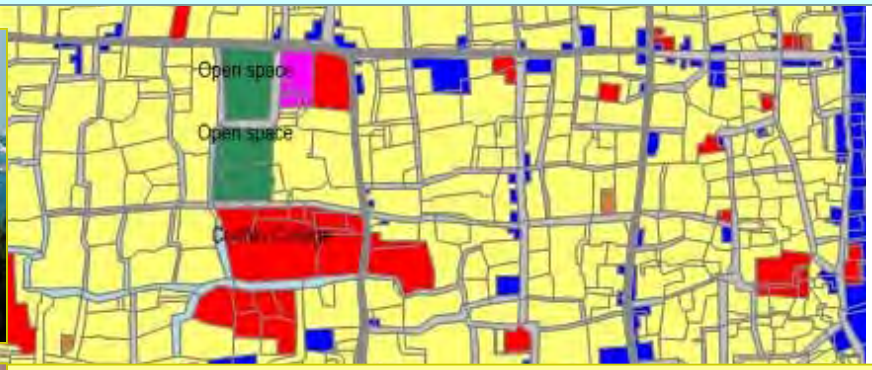
DEVELOPMENT PLAN FOR KOCHI CITY REGION 2031

(Draft)

VOLUME III

DEVELOPMENT PROPOSALS AND DEVELOPMENT CONTROL REGULATIONS



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CONTENTS

List of Tables

CHAPTER 1

MAJOR OBSERVATIONS FROM THE STUDIES AND ANALYSIS

1.1 Limitations of the Development Proposals

- The Development Plan is finalised at a time when population count is taking place under the Census. Census 2011 may be available only after one year of this Plan preparation. The secondary data available as per 2001 Census is used for the purposes of this Plan.

- The State is now in the process of 'delimitation' exercise, before the oncoming Local Government elections of 2010, by which the local government (Municipal and Panchayat) boundaries may be reconstituted. Changes in the boundaries of the city of Kochi and that of the Municipalities and Grama Panchayats within the Planning Area are likely to occur. These changes are not considered for the purposes of this Plan.

- This Plan provides for strategies only, to address the issues of housing sector, environment, and physical infrastructure like Water Supply, Sewerage and Solid Waste Management. Detailed studies under each of the above development sectors need to be carried out and separate proposals in detail have to be prepared further to translate the strategies to projects.

- Four urbanizing panchayats in the periphery of Kochi City, which were included in the Structure Plan for Central City, Kochi are now under the jurisdiction of Goshree Island Development Authority (GIDA).This Plan provides for broad proposals for this area and detailed land use proposals for these panchayats are to be evolved by GIDA while preparing Development Plan for GIDA area.within the broad concept and policy of this Development Plan.

- Another major constraint is 'uncertainties'. Kochi is a fast changing / growing urban region, perhaps the fastest growing city region in Kerala. There could be many changes that could occur which cannot be comprehended or anticipated now. One such major change may be related to technological changes due to innovations /developments. Other uncertainties could be related to major impact making investments that may happen within the planning area and in the immediate region around. Such investments may have an impact on the developments in the City Region. Such uncertainties are not and cannot be comprehended in the preparation of this Development Plan. However such events, when they do happen, can be subjected to study for the review and revision of the Development Plan for Kochi City Region, as and when necessary.

- Detailed study on traffic and transportation done for the Corporation area pertain to 2006 and that of the Panchayats included in the planning area pertain to 2001. The existing land use map prepared is for the year 2007 which was updated in 2009.

1.2 Kochi City Region

1.2.1 Area and Population

Kochi City Region (KCR) considered as the Planning Area in this Development Plan comprises of Kochi City and the immediate surrounding area, which is within the influence of the developments in the city and vice versa. The delineated Planning Area comprises of the following local government constituent units, as shown in the Table 1.1 below with the area and population (2001) of each of the units:

Table 1.1 : Area and population details of proposed Kochi City Region

Sl. No.	Name of Local body	Area (sq. km)	Population as per 2001 Census
1	Corporation of Kochi	94.88	595575
2	Thripunithura Municipality	18.69	59884
3	Kalamassery Municipality	27.00	63116
4	Maradu	12.35	41012
5	Thiruvankulam	10.49	21717
6	Thrikkakkara	27.46	65984
7	Cheranelloor	10.59	26316
8	Eloor	14.21	35573
9	Varapuzha	7.74	24524
10	Kadamakkudy	12.92	15824
11	Mulavukadu	19.27	22842
12	Elamkunnapuzha	14.47*	50563
13	Njarackal	8.6	24166
14	Kumbalam	20.79	27549
15	Kumbalanghi	15.77	26661
16	Chellanam	17.6	36209
17	Vadavukode-Puthenkurisu	36.89	26710
Total		**369.72**	**1164225**

Source: Census, 2001

*Including 2.81 sq.km of accreted land at Puthuvypeen

The above total population of 11,64,225 is projected to 22,73,512 for the year 2031, which includes migration and floating population components. Details of population projection are as follows:

Table 1.2: Projected Population of Kochi City Region, 2031

Planning Division Number	Constituent unit	Projected Population 2031 (natural growth + migration + floating population)
1	Fort Kochi	370912
2	Wellington Island	21400
3	Mainland of Kochi Corporation	537229
4	Chellanam	63154
	Kumbalangi	44131
5	Maradu	110635
	Kumbalam	66791
6	Thrippunithura	149346
	Thiruvankulam	55482
7	Vadavukode-Puthenkurisu	45396
8	Thrikkakara	284700
	Kalamassery	179177
9	Eloor	52543
10	Cheranellur	47724
	Varappuzha	44880
11	Kadamakkudy	25718
	Njarakkal	46120
	Elamkunnappuzha	98119
	Mulavukad	30054
	Total	2273512

1.2.2 Spatial Characteristics of the Planning Area

The city of Kochi has a population of 5.95 lakh (2001) in an area of 94.88 sq km. The city has a population density of 6277 persons per sq km (2001 and within the city, it varies from ward to ward. The traditional town areas of Mattancherry and Fort Kochi are some of the areas which have the highest density of population.

Kochi city has a dominant central commercial area extending in a linear fashion along Mahatma Gandhi road and Banerji road spreading to the sides along Broadway, Foreshore road and market area. This area can be termed as the 'City Centre' of the Kochi City region. However a few other nodes – namely Kaloor-Palarivattom area, Edappally, Vyttila, Thripunithura and Kadavanthara have developed as commercial centres of importance.

One of a few major activity centres that helped Kochi to rise to the level of the city of importance in Kerala is the Kochi port. The port activities centred around the Wellington Island is on the pace of modernization and expansion now. The container port development at Vallarpadom, new road and rail linkages to this terminal, development of Airport – Seaport connectivity, oil-LNG-CNG terminals being developed on the western coast etc. now cause a great push for the development of the western coast of Kochi.

Mattancherry – Fort Kochi area with all its historic edifices and heritage has been a prime place of tourism importance in Kochi and Kerala.

Eloor Panchayat area on the north-east side of Kochi is the most important centre of industrial activity in Kerala. This industrial activity centre had expanded its influence along the national highway up to Kalamassery – Aluva and Angamali. Development of this activity corridor is further strengthened by the establishment of International Airport at Nedumbaserry near Angamali.

The seat of the district headquarters was shifted to Thrikkakara Panchayat situated on the eastern side of Kochi city, causing marginal growth in the surrounding area. But development of Infocity and other Information Technology (IT) related activities at Kakkanad in Thrikkakara Panchayat gave a boost to the development of this Panchayat area as the most sought after development zone of Kochi during the last two decades.

Kumbalangi Panchayat on the southern side of Kochi city is being developed as a tourist centre attracting domestic and foreign tourists. The National Waterway III being developed from the northern side of Kochi towards south up to Kollam has a positive impact in tourism development in Ernakulam district particularly benefiting Kochi city. Aiding this tourism growth in Kochi city is the proposal to develop a Marina at Kochi.

Geographically, Kochi has good natural assets with large sheets of water spread in Kochi city, some navigable, some having potential to be developed as water transport corridors and some aiding natural drainage of water. However, this asset is also a cause of environmental concern, since these sheets of water provide easy way out for waste dumping and since they cause high ground water pollution.

One major investment which caused a big change in the physical growth trend in Kochi city is the formation of NH 47 Bypass from Aroor (northern end of Alappuzha district) along the eastern boundary of the city to Edappally, another sleepy node a few decades ago. Edappally, Vyttila and Kundanoor along this NH Bypass have of late developed into major activity nodes of the city.

CHAPTER 2

BRIEF OUTLINE OF THE DEVELOPMENT CONCEPTS AND DEVELOPMENT STRATEGIES

2.1 The Wider Region around Kochi City

The Development Plan for Kochi City region takes a wider perspective of the developments around, which are influenced by the growth of Kochi city and which have occurred taking advantage of the proximity to Kochi city. Similarly the present trends of developments taking place in this wider region around contribute to the economic and social well being of the Kochi city and environs.

Studies show that in such a mutually conducive and beneficial development scenario developments coming in the area beyond the Planning Area of Kochi City region need to be guided so that the settlements in the wider region around receives guided development inputs and that such developments become beneficial to the Kochi City region. Based on this Concept some of the Development Strategies recommended as means to achieve these objectives are narrated in Volume 2 of this Development Plan dealing with Concepts and Development Strategies. Excerpts from that are highlighted here.

1. Kochi city can be developed as a Global City, as a destination for investments from across the country and from abroad, exploiting its diversified development potentials in port related activities, industries, information technology, tourism, trade etc. The planning area may become a Metropolitan City in the plan period, which may necessitate review of the Development Plan.

2. Planned efforts shall be adopted to address the requirements of the floating population in the city, which shall include reduction in the need for the commuting population to commute daily for work and services within the city region.

- Major urban centres in the district other than Kochi city shall be given impetus for development to arrest the influx of floating population to Kochi city and also to provide opportunities for the other towns in the region to develop.

  Kochi city attracts a huge influx of floating population. This floating population converges to the city for availing of job opportunities, education and health facilities, trade and commerce and other higher order amenities/facilities (travel & recreational facilities etc.). This trend points to the need for stimulating the growth of 'second order' urban settlements around the city to provide the much needed facilities and better job opportunities. This may also partly reduce the stress due to the floating population on the infrastructure within the city.

- New transit oriented development corridors shall be opened up to stimulate growth of other growth centres, to attract more population and thus to reduce their dependency to Kochi City

3. Unplanned urban sprawl which is being experienced in and around Kochi City needs to be arrested / regulated**.**

- The urbanizing peripheral areas immediately surrounding Kochi City need to be developed giving thrust on their development potentials. The Planning area shall include Kochi City and these peripheral areas; and shall be planned as a single unit.

- Separate strategy needs to be devised for the development of the area immediately outside this planning area.

4. Regional transport corridors should be strengthened and better mass transport facilities need to be promoted.

2.2 Kochi City Region or the Planning Area

The concept of development of Kochi City Region, consisting of the Corporation of Kochi, Thripunithura Municipality, Kalamassery Municipality and 14 panchayats identified is as follows:

1. Kochi City and the urbanizing peripheral areas shall be planned as a single unit for planning purposes exploiting the development potentials

    - This area (Kochi City Region) shall be developed to grow as a Global City. This may require attracting investments in many higher order and new functions. Since it may be difficult to accommodate all such distinct functions within the city limits, the urbanizing peripheral areas of the city are also to be considered along with the city to meet these varied challenging requirements. This calls for planned development of the peripheral areas too.

    - Diversification of economic base in the Kochi City Region shall be encouraged. Port based activities, IT sector, tourism, health facility, industrial and commercial activities etc shall be promoted wherever there is potential.

    - The planning divisions shall be identified considering potential for development, physiography, contiguity and homogeneity and access to mass transit systems.

    - There shall be a varied approach in the development of different planning divisions and new major job activities shall be permitted only on a selective basis.

2. The scope for densification of the city both in terms of population and activities shall be utilized to the optimum.

3. Integrated fast transit corridors shall be developed linking the major development centres (I.T., tourism, industries, trade) to support the 'global city'

4. Kochi shall exploit its vast potential for water front development. Quality urban spaces and landmarks shall be developed, especially in newly developing areas.

5. Promote Mass Transport and make Kochi a pedestrian friendly city and integrate different modes of transport viz. road, rail and IWT

6. Hierarchy of facilities and amenities shall be ensured in the planning area.

7. Activities of the informal sector shall be accommodated at specific designated areas within the planning areas

CHAPTER 3

PROPOSED LAND USE

3.1 Estimated future land requirement for various uses in the Planning Area

In order to assess the total land requirement for various uses for the horizon year of 2031 within Kochi City Region, the existing land use pattern is studied and then compared with the assessed future requirement for some major uses using UDPFI (Urban Plan Formulation and Implementation) Guidelines of the Ministry of Urban Development, Government of India. However varying from the general use categories in metropolitan cities as noted in the UDPFI Guidelines, Kochi has activity areas specific to Kochi. These are also taken into account in assessing future land requirement for various uses.

The Existing Land Use (updated in 2009) for various uses is compared with UDPFI recommended figures in the table below.

Table 3.1 : Existing Land Use v/s UDPFI norms within the Kochi City Region

Land Use	Existing Area in ha	Existing % to Gross area	Existing % to Net area	UDPFI recomm. (%)	Existing (Net) / UDPFI ratio	Deviation
Residential	16057.9	43.43	69.39	35	1.98	
Commercial	367.1	0.99	1.59	4	0.40	
Industrial (including 281.12 Ha of accreted land in Puthu Vypeen)	2404.61	6.5	10.39	12	0.87	
Public & Semipublic	1538.37	4.16	6.65	14	0.47	
Transportation	1486.35	4.02	6.42	15	0.43	
Parks, Playgrounds & Open Spaces	113.79	0.31	0.49	20	0.02	
Paddy land / Wet land	6817.55	18.44				
Area under Dry Cultivation (cash crops/plantation crops)	754.06	2.04	3.26			
Water bodies	7011.43	18.96				
SWM Site	23.66	0.06	0.10			
Port and port related	397.3	1.07	1.72			
Total	36972.12	100	100			
Net Area excluding water bodies, paddy lands and wetlands	23143.14					

Uses having Existing (net) / UDPFI ratio below 0.5 are considered to be grossly inadequate. Thus Recreational spaces, Commercial spaces, Transportation and Public & Semipublic uses are found grossly inadequate in the existing land use pattern.

The UDPFI recommends land use allocation within the settlement for various major uses. Different norms are suggested for different size of settlements: small towns, medium towns, large cities and metro cities. Kochi is not yet a metropolitan city; however this Development Plan considers the present city and the immediate surrounding area as a single planning entity and the estimated population size of the planning area in the horizon year is about 23 Lakh. In view of this, land use planning standards for metro cities as recommended in the UDPFI Guidelines are adopted for KCR and the future land requirements for various uses are worked out. However the land requirements so estimated are varied for certain uses which already have a prominent presence in Kochi City region. Kochi City Region has a fairly good industrial base with industries of various types and sizes – manufacturing industries, port and ship building related industries and soft hi-tech industries like Information Technology parks, biotechnology parks, Export Processing Zone (EPZ), Special Economic Zone (SEZ) etc. Therefore land requirement for industries in the KCR is worked out taking the higher percentage of 10 compared to the existing percentage of area under industries. However a lower percentage (7%) is adopted for recreational uses considering the availability of vast expanse of water bodies and marshy areas in the region.

Table 3.2 Estimated Land Requirements for various uses in the KCR

(Area in hectares – Ha)

Land Use	Existing Area in ha	Existing % to Net area	Proposed % to Net area	Proposed Area in ha	Additional requirement for major uses
Residential	16057.9	69.39	40	9653.81	
Commercial	367.1	1.59	4	965.38	598.28
Industrial (incl.puthu vypeen)	2404.61	10.39	10	2413.45	8.84
Public & Semipublic	1538.37	6.65	9	2172.11	633.74
Transportation	1486.35	6.42	7	1689.42	203.07
Parks, Playgrounds & Open Spaces	113.79	0.49	7	1600.12	1486.33
Paddy land /Wet land	6817.55			4674.08	
Agriculture (Dry Cultivation)	754.06	3.26	3.12		
Water bodies	7011.43			7011.43	
SWM site	23.66	0.10	0.10	23.66	
Port and Defense related	397.3	1.72	1.65	397.30	
Total Area	36972.12	100			
Net Area excluding water bodies, Paddy and wetlands	23143.14				

Note: Proposed percentage of uses are adopted with minor modifications from UDPFI guidelines as explained above to suit the local conditions

In the assessment of land requirement for various uses in the Kochi City Region, it has to be accepted that large areas are under water and wetlands. Taking this area under water bodies and wetlands also as the total area of the City Region, the computed area for additional land requirement may give erroneous results and may mislead. In view of that, the area under water bodies and wet lands are excluded from the total area and the future land requirement for various uses is assessed based on the net developable area within the Kochi City Region. However it is accepted that the area under water bodies and wetlands need to be taken into account for the following needs:

- water bodies can be partly used for water transport facilities (in navigable stretches), and hence part of the area under water bodies can be accounted for Transport Uses

- water bodies and wetlands also provide area for open spaces and for recreational purposes, and hence part of the area under water bodies and wetlands can be considered under these.

In the Existing Land Use classification it may be seen that marshy lands and fish farms can be computed together to be wet land. Though the UDPFI Guidelines propose about 20 to 25 % of the total area to be developed for recreational purposes, it may not be a feasible proposition for KCR. When we accept that the existing availability of 0.31% of the total area under recreational open spaces, has caused extreme dearth of open spaces in the City Region, measures have to be found to increase area under open spaces, parks, recreational facilities etc. A modest figure of 7 percent of the total area of City Region is proposed to be developed for parks and recreational open spaces/facilities. The available water bodies, water fronts, agricultural/ cultivation areas, and marshy lands may satisfy the requirement, if developed with suitable strategies.

3.2 Planning Approach

For planning and development purposes, the Kochi City Region is divided into 11 Planning Divisions to achieve the planning and development objectives, envisaged in the Development Concept and Development Strategies.

The Planning Approach for the Kochi City region is based on the following broad strategies derived from the Development Concept and Development Strategies outlined in Volume II of this Development Plan:

(1) Even when considering the entire area of 369.72 sq km of the delineated Kochi City Region (KCR) as a single entity for planning and development, this KCR shall be promoted to be developed as a multi-nodal city region – broadly within the concept of

"City within a City" so as to reduce the need for intra-city trips that converge to the city centre.

(2) The identified Commercial Centres shall receive motivation to be developed with higher order city functions

(3) Further to reducing the volume of intra-city travel needs, the KCR shall be conceived as comprised of many self contained divisions, each one self sufficient with day to day facilities.

(4) There should be a hierarchy of road network – arterial, sub-arterial, mass transport corridors linking different planning divisions with the sub-arterial road and arterial roads.

(5) Land Use Zoning Regulations shall follow a different permissive approach, rather than the oft practiced rigid specific land use regulations – especially in the context of Kerala where public possession of private land holdings has increasingly become difficult.

Based on the above broad approaches the following planning strategies are adopted:

- Identification and promotion of Commercial Centres (City Centre, Sub Centres and Community Centres) at various potential locations within the KCR.

- KCR shall be considered as a single planning unit comprising of eleven (11) Planning Divisions.

- The Planning Divisions should be delineated based on access to major transportation corridors that provide intra-city and or inter-city connectivity .

The strategy is that each of these eleven 'divisions' needs to be planned and developed as:

- A self contained division – affording to accommodate facilities required for day to day life.

- Each Planning Division may be encouraged to adopt 'Pedestrian Friendly' development strategies

- Considering the intensity of development, the Planning Division 3 i.e., the Ernakulam Main Land shall be sub divided into a few Planning Sub-Divisions and the same approach that goes for the other Planning Divisions may be adopted for the Planning Sub-Divisions of the Planning Division -3.

- Considering the large extent and the population size, Planning Division 8 shall be sub divided into 2 Planning Sub-Divisions.

- Each Planning Division and preferably the Planning Sub-Divisions in the Planning Division - 3 may be surrounded by wide transport corridors facilitating movement of Mass Transport Facilities (irrespective of mode of transport), so that each of the Planning Divisions would be accessible through mass transport facilities.

- Traffic generated from the Planning Divisions may flow into the Sub-arterial and Arterial roads which need to be developed as 'first order mass transportation corridors' – opting for higher order of mass transport modes (high capacity bus system (HCBS), electric trolley bus (ETB), electric tram, sky bus, metro rail, suburban rail or any other mode of mass transport based on feasibility and viability studies.

- Road network within the Planning Division/ subdivision shall necessarily be pedestrian friendly encouraging people to walk and/or to use non-motorised /non-polluting vehicles for movement within the Planning Division.

- Each of the Planning Divisions shall be developed predominantly for selective city level functions depending on the geographical features, trends of development and the development potential that is identified based on natural assets, present density, availability of land for future /intensified activities, location, connectivity etc.

Land zoning and permissible intensity of development within each Planning Division shall also be guided by the level to which the transit corridors would be developed. Land parcels which have direct access from the major transport corridors can be considered for higher intensity of development. Intensity of developpment would depend on the width and grade of transport facility. This means that even within a Planning Division development regulations may vary.

3.3 Details of Planning Divisions

3.3.1 Planning Division 1, 2 and 3 – Fort Kochi and Mattancherry, Wellington Island and Ernakulam Main land

- The area under the jurisdiction of the Kochi Corporation is divided into three planning divisions - Planning Division 1 consisting of Fort Kochi and Mattancherry, Planning Division 2 consisting of Wellington Island and Planning Division 3 consisting of the Ernakulam Main land.

