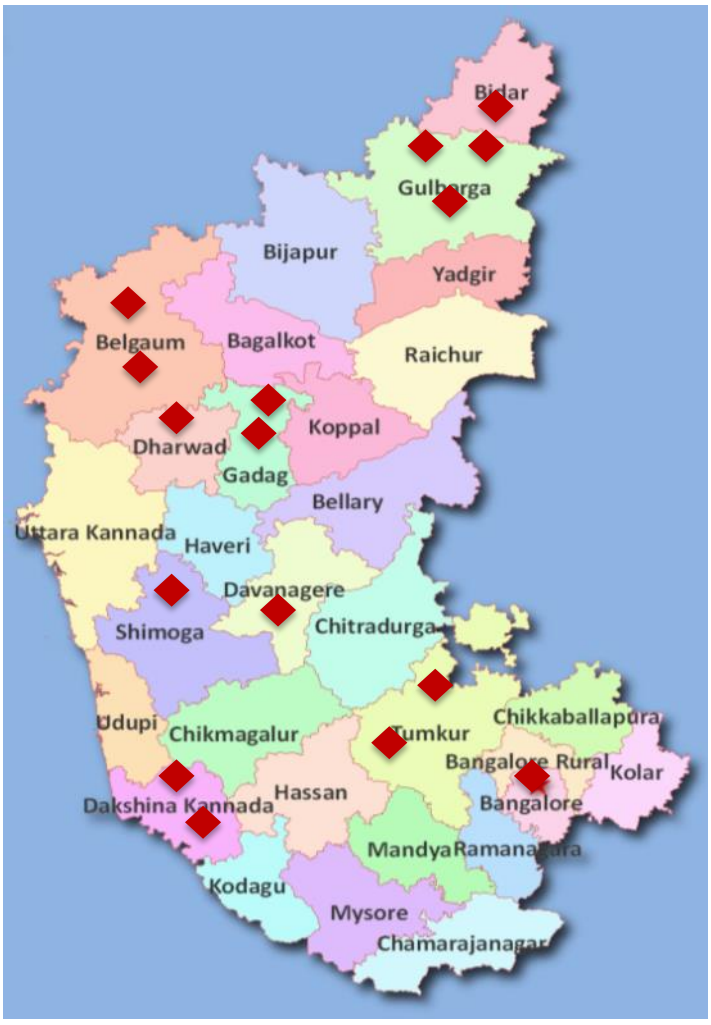
The key developments in agri-logistics have been carried out in the domain of storage, warehousing, post-harvest facilities and connectivity. Both Central and State Governments have played a significant role in development of agri-logistics in the State.

7.3.1. STORAGE & WAREHOUSING INFRASTRUCTURE

Several Central and State Government agencies provide for storage and warehousing infrastructure with respect to agriculture and horticulture produce in the State. These centres are scattered and spread throughout the State.

Central Warehousing Corporation (CWC)

Figure 81: CWC warehouse locations in Karnataka



Source: Central Warehousing Corporation

CWC is a premier warehousing agency in India, established during 1957 providing logistics support to the agricultural sector. At present CWC operates 474 warehouses across the country with a storage capacity of 11.8 million tonnes. Out of these 16 warehouses are located in Karnataka having a total capacity of 67,748 MT.

Warehousing activities of CWC include food grain warehouses, industrial warehousing, custom bonded warehouses, container freight stations, inland clearance depots and air cargo complexes.

The figure on the left lists the warehouses in Karnataka which come under the purview of CWC.

Food Corporation of India (FCI)

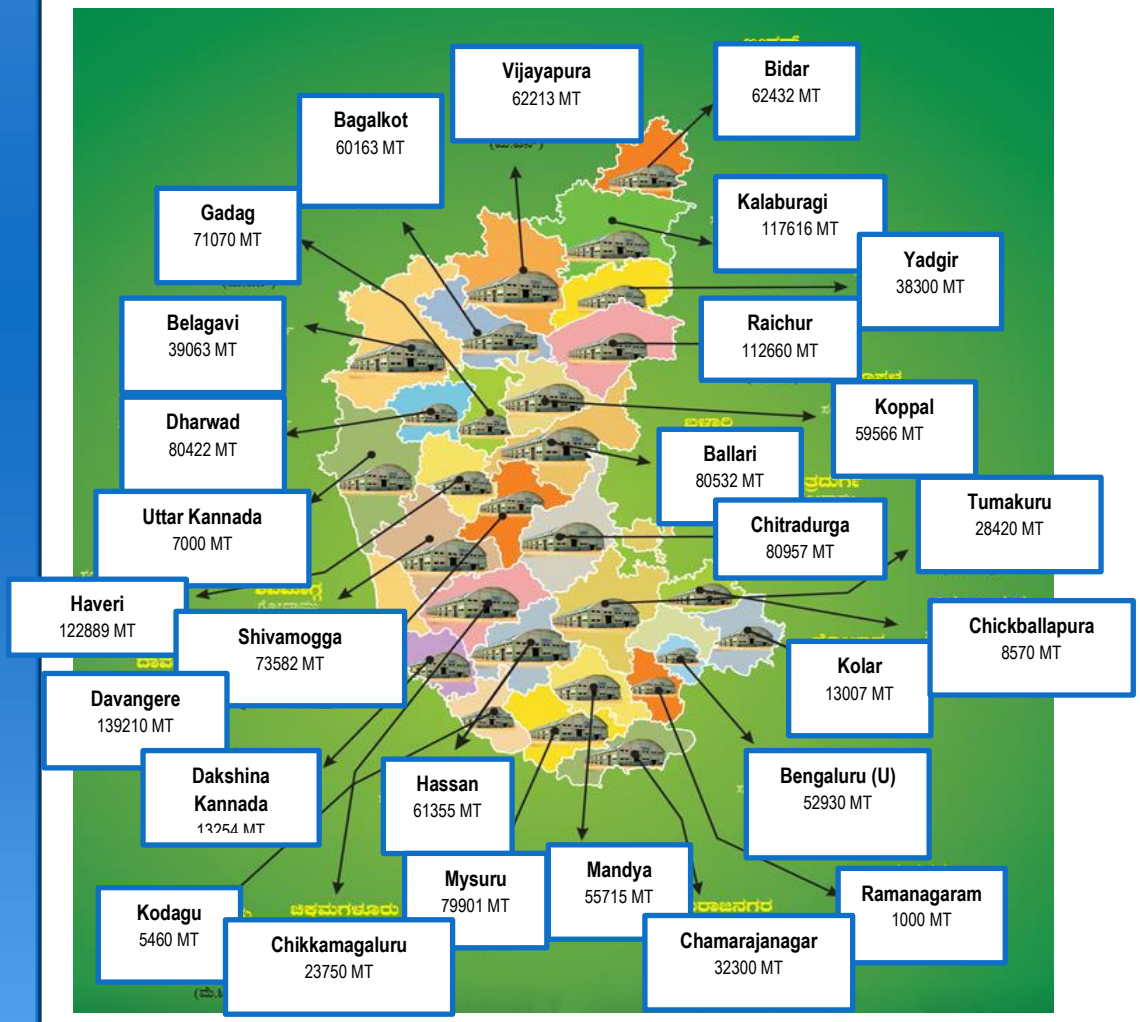
The Food Corporation of India was setup under the Food Corporation's Act 1964, in order to fulfil the objectives of the Food Policy to provide effective price support for safeguarding the interests of the farmers, distribution of food grains throughout the country for public distribution system and to maintain satisfactory levels of buffer stock of food stock to ensure national food security. FCI ensures food security by utilizing the warehousing facilities available with the

Central and State warehousing corporations. The FCI for augmenting the storage capacity in the form of covered godowns and to reduce the dependence on other storage across the country initiated the Private Entrepreneur Guarantee (PEG) scheme. The PEG was launched in 2008, in which godowns are constructed in PPP mode through private parties, as well as various agencies in Public Sector for guaranteed hiring by FCI. In Karnataka through this scheme an additional warehouse capacity of 3.5 lakhs tonnes has been approved and 1.39 lakhs tonnes of capacity has been added[39].

Karnataka State Warehousing Corporation (KSWC)

Currently, there are about 122 warehouses in the State under the control and management of Karnataka State Warehousing Corporation (KSWC) with an overall storage capacity of about 15.5 lakh MT. These warehouses are spread across the State. The map given below sets out the district wise storage capacities of warehouses owned by KSWC;

Figure 82: Storage Capacities of KSWC warehouses (in MT)



Source: Karnataka State Warehousing Corporation Limited

[39] Source : indiastat.com

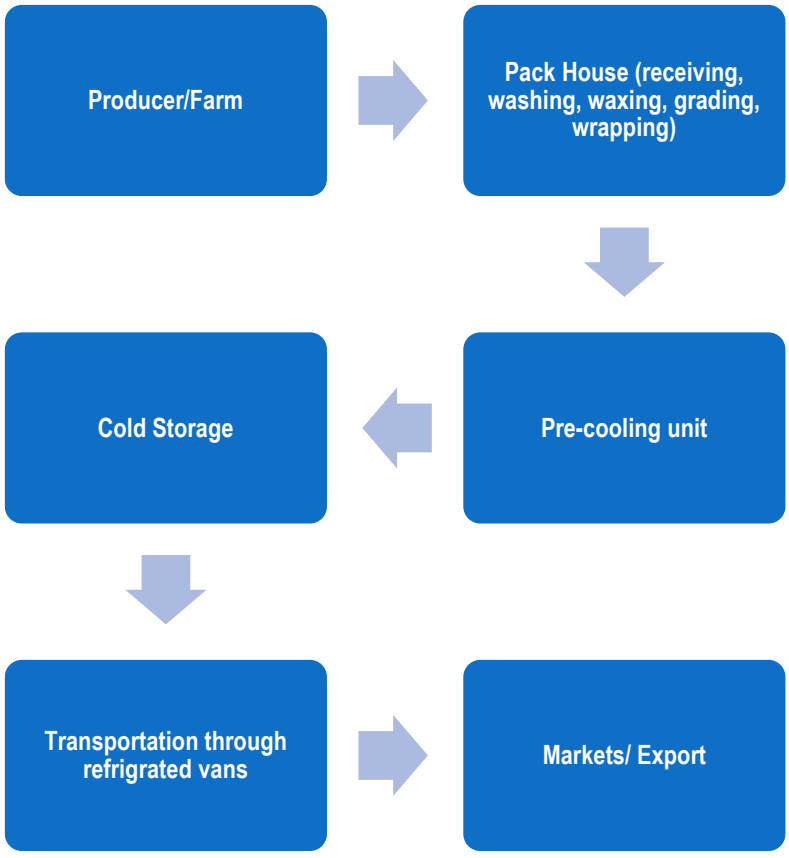
Annexure 7A sets out the detailed list of warehouses under KSWC and their respective storage capacities.

The above mentioned Government owned, managed and controlled warehouses are for the benefit of the farming community and traders. The storage warehouses are usually leased out to the private sector for storing their produce. In addition to the Government owned, managed and controlled warehouses there are other private warehouses which are operated by the private sector; most of them are for captive use and the balance are leased out to other private parties for use.

7.3.2. COLD CHAIN INFRASTRUCTURE

A cold chain includes end to end logistics combined with temperature controlled storage and transport. A cold chain facility would involve a pack house, pre cooling units, cold storage and refrigerated transport. The figure below depicts the cold chain logistics and infrastructure components that are part of it.

Figure 83: Cold Chain Logistics



The entire Government owned cold chain logistics infrastructure in the State is under the aegis of KAPPEC. KAPPEC was established by GoK to develop and promote the production, processing and export of agriculture, horticulture and floriculture products. KAPPEC provides the complete cold chain facility in 5 locations across Karnataka. In these 5 locations there are seven cold storage facilities that have been developed with a capacity of 9,415 MT.

The table given below provides the details of all existing cold chain facilities owned by KAPPEC in Karnataka.

Table 63: Existing Cold Chain Facilities across Karnataka as of 2015

No.	Location of Facility	Pack house	Pre-cooling Unit	Cold storage	Refer Van	Other Facilities included
1.	Vijayapura – KIADB Industrial Area	☑	☑	☑ 3000 MT	☑	-
	KIADB Industrial Area Vijayapura (Expansion)	-	-	1150 MT	-	-
2.	Kustagi – KIADB Industrial Area	☑	☑	☑ 200 MT (for exports) 300 MT (Bulk Storage)	-	-
3.	APMC Yard, Gadag	-	-	☑ 1000 MT	-	IQF Unit
4.	APMC Yard, Hubballi	☑	☑	☑ 100 MT (for exports) 2000 MT (commercial cold storage)	☑	• Ripening Chambers • Administrative Laboratory • Aril separation
5.	Bagalkot at KIADB Industrial Area	☑	☑	☑ 100 MT (for exports) 1500 MT (commercial cold storage)	☑	• Commercial Cold Rooms • Ripening Chambers • Administrative Laboratory • Aril separation

Source: KAPPEC

In addition to the Government owned cold chain infrastructure facilities, there are several privately owned facilities that are operational in the State for captive use which are also leased on a case to case basis.

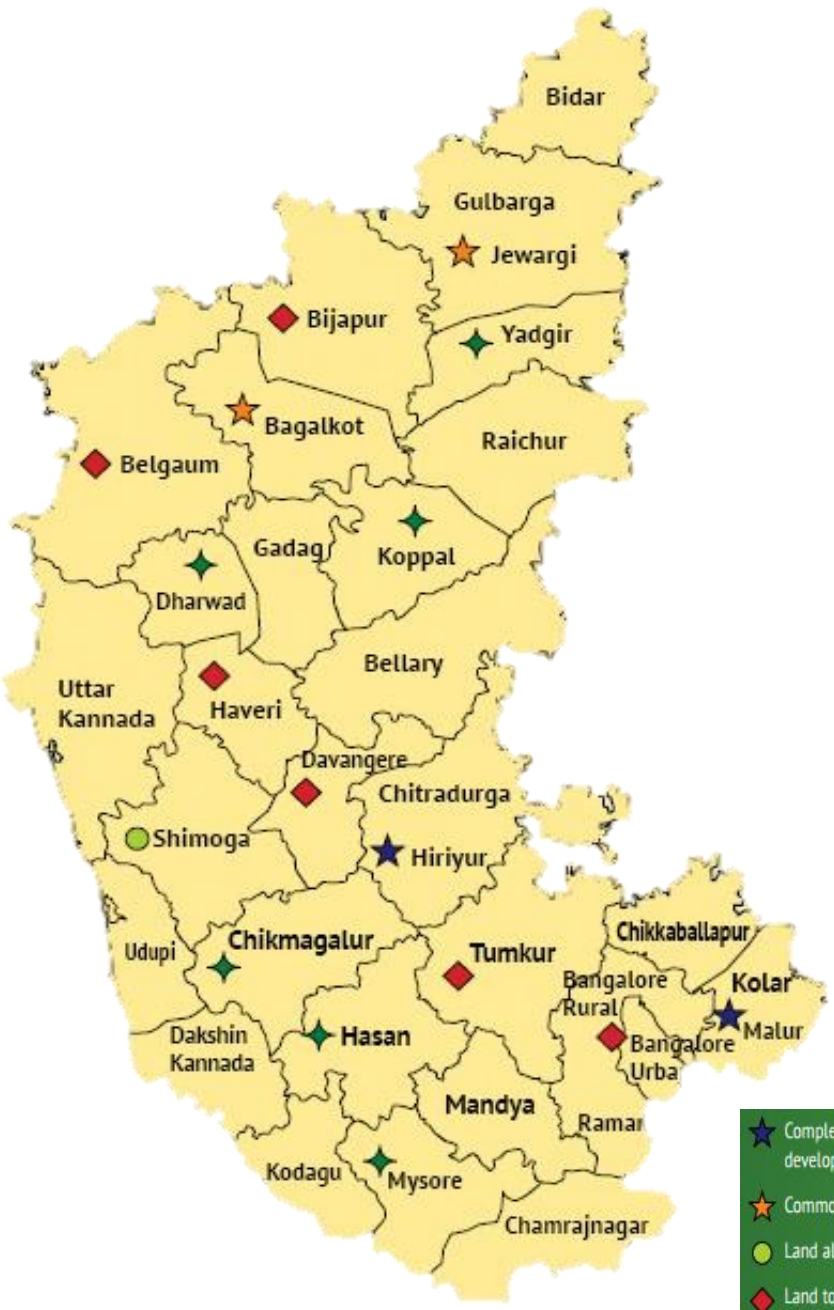
7.3.3. MARKETING & POST HARVEST FACILITIES

Another area in agri-logistic sector where significant quantum of development has been carried out in the State; is with respect to marketing and post-harvest facilities. Agricultural Produce Marketing Committee (APMC) has created several wholesale market yards at every district and lower levels for the benefit of farmers to market their produce to traders and retail customers.

Over the years, APMC has realized the relevance of developing state of the art wholesale market yards which offer several other facilities such as post-harvest facilities (grading, sorting, packaging, etc.), marketing aids (auction yards, real-time market information kiosks, etc.), export promotion facilitation centres, and so on.

In the previous decade, GoK also set up Food Karnataka Limited under the aegis of which Food Parks are being developed across several locations of the Karnataka. The food parks are envisaged to the hubs of agri/ food processing industries where common post-harvest facilities such as grading, sorting, packing, etc. are performed. The map given below sets out the list of food parks proposed and developed in the State.

Figure 84: Food Parks in Karnataka



Source: KSIIDC

Development of APMC Market Yard under PPP framework

During the year 2010-11, APMC selected a private partner (M/s Sobha Developers Limited) to develop a state of the art wholesale vegetable market yard in Byatarayanapura, Bengaluru under Public Private Partnership (PPP) framework. The construction of the said market yard is underway. Upon completion of construction of the project, the daily vegetable market from Yeshwanthpur is likely to be shifted to the new premises created in Byatarayanapura.

LEGEND

- Completed common facilities & Industries developed / being developed in majority plots: Malur & Hiriyur.
- Common facilities being developed: Jewargi & Bagalkot.
- Land allotted & development activities to be taken up: Shimoga.
- Land to be allotted : Bangalore Rural, Tumkur, Davangere, Belgaum, Bijapur & Haveri.
- Proposed Food Parks; Yadgir, Koppal, Dharwad, Hassan, Mysore & Chkkamagalur.

7.3.4. INLAND CONTAINER DEPOTS (ICD) & CONTAINER FREIGHT STATION (CFS)

ICDs and CFSs play an important role in the logistics make up of a region and thus impact its export-import capability. In order for exporters/importers to clear their goods which are sent/arrive by sea, they eliminate the need for the exporter/importer to go to the port of dispatch/receipt of the goods for clearing. It is at the ICDs/CFSs that imported goods or export goods are ordinarily kept before clearance by the Customs and where filing of Customs manifests, bills of entry, shipping bills and other declarations, assessment and all the activities related to clearance of goods for home consumption, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export, transhipment, etc., take place Further, they aid in clearing custom congestions at ports and generate local employment.

The list of ICD/CFS facilities and their current status in Karnataka is given in the table below.

Table 64: List of ICD/ CFS Facility in Karnataka as of 2015

	Place/Location	ICD /CFS	Agency/Company	Status
1.	Mangaluru (Panambur)	CFS	Central Warehousing Corporation	Functioning
2.	Karwar	CFS	Central Warehousing Corporation	Functioning
3.	Whitefield Bengaluru	CFS	Central Warehousing Corporation	Functioning
4.	Bengaluru	CFS	M/s Continental Warehousing Corporation LTD	Not Functioning
5.	Karwar Port	CFS	M/s Vikram Integrated Logistics Pvt. Ltd	Functioning
6.	Hassan	CFS	Vikram Logistics and Maritime Services (p) Ltd	Functioning
7.	Bengaluru	CFS	Hindustan Aeronautics Ltd.	Functioning
8.	Baikampadi, Mangaluru	CFS	ABG Infralogistics Limited, Mumbai	Not Functioning
9.	Whitefield Bengaluru	CFS	Marigold Logistics Private Limited	Functioning
10.	Bengaluru Rural	ICD	Sical multimodal and Rail Transport Ltd	Under Implementation
11.	Anekal Bengaluru	ICD	M/s Palrecha Infrastructure and Developers	Under Implementation

Source: http://commerce.nic.in/trade/icd_list.pdf

Distinction between ICD & CFS

As per the Ministry of Commerce website, Government of India an ICD/CFS is defined as *"a common user facility with public authority status equipped with fixed installations and offering services for handling and temporary storage of import/export laden and empty containers carried under customs control and with Customs and other agencies competent to clear goods for home use, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export. Transshipment of cargo can also take place from such stations."*

The primary distinction between an ICD and CFS is as follows:

- Functionally there is no distinction
- ICD is generally located in the interiors of the country away from the servicing ports.
- CFS is an off dock facility located near the servicing ports
- CFSs are largely expected to deal with break-bulk cargo originating/terminating in the immediate hinterland

7.3.5. CONNECTIVITY INFRASTRUCTURE

In addition to the above mentioned infrastructure, connectivity by means of rail, road and air also are critical factors in logistics. Good quality connectivity infrastructure contributes to quick movement of goods from point of origin to destination which saves time, cost and other resources which has an ultimate bearing on the price of goods. In order to promote seamless movement of goods along the roads which are mostly carried/ transited through long haul vehicles/ trucks; D. Devaraj Urs Truck Terminal Limited (DDUTTL) has developed three truck terminals at Yesvantpur in Bengaluru, Mysuru and Dharwad. In addition, there is one truck terminal which is under construction proposed at Dasanapura in north Bengaluru and two other truck terminals are proposed for development in Hosapete and Hubballi.

Details with respect to the road, rail and air connectivity in the State are explained in the respective chapters of this report.

The regulatory framework for logistics is as shown below in the table:

Table 65: Regulatory framework for Logistics

Sl.no	Regulatory Framework	Details
1.	The warehousing act, 1962	To provide for the incorporation and regulation of corporations for the purpose of warehousing of agricultural produce and certain other commodities
2.	Associated offices	• Central Warehousing Corporation (CWC) • Food Corporation of India (FCI)
3.	The Karnataka Warehouses Act, 1961	The purpouse of the Act is to provide for the regulation and licensing of warehouses in the State of Karnataka
4.	Karnataka Ports (Landing and Shipping Fees) Act, 1961	• Karnataka State Warehousing Corporation (KSWC) • Food Karnataka Limited (FKL) • Agriculture Produce Marketing Committee (APMC) • Karnataka State Agricultural Produce Processing and Export Corporation Limited (KAPPEC) • D. Devaraj Urs Truck Terminal Limited (DDUTTL)

7.4. PROJECT SHELF

The table below provides details of the projects that are proposed for development in the logistics sector;tThe total expected investment in the sector is around Rs. 1421 crores

Table 66: Project Shelf for Railways

Sr. No	Project	Details	Status	Estimated Investment in Rs. Lakhs
1.	KIADB Industrial Area, Humnabad in Bidar District. (Post-harvest and cold storage)	Pack house with receiving, washing, waxing and grading line, two pre-cooling units each 6 mts capacity, cold storage storages for export (4 nos) each of 25 Mts capacity, reefer van – one with capacity of 6 Mts, Vommercial Cold Strorage of 300 Mts (3 chambers one each of 50 Mts, 100 Mts and 150 Mts), Laboratory, Plastic Crates, hand pallet trucks, etc.	Under construction	880
2.	APMC Yard Hubballi (Expansion)	Establishment of warehouse for agriculture produce – 2500 Mts capacity	Under Construction	198
3.	Kudachi in Raibag Taluk of Belagavi Dist	Pack house, pre-cooling unit – 1 nos of 6Mts capacity, cold storage – 50 Mtsx2nos, bulk storage – 1000 Mts, four reefer vans, packing tables – 20 nos	Under construction	860
4.	Green Food Park Ltd, Bagalkot	100 acres with cold storage of 3000 Mts capacity, warehouse of 2000 Mts capacity, sorting and grading	Common facilities are under implementation	2241 + (this is how much has been incurred to estimate as to how much more is required?)
5.	Innova agri bio park Ltd, Malur (Kolar District)	Cold storage of 2500 MT, warehouse (1000 Mts), Sorting and Grading facilities	Almost Common Infrastructure facilities completed	1949
6.	Jewargi Agro Food Park (Kalaburagi District)	Warehouse (3000 MT), sorting and grading centre, common facilities	Common facilities are under implementation	1587
7.	Akshay Food Park Ltd, Hiriyur	Cold storage, warehouse, sorting and grading centre, quality control lab, pomegranate arial separation unit, patchouli extraction unit, fruit and vegetable dehydration unit	Infrastructure facilities completed	1887
8.	Food Park in Shivamogga	The food park is looking at establishing fruit pulping and processing, cereal processing, oil seed extraction, herbal extraction, wine processing industries and complementary infrastructure	Handing over of land	
9.	Food Park in Belagavi	The food park is looking at establishing	Land yet to be	

Sr. No	Project	Details	Status	Estimated Investment in Rs. Lakhs
		fruit pulping and processing, cereal processing, oil seed extraction, herbal extraction, wine processing industries and complementary infrastructure	allotted	
10.	Spice Park in Byadagi, Haveri District	Processing of red chillies, ginger, garlic, vanilla, cardamom, tamarind, turmeric, etc.	Land yet to be allotted	
11.	Food park at Harohalli, Bengaluru Rural	Infrastructure for major crops of the region such as grapes, tomato, mango, potatoes, gherkins, onions, coconut, ragi, ginger.	Land yet to be allotted	
12.	Food Park at Davangere	Infrastructure for major crops of the region such as pomegranate, sapota, figs, tomato, chillies, potatoes, sunflower, maize and ragi.	Land yet to be allotted	
13.	Food Park at Vijayapura	Infrastructure for major crops of the region such as grapes, citrus, banana, pomegranate, mango, papaya, guava, onions tomato, green chillies, potatoes, leafy vegetables, carrot, garlic, coriander, turmeric, etc.	Land yet to be allotted	
14.	Food Park at Yadgiri		Proposed	
15.	Food Park at Koppal		Proposed	
16.	Food Park at Dharwad		Proposed	
17.	Food Park at Hassan		Proposed	
18.	Food Park at Mysuru		Proposed	
19.	Food Park at Chikkamagaluru		Proposed	
20.	Development of Mega Cattle Feed Manufacturing Plants	The project is development of Fully Automated Mega Cattle Feed Manufacturing Plants of capacity 500 MT per day each plant. The project is proposed to be implemented under a public private partnership (PPP) model at three locations. - Vijayapura, Davangere and Chickballapura/Mandya	Project development stage	60000
21.	Development of 2000 MT Cold Chain Storage Facility	The project is development of cold chain facility of 2,000 MT storage both at 4 degree C & at minus 25 degree C including mobile cold chain facilities like trucks, vans, etc. The project is proposed to be implemented under a public private partnership (PPP) model at two locations in two phases. - At Hesarghatta in Bengaluru in 1st Phase and Mandya or Chickballapura in 2nd Phase.	Project development stage	30000
22.	Development of health	The project is development of modern	Project	16000

Sr. No	Project	Details	Status	Estimated Investment in Rs. Lakhs
	drinks, functional & ready to eat foods, flavoured milk, milk shakes etc. manufacturing plant	state of the art automated plant to undertake manufacture of Health Drinks, Functional & Ready To Eat Foods, Flavoured Milk, Milk Shakes etc., of capacity 30,000 bottles per hour. The project is proposed to be implemented under a public private partnership (PPP) model at two locations in two phases. - At Hesarghatta in Bengaluru in 1st Phase and Mandya or Chickballapura in 2nd Phase.	development stage	
23.	Development of Rice Technology Park at Navali-Somnal Village, near Karatagi, Koppal District	The project is development of Rice Technology Park near Karatagi in the jurisdiction of Rice & Paddy Special Commodity Agricultural Produce Market Committee (APMC), Karatagi, Koppal District, Karnataka. The APMC has aquired 300 acres of land at Navali-Somnal Village for the project. The phase-I of project is the development of basic infrastructure components such as compound wall, roads, drainage, water supply, landscaping and common amenities. The project is proposed to be implemented under a public private partnership (PPP) model.	Project development stage	12200
24.	Development of Maize Technology Park at Ranebennur, Haveri District	A Maize Technology Park is proposed to be developed at Agricultural Produce Market Committee (APMC) yard at Ranebennur, District Haveri on BOT framework. The park is proposed to be established in 60 acres of land. The project components are development of basic infrastructure such as compound wall, drainage, road, weighbridge, sewage treatment plant, water treatment plant, street lighting, D.G sets and civil works. Maize flour, maize flakes, poultry feed, dry maize, maize chips popcorn mills would be developed in the park.	Project development stage	11100
25.	Operation and Management of KSWC Warehouses	The Project is operation and maintenance of 27 lakh MT capacity warehouses in various locations in Karnataka.	Project development stage	To be estimated
26.	Total			138902

7.5. CONCLUSION

Development of logistics in any region cuts across several departments and functional areas such as industries, commerce, agriculture, horticulture, transport, warehousing, ports, etc. A cohesive effort of several departments and stakeholders is necessary for projects to materialize in the sector.

Usually, the growth in the logistics sector is being fuelled by key industries such as automotive, engineering, pharmaceuticals, and food processing, among others. The logistics industry is likely to continue its growth momentum in the coming years and the sector is forecast to witness a consolidation wave. However, despite the growth forecast, as on today the logistics sector is not cost competitive and is dis-organised. Further, this disorganisation has heightened the pressure on existing infrastructure. While rail networks are under pressure to accommodate more freight on key routes at a time when passenger volume is also increasing, the road transport sector is under increasing pressure to reduce its impact on the environment. Concurrently, there is a growing need to improve decision-making processes surrounding investments in transport infrastructure, with focus being given to system-wide priorities.

Considering that logistics is the backbone of flourishing trade it requires special attention by the Government / private sector particularly with reference to development activity. The accelerated growth of the logistics industry, coupled with emerging trends of 3PL services, logistic parks, cold chain and warehousing activities, has made the sector a vast and untapped market and demands the need of better infrastructure facilities such as comprehensive logistic parks.

ANNEXURE 7A: DETAILED LIST OF WAREHOUSES UNDER KSWC

Sr. No	District	Storage Capacity			Occupancy in terms of Weight	% occupancy
		Owned	Hired	Total		
1	Bagalkot	5273	860	6133	3107	51%
2	Bengaluru	59200	3585	62785	26308	42%
3	Belagavi	30875	21248	52123	36135	69%
4	Ballari	23460	16340	39800	19679	49%
5	Bidar	1000	0	1000	1000	100%
6	Vijayapura	37118	35887	73005	54434	75%
7	C.R. Nagar	46927	7275	54202	49593	91%
8	Chickballapura	41200	19232	60432	41114	68%
9	Chikkamagaluru	57636	75122	132758	69958	53%
10	Chitradurga	44245	71153	115398	90770	79%
11	D. Kannada	48718	107963	156681	32768	21%
12	Davangere	3000	9019	12019	12014	100%
13	Dharwad	32118	76853	108971	102483	94%
14	Gadag	7900	2928	10828	10654	98%
15	Kalaburagi	77474	1774	79248	42034	53%
16	Hassan	30118	11690	41808	27592	66%
17	Haveri	28481	37516	65997	46016	70%
18	Kodagu	22409	39785	62194	45886	74%
19	Kolar	23500	68	23568	8065	34%
20	Koppal	7000	0	7000	6500	93%
21	Mandya	66925	6694	73619	45738	62%
22	Mysuru	58500	1663	60163	27044	45%
23	Raichur	30804	0	30804	21707	70%
24	Ramanagaram	32000	300	32300	19392	60%
25	Shivamogga	43000	28297	71297	45536	64%
26	Tumakuru	6720	1635	8355	7548	90%
27	U. Kannada	42864	13215	56079	38142	68%
28	Yadgir	87143	26080	113223	69097	61%
	Total	995608	616182	1611790	1000314	62%

Source: KSWC

Chapter 8

Urban Infrastructure

8.1. URBAN SECTOR

India is one of the fastest urbanising economies in the world. Approximately, 590 million people will live in Indian cities by 2030, which is nearly twice the population of the United States today[40]. The cities will account for 70% of the nation's GDP and 40.76% of country's population by 2030. Urbanisation in India is happening at a tremendous rate. With the rural-urban shift happening in the cities, the present infrastructure is under stress. Basic services like water, sanitation, underground sewerage, solid waste management, urban transport are still not accessible to many citizens. There is a constant deficit in service provision and urban infrastructure needs to catch up with the urbanization growth to bridge this deficit. Key reasons attributed to lag in urban service provision are unplanned growth of urban sprawl, slower investments coming into public infrastructure, poor capacities to operate and maintain the created infrastructure, etc.

A paradigm shift in urban infrastructure investments happened with Jawharlal Nehru Urban Renewal Mission (JnNURM), where the focus was on capacity building, along with investment in asset creation. The prime focus of JnNURM was on sixty cities. Ministry of Urban Development (MoUD) used to provide project-by-project sanctions to the projects that were envisaged in the City Development Plan of every city. The success of urban infrastructure depends also on the service delivery aspect along with providing for the basic infrastructure. So the focus should not be merely restricted to creation of assets but also on the O&M requirements of the projects and capacity building.

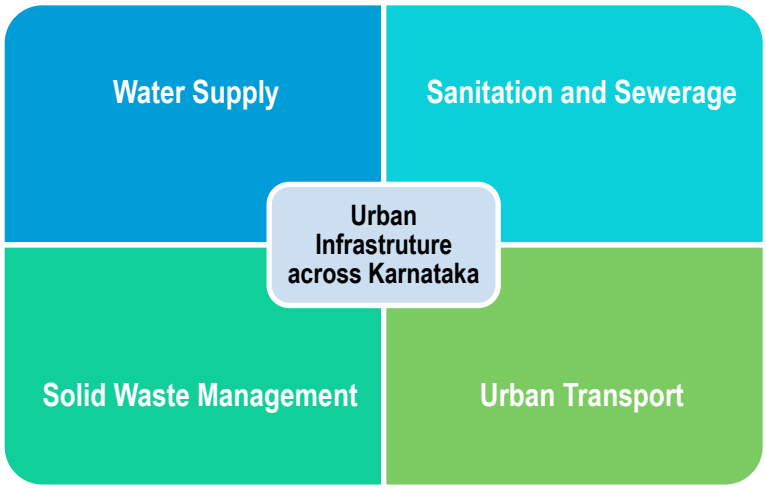
In order to facilitate service improvement, Service Level Benchmarks are defined by MoUD, which sets standards for the status of basic infrastructure. These are developed for water supply, waste water management, solid waste management, storm water management and for urban transport. The cities evaluate their performance against these benchmarks and plan their operations and future investments in a way to achieve the benchmarks.

8.1.1. ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT):

Post JnNURM period, the infrastructure gaps still remain large as many cities were not addressed under the mission. The new mission for urban renewal and transformation is called Atal Mission for Rejuvenation and Urban Transformation (AMRUT). Unlike JnNURM, which was restricted to sixty cities, five hundred cities will be taken up under AMRUT for improvement in the following sectors: water supply, sewerage, septage management, storm water drains, urban transport and development of parks and green spaces. The solid waste management component shall be taken up by a different mission – the Swachh Bharat Mission (SBM) which shall focus on improving solid waste management and sanitation not only in the five hundred AMRUT towns, but in all the urban areas of the country. Unlike in JnNURM, urban roads are not included in the project components of AMRUT. Only the components of non-motorised transport, public transport systems and multilevel parking are included.

[40] India's urban awakening: Building inclusive cities, sustaining economic growth, McKinsey Global Institute, April 2010.

Twenty six cities have been selected from the State of Karnataka for the mission. The chapter provides an account of the current status, future potential for development, shelf of projects and proposed investments of urban infrastructure sectors such as water, sewerage and sanitation, solid waste management and urban transport in these 26 cities. In this chapter, the following are the key sectors that are addressed.



Several stakeholders were consulted to understand the current status of infrastructure development across the key sectors mentioned above. The chapters that follow would discuss each of the infrastructure sector; the current status of infrastructure, quantum of investments in the sector, institutional structures, enabling policies and the summary of development in the sector.

8.2. WATER SUPPLY

8.2.1. WATER RESOURCES IN INDIA

Safe drinking water is a prerequisite for human activity and properly treated wastewater is vital for preventing disease and protecting the environment. Ensuring continuity of drinking water, wastewater treatment and service is essential to modern life and the Nation's economy. Hence, water sector development is immediately relevant for billions of people and affects the quality of the environment in which they live. Financing the development in a sustainable manner is a challenge being faced by most of the countries. Water has been under-priced historically in most developing countries with the belief that they are doing what is socially appropriate. Tariff increases have been met with vociferous opposition from various classes of societies. There are widespread apprehensions about the capability and the willingness of the consumers to pay for water.

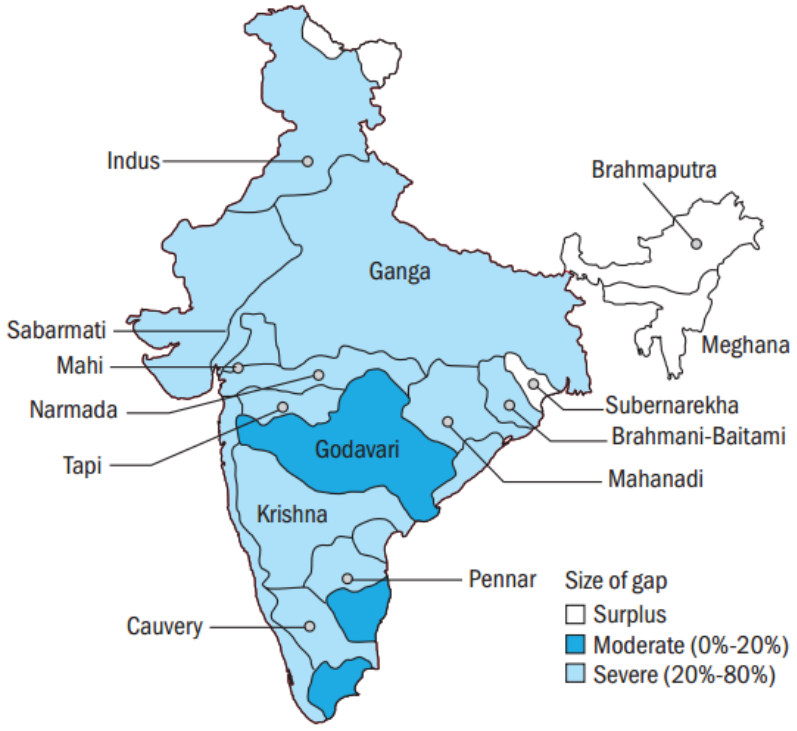
The agenda of providing all people with adequate water supply and sanitation services has resulted in most components of the sector being under Government monopoly. This has resulted in water systems often being poorly run, sustaining losses through physical leaks and poor collection systems. The actual state of the assets is also unknown, as many of the assets are underground. There is a waste of water in every use: agricultural, industrial, municipal and domestic. As water is essential to life, and access to it must be ensured for all, Governments have been trying out various alternatives for managing the intricacies of this sector. There is a growing recognition that the private sector can do much to help meet water and sanitation needs in developing countries. New initiatives of public private partnerships are being experimented by the Governments to overcome the deficiencies.

According to a discussion paper by TERI in October 2014, India sustains nearly 17% of the world's population but is endowed with just 4% of global water resources. About 50% of annual precipitation is received in just about 15 days in a year, which is not being brought to productive use due to limited storage capacity of 36% of utilizable resources. Leakage and inefficiencies in the water supply system waste nearly 50% of usable water. The ground water level is declining at the rate of 10 cm per year. Over 70% of surface water and ground water resources are contaminated.

This is leading to a depletion of water resources at a considerable rate. The country has made investments for infrastructure development of large dams, storage structures, and canal networks to meet the country's water needs, particularly in support of

technology-based interventions to improve production of food grains, pulses, oilseeds, and vegetables. This can be inferred from the huge increase in budgetary allocation in the 12th Five-Year Plan as compared to the 11th Five-Year Plan in irrigation including Watershed Development (from Rs. 243,497 crores to Rs. 504,371 crores) and Drinking Water and Sanitation sector (from Rs.120, 774 crores to Rs.254,952 crores). This step has helped in achieving food and water security to a large extent, but in many areas of less plentiful surface water, the increasing use of water in agriculture and a growing population has led to higher and potentially unsustainable extraction of ground water for irrigation and domestic needs. The water supply and demand gap in India in various river basins as percentage of demand in the year 2030 is depicted in Figure 1 below.

Figure 85: India's water supply demand and gap in 2030



Source: UNICEF, FAO, and SaciWATERs. 2013. Water in India: Situation and Prospects

National Water Policy of India

The National Water Policy (NWP) of the Government of India was first enunciated in 1987. The policy sets out prioritizes for Drinking Water, Irrigation, Hydro-power, Navigation and Industrial and other uses. The NWP 2002 was subsequently introduced in order to address the emerging issues and provide critical policy inputs. NWP 2002 gave emphasis for the first time to ecological and environmental aspects of water allocation. The National Water Policy (NWP 2012) calls for a common integrated perspective to govern planning and management of water resources. This considers local, regional, and national contexts and be environmentally sound. The Policy states that water needs to be managed as a common community resource that is held by the State under the public trust doctrine to ensure equitable and sustainable development for all. NWP 2012 has done away with water allocation prioritization but has emphasized on treating water, over and above the pre-emptive need for safe drinking water and sanitation, as an economic good. NWP 2012 also emphasizes the fact that the service provider role of the State has to be gradually shifted to that of a regulator of services and facilitator for strengthening the relevant institutions.

8.2.2. WATER RESOURCES IN KARNATAKA

Figure 86: River basins in Karnataka

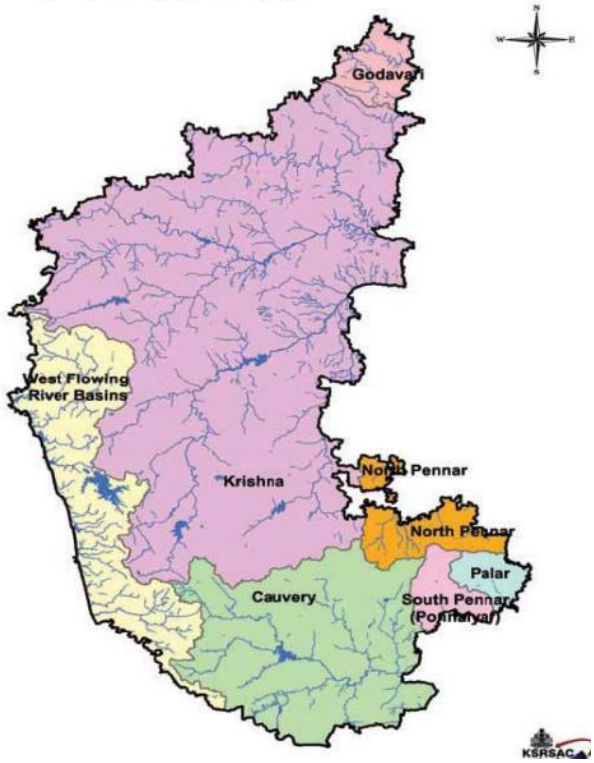


Table 67: Water Resources in Karnataka

Sl. No.	River Systems	Drainage Area	
		1000 sq. km	Percentage (%)
1	Godavari	4.4	2.3
2	Krishna	111.7	59.5
3	Cauvery	34.2	17.9
4	North Pennar	6.9	3.6
5	South Pennar	4.4	2.3
6	Palar	2.9	1.5
7	West Flowing Rivers	24.3	12.73

Source: Karnataka Water resource department

In Karnataka, river water is the primary source of drinking water supply for most ULBs, of which Krishna and Cauvery are the major ones. According to data from Karnataka Water Resource department, about 54% of the ULBs are benefited from the Krishna river basin and 36% from the Cauvery river basin. The other river basins cater to the remaining 10% of ULBs. Canals and reservoirs are the other sources of surface water with bore wells and open wells constituting the ground water sources. The major seven river systems in the State and the area drained by them are set out in the table to the left. For further details regarding the river basins in Karnataka refer to ***Annexure 8A***.

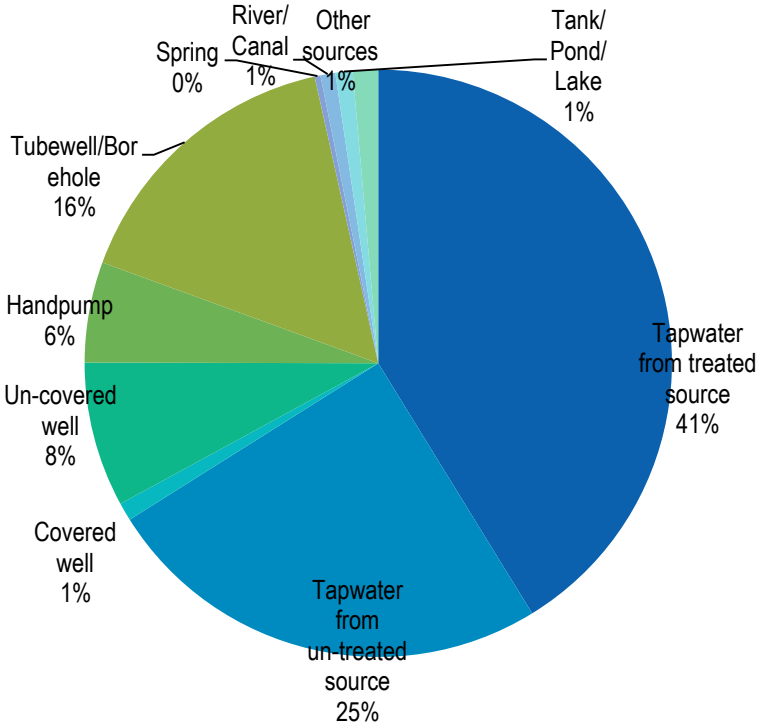
8.2.3. WATER SUPPLY IN KARNATAKA

It is estimated that the population for Karnataka for 2050 will be 59.90 million for rural areas and 21.08 million for urban areas. The total requirement for water is 150.31 thousand million cubic feet (TMC) for rural and 77.71 TMC for urban including the transmission and distribution losses of 30 %.

Water for Domestic Use

The total demand for the State including all areas can be conveniently taken as twice that of the demand for Krishna basin. Accordingly, the total requirement for domestic water needs for urban and rural population in Karnataka in 2050 is 456.04 TMC.[41] The breakdown of source wise water supply for domestic use is given below:

Figure 87: Source wise water supply in Karnataka



Source: Census 2011

According to data from census 2011, there were about 1.4 crores of households in Karnataka of which 17 lakh households were in urban areas. Approximately 80% of the urban households in Karnataka had access to tap water of which 68.4% had access to treated water while 12.9 % had access to untreated water. The sources of drinking water are:

- Tap water from treated source
- Tap water from un-treated source
- Covered well
- Uncovered well
- Hand pump
- Tube well/bore well
- Spring
- River/canal
- Tank/pond/lake
- Other sources

A detailed analysis of district wise data reveals that Kolar, Bidar, Udupi and Uttara Kannada have the lowest access to tap water and this is considerably lower than the state average of 80.4%. Of these districts, Udupi and Uttara Kannada are very water rich areas and people are predominately relying on private wells. Bidar (4.6%) and Kolar (18.6%) rely on other sources of water which are not safe. Districts such as Haveri, Vijayapura, Chamarajanagar and Chickballapura also depend on other sources of water. The above districts require

[41] Karnataka State Water Sector Reform: Current Status, Emerging Issues and Needed Strategies

interventions for providing households access to water. In several districts more than 10 % of water is being supplied through tube wells and hand pumps. These sources of water are not favourable as they put a huge stress on the environment. The table below provide details on the water supply in urban areas across districts.

Table 68: District Wise Water Supply Details in Urban Areas

District	Total number of households	Tap water (%)	Well water (%)	Hand pumps/ Tube wells (%)	Other Sources (%)
Belagavi	2,55,756	78.9	8.7	9.7	2.7
Bagalkot	1,16,631	72.4	1.3	22.4	3.9
Vijayapura	97,092	80.1	3.1	12.3	4.6
Bidar	76,141	55.7	27.2	12.4	4.7
Raichur	95,063	90.5	1.0	6.0	2.5
Koppal	46,179	87.3	0.3	11.1	1.3
Gadag	77,803	89.8	1.3	6.2	2.7
Dharwad	2,14,094	90.0	0.5	7.2	2.3
Uttara Kannada	93,109	42.0	56.6	5.4	2.0
Haveri	71,275	83.6	0.9	11.0	4.5
Ballari	1,90,321	94.5	0.3	3.8	1.4
Chitradurga	72,124	85.4	0.4	11.7	2.5
Davangere	1,31,911	84.9	0.4	11.6	3.1
Shivamogga	1,45,079	89.4	6.5	3.1	1.0
Udupi	71,765	29.0	64.1	5.8	1.1
Chikkamagaluru	56,839	89.0	1.7	8.3	1.0
Tumakuru	1,40,509	86.2	1.4	9.2	3.2
Bengaluru	21,69,428	80.1	0.8	15.7	3.3
Mandya	72,529	88.6	1.0	9.1	1.3
Hassan	89,381	88.5	0.4	10.5	0.5
Dakshina Kannada	2,04,485	63.1	29.7	6.4	0.8
Kodagu	19,794	79.3	13.7	6.1	0.9
Mysuru	2,86,767	94.4	0.1	4.3	1.1
Chamarajanagar	40,450	88.9	0.8	9.1	9.2
Kalaburagi	1,53,714	77.8	1.5	18.6	2.1
Yadgir	38,759	70.6	4.3	23.5	1.5
Kolar	1,04,745	68.1	1.6	11.8	18.6
Chickballapura	62,002	78.6	0.6	14.2	6.6
Bengaluru Rural	62,347	79.4	0.3	10.1	10.2
Ramanagaram	59,623	92.2	0.7	6.2	0.9
Karnataka Total	**53,15,715**	**80.4**	**4.7**	**11.8**	**3.1**

Source: Census 20

Water for industrial use

The water needs for industrial use in Karnataka have been estimated for Krishna Basin at 29.64 TMC in 2025 (4.59 TMC of groundwater and 25.06 TMC of surface water) and to 50.45 TMC in 2050 (4.22 TMC of groundwater and 46.23 TMC of surface water). The groundwater scarcity is largely responsible for shift to surface water for industrial use in the State. Though the areas other than Krishna basin approximately form 25 % of State's area, the industrial development is almost 50 % of the State. Thus, it can be hypothesized that the industrial use in Karnataka will be double the estimate for Krishna basin. Hence the total water use / demand for industry in the State is accordingly 59.28 TMC in 2025 and 100.9 TMC in 2050[42].

[42] Karnataka State Water Sector Reform: Current Status, Emerging Issues and Needed Strategies

8.2.4. COMPARATIVE ANALYSIS

According to data from the Directorate of Water Resources Information System, Karnataka has rivers and canals which are about 9000 Km in length. The complete details of the inland water resources across the country are given below:

Table 69: Inland Water Resources in India

State	River and Canals (in km)
Orissa	4500
Andhra Pradesh	11514
Karnataka	9000
Tamil Nadu	7420
West Bengal	2526
Kerala	3092
Uttar Pradesh	28500
Gujarat	3865
Maharashtra	16000
Arunachal Pradesh	2000
Rajasthan	5290
Madhya Pradesh	17088
Others	84415

Source: Water Resources Information system directorate

According to the report by Central Water Commission in 2013, total annual replenishable ground water potential of the country has been estimated at 431 billion cubic meters (BCM). Only 14 States comprise 91% of ground water potential. Among the States, Uttar Pradesh ranks first (17.5%) in terms of share of replenishable ground water resources followed by Maharashtra (8.3%), Madhya Pradesh (7.9%), Andhra Pradesh (7.8%), West Bengal (7.1%) and Assam (7.0%). Karnataka has 3.9% share with 16.81 BCM of annual replenishable ground water resources. With respect to access to piped water supply, Karnataka was 6th overall as per 2014 data. State wise details of number of habitation and population covered with piped water supply are set out in the table below:

Table 70: Urban Households with Access to Piped Water Supply

SL	State	Urban households (No)	Tap water (%)	Treated water (%)	Untreated water (%)
1	Jammu & Kashmir	517168	87.90	70.6	17.3
2	Himachal Pradesh	166043	95.50	93.3	2.2
3	Punjab	2094067	76.40	66.1	10.4
4	Chandigarh	228276	96.80	93.8	2.9
5	Uttarakhand	592223	78.40	72.7	5.7
6	Haryana	1751901	77.50	70.2	7.3
7	Delhi	3261423	81.90	75.8	6.1
8	Rajasthan	3090940	82.60	75.4	7.2
9	Uttar Pradesh	7449195	51.50	44.7	6.9
10	Bihar	2013671	20.00	15.1	4.9
11	Sikkim	35761	92.10	70.0	22.0
12	Arunachal Pradesh	65891	84.20	46.5	37.7
13	Nagaland	115054	35.70	6.0	29.7
14	Manipur	171400	56.30	50.9	5.4
15	Mizoram	116203	74.40	61.8	12.5
16	Tripura	235002	54.00	43.5	10.5
17	Meghalaya	116102	77.60	68.1	9.4
18	Assam	992742	30.20	27.4	2.8
19	West Bengal	6350113	55.60	50.0	5.7
20	Jharkhand	1495642	41.60	34.7	6.9
21	Odisha	1517073	48.00	42.1	5.9
22	Chhattisgarh	1238738	62.50	44.2	18.2
23	Madhya Pradesh	3845232	62.20	50.6	11.6
24	Gujarat	5416315	85.60	68.8	16.8
25	Daman & Diu	47631	72.60	48.7	23.9
26	D & N Haveli	37655	50.30	35.7	14.7
27	Maharashtra	10813928	89.10	85.7	3.4
28	Andhra Pradesh	6778225	83.50	75.5	8.0
29	Karnataka	5315715	80.40	68.4	12.0
30	Goa	198139	90.20	87.8	2.4
31	Lakshadweep	8180	16.90	11.7	5.2
32	Kerala	3620696	34.90	30.4	4.5
33	Tamil Nadu	8929104	80.30	66.3	14.0
34	Puducherry	206143	95.40	91.8	3.6
35	A & N Islands	34346	97.90	92.7	5.3

Source: Census 2011

8.2.5. PROJECTS IN THE SECTOR

Bulk water Supply projects

Each year the Karnataka Urban Water Supply and Drainage Board (KUWSDB) commissions 4 categories of projects. These are:
Category A- Schemes commissioned and to be completed in the current year
Category B- Schemes targeted for commissioning during the coming year
Category C- Schemes that are on going
Category D- New schemes proposed.

The bulk water schemes under these categories for year 2015-16 are as follows:

Table 71: Category-wise bulk water supply projects

Category A	Category B	Category C	Category D
Karwar Ankola	Yelburga	Channarayapatna	Saligrama
Banahatti	Bagalkote	Srinivasapura	Kappu
Chikkaballapura	Byadgi	Konnur	Manvi
Channagiri	Sagar	Belthangadi	Malavalli
Belur	Aurad	Deodurga	
Bailhongal	Hadagali	Kolar Malur Bangarpet	
Guledgudda	Bidar Remodelling	Manvi	
	Jamkhandi	Madikeri	
	Thirthahalli	Koppal	
	Bhadravathi	Siraguppa	
	Arasikere	Gangavathi	
		Haliyal	
		Shivamogga	
		Annigere	
		Shivamogga	
		Combined WSS to Ramanagara Channapatna	
		Mangaluru Vented Dam	
		Sandur	
		Honali	
		Hiriyur Challakere	
		Ron	

Source: KUWSDB

Over the years GoK has executed/is in the process of implementing a large number of urban drinking water supply projects. Karnataka Urban Water Sector Improvement Project (KUWASIP) has been the first successful project; following which several other projects are being implemented.

Karnataka Urban Water Sector Improvement Project (KUWASIP)

The World Bank assisted Karnataka Urban Water Sector Improvement Project (KUWASIP) is a project for reforms in water sector at the State and ULB levels. The primary objectives of the project are reforms and service improvements through private sector participation in water sector in Karnataka. For this purpose, three cities viz., Belagavi, Kalaburagi and Hubballi-Dharwad were selected for investments for improvement of water supply services. The total cost of project is Rs.237 Crores. The project has been implemented by the Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC), which is the nodal agency for implementing urban infrastructure projects in Karnataka State. The main objectives of the KUWASIP are:

- To initiate GoK's urban water and sanitation reform process based on the "Urban Drinking Water and Sanitation Policy Statement of GoK", and to improve urban water and sanitation services in the demonstration zone of the ULBs (Belagavi, Kalaburagi and Hubballi - Dharwad) where the project was implemented, and demonstrate that sustainable, efficient and commercially oriented service provision can be achieved through private sector participation.

The focus of KUWASIP is on improving water service management. The benefits would be:

- Continuous pressured water supply: Upgraded and modernized technical infrastructure would ensure people get pressurized water supply. This would lead to continuous water flow up to a height of 6 meters.
- Enhanced water quality: Quality checks would be performed at various points resulting in supply of improved quality of water.

For the water supply and distribution sector, the benefits would be:

- Efficient operations: Streamlining the various aspects of water supply and maintenance would result in increased efficiency of operations reducing the water losses.
- Increase in revenue collection: The participation of the private sector would ensure a streamlined billing procedure, thereby increasing revenue collection.

Based on the success of the KUWASIP and demand from the communities and City Corporations of Hubballi, Dharwad and Kalaburagi, Government accorded its approval for up-scaling 24x7 water supply to cover the entire Corporation areas of the three cities on PPP basis. Further, the Government has accorded approval to implement the up-scaled project called “Karnataka Urban Water Supply Modernization Project” (KUWSMP) with assistance from the World Bank. KUWSMP will be implemented in two phases viz., first phase to cater for the population by 2026 and subsequently, Phase-II to cater for the population by 2041. According to data from KUIDFC, Phase-I will be implemented at an estimated cost of US$ 279 million (Rs.1809 crores), with an assistance of US$ 187 million (Rs.1209 crores) from the World Bank. The KUWSMP will be implemented by the municipalities of the three cities, working in collaboration with KUIDFC. The municipalities, which will retain ownership of the water supply assets and control of the service delivery set up, intend to engage professional water supply operating company for twelve years to help them make the necessary improvements to the system, and to manage the refurbished system. Consultations are ongoing in the three cities as the major stakeholders work out the details of the operating model.

Projects under AMRUT

Twenty six cities are selected from the state of Karnataka for the mission. The table below provides details of the service level benchmarks in these cities

Table 72: SLBs for AMRUT cities

Indicator	Coverage of water supply connections (%)	Per capita supply of water (LPCD)	Extent of metering of connections (%)	Extent of non-revenue water (%)	Quality of water supplied (%)	Cost recovery in water supply services (%)	Efficiency in collection of water supply related charges (%)
Benchmark	100	135	100.0	20.0	100	100.0	90.0
Badami	60.0	100	0	35.0	80.0	50.0	45.0
Bagalkot	70.0	83	0	35.0	90.0	50.0	45.0
Ballari	71.0	125	0	40.0	90.0	60.0	55.0
Belagavi		120					
Bhadravathi	42.71	136	0	35.0	90.0	39.8	57.2
Bidar	24.0	89	0	35.0	73.0	60.0	55.0
Vijayapura	69.14	93.24	14.03	43.66	80.11	49.1	33.4
Chikkamagaluru	52.0	70	0	35	90.0	29.0	77.0
Chitradurga	67.0	85	27.0	45	90.0	22.0	22.0
Davangere	40.0	100	0	40.0	80.0	61.0	61.0
Hubballi-Dharwad		135					
Gadag		70.85					
Gangavathi	27.0	75	0	35.0	80.0	53.0	50.0
Kalaburagi							
Hasan	62.0	50	0	40.0	100.0	12.0	35.0
Hosapete	70.0	104	0	35.0	83.0	60.0	55.0
Kolar	33.0	46	0	35.6	60.0	10.0	50.0
Mandya	90.0	70	0	44.0	100.0	36.0	36.0
Mangaluru							
Mysuru	71.0	122	34.0	66.0	100.0	40.0	70.0
Raichur	36.0	76	0	35.0	80.0	60.0	55.0
Ranebennur	60.83	106	0	18.8	90.0	32.6	35.7
Robertsonpet	30.0	35	0	35.0	60.0	8.0	29.0
Shivamogga	92.0	155	9.0	35.0	97.0	88.2	84.8
Tumakuru	47.0	86	0	40.0	88.0	42.0	61.0
Udupi	59.0	104	9.0	30.0	100.0	90.0	80.0

Source: KUWSDB

AMRUT is expected to bring in investment in water supply projects across 26 cities of Karnataka. The table below indicates the amount of investment expected for each city

Table 73: City- wise investment s required under AMRUT

City Name	Rs. crores
Badami	8.34
Bagalkot	72.31
Ballari	70
Belagavi	NA
Bhadravathi	55
Bidar	40.8
Vijayapura	156
Chikkamagaluru	102.57
Chitradurga	112
Davangere	100
Dharwad	NA
Gadag	NA
Gangavathi	25
Kalaburagi	NA
Hassan	117
Hosapete	52
Kolar	7
Mandya	114.48
Mangaluru	NA
Mysuru	156
Raichur	57
Ranebennur	92.51
Robertsonpet	53.72
Shivamogga	42
Tumakuru	38
Udupi	88
Total	1560

Source: KUWSDB

The regulatory framework for Water Supply is as shown below in the table:

Table 74: Regulatory framework for Water Supply

Sl.no	Regulatory Framework	Details
1.	National Water Policy of India, 2012	The policy is formulated by the Ministry of Water Resources of the Government of India to govern the planning and development of water resources and their optimum utilization
4.	Karnataka Urban Water Supply and Drainage Board Act, 1973	The purpouse of the act is to undertake the investigation, preparation and execution of schemes for the regulation and development of drinking water and drainage facilities in all urban areas of Karnataka
5.	Bangalore Urban Water Supply and Sewerage Board Act, 1964	The purpouse of the act is to make provisions for Water supply, Sewerage & disposal of Sewage in Bengaluru metropolitan area
6.	GoK Policy on Urban Drinking Water and Sanitation (2002)	A policy to provide water supply and sanitation facilities to all residents of urban areas
7.	GoK Water Policy (2002)	A policy by the Water Resources Department takes cognizance of the depleting water resources and the need for water conservation/management in the State
7.	Associated Offices - State	• Krishna Bhagya Jala Nigam Limited • Karnataka Neeravari Nigam Limited • Cauvery Neeravari Nigam Limited • Karnataka Urban Water Sector Improvement Project (KUWASIP)

8.2.6. SUMMARY

With increasing population and a growing economy, it is pertinent to have a sustainable infrastructure for water in India. Schemes like AMRUT and KUWASIP will help improve service levels of water supply for the end user. However, it is important that water as a resource needs to be carefully utilized. With increasing population, Karnataka has witnessed depletion of groundwater reserves. To counter this, Government of Karnataka had introduced groundwater control measures to protect drinking water sources. The Karnataka Groundwater Act of 1999 imposes restriction on sinking of wells within a distance of 500 metres from a public drinking water source without the permission of an appropriate authority. According to data from Central Ground Water Board, Karnataka has 15.93 BCM of annual replenishable Ground water resource. However, about 65 talukas are over exploiting the ground water leading to severe depletion. Census 2011 data shows that Karnataka covers 80.4 % of the urban households with piped water supply as compared to the Indian average of 70.6%. However, there is still a large gap to be filled with regard to providing sustainable water supply to 20 % of the urban households of Karnataka. Due to the presence of IT, ITeS, automobile, hardware and hi-tech industries in Cauvery basin, there is a high demand for water. Increased demand for potable water will increase substantially due to large scale employment by hi-tech / IT industries in Bengaluru & Mysuru districts in Cauvery basin. A similar surge in demand will be experienced in other basins in Karnataka due to increasing industrialization.