- **Boundary of Kochi Corporation** (Planning Division 1,2 and 3) : Lakshadweep Sea in the West, Panchayats of Chellanam and Kumbalangi in the South,

Maradu Panchayat in the South East, Municipalities of Thrippunithura and Kalamassery and the Panchayat of Thrikkakara in the East and the Panchayats of Cheranellur, Mulavukad and Elamkunnappuzha in the North

- **Population of Planning Division 1,2 and 3**:
  - As per 2001 Census

Planning Division 1	:	249616
Planning Division 2	:	17282
Planning Division 3	:	328677
Total	:	595575

  - Projected population, 2031 *(Natural growth + Migration + Floating Population)*

Planning Division 1	:	370912
Planning Division 2	:	21400
Planning Division 3	:	537229
Total	:	929541

- **Characteristic features of the Planning Divisions**:

1. Fort Kochi and Mattanchery
   - Traditional town area with heritage precincts/buildings
   - High density mixed used development
   - Place of tourism importance
   - Poor infrastructure & connectivity

2. Wellington Island
   - Harbour and Navy related are the principal activities with major part of the island under these two activities
   - West and East Kochi areas are linked through the island

3. Ernakulam Main land
   - Can be considered as the central zone of Kochi City Region
   - Multiplicity of activities
   - Narrow roads, water logging, low sanitation levels and fairly high density hamper quality of life
   - Except a few roads, all the other roads are narrow and poorly maintained

- **Development potentials**:

1. Fort Kochi and Mattanchery

- Heritage Tourism Zone
- Improved infrastructure required
- Conservation Development Zone
- Limited fishing activities (aiding tourism)
- Improved tourism markets (with regulations) for crafts, spices
- Higher densification though not proposed, shall have planned actions for accommodating the existing density of population with upgrading of infrastructure
- Improved pedestrian facilities to facilitate movement by foot for tourists to visit places of interest and also to reduce vehicle movements through the old traditional narrow paths
- IWT could be promoted through better services

2. Wellington Island
   - Entire island area needs planned development with high level of infrastructure development (Participatory development with Port and Navy)
   - To provide improved connectivity between the western and eastern parts of the city through the Wellington Island

3. Ernakulam Main land
   - Scope for increasing population density on selective basis subject to improving infrastructure quality
   - Priority to be assigned for promoting mass transport, reducing the need for dependency on personalised vehicles and IPT, pedestrian facilities, streamlining of traffic, reducing traffic congestion, improving water supply and sanitation levels, planned inner city development on selective basis and creating small neighbourhood level open spaces
   - This zone can be sub divided into a number of sub-zones and each sub-zone can be divided into a number of neighbourhoods – each as a mini-self contained unit of residences or other uses
   - Within a whole development concept, micro-level approach for development can be phased sub-zone wise

Table 3.3 Existing Land Use, updated in 2009 –Kochi Corporation

SL. No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	5040.93	53.13	73.07
2	Commercial	211.64	2.23	3.07
3	Public & Semi public	444.8	4.69	6.45
4	Industrial	173.5	1.83	2.51
5	Transportation	553.58	5.83	8.02
6	Park & Open spaces	66.68	0.7	0.97

7	Other (SEZ and Unclassified area)	397.3	4.19	5.76
8	Paddy land / Wet land	441.02	4.65	
9	Agriculture/ Dry Cultivation	10.22	0.11	0.15
10	Water bodies	2148.33	22.64	
	Total	9488	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Kochi is 9488 Ha. The net developable area, excluding paddy land, wet land and water bodies, is 6898.65 Ha. The land under residential use include 53.13 % of gross area (73.07% of net area). Other major uses are under transportation (8.02%) and Public and Semi Public use (6.45%). Water bodies constitute 22.64 % of the gross area. The land use under Parks and Open Spaces is very low (0.97%) comparatively.

- **Population density - Kochi**
  - Net density (2001) : 84.25 pph
  - Gross density (2031) : 97.97 pph
  - Net density (2031) : 131.49 pph

Planning Division 3 – Ernakulam Mainland is subdivided into 13 Sub-Divisions (Refer Map 3.1) in such a way that each of the sub-divisions is surrounded by Mass Transport Corridors providing access to the sub divisions from the main roads. These mass transport corridors may carry different modes of mass transport depending on the traffic volume, the available ROW (right of way) and the importance of the activities located within the sub-division. The concentration of activities and population in these areas necessitate detailing of proposals for the subdivisions within the broad framework provided in this development plan.

Table 3.4 Sub-Divisions within Planning Division 3 – Kochi (Ernakulam) main land

Sub-Division No.	Sub-Division boundary	Major Mass Transport Corridors serving the area / Spatial Features
3-A	Shipyard Jn. – Pallimukku Jn. (west) Pallimukku Jn. – Elamkulam Jn. (north) Elamkulam Jn. – Down South upto Canal (east), Canal side road upto Shipyard Jn. (south)	(i) NH 47 from Shipyard Jn. to Pallimukku Jn. (ii) S.A. Road (iii) Elamkulam Jn. down south road
3-B	Thevara Ferry upto Thevara Jn. – upto water boundary (west) Shipyard Jn. - upto canal (north) Canal upto – Thevara Ferry (east & south)	(i) Thevara ferry to Thevara Jn to Shipyard Jn. (ii) Shipyard Jn towards east (new road corridor to be upgraded)
	NH 47 at Thevara Jn – Sea (west)	NH 47

3-C	Beach road – Pallimukku Jn. (north) MG Road from Pallimukku Jn. – Thevara Jn. (east & south)	
3-D	MG Road – Pallimukku Jn. – Katcheripady Jn. (west) Katcheripady Jn. – Kaloor Jn. (along NH) (north), Kaloor Jn.- GCDA Jn. (east) GCDA Jn. – Pallimukku Jn. (south)	(i) M.G. Road (ii) NH 47 (iii) Kaloor – Kadavanthara road (iv) SA road (v) Pullepadi – Kathrikadavu road
3-E	Foreshore Road (sea) – High Court Jn. (west), High Court Jn. – Katcheripady Jn. (north), MG Road Katcheripady Jn. – Pallimukku Jn. (east) Pallimukku towards Sea coast (south)	(i) MG Road (ii) Foreshore road (to be upgraded) (iii) High Court jetty to Katcheripady Jn.
3-F	Kathrikadavu Jn. – Kaloor Jn. (west) Kaloor Jn. – Palarivattom Jn. Along NH 47 (north) Palarivattom Jn. – Thammanam Jn. (east) Thammnam Jn. – Kathrikadavu Jn(south)	(i) Kathrikadavu – Kaloor road (ii) NH 47 (iii) Palarivattom Jn. – Thammanam Jn. (iv) Thammanam – Kathrikadavu Jn.
3-G	GCDA – Kathrikadavu Jn. (west) Kathrikadavu Jn. – Thammnam Jn. Upto Bypass (north) Thammanam-NH Byapss – Vyttila Jn. (east) Vyttila Jn. (SA Road) –GCDA Jn. (south)	(i) Kaloor – Kadavanthara road (ii) Kathrikadavu – Thammanam road (iii) NH Bypass (iv) SA Road
3-H	Vyttila Jn. – Thammanam Jn. –NH Bypass (west) Thammanam Jn. Bypass Jn. – upto City Boundary across NH Bypass (north) Along city boundary upto Vyttila Jn. (east & south)	(i) NH Bypass (ii) Pullepady – Thammanam road to be extended further towards east across NH Bypass
3-J	Thammanam Jn.- Palarivattom – Edappally Jn. (west) Edappaly Bypass Jn. upto Thammanam Jn. Via NH Bypass (east & south)	(i) Thammanam to Palarivattom road (to be upgraded) (ii) NH 47 on the north (iii) NH 47 Bypass to be linked to Thammanam – Pullepady road (with an upgraded stretch)
3-K	Vyttila Jn. – Edappally Bypass Jn. (west & north) City Boundary upto Edapally thodu (East) Thammanam Jn. across NH Bypass (north & south)	(i) Parallel road to NH Bypass (to be upgraded) (ii) Road from Alanchuvadi Jn. To Mathoor Jn. (to be upgraded) – the road is partly outside the present city boundary

3-L	High Court Jn. towards north through GIDA land beyond Pachalam upto Corporation boundary near canal and from there along the canal upto Perandoor and down south via Perandoor – Kaloor road upto Kaloor	(i) Upgrading of the existing road from High Court Jn. To GIDA Bridge and a new stretch along the western shore off Pachalam Jn. upto the northern tip – with links to Pachalam Jn. & to Perandoor Jn. With a new bridge across the canal
3-M	Kaloor Jn. – Perandoor Jn. (west) Perandoor Jn. – Edappally Fort (north) Edappally Fort – to NH and down south upto Palarivattom Jn. (east) Palarivattom Jn. – Kaloor Jn. (south)	(i) Kaloor - Perandoor – Elamakkara – Edappally –NH Bypass road (to be upgraded) – as a continuation of Kadavanthara – Kaloor road (ii) NH Bypass (iii) Elamakkara – Deshabhimani road (to be upgraded as a cross road within the Planning Sub-Divsion)
3-N	City area (2009) north of Perandoor – Elamakkara – Edappally Jn. including the strip of land on the east of NH 47	(i) Perandoor – Elamakkara – Edappalli road (ii) Pachalam – Chittoor Jn. (to be upgraded and linked to Perandoor Jn.) (iii) Chittoor Jn. – Kappela Jn. – St. James Jn. to be connected to NH 17 with a new short stretch (iv) Edappally Jn. to Fort Jn, on the Elamakkara road – towards north to St. James Jn. road

Map 3.1

3.3.2 Planning Division 4 - Panchayats of Chellanam and Kumbalangi

- The Planning Division 4 includes the Panchayats of Chellanam and Kumbalangi

- **Boundary of Planning Division 4** :Lakshadweep Sea in the West, Panchayats of Aroor and Ezhupunna in the South, Vembanad lake in the East and the Kochi Corporation in the North

- **Population of Planning Division 4** :
  - As per 2001 Census : 62870
  - Projected population, 2031 : 107285
    (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 4** :
  - Coastal area - Water-logged and with high water table
  - Moderate density residential development
  - Fishing, Village Tourism (recently developed as a Rural Tourism Centre) – proposed to be developed also as a Coconut Garden under a GoI Scheme

- **Development potentials**:
  - Rural Tourism Zone
  - Coconut Groves
  - Water recreation/sports facilities
  - Green Zone
  - Moderate Residential Density
  - Traditional Fishing
  - Development with Architectural Controls

Table 3.5 Existing Land Use, 2009 – Chellanam Panchayat

SL. No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	525.02	29.83	90.02
2	Commercial	2.61	0.15	0.45
3	Public & Semi public	21.70	1.23	3.72
4	Industrial	10.63	0.60	1.82
5	Transportation	23.24	1.32	3.98
6	Paddy/ Wet land	999.24	56.78	
7	Water bodies	177.56	10.09	

	Total	1760	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area in Chellanam Panchayat is 1760 Ha. The net developable area excluding paddy, wet land and water bodies is 583.20 Ha. The gross area under residential use is 29.83 % (net residential area is 90.02 %). Public and semi public use and Transportation use constitute 3.72 % and 3.98 % respectively of net area. There is no area under parks and open spaces.

Table 3.6 Existing Land Use, 2009- Kumbalangi Panchayat

SL. No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	364.83	23.13	88.84
2	Commercial	1.69	0.11	0.41
3	Public & Semi public	13.01	0.82	3.17
4	Industrial	0.93	0.06	0.23
5	Transportation	22.96	1.46	5.59
6	Paddy/ Marshy	301.21	19.10	
7	Agriculture / Dry Cultivation	7.22	0.46	1.76
8	Water bodies	865.15	54.86	
	Total	1577	100	100

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross area of land in Kumbalangi Panchayat is 1577 Ha and the net developable area, excluding paddy, wet land and water bodies is 410.64 Ha. The net area under residential use is 88.84 %. There is no land use under Parks and Open Space.

- **Population density - Chellanam Panchayat**
  - Net density (2001) : 62.09 pph
  - Gross density (2031) : 35.88 pph
  - Net density (2031) : 108.29 pph

- **Population density - Kumbalangi Panchayat**
  - Net density (2001) : 63.67 pph
  - Gross density (2031) : 27.98 pph
  - Net density (2031) : 105.39 pph

3.3.4. Planning Division 5 – Panchayats of Maradu and Kumbalam

- The Planning Division 5 includes the Panchayats of Maradu and Kumbalam
- Boundary of Planning Division 5: Vembanad lake in the West, Udayamperur

Panchayat in the South, Municipality of Thrippunithura in the East and the Kochi Corporation in the North

- **Population of Planning Division 5** :
  - As per 2001 Census : 68561
  - Projected population, 2031 : 177426
    (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 5** :
  - South of Vyttila Jn., Maradu (Kundanoor) road junction on the NH Bypass has gained importance
  - The new Seaport road takes off at Kundanoor Jn.
  - International Convention Centre (pvt.), a few hotels and hospitals located here
  - Spurt of high density residential development

- **Development potentials**:
  - Potential to be developed with road, water and rail connectivity
  - With such improved connectivity, the available vacant/low density land can be made use of many city functions
  - Needs planned land use plan and development regulations
  - Potential for environmentally sensitive high density development

Table 3.7 Existing Land Use, 2009 – Maradu Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	620.35	50.23	78.36
2	Commercial	45.63	3.69	5.76
3	Public & Semi public	48.33	3.91	6.10
4	Industrial	0.38	0.03	0.05
5	Transportation	76.02	6.16	9.60
6	Park & Open spaces	0.97	0.08	0.12
7	Paddy/ Wet land	234.92	19.02	
8	Water bodies	208.4	16.87	
	Total	1235	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Maraud Panchayat is 1235 Ha and the net area available for development, excluding Paddy, wet land and Water bodies is 791.68 Ha. 50.23 % of gross area (78.36 % of the net area) is under residential use . 9.60%, 6.10 % and 5.76% of net

land area is under Transportation use, Public and Semi Public use and Commercial use respectively. Land area under Parks and Open space is very low (0.12 %).

Table 3.8 Existing land use, 2009 - Kumbalam Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	837.14	40.27	88.49
2	Commercial	4.77	0.23	0.50
3	Public & Semi public	56.39	2.71	5.96
4	Industrial	1.71	0.08	0.18
5	Transportation	46.01	2.21	4.86
6	Paddy/ Wet land	281.27	13.49	
7	Water bodies	851.71	40.97	
	Total	2079	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Kumbalam Panchayat is 2079 Ha with 40.27 % of gross area (88.49% of net area) under residential use. Paddy, wet land and water bodies constitute 54.50 % of the gross area and hence the developable land area available, excluding these uses is only 946.02 Ha. The land under commercial and industrial use is very low and there is no land under the use Parks and Open space.

- **Population density - Maradu Panchayat**
  - Net density (2001) : 50.65 pph
  - Gross density (2031) : 89.58 pph
  - Net density (2031) : 136.63 pph

- **Population density - Kumbalam Panchayat**
  - Net density (2001) : 29.09 pph
  - Gross density (2031) : 32.13 pph
  - Net density (2031) : 70.54 pph

Planning Division 6 – Thrippunithura Municipality and Thiruvankulam Panchayat

- The Planning Division 6 includes Thrippunithura Municipality and Thiruvankulam Panchayat

- **Boundary of Planning Division 6**: Kochi Corporation and Maradu Panchayat in the West, Panchayats of Udayamperoor and Chottanikkara in the South, Vadavukode Panchayat

in the East and Thrikkakara Panchayat in the North

- **Population of Planning Division 6**
  - As per 2001 Census : 81601
  - Projected population, 2031 : 242070
  (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 6**:
  - Historic seat of the royal power of Kochi – remains of that exist
  - Temple and other religious importance
  - High density development in the central area of Thripunithura town – otherwise moderate density town
  - Developable land available

- **Development potentials**:
  - Potential to be developed as high density residential zone of Kochi
  - Cultural Heritage Tourism
  - Transit zone between east-west and north-south traffic corridors
  - Upgrading/improvement of NH 49 requires bypass for Thripunithura
  - Thripunithura and Thiruvankulam junction improvements necessary
  - Strengthening of Pettah – Irumbanam corridor and connecting it to Thrikkakra on the north and to Vadavukode on the north –east

Table 3.9 Existing land use, 2009 - Thrippunithura Municipality

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (net)
1	Residential	1025.64	54.88	84.33
2	Commercial	22.23	1.19	1.83
3	Public & Semi public	77.71	4.16	6.39
4	Industrial	18.2	0.97	1.50
5	Transportation	72.47	3.88	5.96
6	Paddy/ Wet land	507.75	22.8	
7	Water bodies	145	7.76	
	Total	1869	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Thrippunithura Municipality is 1869 Ha with 54.88 % of gross land area (84.33 % of net area) under residential use. The net area for development, ie area excluding paddy, wet land and water bodies is 1216.25 Ha. The land under Public and Semi Public Use constitute 6.39 % and that under transportation, commercial and industrial (net area) is 5.96 %, 1.83 % and 1.50 % respectively. There is no land under the use of Parks and Open Space.

Table 3.10 Existing land use, 2009 - Thiruvankulam Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (net)
1	Residential	458.95	43.75	63.14
2	Commercial	3.74	0.36	0.51
3	Public & Semi public	44.28	4.22	6.09
4	Industrial	140.55	13.4	19.34
5	Transportation	67.69	6.45	9.31
6	Paddy/ Marshy	261.74	24.95	
7	Agriculture/ Dry Cultivation	11.68	1.11	1.61
8	Water bodies	60.37	5.76	
	Total	1049	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Thiruvankulam Panchayat is 1049 Ha with 43.75 % of gross area (63.14 % of net area) under residential use. Area available for development (net land area) is 726.89 Ha. The next prominent use is industrial use, which is 19.34 % of the net area. Transportation and Public and Semi Public use constitute 9.31 % and 6.09 % respectively. There is no land area under Parks and Open space.

- **Population density - Thrippunithura Municipality**
  - Net density (2001) : 46.14 pph
  - Gross density (2031) : 94.44 pph
  - Net density (2031) : 135.98 pph

- **Population density - Thiruvankulam Panchayat**
  - Net density (2001) : 29.35 pph
  - Gross density (2031) : 62.51 pph
  - Net density (2031) : 29.35 pph

3.3.6 Planning Division 7 – Vadavukode- Puthenkurisu Panchayat

- The Planning Division 7 includes Vadavukode - Puthenkurisu Panchayat

- **Boundary of Planning Division 7**: Panchayats of Thrikkakara and Thiruvankulam in

the West, Panchayats of Chottanikkara and Thaniyoor in the South, Panchayats of Poothrikka and Aikaranad in the East and Kunnathunad Panchayat in the North

- **Population of Planning Division 7**
  - As per 2001 Census : 26710
  - Projected population, 2031 : 37830
  (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 7**:
  - Located adjacent to Kakkanad Infopark
  - Availability of developable land
  - Good road connectivity – on the NH 49

- **Development potentials**:
  - Potential to be developed for the expansion of the soft industry parks of Thrikkakara
  - Improvement of north-south connectivity
  - Possible rail connectivity in future
  - Required – improved infrastructure
  - Moderate density residential development

Table 3.11 Existing land use, 2009 Vadavukode- Puthenkurisu Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	1662.25	45.06	51.05
2	Commercial	3.76	0.1	0.12
3	Public & Semi public	66.29	1.8	2.04
4	Industrial	982.6	26.64	30.18
5	Transportation	81.62	2.21	2.51
6	Park & Open spaces	30.14	0.82	0.93
7	Hazardous	21.54	0.58	0.66
8	Paddy/ Wet land	284.79	7.72	
9	Agriculture/ Dry Cultivation	407.73	11.05	12.52
10	Water bodies	148.28	4.02	
	Total	3689	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Vadavukode- Puthenkurisu Panchayat is 3689 Ha with 45.06 % of gross land area (51.05 % of net area) under residential use. The net area is 3255.93 Ha. 30.18 % of the net land area is currently under industrial use and 0.66 % is under hazardous use. The land under commercial use is very low (0.12 %).

- **Population density - Vadavukode- Puthenkurisu Panchayat**
  - Net density (2001) : 8.20 pph
  - Gross density (2031) : 10.25 pph
  - Net density (2031) : 11.62 pph

3.3.7 Planning Division 8 – Kalamassery Municipality and Thrikkakara Panchayat

- The Planning Division 8 comprises of Kalamassery Municipality and Thrikkakara Panchayat This Planning division is sub divided into two subdivisions : Sub division 1 - Kalamassery Municipality and Sub division 2 – Thrikkakara Panchayat

- **Boundary of Planning Division 8**: Kochi Corporation and Eloor Panchayat in the West, Choornikkara Panchayat in the North, Panchayats of Edathala, Kunnathunad and Vadavukode Puthenkurisu in the East and Thriippunithura Municipality and Thiruvankulam Panchayat in the South

- **Population of Planning Division 8**
  - As per 2001 Census : 129100
  - Projected population, 2031 : 463877 *(Natural growth + Migration + Floating Population)*

- **Characteristic features of the Planning Division 8**:
  - Administrative centre and IT Hub
  - Spurt of high density residential development – not followed up by high quality infrastructure development
  - Fairly good road accessibility from the city and from the hinterland
  - Good access from the airport.

- **Development potentials**:
  - To be developed as the most important soft industry zone with very high potential as an economy mover
  - Very high quality of infrastructure to be provided in the zone
  - To be developed as a high density residential zone

- Road, water and rail transport connectivity needs further augmentation
- Organised facilities for goods transport at Kalamassery
- Inter-nodal facility centre for the Industrial and IT Centres

Table 3.12 Existing land use, 2009- Kalamassery Municipality

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	1176.23	43.56	52.61
2	Commercial	26.87	1.00	1.20
3	Public & Semi public	405.55	15.02	18.14
4	Industrial	385.1	14.26	17.22
5	Transportation	195.55	7.24	8.75
6	Park & Open spaces	1.42	0.05	0.06
7	Hazardous	0.8	0.03	0.04
8	Paddy/ Wet land	430.41	15.94	
9	Agriculture/ Dry Cultivation	44.28	1.64	1.98
10	Water bodies	33.79	1.25	
	Total	2700	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Kalamassery town is 2700 Ha, with 43.56 % of land (52.61 % of net area) under residential use. 17.22 % of the net land area is under industrial use. The public and semi public use also has a prominent place ie 18.14 % of the net area. The land under park and open space is grossly inadequate (0.06 %).

Table 3.13 Existing land use, 2009 – Thrikkakara Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	1216	44.28	62.63
2	Commercial	10.06	0.37	0.52
3	Public & Semi public	162.16	5.91	8.35
4	Industrial	196.01	7.14	10.10
5	Transportation	117.77	4.29	6.07
6	Park & Open spaces	2.9	0.11	0.15
7	Paddy/ Wet land	709.38	25.83	
8	Agriculture/ Dry Cultivation	236.53	8.61	12.18

9	Water bodies	95.19	3.47	
	Total	2746	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The gross land area of Thrikkakara Panchayat is 2746 Ha, with 44.28 % of gross land area (62.63 % of net area) under residential use. The area under commercial use and park and open space is very low (0.52 % and 0.15 % respectively of the net land area). 10.10 % and 8.35 % of net land area are covered under industrial use and Public and Semi public use respectively.

- **Population density - Kalamassery Municipality**
  - Net density (2001) : 46.14 pph
  - Gross density (2031) : 94.44 pph
  - Net density (2031) : 135.98 pph

- **Population density - Thrikkakara Panchayat**
  - Net density (2001) : 30.18 pph
  - Gross density (2031) : 103.68 pph
  - Net density (2031) : 130.22 pph

3.3.8 Planning Division 9 – Eloor Panchayat

- The Planning Division 9 comprise of Eloor Panchayat

- **Boundary of Planning Division 9**: Varappuzha Panchayat in the West, Cheranellur Panchayat in the South West, Corporation of Kochi in the South, Kalamassery in the East and Panchayats of Alangad and Kadungallur in the North

- **Population of Planning Division 9**
  - As per 2001 Census : 35573
  - Projected population, 2031 : 63052
    (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 9**:
  - This is the large and medium industrial zone of Kochi
  - Road, rail & water connectivity exist, but not fully exploited

- **Development potentials**:
  - Required planned high order of industrial infrastructure
  - Organised facilities for goods transport

- Inter-nodal facility centre for the Industrial and IT Centres

Table 3.14 Existing land use, 2009 - Eloor Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	843.67	59.37	70.54
2	Commercial	9.8	0.69	0.82
3	Public & Semi public	82.43	5.8	6.89
4	Industrial	201.81	14.2	16.87
5	Transportation	47.29	3.33	3.95
6	Park & Open spaces	5.53	0.39	0.46
7	Paddy/ Wet land	147.97	10.41	
8	Agriculture/ Dry Cultivation	5.54	0.39	0.46
9	Water bodies	76.96	5.42	
	Total	1421	100	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Eloor Panchayat is 1421 Ha with 59.37 % of the gross land area (70.54 % of net area) under residential use. The area under Paddy/ Wet land is less compared to other constituent local bodies of Kochi City Region. The net developable area (area excluding paddy, wet land and water bodies) of Eloor Panchayat is 1196.07 Ha. Industrial land use has a prominent place in Eloor compared to other local bodies in KCR (16.87 %). There is no area under Parks and Open Space, in Eloor Panchayat.