In order to achieve the required services level the key interventions are in the area of bulk water supply and distribution, reduction of non-revenue water and other losses and provision of 24/7 water supply in towns and cities. All these projects are aimed at achieving the service level benchmarks prescribed by the Ministry for Urban Development, Government of India. The likely investments in the sector are to the tune of Rs. 4500 Crores; the breakdown of which is set out in the table below;

Table 65: Investments in Water Supply

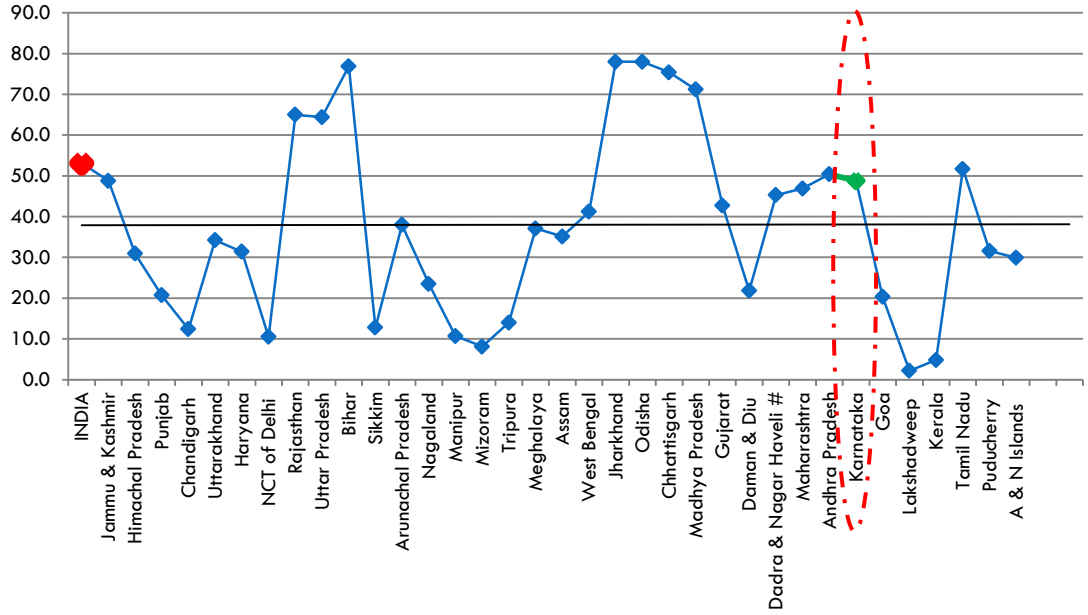
Project	Investment in Rs. crores
KUWASIP- Phase I	1809
KUWASIP Phase II	1209
Bulk Water Supply	NA
AMRUT	1560
Total	**4578**

8.3. SANITATION AND SEWERAGE

8.3.1. BACKGROUND TO THE SECTOR

The national sanitation coverage and the open defecation were estimated to be about 46.9% and 49.2% respectively according to the Census of India.[43] This indicates that nearly 31 million urban households (including slums) have inadequate sanitation facilities across the country. Also, nearly half of India's 1.2 billion people do not have access to sanitation facilities at home. Similarly, one fourth of the urban population in India lacks access to safe sanitation facilities and only 30% to 40% are served by sewerage and wastewater treatment systems.[44] The graph below indicates the percentage of households in India which do not have latrine facilities within the premises:

Figure 88: Households without latrine facility within premises



Source: Census of India 2011

The following sections will talk about the current status of sanitation as well as underground drainage systems with respect to Karnataka State.

The water and sanitation sector in Karnataka has undergone changes over the last few decades resulting in incremental improvements over time. Despite such initiatives there still is a lot to be achieved in terms of quality and sustainable services to all segments of the society. A majority of the urban poor still live in deplorable conditions, characterised by lack of access to basic services such as water, sanitation, roads and health care. In Karnataka, the Government of Karnataka (GoK) through urban local bodies in the State, the Karnataka Urban Water Supply &

[43] Indian census (2011) conducted for enumerating households and population (done once in every 10 years) by the office of Registrar General and Census Commissioner, Ministry of Home Affairs, Government of India
[44] Training Programme, Context to Achieving Universal Sanitation In India, Administrative Staff College of India, Ministry of Urban Development, February 2012

Drainage Board (KUWSDB) and BWSSB have undertaken several initiatives to bridge the gap in demand and available sanitation services.

Census 2011 – on-ground status of the facilities:

It has been noted that open defecation is widely prevalent in many cities and towns undermining environmental sanitation and public health. Inadequate access to sanitation especially in urban slum settlements is one of the key impediments to improvement in the quality of life, public health outcomes and urban productivity. Lack of adequate sanitation facilities and unscientific disposal of waste has led to contamination of surface and ground water and recurrence of diseases among people.

India has seen a series of reforms related to improving urban development with the economic liberalization since 1991 and passing of the 74th Constitutional amendment in 1992[45]. However, such reforms seem to have been uneven among States and cities as evident from the differences in the current sanitation levels. Safe drinking water and sustainable sanitation services continue to be the challenges faced by the administrators of many cities. In Karnataka, with the current spurt in the growth of urban centres, it is pertinent to look into the level of basic urban services being provided and over time extended to the ever growing population. Although, Karnataka has made significant progress in the water supply and sanitation sector over the years, two main targets of fulfilling backlog requirements and meeting the sanitation needs of current and future population; pose a major challenge.

Swachh Bharat Mission (SBM)

Swachh Bharat Mission or Clean India Mission is a national campaign by the Government of India, covering 4041 statutory towns, to clean the streets, roads and infrastructure of the country.

However, the mission is not just about cleaning up of roads. The more specific objectives of the mission are:

- Ensure solid and liquid waste management through gram panchayats.
- Construct individual, cluster and community toilets.
- Eliminate or reduce open defecation. Open defecation is one of the main causes of deaths of thousands of children each year.
- Construct latrines and work towards establishing an accountable mechanism of monitoring latrine use.
- Create public awareness about the drawbacks of open defecation and promotion of latrine use.
- Recruit dedicated ground staff to bring about behavioural change and promotion of latrine use.
- Change people's mind-set towards proper sanitation use.
- Keep villages clean.
- Development of modern and scientific municipal solid waste management.
- Lay water pipelines in all villages, ensuring water supply to all households by 2019.

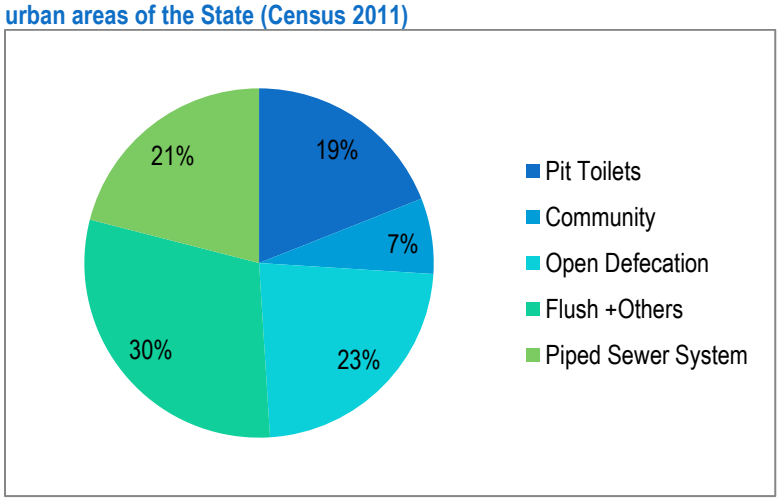
[45] Amendment to the Constitution of India (Supreme law of India) enacted in 1950 which includes statutory provisions for Local Administrative bodies (ULBs) as third level of administration in urban areas such as towns and cities

8.3.2. CURRENT STATUS OF SANITATION IN KARNATAKA

The census 2011 shows that the urban areas of the State have a mix of different systems of household sanitation facilities. There are toilets connected to the underground drainage, septic tanks or the pit latrines. The households with no toilet facility either use a community toilet or end up with the practice of open defecation.

The figure below sets out the % of households having access to sanitation in urban areas of the State.

Figure 89: Percentage of households having access to sanitation in the urban areas of the State (Census 2011)



Source: Census 2011

In terms of sanitation in urban areas, about 70% of households in Karnataka have latrines, 7% use public toilets and remaining 23% of households resort to open defecation. Only 21% of the households are connected to the drainage system and the others are serviced by on-site sanitation systems.

As of 2009, the proportion of urban households having bathrooms and latrines within the house in the State was 79.1% and 75.2% respectively. This indicates that nearly 25% households needed to be provided with toilets. It was estimated that the coverage of toilets was below 50% in the five districts of Gadag (33.5%), Bagalkot (33.7%), Koppal (39.4%), Raichur (43%) and Vijayapura (43.2%). [46] In respect to drainage connectivity for waste water outlet in urban households, it was observed that 19% lacked access to any kind of drainage facility, 41.6% had closed drainage and 39% had open drainage.

[46] Infrastructure Gaps, Urban Development Policy, Urban Development Department, Government of Karnataka, 2009

8.3.3. COMPARATIVE ANALYSIS

As per recent data analysed by the World Health Organization (WHO) and UNICEF, around 1.1 billion people globally do not have access to improved water supply sources whereas 2.5 billion people do not have access to any type of sanitation facility. The most affected people in developing countries, living in extreme conditions of poverty are typically peri-urban dwellers or rural inhabitants. The following graph provides a comparison of water and sanitation indicators in Karnataka, vis-a-vis other states and Indian average.

The following table provide an overview of the best and worst performing States in India, in terms of sanitation facilities.

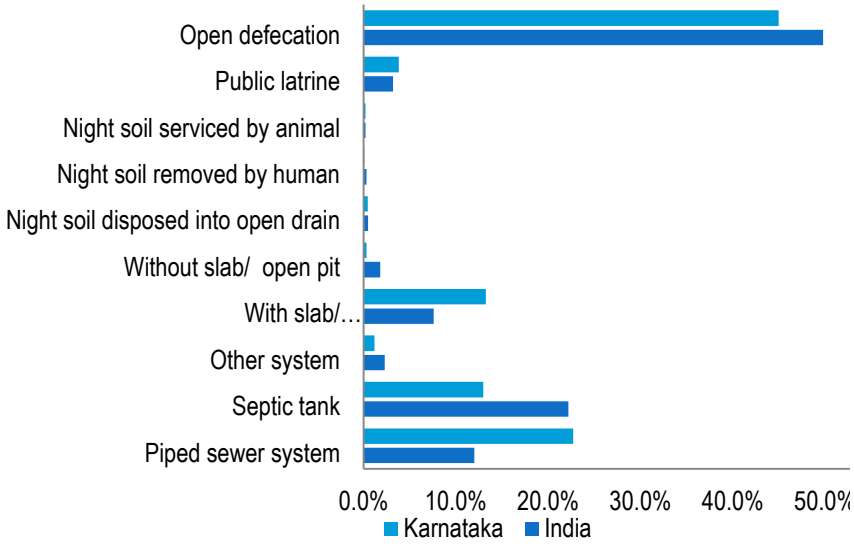
Table 75: Overview of the best and worst performing States in terms of sanitation facilities

Parameter	State/s scoring highest		State/s scoring lowest	
	Name of State	% coverage of population	Name of State	% coverage of population
Water available within premises	Chandigarh	86.0	Manipur	16.0
Water available near the premises	Tamil Nadu	58.0	Punjab	10.0
Latrine facility available within premises	Lakshadweep	97.8	Jharkhand & Odisha	22.0
Use of Public latrines	Maharashtra	13.0	Lakshadweep	0.4
Open defecation	Jharkhand	77.0	Lakshadweep	1.8
Non-availability of closed drainage	Assam & Tripura	3.6	Chandigarh	8.7
No drainage facility	Odisha	81.0	Chandigarh	4.0

Source: India Census 2011 report

In order to get a better understanding of Karnataka's sanitation infrastructure a comparative analysis has been carried out and is presented in the figure below:

Figure 90: Status of Sanitation (Karnataka vis-à-vis India)



Source: Indian Census 2011

The table given below sets out the availability of sanitation infrastructure across the States in India (Households – Urban and Rural)

It can be observed that though Karnataka stands above several States with respect to sanitation in India and there is still scope for development.

Table 76: Comparative Details of Sanitation Infrastructure across India (%)

State	Water available within the premises	Water available near the premises	Water available far away	Latrine facility Available within premises	Latrine Not available within premises	Public latrine	Open defecation	Closed drainage	Open drainage	No drainage
Jammu & Kashmir	48.2	28.7	23.1	51.2	48.8	2.7	46.1	12.6	35.3	52.2
Himachal Pradesh	55.5	35.0	9.5	69.1	30.9	1.2	29.7	24.8	40.4	34.8
Punjab	85.9	10.0	4.1	79.3	20.7	1.2	19.5	27.9	57.0	15.2
Chandigarh	86.2	11.7	2.2	87.6	12.4	9.1	3.2	87.2	8.7	4.1
Uttarakhand	58.3	26.6	15.2	65.8	34.2	1.1	33.1	19.0	42.1	38.9
Haryana	66.5	21.4	12.1	68.6	31.4	1.5	29.8	21.1	65.2	13.7
NCT of Delhi	78.4	15.4	6.2	89.5	10.5	7.2	3.3	59.2	36.6	4.2
Rajasthan	35.0	39.0	25.9	35.0	65.0	0.7	64.3	10.7	30.8	58.5
Uttar Pradesh	51.9	36.0	12.1	35.7	64.4	1.3	63.0	12.9	56.1	31.1
Bihar	50.1	37.9	12.0	23.1	76.9	1.1	75.8	6.7	35.6	57.7
Sikkim	52.6	29.7	17.7	87.2	12.8	1.5	11.3	14.6	38.1	47.3
Arunachal Pradesh	41.1	37.4	21.6	62.0	38.0	3.2	34.8	6.0	27.1	66.9
Nagaland	29.3	42.4	28.3	76.5	23.5	7.0	16.5	4.8	45.4	49.8
Manipur	16.1	46.2	37.8	89.3	10.7	1.8	8.9	4.1	48.8	47.2
Mizoram	31.2	46.7	22.2	91.9	8.1	1.5	6.6	13.1	46.5	40.4
Tripura	37.1	30.5	32.4	86.0	14.0	2.5	11.5	3.7	22.9	73.4
Meghalaya	24.1	43.2	32.7	62.9	37.1	2.8	34.3	5.7	29.6	64.7
Assam	54.8	26.7	18.5	64.9	35.1	1.9	33.2	3.6	16.8	79.6
West Bengal	38.6	34.7	26.6	58.9	41.2	2.5	38.6	9.2	22.4	68.4
Jharkhand	23.2	44.9	31.9	22.0	78.0	1.0	77.0	7.2	22.3	70.5
Odisha	22.4	42.2	35.4	22.0	78.0	1.4	76.6	4.3	15.0	80.7
Chhattisgarh	19.0	54.5	26.5	24.6	75.4	1.4	74.0	5.3	18.9	75.8
Madhya Pradesh	23.9	45.6	30.5	28.8	71.2	1.2	70.0	9.8	30.1	60.1
Gujarat	64.0	23.5	12.4	57.4	42.7	2.3	40.4	37.3	9.4	53.3
Daman & Diu	76.4	22.1	1.5	78.2	21.8	11.3	10.5	39.0	26.1	34.8
Dadra & Nagar	52.6	36.4	11.0	54.8	45.3	5.3	40.0	27.0	10.9	62.1

State	Water available within the premises	Water available near the premises	Water available far away	Latrine facility Available within premises	Latrine Not available within premises	Public latrine	Open defecation	Closed drainage	Open drainage	No drainage
Haveli										
Maharashtra	59.4	27.6	13.1	53.1	46.9	12.9	34.0	33.2	34.2	32.5
Andhra Pradesh	43.2	37.3	19.5	49.6	50.4	2.5	48.0	21.6	35.4	43.1
Karnataka	**44.5**	**37.3**	**18.2**	**51.2**	**48.8**	**3.8**	**45.0**	**26.1**	**34.6**	**39.3**
Goa	79.7	15.5	4.8	79.7	20.3	3.9	16.4	43.7	25.1	31.2
Lakshadweep	83.7	14.3	2.0	97.8	2.2	0.4	1.8	11.4	13.0	75.6
Kerala	77.7	14.1	8.2	95.2	4.8	1.1	3.8	25.3	21.2	53.6
Tamil Nadu	34.9	58.1	7.0	48.3	51.7	6.0	45.7	25.4	24.9	49.8
Puducherry	77.4	21.5	1.1	68.5	31.6	4.4	27.1	24.3	43.8	31.9
A & N Islands	60.6	27.0	12.4	70.1	29.9	2.5	27.5	7.4	44.5	48.1

Source: Indian Census 2011

Status in AMRUT Towns in Karnataka

The table below sets out the availability of sanitation infrastructure across the AMRUT cities, in the States.

Table 77: Comparative Details of Sanitation Infrastructure across AMRUT cities in Karnataka (%)

	Households not having latrine facility within the premises (%)	Households having tap water connections (%)	HHs having Septic tank (%)	HHs using improved Pit latrine (%)	Night soil not disposed into open drain (%)	HHs not resorting to Open defecation (%)	Jetting /suction machines available/1000 households (%)	Slum households (%)	Households having latrine (%)
Badami (TMC)	53	95	11	82	100	86	0	72	37
Bagalkot (CMC)	63	65	30	99	100	77	4	83	28
Belagavi (M Corp. + OG)	93	87	26	67	99	96	1	90	76
Ballari (M Corp.)	70	97	5	84	98	78	0	79	54
Bhadravati (CMC)	79	95	19	99	99	90	3	71	58
Bidar (CMC + OG)	80	39	45	43	92	82	3	71	62
Vijayapura (CMC)	74	87	9	70	100	82	2	91	46
Chikkamagaluru (CMC)	94	84	11	99	100	95	7	91	90
Chitradurga (CMC + OG)	83	89	6	97	99	86	13	78	60
Davangere (M Corp.)	87	85	2	94	99	89	4	87	66
Gadag-Betigeri (CMC)	55	85	31	74	99	78	3	79	17
Gangawati (CMC + OG)	46	82	36	90	100	74	9	58	29
Kalaburagi (M Corp. + OG)	84	77	22	40	97	86	1	90	51
Hassan (CMC + OG)	95	86	6	100	100	97	3	84	92
Hosapete (CMC)	75	87	11	99	100	84	5	74	60
Hubballi-Dharwad (M Corp.)	86	90	14	93	100	91	1	81	71
Kolar (CMC)	95	78	10	98	99	96	3	79	92
Mandya (CMC)	92	82	6	97	98	94	9	80	71
Mangaluru (M Corp. + OG)	98	77	47	99	100	99	2	98	96
Mysuru (M Corp. + OG)	98	97	1	81	100	99	0	96	80
Raichur (CMC)	58	94	17	65	96	69	2	75	31
Ranibennur (CMC)	71	90	32	89	100	80	9	96	44

	Households not having latrine facility within the premises (%)	Households having tap water connections (%)	HHs having Septic tank (%)	HHs using improved Pit latrine (%)	Night soil not disposed into open drain (%)	HHs not resorting to Open defecation (%)	Jetting /suction machines available/1000 households (%)	Slum households (%)	Households having latrine (%)
Robertson Pet (CMC + OG)	61	35	14	89	97	87	6	88	54
Shivamogga (CMC)	91	94	29	99	99	93	1	81	80
Tumakuru (CMC)	91	92	20	98	100	93	1	83	80
Udupi (CMC + OG)	97	37	70	100	100	98	3	95	95

Source: KUWSDB

A comparative analysis of SLBs as set out in the SLIP developed by AMRUT cities for sanitation sector is set out in the table below.

Table 78: SLBs for AMRUT towns

Indicator	Coverage of latrines: individual or community (%)	Coverage of sewerage network services (%)	Efficiency of collection of sewerage (%)	Efficiency in Treatment: adequacy of sewerage treatment capacity (%)
Benchmark	**100**	**100**	**100**	**100**
Badami	80	85	60	90
Bagalkot	94	57	50	70
Ballari	77.7	80.9	90.9	90
Belagavi	93.5	53	60	0
Bhadravathi	87.04	0	28.43	28.76
Bidar	53	0	0	0
Vijayapura	not available	not available	not available	not available
Chikkamagaluru	not available	not available	not available	not available
Chitradurga	not available	not available	not available	not available
Davangere	80	70	60	0
Hubballi-Dharwad	65.85	45.15	45.94	58.64
Gadag	63.6	0	0	112.5
Gangavathi	75	22	0	0
Kalaburagi	84.09	34.22	23.86	34.05

Indicator	Coverage of latrines: individual or community (%)	Coverage of sewerage network services (%)	Efficiency of collection of sewerage (%)	Efficiency in Treatment: adequacy of sewerage treatment capacity (%)
Hasan	not available	not available	not available	not available
Hosapete	15	45	36	0
Kolar	80	72	84	63
Mandya	97	60	70	100
Mangaluru	100	35	24	59
Mysuru	not available	not available	not available	not available
Raichur	58	18	5	0
Ranebennur	not available	not available	not available	not available
Robertsonpet	80	0	0	0
Shivamogga	98.33	43.28	0	0
Tumakuru	96	29	18	49
Udupi	100	17	25	62.5
Average of all towns	**79.9**	**41.3**	**37.2**	**43.7**

Source: KUWSDB

8.3.4. PROJECTS AND INVESTMENT

State Annual Action Plan (SAAP) based on the Service Level Improvement Plans (SLIPs) submitted by the ULBs is approved by the MoUD, GoI for FY 2015-16 is as follows.

Table 4: AMRUT funds for FY 2015-16 for Sewerage improvement in Karnataka cities

Name of the ULB	Name of the Project	Funds as per SAAP of Karnataka as approved by MoUD, GoI FY 2015-16 for Sewerage (Rs. Cr)
Badami	Providing Sewer network	4
Bagalkot	Providing HSC to existing network	2.5
Ballari	Providing and laying of 50 Km new Sewer line and Rehabilitation of existing sewer network	36.25
Belagavi	Providing Sewer network	60
Bhadravathi	efficiency in collection and treatment	6
Bidar	Laying of sewerage network in non-covered area/zones for a length of 37 km with road restoration	22
Vijayapura	-	-
Chikkamagaluru	-	-
Chitradurga	-	-
Davangere	Providing Sewer network	10
Dharwad	Providing Sewer network	75
Gadag	UGD Scheme to Gadag-Betageri city	45
Gangavathi	Providing and laying of Sewer network for around 8 km with road restoration	9
Kalaburagi	Sewers and allied works - 110 km	66
Hassan	-	-
Hosapete	Laying of sewerage network in non-covered area/zones in 25 km with road restoration.	12
Kolar	Efficiency in treatment	15
Mandya	Remodelling of existing sewer network	4
Mangaluru	-	-
Mysuru	-	-
Raichur	Laying of sewerage network in non-covered area/zones in 30 km with road restoration.	37.9
Ranebennur	-	-
Robertsonpet	Efficiency in treatment	5
Shivamogga	Rehabilitation of existing systems	13
Tumakuru	Providing, laying sewer laterals (40 km) to Provide HSC in the 1st Stage	10
Udupi	-	-

Source: KUWSDB

The regulatory framework for sanitation and sewerage is as shown below in the table:

Table 79: Regulatory framework for Sanitation and Sewearge

Sl.no	Regulatory Framework	Details
1.	Swachh Bharat Mission	The objectives of the mission are: • Ensure solid and liquid waste management through gram panchayats. • Construct individual, cluster and community toilets. • Eliminate or reduce open defecation. Open defecation is one of the main causes of deaths of thousands of children each year. • Construct latrines and work towards establishing an accountable mechanism of monitoring latrine use. • Create public awareness about the drawbacks of open defecation and promotion of latrine use. • Recruit dedicated ground staff to bring about behavioural change and promotion of latrine use. • Change people's mind-set towards proper sanitation use. • Keep villages clean. • Development of modern and scientific municipal solid waste management. • Lay water pipelines in all villages, ensuring water supply to all households by 2019
2.	Associated Offices - State	• Urban Local Bodies in the State • Karnataka Urban Water Supply & Drainage Board • BWSSB

8.3.5. SUMMARY

In India sanitation and sewerage is an inadequately addressed service. Most households in urban areas including those in Karnataka have poor access to toilets and centralised sewerage systems. In AMRUT cities the percentage of households with access to a toilet within premise ranges from 50% to 98%. Also, the sewerage coverage across AMRUT cities ranges from 0 to 80%. This signifies that the status of sanitation and sewerage across cities in Karnataka are not at the same level. There is clearly a need for interventions in the sector as no city including Mysuru, the cleanest city in the country is able to achieve the Ministry of Urban Development, Government of India prescribed Service Level Benchmarks. The total allocation for the sector as part of AMRUT is to the tune of Rs. 612.65 crores for the year 2015-16. Over the next five years, a total investment of 2266.97 is expected in the sector.

It is important to note that most sanitation schemes in India are focused on increasing access to toilets and improving the coverage of UGD networks in cities. However, in order to improve sanitation outcomes of a city it also important to focus on developing STPs and improving sewage collection and treatment. Improper disposal of sewage is a key concern in most cities very illegal dumping in local lakes and nallas is common. There is a need for state to be more holistic in its approach while planning intervention in this sector.

8.4. SOLID WASTE MANAGEMENT

8.4.1. BACKGROUND TO SECTOR

Solid waste management is one of the obligatory functions of the urban local bodies in the country under 12th schedule of the 74th constitutional amendment. The collection, transportation, treatment, safe disposal and reuse of all the solid waste produced in the city are the responsibilities of the urban local body.

Effective municipal solid waste management ensures clean environment, thereby has positive externalities on public health. Therefore it becomes one of the most important functions to be performed by the local body for the well-being of the society. However, the performance of our cities is visibly poor in this area. Besides the methods adapted for solid waste management are unscientific in most of the cases. Our cities face a problem where even the adapted unscientific methods are not implemented properly, resulting in garbage black spots and litters in the cities. With the ever growing population in the urban centres, the amount of waste generated is also increasing. Economic development results in improved living standards and the per capita waste generation increases. This adds to the problem, as the cities often fail to raise the capacities of its MSW infrastructure. Also, effective solid waste management in Indian cities demands considerable amount of behavioural change among the citizens in order to check the practices like littering and burning garbage.

National Urban Sanitation Policy 2008

The policy to ensure clean and liveable environments for the citizens was part of the Environment Protection Act 1986. The Municipal Solid Wastes (Management and Handling) Rules, 2000 (MSW 2000) followed to lay down the compliance criteria. The first dedicated policy for urban sanitation, the National Urban Sanitation Policy (NUSP) was formed in 2008, with a vision for the cities to become totally sanitised, healthy and liveable. The NUSP suggests preparing City Sanitation Plans, complete with situation analysis, institutional and financial mapping, sanitation and solid waste sector analysis, strategy and approach to ensure total sanitation in the city and financing the action plan. The projects proposed in the City Sanitation Plan were funded through JnNURM and other sources of State and ULB funding.

Several cities in Karnataka have already prepared the City Sanitation Plan and started taking a comprehensive and systematic problem solving approach towards dealing with the issues related to solid waste management and sanitation. Under this, the cities are encouraged to explore the decentralised waste management approach by developing Decentralised Processing Units (DPU) and Dry Waste Collection Centre (DWCC) wherever the land and other resources are available, in order to reduce the operation and maintenance cost and stress on the existing infrastructure. Presently, the twenty six AMRUT cities in the State have 8 Decentralised Processing Units (DPU) and twenty three Dry Waste Collection Centres (DWCC). These have an approximate capacity of handling waste of about 5 tons each.

Municipal Solid Wastes (Management and Handling) Rules, 2000

GoI has issued Municipal Solid Wastes (Management and Handling) Rules, 2000, has laid down the compliance criteria for handling the waste and the specification for disposal sites and composting, incineration etc. The roles of pollution control board to monitor the compliance of the standards are also mentioned.

Table 80: Agencies and authorities involved in ensuring compliance to Municipal Solid Waste Rules, 2000

Agency / Authority	Responsibility
Municipal Authorities	Ensuring that municipal solid wastes to be handled as per rules, Seeking authorization from State Pollution Control Board (SPCB) for setting up waste processing and disposal facility includes landfills.
State Government	
Secretary In-Charge of Department of Urban Development	Overall responsibility for the enforcement of the provisions of the rules in the metropolitan cities.
District Magistrates/ Deputy commissioner	Overall responsibility for the enforcement of the provisions of the rules within the territorial limits of their jurisdiction.
Central Pollution Control Board (CPCB)	Co-ordinate with State Boards and Committees with reference to implementation and review of standards and guidelines and compilation of monitoring data. Laying down standards on waste processing/ disposal technologies including approval of technology.
State Pollution Control Board (SPCB)	Monitor the compliance of the standards regarding ground water, ambient air leachate quality and the compost quality including incineration standards as specified Issuance of authorization to the municipal authority or an operator of a facility stipulating compliance criteria and standards.

Source: iDeck

Karnataka State Policy on Integrated Solid Waste Management

Karnataka formulated a State policy on Integrated Solid Waste Management in the year 2000. The objectives of the policy are:

- Providing directions for carrying out waste management activities in a manner which is not just environmentally, socially and financially sustainable but is also economically viable;
- Establishing an integrated and self-contained operating system for MSWM which would include the development of appropriate means and technologies to handle various waste management activities.
- Enhancing the ability of the ULBs to provide waste management services to their citizens.

The normative standards and procedure for collection, storage and transportation of MSW and guidelines for establishment and operations of treatment and landfill facilities in the towns of Karnataka are suggested as part of the policy.

8.4.2. STATUS OF THE CITIES IN THE STATE

Karnataka has 218 ULBs excluding BBMP. The State generates 5197.2 TPD of solid waste every day, and the treatment facility is available only for 38% of this waste (1975.5 tons). 207 out of the 213 ULBs have landfill sites. Presently about 4800 tons of solid waste is generated every day from 218 ULBs in the State of Karnataka, of which 2917 tons (56%) is generated by the 26 AMRUT cities. Of the 26 cities, all of the cities except Vijayapura, Kolar and Tumakuru have acquired landfill sites. However, these sites are under capacity, i.e., the waste produced in the cities is more than the capacity of the land fill / centralised processing facility. Of the 2917 tons generated, only 34% (1013 tons) of the waste reach centralised processing facility.

Table 81: Existing status of Solid waste processing in AMRUT cities

Name of the ULB	Total quantity of Waste generated (in TPD)	Existing Status	
		Centralised processing (in TPD)	Decentralised Processing Unit (DPU) / Dry Waste Collection Centre (DWC)
Vijayapura	14	0	0
Chitradurga	49	40	NIL
Davangere	140	0	4DWC
Kolar	48	0	4DPC & 1DWC
Robertsonpet	50	0	NIL
Bhadravati	52	10	0
Shivamogga	98	50	1DPC(1TPD)
Tumakuru	120	100	4DWC(UP)
Chikkamagaluru	42	11	NIL
Mangaluru	250	170	1DWC& 2TPD(Biometh)
Hassan	47	0	15TPD(3ZWM)
Mandya	48	70	NIL
Mysuru	400	200	9ZWM(40TPD)
Udupi	44	40	1DWC (4 DWC sites identified)
Badami	8	3	NIL
Bagalkot	39	27	NIL
Belagavi	195	210	NIL
Vijayapura	131	20	NIL
Hubballi-Dharwad	400	0	NIL
Gadag-Betegeri	74	40	1DWC
Ranebennur	40	4	NIL
Bidar	75	15	8DWC
Ballari	164	0	1DWC
Hosapete	72	0	1DWC
Kalaburagi	190	0	NIL
Gangavati	37	10	NIL
Raichur	90	30	1DWC
Total	**2917**	**1050**	

Source: DMA, GoK

Though the site for landfill is procured for 24 towns, the basic amenities for the landfill as per the standards are developed only in 10 towns. All the towns in the State are asked to prepare Detailed Project Reports (DPRs) on municipal solid waste management under Swachh Bharat Mission. Seven municipalities have submitted the DPRs and the same has been placed before the high powered committee (HPC) for approval.

8.4.3. INVESTMENT AND PROJECTS IN THE SECTOR

State Finance Commission (SFC) Grants:

Table 82: SFC grants for solid waste management provided to ULBs

Name of the ULB	Grants for Solid Waste Management in 2014 - 15 (in lakhs)	Grants for Solid Waste Management in 2013 - 14 (in lakhs)
Badami	4.5	6.0
Bagalkot	12.0	17.0
Belagavi	22.5	120.0
Ballari	22.5	70.0
Bhadravati	14.5	27.0
Bidar	24.5	27.0
Chikkamagaluru	12.0	17.0
Chitradurga	94.5	227.0
Davangere	22.5	70.0
Gadag-Betegeri	13.0	35.0
Gangavati	12.0	17.0
Hassan	12.0	27.0
Hosapete	164.0	85.0
Hubballi-Dharwad	25.0	70.0
Kalaburagi	160.0	70.0
Kolar	0	77.0
Mandya	35.5	17.0
Mangaluru	22.5	70.0
Mysuru	210.0	530.0
Raichur	0	17.0
Ranebennur	12.0	17.0
Robertsonpet	14.5	17.0
Shivamogga	24.0	18.0
Tumakuru	24.0	28.0
Udupi	22.0	17.0
Vijayapura	24.0	28.0
Total	**1004.0**	**1721.0**

Source: DMA, GoK

At present, implementation of SWM Programme is being taken up under SFC grants, 13th finance commission grants, Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), Chief Minister's Small and Medium Towns Development Programme (CMSMTDP) etc. Apart from the above, Rs. 100 crores was allocated in the State Budget 2013-14 for SWM Programme, out of which Rs. 51.82 crores of grants has already been released to concerned ULBs. In the 2014-15 Budget, Rs. 75.00 crores of grants was allocated for SWM activities, out of which Rs. 36.59 crores of grants has been already released to ULBs. The funds allocated to the twenty six AMRUT cities in the State are as given below.

The following major activities have been taken up under MSWM programme.

- Procurement of landfill site.
- Development of basic Infrastructures (approach road, compound wall, watchman shed, bore well, tree plantation etc.), Waste Processing and Disposal facilities at Landfill site.
- Procurement of Tools, Equipment, machineries and vehicles.
- IEC Programme.

Swachh Bharat Mission (SBM)

Swachh Bharat Mission was launched on 2nd October 2014, in order to carry out the activities envisaged under NUSP in a mission mode. The mission will be implemented in the next five years, up to 2nd October 2019. All the 4041 census towns and cities in the country are covered under the mission. The components of the mission are: individual household toilets, community toilets, public toilets and municipal solid waste management.

For solid waste management component, 20% of the project cost shall be funded by the Central Government and 6.66% shall be funded by the State Government. The rest of the project cost is to be mobilised by the ULB from various resources. Since most of the city DPRs are still in the making, the project costs and the shares could not be estimated. However, the estimated GoI fund required for the solid waste management projects for the entire State for the year 2015-16, i.e., 219 ULBs is Rs. 159.43 Crores, at Rs. 240 per capita. The State share for the same is 51.25 Crores.

Table 83: Year-wise Swachh Bharat Mission funding allocation for all the ULBs in Karnataka:

Year	Central Government Share (in Rs. Crores)	State Government Share (in Rs. Crores)
2014-15	-	-
2015-16	159.43	51.25
2016-17	205.02	68.34
2017-18	102.51	34.17
2018-19	51.24	17.08
Total	512.52	170.84

Source: DMA, GoK

43% of Karnataka's urban population resides in Bengaluru and 30.2% of the population resides in the 26 AMRUT cities. The mission target for the entire State is to cover all the 219 ULBs in the State and 80% of the total urban population. All the towns are in the process of making their Solid Waste Management DPRs and getting them approved for funding.

The regulatory framework for Solid Waste Management is as shown below in the table:

Table 84: Regulatory framework for Solid Waste Management

Sl.no	Regulatory Framework	Details
1.	National Urban Sanitation Policy 2008	The policy was formed with a vision for the cities to become totally sanitised, healthy and liveable. It suggests preparing City Sanitation Plans, complete with situation analysis, institutional and financial mapping, sanitation and solid waste sector analysis, strategy and approach to ensure total sanitation in the city and financing the action plan.
2.	Municipal Solid Wastes (Management and Handling) Rules, 2000	GoI has issued Municipal Solid Wastes (Management and Handling) Rules, 2000, has laid down the compliance criteria for handling the waste and the specification for disposal sites and composting, incineration etc. The roles of pollution control board to monitor the compliance of the standards are also mentioned.
3.	Karnataka State Policy on Integrated Solid Waste Management	The objectives of the policy are: • Providing directions for carrying out waste management activities in a manner which is not just environmentally, socially and financially sustainable but is also economically viable; • Establishing an integrated and self-contained operating system for MSWM which would include the development of appropriate means and technologies to handle various waste management activities. • Enhancing the ability of the ULBs to provide waste management services to their citizens.
4.	Agencies and Authorities	• Municipal Authorities • Secretary In-charge of Department of Urban Development • District Magistrates/ DC • Central Pollution Control Board (CPCB) • State Pollution Control Board (SPCB)

8.4.4. SUMMARY

All urban areas in Karnataka together generate around 22,845 TPD[47] of waste. Of this around 3500 – 4000 TPD is generated in Bengaluru city. The 26 AMRUT cities generate around 2912 TPD and have processing facilities for only around 1050 TPD. Thus there is a shortage in processing facilities across all AMRUT cities. 100% door to door collection of waste is still not a reality in the towns of Karnataka; only 3939 municipal wards out of 5252 wards have the facility. Landfills and decentralised collection and processing units are clearly under capacity and often, absent.

The future investment in the sector should concentrate on bridging not only the infrastructure gap, but also the gap in the capacities. New innovative and improved methods for environmentally safe disposal of waste and reuse and recycling of waste need to be explored for all the cities based on the composition of waste. In addition to that, the following areas could be focused on while designing the projects seeking funds.

- Effort towards source segregation of waste and 100% door to door collection of waste
- Decentralised processing units to handle dry and recyclable wastes at ward level
- Emphasis on behavioural change against littering and segregation of dry and wet waste
- Involving citizen groups, self-help groups and resident welfare associations in solid waste management
- Cost recovery for O&M services.

In order to achieve the required service level, investments are being planned and carried out for the sector. The two main sources of investments are the SFC grants and the Swachh Bharat Mission. SFC grants for 2014-15 were around Rs. 1004 crores and Rs.1721 crores in 2013-14. Typically around Rs. 1000 crores of SFC grant is available for solid waste management each year. In the coming 5 years the investment through Swachh Bharat Mission is expected to be Rs. 683 crores. Thus over the next five year period the investments in the sector can be expected to be in the tune of Rs. 5683.

[47] indiastat.com

8.5. URBAN TRANSPORT

8.5.1. BACKGROUND

Urban transport has emerged as one of the key infrastructure sectors that require immediate attention. With rapid urbanisation in the country, more and more people are migrating from rural to urban areas in search of better livelihood and the urban areas are facing congestion and pollution. As urban areas are becoming increasingly crowded, the development of an efficient, sustainable, safe urban transport system is essential. It is observed that, in order to ease the pressure of urbanisation from Tier-I cities and to encourage a regionally balanced urban transport system, the planning and development of efficient transport systems in Tier-II / Tier-III cities has become important. In line with this objective, the Ministry of Urban Development is promoting the Metro Rail in Tier II cities like Lucknow, Kanpur, Patna, Jaipur, Ahmedabad, Pune, Surat, Indore, Nagpur, Kochi, Coimbatore, and Kozhikode. This indicates that the growth and development of urban transport systems has now shifted from big metropolitan cities to smaller cities.

The urban transport system in most Indian cities are characterized by high densities, intensely mixed land use patterns, short trip distances and high share of walking and non-motorized transport. The spatial spread of most cities has been changing and comprises core areas that are usually congested. As cities have more than one Central Business Districts (CBD), providing efficient public transport systems has become a daunting task for the Government agencies concerned. This section on urban transport primarily focuses on the mass transit systems that are developed or being proposed in Karnataka.

Karnataka is one of the fifth most urbanized States in the country[48] and it is estimated that 50% of the population of the State would be living in its urban areas by 2030. Urbanization brings many challenges in its wake and a significant one of them is that of ensuring sustainable mobility options for the urban populace. Most cities in Karnataka including Bengaluru are suffering the impact of poor mobility planning. The cities of Karnataka are also characterised by a similar pattern of urban setting. With the rising number of vehicular population along with the city's growth and rise in per capita income, high volumes of vehicular traffic and congestion has drawn attention towards improving transportation systems in Tier –II and Tier-III cities.

Government owned and operated vehicles for public transport emerge as the dominant means of urban transport, in terms of the carrying capacity of commuters and urban road transport dominates the overall transport landscape of the State. To ensure an efficient, sustainable, safe, and regionally balanced transportation system in urban areas there is a need to integrate various urban transport modes, so that each mode operates in its field of economy and usefulness, with competitive and non-discriminatory prices that are adequate to support progressive development of transport infrastructure and services. This would also enable the comparative advantages and economic efficiencies to be properly reflected in the user costs.

[48] Economic Survey of Karnataka 2013-14

8.5.2. CURRENT STATUS OF URBAN TRANSPORT IN KARNATAKA

There are many mass urban transport systems that have been developed or are being developed in the State. Mostly, these mass transit systems are present in the larger ULBs/ corporations of the State particularly in Bengaluru. Urban Transport with respect to Bengaluru city is dealt with in Chapter 9: Bengaluru City in detail. Karnataka State Road Transport Corporation (KSRTC) is the key agency providing bus transport across Karnataka and has a fleet of around 8190 buses. In addition to KSRTC, 4295 bus are run by North East Karnataka Road Transport Corporation (NEKRTC) and 4716 buses are run by North West Karnataka Road Transport Corporation (NWKRTC) in the State. The Karnataka State Tourism Development Corporation (KSTDC) also runs a fleet of 52 buses for the purpose of tourism. A BRTS system has been proposed for development in Bengaluru as well as Hubballi-Dharwad.

This section sets out the current status of urban transport systems in Karnataka; the focus is however on the mass transit systems.

Bus Rapid Transit System (BRTS) for Hubballi Dharwad

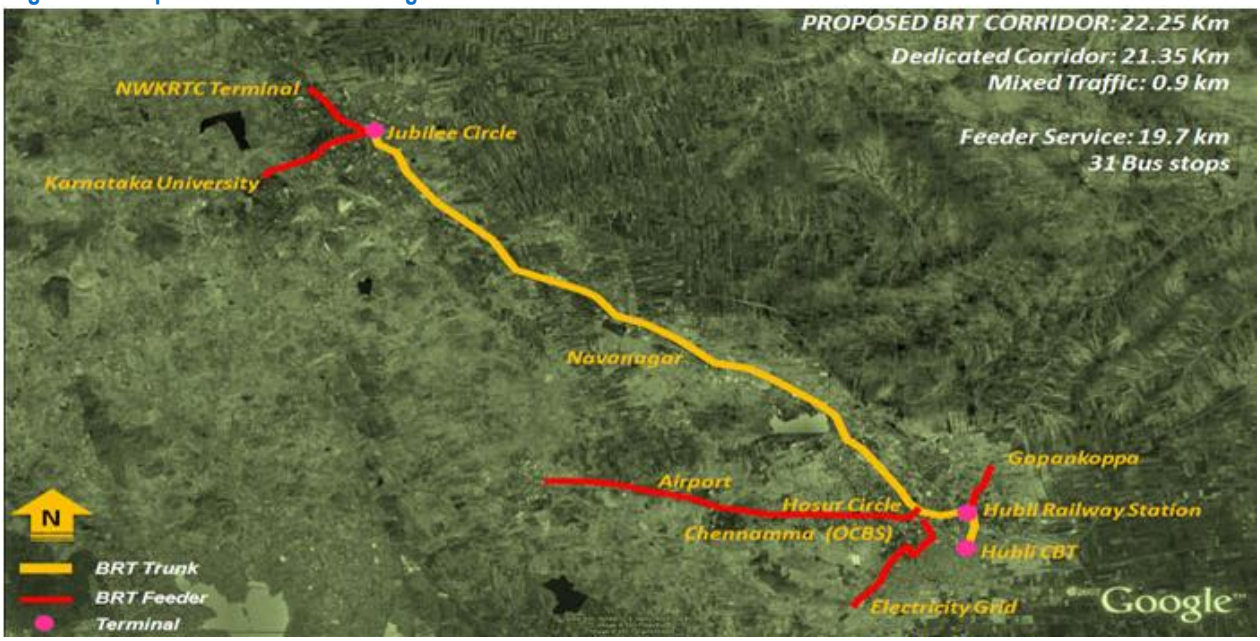
Hubballi and Dharwad cities are about 20 km apart, and on account of the fact that Dharwad is the seat of education and is the district headquarters and Hubballi is an important commercial centre, about 1,70,000 trips happen between the twin cities. Buses are the most preferred mode of travel carrying about 70% of the commuters along this corridor though the number of buses is only about 7% of the total number of vehicles. The number of motorized vehicles in Hubballi Dharwad was about 3 lakhs (as on March 2011) and this number is growing at an average rate of 14% per annum. The high percentage of personal vehicles in the city has led to congestion along the road between Hubballi-Dharwad. The travel time between the cities is about 45 min during off peak hours and it takes about 60 min during peak hours to travel a stretch of 20 km.

The width of the road which includes the BRT corridor, mixed traffic lanes, foot paths etc. is as follows:

- Hosur circle, Hubballi to Naveen Hotel: 35m
- Naveen Hotel to Gandhinagar cross: 44m
- Gandhinagar cross to Jubilee circle: 35m

The figure given below indicates the route of the proposed BRTS connecting Hubballi and Dharwad on the satellite image;

Figure 91: Proposed BRTS corridor alignment in Hubballi- Dharwad



Source: Hubballi Dharwad BRTS website

The trunk corridor includes segregated bus ways, controlled bus stations, physical and fare integration with BRT feeder, off-board ticketing through smart cards and tokens, and high quality buses (standard as well as articulated). The corridor is designed for operating regular and express services. The BRT corridor consists of 2 lanes for BRTS buses on either side of the median bus station facilitating overtaking lanes for express services. 4 vehicular underpasses are proposed to facilitate movement of traffic across BRTS corridor.

NWKRTC is a State owned company running public transport services within Hubballi-Dharwad Municipal Corporation. According to projections made in CTTP prepared for Hubballi-Dharwad, if nothing were done to improve the public transport by way of introducing measures like mass transit/ augmentation of buses etc., the share of public transport would come down drastically by 2028. CTTP also recommends for implementation of BRTS for about 70 km. in Hubballi-Dharwad in a phased manner.

BRTS gives scope for both low and high density passenger movement; high quality, customer oriented transport and low cost urban mobility. The objectives of BRTS are reduction in private vehicle dependence; reduction in travel time; increased passenger safety and comfort; high reliability and high quality infrastructure.

The proposed BRTS corridor length is 22.25 km with cross sections ranging from 44 m to 35 m in between and within the cities limit respectively. The corridor will be a closed system i.e., no other vehicle except BRTS buses will be allowed in the corridor. There will be two kinds of services – regular and express services to cater to the requirements of different section of commuters. Foot over bridge is proposed at seven locations, PELICAN signals and synchronized signal management are proposed to facilitate easy approach of passengers to bus stations. The project also includes improvements in transit infrastructure like terminals, depots and interchanges and improvements to non-motorized

transport infrastructure for about 60 km.

Intelligent Transport System (ITS)

Karnataka State Road Transport Corporation (KSRTC) currently operates in Mysuru through 384 schedules from 3 depots with a fleet strength of 416. The modal split figures for Mysuru city indicate that the share of trips performed by public transport is only 13%, which can still be increased, as the proportion of walk and two-wheeler trips is high. With the traffic in Mysuru becoming a nightmare, and parking problems all the more bothersome considering the urbanization in the city of Mysuru, a high-tech solution in public transport system, ITS, which allows monitoring and tracking of fleet of buses is being planned for implementation by KSRTC in Mysuru. ITS provides benefits in terms of reduce waiting time and uncertainty, increase the accessibility of the system, increase the safety of users, reduce the fuel consumption and emissions, reduce the operational costs, improve traffic efficiency, reduce traffic congestion, improve environmental quality and energy efficiency, improve economic productivity.

ITS covers core systems such as Vehicle Tracking System, Real Time Passenger Information System and Central Control Station. Core technologies include Geographical Positioning System (GPS), Electronic Display Systems, and Information & Communication Technologies. The Global position system (GPS) mounted as part of the Vehicle Mounted Unit in the bus will receive the longitude and latitude coordinates from the Satellite through a process of triangulation. This information is then sent across to the Central Control station through the wireless communication link; GSM / GPRS. The application at the Central control station on receiving the position inputs will update the display boards at the bus shelters / stops enroute and at the bus terminal platform display panel and the general display panel at the related bus terminals.

KSRTC is going to implement ITS in Belagavi, Mangaluru, Kalaburagi, Dharwad in the near future.

The project cost of implementing BRTS is estimated at Rs. 692 crores[49], out of which US $ 47 million is the anticipated assistance from the World Bank-GEF assisted SUTP. In addition, a grant of US$ 1.9 million will be technical assistance which is proposed to be used for communication & outreach programme, monitoring and evaluation study, city bus route rationalization study, parking management plan, integrated transport and land use plan etc. BRTS project results in substantial benefits for the people of Hubballi-Dharwad and the region and the viability of such system has been well established through a process of detailed study.

[49] Economic Survey of Karnataka 2013-14

8.5.3. INSTITUTIONAL FRAMEWORK

The Directorate of Urban Land Transport (DULT) was set up in 2007, close on the heels of National Urban Transport Policy coming into existence. Functioning under the Urban Development Department of Government of Karnataka, the key functions of the DULT, which are given below, reflect the awareness about the need for a paradigm shift in the way urban transport solutions are being planned and implemented;

- To take up periodic assessment of travel demand and determination of level of public transport required on different corridors and the type of Transport system required in a given area through City Traffic and Transportation Study (CTTS) and other studies.
- To provide necessary hand-holding support for conceptualising and implementing mass transit/ public transport/ NMT Projects.
- To advise Government on urban transport matters referred to it/policy issues.
- To initiate in-house studies on appraisal of transport infrastructure related projects.
- To leverage Urban Transport fund for promoting Public Transport (PT)/Non-Motorised Transport (NMT) initiatives.
- To work in close tandem with stakeholders in Urban Transport sector/ academic institutes/lobby groups towards achieving sustainable mobility.

DULT has over the years prepared mobility plans for all six city corporations and plans for nine other cities- Tumakuru, Shivamogga - Bhadravathi, Davangere, Udupi, Chitradurga, Bidar, Vijayapura, Raichur and Hosapete are in advanced stage of preparation. DULT also introduced a parking policy for nine cities including Bengaluru and Mysuru where parking was managed through parking pricing; restriction and regulation of on-street parking and professional management of existing parking resource, both on-street as well as off-street etc. DULT has also prepared a parking action plan for core areas of the Bengaluru metropolitan area and is actively working with BBMP for the implementation of the same.

DULT has identified the multimodal integration at metro stations as a critical component to promote the public transport usage. The Directorate is in the process of preparing the Station Accessibility Plans for all metro stations and the work has been awarded in case of twelve metro stations. The focus is on enhancing the reach and access of the pedestrians and bus users to the metro stations. Continuing the focus on mobility plans, the DULT has taken up implementation of the recommendations of the mobility plans. Demonstration projects aimed at better junction and road space management are under way in Tumakuru district. A proposal for public bike sharing in Mysuru is under way with Global Environment Facility (GEF) grant of US $ 1.9 million. Assistance is continued under State Urban Transport Fund for strengthening and introduction of urban bus systems in two-tier cities of the State. City bus services in Tumakuru, Hassan, Davangere, Mandya, Gadag-Betageri, Kalaburagi and other cities have quickly gained massive acceptance, underlining the felt need for good public transport in even smaller cities. DULT has conducted evaluation of urban bus systems partly funded through State urban transport fund in Tumakuru, Davangere, Hassan, Mandya, KGF, Kolar etc., and the studies have shown that the city bus services have considerably reduced the travel expenditure of daily travellers and students. Hassan city bus service is a very good example of a transit system making profit within a very short span of its implementation. An amount of Rs. 27.94 crores has been released as assistance to State Road Transport Corporations[50].

[50] Economic Survey of Karnataka 2013-14

Other organisations in Karnataka responsible for urban transport initiatives across districts and the notable ones are mentioned below:

- Karnataka State Road Transport Corporation (KSRTC),
- North West Karnataka Road Transport Corporation (NWKRTC),
- North East Karnataka Road Transport Corporation (NEKRTC)
- Bangalore Metropolitan Transport Corporation (BMTC)
- Bangalore Metro Rail Corporation Limited

Of the above except BMRCL, the rest are road transport corporations. Of all the road transport corporations, KSRTC has 8,280 buses, NWKRTC has 4,716, NEKRTC has 4,295, while the BMTC has close to 6,420 buses. The urban transport initiatives undertaken by these organisations are detailed out in Section 1.3. However, there are many districts in Karnataka such as Dakshina Kannada, Udupi etc. where the public bus transport are managed by private players. Total number of privately managed buses, initiatives taken up by them is largely unknown mainly because of the unorganised nature of business.

Intermediate Public Transport Systems

Informal public transport systems like auto-rickshaws, cycle-rickshaws, informal car-pooling systems, etc., also called as Intermediate Public Transit Systems (IPT) forms a vital share of the public transit systems in any city, ranging from 3- 8 per cent of the total modal shares in different sized cities. Nearly 75% of the global auto rickshaw population is found in India[51]. Their role as a feeder to existing public transit systems, providing the first-last mile connectivity helps increase the coverage of the main/trunk public transit systems like the Metro/suburban rail/bus transit. This is true for cities that are larger and have some sort of public mass transit system available. IPT plays the role of public transit systems, especially in small and medium sized cities where formal public transit system is absent. Small towns with low population, small trip lengths, scattered economic nodes, always cannot justify an efficient public transit systems. Thus, IPT can be seen as an alternative to public transit systems in these cities. It is demand driven and has evolved with the growth of the city. Due to their informal nature, there are issues of planning, organization, safety, efficiency, and environment friendliness that need to be addressed, to improve these systems and make them more effective toaddress the travel needs of the people in these cities.

[51] Autorickshaw Sector, 2012

The regulatory framework for Urban Transport is as shown below in the table:

Table 85: Regulatory framework for Urban Transport

Sl.no	Regulatory Framework	Details
1.	National Urban Sanitation Policy 2008	The policy was formed with a vision for the cities to become totally sanitised, healthy and liveable. It suggests preparing City Sanitation Plans, complete with situation analysis, institutional and financial mapping, sanitation and solid waste sector analysis, strategy and approach to ensure total sanitation in the city and financing the action plan.
2.	Municipal Solid Wastes (Management and Handling) Rules, 2000	GoI has issued Municipal Solid Wastes (Management and Handling) Rules, 2000, has laid down the compliance criteria for handling the waste and the specification for disposal sites and composting, incineration etc. The roles of pollution control board to monitor the compliance of the standards are also mentioned.
3.	Karnataka State Policy on Integrated Solid Waste Management	The objectives of the policy are: • Providing directions for carrying out waste management activities in a manner which is not just environmentally, socially and financially sustainable but is also economically viable; • Establishing an integrated and self-contained operating system for MSWM which would include the development of appropriate means and technologies to handle various waste management activities. • Enhancing the ability of the ULBs to provide waste management services to their citizens.
7.	Agencies and Authorities	• Municipal Authorities • Secretary In-charge of Department of Urban Development • District Magistrates/ DC • Central Pollution Control Board (CPCB) • State Pollution Control Board (SPCB)

8.5.4. SUMMARY

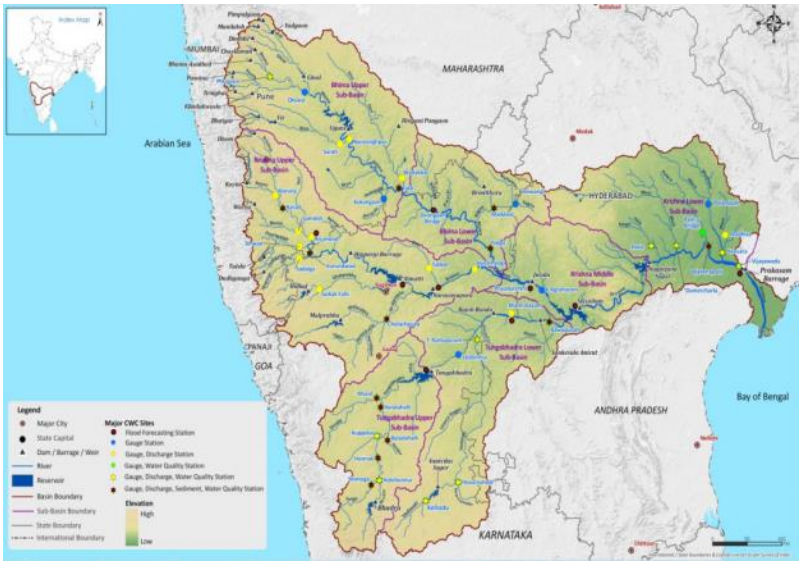
With growing population and urbanization of cities, it is necessary for all the cities to give proper importance to mass transit / urban transport systems. Therefore, there is a need to have clear emphasis on urban transport during the city planning/ city expansion stage itself. This will not only benefit Government with respect to proper financial planning, allocation of lands etc. but also all the concerned stakeholders including general public smooth management across the city.

The key urban transport project in Karnataka is the Hubballi- Dharwad BRTS project which is estimated at Rs. 692 crores. Most of the urban transport projects are within the city of Bengaluru and is addressed in the chapter “Bengaluru City”.

ANNEXURE 8A: RIVER BASINS IN KARNATAKA

Krishna Basin

The Krishna River and its tributaries are an inter-state river system flowing through the States of Maharashtra, Karnataka and Andhra Pradesh. This river receives several tributaries on both the banks, out of which its principal tributaries joining from right are the Ghatprabha, the Malprabha and the Tungabhadra whereas those joining from left are the Bhima, the Musi and the Munneru. The figure below depicts the Krishna Basin.



Source: India- WRIS

The state wise basin area of Krishna River is:

1. Karnataka -111650.68 sq.km
2. Maharashtra- 67146.95 sq.km
3. Andhra Pradesh- 75948.59 sq.km

Krishna basin consists of surface water bodies in the form of lakes, ponds, reservoirs, tanks etc. Generally the water bodies in the basin provide water suitable for irrigation, and water supply. Tanks are the most predominant with the total number of 29237 in the basin. There are 660 Dams, 12 Barrages, 58 Weirs, 6 Anicuts and 119 lifts situated in the Krishna basin. Around 90% dams are used for the purpose of irrigation. [52]Main AIBP projects falling under the basin are Bhima (Sangambanda) Project, Nagarjuna sagar left Project, Sriram sagar stage I (Pochampad), Sriram sagr stage II, Chaskman Project, Ghataprabha Stage-III Project, Jurala (Priyadarshini) Project, Kukadi Project, Malaprabha Project and Upper Krishna Project Stage-II.

At present there are 76 Major and 135 Medium irrigation projects in the Krishna basin. [53]Other than this there are 10 ERM projects, 30 hydroelectric projects and 119 Lift irrigation projects are in this basin. The important projects in the basin are Nagarjuna Sagar Major Irrigation Project, Krishna Barrage (including old Krishna Delta system), Upper Krishna Stage - I Major Irrigation Project, Tungabhadra Left Bank Canal & Dam Major Irrigation Project, Handri Neeva Sujala Sravanti (HNSS) Major Irrigation Project, Telugu Ganga Major Irrigation Project, Kukadi Major Irrigation Project, Bhima Major Irrigation Project, Upper Krishna Stage - II Major Irrigation Project and Malaprabha Major Irrigation Project.

Cauvery Basin

The Cauvery basin extends over States of Tamil Nadu, Karnataka, Kerala and Union Territory of Puducherry, draining an area of 85,626.23 Sq.km which is nearly 2.7% of the total geographical area of the country with a maximum length and

[52] India- WRIS

width of about 560 km and 245 km, respectively. Out of this, **42**% area lies in **Karnataka**, 54% area in Tamil Nadu & Karaikkal region of Puducherry and 4% in Kerala. It rises at an elevation of 1,341 m at Talakaveri on the Brahmagiri range near Cherangala village of Kodagu district of Karnataka and drains into the Bay of Bengal. The total length of the river from origin to outfall is around 800 km. Its important tributaries joining from left are the Harangi, the Hemavati, the Shimsha and the Arkavati whereas the Lakshmantirtha, the Kabini, the Suvarnavati, the Bhavani, the Noyil and the Amaravati join from right. The utilizable surface water resource for the basin is 19 Billion Cubic Meter (BCM). The Average Annual Runoff and Average Annual Water Potential in the basin are same as 21.36 BCM. The figure below depicts the Krishna Basin.

Source: India-WRIS

The longest tributary, River Hemavathi (233 km) is the fifth largest river in catchment area and lies wholly in Karnataka. The Kabini River is an important tributary of the Cauvery. It is a perennial river, 150 to 200 m. wide and has a course of about 240 km. It rises in the Western Ghats in North Wayanad in Kerala State as two streams i.e. the Mannantoddypuzha and Panamarampuzha. About 16 km below their confluence, the Kabini forms a border between Kerala and Karnataka for about 12 km before entering Karnataka State.

ANNEXURE 8B: INSTITUTIONAL FRAMEWORK IN THE STATE FOR WATER SUPPLY PROJECTS

The department dealing with bulk water and water resources in Karnataka is Water Resources Department. It is headed by the Honourable Minister for Major and Medium Irrigation. The Department harnesses Surface Water for Irrigation and Drinking Water Purposes. The Water Resources Department consists of three major corporations- Krishna Bhagya Jala Nigam Limited (KBJNL), Karnataka Neeravari Nigam Limited (KNNL) and Cauvery Neeravari Nigam Limited (CNNL). These three corporations are unique establishment of the State of Karnataka as these are envisages as Special Purpose Vehicle for speedy implementation of irrigation projects and to enable the Government to borrow funds from external sources. In addition to these three corporations, there are some projects which are being handled by Water Resources Department directly.

- CNNL came to existence in year 2003. The Nigam is proposed to raise Rs.1500 crores in the period of 3 years for completion of all on going works and modernisation of completed projects in Cauvery basin.
- KNNL was incorporated in 1998 under the company's act, as a wholly owned company of the Government of Karnataka to expedite the completion of the On-going Irrigation Projects in Krishna Valley. This is the second company in the State, the first being Krishna Bhagya Jala Nigam Limited which was incorporated in 1994 to complete the Upper Krishna Project. The State Government has transferred 10 projects to the KNNL for implementation, out of 28 major & Medium Irrigation Projects in Krishna Basin.
- The State has constituted "Krishna Bhagya Jala Nigam Limited" under the company's Act of 1956 with a view to expedite the works of Upper Krishna Project by mobilising additional resources required for project through private and public issue of Bonds/Debentures.

The statutory framework dealing with the water supply in Karnataka is governed principally by the following statutes:

a) Karnataka Urban Water Supply and Drainage Board Act, 1973 (KUWSDB Act)
b) Bangalore Water Supply and Sewerage Board Act, 1964 (BWSSB Act)

These statutes deal with the entire breadth of issues relating to designing, financing, construction and creation of assets for bulk supply, storage and distribution of water and drainage systems, operation and maintenance of assets relating thereto, tariff setting and revisions thereto, billing and collection of water and sewerage charges, land use, municipal waste management, regulation of other municipal services, functioning of Urban Local Bodies (ULBs) and all other related matters.

The Karnataka Urban Water Supply and Drainage Board Act, 1973

The Karnataka Urban Water Supply and Drainage Board Act, 1973 was enacted when it was considered necessary to establish a statutory Board at the State level to undertake the investigation, preparation and execution of schemes for the regulation and development of drinking water and drainage facilities in all urban areas of Karnataka. This is to bring about co-ordination in the activities relating to the implementation of schemes relating to drinking water and drainage services. Under the provisions of the Karnataka Urban Water Supply and Drainage Board Act, the Board executes water supply and drainage schemes on behalf of local authorities and also when such schemes are entrusted to it by Government. Thus the establishment of the KUWSDB Board was meant to bring in technical and managerial expertise, which the local bodies lacked. The Board is responsible to develop water supply and underground drainage schemes throughout the State, except Bengaluru city.

Bangalore Water Supply and Sewerage Board Act, 1964 (BWSSB Act)

"The Bangalore Water & Sewerage Sanitary Act 1964" was enacted to make provisions for Water supply, Sewerage & disposal of Sewage in Bengaluru metropolitan area. Prior to this enactment, the head works and the mains for the water supply were controlled by the Government and only the distribution of water is carried out by the Bengaluru Municipal Corporation. Under Section 15 of the Act, the Board is vested with the following duty:

i. To provide a supply and improving the existing supply of water in the Bengaluru Metropolitan Area and of making adequate provision for the sewerage and the disposal of the sewage in the Bengaluru Metropolitan Area.
ii. To ascertain the sufficiency and wholesomeness of water supplies within the Bengaluru Metropolitan Area.
iii. Prepare and carryout schemes for the supply of wholesome water for domestic purposes within the Bengaluru Metropolitan Area.
iv. Prepare and carryout schemes for the proper sewerage and the disposal of the sewerage of, the Bengaluru Metropolitan Area.

As per the 74th Constitutional Amendment Act in 1992, the local authorities are delegated with the specific obligation of water supply and sewerages in the Bengaluru Metropolitan Area and thereby the Board is exercising the function of operating water supply and sewerage services, on behalf of the Corporation.