- **Population density - Eloor Panchayat**
  - Net density (2001) : 28.72 pph
  - Gross density (2031) : 44.37 pph
  - Net density (2031) : 50.90 pph

3.3.9 Planning Division 10 – Panchayats of Cheranellur and Varappuzha

- The Planning Division 10 includes the Panchayats of Cheranellur and Varappuzha

- Boundary of Planning Division 10: Panchayats of Kadamakkudy and Kottuvally in the West, Kochi Corporation in the South, Eloor

Panchayat in the East and Panchayats of Alangad and Kottuvally in the North

- **Population of Planning Division 10**
  - As per 2001 Census : 50840
  - Projected population, 2031 : 94624
    (Natural growth + Migration + Floating Population)

- **Characteristic features of the Planning Division 10:**
  - Connectivity through water transport is an added advantage
  - Good road accessibility from Ernakulam city side – also from NH 17
  - Low density development with large extent of low lying land surrounded by water bodies

- **Development potentials**:
  - Planned moderate level infrastructure development
  - Proximity to the existing city development and availability of low density land are advantages to be explored
  - Good location for city/region level recreational centre (water theme based)
  - Improvement of good water transport from High Court jetty

Table 3.15 Existing land use, 2009 - Cheranellur Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	398.1	37.59	80.5
2	Commercial	5.35	0.51	1.08
3	Public & Semi public	22.97	2.17	4.64
4	Industrial	2.99	0.28	0.6
5	Transportation	34.6	3.27	7.00
6	Park & Open spaces	0.6	0.06	0.12
7	Paddy/ wet land	403.74	38.12	
8	Agriculture/ Dry Cultivation	29.95	2.83	6.06
9	Water bodies	160.7	15.17	
	Total	1059	100	100

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Cheranellur Panchayat is 1059 Ha with 37.59 % of the gross land area under residential use and an equivalent area (38.12 %) under Paddy/ wet land. The net developable area of Cheranellur Panchayat is 494.56 Ha. The net area under residential use is 80.50 %. The land area under Parks and open space is grossly nil/ inadequate.

Table 3.16 Existing land use, 2009- Varappuzha Panchayat

Sl.No	Land use category	Land area in Ha	Existing% (Gross)	Existing% (Net)
1	Residential	234.11	30.25	75.77
2	Commercial	6.25	0.81	2.02
3	Public & Semi public	26.86	3.47	8.69
4	Industrial	3.25	0.42	1.05
5	Transportation	36.29	4.69	11.74
6	Hazardous	1.32	0.17	0.43
7	Paddy/ wet land	303.45	39.21	
8	Agriculture/ Dry Cultivation	0.91	0.12	0.29
9	Water bodies	161.56	20.87	
	Total	774	100	100

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Varappuzha Panchayat is 774 Ha. A greater share of the gross land area (39.21%) comes under Paddy / wet land. The net developable area (area excluding paddy, wet land and water bodies) of Varappuzha Panchayat is 308.99 Ha. The net area under residential use is 75.77 %. There is no area under Parks and Open Space, in Varappuzha Panchayat.

- **Population density - Cheranellur Panchayat**
  - Net density (2001) : 53.21 pph
  - Gross density (2031) : 73.78 pph
  - Net density (2031) : 157.98 pph

- **Population density – Varappuzha Panchayat**
  - Net density (2001) : 79.37 pph
  - Gross density (2031) : 57.98 pph
  - Net density (2031) : 145.25 pph

3.3.10 Planning Division 11 – Panchayats of Elamkunnappuzha, Mulavukadu, Njarakkal and Kadamkkudy

- The Planning Division 11 includes the Panchayats of Elamkunnappuzha, Mulavukadu, Njarakkal and Kadamkkudy

- Boundary of Planning Division 11: Lakshadweep Sea in the West, Kochi Corporation in the South, Panchayats of Cheranellur and Varappuzha in the East and Panchayats of Nayarambalam and Varappuzha in the North

- **Population of Planning Division 10**

- As per 2001 Census	:	Elamkunnappuzha: 50563, Mulavukad:22842, Njarakkal: 24166, Kadamakkudy : 15824
- Projected population, 2031 *(Natural growth + Migration + Floating Population)*	:	Elamkunnappuzha: 98119, Mulavukad:30054, Njarakkal: 46120, Kadamakkudy : 25718

- **Characteristic features of the Planning Division 11:**
  - Island areas under GIDA
  - High density -low income group development
  - Poor infrastructure
  - Elamkunnapuzha & Njarakkal connected to Ernakulam main land by the new Goshree bridge

- **Development potentials**:
  - Elamkunnapuzha Panchayat & Njarakkal Panchayat (Vypeen) require higher development inputs
  - GIDA bridge and the N-S road to be improved as an important sub-arterial road to link to NH 17
  - Other islands require moderate level of infrastructure and promotion of livelihood improvement programs for the residents
  - No substantial organised developments to be envisaged in the small islands except support activities surging out of Vallarpadom Container Terminal
  - Scope for coastal highway and rail link to connect Kochi to Thrissur through the famed 'Muziris'- also to open out new areas for development within KCR

Table 3.17 Existing land use, 2009 - Elamkunnappuzha Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (net)
1	Residential	488.41	33.75	56.94
2	Commercial	4.84	0.33	0.56
3	Public & Semi public	23.07	1.59	2.69
4	Industrial	4.57	0.32	0.53
5	Transportation	53.24	3.68	6.21

6	Park & Open spaces	2.53	0.17	0.29
7	Paddy/ wet land	348.19	24.06	
8	Water bodies	241.15	16.66	
9	Port Land (Puthuvype)	281.12	19.43	32.77
	Total	1447.12	100.00	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Elamkunnappuzha Panchayat is 1447.12 Ha with 33.75 % of the gross land area (56.94 % of net area) under residential use. Paddy/ Wet land constitutes 24.06 % of gross area. The net developable area (area excluding paddy, wet land and water bodies) of Elamkunnappuzha Panchayat is 857.78 Ha.

Table 3.18 Existing land use, 2009 - Mulavukadu Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (Net)
1	Residential	266.98	13.86	87.45
2	Commercial	6.65	0.35	2.18
3	Public & Semi public	18.24	0.95	5.97
4	Transportation	13.44	0.70	4.40
5	Paddy/ Wet land	464.33	24.10	
6	Water bodies	1157.05	60.05	
	Total	1926.69	100	100

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Mulavukadu Panchayat is 1926.69 Ha with 13.86 % of the gross land area (86.45 % of net area) under residential use. Paddy/ Wet land constitutes 24.10 % of gross area. The net developable area (area excluding paddy, wet land and water bodies) of Mulavukadu Panchayat is 305.31 Ha. There is no area under Parks and Open Space, in Mulavukadu Panchayat.

Table 3.19 Existing land use, 2009 - Njarakkal Panchayat

Sl.No	Land use category	Land area in Ha	Existing% (Gross)	Existing% (Net)
1	Residential	478.43	55.63	91.66
2	Commercial	0.68	0.08	0.13
3	Public & Semi public	14.53	1.69	2.78
4	Industrial	0.7	0.08	0.13

5	Transportation	24.62	2.86	4.72
6	Park & Open spaces	3.02	0.35	0.58
7	Paddy/ Wet land	188.06	21.87	
8	Water bodies	149.96	17.44	
	Total	860	100.00	100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Njarakkal Panchayat is 860 Ha. Paddy / wet land constitutes 21.87 % of gross area. The net developable area (area excluding paddy, wet land and water bodies) of Njarakkal Panchayat is 521.9865 Ha. The net area under residential use is 1.66 %.

Table 3.20 Existing land use, 2009 - Kadamakkudy Panchayat

Sl.No	Land use category	Land area in Ha	Existing % (Gross)	Existing % (net)
1	Residential	420.86	32.57	93.18
2	Commercial	0.53	0.04	0.12
3	Public & Semi public	10.05	0.78	2.23
4	Industrial	0.25	0.02	0.06
5	Transportation	19.96	1.54	4.42
6	Paddy/ Wet land	510.08	39.48	
7	Water bodies	330.27	25.56	
	Total	1292		100.00

Source: Land use survey updated by the Department of Town and Country Planning in 2009

The total land area of Kadamakkudy Panchayat is 1292 Ha. A greater share of the gross land area (39.48%) comes under Paddy / wet land. The net developable area (area excluding paddy, wet land and water bodies) of Kadamakkudy Panchayat is 451.65 Ha. The net area under residential use is 93.18 %. There is no area under Parks and Open Space, in Kadamakkudy Panchayat.

3.4 Land Use Proposals

Master Plans (Development Plans) for urban areas in Kerala had hitherto tried to propose specific land uses for the different parcels of urban land taking into account the estimated land requirements for various uses during the horizon period (Plan period) in the urban area. To make such proposals the existing predominant land use in the area, development potential of the specific area, land requirement in the town/city, availability of infrastructure to support the proposed use and the possibility of improving/augmenting infrastructure capacity to support higher order use etc. used to be considered. In spite of this exercise in formulating 'proposed land use plan', experience shows that such land use proposals in the Development Plans are not effectively translated and adopted and people wantonly deviate

from the proposals under various pretexts. Land use violations have been regular feature, much to the distress of Planners. Zoning ordinance is often mistaken as only a regulatory mechanism and not as a guidance mechanism, which it is meant to be.

This Development Plan for Kochi proposes that it is necessary to review this traditional method of Land Use proposals and shall propose a different strategy which is permissive and promotional. The approach adopted is to consider each of the 10 Planning Divisions and the Planning Division 3 – Ernakulam main land Division with its 13 Sub-Divisions - for allocation of the estimated land requirements and proposing what land uses and in what measure and in what intensity need to be accommodated.

3.4.1 Basic Principles in Formulating the Land Use Plan 2031

(i) The entire Planning area comprised of 11 Planning Divisions shall be considered as a single entity for planning and land use proposals

(ii) However each of the 11 Planning Divisions may have specific land use characteristics to be highlighted as variations to the general land use regulations

(iii) Planning Division 3 - Ernakulam Mainland shall have various sub-divisions and the strategy adopted for the other Planning Divisions may be applied to each of the Sub-Divisions

(iv) Planning Division 8 – covering Kalamassery Municipality and Thrikkakara Panchayat has two sub divisions

(v) Land use within the Planning Divisions would generally be guided by Mass Transit Corridors - intensive developments being permitted for land parcels having direct access from the mass transit corridors and lower intensity of development for properties in the inner areas

(vi) The overall approach adopted is that the population estimated (projected) for the year 2031 in the Planning Region would as far as possible be accommodated within the Planning Region without causing need to further the urban sprawl.

(vii) Proposed density of population in each of the Planning Divisions is arrived at based on the development characteristics and proposed development activities in the respective Planning Division. Densification of resident population when proposed in any Planning Division /Sub-Division of Planning Division 3 is based on:

- Access from the Planning Division to major mass transit corridors – Planning Divisions which have direct access from major transport corridor may receive priority for densification

- Planning Divisions which have high potential for economic activities and establishment of such job centres may receive consideration for densification

- Availability of developed / developable land within the Planning Division

- Availability of infrastructure and possibility for augmentation of service levels

- Planning Divisions through which/ along which new major roads are proposed to be constructed

(viii) Land Use strategies for the 'Planning Division 3 - Ernakulam main land' would be different compared to that adopted in the other Planning Divisions – This Planning Division would be considered as consisting of a number of small units and for each of these sub divisions the strategies adopted for the other Planning Divisions would be adopted.

3.4.2 Land Use Categories

Urban Land Use categories are usually generalized based on traditional concepts. However, there are variations depending on the characteristics of the individual urban settlements. Geographic and spatial characteristics of the Kochi City Region are explained in 13.2 (2) above. Based on these the Land Use Categories adopted for the Kochi City Region (KCR) are:

The Land Use Categories adopted for Kochi City Region (KCR) are as follows:

(1) Predominantly Residential
   (i) Low density residential – R1
   (ii) High density residential – R2
(2) Predominantly Commercial
   (i) Community Centre – C1
   (ii) Sub Centre – C2
   (iii) City Centre – C3.

(3) Predominantly Industrial
   (i) IT/ ITES – M1
   (ii) Medium and Large Industries – M2
(4) Public and Semi Public - P
(5) Transport – T
(6) Heritage Conservation - H
(7) Parks, Open Spaces and Recreational – O

(8) Paddy lands and wetlands –W
(9) Agriculture (Dry cultivation) - A

3.4.2.1 Residential Uses

The total area required for residential uses within the Kochi City Region (KCR) is estimated for a population of 2273512 in the year 2031 as 9653.81 ha based on the land use standards for Metropolitan Cities as given in the UDPFI Guidelines. This is worked out expecting a standard that 40% of the expecting total area of the city would be under residential uses. The towns and cities in Kerala are found to utilize about 50% of the land area within the town / city for residential uses. This percentage may be higher in the small towns and lower in the cities. This feature is mainly due to the reasons that the families in Kerala mostly prefer plotted independent buildings and the residential buildings are surrounded by wide open spaces with coconut trees . However this trend is gradually declining in cities, where smaller plot sizes (land parcels) and higher intensity of development is the order of the day especially due to the sharp increase in urban land prices during the last two decades. Urban households increasingly prefer multistoried residential apartments. The Development Plan for Kochi City Region envisages that:

(i) The entire estimated population of the KCR should be accommodated within the Planning area;

(ii) In order to contain urban sprawl and to reduce the stress on infrastructure caused by the floating population, who are necessitated to commute daily to the city from the outer regions within the district, even part of the floating population should be encouraged to take up residences within the KCR. This may indirectly provide opportunities not to drag residential development activities outside the KCR causing unplanned urban sprawl and exerting pressure on urban infrastructure.

43.43% of the total land within the KCR (16058 ha) is already under residential uses. This means that additional land area may not be necessary for the future additional population. However to accommodate the increase in population (from 11,64,225 in 2001 to 1915713 in 2031 i.e the total estimated population less the floating population) the existing residential areas need to undergo densification. Total area of the KCR is 36,691 ha. The average Gross density of population, which was 32 persons per ha in the year 2001 has to be increased to 51.82 persons per hectare by 2031. Based on this estimation, the additional requirement of residential units is also worked out.

Table 3.21 Estimate of Housing Demand

Estimated Pop. 2031	Addl. Population expected within the KCR	Estimated No. of HHs (with av. of 4.5 HH size)

19.16 lakh	2.26 lakh	50223

Housing strategies need to be devised to increase the housing stock by about 50223 during the next 20 years.

The total requirement of houses during the next 20 years would be housing stock required for the additional households, reconstruction of existing dwelling units which may face obsolesce during the next 20 years and reconstruction of existing dwelling units for modernization and for extension of life cycle.

In order to accommodate the additional estimated population within the Kochi City Region and also to have a balanced distribution of landuse with adequate commercial, recreational and public uses, it is proposed to increase the density of population within the Kochi City Region. The Land Use Plan for the Kochi City Region shall include proposals for increasing density of population in the various Planning Divisions within the KCR.

Population density is proposed to be considerably high in the following Planning Divisions:

- Thrikkakara and Kalamassery (Planning Division 8)
- Maradu and Kumbalam (Planning Division 5)
- Kochi Main Land (Planning Division 3) – selectively in the Sub Divisions
- Thripunithura and Thiruvankulam (Planning Division 6)
- Cheranellur – Varppuzha and
- Elamkunnapuzha in Vypeen Islands

The remaining Planning Divisions namely:

- Fort Kochi – Mattancherry (Planning Division 1)
- Wellington Island (Planning Division 2)
- Chellanam – Kumbalangi (Planning Division 4) and
- Eloor (Planning Division 9)
- Other islands in the GIDA area that are part of the KCR

are not proposed for conscious actions for increasing the density of population to very high levels. Vadavukode - Puthenkurisu (Planning Division 7) has very large extent of land in it and the projected additional population comes in would not result in high density. Ths planning division is proposed as a preferred destination for non-polluting heavy industries.

It is proposed that there shall be consolidation of residential areas in different planning divisions and could result in making available land for other uses such as recreational and commercial which are essential for the balanced development of the region.

Planned large scale residential development need to be promoted in **Planning Division 8, 5 and 7 (Thrikkakara & Kalamassery, Maradu & Kumbalam and Vadavukode &**

Puthenkurisu respectively) in Phase 1. Large parcels of land can be brought under public ownership and/or public agencies can develop such land parcels through 'land pooling' (plot reconstitution techniques) with the participation of the land owners and/or encourage private sector through incentives to invest in housing and develop planned 'large plot' developments with high density –low rise and high rise. Public agencies and Local Self Governments have a role in planning for such developments and enabling such actions. When Planning Division 8 and 7 (Thrikkakara – Kalamassery and Vadavukode – Puthenkurisu) are recommended for high rise – high density developments, the Planning Division 5 (Maradu and Kumbalam) is recommended for low rise high density developments.

Planning Division 3 – Ernakulam Mainland is also proposed for densification; however the strategy adopted is based on Sub-Division analysis. The existing developments (predominant uses and intensity of development) within each Sub-Division, future development potential, geographical features, ROW of the access roads and the availability of infrastructure are considered when proposing further densification. Permitting higher density and higher intensity of development (increased FAR – Floor Area Ratio) may depend on the above. Only if the above parameters are satisfied i.e., only if the infrastructure in the Sub-Division is improved (either by any public agency or by the public agency with active support from the private sector/land owners) such high density developments may be permitted. Such parameters also include the minimum basic facilities to be made available within the Sub-Division. These parameters are listed below:

(1) The roads around the Planning Sub-Division (PSD) proposed to be widened and improved with street drain and road furniture should be widened and improved, so that the connectivity from the PSD to an arterial road is ensured.

(2) The internal motorable roads having thoroughfare should be widened to a minimum width of 5.50 m with road side drain unless the proposed ROW is specified in the Development Plan

(3) The public agencies (Government Departments and/or parastatals) responsible for improving the infrastructure shall commit based on an approved project to improve/augment the infrastructure within the PSD

(4) The PSD shall have at least one public open space/ park/playground within the PSD area (also to serve as a place where the people can assemble in case of a disaster)

(5) The PSD shall have at least one Public Toilet Cluster facility within the PSD area

(6) The PSD area shall have convenient shops (if not a mini-public market), banks, post office, police station, public vehicle parking area (at grade and/or multi level as free parking facility or as pay & park facility)

Methods of achieving such minimum facility requirements so as to enable the PSD to absorb high density developments are suggested below. The Local Self Government (Urban Local Body or the Gram Panchayat) may adopt any one or a combination of more than one of the methods to cause developments in a Planning Sub-Division.

(a) The entire developments may be arranged to be planned, including project preparation and implementation by the Local Self Government (ULB or Grama Panchayat)

(b) LSG may join hands with the residents' associations, traders and other establishments in the area for planning and development of the minimum requirements (partly with LSG funds, partly with the funding of the various participants and perhaps in convergence with any Central/State/LSG Plan schemes under Public Private Partnership)

(c) LSG with partnership with real estate developers who would like to avail of the opportunities for higher intensity of development in any PSD

A possible alternative to the above would be to consider the area within any specific PSD as a single entity and adopt a total redevelopment plan under **PRT (plot reconstitution scheme)** /land pooling scheme/land consolidation scheme in which all the land owners and tenants can be made to participate in the redevelopment scheme; at the same time making available land required as per a Plan for public uses including road widening. High density development within the PSD may offer scope for mobilizing the minimum required land for creation of required play grounds/ parks/recreational open spaces

3.4.2.2 Commercial Uses

The earlier Urban Master Plans used to be prepared based on residential neighbourhood concepts, but later on Planners considered Commercial Centres as a deciding factor for sub dividing the town/city into many self contained sectors. Commercial activity, as an in important daily activity of the residents has a deciding effect on the spatial structure of any city. In the case of Kochi also the commercial activities guided the growth of the present spatial structure.

Kochi City region has at present only 0.99 percent (367.10 hectares) of the total area used for commercial purposes. The major commercial activity areas are spread around M.G. Road, Broadway, Banerji road and Foreshore road. This causes convergence of people from all parts of the City Region increasing intra-city trips. Planning Standards recommend 4% of the total area of the City Region to be used for commercial uses. This works out to 14788.85 ha of land, showing that an additional area of 1111.79 ha may be required for commercial uses. This is a huge additional requirement caused by our computing the land requirement for various uses taking into consideration 7011.43 ha (18.9% of the total area) of water bodies and 5826.17 ha of wetlands (15.76% of the total

area) in assuming the total area of the Kochi City Region. Excluding this area under water bodies and wetlands from the total area, we may assess the total area of the KCR as 24134.52 ha and 4% of this area is 965.38 ha which can be taken as the total area required for commercial uses. This shows an **additional land requirement of** 598.28 **ha for commercial uses.**

This additional land requirement of 598.28 ha needs to be distributed to various hierarchical levels under the following sub-categories:

- Housing cluster (catering to around 3000 people)
- Sectors (catering to around 15000 people)
- Community Centres (catering to around 60000 people)
- Sub Centres (catering to around 3,00,000 people)
- City Centre (catering to the whole of the Planning Area and beyond)

At the development Plan level, the first 2 categories are not located or identified. They shall be provided at the appropriate level. Detailing of these centres could be done through Detailed Town Planning Schemes, if necessary.

Assessment and location of higher level commercial centres i.e Community centres, Sub centres and City centre are detailed out in the table below:

Table 3.22 Location of higher level commercial centres in KCR

Sl. No	**Planning Division**	**Projected Population (2031)**	**Number of Planning units**
1	Fort Kochi, Mattanchery	370912	1 District, 4 Communities
2	Wellingdon Island	21400	Only a Sector
3	Main Land CoC	537229	1 City Centre, 2 Distrcits, 10 Communities
4	Chellanam, Kumbalangy	107285	2 Communities
5	Kumbalam, Maradu	177426	2 Communities
6	Thrippunithura, Thiruvankulam	204828	1 District and 3 Communities
7	Vadavukode-Puthencruz	45396	1 Community
8	Thrikkakara, Kalamassery	463877	1 District and 5 Communities
9	Eloor	52543	1 Community
10	Cheranalloor, Varappuzha	92604	2 Communities
11	Elamkunnapuzha, Njarakkal, Mulavukadu, Kadamakkudy	200012	1 Distrcit and 2 Communities

3.4 .2.2.1 City Centre, Sub Centres and Community Centres

The commercial activities have given a place of pride for Kochi and therefore Kochi has become a commercial magnet attracting population from a vast hinterland extending beyond the district boundaries. The main commercial centre (perhaps can be referred to as the City Centre) is the Mahatma Gandhi Road (M.G.Road) extending from Ravipuram Jn. on the south up to Katcheripady Jn. on the north, with its sub roads including Foreshore road, Broadway and Banerji Road. This long corridor remains the main commercial convergence area in the city. However recent trends show commercial nodes developing at other points as well. With the intention to develop Kochi City region as a multi nuclei city and recognising the fact that commercial hubs have a great influence in deciding the travel patterns, especially intra city travel patterns, it is proposed that a few sub centres may also be developed taking into consideration the location advantages, development of other sectors around and even distribution to cater to the entire city region needs.

These commercial Sub Centres would accommodate higher order commercial and related uses so that most of the requirements of the people (residential and business communities) may be served by the Sub Centres in that sub-region. However, this may not provide answer for the specialized products and for preferential shopping needs. Though intra-city commercial shopping trips cannot be totally avoided, development of Sub Centres may to a large extent reduce the compulsions for such trips, since the facilities people seek may be available in the vicinity.

Sub Centre locations identified are as follows (Refer Map 3.2):

(1) Edappally
(2) Vyttila
(3) Kakkanad and
(4) Thripunithura -Thiruvanakulam
(5) Edakochi
(6) Elamkunnapuzha

Development of the above Sub Centres shall be promoted by Government and Local Government actions, incentives to the private sector and through public private partnerships. The Sub Centres may have higher order commercial facilities; some of which are listed below:

- Wholesale trade centres
- Shopping Malls / Departmental Stores / Supermarkets /Hypermarkets etc.
- Food Plazas
- Restaurants and Hotels
- Commercial Offices
- Banks and other Financial Institutions
- Retail shops

- Movie houses / Multiplexes / I-max Theatres /auditoria /conference –convention facilities / community halls
- Public amenities / police station/ post office and other telecom facilities etc.
- Public parking facilities
- Pedestrian facilities
- Recreational spaces
- Urban Design

Development of Sub Centres would greatly depend on (i) good road /transport connectivity from the Planning Divisions surrounding each such facility and (ii) improving the level of service of infrastructure in that area. Availability of vacant buildable land in the identified Sub Centres locality, though an important consideration, is not taken into consideration, since more profitable land uses may promote conversion of existing lower order uses to higher order uses either on individual plot of land or on pooled land parcels.
Promotion and development of Sub Centres would depend on the following actions envisaged in the Kochi City Region Master Plan:

- Transport, especially Mass Transport, facilities converging to Sub Centre locations
- Promotion of infrastructure in the location
- Incentives offered for developments in the Sub Centres
- Positive actions for mobilizing private sector participation in overall development activities in the area
- Preparation of Detailed Master Plans for the specified Sub Centre locations (Planning Divisions), publicizing the Plan proposals and announcing the incentives offered for Sub Centres functions in the area

- Twenty Community Centres are proposed at Planning Division level. Sector level/ cluster level Community centres are not identified in this Plan. This may be attempted while preparing Detailed Town Planning Schemes.

Map 3.2

3.4.2.3 Industrial Use

The Planning divisions of Thrikkakara – Kalamasserry, Eloor and Vadavukodu Puthen Kurisu have strong presence of Industrial use within the Planning area. While Eloor accommodates many heavy industries, Vadavukodu Puthen kurisu has many non-polluting heavy industries.

Two categories of Industrial uses are identified

(i) IT/ITES – M1 - at Thrikkakara

(ii) Medium and large Industries – M2 – at Vadavukode- puthenkurisu Panchayat and Eloor Panchayat

3.4.2.4. Public and Semi Public - P

Public and Semi public use is proposed at Thrikkakara- at 250 m on either side of Sea Port –Air Port Road

3.4.2.5 Paddy lands and wetlands –W

The total area under Paddy lands and wetlands in the Kochi City Region is 5826.17 Ha and this constitutes 15.76% of the gross area. The wetlands include marshy lands and the fish farms as identified in the existing land use plan.

Conversion of wetlands for urban use has been a feature of the development of Kochi for the last few decades. On one hand this has paved way for the supply of developable land for urban use and on the other, contributed considerably towards the degradation of environment and the balance in land use. This is true with other urban centres in the State as well and considering the ecological, economical and social importance of these lands, the Kerala Conservation of Paddy lands and wetlands Act 2008 was enacted in 2008. The paddy lands and wet lands in the Kochi City Region are therefore to be conserved as provided in the Act.

In the proposed land use, the entire existing area under paddy lands and wet lands i.e 5826.17 Ha is retained as it is. It is expected that considerable share of the wetlands could be put to recreational use, within the framework of the conservation Act, and this would

address to the gross inadequacy of organised recreational and open spaces in the city region.

3.4.3 Proposed land Use, 2031

The details of proposed land use is shown in **Table 3.23** and Map **3.3**

Table 3.23

Table 3.23 page 2

3.4.4 DEVELOPMENT CONTROL REGULATIONS (DCR)

This part of the Plan document presents a comprehensive set of Development Control Regulations aimed towards ensuring urban development in accordance with the plan proposals. These regulations and the planning parameters form a tool for effective implementation of proposals envisaged in the Development Plan for Kochi City Region 2031.

The regulations specify uses that may be normally permitted by the Secretary of the LSGI, restricted uses that may be permitted by the Secretary of the LSGI on appeal to the competent authority and uses that are prohibited. The Senior Town Planner Ernakulam shall be the Competent Authority for the purposes of enforcing this Development Control Regulations. Detailed guidelines for permitting the restricted uses will be issued by the Chief Town Planner separately and such detailed guidelines will become part of this Development Control Regulations.

The Development Control Regulations are stated in 3 different parts. Part I covers General Regulations applicable to the whole of the planning area. Part II covers Regulations that are applicable to specific Transportation Corridors and modifies the regulations in the first part. Part III covers Regulations that are applicable to specific Planning Divisions and modifies the regulations in the first and second parts. To confirm the permissibility of a specific use anywhere in the planning area, provisions in all the three parts are to be considered.

3.4.4.1 Land Use Categories

Urban Land Use categories are usually generalized based on traditional concepts. However, there are variations depending on the characteristics of the individual urban settlements. Specific land use zones are not identified as part of this Development Pan but broad land use categories based on development potentials are indicated.

Detailed Plans having specific land use allocations for each of the Planning Division could follow this Plan as a separate exercise, within the framework of the Development Plan. Detailed land use Plan for the Panchayats of Elamkunnapuzha, Njarakkal, Mulavukadu and

Kadamakkudy, which form part of the GIDA area, shall also be prepared within the framework of the Development Plan for Kochi City Region.

The Land Use Categories adopted for Kochi City Region (KCR) are as follows:

(1) Predominantly Residential
    (i) Low density residential – R1
    (ii) High density residential – R2

(2) Predominantly Commercial
    (i) Community Centre – C1
    (ii) Sub Centre – C2
    (iii) City Centre – C3.
(3) Predominantly Industrial
    (i) Information Technology / Information Technology Enabled Services (IT/ ITES) – M1
    (ii) Medium and Heavy Industries – M2
(4) Public and Semi Public - P
(5) Transport – T
(6) Heritage Conservation – H
(7) Parks, Open Spaces and Recreational – O
(8) Paddy lands and wetlands –W
(9) Agriculture – A

For the purposes of interpretation of "Predominantly Commercial" under the land use categories, the following may be noted:

Hierarchy of commercial centres is a function of the population it serves. The Development Plan for Kochi City Region identifies and provides for three levels of Commercial Centres as detailed below:

Table No. 3.24

Hierarchy of Commercial Centres adopted in the Development Plan

Sl.No	Hierarchy of Commercial Centre	Approximate Population served
1	Community Centre	60,000
2	Sub Centre	3 Lakh

3	City Centre. The term City centre is synonymous with the term CBD used previously in the Structure Plan.	23 Lakh

Sector centres catering to an approximate population of 15000 and Cluster centres catering to an approximate population of 3000 shall also be developed along with the commercial centres mentioned above. These shall be identified and proposed for development while preparing Detailed Town Planning Schemes. Permissible occupancies in these centres could follow the occupancies prescribed for the higher order centres of Community Centre, Sub Centre and City Centre.

Development Control Regulations have to be enforced for effecting the plan proposals and guiding the built-form, uses and densities in different planning divisions of the Kochi City Region. But these regulations are not intended to prohibit existing uses that have been lawfully established prior to the enforcement of these regulations. These regulations are essentially intended to help in taking decision regarding granting or refusal of planning permissions for change of occupancy and construction of buildings.

3.4.4.2 PART 1 - DEVELOPMENT CONTROL REGULATIONS (GENERAL) - APPLICABLE TO THE ENTIRE PLANNING AREA

The regulations contained in this part of the development control regulations are of general nature and are applicable to the entire planning area. The regulations contained in Part II and Part III modify this general regulations to the extent specified there in and therefore shall be read in conjunction with this.

Table No. 3.25

Prescribed uses in different categories of land use

Sl. No	Land use category	Sub Category	Prescribed uses *
1	**Predominantly Residential**	**Low density residential (R1)**	**(i) Permitted** 1. Residential buildings consisting of one or two family dwellings, apartment houses, lodging or rooming houses and dormitories 2. Community shops, bunk shops clearly incidental to residential use having a built up area not more than 150 sq. m. 3. Small professional offices having a built up area not more than 150 sq.m or customary home occupation and cottage industries not involving the use or installation of any machinery driven by power of any kind and which do not create noise, vibration, smoke, dust or other nuisance. 4. Educational institutions essentially serving the needs of residential community such as Nurseries, Kindergartens and Schools offering general education etc having a built up area not more than 150 sq.m . 5. Health institutions essentially serving the needs of residential community such as dispensaries, clinics, Nursing homes etc and having a built up area not more than 150 sq.m. 6. Community facilities such as community hall, places of worship, libraries, clubs etc having a built up area

			not more than 150 sq.m. 7. Utility installations essentially serving the needs of residential community such as post offices, police station, telephone exchange. electric sub-station etc. 8. Parks and play grounds, plant nurseries incidental to the community needs. 9. Service Industries and light industries on a mini scale as listed in Appendix 1 but not employing more than 5 workers with power limited to 10 HP except automobile repairing and / or servicing units provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions. **(ii) Restricted** 1. Vehicle Fuel retailing stations. 2. LPG distribution centres excluding bottling plants and bulk storage godowns but limiting the built up area to 150 sq.m 3. Uses permitted under (i) above exceeding the limits specified therein, as the case may be, but limiting the built up area to 300 sq.m. 4. Automobile repairing and/ or servicing units. **(iii) Prohibited** All uses not specifically permitted under section (i) and (ii) above.
		High Density Residential (R2)	**(i) Permitted** 1. Residential buildings consisting of one or two family dwellings, apartment houses, lodging or rooming houses and dormitories 2. Community shops, bunk shops clearly incidental to residential use having a built up area not more than 300 sqm. 3. Small professional offices having a built up area not more than 300 sq.m or customary home occupation and cottage industries not involving the use or installation of any machinery driven by power of any

			kind and which do not create noise, vibration, smoke, dust or other nuisance. 4. Educational institution essentially serving the needs of residential community such as Nurseries, Kindergartens and schools offering general education etc having a built up area not more than 300 sq.m . 5. Health institutions essentially serving the needs of residential community such as dispensaries, clinics, Nursing homes etc and having a built up area not more than 300 sq.m. 6. Community facilities such as community hall, places of worship, libraries, clubs etc having a built up area not more than 300 sq.m. 7. Utility installations essentially serving the needs of residential community such as post offices, police station, telephone exchange. Electric sub-station, Petrol filling station, Telecommunication Towers etc. 8. Parks and play grounds, plant nurseries incidental to the community needs. 9. Service Industries and light industries on a mini scale as listed in Appendix 1 but not employing more than 5 workers with power limited to 10 HP except automobile repairing and / or servicing units provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions. **(ii) Restricted** 1. Vehicle Fuel retailing stations. 2. LPG Distribution centres excluding bottling plants and bulk storage godowns 3. Uses permitted under (i) above exceeding the limits specified therein, as the case may be, but limiting the builtup area to 500 sq.m. 4. Automobile repairing and/ or servicing units **(iii) Prohibited** All uses not specifically permitted under sections (i) and (ii) above.

2	**Predominantly Commercial**	**Community Centre (C1)**	**(i) Permitted** 1. All shops, restaurants, hotels, Banks and business offices limiting built up area upto 500 sq.m. 2. Civic, cultural and entertainment facilities of all types limiting built up area upto 500 sq.m 3. Residential buildings not exceeding 3 floors, lodging or rooming houses and 4. Parks, Grounds and play fields. 5. Service garages, service industries and light industries on a mini scale as listed in Appendix 1 except items 21 and 23 but not employing more than 5 workers with power limited to 10 HP or not more than 10 workers without power, provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions 6. Health institutions like nursing homes limiting builtup area to 500sq.m. 7. Bus terminals, Parking plazas, taxi stands, scooter stands etc 8. Public utility installations **(ii) Restricted** 1. Vehicle Fuel retailing stations 2. Community buildings such as places of worship and community halls with a builtup area not exceeding 500 sq.m. 3. Service Industries and light industries on a mini scale as listed in Appendix 1- items 4, 8, 21 and 23 but not employing more than 10 workers with power limited to 10 HP or not more than 20 workers without power, provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions. 4. Automobile repairing and/ or servicing units

			(iii) Prohibited All uses not specifically permitted under sections (i) and (ii) above.
		Sub Centre (C2) and City Centre (C3)	**(i) Permitted** 1. All shops, restaurants, hotels, Banks and business offices 2. Civic, cultural and entertainment facilities of all types 3. Residential buildings including apartment houses, lodging or rooming houses and dormitories 4. Parks, Grounds and play fields. 5. Service garages, service industries and light industries on a mini scale as listed in Appendix 1 except items 21 and 23 but not employing more than 10 workers with power limited to 10 HP or not more than 20 workers without power, provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions 6. Health institutions like nursing homes limiting builtup area to 300m. 7. Bus terminals, Parking plazas, taxi stands, scooter stands etc 8. Public utility installations **(ii) Restricted** 1. Vehicle Fuel retailing stations 2. Community buildings such as places of worship and community halls. **(ii) Prohibited**

			All uses not specifically permitted under sections (i) and (ii) above.
3	**Predominantly Industrial**	**(i) IT and ITES – M1**	**(i) Permitted** 1. Information Technology buildings and Information Technology Parks. *Information Technology building* refers to building occupied by industries and other business establishments, whose functional activities are in the field of Information Technology, Information Technology Enabled Services (IT/ITES) and Communications Technology. Of the total built-up area in such buildings, at least 70% of the area should be earmarked for this purpose and the remaining could be utilised for supporting activities like restaurants, food courts, meeting rooms, guest houses, recreational facilities. *Information Technology Park* refers to integrated township, which would contain Information Technology buildings, as well as other buildings. The Information Technology buildings in the Information Technology Park would be constructed for the purpose of carrying out the activities set out in the definition given above for Information Technology building and the remaining buildings in the Information Technology Park are meant to play a complementary role, supporting the activities in the Information Technology buildings. In the Information Technology Park, 70% of the land area is to be set aside for the construction of Information Technology buildings and the remaining land area could be utilised for all the supporting activities. The buildings for the supporting activities could include residential buildings, recreational facilities, educational

			facilities, convention centres, hospitals, hotels and other social infrastructure meant to support the activities in the Information Technology buildings and Information Technology Parks. 2. Hardware industries- manufacturing, assembly and servicing. 3. Permitted subject to compatibility to surrounding developments - a. Service industries and light manufacturing specified in Appendix 1 and 2 employing not more than 10 workers with power not more than 10 HP or 20 workers without power, provided that such activities would not cause obnoxious and/or injurious and/ or hazardous, noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions. b. Retail shopping, commercial buildings, banks and professional offices not exceeding a total builtup area of 300 sq.m. c. Individual residential building not exceeding a total built up area of 300sqm. d. Educational facilities, convention centres, hospitals, hotels and other social infrastructure subject to a total built-up area of 300sqm. 4. Recreational facilities including parks and play grounds **(ii) Restricted** 1. Vehicle fuel retailing stations 2. Public utility installation. 3. Bus and truck terminals. 4. All uses mentioned in 3b,3c & 3d of Section (i) above exceeding total built-up area of 300 sq.m limiting to 500 sq.m **(iii) Prohibited** All uses not specifically covered under sections (i) and (ii) above.

		(ii) Medium, Large Scale Manufacturing and Heavy Industries-M2	**(i) Permitted** 1. Service industries and light manufacturing specified in Appendix 1 and 2. 2. Medium scale manufacturing as listed in Appendix 3 employing less than 250 persons and using power less than 500HP and which do not cause excessive, obnoxious, injurious, and hazardous or objectionable conditions. 3. Roofed storage and sale of goods and related commercial, and business offices incidental to the manufacturing activity of the use zone. 4. Public utility installations such as electrical sub station incidental to the manufacturing and allied activities of the use zone. **(ii) Restricted** 1. Medium scale manufacturing as listed in Appendix 3 employing more than 250 persons or power of more than 500 HP or those which involve excessive, obnoxious, injurious, hazardous, objectionable conditions or other pollutants. 2. Large scale manufacturing as listed in Appendix 4 **(iii) Prohibited** All uses not specifically permitted in section No. (i) & (ii) above.
4	**Public and Semi Public (P)**		**(i) Permitted** 1. Local, State and Central Government offices, Social and cultural institutions including Municipal and community facilities. 2. Institutions for entertainment not running on a commercial basis. 3. Educational institutions of all types and research establishments. 4. Health institutions having a built up area not more than 300 sq.m.

			5. Residences, hostels and other types of accommodation incidental to the permitted uses as above not exceeding a total built up area of 300 sq.m. 6. Banks, Shops, Canteen and restaurants incidental to the permitted uses as above not exceeding a total built up area of 300 sq.m. 7. Service industries and light industries on a mini scale as listed in Appendix 1 except items 4, 8, 21 and 23 but not employing more than 10 workers with power limited to 10 HP or not more than 20 workers without power, provided such activities would not cause obnoxious and or injurious and or hazardous noise, vibration, smoke, gas, fumes, odour, dust, effluent or other objectionable conditions 8. Parks and open spaces. 9. Individual residential building for the owner, not exceeding a total built up area of 300sqm. 10. Commercial buildings not exceeding a total built up area of 300sqm. 11. Utility institutions such as telephone exchange, electric sub stations, water works etc. which does not create nuisance or hazard. 12. Traffic terminals. 13. Garages and workshop incidental to the uses (11) and (12) above. 14. Place of worship **(ii) Restricted** 1. Health institutions of all types 2. Utility installations such as sewage treatment plant waste disposal schemes, incinerators, which create nuisance or hazard **(iii) Prohibited** All uses not specifically mentioned under Section (i) & (ii) above
5	**Transport (T)**		**(i) Permitted** 1. Parking Plaza, Bus terminal / stand, Lorry stand,

			taxi / Jeep/ Auto rickshaw stand, Railway station, airport, harbours, Ports, Container terminal, boat jetty 2. Shops incidental to main use not exceeding 150 sq.m, automobile workshops, garages, service stations etc. incidental to main use. 3. Residential uses and night shelters incidental to main uses but not exceeding 300 sq.m total builtup area. 4. ATMs, weigh bridge. 5. Transmission towers and wireless stations. 6. Tot lots, parks and open spaces. 7. Vehicle fuel retailing stations **(ii) Restricted** 1. Commercial uses of built up area not exceeding 300sqm. 2. Storage of hazardous and non-hazardous materials etc incidental to transport terminals but not exceeding a total built-up area of 500 sq.m. **(iii) Prohibited** All uses not specifically mentioned under Sections (i) & (ii) above.
6	**Heritage and Conservation (H)**		Not withstanding anything contained in the Development Control Regulations of the Development Plan and subject to modifications as prescribed hereunder, no development, re-development, construction including additions, alterations, repairs, renovations, replacement of special and architectural features, demolition of any part or whole in respect of any objects or buildings in this area shall be allowed except with the prior written recommendation of the Art & Heritage Commission constituted by the Government as per the Kerala Municipality Building Rules in force, in order to conserve the heritage character of the area.

			Provided that, no area or buildings or objects, which in the opinion of the said commission have architectural, aesthetic, archaeological, cultural or historic value, will be allowed to change from the existing condition without the recommendations of the Art & Heritage Commission. Provided also that the use or reuse of any site or building shall be as per the recommendations of the Art & Heritage Commission. Provided also that the local body shall ensure the conformity with all other applicable statutes. The Art & Heritage Commission may, if found necessary, entrust the above regulatory aspects to committee(s) constituted for the purpose by the Art and Heritage commission.
7	**Parks, Open Spaces and Recreational Use (O)**		**(i) Permitted** 1. Parks, Nurseries, Botanical garden, ponds and lakes, Zoological parks and bird sanctuaries essentially planned for the preservation of flora & fauna and accessible to the public. 2. Dwellings for the watch and ward staff and other essential personnel incidental to the above use but not exceeding a total built-up area of 50 sq.m. 3. Observatory towers. 4. Stalls, Snack bars and booths incidental to above uses and catering to the public but not exceeding a total built-up area of 50 sq.m. 5. Public institution such as libraries, clubs, toy centers etc. incidental to above and of public interest but limiting to a total built-up area of 150 sq.m. 6. Public utility service incidental to above use and of public interest. 7. All public and semi public recreational uses including playgrounds, parks, exhibition and fair grounds, parking, special recreational areas like picnic spots, aquarium, waterfronts, areas of civic interest and open-air theatres.

			(ii) Restricted 1. Cottages, hotels of tourism interest and guest houses but limiting to a total built-up area of 300 sq.m. 2. Archeological Museum etc. 3. Public utility services which do not cause nuisance or hazard. **(iii) Prohibited** All uses not specifically mentioned under sections (i) & (ii) above.
8	**Paddy and Wet land (W)**		**(i) Permitted** As provided in the Kerala Conservation of Paddy land and Wet land Act, 2008 **(ii) Restricted** Recreational uses, within the frame work of the Kerala Conservation of Paddy land and Wet land Act, 2008 **(iii) Prohibited** As provided in the Kerala Conservation of Paddy land and Wet land Act, 2008
9	**Agriculture (Dry cultivation) (A)**		**(i) Permitted** 1. Agriculture 2. Horticulture and other types of cultivation including social forestry 3. Dairy 4. Milk chilling centers. 5. Poultry farming 6. Farmhouses and buildings accessory to the above uses. 7. Storage, processing and sale of farm products in the property where produced limiting the total builtup area to 300 sq.m. 8. Creation of botanical gardens, zoological parks, bird sanctuary etc. 9. Ponds and pools for agricultural, domestic and

			recreational purposes. 10. Cottage industries and such other traditional trades and occupation, which use agricultural produce, not causing nuisance buitlup area limiting to 300 sq.m. 11. Individual residential building not exceeding a total built up area of 300sqm. 12. Retail shops or other uses incidental to the residential use having a built up area not more than 150sqm. 13. Servicing and repairing of farm machineries and sale of agricultural supplies. **(ii) Restricted** 1. Place of worship, Schools, libraries, Educational and Cultural buildings not exceeding a total built up area of 300sqm. 2. Public utility buildings like water supply and electrical installations, sewage treatment plant etc. 3. Brick kiln 4. Service industries and community shops as given in Appendix 1. **(iii) Prohibited** All uses not specifically permitted under sections (i) & (ii) above.

* Detailed guidelines for permitting the restricted uses will be issued by the Chief Town Planner separately and such detailed guidelines will become part of this Development Regulations.

3.4.4.3 Additional provisions in respect of permissible FAR and Coverage in different categories of land use in the Development Plan

FAR and Coverage for occupancies specifically mentioned in the table below will be applicable to different land use categories identified in the Development Plan. Unless otherwise specifically mentioned in this Plan or any other DTP scheme, all other development regulations will be as per the provisions in the Kerala Municipality Building Rules (KMBR) in force, without contravening the concepts of this Plan.