The policy regarding water in Karnataka is guided by following policies:

GoK Policy on Urban Drinking Water and Sanitation (2002)

The Policy statement confirmed the commitment of the following institutions to provide water supply and sanitation facilities to all residents of urban areas – GoK, the State's ULBs, Karnataka Water Supply and Drainage Board (KUWSDB) and Bengaluru Water Supply and Sewerage Board (BWSSB). The policy aims at (a) ensuring universal coverage of water and sanitation services to all households willing to pay for the services; (b) providing such facilities so as to preserve water resources; (c) ensuring that the facility operations are commercially and economically viable; and (d) ensuring that all citizens receive minimum service levels. The policy identifies appropriate institutional mechanisms to address the objectives, tariff frameworks for commercial sustainability and the role of private sector in service delivery.

GoK Water Policy (2002)

Government of Karnataka's State Water Policy, 2002, issued by the Water Resources Department takes cognizance of the depleting water resources and the need for water conservation/management in the State. A key objective in relation to drinking water supply is to provide drinking water at the following rates

- 55 litres per person per day in the rural areas;
- 70 litres per person per day in towns;
- 100 litres per person per day in the city municipal council areas
- 135 litres per person per day in city corporation areas.

Salient features of the GoK Water Policy comprise (a) conservation of surface water based on the fact that surface water sources are key provides of drinking water; (b) future vision lays emphasis on efficient operation and maintenance and repairs and modernization of water supply systems with a planned approach to completing ongoing schemes/committed projects and promoting participatory management of resources; (c) water rates for various users to be revised in a phased manner and fixed so as to cover at least the operation and maintenance charges of providing services.

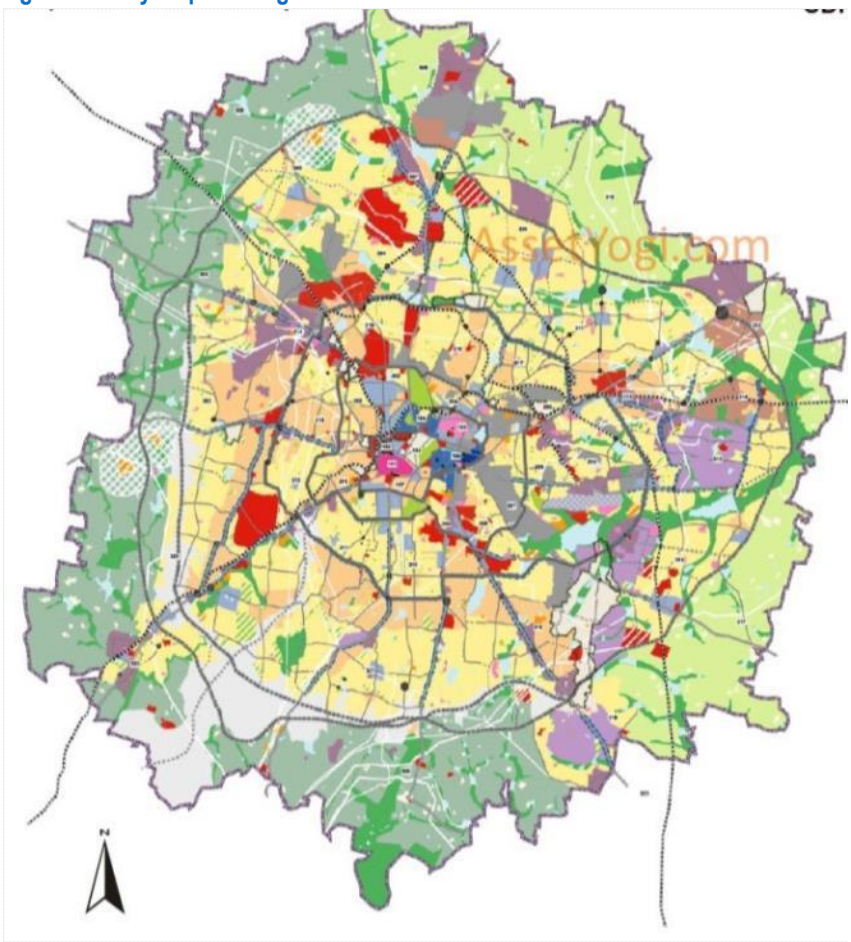
Chapter 9

Bengaluru City

9.1. ABOUT BENGALURU

Bengaluru is one of India's cosmopolitan cities. It is well known as the "Silicon Valley of India" and IT capital of the country. Around 40% of software exports of the country come from Karnataka mainly from Bengaluru[54].The thriving IT sector has generated a vast number of jobs which has resulted in economic wealth and high population growth. The population of the city has grown phenomenally between 2001 and 2011 census from a mere 5.7 million to 8.5 million. This corresponds to a growth of 49.7% over the decade (CAGR 4.7%). In order to accommodate the increase in population the city has been expanding in all direction.

Figure 92: City Map of Bengaluru



Source: CDP Map Bengaluru- Master Plan 2015

The city is home to some of India's premier educational and research institutions such as ISRO, Indian Institute of Science (IISc), Indian Institute of Management (Bengaluru) (IIMB), National Institute of Fashion Technology, Bengaluru, National Institute of Design, Bengaluru (NID R&D Campus), National Law School of India University (NLSIU), National Institute of Mental Health and Neurosciences (NIMHANS) etc. Numerous state-owned aerospace and defence organisations, such as Bharat Electronics, Hindustan Aeronautics and National Aerospace Laboratories etc. are located in the city.

9.1.1. DEMOGRAPHICS

Presently, Bengaluru is the third most populous city in the country after Mumbai and Delhi with a population of around 11.5 million persons as of 2016. There are 597 slums in the city that have identified by Karnataka Slum Development Board. It is estimated that around 40.50 lakh people are living in slum areas which translates to around 22.56% of the City's population. Increase in slum areas is a major concern for the city. In the 2001 census, the city had only 10% of its population living in slums. The percentage has now grown significantly which is one of the outcomes of very rapid urbanization that is happening in the city. On a positive note, Bengaluru's ability to generate quality jobs has resulted in the migration of people from other states and countries, which has over time developed the city's cosmopolitan culture.

[54] VTPC Website

9.1.2. CONNECTIVITY

Bengaluru is well connected regionally, nationally as well as internationallyby several modes of transportation.

Air: Air connectivity for Bengaluru is mainly through the Kempegowda International Airport (KIAL) at Devanahalli, located about 40 km from the city centre. KIAL is India's first greenfield airport developed through Public Private Partnership model. It is considered to be one of the most successful AAI's airport managed by a consortium led by the GVK group. It started operations since May 2008, and is the third busiest airport in India after Delhi and Mumbai in terms of passenger traffic which is around 14 million passengers in 2014-15[55]. The airport is connected to the city via the elevated corridor from Hebbal and several buses operate between the airport and city.

Rail: There are four major railway stations located in the city viz. Bengaluru City Junction, Bengaluru Cantonment, Yeshwantapur Junction and K.R Puram.

Metro: Bengaluru is currently in the process of developing a public transport system "Namma Metro" The project is being handled by Bangalore Metro Rail Corporation Limited (BMRCL). BMRCL is a joint venture between Government of India and Government of Karnataka. The project is being implemented through a Special Purpose Vehicle format. The project involves developing an east-west and a north-south corridor. The east-west corridor is 18.10 km long starting from Baiyappanahalli in the east and terminating at Mysuru Road terminal in the west, while the north-south corridor is 24.20 km long commencing at Nagasandra in the north and terminating at Puttenahalli in the south. Presently commercial operations have started on the following lines

- MG Road - Baiyappanahalli
- Nagasandra -Mantri Square
- Peenya Industry - Nagasandra
- Magadi Road - Mysuru Road Terminal.

Road: Bangalore Metropolitan Transport Corporation (BMTC) is a vital and reliable means of public transport in the city. BMTC also runs several buses on major routes, as well as shuttle services to the International Airport, from various parts of the city. Karnataka State Road Transport Corporation (KSRTC) operates buses connecting Bengaluru with other parts of Karnataka as well as other neighbouring States. The main bus depot is located at Subhasnagar from where both local and out station buses ply from. In addition, there are Satellite Bus Stations at Shantinagar, Kengeri and Baiyappanahalli.

[55] http://www.aai.aero/traffic_news/Dec2k15annex3.pdf

9.2. GOVERNANCE STRUCTURE IN BENGALURU CITY

There are numerous government agencies/parastatal in providing Bengaluru municipal services such as water supply, sanitation and sewerage, solid waste management, urban transport, etc. The table below provides details the governance framework for the city.

Table 86: Governance Framework for Bengaluru City

Sector	Nodal Agency	Roles and Responsibilities
Water Supply	BWSSB	Manage city's water resource to ensure supply of adequate quantity & quality of water, through conservation, re-use and regulating the depletion of supply source.
Sewerage	BWSSB	Managing the collection, treatment & disposal of waste water.
Storm Water Drainage	BBMP, BWSSB	Prevention of sewage entry into storm water drains (SWD). Optimum utilization of natural drainage system to reduce effects of erosion & flooding.
Solid Waste Management	BBMP	Segregation at source, maximize recycling and re-use, treatment & scientific disposal.
Roads	BBMP, BDA	Construction and maintenance roads, creation of skywalks, bus shelters, pedestrian crossings, road-humps and other traffic engineering related systems. good maintenance and planning, digitization of road inventory and road history.
Urban Transport	BMTC, BMRCL, KSRTC,	Create transport mode choices to riders with reduced private trips. Improved connectivity and safe access.
Parks & Play Grounds	BDA, BBMP	Improve green cover and develop open spaces.
Lakes	BDA, Forest Department, BBMP, LDA,	Conservation and ecological restoration of lakes. Improve quality of water. Recreation for community.
Urban Poverty Alleviation	KSDB, BBMP	Create slum free city with improved quality of life. Providing shelter and amenities at affordable cost.

Source: ideck assessment

Governance institutions in Bengaluru can be categorised as follows:

a. Elected Urban Body (ULB) Bruhat Bengaluru Mahanagara Palike (BBMP)

*(For detailed information regarding the history and functioning of BBMP refer to **Annexure 9A**)*

b. Statutory Authorities

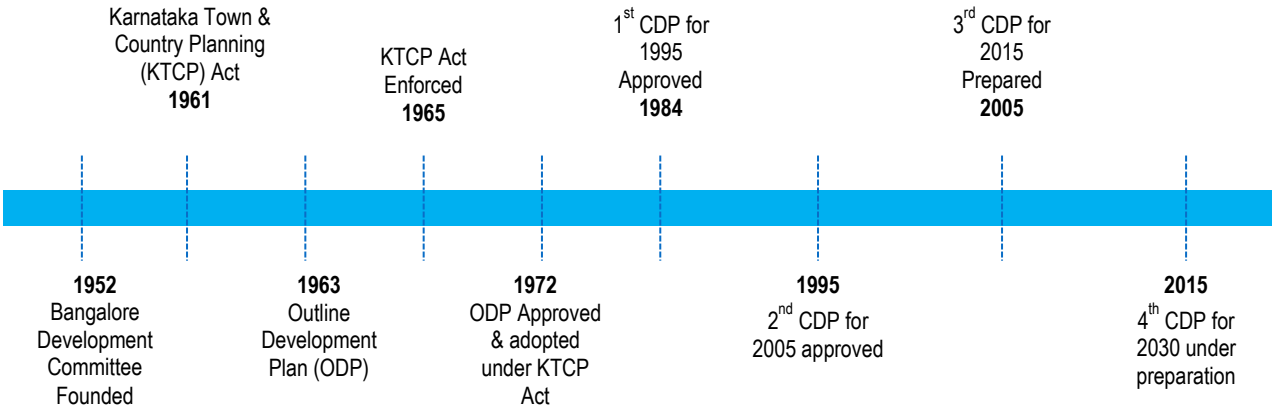
- Bangalore Development Authority (BDA)
- Bangalore Metropolitan Region Development Authority (BMRDA)
- Bangalore Water Supply & Sewerage Board (BWSSB)
- Bangalore Electricity Supply Company (BESCOM)
- Bangalore Metropolitan Transport Corporation (BMTC)
- Bangalore Metro Rail Corporation Limited (BMRCL)
- Bangalore International Airport Area Planning Authority (BIAAPA)
- Lake Development Authority (LDA)
- Karnataka Slum Clearance Board (KSCB)
- Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC)

Source: Bangalore Citizen Perceptions on Democratic Capital Cities of the Future, PWC

9.3. OVERVIEW OF INFRASTRUCTURE IN BENGALURU

Metropolitan cities in developing countries need to address several issues related to pollution, logistics and socio-economic problems. Among the top 10 populated cities in India, Bengaluru (49%) after Surat (63%) has the highest population growth rate (2001 to 2011census). In comparison Mumbai, Delhi, Kolkata and Chennai have grown at 18%, 12%, 6% and 32% only. The impact of rapid urbanization is visible across all cities in India but more so in Bengaluru where migration from across the country has been on the high. The problems that accompany rapid urbanization such as escalating social inequality, mass displacement and dispossession, proliferation of slum settlements, public health issues, water shortage, sewage problems, pollution, indiscriminate dumping of wastes, etc. are being faced in Bengaluru. The city urgently needs to invest in improving its urban infrastructure. Along with developing infrastructure there is also a need to improve service levels of core municipal services. Improvement in municipal services needs to achieve not only by creation of assets but also through effective utilization of existing assets. Policies, guidelines, city plans and capacity building initiatives are been used to enable ULBs to effectively manage its existing assets, identify the gaps and assist in identify gaps in the current infrastructure that needs to be bridged. Some of the key interventions in this regard are set out in the figure below.

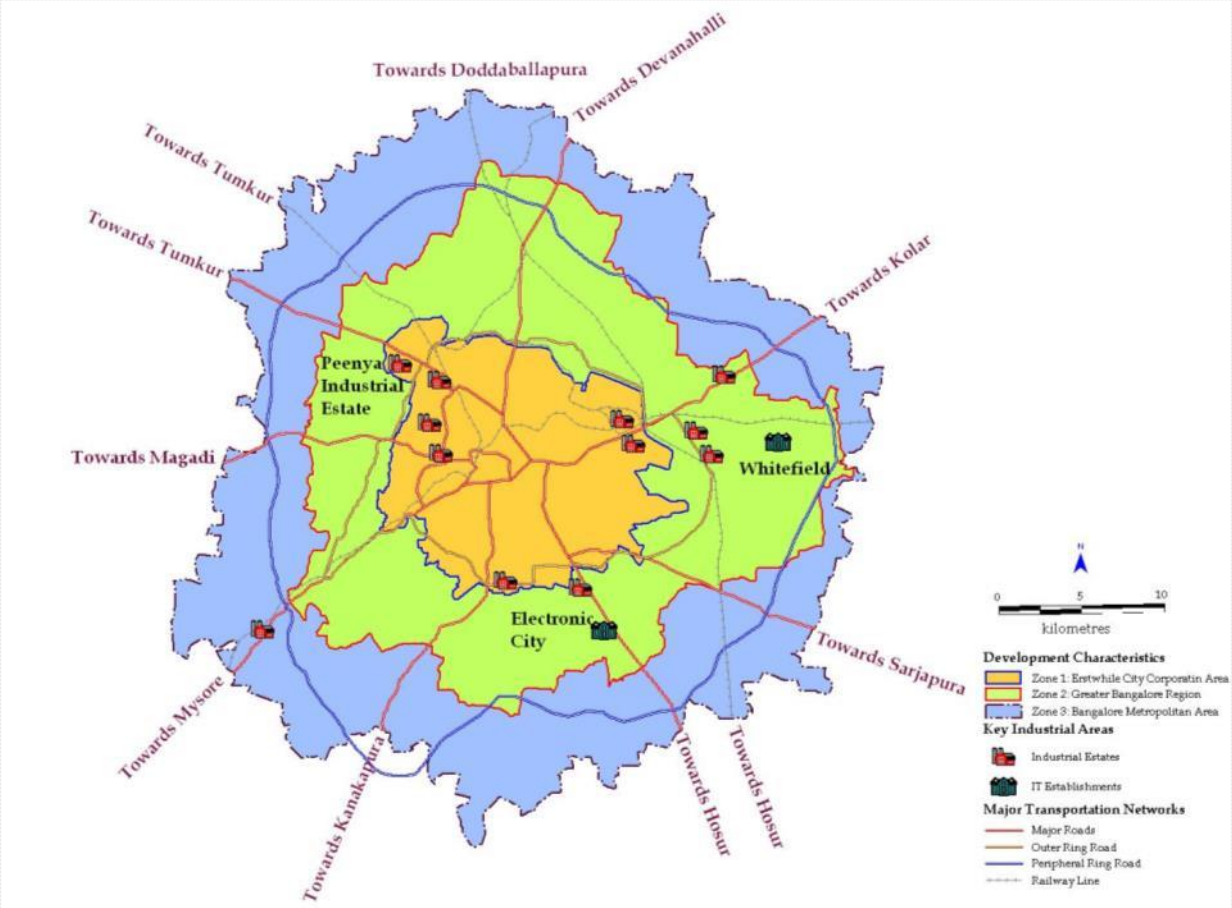
Figure 93: Key planning milestones for Bengaluru City



Source: iDeck Assessment

Like all cities in India, Bengaluru is an unplanned city and the city has been growing in an unplanned manner. The city has multiple centres of commerce and business such as Whitefield, Peenya Industrial Estate, MG Road and Electronic City as seen in the map below. The centres are located across the city and maximize traffic movement through the city. Presently there are around 5.5 million cars on Bengaluru's roads creating severe congestion. Further, the emergence of many new unplanned areas in the periphery of the city is taking a toll on the environment. Almost all the new layouts which support residential and commercial activity are encroaching into Bengaluru's green belt. These new areas often have severe infrastructure deficiency and lack basic facilities such as UGD, water supply, etc. The diagram below sets out the development characteristics of the city. It is evident that there is a need for rational planning and improvement of key urban services in order to keep pace with the city's growth potential.

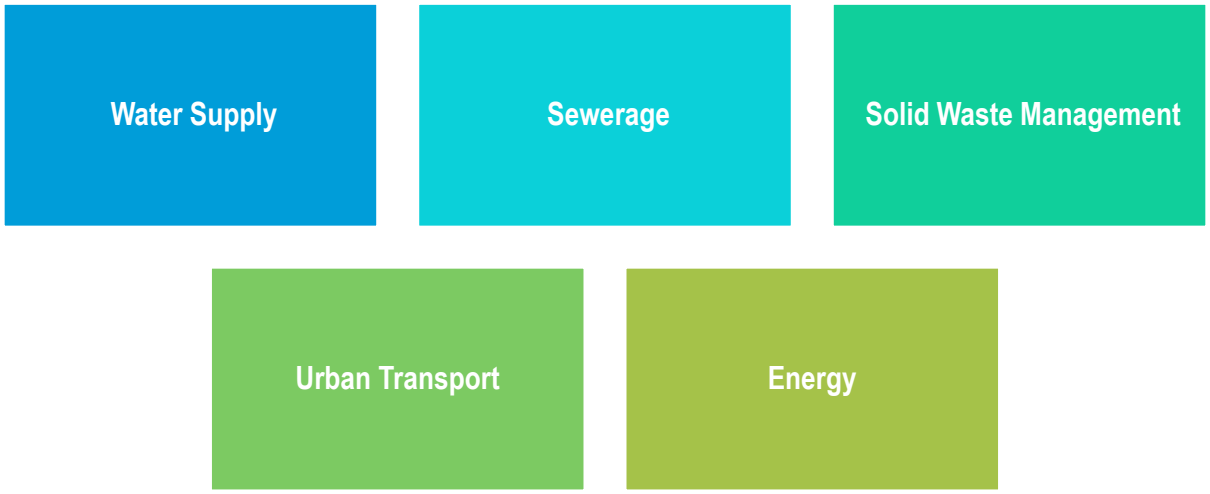
Figure 94: Development Characteristics of Bengaluru City



Source: IISc

The chapter provides an account of the current status, future potential for development, shelf of projects and proposed investments of core infrastructure sectors in Bengaluru City viz. water, sanitation, solid waste management, energy and urban transport. Wherever necessary, certain references in the report are also made to other sectors such as state level infrastructure and industrial infrastructure to clarify the context. However, the primary focus of the chapter is on development of core infrastructure.

The following are the key sectors are addressed in this chapter.



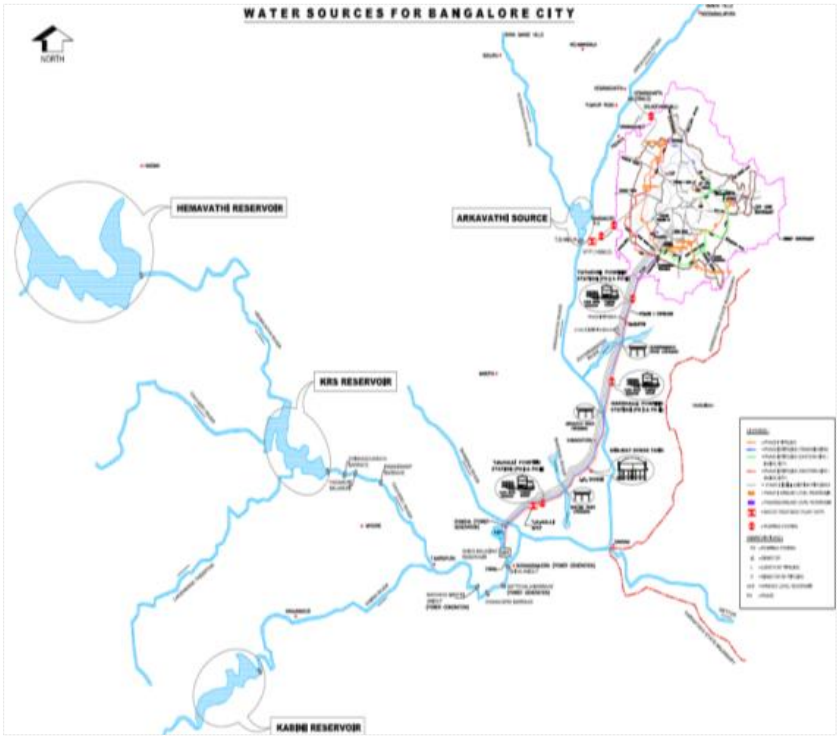
9.4. WATER SUPPLY

9.4.1. WATER RESOURCES IN BENGALURU

Cities in India typically have intermittent water supply and there is a gap between water supply and its demand. Further the coverage of the water supply networks in cities is not 100%. Often slums, new outgrowths of the city are not connected to the water supply network. To compensate for the gap in demand and supply people depend on other sources such as ground water, rain water harvesting, etc. A study by the Department of Mines indicates that 2.2 million people in Bengaluru face the prospect of severe water shortage in the near future.[56]

Bengaluru city is located at more than 920m above mean sea level and forms a part of the catchments of Arkavati River to the west and Ponnaiyar River in the east. Bengaluru receives most of its water from river Cauvery, being transported for a distance of around 95 kms. In addition to river source Bengaluru is also dependent on ground water which is extracted through either tube wells, bore wells, wells, hand pumps, etc.

Figure 95: Water Sources for Bengaluru City



Source: BWSSB

River Sources:

The overall potentiality from:

- Cauvery river (stages I–IV, phase I – 29,565 ha m/ year) sources is 35,605 ha m/yr.
- Arkavati river (Hesarghatta and Tippagondanahalli reservoirs – 6040 ha m/yr)[57]

Ground Water:

- 7000 government-owned bore wells draw 1300 ha m/year with yield of 5,000 lpd.
- 105,500 privately owned bore wells draw 3,851 ha m/year with yield of 1,000 lpd, both for domestic purposes.
- About 2 lakh unregistered private bore wells draw 7,300 ha m/year, to meet the domestic, commercial & industrial needs. [58]

56

[57] BWSSB
[58] BWSSB

Projected Water Demand

In Bengaluru, the total demand of water at present is around 1650 MLD; the corresponding demand supply gap is 180 MLD. The table below indicates the projected demand supply gap as identified by BWSSB.

Table 87: Demand – Supply Gap projections for Bengaluru

Year	Population (in Lakhs)	Water Demand (MLD)	Water Supply (MLD)	Shortfall (MLD)
2001	53.79	870	540	330
2010	85.00	1275	900	375
2015	110.00	1650	1470	180
2021	130.00	1950	1470	480
2036	150.00	2250	1470	780

Source: BWSSB

As seen in the table above the presently the gap is at 180 MLD but the gap is expected to increase to 480 MLD and 780 MLD in 2021 and 2036. The Cauvery Water Supply Scheme Stage V will increase the supply by around 775 MLD and is expected to be implemented by 2025. Thus the water supply after the commissioning if CWSS V is 2245 MLD which seems sufficient to meet demand till 2036. However BWSSB has estimated the growth rate of population of the city from 2015 to 2021 at CAGR of 3 % and between 2021- 2036 at CAGR of 1%. Given that the CAGR was 4.7 % during 2001-2011, the water demand values given by BWSSB look highly under estimated. The table below gives a more realistic picture of the water supply and demand.

Table 88: Demand – Supply Gap projections for Bengaluru (at growth of 3%)

Year	Population (in Lakhs)	Water Demand (MLD)	Water Supply (MLD)	Shortfall (MLD)
2001	53.79	870	540	330
2010	85.00	1275	900	375
2015	110.00	1650	1470	180
2020	128	1913	1470	480
2025	148	2217	1470	747
2030	171	2571	1470	1101
2035	199	2980	1470	1510

Source: BWSSB and ideck Assessment

There is need for the city to conserve water and find alternate sources in order to keep pace with the increase in demand. At present, Arkavathy and Cauvery Stage-I, Stage-II and Stage-III are the source of water supply. To meet the future water demand CWSS Stage-V will be sufficient to meet water demands up to 2025. To meet demands beyond 2025, BWSSB has to go for new resources. The table below indicates the projected demand supply gap.

9.4.2. WATER SUPPLY DISTRIBUTION SYSTEM

Bengaluru water supply system is more than 100 years old. The first filtered water supply scheme from Hesarghatta was commissioned in 1896. Since then several water supply schemes have been commissioned in the city in order to provide for the city's growing needs. The Hesaraghatta project involved building a reservoir across the Arakavathi called the Chamarajasagara. This project was able to serve a population of 2.5 lakh people. As the city grew a second phase was commissioned so that another 8.4 lakhs people could be served. Post 1960's, the water supply from the Arkavathi was insufficient and unable to address the city's requirement and the Cauvery Stage I project was implemented by 1974 and several phases have been implemented to augment the water supply from the Cauvery. The following projects have been completed over the years to provide water supply to the city.

Table 89: Completed projects under Water Supply Sector

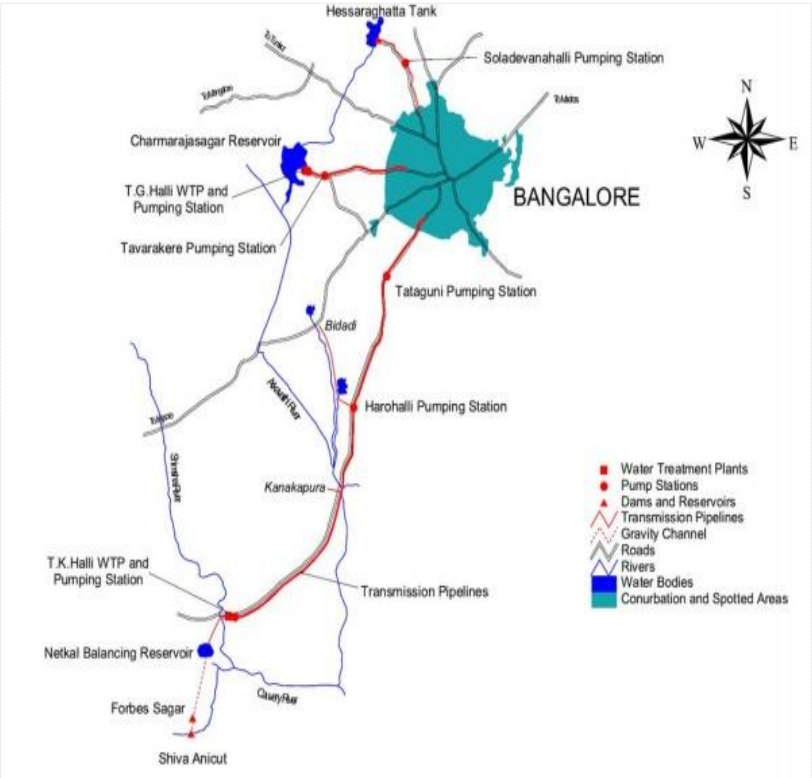
Projects	Year of Commissioning	Installed Capacity (MLD)	Present Supply (MLD)
CRS Water Works, Thippagondana Halli	1930, 1957 & 1964	13 (In Stages)	Nil.
Cauvery Water Supply Scheme Stage I	1974	135	145
Cauvery Water Supply Scheme Stage II	1983	135	145
Cauvery Water Supply Scheme Stage III	1993	270	330
Cauvery Water Supply Scheme Stage IV, Phase – I	2002	270	300
Cauvery Water Supply Stage IV, Phase – II *	2012	500	200

Note: The Cauvery Water Supply Stage IV, Phase II is not fully completed however the water supply component of the scheme was commissioned in 2012.

Source: BWSSB Report

The Cauvery Water Supply Project was sanctioned in 1958. It is the key project that supplies water to the entire city of Bengaluru. The table above shows that several stages of the project have been implemented over the years to augment water supply of the city. It is observed that the supplied MLD is much higher than the installed capacity. The figure below depicts water distribution system in Bengaluru.

Figure 96: Water Supply System for Bengaluru City



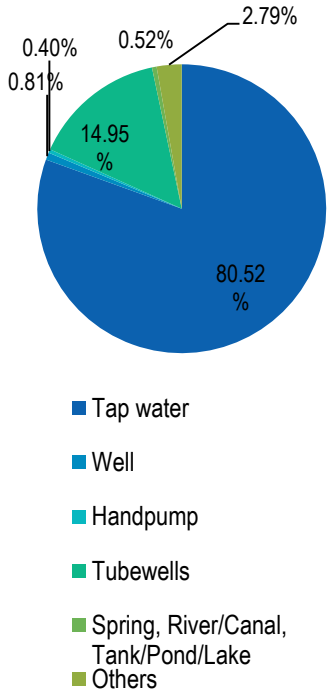
Source: BWSSB

The figure above shows how the water drawn from the Cauvery Head Works reaches the city. The Cauvery Head Works draws the water from the Cauvery River through the channels from the Shiva Anicut to the Netkal Balancing Reservoir; the pipelines from the balancing reservoir draw raw water to Thorekadanahalli (T.K. Halli) where water is treated to the required standards. Due to the elevation difference of 400 m between T.K. Halli and the city, three stage pumping at T.K. Halli, Harohalli, and Tataguni is carried out in order for water to reach the city reservoirs.

Decentralized sources of Water

Only around 80% of the cities needs are met through the centralized distribution system. As seen in the figure below only 80.52 % of the households have access to tap water. 20% of Households in the city are using tube wells, wells, hand pumps and other sources of water.

Figure 97: Sources of water for Bengaluru City



Source: Census 2011

There is a need to provided 100% coverage across the city. This is challenging particularly due to the proliferation of slums and indiscriminate expansion of the city. Further, only 88% of tap water provided is treated.

9.4.3. COMPARATIVE ANALYSIS

In cities centralized water supply typically depend on sources such as rivers and lakes. The cost of water transmission from the river/lake to the city depends on the distance and terrain over which it traverses to reach the central reservoir of the city. Transmission losses can also vary based on transmission distance. Only when surface water sources fail to meet the rising demand, groundwater reserves are being tapped, often to unsustainable levels. The table below compares the water demand and supply of selected urban cities. The table also provides details on the water resources being used presently and the possible future resources that the city may have to tap in order to address demand.