Table 3.26
FAR and Coverage in different land use categories

Sl. No	Land use category	Occupancy as per KMBR	FAR#	Coverage
(1)	(2)	(3)	(4)	(5)
1	Low density Residential (R1)	Residential	1.5*	As provided in the KMBR
2	High density Residential (R2)	Residential	2.0	As provided in the KMBR
3	Other land use categories where residential buildings upto 300 sq.m only are permitted in this Plan	Residential	1.5	As provided in the KMBR
4	Public and Semi Public	Office/ Business	2.50	35%
5	Community centre C1, Sub Centre C2, City Centre C3	Mercantile & Office/Business	2.50	As provided in the KMBR
6	IT/ ITES (M1)	As provided in the KMBR		
7	Medium, Large Scale Manufacturing and Heavy Industries (M2)	Industrial	1.50	As provided in the KMBR

The FAR for occupancies not mentioned in column (3), but permitted/restricted in the respective land use category as per the DCR shall be limited to the values mentioned in column (4) or as stipulated in KMBR whichever is less.

* The FAR shall be further increased subject to the conditions in Part II.

3.4.4.4 Other Special Provisions for Large Scale Developments

Large scale development proposals in an area not less than 4 Ha, exceeding investment of Rs 50 crore, which provide direct employment (after commissioning of the project) to the tune of not less than 500 persons may be permitted in the preferred locations specified under Part III below , subject to the recommendation of a committee to be constituted by the Government for this purpose, under the chairmanship of the Secretary to Government ,Local Self Government Department, consisting of the Chief Town Planner, Department of Town and Country Planning, , Secretary, Greater Cochin Development Authority, Secretary ,Goshree Island Development Authority, Senior Town Planner, District office of the Kerala State Town and Country Planning Department, Ernakulam and the Secretary of the local body concerned, and satisfying the following conditions:

- The developer shall produce project cum feasibility report and Environmental impact Assessment Report of the project, if required, to the convener of the committee, 15 days in advance of the committee meeting.

- The developer shall produce before the committee all required clearances from Stale and Central Govt. agencies concerned.

- Adequate provision shall be made by the developer for supporting infrastructure such as water supply, sewerage, solid waste management etc. Separate sewage treatment plant and solid waste management measures shall be provided and maintained by the developer at his cost.

- Adequate MoU between the developer and the secretary of the local body concerned shall be undertaken to bring this into effect.

- Maximum F.A.R shall be 2 and minimum access width shall be 15m.

- The project shall be completed within a period of 3 years if not specified otherwise.

- The Senior Town Planner, District office of the Kerala State Town and Country Planning Department, Ernakulam district shall be the convener of the committee.

3.4.4.5 PART II - DEVELOPMENT CONTROL REGULATIONS – APPLICABLE TO SPECIFIC TRANSPORTATION CORRIDORS

More mixing of uses and intensity of development, mainly in residential areas, is permitted along major transportation corridors. This modifies some of the regulations specified in Part I. Likewise, the mixing permitted in this Part is subject to the regulations contained in Part III. Hence this Part shall be read in conjunction with Part I and Part II of the Development Control Regulations.

(i) **Roads having a width of 22 m and above**. Within the Planning Division 3, on either side of the roads having a proposed width of 22m and above as shown in Map 3.4.5.1, upto a depth of 150m, the permissible FAR for buildings under residential occupancies will be 2. For plots abutting and gaining direct access from these roads, the uses permitted in Community Centre (C1) will also be permitted.

If the existing width of any of these roads is less than the width proposed in the Development Plan, this provision shall be applicable as and when the roads are widened and upgraded to the widths proposed in the Development Plan.

(ii) **Roads having a width of 12m and above**. The roads having a proposed width of 12m and above are identified and shown in Map 3.4.5.1. In Low density residential area (R1), on either side of these roads, to a depth of 75m from the boundary of the road, the permissible FAR for buildings under residential occupancies will be 2. For plots abutting and gaining direct access from these roads, uses permissible in High density residential area (R2) will also be permitted.

If the existing width of any of these roads is less than the width proposed in the Development Plan, this provision shall be applicable as and when the roads are widened and upgraded to the widths proposed in the Development Plan.

3.4.4.6 PART III - DEVELOPMENT CONTROL REGULATIONS – APPLICABLE TO SPECIFIC PLANNING DIVISIONS

The provisions contained in this Part are specific to different Planning Divisions and they modify the regulations contained in Part I and Part II.

(i) Planning Sub Division 1 (Thrikkakara) of Planning Division 8

a) On either side of seaport airport road, to a depth of 250m, Public and Semi-public uses will be permitted. This area is earmarked for Public and Semi public use category in the Development Plan.
b) The area to the western side of Smart City road to a depth of 250m and up to the eastern boundary of the planning area on the east is earmarked for Industrial use (IT/ ITES – M1)
c) Preferred location for Large scale projects

(ii) Planning Sub Division 2 (Kalamassery) of Planning Division 8

a) On either side of NH-47 to a depth of 150m the permissible FAR for buildings under residential occupancies will be 2. For plots abutting and gaining direct access from these roads, the uses permitted in Community Centre (C1) will also be permitted.
b) Preferred location for Large scale projects

(iii) Planning Division 7 – Vadavukodu – Puthen kurisu

a) Preferred location for Large scale projects
b) No new Obnoxious and Hazardous industries other than the expansion of existing units shall be considered.

(iv) Planning Division 9 – Eloor

a) Preferred location for Large scale projects.
b) Obnoxious and Hazardous Industries could be considered.

(v) Planning Division 4 - Kumbalangi and Chellanam

a) Hotels and Resorts shall be permitted with height restricted to 9 metres.
b) Multi storied concrete buildings including high-rise residential apartments will not be permitted.

3.4.5 Transportation Proposals

3.4.5.1 Existing traffic network and transportation system

Kochi is uniquely served with different modes of transportation on air, water and land. The transportation system may be classified broadly into intercity linkages, regional linkages and city level linkages depending on their predominant function and area of operation. The airport, the harbour, the railways and the national highways mainly serve the intercity transportation needs. The inland water ways and state and district roads serve the regional level function. There is of course some amount of overlapping. The city level linkages are provided by other roads and ferry services.

3.4.5.1.1 Inter City Linkages

i. Air transport network

The International Airport located at Nedumbassery, which is nearly 28 km from Kochi city, caters to the needs of domestic and international passengers of Kochi and surrounding regions. The Cochin Port is connected to International Air Port by a newly developed road link called Seaport-Airport road. Another airport located at Willington Island, is under the control of Defence Department. Kochi International Airport is connected to all major cities in India by domestic flights and to foreign countries by international flights. This is the first airport built under the Public Private Partnership (PPP). It handles about 46 domestic and 70 international services per week.

ii. Port and Harbour

Cochin Port is the only major port in Kerala state with an ISO 9001-2000 certification. Facilities offered by the port are berths for handling cargo and passenger ships, cargo handling equipments, storage accommodation, dry dock, bunkering facilities, fisheries, harbour etc. Passenger ships are operated to Lakshadweep Islands from the Cochin Port. The construction of Vallarpadom Container Transshipment Terminal, one of the major schemes of port development, is in progress.

iii. Railways

Rail transport system caters mainly to the needs of inter-city passenger and goods traffic. Kochi city is connected to major urban centers in the state as well as to the up-country destinations through two major railway lines. These are the Thiruvanathapuram-Thrissur railway line via Kottayam and the railway line from Ernakulam to Kayamkulam via Alappuzha. Kochi city has the benefit of two major railway stations viz., Ernakulam Town (North), and Ernakulam Junction (South). Of these two stations, Ernakulam South is the most frequently used, as maximum number of trains are operated from this station. Ernakulam South station handles about 65% of traffic generated from the City and the rest is handled by Ernakulam North station.

The railway line divides the city into two parts. The older parts of the city are located on the western side of the railway track, while new developments are on the eastern side of the railway line. Out of the ten railway over bridges (ROBs) five major ROBs given below provide uninterrupted flow of traffic between western and eastern parts of the city.

The location of these ROBs are :-

- Near North railway station on the Banerji Road.
- Near Manorama junction on Sahodharan Ayyappan road
- Near Kathrikkadavu on Kaoloor- Kadavanthra road.
- NH 47 A Kundannur – Thevara Bridge
- Thevara Jn – Perumanoor Bridge.

There are a number of railway level crossings within the city, which remains as major bottlenecks to the free flow of vehicular traffic along certain travel corridors. Of these, seven level crossings are located along major travel corridors and are listed below:-

- Edappally on NH – 17
- Pulleppady on Pulleppady – Kathrikkadavu road
- Ravipuram on Panampilly Nagar to Chittoor road
- Pachalam on Chittoor road
- Vaduthala on Chittoor road
- Ponnurunni on Thammanam – Vyttila road and
- Atlantis on Panampilly Nagar to MG road

Constructions of ROB are in progress at Pulleppady and Edappally level crossings.

The important railway terminals of the city are Ernakulam Town and Ernakulam Junction. In view of the fast development of the town on the eastern side of the railway line, entries to the stations from the east will be most desirable. This will relieve number of criss-cross traffic in the city. Even if the eastern entry of the Ernakulam Junction is functioning, it is not in a full fledged manner.

iv. National Highways

Within the city the NH-47 passes through the heavily built up areas of Ernakulam, Mattancherry and Palluruthy. A by-pass to NH-47 starting from Aroor at south and passing through Maradu and Vyttila and ending at Edappally reduces the congestion at city roads to a greater extent and widening of this by-pass is in progress. NH-47A connects Willingdon Island to NH-47 by-pass and it extends towards east up to Madura as NH-49. NH-17 is a direct link to Parur and extends towards north end of Kerala as a parallel highway to NH-47, starting from Edapally.

3.4.5.1.2 Regional Linkages

i. Regional Level Road Network

Even if the planning area is served by four dominant modes of transport viz. road, rail, water and air, the road network has a wide presence throughout the planning area due to its penetration into every nook and corner of the city and all terrain conditions. In the case of rail network, it has a limited but dominating influence. Air network has its usual supplementary role, while water ways are mostly confined to western side of the city. The city is connected to other urban centres of the region through the following regional level roads which radiate from city centre to the environs.

The existing regional level roads, other than NH, in Kochi City Region are:-

1. Ernakulam – Vaikom Road
2. Ernakulam – Muvatupuzha Road
3. Ernakulam – Perumbavoor Road
4. Fortkochi – Chellanam Road
5. Vypeen-Munambam Road
6. Thripunithura – Karimugal Road

The operational efficiency of these roads are very poor due to uncontrolled ribbon development, bottlenecks created by narrow bridges, railway crossings, poor alignment and road geometrics etc. A proper road network system for the Kochi City Region can be developed by substantial improvement of these roads and incorporating ring roads as links between the radial roads.

ii. Water transport network

Kochi has a good network of inland waterway system consisting of backwaters, canals, lagoons and estuaries. National Waterway No.3 connecting Kollam and Kottappuram pass through the region. The State Water Transport Department (SWTD), Kerala Shipping and Inland Navigation Corporation (KSINC) and private operators are providing passenger and cargo boat services to the adjoining islands and industrial centers located in this region.

The passenger traffic by boat shows a decreasing trend owing to lack of proper fast services and poor schedules.

The waterways form the direct and economic route for industrial and commercial goods to the city from places all along the coastal belt. Introduction of goods oriented boat services and improvement of canal system will substantially improve the role of waterways for cargo movemen

3.4.5.1.3 City Level Traffic Network

The city level movement of goods and passengers in Kochi is effected through the city road system and inland waterways. The road network is constituted by a broken grid iron pattern, the main emphasis is on the North-South axis with minor roads giving East- West connection resulting in undue concentration of services in certain areas of the city. Lack of accessibility is caused by poor quality of roads, inadequate width of roads with a number of crossings across railway lines, canals and backwaters.

The road network in Kochi City is maintained by agencies like Kochi Corporation, Public Works Department (PWD), Greater Cochin Development Authority (GCDA) and Cochin Port Trust. Of the total length of 614 km of road network, major portion (88%) of the roads in the City is under the control of Corporation of Cochin. GCDA handed over 52.61 kms of roads to Kochi Corporation and 5.5 km is to be handed over. It could be seen that the city had a road density of 1.03 km/1000 population and 6.47 km/ Sq. km of surface area.

For the purpose of inventory of the road net work, the roads in the city were classified as arterial, sub arterial, collector and local streets. The share of arterial roads in the total road net work in the city was only 2.75% where as that of sub-arterial roads was around 9%. Local streets formed the major share (nearly 64%) of the road net work in the city. Distribution of roads in Kochi city according to their functional classification is given in Table 5.1 below

Table 5.1 : Distribution of road net work in Kochi city according to functional classification.

Sl. No	Type of road	Length (km)	Percentage
1	Arterial road	16.90	2.75
2	Sub-Arterial road	53.00	8.63
3	Collector street	151.40	24.66
4	Local streets	392.67	63.96
Total		613.97	100

Source: Report on Traffic and Transportation System study for Cochin City by NATPAC, 2006

Road network data of Kochi city was also defined in terms of right of way availability. 53 % of the total length of roads in Kochi city was having a right of way less than 5m. 35 % of roads in the city area was having a right of way ranging from 5 to 10m while 8% of the roads were having a right of way ranging from 10 to 20 m. Hardly one per cent of the total roads (5.939 Km) in Kochi city had right of way more than 40 metres. Distribution of road network in Kochi city according to right-of-way availability is given in Table 5..2

Table 5.2: Distribution of road network in Kochi City according to right-of- way availability

Sl. No.	Right of way (m)	Road length (km)	Percentage
1	< 5	325.604	53
2	5 – 10	214.887	35
3	10 – 20	49.117	8
4	20 – 30	18.418	3
5	> 40	5.939	1
	Total	613.965	100

Source: Report on Traffic and Transportation System study for Cochin City by NATPAC

Main roads catering to the core area are MG Road, Shanmugham Road, Chittoor Road and Kaloor-Kadavanthra Road running North – South. There are only two east west corridors namely Banerji road and Shahodaran Ayyappan (SA) road giving access to the core area. Trunk routes connecting the city are NH 17, NH 47 and NH 49. After the completion of Goshree bridges it has emerged as a trunk route connecting city centre to Kodungallor.

3.4.5.2 Trend of Growth of Vehicle population and its composition

The number of vehicles in Ernakulam district has increased from 91411 to 525204 within a span of 15 years showing an average growth rate of 13 %. Two wheelers constituted a major share of increase in vehicle population in Ernakulam.

Table 5.3 gives the growth trend in vehicle population in Ernakulam District during the period between 1990 and 2005

Table 5.3: Growth of vehicle population in Ernakulam District

Sl. No.	**Type of Vehicle**	**1989-1990**	**1994-1995**	**2002-2003**	**2003-2004**	**2004-2005**

1	Goods Vehicle	12059	15315	36628	39874	43922
2	Bus/minibus	2076	5176	9753	10931	12247
3	Car/Jeep/Van	24737	37481	71404	80448	91402
4	3-Wheelers	6219	17012	33478	35511	37629
5	2-Wheelers	44129	165250	283283	285221	326491
6	Others	2221	1547	12413	12937	13513
Total		**91441**	**241781**	**446959**	**464922**	**525204**

Source: Economic Review, Kerala State Planning Board.

5.4.5.3 Travel Characteristics

A total of 2.28 lakh trips were performed by the resident population of Kochi Corporation in 2006. The per capita trip rate was found to be 0.06. Majority of trips were performed in public buses, followed by 26% in two wheelers and 20% by walk. Distribution of person trips according to mode of travel is given in Table 5.4.

Table:5.4: Distribution of person trips according to mode of travel

Sl. No.	Purpose	No. of trip makers
1	Bus	141364
2	Car	17534
3	Two wheelers	58492
4	Auto	8522
5	Taxi	1933
6	Walk	46523
7	Ferry/boat	745
8	Train	93

On an average altogether there are 141293 trip makers in the city per day.

The distribution of bus terminals in the city and the services commanded from these terminals indicate that there exists much overlapping of function. There is also overlapping of suburban and city services within the city. Another aspect of the haphazard distribution is the lack of integration of terminal facilities. Hence terminal facilities and interchange facilities should be designed properly.

3.4.5.4 Goods Traffic and Terminal Facilities

Inter-city goods traffic in the study region was handled by a number of goods vehicles consisting of 11,176 trucks, 8,690 mini-trucks/tempos and 6,262 goods auto. Goods traffic to the tune of 80,797 metric tonnes was transported to various destinations, of which the

share of trucks constituted 78 % (62,605 mt), followed by mini-trucks 19 % (15,688 mt) and goods autos 3% (2,504 mt).

Bulk of inter-city goods vehicles (78%) either originated from or terminated in Kochi city. 21 % of the goods vehicles were found to be bypassing the city. In terms of total tonnage carried, only 66 per cent of around 80,000 mt had their origin or destination in Kochi City. Most of the remaining vehicles with a tonnage of 26,000 mt (32%) were bypassing the city.

A maximum of 10,618 goods vehicles including trucks, mini-trucks and goods auto passed through Edappally on NH-47, followed by 7,192 goods vehicles through Thycoodam on NH bypass and 5,968 vehicles through Petta bridge on Thrippunithura road.

3.4.5.5 Observations

The issues in traffic and transportation, identified in Kochi City are as follows:

- Majority of traffic problems are concentrated along two east west corridors of the city
- The City roads and the Regional Road corridors are overstressed due to increasing traffic volume
- Time delay, pollution and increasing traffic accidents are caused by mixed traffic
- Public mass transport facility is not well organized and route selection of public transport is unscientific.
- Improper traffic junctions, insufficient carriage way width to accommodate high volume of traffic and inadequate lane widths, chronic parking problems in core areas, road side parking etc cause traffic block
- Absence of integrated terminal for different modes of transport , truck terminals, bus bays, proper link roads, and pedestrian facilities add to the problems
- Narrow bridges and inadequate number of railway over bridges
- Encroachment of road by foot path vendors and petty shops

An analysis of the existing traffic and transport system in the city reveals the need for better planning and co-ordination between the various modes of transportation such as roads, railways and waterways for optimum utilization of the available resources.

Kochi city with vast portions of its area under canal and backwaters, presents scope for developing an efficient and economic transportation system. This unique advantage can be singled out as a major potential and absolute dependency on roads could be turned to use water transport as a better alternative.

The analysis also directs attention to the lack of co-ordination between the various modes of transport for transit at terminal points and interchanges. The waiting time required for this modal change is usually high in most cases.

The inter change from the suburban bus system to the city bus system and vice versa is not defined. Similarly, no coordination exists between the terminal facilities of buses operated by public and private agencies. The interchange between water ways and roadways are very important owing to the complementing roles of these two modes in the transportation system. The facilities at these interchanges are noticeably poor considering the character and volume of traffic. These are to be specially designed for efficient and comfortable transfer of goods and passengers.

3.4.5.6 Development Strategies for Traffic and Transportation :

The development strategies for traffic and transportation in Kochi is worked out with the aim to support the concept of making Kochi City Region a 'Global City'. The strategies also aim to ensure safe and economical commuting between place of origin and destination, convenient and quick access to all areas, reduction of pollution and congestion, energy efficiency and conservation, safety for all sections of the road and transport users.

The strategies are identified at regional level and at the level of planning area (Kochi City Region) and are as follows:

I. At Regional level

(1) Promoting transit oriented development:

- In order to arrest urban sprawl, reduce the dependency on Kochi City and to open up new areas of development in the Region, it is proposed to develop a transit oriented development corridor connecting centres of Kodungallur, Angamaly, Perumbavoor, Kolenchery, Piravom, Thalayolaparambu, and Cherthala. This road linkage connecting the above centres would also function as a bypass to the Kochi Urban Agglomeration and shall be developed in such a way that MRTS could be introduced in this corridor at a later stage.

- The Angamaly – Perumbavur- Kolenchery - Piravom corridor shall be developed in the first phase followed by the corridors of Cherthala - Thalayolaparambu and Thalayolaparambu - Piravom respectively. The east west linkages connecting Kochi city with the proposed development corridor shall be developed in accordance with the development of corresponding Transit Oriented Corridor.

- The stretch linking Angamaly – Nedumbassery – Aluva – Kalamassery - Kochi - Tripunithura – Mulamthuruthy- Piravom shall also be promoted for transit oriented development to complement the development of the proposed Angamaly- Cherthala corridor. Intense development shall be promoted along Angamaly -Thripunithra -

Piravom corridor in the first phase to induce development along Angamaly - Kolenchery - Piravom- Cherthala corridor, with the main focus on Angamaly.

- The above two transit corridors could be connected by a link road from Arookutty to Mulanthuruthy via Poothotta-Kanjiramattom ,across Perumbalam Island.

(2) Strengthening regional linkages:

- The regional transport corridors are overstressed due to the commuting traffic. These corridors mainly include the following viz. Chellanam –Fort Kochi road, Vypeen-Munambam road, National Highway-47 connecting Aroor and Angamaly, National Highway-17 connecting Edappally and Calicut, National Highway 49 connecting Kochi and Madurai via Muvattupuzha, Thripunithura – Vaikom road, Edappally – Perumbavoor road, Kochi - Munambam via GIDA Bridge, Palluruthy - Kumbalangy road etc. It is necessary to strengthen these corridors, augment the existing transport facilities and open out new transport facilities.

(3) At planning division level

- Prepare and operationalise an integrated multi-modal traffic and transportation plan comprising road, rail, water and air network and link areas of future development to this integrated transport network

- Constitute a Unified Transportation Management Authority (UTMA) in tune with the National Urban Transport Policy ,2006 to coordinate proper integration of different modes of transport such that mutual accessibility , timely availability of each mode in a sequential manner, proper maintenance of the entire system etc are fully ensured under the control of a single agency.

- **Promote mass transport system in the planning area:**

  - Identify and improve road stretches along which mass transport has to be promoted in the planning area.

  - Encourage reliable and efficient multi modal mass transport system through provision of additional stations, park and ride facilities, introduction of multi-modal single ticketing system etc and utilise the potential of water bodies also in the integrated transport system. The coverage of mass transport facility in the city shall be enhanced.

- As part of promoting mass transport system, along the narrow congested roads in the planning area the use of minibuses shall be adopted. Simultaneously pedestrianisation of internal roads and / or provision of pedestrian facilities shall also be promoted identifying such roads in a manner that mass transit corridors are accessible within walking distance. Use of personal vehicles shall be discouraged as well.

- Provide exclusive lanes for mass transport and container movement where ever possible; and develop goods and passenger terminals with adequate infrastructure.

- Informal sector shall be promoted providing organized space for informal sector activities thereby relieving encroachment by street vendors on roads and foot paths. Separate strategy shall be devised to promote informal sector development in select areas.

- Fast corridors need to be developed linking the airport and the major potential job centres in the urbanising peripheral areas in Kochi city region integrating well with the road, rail and canal system.

- Suitable strategy for off street parking of vehicles shall be devised and parking facilities shall be developed at the planning division level. The feasibility of making available these facilities through PPP shall be explored.

- Optimal utilisation of the existing road network through short term traffic management measures including prohibition of on street parking in identified stretches, regulatory measures for controlling mixed traffic, traffic management plan for specific areas, and rationalization of bus routes and bus stop locations etc shall be tried under a proper evaluation and monitoring system.

- The potential of water bodies and canals in the planning area shall be fully utilised for transportation of goods and people, both passengers and tourists.

- Establish effective linkages among various planning divisions

- Provide restricted direct access on main arterial roads through service roads

- Strengthen and maintain the grid iron pattern network of roads within the City

- Develop sub urban rail network utilising the existing rail network also extending the coverage to unserved areas in the City Region.

3.4.5.7 Transportation Proposals

The proposal for traffic and transportation in Kochi City Region is prepared based on the Report on Traffic and Transportation System Study for Kochi City, 2006 by NATPAC and are modified to commensurate with the strategies identified in this Plan, for development of traffic and transportation in Kochi City Region.

Ever growing demand for transportation in Kochi City cannot be met with the existing infrastructure facilities alone. There has to be greater emphasis laid on developing additional transport infrastructure facilities and phasing of the improvement schemes to suit the budget. This highlights the need for preparation of short term, medium range and long-term improvement strategy.

3.4.5.7.1 Short-Term Improvement Schemes

The short-term measures are those schemes that could be implemented in the immediate future with reasonable budget allocations to bring immediate relief at certain areas. The guiding principles involved in the preparation of short-term improvement schemes are :.

i. No major land acquisition is envisaged.
ii. Budget could be made available within the normal allocation process.
iii. Recommendation would fit in with the overall transportation schemes and would not cause problems later on.

Short Term Improvement Schemes proposed for Kochi City includes the following

- Fuller utilization of the existing facilities through the application of Transportation System Management (TSM) techniques
- Improvement schemes for important road intersections, accident prone locations, congested commercial roads in the city
- Traffic management/ operation plan for specific congested commercial areas.
- Bus routing plan, and rationalizing bus stop locations
- Regulatory measures for controlling mixed-traffic
- Restrictions of heavy goods vehicles on narrow roads and for certain time of the day
- Restricting turning movements at problematic junctions,
- Installation of traffic control devices, signs, road markings etc
- One-way regulation for narrow roads
- Preparation of scientific improvement plans for control of parking, loading/unloading operations
- Signalization plan for selected intersections

- Construction of bus bays, foot paths and junction improvements

  - It is proposed to improve/develop foot paths in the city. Grade separated pedestrian crossings are proposed at following locations:
    1. Kacheripady
    2. Town Hall
    3. Menaka Jn
    4. Kaloor jn
    5. Edapally jn
    6. Vyttila jn
    7. Pallimukku

  - The main junctions identified for improvement in Kochi City Region are given in Annexure B

3.4.5.7.2 Medium and long term Transport Development Plan

While formulating the transport development plan for Kochi City, the committed transport infrastructure projects being implemented within the city and its environs were taken into account. Also, various development schemes which are in the planning stage of various implementing agencies were given due consideration.

The aspects considered in the medium and long term measures are:-

1. Road network development scheme
2. Mass Transportation system including Bus system, ring rail system, Inland Water Transport (IWT) and Metro rail
3. Integration of different modes of transport
4. Proposals for Truck terminals
5. Development of grade separated facilities
6. Development of parking infrastructure
7. Development of pedestrian facilities

3.4.5.7.2.1 Road network development scheme

The road network development scheme include proposals for development of transit oriented development corridor, strengthening of regional roads, major roads and other important roads.

(1) Promoting transit oriented development Corridor

The existing stretch linking Angamaly – Nedumbassery – Aluva – Kalamassery - Kochi - Tripunithura – Mulamthuruthy- Piravom is to be promoted as transit oriented development corridor. As part of this, intense development shall be permitted in the Angamaly – Thrippunithura – Piravom corridor.

NH 47 (along with NH By pass) from Kalamassery to Maradu (meeting at proposed NH49 bypass), will form part of this development corridor.

Transit stations permitting high density development around, are to be identified along this corridor.

(2) Strengthening of regional roads

- The existing regional roads identified in the Kochi City Region are:
  (i) Kochi- Munambam Road (through Vypeen Islands)
  (ii) NH 17- from Edappally to Kodungallur
  (iii) Kochi - Aluva (NH 47)
  (iv) Kochi - Perumbavur road (through Thrikkakara),
  (v) Kochi - Moovattupuzha road (NH 49 through Thiruvankulam),
  (vi) Kochi – Vaikom through Udayamperur
  (vii) Kochi –Alappuzha (Old N.H) through EdaKochi
  (viii) Kochi-Chellanam – Alappuzha through the coast
  (ix) NH 49 A

- All these regional roads other than the National Highways were proposed to be developed as 27 m wide road in the Structure Plan for Central City, Kochi. As it is not possible to widen the existing Kochi-Munambam Road (through Vypeen Islands), a new regional road parallel to the existing road from Kalamukku Jn in Elamkunnappuzha Panchayat, with 22 m width is proposed. This road will join NH 17 near Munambam.

- The Kochi- Munambam Road (through Vypeen Island) and the Coastal road through Kochi - Chellanam - Alappuzha are proposed to be developed as 15m wide road.

- Kochi - Perumbavur road (through Thrikkakara), Kochi - Moovattupuzha road (NH 49 through Thiruvankulam), Kochi – Vaikom through Udayamperur, Kochi – Alappuzha (Old N.H) through EdaKochi and NH 49 A are proposed to be developed to 27 m width

- New bypass to existing NH 49, from Kundannur to Puthenkurisu via Chottanikkara is proposed for development. The mass transport corridor (transit oriented development corridor) from Kalamassery will join the proposed NH 49 bypass.

- Thripunithrua- Karimugal road is proposed to be developed to 27 m width only upto the Smart City Road in the first phase and could be developed further after the development of the transit oriented development corridor proposed from Kodungallur-Piravom via Kolencherry

(3) Major roads

- The existing road from Vallarpadam to NH 47 via Kadamakkudy and Eloor (Container Terminal road) is proposed to be developed as 45 m wide road. This road , is proposed for exclusive movement of containers from Vallarpadam towards northern side. A link road is proposed from this Container terminal road to connect it with with NH 47 at a point beyond Angamaly, so as to reduce congestion in the Kochi City Region. The alignment of this new link road is to be fixed after detailed studies. Container movement towards southern side is not expected to enter into the Kochi City Region. It is proposed to utilize Inland Water Ways for container transport towards southern side.

- New link road with 22 m width, connecting the 22 m wide proposed road (parallel to Kochi – Munambam road, from Elamkunnappuzha) and the Container Terminal road is proposed.

- A 27 m wide road linking Old NH at Edakochi and NH 47 at Madavana Jn (Kumbalam) is proposed to increase the connectivity from Fort Kochi, Mattanchery, Chellanam and Kumbalangi area to the new transit oriented development corridor.

- A new road (Smart City Road) connecting major potential job centres in the urbanizing peripheral areas in eastern side of Kochi City region viz. Kalamassery, Thrikkakara and Vadavukode Puthenkurisu is proposed . This road, from HMT road at Kalamassery to NH 49 at Puthenkurisu, is proposed to be developed as 27 m wide road.

- The existing Sea Port Air Port road is proposed to be widened as 45 m road and is proposed to be extended from Irumbanam Junction (at Thiruvankulam) and connected to the proposed NH 49 bypass.

- A 22 m wide link road connecting NH 47 Bypass and the Smart City road is proposed as extension from Thammanam –Pulleppady road.

- A 22 link road connecting NH 47 bypass (at Madavana Jn, Maradu) and Kaloor – Kadavanthra Road is proposed

- Another 22 m link road is proposed connecting Kochi- Chellanam –Alappuzha Road and Kumbalangi Road

(4) Other important roads

- Other roads of 18 m, 15m and 12 m, within the planning divisions and connecting various planning divisions are proposed.

- The proposals for road improvement is shown in Map No 3.4.5.1 and details are given in in Annexure C

Map 3.4.5.1

3.4.5.7.2.2 Development of Mass Transport System

Mass transport systems in urban areas play an important role in the movement of people and goods because of their comparative low cost of transportation. The absence of adequate mass transport system within the city has contributed to the substantial increase in the number of IPT modes and personalized modes.

In Kochi, the predominant mass transport modes used for intra-city passenger transport were city buses, boats, mini buses and vans. These modes were operated on fixed route basis. The city bus services were operated in 168 urban routes and 31 rural routes. Boats were operated in eight routes and they were mainly used as ferry services to link the adjoining islands with the main land. Modes like mini-buses and vans were operated on flexible routes depending on the passenger demand. The MG road, Shanmugham road, Bannerji road and SA road are the major travel corridors with heavy movement of passengers using public, IPT and private modes of transport. In these corridors, there are passenger movements in excess of one lakh during the 12-hour period between 8 AM and 8 PM. Mass transport modes in these corridors carried more than 70 per cent of the total passenger movements.

The roads in Cochin City are not adequate enough to cater to the future demand of vehicular traffic arising out of commercial development. The increased vehicular traffic would pose a severe ecological problem for not only the city but also the surrounding regions due to its emission of pollutants and noise. This calls for providing adequate mass transport system minimizing the need for personalized vehicles.

After considering various travel and physical factors prevailing in Kochi City and the feature of various transport options available for selection, a combination of different systems has been recommended for implementation in Kochi City Region for various horizon years. The mass transport system proposed for Kochi City comprises of bus transport system, sub-urban rail system, inland water transport system, MRTs/ metro rail system and short distance mini bus system for narrow roads and residential areas.

(1) Bus Transport System

It is proposed to develop a bus transport system to serve Kochi City Region by complementing and supplementing the other three mass transportation systems identified. The planning of the bus transport system involved the assessment of travel demand along various travel corridors for different horizon years, rationalization of bus routes, development of terminals and working out an operation plan for the bus transport system. In the initial years, priority needs to be given to the optimization of bus line network, the construction of transit terminals and the rapid development of high capacity public passenger transportation. The terminals located at various places in Kochi along with terminals identified at new locations need to be constructed or renovated so as to form a rationally located, easily accessible and efficient public passenger service network.

The development of bus transport system of Kochi City Region includes the following:

- Development and optimization of the bus and mini bus service network and integration with other modes of public transport including sub-urban rail, metro rail and inland water transport. Expansion of the service areas to form an efficient passenger transport network by rationally grading and structuring the various categories of roads proposed
- Development of dedicated bus ways on selected corridors
- Construction of bus interchange terminals and improvement of service facilities.
- Introduction of GPS, wireless communication systems and lower chassis vehicles to upgrade the operation level and the application of science and technology
- Promoting the application of clean energy in public transit vehicles with the buses using clean energy
- Improvement in the public transport information service system to meet the demand of high quality communications and information search
- Introduction of electronic ticketing with unified ticketing system for all public transport modes

a. Proposed routes

- The high demand corridors for urban mass transport travel are identified (NATPAC, 2006) as follows:

(i) Kaloor-Palarivattam section (369,331 passengers/day)
(ii) Kaloor-Madhava Pharmacy (332,893)
(iii) High Court-BTH (300,319)
(iv) Madhava Pharmacy-High Court (278,262)
(v) Jos-Pallimukku (277,713)
(vi) Valanjambalam-Vyttila(248,764)

(vii) Palarivattam-Kaloor (368,430)
(viii) Pallimukku-Thevara (246,560)
(ix) Edappally-Palarivattam (196,858)
(x) Madhava Pharmacy-Jose (170,660)
(xi) Edappally-Edappally bridge (169,773)
(xii) South-Valanjambalam (158,704)
(xiii) Vyttila-Petta (158,083)
(xiv) Palarivattam-Palarivattam bypass (152,316)
(xv) Thevara-Thoppumpady (150,733)
(xvi) Hospital-Maharaja (121,845)
(xvii) Palarivattam-Kakkanadu (128,389)
(xviii) Paramara road (104,451)
(xix) Palarivattam-Vyttila (94,266)
(xx) Kacheripady-South (88,416)

While formulating the revised bus routes, these corridors are to be given high priority.

- In addition, each planning division is proposed to have access to the mass transportation corridor. As the bus transport plays a vital and irreplaceable role in the ongoing functioning of the transport system in the city and the bus network improvements provide significant, economic and social benefits to a wide range of community interests, especially the urban poor, the roads proposed to be developed in each planning division shall be identified as mass transport routes.

- To facilitate easy transfer, terminals have been proposed at appropriate locations.

b. Bus terminals and bus stops

Terminals are important elements of the bus system. They provide the interface between the system and the users, as well as non-users. They are critical, to enable easy and efficient transfer within the system amongst different routes in the proposed route network system. They are also important physical elements in the urban scape of the city affecting the visual image of the city. They need to be conveniently located, sensitively designed and efficiently managed.

The major and mini bus terminal facilities proposed for Kochi City Region are as follows:

(i) Major Bus Terminals: Vyttila (Major Terminal), Existing KSRTC Bus Terminal, Thripunithura, Kakkanad, Vypeen, Kalamassery

(ii) Mini Bus Terminals : Fort Kochi, Mattancherry, Kumbalanghy, Wellington Island, Edakochi , Chellanam, Eloor , Thevara Ferry, Perumpadappu, Konthuruthy, Chilavannur, Petta, Puthukkalavattam, Corporation Jetty, Edappally, Kaloor Maradu , Eastern Side of South Railway Station, Palluruthy, Njarakkal, Panumpukad , Mulavukad , Cheranallur, Chennur, Kothad, Varapuzha

A self-financing and revenue generating model for bus terminals and stops through a combination of commercial floor space and advertisement rights is proposed for Kochi City. Accordingly, private operators will be allowed to operate both terminals and bus stops with revenue accruing to them from commercial floor space and advertisement rights. The terminals and bus stops will have all the passenger amenities and adequate information system regarding bus arrival and departure timings etc. Some of these terminals need to be developed as multi-modal terminals for proper integration with metro-rail , sub urban and IWT.

Bus stops are important to facilitate easy, convenient and safe access to the service. They must be within the walking distance of majority of the passengers. On an average the bus stops may be located at a spacing of 500-600 meters. The bus shelters need to be designed scientifically so that they add to the aesthetic quality of the streetscape.

c. Operation plan for bus transport system

For an efficient and effective public transport system, it is essential that sound management plan for operation of bus transport system is prepared and implemented. It should attract more passengers into the system so that dependence on the personalized modes of transport are minimized. For Kochi City , the following operation plan are proposed.

(i) Formation of a single authority to run city services in public-private partnership.

(ii) Development of bus terminals and bus stops with passenger amenities and passenger information system

(iii) Coordination of various modes of public transport like bus transport, metro rail, sub-urban rail and IWT

d. Mini buses

53 % of roads in Kochi City are having right of way less than 5 m. It is proposed that short distance mini bus service shall be introduced in narrow congested lanes and in residential areas.

(2) Ring rail system

Two major railway lines (Thiruvananthapuram – Thrissur railway line via Kottayam and Ernakulam to Thiruvannathapuram via Alappuzha) connects Kochi to other major urban centres of the State. The Thiruvananthapuram - Alappuzha - Ernakulam railway line enters Ernakulam South Railway Station via Nettur and Thiruvananthapuram – Kottayam- Thrissur railwayline enters Ernakulam North Railway Station via Thrippunithura. The rail traffic, directed to these two stations located in the city centre and then outwards again, cause unnecessary congestion.

It is proposed to divert long distance rail traffic from the city centre. For this, a new line is proposed to connect the existing Ernakulam – Alappuzha line (at Nettur) and Ernakulam-Kottayam line (at Thrippunithura) along proposed NH 49 bypass. From Thrippunithura, a new line is proposed to be connected to Kalamassery via Thikkakara. All long distance trains will be diverted through his proposed line.

A major railway station is proposed to be constructed at Eroor road (near the extension of Thammanam –Pulleppady road to Smart City road.

A ring rail service is proposed to be introduced in the existing railway line for intra-city traffic connecting South railway station, Thrippunithura, Kalamassery, High Court junction and North railway station.

Tentative alignment of the proposed railway line and the tentative location of new railway station is shown in Map no 3.4.5.2. The alignment has to be finalized after separate feasibility studies.

Map 3.4.5.2

(3) Inland Water Transport System

At present, a limited service of water transport network catering for travel from island communities to the main land as well as travel between island communities surrounding the back water exists. There are certain regions where IWT can be used as a complementary mode of transport in meeting the travel demand of passengers and goods. To sustain the growth of national economy and for the development of a region, IWT can play a vital role by its low operational cost by connecting the undeveloped and under developed areas in a region to the city center. Water transport does not hamper other modes of transport by causing congestion and traffic jams. Waterways are generally able to take much more load compared to road transport. IWT has very low accident rate and does not damage the environment. It causes no air pollution or noise pollution worthy of mention. River pollution is of low order due to water transport. Also inland waterways could be considered as a source of employment, directly and through dockyards and other auxiliary units.

It is estimated that capital cost of developing inland waterways is about 5-10% of the cost of developing an equivalent 4-lane expressway or railway. There is also the potential for lower maintenance costs. Comparative studies of capital and maintenance costs of IWT vis-à-vis road and rail have estimated that maintenance costs are potentially of the order of 20% of that of road. The same studies show that IWT also has the potential to be very fuel-efficient. It is estimated that one liter of fuel can move 24 ton-km of freight by road, 85 ton-km by rail and 105 ton-km by inland water transport.

The container movement from Vallarpadam to the South is expected to be carried out through Water Ways.

(a) Proposed Inland water transport (IWT) network and Terminal facilities

1. National Water way III and its branches to Udyogamandal and Ambalamugal - with terminals at Edakochi, Thoppumpady, Mattanchery, Fort kochi, Vypeen, Ochanthuruthu, Karthedam and Pookkad

2. Kumbalam – Vaduthala via T.P canal with terminals at Kumbalam, Thevara ferry,

Thevara , KSRTC, Kaloor , Pottakkuzhy and Perandur

3. Chathamma – Varapuzha via Edappally thodu with terminals at Chathamma, Valanthakad , Thekkumbhagom , Champakkara , Vyttila , Arakkakadavu , Edappally , Manjummel , Varapuzha

4. Poothotta – Arkkakadavu via Thiruvankulam

5. Edakochi – Poothotta via Panangad with terminals at Edakochi , Kumbalam , Panangad , Chattumma and Poothotta

6. Thevara – Cheppanam via Kumbalam

7. Ernakulam – Varappuzha via Moolampilly with terminals at Thevara ferry, Mattammel, Corporation, Bolgatty, Ponnarimangalam , Mulavukad , Kurunkotta , Pizhala , Chennur , Varapuzha

8. Ernakulam – Nedumbassery via Aluva

(b) **Constraints in the promotion of IWT**

Despite cost advantages of capital, maintenance and operation over other modes of transport like road and rail, IWT plays only a very marginal role in the transport sector of Kochi City. Goods traffic movements are mainly handled from Murukkupadom jetty and Thevara jetty. They constituted only a negligible portion of the total goods traffic. In the case of passenger transport, the percentage share of IWT was only two percent compared to the total passenger movements in Kochi region during 2005.

The first reason for the low utilization of IWT is the poor condition of the infrastructure. Most of the waterways suffer from navigational hazards like shallow waters, narrow width of channels during dry season, siltation, bank erosion, and inadequate navigational aids to permit 24-hour a day operations.

Another constraint is the lack of adequate and modern vessels. Most of the available vessels for inland waterway transport in the public and private sectors are of obsolete technology and can operate only at limited speed. These vessels also lack modern facilities like seating comfort and other passenger amenities.

There is also a lack of supporting infrastructure like adequate and properly equipped terminals and warehouses. Well designed Terminal and Storage facilities are very important to make IWT attractive to users.

(c) Development proposals for the navigational canals:

The following developments are proposed for the identified canals in Kochi City

- The canals of the city have varying functions such as navigation, recreation, tourism and carrying the surface run-off during monsoons. The width, draft and side protection works have to be provided according to the standards.

- The environment on the bank side could be enhanced, by providing, landscaping with strips of boulevards/ walkways and parks

- The natural watercourses on one side and sewages on the other, should be treated as separate entities. A Master Plan for drainage system of the region needs to be developed and implemented.
- Environment friendly solid waste management needs to be provided, with capacity to process the entire solid waste generated, along with modernization of the slaughter houses.

- The liquid waste of factories should be released into the canal only after treatment. The interfacing of canals with sea/backwaters on both ends needs to be restored.

- Weeds in stagnant waters are the breeding grounds for mosquitoes. Opening up of the canals to the sea will flush these weeds. It is essential that modern equipments to remove weeds from the canals need to be procured for proper upkeep of the canals in the city.

(4) Mass Rapid Transit System- Metro Rail

Public transport system is an efficient user of space and with reduced level of air and noise pollution. As the population of a city grows, share of public transport, whether road or rail-based, should increase. Experience has shown that, in cities like Kochi where roads do not have adequate width and which cater to mixed traffic conditions comprising slow and fast moving vehicles, road transport can optimally carry 8,000 persons per hour per direction (phpdt). When traffic density increases beyond this level average speed of vehicles comes down, journey time increases, air pollution goes up and commuters are put to increased level of inconvenience. In any case, it is not feasible to operate bus transport beyond 10,000 phpdt in mixed transport scenario, prevailing on Kochi city roads.

Greater Kochi area, with its present population of 1.9 million and employment of 7 lakhs has a travel demand of 14 lakhs passenger trips every day, with 2.4 lakhs trips during

peak hours. With growing population and mega development plans coming up for this port city, the travel demand is expected to grow steeply. With inadequate public transport services, passengers will shift to private modes, which is already evident from the high vehicle ownership trends in the region. This will not only aggravate the congestion on the city roads but will also increase the pollution level.

Peak hour traffic demand on Aluva - Petta Corridor has been assessed as 13,681 phpdt for the year 2011 and this is likely to increase 23,621 phpdt by the year 2025 as reported in the study report "Detailed Project Report Kochi Metro Project – Alwaye - Petta Corridor'. Road-based public transport, therefore, cannot meet this demand. There is an urgent need to introduce a light Metro System in the city to provide fast, safe, economic and environment-friendly mode for mass movement of passengers. Carrying capacity of Light Metro System is up to 25,000 phpdt which will be adequate to take care of the traffic problems for Greater Kochi area for the next about 25 years.

Delhi metro rail corporation has prepared a detailed plan for the development of metro rail corridor between Aluva and Petta (25.253 kms). A total of 24 stations have been proposed by DMRC along the proposed corridor. The alignment of metro rail, as proposed by DMRC, is shown in Map no 3.4.5.2

3.4.5.7.2.3 Development of grade separated facilities

Intersections are the major traffic conflict locations and they need to be properly designed so that traffic conflicts are minimized and traffic movements are smoothened. In order to achieve the same, it is proposed that all conflict points in the proposed road network are properly designed as per the typical design for intersections. However, at certain points, at grade treatment of intersections may not be functionally efficient in view of the high volume of traffic passing through the intersections. At such locations, it is proposed to have grade separated intersection facilities. As part of the proposed road network development plan, various grade-separated infrastructure facilities are proposed. They include flyovers for high-traffic intersections, rail over bridges and bridges across water bodies.

(a) Flyovers/underpass

The location of Flyovers proposed is as follows:

Sl No	Location
1	Atlantis junction on MG road
2	Ravipuram junction on MG road
3	Pallimukku junction on MG road
4	Kundannur junction on NH by pass
5	Chakkaraparambu on NH by pass
6	Palarivattom junction on NH by pass

7	SN junction at Thripunithura
8	Fly over at NH 47 (Thammanam – Pulleppady road extension to sea port – air port road)
9	On NH by- pass from Aroor to Edappally
10	On MG road from Manorama jn. to foreshore road

The location of Under pass/ Sub way proposed is as follows:

Sl.	Location
1	Kaloor junction on Banerji road
2	Vyttila junction on NH by pass
3	Edappally junction on NH by pass
4	NH – 47 at Kochi university
5	Sub way at Menaka with connection to Broad way
6	Sea port – Air port road near collectorate

(b) Rail over bridges

Thiruvananthapuram-Thrissur railway line and Ernakulam-Alappuzha railway line pass through the center of Kochi city. These railway lines will intersect the proposed north-south and east-west linkages at many locations. These level crossings could pose major traffic hurdle for free flow of traffic, due to the frequent closure of railway gates. To avoid such occurring, the following rail overbridges are proposed at the identified locations.