Table 90: Comparison of Water Demand and Supply Selected Urban Cities

Urban Agglomeration (Metro Cities)	Water Demand		Water Availability/Supply		Present Source of Water Supply	Resource to meet Future Demand
	2001	2021	2001	2021		
Bengaluru (Karnataka)	1176-1680 MLD	2232-1910 MLD (HGR&LDR) - (LGR&LDR) 3189-2729 MLD (HGR&HDR) - (LGR&HDR)	705.5 MLD	2575 MLD	1. Arkavathy 2. Cauvery i).Stage-1 ii). Stage-11 iii). Stage-III	Cauvery Stage-IV i). Phase-1 ii). Phase-II Cauvery Stage-V will be sufficient to meet water demands up to 2025. To meet demands beyond 2025, BWSSB has to go for new resources.
Hyderabad (Andhra Pradesh)	956 MLD	1817 MLD	Total supply is 770 MLD Deficit is 186 MLD).	From identified sources is 2000 MLD	Osman sagar, Himayat sagar, Manjira Phase-1 & II and Manjira Phase-111 & IV. Ground water through bore wells.	To Meet the future water demand, the proposal prepared by HMWSSB envisages drawing raw water from fore shore of Nagarjuna sagar in three phases
Pune (Maharashtra)	635 MLD (total requirement as per PMC) 468 domestic requirement as per CPHEEO norms)	777 MLD (as per CPHEEO norms)	At present 750 MLD water is supplied to the PMC area.	892.20 MLD from Khadak wasla project and an additional 29.64 mid from ground water.	Khadakwasla Project and Temghar dam	PMC required to identify new sources since sanction to draw water from Khadakwasla project is valid up to 2002
Chennai (Tamil Nadu)	809 MLD	1230 MLD	299 MLD	Future availability from surface	Poondi, Cholavaram and Red Hills	Gap may be bridged through Krishna Water

Urban Agglomeration (Metro Cities)	Water Demand		Water Availability/Supply		Present Source of Water Supply	Resource to meet Future Demand
	2001	2021	2001	2021		
				water, ground water and seawater sources.	reservoirs system and ground water.	Supply Project. Balance need to be met from other sources.
Kolkata (West Bengal)	2258.4 MLD	3124 MLD	3207.7 MLD	Future requirement can be met from surface and ground water sources.	River Hoogly is the only source of surface water for KUA. Water Treatment Plants are functioning for water supply. Groundwater is also used through deep tube wells and hand tube wells.	Future demand has been proposed to be met by installation of new plants as well as increasing the capacity of the existing treatment Plants e.g. Garden Reach Water Works and Palta Water Works.
Delhi (Delhi)	2445 -3632 MLD	4310- 6265	3369 MLD	11000 MLD	River Yamuna, River Ganga, Bhakra Storage and ground water	Apart from the present sources water is also proposed to be made available from the proposed Tehri Renuka, Kishau and Lakhwar-Vyasi dams
Greater Mumbai (Maharashtra)	3878 MLD (total requirements per GMMC norms) 2056 MLD (Domestic Requirement as Per CPHEEO Norms)	5081 MLD (total requirements per GMMC norms/2741 MLD (domestic requirement as per CPHEEO norms)	2906 MLD (surface water) 60 MLD (ground water)	5293 MLD (surface water) 288 MLD (ground water)	Tulsi lake, Vehar Lake, Tansa dam, Vaitarna dam, Upper Vaitarna darn, Bhatsa dam and ground water	Middle Vaitarna, Gargai, Pinjal, Kalu project and Ground water

Source: indiastat.com

Bengaluru is highly depended on the Cauvery Water Supply Scheme (CWSS). The table above shows that in 2021 at high or low growth rate of the city and low demand rate for water, the water available will be able to meet the demand through Cauvery Stage IV Phase II and Stage V, but at high or low growth rate of the city and high demand rate for water there will be a deficit in supply varying from 200-600 MLD. Beyond 2025 Bengaluru will have to look for newer and alternate sources of water to meet the demand.

In New Delhi, approximately 11% of the water comes from groundwater reserves, tube wells and the remaining from the Yamuna River. It is, however, difficult to establish the total quantity of groundwater

extracted because large number of tube wells is unregistered. To meet the future demand apart from the present sources it is proposed that water will be made available from Tehri, Renuka Kishau and Lakhwar-Vyasi dams.

In Chennai, sources of public water supply are the three reservoirs - Poondi, Redhills and Cholavaram, and the usage of bore well water is limited due to the poor quality of ground water. The other major resource is groundwater from the well fields in the Araniar-Kortaliyar basin, the southern coastal aquifer, and a large number of wells/ tube wells spread all across the city.

In addition to analysing the water resource requirements of a city it is also important to analyse the service level benchmarks. The table below compares Bengaluru with other major cities in the country in term the benchmarks set out by MoUD. As seen in the table below the per capita LPCD for Bengaluru is the lowest and well below the benchmark. Also coverage of water supply is only 51% in terms of geographic area. However BWSSB data and census 2011 indicates that 80% of households have access to tap water supply. Therefore it important for the city to expand its water supply system so that all areas within the city are covered. On a positive note, Bengaluru fares better in terms of continuity of water supply, redressal of customer complaints, metering and cost recovery.

Table 91: Comparative Analysis of water supply benchmarks

Indicator	Benchmark	Bengaluru	Hyderabad	Pune	Delhi	Mumbai
Coverage of water supply connections (%)	100	51	66	94.2	71.5	100
Per capita supply of water (LPCD)	135	96	122	194	144	135
Extent of Metering of connections.(%)	100	98	15	27.7	52.4	81
Extent of Non-revenue water	20	46	38	30	55.3	18
Continuity of supply (hrs.)	24 hrs.	5	1	5	3	2.5
Quality and Treatment (%)	100	83	52	100	99.5	99
Redressal of Customer Complaints (%)	80	87	99	98.4	73	60
Cost recovery in water supply services (%)	100	92	69	70.7	41.6	100

Source: SLB databook 2010 – 11, MoUD website

9.4.4. WATER SUPPLY PROJECTS

The main ongoing project for water supply is CWSS Stage IV, Phase two. The CWSS Stage IV, Phase II project has multiple components under it. The following are the components

1. Water supply: 13 Contract packages that include supply of raw water line, water treatment plants, transmission lines and ground level reservoirs, etc. (has already been completed)
2. Sewerage – 18 contract packages including construction of 11 water treatment plant, rehabilitation of trunk sewers and procurement of jetting machines. (for details refer to in Part 2; Sewerage and Sanitation)
3. Distribution Improvement (UFW) – 3 contract packages for south, central and west divisions
4. Slum Development- 4 contract package to provide water and sanitation facilities to 362 slums with support from NGOs (for details refer to in Part 2; Sewerage and Sanitation)

The table below provides details of the ongoing water supply projects.

Table 92: On-going projects under Water Supply Sector

Projects	Funding	Year of Commencement	Progress	Capacity (MLD)	Cost (in Cr.)
CWSS Stage IV, Phase – II Distribution Improvement Component (UFW) - Construction of Civil Works in respect of Tender work pertaining to Water Supply division – South, West and Central zones	Japan International Co-operation Agency (JICA)	2012	Around 50%-60%	NA	266
Water Supply under DC works of KHB, KUWS & DB, RDPR	UDD, GoK	Nov 2014	34km pipeline laid – 29.32cr	30	168
Water Treatment Plant (WTP) at T.K. Halli, Stage - I & II	JnNURM	Dec 2014	Commenced on Apr '15 Cost = 12.23cr	300	148
Providing UGD system and Water Supply Facilities to Newly Developed roads / missed out BBMP roads		2012			917
Total					1499

Source: CE Report BWSSB

BWSSB has estimated that the city will experience a shortage of 780 MLD of water by 2036. For this, the BWSSB has made a request the State Government to allocate an additional 10 TMC of water from the river Cauvery for the city. Also, feasibility study for CWSS Stage V scheme to cover areas yet to be covered under piped water supply is planned. Recommendations are being made to harness other rivers like Yettinahole, Kakkattahole, Konganahole, Linganamakki and Arakavathi. A report is being prepared for providing water supply to residential extensions in 110 villages under BBMP.

The table below gives details of the proposed projects that will provide water to the city.

Table 93: Proposed projects under Water Supply Sector

Projects	Funding	Year of Commencement	Capacity (MLD)	Cost (in Cr.)
Extension of Addn. Raw Water Transfer MS Pipeline of 2778 mm dia. from Forbes Sagar to NBR and to T. K. Halli.	KUIDFC GoK BWSSB	Sept 2015 (Awaiting approval)	-	160
CWSS Stage V Scheme – Addn. Cauvery Water supply to 110 Villages of BBMP area	BWSSB UDD, GoK	Jan 2014 (DPR under finalization)	775 MLD / 10 TMC – 300 cusecs/day	3053
Total				3213

Source: CE Report BWSSB

Bengaluru has been selected as one of the AMRUT cities in India. An investment of around 27.5 crores is expected under AMRUT for water supply for the period 2015-16. For the next five years it is estimated at the current around 150 crores will be available for Bengaluru city for water supply project through AMRUT.

9.4.5. SUMMARY

The city is highly depended on Cauvery River to meet its water demand. Presently no water is being supplied through Arkavathy River. Several projects are on ongoing to augment the water viz. CWSS Stage IV, Phase II. In addition to this CWSS Stage V has also been planned. The two Cauvery schemes will be able to meet the demand of the city up to 2025 if Bengaluru does at a growth rate of 3% per annum. Beyond that the city faces the prospect of experiencing water shortage unless new sources are identified.

Thus it is very important for the city to plan its water usage and efficiently the effectively utilize the existing resources. City needs look at other options like waste water treatment, rain water harvesting and ground water recharging to increase its water resource base.

In addition to looking at water supply issues the city needs also to improve its distribution system as currently only 80% of the households are supplied through the centralized system. There is need to plan to cover the entire city in the coming period.

The investment in water supply for Bengaluru city is estimated at around Rs. 4712 crores and covers major ongoing and future projects in the sector

9.5. SEWERAGE

9.5.1. DRAINAGE SYSTEM IN BENGALURU CITY

The city area of Bengaluru has increased from 226 sq. kms to 800 sq. kms in just 10 years. This has led to an increase in liquid and solid waste generated in the city. Over 1000 MLD of waste water flows out of the city every day. BWSSB is responsible for managing the waste water generated in the city.

Bengaluru is situated at a height of 920m above sea level. Radial slopes towards east and west and a ridge running in north-south direction characterize the topography of the city. This undulating terrain enables the water to flow into the Koramangala, Challaghatta, and Vrishabhavathi and Hebbal valleys, which create 4 distinct drainage zones of the city.

The figure below gives the sewer line, the sewerage network and the drainage zones of the city.

Vrishabhavathi with a capacity of 123 MLD and Koramangala and Challaghatta (K&C) treatment plants with capacity of 163 MLD were commissioned in 1974 to treat waste water up to primary level. Subsequently, Vrishabhavathi plant has been expanded to treat 180 MLD and K&C to 248 MLD of waste water to secondary level. Hebbal wastewater treatment plant with a capacity of 60 MLD was commissioned under CWSS Stage III which treats waste water up to secondary level. Seven additional waste water treatment plants were commissioned during 2002-2003 and have a total capacity of 245 MLD.

Figure 98: Sewerage Network

Source: BWSSB

For non-potable water, a tertiary treatment plant with a 60 MLD capacity at Vrishabhavathi valley and a 10 MLD capacity treatment plant at Yelahanka were commissioned under Indo–French protocol in May, 2003.

Bengaluru has an underground network that covers only 38% of the city. To enable the cleaning of sewerage lines there are 1, 28,000 manholes at regular intervals along the network. There are 14 Sewage Treatment Plants of secondary and tertiary level with a total capacity of 721 MLD to treat sewage.[59]

The table below provides details of all the treatment plants in the city.

Table 94: Waste water treatment plants in Bengaluru

	Treatment Plant	Capacity	Treatment Facility
1.	Koramangala and Challaghatta Valley treatment plant	248 MLD	Secondary: Trickling Filters
2.	Vrishabhavathi valley treatment plant	180 MLD	Secondary: Activated Sludge
3.	Hebbal valley treatment plant	60 MLD	Secondary: Activated Sludge
4.	Madivala water reclamation plant	4MLD	Secondary
5.	Kempambudhi water reclamation plant	1 MLD	Secondary
6.	Yelahanka Tertiary treatment plant	10 MLD	Tertiary
7.	Mylasandra	75 MLD	Secondary
8.	Kadabesanahalli	50 MLD	Secondary
9.	Krishnaraja Purum	20 MLD	Secondary+ UASB
10.	Jakkur	10 MLD	Secondary+ UASB
11.	Raja canal	40 MLD	Secondary
12.	Nagasandra	20 MLD	Secondary
13.	Cubbon Park	1.50 MLD	Membrane
14.	Lalbagh	1.50 MLD	Secondary+ Plate Settlers + UV disinfection
	Total	**721 MLD**	

Source: BWSSB website

Sewage treated to the secondary level is disposed to natural courses while that which is treated to tertiary level is supplied for non-potable purposes. Currently, around 400 – 500 MLD of sewage is collected and is treated at these STPs. Therefore, it would seem that the installed capacity is higher than required, however actually the city generates around 1000 MLD of sewage. A significant amount of sewage is not being treated as the coverage of the UGD network is only 38 %. Thus in order to address disposal of sewage, de-centralized systems have been developed like tankers with water jetting and vacuum suction machines that transport septage from septic tanks across the city. These tankers are largely operated by private sector and are mostly in the unorganized sector.

In 2011 over 1000 MLD of waste water was generated in the city and flows out of the city every day. BWSSB is responsible for managing the waste water that is generated in the city. BWSSB has a sewerage network of more than 4,000 km in the city to collect and treat the wastewater that is generated. It is estimated that by 2021 waste water generated will increase to 1464 MLD and by 2036 to 1949 MLD per day.

[59] BWWSB website

Table 95: Completed Projects under Sewerage Sector

Projects	Funding	Year of commissioning	Installed Capacity (MLD)
K & C Valley waste water treatment plant (Primary)		1974	163
Vrishabhavath Valley STP (Primary)		1974	123
K & C Valley and Vrishabhavath Valley upgraded to secondary		1980-2000	
Hebbal Valley STP (secondary)	CWSS Stage III	1993-2000	60
7 treatment plants at Mailasandra, Nagasandra, Raja canal, Jakkur, KR Puram, Kadabeesanahalli, Koramangala valley and Challaghatta	CWSS Stage IV Phase 1	2002-2003	245
Vrishabhavathi valley (tertiary)	Indo French Protocol	2003	60
Yelahanka Treatment plant (tertiary)	Indo French Protocol	2003	10
EAP- A Project	National River scheme 70 % GoI, 30% GoK.	2010	40
Zero Sewage Flow in Storm Water Drains of Hebbal Valley – 18km	Mega City Revolving Funds of KUIDFC 50% loan, 50% Board funds	2013	40
CWSS Stage IV- Phase 2 under Slum development component (ph 1)–provide water supply and sewerage facility form 96 slums	JICA	2013	NA

Source: CE Report, BWSSB

Services For Urban Poor

The BWSSB-AusAID Master Plan Project was implemented during the period 2000-2002 to improve water supply and drainage system in slums. The Community Development Component of the Project worked towards examining and testing options for improving services to the urban poor. Three slums from Bengaluru city- Cement Huts, Sudamanagar and Chandranagar were selected for demonstration. These pilot projects provided BWSSB an opportunity to implement alternative and innovative methods for delivering services to the urban poor and also to create systems to reach the excluded and disadvantaged sections. The project benefited the slums by providing water pipeline and pipes and improved drainage system leading to better living conditions in these slums.

During 2003-2006 the Social Development Unit of BWSSB in its effort to scale up the ideas and concepts of the pilot continued to extend water supply and underground services to the slums being covered under the 'Package Programme', a joint infrastructure expansion program of the Municipal Corporation and BWSSB.[60]

[60] *BWSSB.org*

9.5.2. COMPARATIVE ANALYSIS OF SEWERAGE AND SANITATION

The table below compares Bengaluru with some of the major cities in India in terms of Service Level Benchmarks developed by MoUD with respect to the sewerage sector..

Table 96: Comparative Analysis of Sewerage and Sanitation (in %)

	Benchmark	Bengaluru	Hyderabad	Pune	Ahmedabad	Mumbai	Delhi
Coverage of toilets	100	100	98	97.6	80	89	78
Coverage of Sewerage network services	100	38	46	97.6	90	62	54
Collection efficiency of sewerage network	100	55	40	69.6	90	65	63
Adequacy of sewerage treatment capacity	100	106	55	66.8		100	89
Reuse and recycling	20	36	2.3	5.4	0	68	27.4
Quality of sewerage treatment	100	100	99	100	100	20	94.6
Efficiency redressal of customer complaints	80	94	56	100	88	50	39.9
Cost recovery	100	110	69	76.1	80	100	70
Efficiency in recovery of charges	90	97	77	68	80	80	80

Source: SLB databook 2010 – 11, MoUD website

As seen in the table above, Bengaluru has the lowest UGD coverage among all cities. This is also a reason for the poor collection efficiency in the city. Only 55% of sewage generated is actually being treated at the STPs in the city. Across all other parameters the city is in the top two. Due to low collection efficiency, a very large amount of sewage around 500 MLD is not being treated and is illegally disposed. This is a huge environmental burden and needs to be addressed immediately. It is critical for the city to invest in increasing the UGD network as well as to look into de-centralised options. As presently a large portion of the city is being serviced via private sector there is need for stringent regulation to ensure that the private operators legally and appropriately handle sep

9.5.3. PROJECTS

The quantity of waste water generated is projected to reach 1,320 MLD by 2021 and 1,570 MLD by 2036. BWSSB has plans to treat and reuse this water for non-potable purposes.

BWSSB uses the most advanced technologies such as the Trickling Filter Process, Activated Sludge Process, Up-flow Anaerobic Sludge Blanket process and Extended Aeration and Membrane Bio-reactor. The advanced PLC hardware and SCADA software for telemetry treatment have been included at the sewage treatment plants.[61]

Table 97: Ongoing Projects in Sewerage Sector

Projects	Funding	Progress	Capacity (MLD)	Cost (in Cr.)
EAP - B. 16 packages : 70 Kms, for rehabilitation and replacement of balance existing sewerage system	JnNURM & JICA	80% completion, Cost = 294cr 12 packages – complete, 3 packages – under progress	150	490
CWSS Stage IV- Phase 2 under Slum development component (Phase 2)– provide water supply and sewerage facility form 68 slums	Japan International Co-operation Agency (JICA)	13 packages -progress achieved 88%	NA	-
Total				**490**

Source: BWSSB Report

By 2036 it is estimated that BWSSB will have to treat an additional 500-600 MLD of waste water. The additional waste water generated in the city needs to be treated for which 11 additional waste water treatment plants at different locations would need to be built with a total capacity of 339 MLD. Construction work for these plants is in progress.

Table 98: Future Plans of the Board: Increasing the use of treated water.

Projects	Funding	Year of commencement	Capacity (MLD)	Cost (in Cr.)
EAP – C Rehabilitation / replacement of sewers of 74 Kms (DPR Prepared)	KUIDFC	-	-	500
Establishing **6 New Waste Water Treatment Plants** in Valleys of – Vrishabavathi, Hebbal, K&C, KR Puram, BU, Doddabele.	KUIDFC	-	520	1500
Additional **5 new waste water treatment plants** – Sarakki, Hulimavu, Agaram, Begur	LDA & MOEF	-	175	-
Total				**2000**

Source: CE Report, BWSSB

[61] *Meeting the Vital need for water: A Golden Journey, BWSSB*

Bengaluru has been selected as one of the AMRUT cities in India. An investment of around 180 crores is expected under AMRUT for Sewerage (UGD) for the period 2015-16. For the next five years it is estimated at the current around 900 crores will be available for Bengaluru city for water supply project through AMRUT.

Storm Water Drains

The storm water drainage system consists of storm water drains, natural stream, natural water-bodies and waterway system. There are 850 kms of storm water drains in the city. However, 200 kms of storm water drains in and around Bengaluru have been encroached upon. There were 796 kms of natural streams, but in 2014, 376 kms of them were reported missing. Many of the water bodies have become dumping sites for not only liquid waste but also for solid waste. This has resulted in high levels of pollution. Litter, discarded building material and other solid waste thrown in the water bodies has caused blockages in the drainage system. This is a major reason for water logging and flooding in Bengaluru.

Under JnNURM the city, took up a program to revamp the storm water drains. The Centre approved the plan for modifying the primary and secondary drains leading to the four major valleys - Hebbal, Vrishabhavati, Koramangala and Challaghatta. The funds were to be utilized for de-silting, re-modelling, erecting metal chain link fence along the drains and constructing retaining walls. As per the data provided by Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) the nodal agency, Rs. 372.24 crores has been utilized.

For storm water drain BBMP has allocated Rs.147.33 crores and Rs.10 crores has been reserved for renovation of storm water drains in the new zones.

In 2009, BWSSB brought out guidelines making all sites that are 40 ft. X 60 ft. and above to implement rain water harvesting (RWH) within a year. Of around 55,000 properties that this applied, only close to 25,000 implemented RWH.

9.5.4. SUMMARY

A system needs to be designed to collect and transport 100 per cent of sewage to the treatment system. Besides there is a need for projects for covering newly developed areas by connecting them into the existing system or through new de-centralised systems. There is a need to create systems to monitor ground water infiltration, inflows into the sewerage system from other sources so as not to exceed the current treatment capacity. The investment in sewerage for Bengaluru city is estimated at around Rs. 2490 crores and covers major ongoing and future projects in the sector.

9.6. SOLID WASTE MANAGEMENT

9.6.1. SOLID WASTE IN BENGALURU

Solid waste management is a basic essential service provided by municipal authorities in the country to keep urban centres clean. However, it is among the most poorly delivered services especially in developing countries. Often the systems used are unscientific, out-dated and inefficient. Collection across all segments in cities is not achieved and the collection coverage is very low. In such situation, the poor and the marginalized are typically left out. It is quite common to find waste dumped in open spaces, street corner, road sides and in poorly lit areas leading to unhygienic living conditions. As per the 74th amendment the urban local body is entirely responsible for solid waste management. However, most ULBs including large corporations do not have adequate systems, mechanisms, knowledge and human resource to effectively handle solid waste generated. Safe and effective disposal of waste is a major challenge for the ULBs and society as a whole. Rapid urbanization has further increased the problem faced by ULBs.

Table 99: Source and Composition of waste generated

Source and	Type of waste	Composition of solid waste
Single and multifamily dwellings	Residential Waste	Food waste, paper, cardboard, plastics, textiles, glass, metals, garden waste special wastes (bulky items like consumer electronics, batteries, old tyres)
Stores, hotels, shopping malls, restaurants, tourist spots, marriage halls, markets	Commercial Waste	Food waste, Paper, cardboard, plastics, wood, glass, metals, electrical and electronic waste.
Schools, colleges, private offices, government offices, prisons)	Institutional Waste	Paper, cardboard, plastics, wood, glass, metals, electrical and electronic waste and food waste
Industrial units, industrial estates)	Industrial waste	Food waste, paper, cardboard, plastics, textiles, glass, metals, electrical and electronics,
Construction and demolition sites	Construction waste	Paper, cardboard, plastics, wood waste, metals, glass, electrical and inert waste and food waste
Street cleaning and municipal cleaning services	Municipal Waste	Waste from street sweeping, parks and gardens, waste from cleaning drainage and manholes
Hospitals, dispensaries, private clinics and medical institutions	Medical waste	Old drugs, biomedical waste

Source: ideck Assessment

Municipal Solid Waste (MSW) includes waste generated by households, commercial establishments (hotels, restaurants, shops, markets, institutions (private offices, government offices, schools, colleges and hospitals) industries, construction sites and municipality itself through its cleaning services. Waste can be categorized as organic or inorganic and hazardous or non-hazardous waste. Each category of waste has to be handled safely and effectively.

Sources of MSW and composition of the waste generated in urban centers are shown in the table on the left.

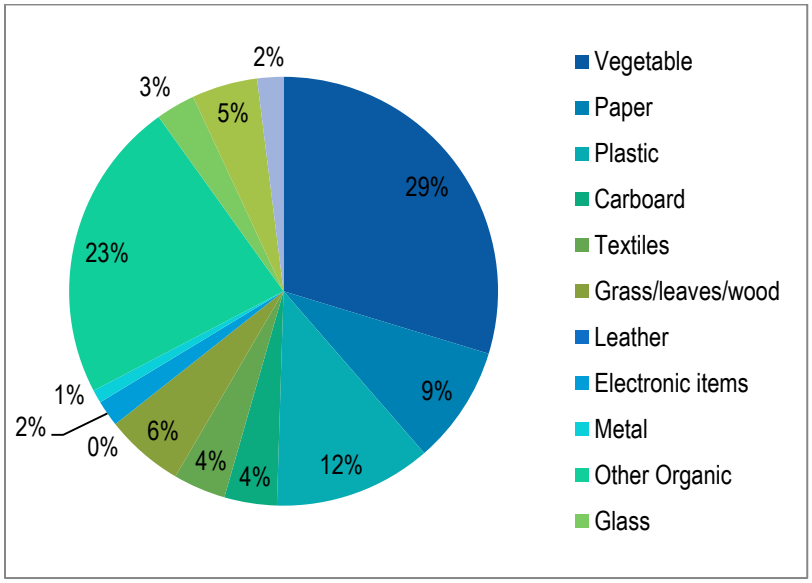
The amount of waste generated and the composition of MSW vary from city to city depending on the city's level of development, pace of urbanization and key city functions. Bengaluru city generates around 3500 - 4000[62] metric tons per day (MTPD) of solid waste. The per capita waste generation per day in Bengaluru city is 0.45 kgs per day.

[62] BBMP and ideck assessment

In Bengaluru city around 54% of the total MSW is generated at the household level, 20% by markets, community and marriage halls and 17% by commercial establishments and institutions[63].

The figure below gives the composition of waste generated in Bengaluru.

Figure 99: Composition of waste generated in Bengaluru city



Source: Based on City statistics data, BBMP website

In most cities in India organic waste forms a large proportion of the waste generated. In Bengaluru, it accounts for more than half the waste generated. According to the data provided by BBMP, organic waste accounts for 70-75% of the waste generated by Bengaluru city. Organic waste also known as bio degradable waste includes all food waste/items, paper items, cardboard boxes, milk cartons, plants and flowers, garden waste like leaves and tree trimmings which is compostable or recyclable.

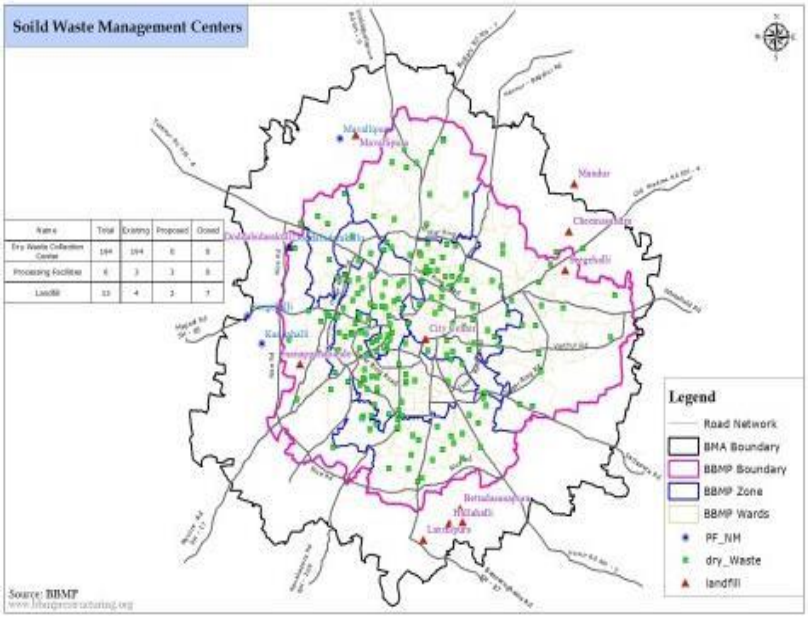
Metal, plastic, glass, rubber, chemicals are inorganic or non-bio-degradable waste. Some of such waste can be recycled. But the rest has to be scientifically disposed in a landfill site to avoid environmental problems. In Bengaluru city inorganic waste is about 20 % of the total waste generated. BBMP has to develop systems and mechanisms to process and dispose safely and effectively all types of waste that is generated in the city.

[63] Solid Waste Management in Bruhat Bengaluru Mahanagara Palike (BBMP): A Note, BBMP

9.6.2. WASTE COLLECTION SYSTEM IN BENGALURU

BBMP has 198 wards that are divided into 8 zones. BBMP is responsible for collection, transportation, processing and disposal of municipal solid waste generated from all sources. It is also responsible for street sweeping and providing other municipal cleaning services. Currently, BBMP is able to collect only around 85% of the waste generated in the city[64].

Figure 100: Collection System Map



Source: Waste-to-Energy Research and Technology Council (WTERT)

BBMP has set up a system for house-to-house collection of waste from the households. At present 85 % of the households are covered under this system. Bengaluru is a binless city with no intermediate bin or space to dump the waste. The waste collected from the households is transferred to large bins from where it is transported directly to waste processing sites.

Vegetable and fruit market waste is collected separately and transported to composting sites.

Dry waste collection centres have been set up at the ward level. Dry waste collected from the households is brought to these centres, segregated and send for recycling.

BBMP has devised a system to collect waste from bulk waste generators like hotels, restaurants, shopping centers, marriage and community halls and offices. It is in the process empaneling service providers for each ward to manage bulk waste generated.

There are 7 sites to dump construction and demolition waste. A Draft Guideline for disposal of construction and demolition waste has been prepared to streamline and improve the quality of services.

There are 5 centralized waste processing sites located around the city with a total capacity of processing 2150 MTPD.

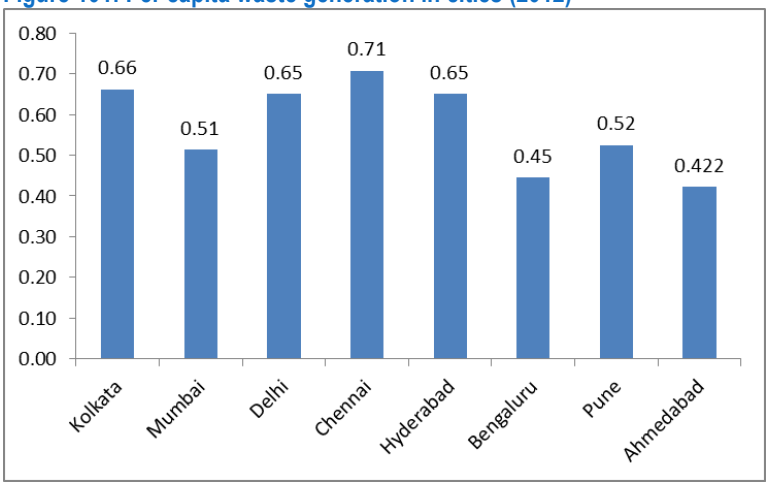
Efforts are been made to decentralize waste management by setting up decentralized wet waste processing unit and dry waste collection centers at ward level and small units to convert organic waste into bio fuel and wet waste into bio gas.

[64] Based on City statistics data, BBMP website

9.6.3. COMPARATIVE ANALYSIS

Waste generation varies from city to city. It depends on among other factors on the population, life style, level and type of economic activity, degree of commercial and industrial activity. The figure below gives the per capita waste generated per day in some of major cities in India.

Figure 101: Per capita waste generation in cities (2012)

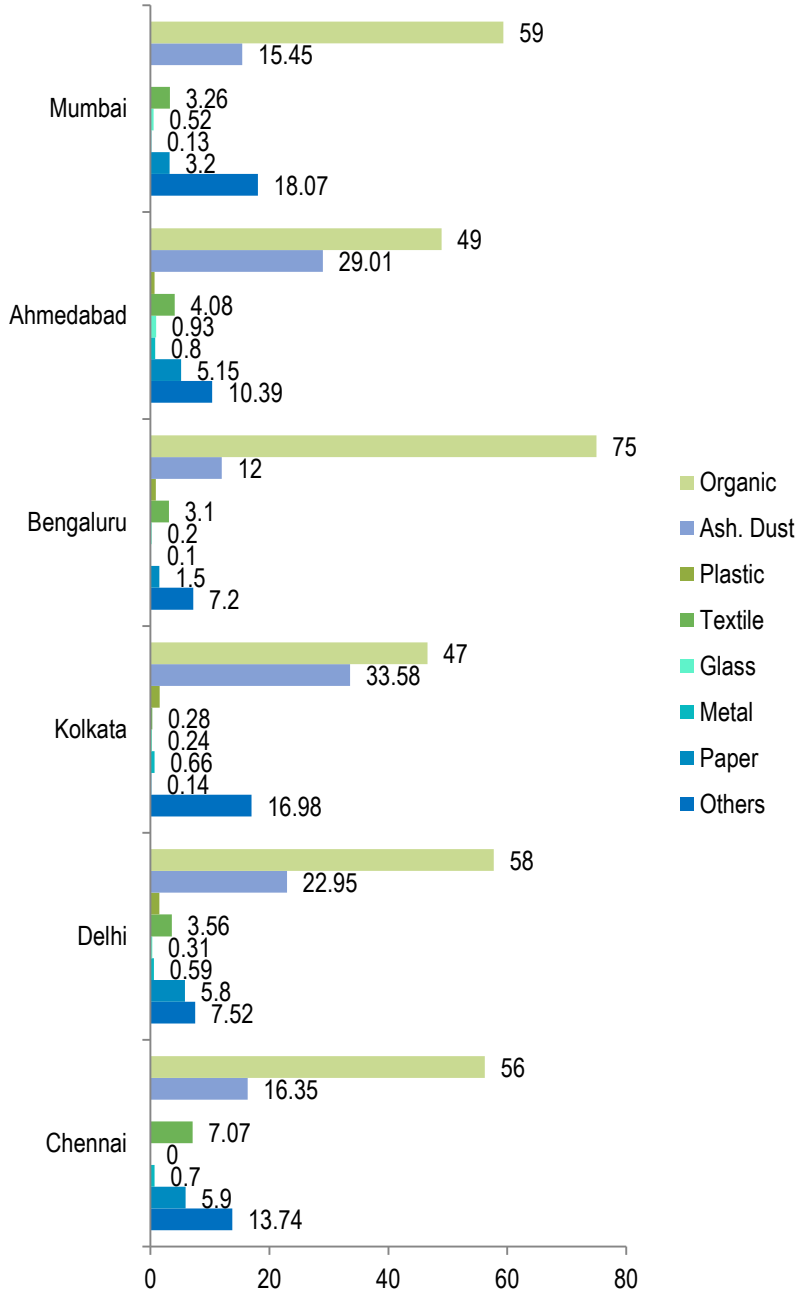


Source: Sustainable Solid Waste Management in India, Waste-to-Energy Research and Technology Council (WTERT)

Given the large size of the city and the nature of its economic and commercial activity Mumbai fares better than Kolkata and Delhi and even Chennai and Hyderabad in per capita waste generation; Bengaluru fares better in per capita waste generation as compared to Chennai, Hyderabad and Pune as can be seen from the figure. Not only it the waste per capita different for cities bit also the waste composition.