Sl No	Location
1	Atlantis along Kizhuvana road
2	KSRTC station along Salim Rajan road
3	Pulleppady along Pulleppady road (under construction)
4	Pachalam along Chittoor road
5	Vaduthala along Chittoor road
6	Amritha hospital along Ponekkara road
7	Edappally along NH – 17 (under construction)
8	Ponnurunni along Vyttila – Thammanam road
9	Eroor road – Thripunithura Municipality
10	Kampivelikkakam – Thiruvankulam Panchayat
11	Sea port – Air port road (2 Nos.) – NAD lane & Thiruvankulam
12	Kathrikadavu 2nd bridge
13	Ponekkara
14	Methanam – Kalamassery Municipality

15	South Over Bridge renovation
16	North Over Bridge reconstruction
17	Vathuruthy

Also, the existing rail over bridges needs to be widened to six-lane/ four-lanes depending on the hierarchy of the road on which these ROBs are located.

(c) Bridges

The existing bridges linking the main land and adjoining islands are over saturated with traffic flows beyond the capacity. Apart from widening those bridges which form part of the proposed road development plan, new bridge need to be constructed. The details are as follows:

1	SB Road, Chettichira (Match point), 2 Nos
2	Pandarachira Bridge (Valummel)
3	Giri Nagar Panampally Nagar Bridge
4	Culverts and Bridges for existing crossings of rail across railway line from Thevara to Edappaly (13 Nos)
5	Kurungotta bridge, Cheranellor Panchayat
6	Santhom convent road bridge
7	B.T.S road bridge across Chengadampokku thodu
8	Vaduthala Perandoor Bridge near Chinmaya school
9	Peeliyadu Bridge across Chengadampokku thodu
10	Pashnithodu bridge
11	Thevara Mattummel bridge
12	Thevara Kumbalam bridge
13	Ponekkara bridge
14	Chambakkadavu Kalamassery municlipality
15	SA Road 2 Nos, Puthiya palam, TP Canal
16	Gosree Mamangalam road, 2 Nos
17	Pulleppady thammanam Road, 2 Nos
18	Bund Road, 2 Nos
19	Vyttila to SN Jn, 2 Nos Chambakkara and Petta
20	Chellanam road, 2 Nos
21	Kumaranasan road
22	4 bridges for Kothad Chathanad new road
23	Puthussery to Vaduthala Chathanad road (new) , 2 bridges
24	NH 47 to Sea Port road (extension of Thammanam Pulleppady road)

25	Panampally nagar extension to NH 49, 2 Nos
26	Ernakulam Vypeen, Bolgatty Bridge
27	Irimpanam Kalamassery extension
28	Model road, Mullassery canal
29	Poisha road, Amrutha hospital
30	Deshabhimani road, near circle Manor, BTS road, 2 Nos
31	Vypeen, Munambam road, 4 Nos
32	Pandykkudy Chellanam road, 2 Nos
33	Chalikkavattom road, Punchathidu
34	Extension to Kaniyampuzha road
35	Kunnumpuram Kalamassery road
36	Pukkattupady road, 2 Nos
37	Arakkadavu road, 3 Nos
38	Thripunithura Chottanikkara road
39	Kumbalanghi Aroor road
40	Palarivattom Kakkanad road, Edapally Thodu
41	Mattancherry road
42	TD road, Mullassery canal
43	Market road, 2 Nos
44	Palluruthy thoppumpady road
45	Santogopalan road
46	Nettoor Kadavanthra bridge
47	Kundanoor Chilavanoor bridge
48	Vallarpadam-Vypeen bridge, Parallel to existing bridge
49	Manthra canal road
50	Kothad Kadamakkudy 2 bridges
51	Stadium link road
52	Link road, Chitrapuzha, 3 Nos
53	Eloor-Chowka ferry, connecting Cheranalloor and Eloor Panchayats
54	Kannangattu W. Island (NH 49)
55	Eloor Manjummal bridge

3.4.5.7.2.4 Development of parking infrastructure

Increased urbanization and growth in number of personalized vehicles have resulted in phenomenal increase in demand for parking of vehicles. Parking of motor vehicles on the roadside reduces capacity of roads and cause accidents also. While restrictive measures

like high parking fee, no-parking area could be attempted in the short run, the long-term policy should aim at providing off-street parking complexes based on assessment of demand-supply situation in the long run. Wherever the existing parking demand could not be effectively met within the existing supply, construction of exclusive off-street parking complexes should be given the necessary priority. Parking development scheme like off-street surface parking, multi-storied parking and mechanical and automated car parking are to be considered.

- Off-street surface parking facilities could be developed at the identified locations in the first phase and few of these lots could be subsequently developed as multistoried parking cum commercial complexes on vacant land near office or shopping complexes

- As an alternative to surface and multi-storied car parking facilities, automated car parking system is proposed. In this system of car parking, cars are lifted to the parking lots by means of a lift and from the parking stall by means of wheeling or mechanically operated transfer dollies or cradles

- Apart from development of on-street and off-street parking, parking supply could be increased through the sharing of parking facilities available at the off-street locations of both public and private buildings. This would help in productive use of available parking capacity, which are under utilized and would help in mitigating parking related problems.

- A suitable parking policy framework need to be evolved to make the system workable yielding tangible results.

- Development incentives like FAR bonuses, height bonuses etc could be made available for private development of public parking supply

- Efforts need to be initiated to work with owners of private lots to enter into shared use agreements to allow underutilized parking lots to be made available to customer/visitor or employee uses. Suitable incentives could be provided to encourage such agreements in the form of proper signage, landscaping, lighting, sidewalk improvements, leasing, etc.

- Land shall be identified for development of off-street parking facilities in peripheral areas of Kochi Corporation. Strategically locating future parking sites allows the City to use such sites as (a) interim surface parking locations, until desired development would transition the sites to commercial or retail, (b) future parking structure

locations, or (c) “satellite” facilities that would be linked by shuttle and/or circulator systems in the future.

- Tentative locations for provision of parking facilities are given in Annexure D

3.4.5.7.2.5 Development of pedestrian facilities

Walking is such a basic human activity that it has frequently been overlooked in the quest to build sophisticated transportation systems. As a result, accidents involving pedestrians are a regular phenomenon in most of the urban areas. Improving the pedestrian environment on a street-by-street, neighborhood-by-neighborhood basis should be undertaken on priority basis.

A complete program of pedestrian safety improvements include:

- Provision of pedestrian facilities, such as sidewalks and crosswalks.
- Roadway and engineering measures, such as traffic control devices, lighting, and roadway design strategies implemented on streets and highways for both pedestrian and vehicular movements.
- Programs to enforce existing traffic laws and ordinances for motorists (e.g., obeying speed limits, yielding to pedestrians at zebra crossings, traffic signal compliance and pedestrians (e.g., crossing the street at legal crossings, obeying traffic and pedestrian signals).

The pedestrian facilities that need to be considered are:

(i) **Sidewalks or walkways:** These are “pedestrian lanes” that provide people with space to travel within the public right-of-way, that is separated from roadway vehicles. Walkways should be part of every new and renovated facility and every effort should be made to retrofit streets that currently do not have sidewalks. Sidewalks should be continuous along both sides of a street and sidewalks should be fully accessible to all pedestrians, including those in wheelchairs. Guard rails need to be provided to segregate the moving vehicle and pedestrians and also to discourage the encroachments by street vendor.

(ii) **Marked crosswalks and enhancements:** These indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians. Cross walk markings are proposed at all the arms of intersections and at major high pedestrian volume locations like educational institutions, hospitals and commercial centres.

(iii) **Pedestrian Overpasses/Underpasses:** These allow for the uninterrupted flow of pedestrian movement, separated from the vehicle traffic. Pedestrian underpass/overpasses are proposed at selected locations in Kochi City which have high concentration of commercial establishments and pedestrian volume.

(iv) **Road side appurtenances:** These help in capacity augmentation of road network by facilitating orderly and smooth flow of traffic, minimizing accident occurrence and imparting road user information. Proper road way marking such as pedestrian crossing, traffic lane marking, bus bay marking, stop lines, parking area marking, centre line marking etc will promote road safety and bring about smooth and harmonious flow of traffic along guided paths of travel.

3.4.5.7.2.6 Truck Terminals

The restructuring of highway freight industry in India is being accelerated to optimize the vehicle composition and payload structure, and improve freight yards and logistics infrastructure. On similar lanes, priority needs to be given to the development of urban logistics distribution, container transportation and multi-mode combined transportation, upgrading Kochi's freight transport industry to the standards of a modern international metropolis with advanced facilities, professional management, well regulated markets and smooth flow of freight. The highway transport information platform will take shape for the intelligent and IT application in the dispatch of passenger and freight transport. The highway freight industry will realize its modernization in vehicle equipment, transport organization, yard facilities, information exchange and social service, and meet the freight transport and logistics service demands of the horizon years.

Proposed truck terminals

Truck terminals are being planned in various cities in the country with the prime objective of reducing the problem caused by heavy vehicle traffic during peak hours. Truck terminals have become a reality in many of the cities like Visakhapatnam, Kolkatta, Mumbai, Pondicherry etc.

It is proposed to have freight terminals in Kochi city which would provide integrated facilitates of highway transport functions, such as, truck parking facility, transit and transshipment facilities for goods & trucks, communication & networking, amenities and facilities to crew, transport agency offices, vehicles repairs and maintenance and related activities etc., it should also act as logistics center for goods warehousing, inter-modal transport, container transport and freight forwarding services etc.

Considering the intensity of goods vehicles on entry/exit points of Kochi City, the following locations are proposed for truck terminals.

(1) Kalamasserry
(2) Thiruvankulam
(3) Kumbalam
(4) Cheranallur
(5) Eloor
(6) Vallarpadam

The terminals will have facilities like offices and godowns of transport companies, easy loading and unloading facilities, weigh bridge, large parking areas for idle trucks and other related facilities like banks, restaurants, dormitories for essential staff, dispensaries, motor spare part shops, petrol / HSD pumps, repair garages, workshops, etc.

Apart from the above first class terminals, it is also proposed to have a parking lot for trucks and min-truck at Marine Drive to cater to the goods vehicles using the markets in the locality.

The truck terminals can be developed either in the private sector or in the public-private joint sector and governed by relevant laws to be enacted by the Government in this regard.

With the development of terminals, entry of trucks along major roads in the city during day time can be restricted which would result in reduction of traffic congestion.

3.4.5.8 Integration of Different Modes of Transportation

Integration of different modes of transportation system / System integration in Kochi is required for improving public transit services in urban areas. It is essentially a management technique applied to a group of functions that are currently being administered independently, but are, in fact, highly interdependent and could be managed more effectively by being treated as interrelated parts of a single system.

The objectives of this transit integration process are to:

- Operate all the diverse publicly and privately owned services as through they were parts of a single, area wide transit system.
- Eliminate wasteful duplications and extend the availability of service.
- Benefit from combined planning, purchasing, and marketing efforts and joint use of facilities.
- Enable the transit user to travel anywhere in the community on a single fare, transferring efficiently and comfortably between different modes and services.

The integration of different modes of mass transportation includes Operational integration and Physical integration.

(a) Operational integration

'Unified Transport Management Authority' is proposed for mass transport services which would undertake planning, and coordination of mass transport services eliminating redundant services, proposing uniform fare structure, single ticket, and public information system

(b) Physical integration

For physical integration, inter-modal terminals or "transportation centers" are proposed at points of transfer between modes of transit service. These terminals will provide with facilities for transfer from circulation feeder services, taxis, or private vehicles. Parking accommodations are proposed to be provided in these inter modal transport terminals to encourage park-and-ride travel, loading areas permitting passengers to be dropped off by car, secure bicycle storage to those who use this mode to reach the terminal and protected pedestrian paths for those who live or work close enough to walk. Adequate public information system is to be provided at all bus stops, terminals and in the transit vehicles for helping the commuters.

Inter-modal terminals are proposed at the following locations.

B. Road and IWT
   a. Thevara Ferry
   b. Konthuruthy Ferry
   c. Chilavannur Ferry
   d. Corporation Jetty
   e. High Court Jetty
   f. Thiruvankulam
   g. Thripunithura
   h. Edappally
   i. Varapuzha
   j. Vyttila
   k. Vallarpadom
   l. Road & metro
   m. Edappally
   n. Palarivattom
   o. Stadium
   p. Kaloor
   q. Lissie
   r. Madhava pharmacy
   s. Maharaja's college ground
   t. Ernakulam south
   u. GCDA

v. Fathima church
w. Elamkulam
x. Vyttila
y. Thykoodam
z. Petta

C. Road and Sub Urban Rail
   a. Edappally
   b. Kalamassery
   c. Thripunithura
   d. Maradu
   e. Kizhakkambalam
   f. Chembumukku
   g. Vallarpadom

D. Road, IWT, Rail / Metro
   a. Vyttila
   b. Thripunithura
   c. Edappally
   d. Vallarpadom
   e. Maradu

CHAPTER 4

URBAN ENVIRONMENT OF KOCHI

4.1 Introduction

The urban environment is not comprised of a single component to say that by improving that aspect of the component we may succeed in obtaining a good livable urban environment. Environment is that surrounds one. All living and non living things around us form the environment. Constructed surroundings that provide the setting for human activity ranging from the large scale civic surroundings to the personal spaces form the Built Environment. The surroundings of a physical system that may interest and influence the system may be termed the environmental system. The urban environment is too complex to be defined in simple terms, since a large number of factors constitute an Urban Environment System.

Without entering into the complexities of the term 'urban environment', for the purposes of the Development Plan for Kochi City Region, the following aspects are discussed with the intent that they contribute directly to enhance the quality of urban environment of Kochi to the level of a place which offers higher level of satisfaction for living, visiting and to work, retaining a character and identity of its own.

Urban Environment :

(1) Natural Assets and Conservation
(2) Architectural and Historical Heritage
(3) Quality of Infrastructure
(4) Waste Management, Sanitation and Hygiene
(5) Identity and Character of built forms as part of Urban Design
(6) The recent challenges to environment

4.2 Natural Assets and Conservation

Compared to many other urban areas in Kerala, Kochi city and environs have very unique natural assets which give Kochi its character. The most important of these is the water bodies- rivers, canals and backwaters which cover almost 20 percent of the area of

Kochi City Region. Being at the mouth of Periyar River and Vembanad backwaters, where these two major water bodies unite the sea, the western side of Kochi City Region can be characterized as land masses within large sheets of water. A number of small natural islands exist, some of them accommodating certain economic functions of importance. Vallarpadam Island is developed to accommodate container handling facilities of Cochin Harbour and the Bolghatty Island and the old Palace therein are frequented by the tourists. However it is the artificially formed Wellington Island, which is the largest among the Islands, which accommodates activities of national importance like the Southern Naval Command and the Cochin Harbour activities.

These western water sheets are connected to a large number of Canals which traverse the length and breadth of the city region area. However due to long years of neglect and failure to exploit the existence of the Canals, rivers and backwaters, some of them have suffered misuse and disuse Though many were in use as water transport corridors, non-recognition of the potential of water transport facilities, ended in a few of the Canals being filled up and converted to other uses and a few others being used as waste dumps.

The Development Plan recognizes the importance of this natural assets and stipulates that filling up and conversion of the existing water bodies would be culpable offence. It is recommended that a separate detailed Master Plan for the water bodies be made, wherein detailed conservation policies, area and characteristics, mitigation measures for pollution etc. be addressed and regulations prescribed.

The Development Plan recognizes the importance of water bodies in developing water transport facilities and this aspect is dealt with in the discussion on Traffic and Transportation in the Report.

The Local Self Governments within the Planning Area may issue guidelines for all existing and new developments within 200 meters of any water body-canal, river and backwater-specifying methods of disposal of waste (solid waste, sullage and sewage) restricting any act which directly or in directly cause pollution of the water bodies. This would require concerted efforts from the Local Governments to prepare waste management plans for the immediate areas on either side/surrounding the water bodies. Tailored programmes for regular field verifications for detection of breach of guidelines may be instituted and violations may be charged with punitive actions. Avoidance of pollution and encroachments or misuse of natural water bodies may also require positive actions from the LSGS for translating to projects to be implemented in the immediate surrounding areas of water bodies, avoiding any chance for polluting the water bodies by discharging waste into them.

The second most noticeable feature is the existence of islands. Most of these Islands on the western side are within the area of jurisdiction of Goshree Island

Development Authority(GIDA), who are in the process of preparation of a Separate Master Plan for the GIDA area. In view of this, detailed proposals are not included in this Development Plan. However, it is recommended that definite policies within the guidelines of the Coastal Zone Regulations be evolved for development activities in these islands. .

The third most significant feature is the terrain of the land. Though the Central Areas of Kochi City and the western Island parts are almost flat with high ground water table, the eastern parts of the Kochi City Region have hillocks and valleys, especially in areas under Thrikkakara, Vadavucode-Puthenkurisu and Kalamassery areas. The northern parts-Varapuzha, Cheranallur areas are gaining importance due to priority to the city area and nearness to NH17. However caution needs to be exercised since the land masses are partly marshy and floodable with high ground water table. In addition to enforcing conservation regulations, there also need be regulations to limit the development and building activities so that these be within the carrying capacity of these areas and do not cause to enhance the qualities of the natural environment.

It is noticed that the eastern parts of the Kochi City Region, the hill locks and mounts are cut down and the spoil is removed to the western parts to fill up marshy and low lying areas in the process of conversion for construction purposes. Both these actions of demolishing and moving down the mounts and filling up of low lying areas have negative impact on the environment. The areas where the mounts are moved down face denudation of greenery and lowering of ground water table. Many open well go dry causing serious water issues. The low lying areas and marshy areas were acting as drainage basins during Monsoons. By filling up of these areas, artificial storm water drainage issues are caused and many of the city areas are flooded impeding movement and work. There needs to be stringent regulations to prevent alteration of terrain. Though terrain and slope alterations of minor nature may be allowed to make the developable land suitable for construction activities, it is necessary to discourage terrain alterations of major nature. These actions need to be distinguished and regulated accordingly.

Indiscriminate construction activities result in denudation of greenery and cutting down of existing trees. The city region is gradually losing its greenery and is turning into a concrete landscape. This is not only visually harsh, but also has a deterrent effect on the micro climate. The city is turning warmer. Unlike in the southern and the northern parts of Kerala, there is not much marked difference between the day time and night time temperature in Kochi. The nights remain warm, due to reflected heat from the RCC structure. In addition to this, it is also noticed that people have a tendency of paving the entire open area around their buildings without allowing any water to percolate into the soil and without any natural greenery. The entire rain water and sullage ('grey water') are allowed to flow down into the street drains, perhaps causing pools of water on the roads. This practice also needs to be regulated. At least 50% of the vacant open spaces around a building needs to be left unpaved and shall be planted. This would not only allow percolation of water into the soil, but would also reduce reflected heat.

4.3 Architectural and Historical Heritage

Though there is no separate legislation on Conservation of Urban Heritage, Kerala Municipality Building Rules, 1999 do have indicative provisions on Conservation. It is necessary for a city to identify structures and precincts (areas) having historic, architectural and heritage value and notify them. Simultaneously, the City Government or any agency on their behalf has to prepare development regulations for such structures/precincts. Statutory legal support for such notification and development regulations need to come through suitable Heritage Conservation Laws.

The Development Plan makes a case for the whole of Fort Kochi and Mattancherry area to be declared as a conservation area. Specific conservation regulations may be made for this area, which has to be statutorily adopted. The heritage value of this area due to the historic fabric, needs to be conserved allowing room for strengthening the structures, renovation and rebuilding. The entire area has to be made pedestrian oriented, with vehicular traffic limited to identified streets.

4.4 Quality of Infrastructure

Perhaps the first noticeable factor that gives an impression on the Urban Environment is the quality of urban infrastructure. Service levels of water supply, existence of good roads and transportation facilities, cleanliness and hygiene etc. contribute to a good urban environment, which attracts one to opt for that city to reside , to work and to visit. How the city manages its waste is very important in creating a good environment. Heaps of garbage on the road margins and on vacant land parcels, garbage being dumped on the water bodies and on street drains, absence of sanitary disposal of sewage, open defecation and other unhygienic practices make a city very unacceptable to live and to work. People generally hesitate even to visit such a city, which is a health hazard. Waste management is dealt with in this chapter separately.

It is necessary for Kochi City Region (for all the constituent local Government units within Kochi City region) to go in for Service Level Benchmarking (SLB) of all the components of infrastructure. SLB will be an indicator of service levels- existing in comparison to acceptable/ desirable standards- of each of the infrastructure components. Based on this study, it is possible to prepare Performance Improvement Plan (PIP) for all the components. PIP can be discussed for prioritization and phasing. PIP can give rise to specific project proposals for implementation so as to improve the quality of infrastructure in a phased manner.

Improvement in the quality of infrastructure has two distinct components:

(i) Maximising the benefits from the existing infrastructure-through scientific 'asset maintenance and management measures, and

(ii) Improving/augmenting/upgrading the infrastructure in quality and quantity through capacity improvement projects, leading to increased coverage, increased service levels by increasing the supply to match the demand and upgraded quality. These plans have to opt for improved technological options, improved management etc.

Though project oriented augmentation of service levels through capital intensive projects is often discussed, funded and implemented, the 'asset management' (facility management) aspect is not given due importance. Examples from many of the infrastructure components could be cited to elucidate this aspect. One component of infrastructure that is often been discussed in the context of Kochi is the traffic congestion and roads. There can be no doubt in the need to widen and improve the roads considering the increasing traffic volume. However, it is also apparent that the existing road infrastructure is not adequately utilized:

(i) The existing ROW (right of way) of the roads are not fully utilized, undesignated spaces are available on the side of carriageway where street hawkers occupy, garbage is dumped, street light poles and other posts are erected in a haphazard manner obstructing pedestrian movement and political parties and trade unions erect flag marts and commemoration structures.

(ii) All the existing roads do not have side drains. Since Kochi city has a flat terrain, storm water does not drain off fast or percolate into the earth due to existence of high ground water table. As a result of this, large pools of water are seen collected on the roads at many places in the city. This not only reduces the usability of roads, but also damages road surfacing. Rains or no rains, Kochi roads always have bad riding surface- withered away and cracked surface, pot holes and bottle necks when part of the carriageway cannot be used for traffic movement.

(iii) Roads do not have lane markings- this results in the entire carriage way being used for mixed traffic (buses, trucks, small goods vehicle, cars, three wheelers, two wheelers and pedestrians). Road discipline results from lane discipline. Road markings are significantly absent.

(iv) Pedestrian facilities are generally absent. Even when side footpaths are provided for a few road stretches, pedestrian movements are not directed towards the footpaths. Road crossing facilities are absent, except at a few locations on the major roads where "Zebra Lines' are provided for pedestrian crossing.