The waste composition for major Indian cities is given in the figure below.

Figure 102: Waste composition (%)



Source: http://wgbis.ces.iisc.ernet.in/energy/paper/Solidnew/overview.html

As evident from the figure to the left, the composition of organic waste is high in all the cities and Bengaluru ranks the highest. Waste densities and moisture contents are high, which require different technology and management system.

The table below provides a comparative analysis of solid waste management service benchmarks across key cities in the country

Table 100: Comparative analysis of Service Level Benchmarks in Solid Waste Management

Solid Waste Management	Benchmark	Bengaluru	Hyderabad	Pune	Ahmedabad	Mumbai	Delhi
Household level coverage (%)	100	70	72	52.7	96	100	4.2
Efficiency of collection of MSW (%)	100	60	80	100	96	100	80.8
Extent of segregation of MSW (%)	100	2	0	27.9	5	15	31.6
Extent of MSW recovered (%)	80	33	12	85	15	2	31.6
Extent of scientific disposal (%)	100	54	0	100	100	0	Nil
Efficiency in redressal of customer complaints (%)	80	0	75	84.7	90	100	90
Cost recovery (%)	100	1	13	60.9	20	100	1.2
Efficiency of collection of charges (%)	90	16	65	67	20	100	Nil

Note: MoUD benchmarks indicate Bengaluru's Household coverage to be around 70% however the BBMP stated value is higher at around 80% to 85%

Source: SLB databook 2010-11, MoUD

The data shows that in terms of household coverage and efficiency of collection of MSW, Bengaluru is average show that there is significant scope for improvement and the city ideally needs to target 100 % coverage and collection efficiency. In terms of extent of segregation of waste, Bengaluru is very poor and only 2 % of waste collected is segregated. Bengaluru also fares poorly on other parameters such as redressal of consumer complaints, cost recovery and efficiency of collection of charges.

The above table clearly indicates that Bengaluru needs immediate intervention in solid waste management and the current service levels needs improvement.

9.6.4. PROJECTS IN THE SECTOR

The Solid Waste Management Cell is responsible for all functions concerned with MSW collection, transportation, treatment and disposal in Bengaluru city. The cell is responsible for the overall implementation and monitoring of SWM programs in the city, including establishing new infrastructure and implementation of MSW rules, preparing plans, budgets, documents and engaging with the community to improve SWM services.

Bengaluru has 4 waste processing plants which collectively process 1000MT of waste per day. The largest plant is operated by the State Corporation, Karnataka Compost Development Corporation, (KCDC). Other plants are operated on PPP model. BBMP also operates an Organic Waste Converter at Malleshwaram Market and has established a Dry Waste Collection Centres (DWCC) in each of the 198 wards. The remaining MSW that is not processed or recycled is sent to the landfill site in Mandur.

Table 101: Completed Projects

Projects	Funding	Year of commissioning	Capacity (tons)	Cost (in Cr.)
Dry Waste Collection Centre – 198 nos.	XIII finance	-		35
Bio Methanisation Plants – 16 nos.	XIII finance	-		13
Composting Plants – 7 nos.	GoK	-		440
Sanitary Landfill at Mavallipura – Ramky	PPP	2004	300	13

Source: SWM Department Data, BBMP

Waste to Energy (WTE)

Waste-to-energy (WTE) facilities recover energy through mass burning, refuse-derived fuel incineration, pyrolysis, or any other means of using the heat of combustion. A volume reduction of 90 per cent is typical for these facilities; the unburned waste fraction (ash) continues to require landfill disposal or may, in certain circumstances, be recycled into useful products such as bricks or concrete.

BBMP has initiated the process to set up 3 WTE on PPP model in Bengaluru city with an estimated investment of 300 crores.

In 2012, BBMP prepared an Integrated Solid Waste Management Policy, and prepared an Action Plan, which mandated –

- Separate collection and management of waste from bulk generators
- Setting up systems for door-to-door collection, segregation and transportation;
- Setting up systems for road sweeping and nuisance detection;
- Decentralized waste processing and scientific landfill management;
- Responsibility of BBMP towards plastic waste, bio medical waste, hazardous waste and e-waste rules.

Action Plan – 01, for collection and disposal mechanism for construction waste / debris, collection mechanism for bulk waste producers, handling of garden / green waste, handling of waste from public gathering.

Action Plan – 02, for door to door collection of waste, segregation and transportation, collection mechanism, market waste, dry waste management, waste reduction, wet waste processing site, transfer stations.
Action Plan – 03, street sweeping and nuisance detection, provision and maintenance of litter bins
Action Plan – 04, scientific processing and landfill of waste, waste processing plant, decentralized smaller plants, facilities at landfill site

BBMP spent Rs. 459 crores in 2014-2015 and Rs. 447 crores in 2013-2014 on solid waste management.[65] About 2,300 tonnes of solid waste is processed every day, and BBMP pays tipping fee (paid to private landfills where garbage is dumped) and support fee for this. By setting up of the proposed 600-tonne per day (TPD) waste-to-energy plant with a power generation potential of 12 MW an hour, BBMP would be self-sufficient in its electricity requirements for power streetlights, administrative offices, its schools and hospitals etc.

Table 102: On-going Projects

Projects	Funding	Year of commencement	Capacity (tonnes)	Cost (in Cr.)
Bio Gas Plant & Landfill – Terrafirma	PPP	2014	20	3
Waste – to – Energy Plants – 3nos	PPP	2012	1000 – 8MW	150
De-Centralized Projects	BBMP	2012		1
Waste – to – Biogas Plants – 16 nos Pilot project with Nexus Novus	PPP	2014	800KW	95
Waste Collection & Transportation 80% contracted	PPP			450
Total				699

Source: SWM Report, BBMP

BBMP Expert committee in 2013 prepared a "No Landfill" strategy; defining its vision of "Zero Waste to landfills", designed to eliminate the practice of sending unlimited trash to landfills and incinerators. The crisis in Bengaluru in August 2012, wherein the KSPCB ordered the Mavalipura landfill site to temporarily stop accepting waste to enable site clean-up, provided opportunity to suggest systemic corrections, bring in third-party assessment and create public awareness. In this effort, the BBMP has planned for a city-level waste management strategy through PPP model.

BBMP has earmarked Rs. 415 crores for waste management in its budget for the financial year 2015-16. The resources will be used for setting up of additional 12 bio-methanisation units for producing biogas from wet waste.

Table 103: Proposed Projects

Projects	Funding	Year of commencement	Capacity (tonnes)	Cost (in Cr.)
MSW Strategic Master Plan Treatment & Facility, Waste-to-energy, C&T	PPP	2015	-	740

Source: SWM Report, BBMP

[65] Budget 2013 , 2014, 2015, BBMP

9.6.5. SUMMARY

Given the rapid rate of population and expansion of the city, MSW generated by the city is expected to increase. BBMP will have to update its integrated plan prepared in 2012 to manage the future needs. At present only a very small percentage of the waste generated is segregated at source. Concerted effort to segregate waste at source needs to be made. All green waste should be composted and mechanism created to use the compost generated. Rejects from the composting facility should be combusted in a waste-to-energy facility to recover energy. BBMP needs to give more attention to recycling of waste. If composting and recycling are done the remaining volume of waste to be disposed at the landfill will be reduced and increase the life span of the landfill. These systems need to be developed. If MSW is managed effectively and safely it will reduce the disease burden of the city and improve the quality of life of areas and avoid environmental pollution.

The investment in solid waste management for Bengaluru city is estimated at around Rs. 1439 crores and covers major ongoing and future projects in the sector.

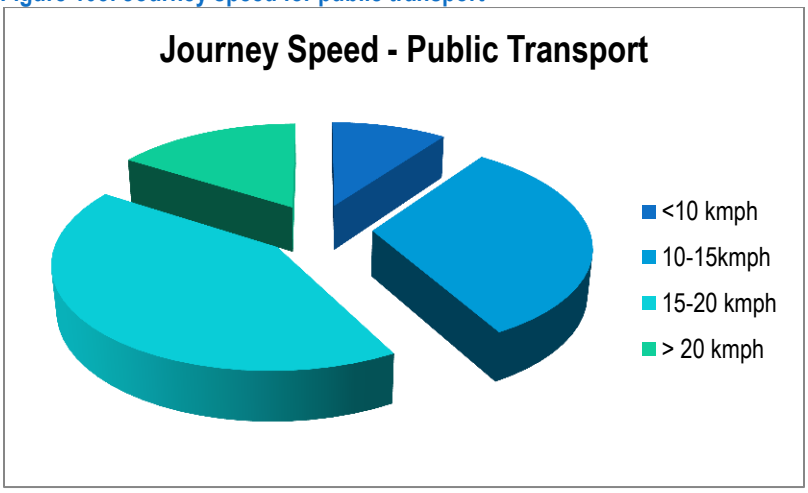
9.7. URBAN TRANSPORT AND ROADS

9.7.1. URBAN TRANSPORT IN BENGALURU

Transport is an integral component of a city. For day to day commuting the most preferred option of commuters/ passengers is road.

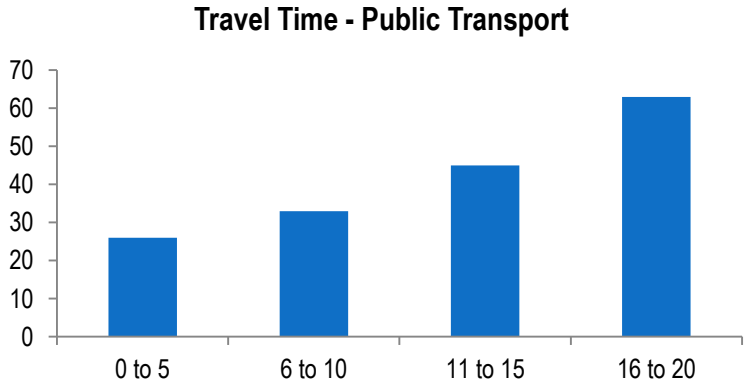
Bengaluru city in recent years has been under great stress with reference to its transportation network. Congestion on the roads and the transport network has become a major bottleneck in the city's progress. Roads and transportation infrastructure needs urgent interventions to improve quality of travel for commuters.

Figure 103: Journey speed for public transport



Source: Bangalore Mobility Indicators 2010-11,Directorate of Urban Land Transport

Figure 104: Travel time for public transport



Source: Bangalore Mobility Indicators 2010-11,Directorate of Urban Land Transport

There has been a phenomenal growth in the population of vehicles both two and four wheelers due to rising household incomes. In the absence of adequate public transport system, people are using the personal vehicles adding to the congestion on the road network and increasing environmental pollution. It has been estimated than an average citizen of Bengaluru spends more than 240 hours stuck in traffic every year. Such delays result in loss of productivity, reduced air quality, reduced quality of life, and increased costs for services and goods.[66]

The speed and delay survey for vehicles show that, the average journey speed for the public vehicles in Bengaluru is around 15 to 20 kmph. Similarly the average journey speed for private vehicle is 15 kmph.

In Bengaluru, about 35% of the daily trips are Non-Motorized Transport (NMT) trips, 27% of the trips are carried by Public transport, 31% of the trips by private vehicles and 7% of the daily trips by Intermediate Public Transport (IPT).[67]

66 Bangalore Mobility Indicators 2010-11, Directorate of Urban Land Transport
67 Bangalore Mobility Indicators 2010-11, Directorate of Urban Land Transport

Following are some of the major issues regarding the transport system of Bengaluru are[68]:

- Capacity of the road network in Bengaluru city is inadequate. Most roads are four lane or less and the scope for widening is limited.
- There is very high density of 2 wheelers on the road. 69 % of vehicles on the road are 2 wheelers
- The number of registered vehicles on the road in the city has increased from 4 lakhs in 1987 to 37 lakhs in 2010.
- The average traffic speed on city road is low as low as 15 kmph during the peak hours.
- There is a decline in share of public transport over the last two decades. This might fall further if quality transport services are not provided and add to private vehicles on the road. The proposed mass transport network needs to be planned taking into account the future needs.
- Parking is also a major issue in Bengaluru with limited parking facility available in main shopping and commercial areas.
- Footpath are poorly maintained and in adequate. There is need to improve the existing footpath and provide new ones to take care of the pedestrians especially in the city centre, shopping and commercial areas.

Comprehensive Traffic & Transportation Plan, CTTP 2007

An integrated multi-modal mass transport system plan on various corridors has been suggested in order to cater to traffic up to the year 2025. The mass transport systems have been proposed on various corridors. The balance traffic should be carried by road system in order to satisfy the needs of normal bus system and other modes such as two wheelers, cars, bicycles, trucks, pedestrians etc.

The proposed Traffic and Transportation Plan for Bengaluru presents proposals, which will cater to requirements of the projected travel demand in sectors such as: Mass Transport System, City Bus System, Integrated Multi-modal Transit Centres, Inter-City Bus Terminals, Transport System Management Measures, and Road Development Plan.

Overall cost of the entire plan was estimated as Rs. 53,367 crores. Rs. 23,987 crores for Phase I (2011-15), and Phase II (2016-20), Rs.26,080 crores.

[68] Based on findings by Praja a citizens group

9.7.2. ROADS IN BENGALURU CITY

Bengaluru's road network exceeds 3,000 km and consists of ring roads, arterial roads, sub-arterial roads and residential streets. The city road network is mainly radial, converging in the centre. The main roads coming into Bengaluru city include Bellary Road in the north, Tumakuru Road and Mysore Road in the west, Kanakpura Road, Bannerghatta Road and Hosur Road in the south and Old Airport Road and Old Madras Road in the east.

The city road network is ring cum radial in fashion. All highways and district roads are radially converging into core area. More than 2 lakh vehicles enter the city from major highways (NH4, NH7, NH209, SH17) and another 1 lakh from other radial roads (Varthur road, Magadi road, Bannerghatta road, Tannery road).

Post-independence many of Bengaluru's erstwhile colonial and town streets were developed into commercial, business cnetres, shopping streets and entertainment areas. The B.V.K Iyengar Road became the retail hub of Bengaluru, while MG Road, Commercial Street and Brigade Road became important shopping, recreation and corporate areas. Consequently, traffic increased exponentially, especially on MG Road, which forms the main artery for the city's east-west traffic.

Bangalore's vehicular traffic has increased manifold, with 5.5 million registered vehicles in the city – the second highest for an Indian city, after New Delhi. The maintenance and construction of roads to address the growing traffic in the city has been a challenge. Rapid population growth in Bengaluru was brought about by the IT and other associated industries, leading to an increase in the vehicular population by 7-10% every year. The city's roads need widening, strengthening to match the current and future traffic demands, besides, new roads are to be built to improve accessibility, reduce travel time and decongest the existing roads. It is estimated that Rs.17,802 crores have been spent on construction and repair of roads in the past 10 years in Bengaluru.

Numerous stakeholders deal with the Road System in the City such as – BBMP, BDA, Traffic Police, PWD, NHAI, BMRDA, Transport Department, DULT, BMTC etc.

BBMP has under its jurisdiction a road network of about 13000 km. Out of this road network; about 1500 km have been identified as arterial, sub-arterial and other major roads. Projects such as development and resurfacing of arterial, sub-arterial and other major roads, road widening, grade separators (underpass and flyovers), development of selected roads on Tender SURE guidelines, signal free corridors have been implemented.

Tender S.U.R.E

Tender S.U.R.E roads are pilot / model roads that are planned under the BBMP to last longer than the current conventional LCE roads that not only need constant maintenance and repair but also keep getting dug up by other service providers. In Tender S.U.R.E model, the monitoring system is stringent and ensures that standards are adhered to maintain quality of roads in the city.

Focus points of Tender S.U.R.E :

- Improve movement for Motorised and NMU
- De-incentivise use of private transport
- Uniform lane width Pedestrian-friendly footpaths
- Stream lined underground utility ducts
- Cycle lanes wherever feasible
- Improve quality and experience of Road

In addition in order to aid in good maintenance and planning, modern engineering tools such as GIS have been used to digitize road inventory and road history of all arterial and sub-arterial roads. Additionally, Road Infrastructure Division is implementing structures such as skywalks, bus shelters and high-raised pedestrian crossings (HRPC), scientific road-humps and other traffic engineering related systems.

The Bangalore Development Authority is also an important stakeholder in the sector it came into existence in 1976 as a successor to the erstwhile City Improvement Trust Board viz. the BDA Act 1976. Development of Bengaluru in a planned manner, creating quality infrastructure, provision of sites and services and catering to the housing needs of the under privileged are the focus areas of BDA. The Engineering Department is primarily concerned with the execution of various developmental schemes in the layouts as also infrastructural works. The Department focuses on the implementation and construction of grade separators, flyovers & underpasses across the city as well as development of ring roads.

Projects completed by BDA include – Planning and execution of Outer Ring Road, construction of grade separator at Jayadeva Institute of Cardiology, flyover at Anand Rao Circle, and flyover at Old Airport – Inner Ring Road Junction.

Peripheral Ring Road (P.R.R)

The city road network is ring cum radial in fashion. All highways and district roads are radially converging into core area. With the need of bypassing heavy trucks, trailers, penetrating the city roads, which clog local traffic, the outer ring road was conceived in 1964 and took nearly 4 decades for total implementation. The Outer Ring Road (ORR) was completed in 3-phases, with the third phase completing in 2002.

The Proposed P.R.R alignment links major highways and district roads, thereby creating direct corridor passage round the city.

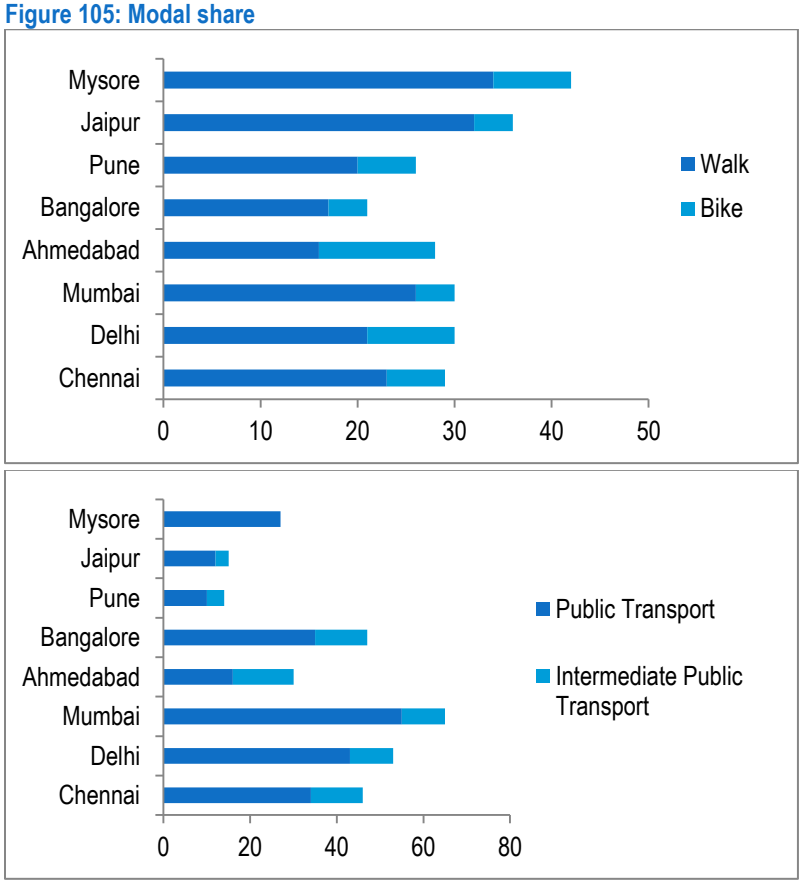
The total length of the PRR is around 116 kms. However, the pre-feasibility study has been carried out for only 64.74 kms of stretch. The PRR will be developed starting from Hosur Road to Tumakuru Road via K R Puram, Bellary Road, Old Madras road and Sarjapur road.

The cost of executing the project is estimated at Rs. 3,850 crores, and support will be provided by Japan International Cooperation Agency (JAICA).

9.7.3. COMPARATIVE ANALYSIS

Demand for transport in large cities has increased in recent years due increase in population and also due to migration from other cities, smaller towns and rural areas. In most Indian cities the share public transport has shown a decline and the share of private transport on the rise. 95% of the vehicles on the road in the major cities are motorized vehicles. The average journey time in major Indian cities is very low. The average journey time in Delhi is around 16 kmph, in Mumbai around 18-20kmph and is less than 20kmph in Chennai, Hyderabad and Bengaluru.[69]

Figure 105: Modal share



Source: CTTP 2007

A study on motorist behaviour showed that among the seven Indian cities surveyed, Bengaluru scores the lowest –30 out of 100. Bengaluru's low score implies that vehicles seldom stop for pedestrians to cross a road or halt on the zebra crossing at signals. At times, vehicles are driven on the footpaths, creating safety issues for the pedestrians.

In the motorized group 30 % people use public transport and 10% use intermediate public transport and rest use private vehicles.

Of the 9 parameters set by Clean Air Initiative for Asian Cities, Bengaluru scored the lowest in the 'disability infrastructure' category with a score 24 out of 100. This means the differently abled people (visually challenged or wheelchair bound) will find the city roads very unfriendly, with difficulty in moving on the footpaths or even crossing roads in the absence of facilities like ramps, lifts, etc.

[69] *URBAN TRANSPORT SYSTEMS AND CONGESTION: A CASE STUDY OF INDIAN CITIES*
M. Absar Alam and Faisal Ahmed

9.7.4. PROJECTS IN URBAN TRANSPORT

Considering proposed land use, transport sector requirements up to 2025 have been assessed using travel demand modelling. The transport sector recommendations are contained in the BMTC Vision 2025, Comprehensive Traffic & Transportation Plan, Master Plan for BMA, City Development Plan proposed by BBMP under JnNURM, Regional Development Plan prepared by BMRDA, Development plans of BIAAPA and BMICAPA

Bus Transit System

1. **Luxury Bus Service**
   Volvo's city bus first started in Bengaluru in India in 2006 and is built using the B7RLE chassis and the bodywork is based on the Volvo 8700. Costing close to Rs. 62 lakh each, the Volvo buses have a seating capacity of about 40 passengers. They have low entry, wheelchair ramp and air conditioning. The chassis are assembled at Volvo's factory outside Bengaluru while a local company does the bodybuilding.

2. **Intelligent Transportation System**
   BMTC has adopted latest technologies to improve the service. Under Intelligent Transportation System (ITS), all BMTC buses are fitted with GPS. An advanced application is also being developed to enable commuters to track the buses. The new system will offer several features such as tracking the expected time of bus arrival and departure, number of passengers commuting in a particular bus etc. Buses are also given Electronic Ticketing Machines. The total cost of this Build-Operate-Transfer (BOT) project is Rs. 79 crores.

   Intelligent Transportation System itself is a comprehensive project. It improves the travel experience in many ways, both in terms of getting real time information about buses, and also the entire data that the ITS will provide BMTC help to internally analyse and optimise the service. BMTC could detect the buses plying empty at which time and those buses that are plying full with passengers.

Bengaluru Transport + Traffic Information System (BTIS)

Launched in 2009, BTIS is the first technology based solution for tracking Bengaluru traffic online. This is a geo-spatial application which also uses APIs exposed by Google Maps and Open Layers that would be used to provide spatial information.

With more than 40 cameras installed at various towers, this application provides traffic information with the help of live cameras. This site also provides traffic condition across various parts of the city using intelligent prediction method and different colour codes. Apart from being a traffic reporter, the site also provides various other traffic related information like bus directions, traffic rules and regulations, fines for various traffic violation.

Features in BTIS

- Live traffic updates
- Live snapshots from the traffic junction cameras
- Bus stops and routes
- Track buses on the map
- Carpool partners for your daily commute
- Commute to and from Airport
- Traffic violation fines against your vehicle
- Registration details about a vehicle
- Parking availability

3. **Traffic Transit Management Centres**

BMTC has also developed Traffic Transit Management Centers (TTMC) which are spread across the city at 10 locations; viz. Shanthinagar, Jayanagar, Kengeri, Vijayanagar, Banashankari, Koramanagala, Yeshwanthapura, Domlur, ITPL and Bannerghatta. In addition to the above, there are 26 minor bus stations spread across the city. These bus stations serve as hubs for the city buses while commuting the length and breadth of the city.

Bus Rapid Transit System

Directorate of Urban Land Transport (DULT) is collaborating with BMTC and BDA for development of Bus Rapid Transit System for Bengaluru. The CTTP for Bengaluru identifies 279.60 km of BRT system. In the first phase a 30 km stretch (along eastern stretch of ORR) Central Silk Board to Hebbal has been proposed for being taken up at a cost of Rs. 542.40 crores, DPR is under preparation. The project involves signal synchronization and prioritization for buses at the junctions besides dedicated rolling stock of articulated buses. The design capacity of the project is 15000 persons per hour per direction. The project is expected to result in reduced travel time, reliable and comfortable service.

Another project involves Metro users having easier access to metro stations easily as the Bangalore Metropolitan Transport Corporation (BMTC) plans to connect its three traffic and transit management centres (TTMC) and a bus stop with the stations. BMTC has identified three centers located in Banashankari, Yeshwanthpur and Vijayanagar, and a bus stop in Kalasipalyam for connecting with skywalks and subways. The DULT will bear the cost of building the infrastructure. Among the identified places, the metro is already operational on Tumakuru Road where the Yeshwanthpur TTMC is located.

Non Motorises Initiative (NMT) Initiative

In the recent years DULT has taken initiatives to improve the NMT facilities in Bengaluru. As part of this, a Detailed Project Report and Feasibility study report has been prepared for different areas in Bengaluru. Malleshwaram, Gandhi Bazaar, Madiwala, Indiranagar etc.

Namma Metro

The first phase of the project costing Rs. 6,325 crores is currently functional. The first line opened in 2011, from Byappanahalli to M.G.Road Station is 6.75 Kms. The second line from Peenya to Mantri Square Sampige Road Station of 10.75 Kms. with 10 stations was open for use in 2014. BMRCL has already secured all approvals for Phase II of the Metro. Phase II covers 72 kms with 61 metro stations, with an estimated cost of Rs. 26,400 crores. Completion of Bangalore Metro Rail Phase I (42.3 km) and Phases II (72.10 km) will create a total metro network of 114.40 km in Bengaluru city, with 101 stations of which 80 will be elevated, 19 will be underground and 2 at ground level.

The investment in the project is raised through - Central Government's contribution- Rs. 53 billion, Karnataka Government - Rs.90 billion of which grant portion will be Rs.17 billion and the remaining Rs.121.44 billion will be sourced from the market.

Bengaluru Light Rail Transit

Bangalore Airport Rail Link limited (BARL) has proposed a new rail transport system in Bengaluru in the form of Light Rail Transit (LRT) system. The proposed system would comprise two separate intersecting routes known as Corridor 1 (J.P Nagar to Hebbal) and Corridor 2 (Peripheral Ring Road- Magadi Road toll gate).

The proposed system would allow passengers to interchange with Bengaluru Metro, the first phase of which is now in operation, and the second phase of which is currently under development, including the future High Speed Rail Link to Bangalore International Airport. The estimated project cost is approximately Rs. 9,000 crores. Since this is a GoK initiative, it is envisaged that the equity contribution for the project would be done by the Government itself.

Sub-Urban Rail System

CTTP has recommended the implementation of a suburban rail system connecting Bengaluru to nearby towns like Ramanagaram, Chennapatna, Tumakuru and Doddaballapura etc. GoK has also repeatedly requested Ministry of Railways (MoR) and Government of India to sanction a suburban rail system to Bengaluru in the lines of Multi Modal Transport System (MMTS) in Hyderabad and suburban rail system in Chennai.

GoK had also engaged M/s. RITES to conduct a detailed assessment of the existing suburban rail traffic and its potential future demand; identification of gaps in the existing infrastructure, system constraints, if any and infrastructure requirements at the terminals and the corridors for effective implementation of suburban rail system. The findings suggested that even with most conservative estimates the current demand is more than twice of current ridership. The report has evaluated major suburban rail corridors and has clearly recommended extension of services on Baiyyappanahalli - Hosur section; Yeshavantpur – Tumakuru section; Bengaluru – Mandya section and Yelahanka- Chickballapura sections.

Implementation of the suburban rail system has also been recommended to be taken up in phases as doubling and electrification works along various corridors have been completed to different extents. The total project cost is estimated to be Rs.8759 crores. The State is now preparing a detailed project report for the implementation of Phase-1 of the project which is expected to cost around Rs.1500 crores.

Investments in the Sector

There are several projects in the pipeline in urban transport. Most of these projects are expected to be implemented over longer period of time in a phased manner. The table below provides details on the ongoing and future projects in the sector.

Table 104: Ongoing and future projects in urban transport for Bengaluru city

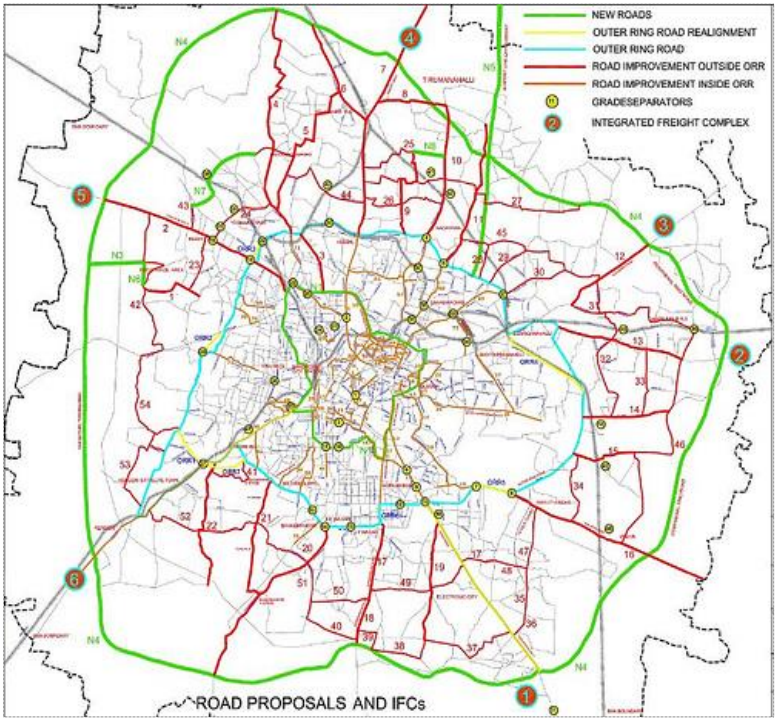
Project	Estimated Investment in Rs. crores
Intelligent Transport System - Equipping BMTC buses Electronic Ticketing Machine	79
Traffic Transit Management Centre -	-
Bus Rapid Transit System	542
Namma Metro –Phase II	26,400
Light Rail Transit System	9,000
Sub-Urban Rail System	8,759
Total	44780

9.7.5. PROJECTS IN THE ROADS SECTOR

The Karnataka budget for 2014-15 proposes to invest Rs.3,577 crores for the infrastructure development of Bengaluru, including roads, flyovers, underpasses and bridges across railway crossings, protection of lakes and waste disposal. In addition, Rs.1,527 crores is available as grants from various Central and State schemes and BBMP proposes to spend Rs.2,050 crores to implement new projects and complete unfinished projects to improve infrastructure facilities across the city.

Development of the city road infrastructure has evolved by imposing one-way traffic in certain areas, improving traffic flow in junctions, constructing ring roads, bridges, flyovers and other grade separators. Six high volume junctions were identified for improvements, through a public-private partnership involving corporate sponsors and various State Government agencies, such as the Siddapur Road and Hosur Road junction, sponsored by Infosys and the Airport Road and Intermediate Ring Road junction sponsored by the TATA.

Figure 106: Map of key road network of Bengaluru



Along with the population the city has also seen great improvements to its roads, highways and other infrastructure. Several flyovers have come into existence in the last 10 years easing the traffic and making travel easier. Additional grade separators, RoB, RuB are proposed at various locations across the city. Apart from grade separators – flyovers & underpasses, city has seen incorporation of diverse solutions for easing traffic across the city through introduction of Signal Free corridors and elevated corridors. Elevated roads have been implemented to International Airport and Electronic City. Major corridors such as – Bellary Road, Outer Ring Road have been transformed as Signal Free Corridors.

Another significant project is the Bengaluru–Mysuru Infrastructure Corridor (BMIC) also called NICE road which is a proposed 4 to 6 lane private tolled expressway intended to connect Bengaluru and Mysuru Constructed by Nandi Infrastructure Corridor Enterprises (NICE) on Build-Own-Operate-Transfer (BOOT) basis, the expressway also links the 75m wide 40 km peripheral ring road stretches from Hosur Road (NH7) to Tumakuru Road (NH4).

Table 105: Completed Projects

Projects	Funding	Year of completion	Cost (in Cr.)
Outer Ring Road	BDA	2002	
N.I.C.E Peripheral Ring Road Part of Bengaluru – Mysuru Infrastructure Corridor	GoK		
Grade Separators Jayadeva Hospital, Dairy Circle, Indiranagar, Hebbal, Yeshwanthpur, Mekhri Circle			
Elevated Corridors Electronic City – 10Km Link	BBMP & BDA	2010	
Elevated Corridors Airport Link – 24km	NHAI	2013	1030
Signal Free Corridor Windsor Manor to Hebbal and ORR	BDA		337
Rail over Bridge & Rail under Bridge Kasturinagar, Judicial Layout, Sarjapur Road, Hoody, Bapujinagar, Yelahanka	BBMP, GoK, K-Rail		7
Pedestrian Sky Bridges	BBMP		

Source: Data collected from BBMP and BDA

BBMP is preparing an action plan to develop arterial and sub-arterial roads in the city as announced in the State Budget 2015-16. Eight major roads in the City will be widened up to 45 meters. Detailed Project Reports (DPRs) on some of the roads are completed. Widening Jayamahal and Bellary Roads would cost Rs. 90 crores, 7.5 km of stretch from Bannerghatta Road from JD Mara Junction till Nice Road will be widened at a cost of 150 crores, Sarjapur Road from ORR to Dommasandra will be widened at total cost of Rs. 200 crores.

Table 106: On-going Projects

Projects	Funding	Year of commencement	Cost (in Cr.)
Grade Separators – 18 nos.	BDA	2005	200
Tender S.U.R.E -12 roads	BBMP	2010	300
Road Improvements Asphalting and improvement of roads	BBMP	2014	342
Road Widening CDP roads	BBMP	2014	300
New Roads In newly added villages	BBMP	2014	250
Nagarothana 2014-15 - Awarded Works	BBMP	2014	417
Pedestrian Sky Bridges & Bus Terminals	BBMP / PPP	2014	
Total			1089

Source: Data collected from BBMP and BDA

Hi – Tech Corridor between Sarjapur Road and Hosur Road:

The BDA has proposed Hi Tech Hub and Corridor Road that facilitates the demands of IT sector. The project area is located 14 km. from the city centre and comes under the jurisdiction of the villages in Varthur Hobli, Begur Hobli, and Sarjapura Hobli. It is proposed to provide an approach road from Outer Ring Road at the Belandur junction to the Electronic City at the Hosur Road junction with a "Corridor" Road of 8.5 km to enable better connectivity. The Corridor road will be constructed as per highway standards with a six-lane carriageway and a median of about 1.5 meters, with an estimated cost of Rs. 35 crores. The corridor in addition will feature a Hi-Tech Hub with residential, retail, services development and 20% area for Parks & Lake development.

The BDA and BMRDA have planned 3 more ring roads beyond the existing ring road. The first of these, the Peripheral ring road will connect to the N.IC.E Peripheral Ring road. The second and third will be known as the Intermediate Ring Road and the Satellite Town Ring Road respectively

Table 107: Proposed Projects

Projects	Funding	Cost (in Cr.)
Hi – Tech Corridor 8.5km six-lane carriageway. Belandur, ORR to Electronic City	BDA	35
80 nos. of **Arterial** and 285 nos. of **Sub – Arterial Roads**	BBMP	500
Peripheral Ring Road 65km eight-lane ring road. Linking NICE Road From Tumakuru Rd up to Sarjapur Rd.	BDA, GoK, JICA	11,950
Elevated Corridor 1. Central Silk Board to Jayamahal Rd 2. Jnana Bharati to Varthur Kodi 3. Beninganahalli to Mekhri Circle 4. J C Road – Minerva Circle to Hudson Circle	BDA	5800
Signal Free Corridor 1. Dr. Rajumar Road – Okalipuram to Yeshwanthpur 2. Old Airport Road – Vellara to Whitefield 3. Ring Road – Mysore Road to Silk Board 4. Old Madras Road – Ulsoor to Hope Farm	BBMP	380
RoB between Yelahanka and Rajanakunte	K-RIDE & GoK	25
Total		18690

9.7.6. SUMMARY

Urban Transport development in a large growing city like Bengaluru needs to be addressed from larger perspective of urban planning and development. Bengaluru needs a demand-segmented, service-oriented urban transport strategy, which would balance growth with equity concerns, with a strong but cost conscious orientation in favour of public transport modes.

Transportation from place to place takes an enormous amount of time. Roads have not been developed as quickly as our logistical demands requires, hence it is crucial to expand roads and improve the quality of roads. For a sustained progress of the city, we have to build better roads so that the transportation of goods becomes efficient. Incorporation of PPP model in developing and expanding road infrastructure is the need of the hour.

The city needs to provide for more roads, better parking and footpath facilities. Development of public transport facilities need to be fast tracked to decongest the existing roads. The Namma metro project on completion will add 114.4 kms of metro transport system. However this project has been delayed and needs to speeded up. In addition the city is geographically expanding and the planned 114.7 km metro line will not be sufficient to cater to the upcoming areas. Bus services should be improved to connect the new areas and the areas that not covered adequately to the metro rail and other mass transit system.

BBMP and BDA are carrying out several projects to enhance the connectivity within the city, efforts is also witnessed in strengthening the roads and also to decongest the city. However, despite all the mechanisms there still seems to be a gap at the service level that needs to be bridged.

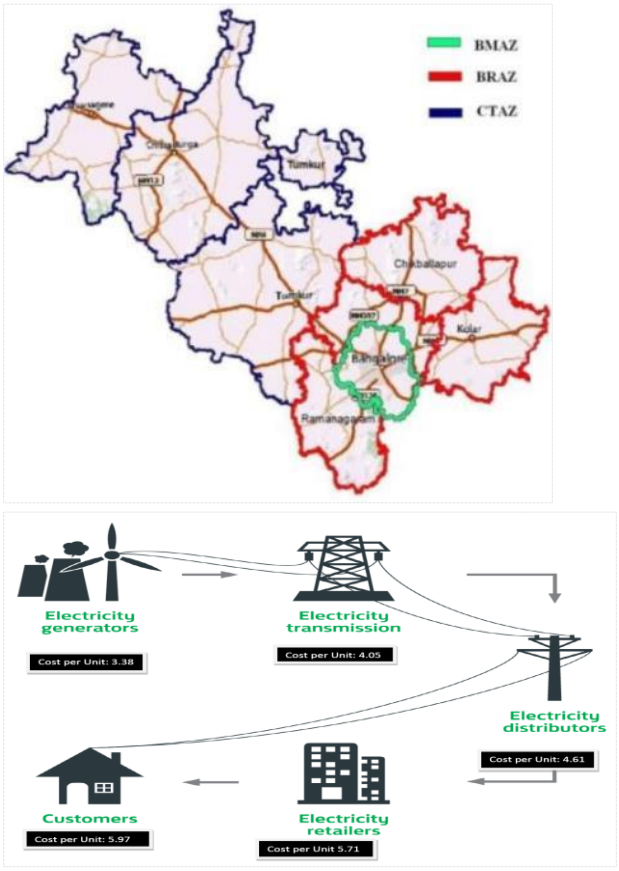
The investment in urban transport for Bengaluru city is estimated at around Rs. 44780 crores and for development of roads is around Rs. 19779 crores.

9.8. ENERGY

9.8.1. CURRENT STATUS

The Twelfth Five Year Plan lays special emphasis on development of the infrastructure sector including energy, as the availability of quality infrastructure is important not only for sustaining high growth but also ensuring that the growth is inclusive. During the Eleventh Five Year Plan, nearly 55,000 MW of new generation capacity was created across India, yet there continued to be an overall country-wide energy deficit of 8.7 per cent and peak shortage of 9.0 per cent. Resources currently allocated to energy supply are not sufficient for narrowing the gap between energy needs and energy availability.

Figure 107: Electricity Distribution of BESCOM



Source: BESCOM

Previously the Karnataka State Electricity Board (KEB) was looking after generation, transmission and distribution of electricity in the State of Karnataka. But after the enactment of Electricity Act 2003, KEB was restructured and electricity generation, transmission and distribution Companies were formed. The Bangalore Electricity Company (BESCOM) is one such entity that was formed during the restructuring of KEB.

BESCOM was incorporated in April 2002 and commenced its operations with effect from 1st June 2002. BESCOM supplies electricity to 2.07 crores population across 8 districts in Karnataka. There are about 71.55 lakh residential, 8.69 lakh commercial, and 7.70 lakh agricultural, 1.8 lakh industrial and 4.72 lakh other customers served by BESCOM.

BESCOM is procuring energy from different source i.e., hydel, thermal, and non-conventional sources through long term power purchase agreement, short term power purchase agreement and bidding process. Average approved power purchase cost for 2015-16 is Rs. 3.38 per unit. Purchased energy is transmitted through transmission lines of State/Central transmission units. During transmission, about 3.80% transmission loss is incurred. Transmission Company incurs cost for maintenance of the existing network and to build additional network. Taking into account the cost of transmission losses, per unit of electricity at the BESCOM network periphery will costs Rs. 4.05 per unit.

9.8.2. ENERGY SECTOR

The Master plan of BESCOM envisages higher population growth in next five years through migration from other part of India and also natural growth. It has been highlighted in the plan in order to cater these consumers; infrastructure has to be developed in long term perspective. It is projected that future increase/growth will be both because of relocation/migration & natural growth.

BESCOM has identified the following key areas for the need based investments.

1. **AT&C losses reduction:**
   - Target for AT&C loss reduction based on the several recommendations and has under taken every effort to achieve the targets.

2. **Metering:**
   - Programme for replacing all electro mechanical meters by electro static meters to the reduce AT & C loss. Metering Distribution Transmission Centres (DTC's) in rural areas.
   - Smart meters trial.
   - High tension (HT) installations above 500 KVA having 3Ph 3 wire metering are proposed for replacing with 3Ph 4 wire for enabling accurate unbalance load recording there by reduction in AT&C Loss.

3. **Re-Conductoring of lines (HT and LT)**
   - Re-conductoring of ACSR / Rabbit to Coyote in Bengaluru Urban and Rural, as a part of the R-APRDRP.
   - Proposed length of 500kms at a total cost of 70 crores.

4. **Evacuation of New Line/link Line for Urban / Rural Area:-**
   - Draw new line / link line to augment power station to reduce T & D Losses, reduction in interruption and better voltage regulation providing additional DTCs to reduce overloading and also to cater to the load growth.

5. **Improvement in quality of supply:**
   - Implementation of NJY (Niranthara Jyothi Yojane)
   - Restructured Accelerated Power Development & Reform Programme (RAPDRP) works & Distribution Automation System (DAS)
   - Providing Ariel Bunched Cables (ABC works)

6. **IT Interventions:**
   - Providing ETV meters of class 0.5 to HT and of class 0.2 to EHT installations with ABT features

7. **Niranthara Jyothi**
   Niranthara Jyothi Project is a prestigious scheme of Government of Karnataka, intends to provide 24 hrs 3 phase power supply to non-agricultural loads like domestic, commercial, water supply, street light, rural industries, milk dairies etc., in rural areas by segregating the agricultural loads, which is a boon to the rural economy.
   - This will enable BESCOM to give 24X7 supply to non-agricultural loads in rural areas.
   - Reduction in transformer failure
   - Increase in metered sales
   - Reduction in technical losses
   - Improved load management
   - Reduction in interruption of Power supply

Table 108: Completed Projects

Projects	Funding	Year of completion	No. of Feeders	Cost (in Cr.)
Niranthara Jyothi – Phase 01. Bengaluru Rural – 208 villages	Grant	2014	17	46
Niranthara Jyothi. – Phase 02 Bengaluru Rural – 475 villages	Grant	2015	18	64
APDRP. Part – A Bengaluru Rural	XII plan	2013		147
Total				257

Source: BESCOM Data

R-APDRP

Government of India proposed to continue Restructured Accelerated Power Development Reforms Programme (R-APDRP) during the XI Plan with revised terms and conditions as a Central Sector Scheme. Government of India will provide up to 25% Loan for Part B. The balance 75% shall be sourced from FIs/REC/PFC etc. As per the guidelines, the DPRs were prepared for 24 towns. BESCOM invited tenders for 24 towns for RAPDRP Part-B on total turnkey basis. Accordingly, detailed work award for RAPDRP Part-B have been issued for SCADA and RAPDRP Part-B project shall be completed within the targeted time.

Table 109: On-going Projects

Projects	Funding	Year of commencement	No. of Feeders	Cost (in Cr.)
R-APDRP Part – B Reduce overall AT&C losses	GoI, JICA & Funds	-	24	416
DDUGJY (DPR Prepared)	Grant	-		431
RGGVY 90% subsidy for rural	XII plan - GoI	2005		260
Regularization of IP Sets	BESCOM			200
Service Connection Works	BESCOM	2012		25
Total				1332

Source: BESCOM Data

Table 110: Proposed Projects

Projects	Funding	Year of commencement	No. of Feeders	Cost (in Cr.)
H.V.D.S		-	24	76
Service Connection Works 2012-18 Network Augmentation				50
Capital & Construction Works 2012-18				612
Total				738

Source: BESCOM Data

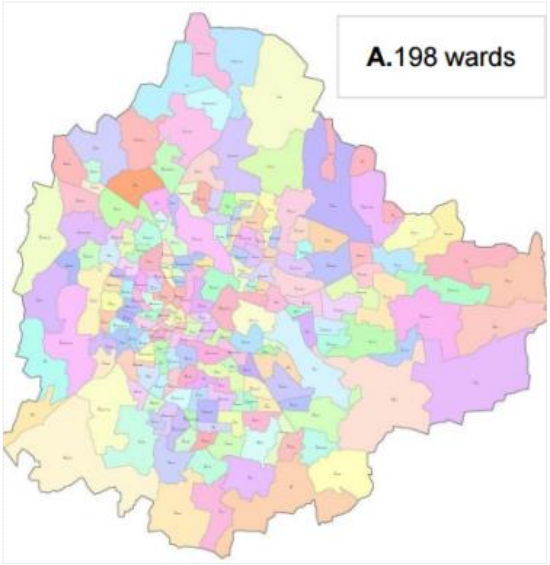
9.8.3. SUMMARY

The potential for energy generation depends upon the country's natural resource endowments and the technology to harness them. Certain key areas have need – based investments, such as reducing AT&C losses, incorporation of smart metering, improvement in quality of supply and introduction of state-of-the-art IT interventions, and ensuring 24x7 uninterrupted supply to both urban and rural areas of Bengaluru. BESCOM needs to enhance the supply to meet the city's growth demands by solar roof top in the cities and to reduce the self-consumption of domestic consumers (subsidized category).

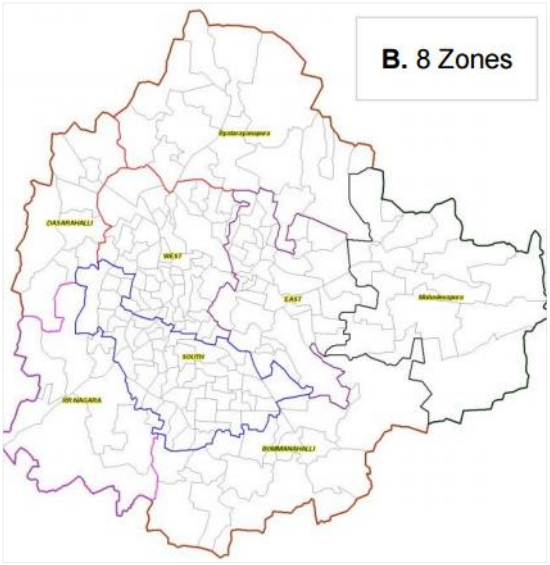
Investments of around Rs. 2070 are expected for the development of Energy related infrastructure for Bengaluru city.

ANNEXURE 9A: BRUHAT BENGALURU MAHANAGARA PALIKE

The history of municipal governance of Bengaluru dates back to March 27, 1862, when Municipal Board was formed for the Pette and Cantonment under the Improvement of Towns Act of 1850. The two boards were legalized in 1881, and functioned as two independent bodies called the Bengaluru City Municipality and the Bengaluru Civil and Military Station Municipality. The following year, the concept of elected representatives come into being and also saw the introduction of property tax.



The two Municipal Boards were merged to form the Corporation of the City of Bengaluru in 1949, under the Bangalore City Corporation Act. The corporation then consisted of 70 elected representatives and 50 electoral divisions. The name of the council then changed to Bangalore City Corporation (BCC) and then to Bangalore Mahanagara Palike (BMP).



The Bruhat Bengaluru Mahanagara Palike (BBMP, Greater Bengaluru Municipal Corporation) is currently in charge of the civic administration of the city. It was formed in 2007 by merging 100 wards of the erstwhile Bangalore Mahanagara Palike, with 7 neighbouring City Municipal Councils, 1 Town Municipal Council and 110 villages around Bengaluru. The number of wards increased to 198 in 2009. The BBMP is run by a city council composed of 250 members, including 198 corporators representing each of the wards of the city and 52 other elected representatives, consisting of members of Parliament and the State legislature.

The Bangalore Water Supply and Sewerage Board (BWSSB) was constituted in 1964 to supply water to the city and to provide for the disposal of sewage. The Karnataka Electricity Board (KEB) was corporatized into the Karnataka Power Transmission Corporation Limited (KPTCL), with the distribution of Bengaluru division vested with the Bangalore Electricity Supply Company Limited (BESCOM), which caters to 2.1 million customers in the Bengaluru metropolitan area. The Bangalore Metropolitan Transport Corporation (BMTC) was separated from the parent Karnataka State Road Transport Corporation through private sector investment, operating close to 3000 busses and servicing 2.8 million customers daily. The Bangalore Agenda Task Force (BATF), a private-public partnership enterprise, was established to coordinate civic improvement and development activities with the BDA and BBMP.

ANNEXURE 9B: INSTITUTIONAL FRAMEWORK IN THE CITY FOR WATER AND SEWERAGE

The Bangalore Water Supply & Sewerage Board (BWSSB) provides water supply and sewerage services in Bengaluru and surrounding village areas.. Though initially restricted to the area under the erstwhile BMP's jurisdiction, BWSSB is progressively increasing its services coverage area to the entire Bangalore Metropolitan Region (BMR).

Bangalore Water Supply and Sewerage Board Act, 1964 (BWSSB Act)

"The Bangalore Water & Sewerage Sanitary Act 1964" was enacted to make provisions for Water supply, Sewerage & disposal of Sewage in Bengaluru metropolitan area. Prior to this enactment, the head works and the mains for the water supply were controlled by the Government and only the distribution of water is carried out by the Bengaluru Municipal Corporation. Under Section 15 of the Act, the Board is vested with the following duty:

- To provide a supply and improving the existing supply of water in the Bengaluru Metropolitan Area and of making adequate provision for the sewerage and the disposal of the sewage in the Bengaluru Metropolitan Area.
- To ascertain the sufficiency and wholesomeness of water supplies within the Bengaluru Metropolitan Area.
- Prepare and carryout schemes for the supply of wholesome water for domestic purposes within the Bengaluru Metropolitan Area.
- Prepare and carryout schemes for the proper sewerage and the disposal of the sewerage of, the Bengaluru Metropolitan Area.

As per the 74th Constitutional Amendment Act in 1992, the local authorities are delegated with the specific obligation of water supply and sewerages in the Bengaluru Metropolitan Area and thereby the Board is exercising the function of operating water supply and sewerage services, on behalf of the Corporation.

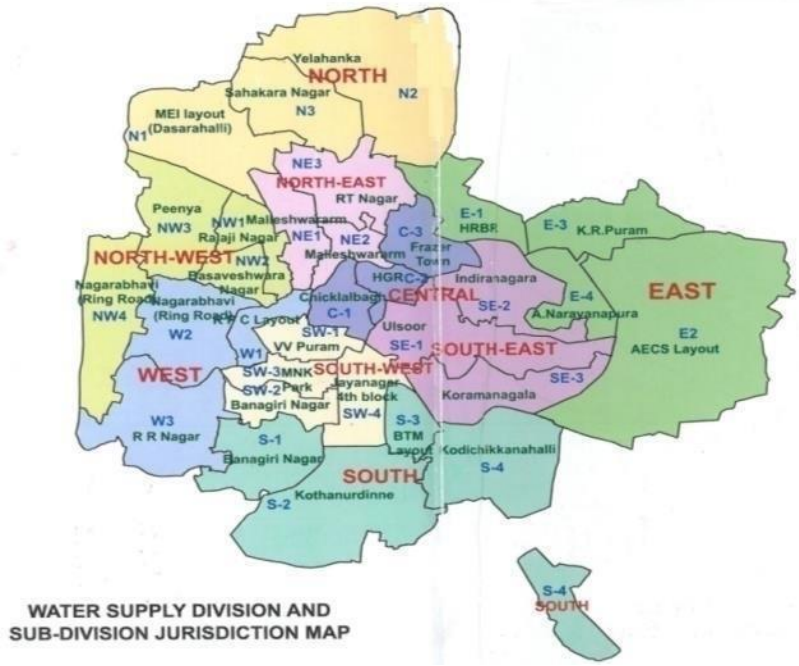
Bangalore Water Supply & Sewerage Board (BWSSB)

The Bangalore Water Supply & Sewerage Board (BWSSB) constituted as a statutory organization and autonomous board under the BWSSB Act in 1964, has been discharging the responsibilities of Water Supply and Sanitation for the Bengaluru Metropolitan Area (BMA). The service area of BWSSB covers 850 sq.km of the city with 5975 km length of Distribution Network. With 8.46 lakh connections, the per-capita supply is about 100-120 litres/day.

The basic responsibilities of BWSSB is to provide pure drinking water to the citizens living in BBMP area and to convey the sewage water generated from houses to the effluent treatment plant for treating the sewage to the non-potable standards.

Functions of BWSSB Board:

- Providing water supply and making arrangements for the sewerage and disposal of sewage in the existing and developing new regions
- Investigating adequacy of water supply for domestic purpose.
- Preparation and implementation of plans and schemes for supply of water for domestic purposes to the required standards.
- Preparation and implementation of plans and schemes for proper sewerage and disposal of sewage.
- Levy & collection of water charges on "no loss no profit basis."



WATER SUPPLY DIVISION AND SUB-DIVISION JURISDICTION MAP

Water is supplied regularly on designated date & time applicable to concerned areas. In case of interruption of water supply, board supplies water through its tankers at free of cost. BWSSB collects over 1,600 water samples across the city each month and carries out tests in laboratories as per guidelines stipulated by the Central Public Health and Environmental Engineering Organization (CPHEEO) and the World Health Organization (WHO). Mobile laboratories are also used to ensure water is supplied as per the WHO standards. Water supply & UGD complaints are recorded in the respective service stations.

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.

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

ANNEXURE 9C: STAKEHOLDERS IN URBAN TRANSPORT SECTOR

In Bengaluru, the fragmentation is truly extreme: in addition to state and city agencies, metropolitan area development authorities, traffic police department, special purpose para-statals such as the Bangalore Mass Rapid Transit Ltd., Karnataka Road Development Corporation, Karnataka Urban Infrastructure Development and Finance Corporation; all of whom pursue urban transport activities. The State has attempted to overcome the fragmentation by creating ad hoc bodies, such as Agenda for Bengaluru, Transport Advisory Forum, and Task Force for Traffic and Transport, but these appear also to hold merely pieces of the pie. Bangalore Development Authority has no transport group, apparently no transport professionals at all. Indeed, its charter does not include transport planning. The last study with a comprehensive coverage was done long ago. In this forest of institutions, no single body appears to make comprehensive policy or medium-to-long term investment plans.

Government of Karnataka formulated a State Directorate of Urban Land Transport (DULT) under the Urban Development Department with the intended objective of ensuring integration of transport planning and development of transport infrastructure in urban areas. The Government has also sanctioned setting up of Bengaluru Metropolitan Land Transport Authority (BMLTA) for BMR. BMLTA will function as an umbrella organization to co-ordinate planning and implementation of urban transport programs and projects.

Directorate of Urban Land Transport (DULT)

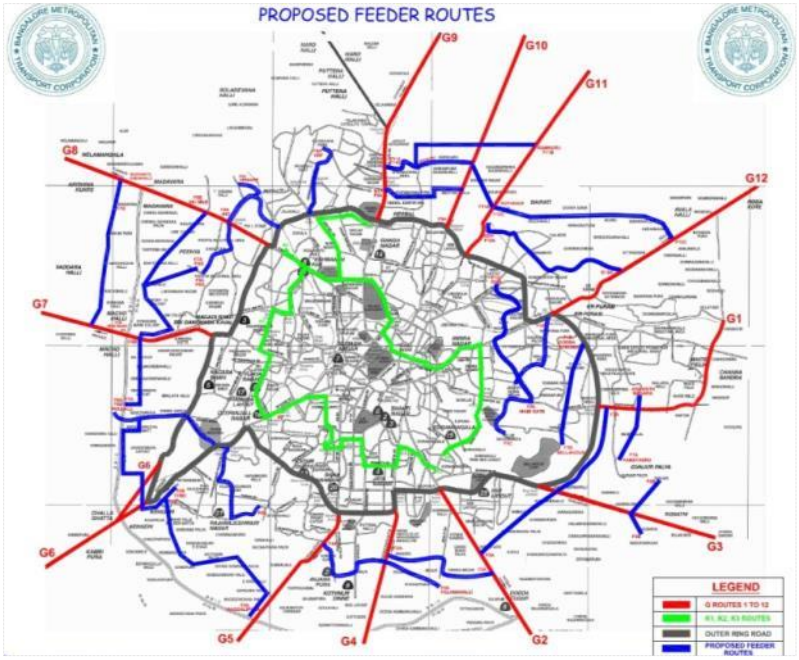
DULT was set up in 2007, close on the heels of National Urban Transport Policy coming into existence, and since several action plans & policies have been introduced in the city.

DULT introduced a parking policy, where parking was managed through parking pricing; restriction and regulation of on-street parking and professional management of existing parking resource, both on-street as well as off-street etc. DULT has also prepared a parking action plan for core areas of the Bengaluru metropolitan area and is actively working with BBMP for the implementation of the same.

Multi-modal integration proposal by DULT at metro stations as a critical component to promote the public transport usage. It is in the process of preparing Station Accessibility Plans for all metro stations and the work has been awarded for 12 metro stations. The focus is on enhancing the reach and access of the pedestrians and bus users to the metro stations.

Bangalore Metropolitan Transport Corporation, BMTC

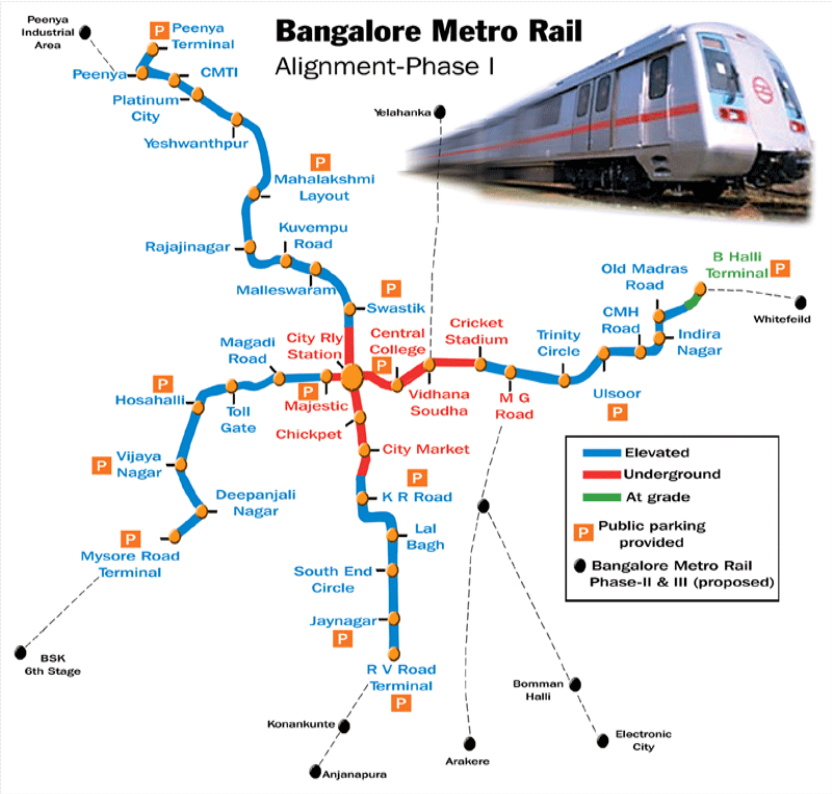
The Bangalore Metropolitan Transport Corporation is the sole public bus transport provider for Bengaluru, serving urban, sub-urban and rural areas. BMTC is a Government agency that operates the city public transport bus service. It has the highest number of Volvo buses operated by a public transport company in India. With 6,500 buses in its fleet, BMTC 50 lakh people per day. Operating from 39 depots, BMTC services 13 lakh km of area, making 82,800 trips per day. BMTC has 34 bus stations across the city and the 3 major bus stations are located at Majestic, K.R Market and Shivajinagar. Satellite Bus Stands are located at Shantinagar and Kengeri.



Service	Description
BIG 10	Suvarna class buses plying on 12 major corridors towards the city center
BIG Circle	Suvarna class buses plying on inner and outer ring roads
Atal Sarige	Low fare buses connecting immediate rural areas with the city
Vajra	Air conditioned Volvo serving IT corridors and major residential areas.
Vayu Vajra	Air conditioned Volvo connecting to International Airport – 12 routes
Metro Feeder	Special buses running as feeder network to the Metro stations - 10 routes
Hop on - Hop off	For sightseeing service, connecting about 20 landmarks

Bangalore Metro Rail Corporation Ltd, BMRCL

BMRCL, a joint venture of the Government of India and the Government of Karnataka, operates the metro system - Namma Metro in the city. The project has an 18.10km East-West corridor starting from Baiyappanahalli in the east and terminating at Mysuru Road terminal in the west and a 24.20 km North-South corridor commencing at Nagasandra in the North and terminating at Puttenahalli in the South. The commercial operations on MG Road to Baiyappanahalli station commenced on 20th October 2011 and the commercial operations on Peenya Industry to Mantri Square Sampige Road Station commenced on 1st March 2014. The new extended Green Line from Peenya Industrial area to Nagasandra of Bengaluru Metro became operational in May 2015.



Source: BMRCL

The underground work of Phase I commenced in May 2011. Each corridor consists of two tunnels which are the first underground tunnels built for trains in South India. The tunnels, dug using tunnel boring machines (TBM), are located approximately 60 feet below ground level, have a diameter of 5.5metres and are 5metres apart.

All metro trains are Wi-Fi enabled (the first metro in India to have this feature), so passengers can use laptops, tablets as well as mobile internet. The free Wi-Fi service was made available to commuters since July 2013