(v) Kochi is one city in Kerala which can boast of street names prominently displayed on almost all the roads. But the P.W.D. roads do not have that satisfying coverage. In the case of other road furniture, Kochi is as bad as any other city or town in Kerala.

Majority of the road stretches in the city are maintained by the Municipal Corporation of Kochi. But the city Corporation does not maintain an updated 'asset register' for the roads. A computerized 'regular road maintenance plan' and digital road data base is very much essential for the effective functioning of the local bodies.Similar analysis for any other infrastructure component can be attempted to emphasis on the necessity for a well documented and followed up 'Facility Management Plan', for maintaining good quality infrastructure.

4.5 Waste management, Sanitation and Hygiene

Sanitation has become the greatest challenge of the settlements -both rural and urban- of Kerala. In spite of the urban settlements in the State gearing up their efforts towards sanitation improvement, the sanitation situation in the small, medium and large towns and cities still remains a challenge. Health and well being of the urban dwellers and those visiting the urban area, depend on the sanitation condition that exist there. Bad sanitation condition in the city has direct negative impact on the quality of urban environment.

Good sanitation in Kochi may depend on how the city is equipped to provide for and manage the following sub-components of sanitation and waste management:

(i) Arrangements for collection, transportation and disposal/processing of solid wastes
(ii) Coverage of all households with sanitary latrines- sewage collection, conveyance and treatment systems

(iii) Complete eradication of open defecation –increasing coverage of household level sanitary latrines, existence of public toilets in establishments and public toilets at strategic locations in the city where people congregate.
(iv) Arrangements for handling storm water- drain cleaning, drainage/ground recharging/collection and reuse.
(v) Facilities like hygienic abattoirs, crematoria etc. and
(vi) On how the water bodies- rivers, canals, backwaters and ponds are conserved, developed and managed.

Each of the above aspects is important and needs to be discussed in detail. Instead of the usual attempts to plan and implement project proposals for a city wide centralized system for improvement and management, it is often advisable to adopt decentralized

smaller area level coverage and improvement by suitable plans and projects. It would be inadvisable to imagine that the entire solid waste generated in the western side of the city - say Mattancherry and Fort Kochi area would be collected and transported across the city to Brahmapuram on the eastern side Panchayat area, for processing/recycling.

Similarly, a city wide single disposal arrangement for Surface Water Drainage (SWD) is unworkable and not necessary at all, when there are a large number of canals, rivers and back waters spread within the city area. They act as drainage channels and decentralized area level schemes to collect storm water through road drains and small branch canals to discharge into these water bodies (perhaps with a minimum level of sieving and water quality improvement) would make a good area level drainage plan. More than draining off the collected surface water, attempts should be made at sub-regional level water recharge and reuse systems. All these means planned to converge would make a good Drainage Plan for an area. A number of such area level Drainage Plans can together make a good city Drainage Plan. The Development Plan for Kochi City Region emphasises on preparation of a well studied 'Drainage Plan' for the entire Kochi City Region Area. This component is very important as far as Kochi City Region is concerned.

Preparation of City Sanitation Plan (CSP), Service Level Benchmarking(SLB), Information System Improvement Plan(ISIP) and Performance Improvement Plan(PIP), all of which are Government of India sponsored schemes, need to be taken up with serious intentions and religiously followed up for improvements in Service Levels in each of the subcomponents noted above.

4.6 Identity and Character of Built Forms as part of Urban Design

Identity or imageability of a city is a subject seriously studied and discussed by Masters like Kevin Lynch, Christopher Alexander and many others. Every city has an image/images. The identity and character of constituent units of Kochi City Region and the policies to conserve or retain such identity and character is discussed in detail in Chapter 5.
The origin of Kochi was from settlements in Mattancherry area, and later on with British colonization, the Fort Kochi area also developed with colonial architecture and character. Therefore, Kochi brings to mind images of the old city of Mattancherry and Fort Kochi.

The royal seat of power shifted to Kochi, when the trade and harbor activities became dominant and when the British Resident made Kochi his head quarters. With that the main land part of Ernakulam developed with market streets, public and institutional buildings and water font open spaces. These are today reckoned as land marks of Kochi.
The royal palace (known as Hill Palace) was built on a hillock in Thripunithura. Along with that was built the famed 'Poornathrayeesa' temple and smaller palaces / malikas for members of the royal family. All these define the character of Thripunnithura. The images, land marks and heritage structures are discussed further in Chapter 7 from better understanding of the subject.

4.7 Recent challenges to Environment

A few of the Environmental challenges which are discussed in many fora during the recent years are:

- Climate change;
- Disaster Management;
- Green Settlement concept – including energy efficiency in settlement development etc.,

(i) Climate change

This is an issue discussed at Global level, but still has implications at a settlement level, There could be many factors within a major urban settlement like Kochi, which could contribute to climate change. The basic approach of the Development Plan to relate the development actions with the KCR to:

- self sufficient planning units
- reduction in intercity travel needs
- provision of planning division wise open spaces
- augmentation of mass transport facilities and reduction of personal transport vehicles
- measures for maximum utilization of water bodies for transportation of goods and passengers thus reducing pollution
- impetus for development of intercity water transport facilities
- conservation of paddy land and wet land
- Improving pedestrian facilities etc are expected to reduce factors which contribute to climate change

ii) Disaster Management:

Being a harbour city and a major industrial hub, Kochi is vulnerable to disasters. There is potential danger in the movement of oils, gases, explosives, chemicals etc through road. There have been past instances in the state, of large vehicles carrying oils and explosives, capzing and spilling oil etc on the roads and surrounding areas creating fire hazard and water pollution. Traffic along the roads had to be suspended for long hours. Separate container movement corridors to Vallarpadam Container Terminal are proposed. Conveyance of oil products to Tamilnadu has now been effected through underground pipes.

The Development Plan itself proposes a network of wide mass transport corridors, so that such dangers and explosive materials would only be moved along these corridors with less hindrance to local traffic. Moreover 'lay by's are proposed to be developed along such mass transport corridors, so that stopping

of these container trucks shall not obstruct the traffic stream along these corridors.

With the development of intra-city water transport facilities, it is hoped that more and more commodity transport between various locations within the city region may happen through motorised boats, reducing traffic pressure and pollution on the roads.

The whole of Kerala is now zoned under Earthquake Zone-3 and hence Kerala (and Kochi can be considered as earthquake prone area (perhaps of a lower magnitude). Though earthquake cannot be averted, it may be possible to minimize the effects causing damage to life and properties. Buildings and structures within Kochi need to be designed as earthquake-resistant structures. The Development Plan proposes that in every Planning Division and Sub Division, open spaces and community halls may be developed/built, so that these may not only be used as recreational spaces, but also as public congregation areas in case of earthquake.

The City Region shall have an exclusive 'Disaster Management Unit' to address pre-disaster preparedness developments and protocols, post-disaster action programmes and protocols etc. Systematic procedures and actions to be undertaken by the police, fire and rescue services, revenue department, water resources department and others need to be prescribed, communicated and the stakeholders need be trained.

iii) Green Settlement Development

Perhaps the terms 'Green Settlement Development' comprehends all the relevant issues / aspects like waste (solid/liquid) management, urban sanitation, Pollution Control, energy efficiency, greening-open spaces, conservation of water bodies etc.

The Development Plan proposes the waste management issues under infrastructure development aspects. Projects being implemented Kerala Sustainable Urban Development Project (KSUDP) and Jawaharlal Nehru National Urban Renewal Mission (JNNURM) may bring about substantial improvements to the present waste Management scenario. However special mention needs to be made of the components noted below:

(a) **Surface Water Drainage**: A major part of Kochi city area is flat land with only one metre above MSL. About 20% of the area is covered by water. Since the ground water table is high, the storm water does not practically percolate into the soil. Shallow drains cannot drain off the entire surface water into the canals / water bodies. However, the positive factor is that there are many narrow and wide canals

penetrating into the city area. This gives facility for the street drains to drain off into these canals / water bodies. In turn, de-silting, cleaning and conservation of these canals may enable draining off the surface run off. This aspect of Surface Water Drainage (SWD) needs to be studied in detail based on contour maps prepared with 0.50 m interval. It is necessary to prepare a Master Plan for SWD. The Drainage Master Plan shall divide the city area into a number of drainage zones based on 'catchment area' and propose detailed drainage proposals.

(b) **Sewerage**: Kochi city area has very poor coverage of sewerage system. The existing sewerage system covers only 5% of the city area, covering only 2.50 sq. km. in the central city area near the General Hospital and 1.50 sq. km. in Gandhi Nagar area. This poor coverage, forces people to go in for other means of sewage disposal like provision of septic tank. In the absence of better methods for collection and treatment (or even partial treatment) of septic tank effluent water, it is allowed to flow into the street drains or into the canals or water bodies. Such discharge of polluted water into the public open spaces / road side drains / canals / water bodies cause mosquito breeding and vector diseases. It is necessary to study various options noted below and prepare sewerage improvement plans accordingly to cover the entire city region area.

i) Adopting Planning Division wise or Planning Sub Division wise sewerage scheme with community septic tanks, partial treatment facility, for effluent water and 'septage' removal and disposal arrangements.
ii) Adopting decentralized sewerage systems with mini-sewage treatment plants, with one of the modern improved techniques.
iii) Retaining the existing septic tanks with additional facility for effluent water collection and conveyance to many decentralized partial treatment facilities and also providing city level septage removal facility (suction method) to be disposed of for treatment in central sewage treatment facility.

Sewerage coverage can be increased using one or more of the methods noted above or any other appropriate method.

The Development Plan proposes creation of green spaces / parks / recreational facilities at each Planning Division level and within Planning Sub Divisions. This may increase green coverage. Moreover it is proposed that all roads which are proposed to be widened to more than 15 metres in width shall have road side planting. To reduce temperature and to improve the micro-climate more greening within the city area is recommended.

The state has promoted use of LED and CFL based lighting to reduce energy conservation. Many other energy conservation measures are also being advocated. It may also be necessary to tap solar energy for lighting, heating etc. LNG and CNG terminals are

being developed in Kochi, the use of LNG and CNG for very many applications (in addition to using as fuel for vehicles) may reduce the consumption of hydro-electric power that is fully depended on now.

CHAPTER 5

IDENTITY AND CHARACTER AS PART OF URBAN DESIGN

5.1 Concept of Urban Character

Image of the City and theories of urban design have been in practice in Urban Planning from the very early ages. The discussion of the subject of imageability and character in the Development Plan for Kochi City Region is not to put in certain 'regulations', but to seek an identity for the City Region as a whole, without resorting only to 'rules and regulations' which may limit architectural freedom.Kochi is a large city region partly grown historically, partly developed over more than a century and partly developed during the last few decades. Kochi City Region (KCR) is now in a pace of fast development. KCR is comprised of many constituent units/areas of historic, traditional, of recent past and new. Such a city region cannot have a single identity or character. However, Kochi has an identity and character of its own. Detailed studies on this topic are required to find out the identity and character of Kochi and to propose policies to conserve or retain such identity and character.

5.2 Locations / Areas in KCR having distinct Character

A few of the locations within the Kochi City Region which either already have distinct identity or new developments which by the nature of developments proposed in the Master Plan shall have distinct character are discussed below. Each of these areas shall have Development Control Regulations (DCR) specifically designed for the location.

(i) Mattancherry and Fort Kochi

These areas situated on the western side of the city are the earliest developments of the Kochi. The existing urban form in these two areas is unique having been developed partly organically, partly inherited from the many foreign colonial powers and partly developed during the post independence period. These remarkable qualities of the built heritage interests not only Keralites but also visitors from far and wide. It is this reason that qualifies this area as a place of tourist attraction and a 'must see' location in the KCR. The unique character of this area is not just a few buildings of architectural value, but also the

layout of the roads and streets, streetscape and the open spaces. Enforcement of Building Rules and Development Control Regulations (DCR) which can be applied to the other towns and cities, if applied to this area may disrupt the urban fabric and quality of the heritage. It is necessary to develop Building Byelaws and DCR exclusively for this area. The regulations shall help conserve the character, permit repairs and maintenance to the existing buildings and structures, without adversely affecting the existing fabric and also permit redevelopment, reconstruction and new constructions. The roads and streets shall not be given the kind of consideration that is usually given to other urban roads – widening and improvement in tune with the traffic volume, surfacing and providing street furniture as is provided for the other city roads etc.

This area is already declared as a heritage zone under the Kerala Municipality Building Rules, 1999 and the development requests are being scrutinized by the Heritage Commission constituted by the State Government. However, this Commission is now not armed with regulations that are suitable for this area. Such DCR for this area shall be evolved based on detailed studies of the built forms in the area.

(ii) Broadway Commercial Area

This is an early part of the city being developed as a city level commercial street. Though commercial activities with malls, shopping centres and departmental centres have spread to many other parts of the city region, during the last few decades, the importance of Broadway as a commercial hub has still not declined. Though the name 'Broadway' suggests a wide road with shopping arcades on either side, the road is not wide by any modern standards. The buildings, housing the commercial activities of the traditional business community of Ernakulam, are mostly old and structurally unsound. Though many shop owners would like to rebuild their buildings, they do not attempt this since abiding by the KMBR provisions, they may lose precious built space after leaving statutorily required open spaces around and observing vehicle parking space requirements.

In spite of the above, it is necessary to rebuild this central commercial area by using any one or more of the planning and development tools like land pooling/ plot reconstitution/land consolidation etc. Beneficial development may be possible if more of the land and building owners join together and pool their land parcels to participate in a proportionate development activity. Perhaps, this is something to be worked out in detail with details of all land parcels, ownership, tenancy and sub-tenancy details and the existing built up area owned by each of the traders and people owning /occupying other use areas. Public intervention with suitable laws, planning techniques and tools and facilitation role through a public authority is required to enable redevelopment of Broadway area.

Since redevelopment of this traditional business area of Broadway needs to have a character of its own, it is necessary to frame Development Regulations specifically applicable to the Broadway area.

(iii) Bolghatty Island Area

Bolghatty Palace is a colonial legacy, which now is converted into a tourist hotel under the control of the State Tourism Development Corporation. Extensions and improvements recently carried out are in tune with the architectural quality of the edifice. Since the Palace Hotel and the island are among the few attractions to the visitors to Kochi and are factors attracting tourists from abroad, it is necessary to see that any development action within the island, whether construction of buildings / structures, laying out of internal roads and road furnishing, erection of sign boards, construction /renovation of boat landing facilities etc. follow rigorous regulations so that the architectural quality of the precincts is not lost.

(iv) Kumbalangi Rural Tourism Area (new developments)

Kumbalangi panchayat area is a typical rural area situated on the south – west of the KCR. With its water bodies, wet lands and rustic character offering native Kerala attractions, during the last decade, Kumbalangi was transformed to a tourist village. The best, perhaps the only, tourism attraction of Kumbalangi being 'nature and its rustic beauty', nothing should be done with manmade interventions which may degrade the natural quality. Whatever development actions are envisaged should be to enhance the quality of natural beauty of the place. What should be avoided in Kumbalangi are: multi storeyed concrete buildings, modern structural glass facades, vehicular traffic – if at all permitted, they should be based on planned routing without adversely hindering pedestrian traffic -, pompous western influences in outdoor and indoor finishes and embellishments of buildings, conversion of water bodies and wet lands, indiscriminate disposal/throwing of wastes, dwelling units without arrangements for sanitary disposal of sewage etc.

What should be encouraged are: detailed land use planning on cadastral maps, vernacular architecture, horticulture and gardening, parks and open spaces, water based recreational facilities, mini play fields, actions directly contributing to enhancement of the quality of water bodies and wetlands, buildings of not more than two or three storeys, commercial activities at a modest scale, actions to improve sanitation and hygiene, support schemes for the improvements /construction of the dwelling units of the native poor, tourist accommodations and related facilities at modest scale etc.

Considering the do's and don'ts suggested above it is obvious that Kumbalangi panchayat area requires tailored Development Regulations which would aim at enhancing the quality of nature and reduce negative impacts.

(v) Cheranallur City level Recreational Area (newly developing area)

This is a fairly undeveloped area situated on the northern side of the city. Mostly an island with water logged areas; developments in this area were restricted through the earlier approved Structure Plan for Kochi. However, tendencies are observed at slow conversion of wet lands. Such tendencies may lead to haphazard and unhealthy developments, if not regulated through stringent laws.

Kochi City Region has dearth of organised open spaces, play grounds and recreational facilities. A healthy society (with less of unsocial activities) can be sustained only if adequate open spaces and recreational facilities are provided for the residents. It is roughly estimated, based on All India norms and standards derived for large cities, that about 2200 hectares of land is additionally required to be planned for parks, open spaces, play fields, recreational facilities etc. These can be provided at three levels – at the city level, at the level of the Planning Divisions and at neighbourhood level.

Cheranallur is almost a virgin area suited to be developed as City level Recreational Facility. Cheranallur together with the neighbouring Varapuzha offers good opportunities for such a development and is so proposed in the Master Plan for Kochi City Region. These areas can be developed as water based recreational facilities offering good week end outdoor facilities for the residents in the KCR. Being not far from the city, it may be affordable even for the 'not so affordable' sections of the society.

However developments in these areas need to be guided/regulated through area specific development regulations. These regulations shall aim at conservation of water bodies, minimum conversion of wet lands, actions to enhance the quality of the environment, buildings of native character, and activities/used which would not invade into the spirit of developments proposed in the area.

CHAPTER 6

CONSERVATION OF NATURAL AND MANMADE HERITAGE

6.1 Urban Environment and Kochi

In the context of Kochi City Region, Urban Environment is discussed in Chapter 19 of this Master Plan as mainly comprised of:

- Natural Assets and Conservation
- Architectural and Historic Heritage
- Quality of Infrastructure
- Waste Management, Health and Hygiene
- Identity and Character as part of Urban Design

Perhaps, topics on conservation of natural assets, conservation of manmade (architectural/archaeological/historic) structures and precincts and 'imageability', identity and character as part of urban design are interrelated subjects. Often it is the practice to discuss 'tourism' also as part of this subject. It is argued that heritage and tourism are synonymous and that heritage is the main feature of any city that attracts tourists to the place. However, we are not discussing the aspect of tourism in this Chapter as it is a major economic activity and is dealt with separately. Kochi has always been special for its heritage and pluralistic culture through inherited from its history of shipping and trade with the Europe and Arabian countries. The colonial powers brought with them their architectural styles which merged with the native styles. Kochi being a coastal city, the rich architectural and cultural heritage are highlighted by nature's endowments.

An equable climate, serene beaches, vast spread of back waters, lusty hill stations, plantations and paddy fields, ayurvedic health resorts, enchanting art forms, traditional festivals, historical and cultural monuments are all features which offer unique experiences.

A few of the natural and/or manmade heritage areas are discussed below.

(i) Fort Kochi, Mattancherry, Fort Vypeen Integrated Heritage Zone:

The Fort Kochi area, Mattancherry and Fort Vypeen, located right at the sea mouth, have experienced immense trade related activities from the historic times and have developed rich pluralistic culture and tradition unique to this heritage zone. These are reflected in the monuments, structures and in the settlements around. Churches, residences, public buildings and public squares proclaim the colonial past. Fort Kochi and Mattancherry can proudly claim to have unique character and this makes it a major tourist attraction.

(ii) Wellington Island Heritage Zone:

During the period of British rule in early 20th century, dredging of port and formation of Wellington Island were executed under Sir Robert Bristow. Subsequently Kochi emerged as the major port in the entire region. Wellington Island developed as harbour and also as the seat of power for British rule. The entire port town was designed by Bristow, who left behind an outstanding heritage settlement built during the British period. The port building, palatial bungalows, commercial godowns and public places of the Southern Naval Command have all become part of this heritage zone.

(iii) Ernakulam Central Area Heritage Zone:

During the British Rule in the 19th century, the rulers of Kochi shifted to Ernakulum. As a result of this market and associated settlements developed. The Ernakulam Heritage Zone is in fact the heart of today's city of Kochi. Most of the work places, administrative and institutional centers and market places are located here. Broadway is one of the notable commercial streets in this area. The popular parks and public open spaces of the city are located defining the landward edge of this zone, which connects the city to its natural heritage of backwaters. Many cultural and religious institutions with some of the oldest temples, churches, mosques and synagogues also become part of this heritage zone. Old commercial streets with buildings abutting roadsides are also seen in this area, especially in Broadway. Redevelopment of the area on conservative principles will increase the productivity. Since this central city area is also home to a large number of 20th and 21st century buildings declaring modern architecture with its myriad styles, it may be difficult to decipher heritage character and to evolve urban design character with development regulations for this zone.

(iv) Canal and Backwater Network Heritage Zone:

The innumerable canals, the backwaters and the river estuaries contribute Kochi its natural character. Canal network is part of Kochi's legacy. Perhaps the entire Ernakulam main land area was long ago characterized by low lying marshy land and water bodies. The

entire developments that happened in the later years in the low lying coastal areas have been dependent on canal systems integrated by backwaters, lagoons and estuary and was instrumental for trade and commercial activities due to the over dependence on water transport. The canal network in Kochi is intervened with rivers and backwaters. Most of the traditional areas and heritage zones are connected by such canal system. The issues related to the canal network are basically the major issues of Kochi city itself. The positive features of the water bodies contribute to the well being of Kochi and the negative factors including water pollution, spread of vector diseases, dumping of wastes into the water bodies etc. tell upon the health, sanitation and hygiene of Kochi city region. Therefore conservation and development of water bodies – canals, rivers and backwaters – may tremendously contribute to urban sanitation, making available recreational areas (water bodies and planned waterfronts), increased potential for water transport etc.

(v) Mangalavanam Natural Heritage Zone:

Mangalavanam mangrove area comprises of a shallow tidal lake in the centre with its edges covered with thick vegetation. It gained importance because of the mangrove vegetation and also due to the congregation of commonly breeding birds. It is considered as a 'green lung space' of Kochi city.

(vi) Kochi Estuary Natural Heritage Zone:

Kochi estuary is an important natural ecological feature in the entire Vembanad lake region. A major transactional point for most of the marine species and habitat for many of them, Kochi estuary becomes a major zone of great environmental significance.

(vii) Thripunitura Heritage Zone:

Thripunithura used to be the seat of royal powers of Kochi. Thripunithura town has many heritage features like the Hill palace, the fort, 'Poornathrayeeswara' temple and the other temples, smaller palaces and 'malika's, churches, christian settlements and Tamil and Konkani settlements. The temple forms the focal point of the city. Many palaces in and around the town and Kochi city continue to carry memories of the rich tradition and history of the place.

(viii) Bolghatty Island:

Bolghatty Island accommodated the residence of the British Resident during the colonial period. The palatial bungalow used as his residence, known as Bolghatty Palace, is used as tourist hotel by the Kerala Tourism Development Corporation. There is a golfing turf also adjoining the palace building. The island itself is beautifully located with a commanding view of the backwaters and sea and is frequented by tourists. Good water transport connectivity exists between the island and the mainland of Ernakulam.

(ix) Edappally:

Edappally was once the capital of a principality called Elangallur Swaroopam within the kingdom of Kochi. An old palace built in the Kerala style of architecture reminds us of that old age. Edappally is also an important centre of Christian Pilgrimage. The St.George church draws thousands of pilgrims. History records that a session of the synod of Diamper (1599) was held here. It is also the birthplace of the celebrated Malayalam poet Changampuzha Krishna Pillai. Changampuzha Park is established here in memory of the great poet. A museum of Kerala history is also established here. Edappally is an important node in the transport network of Kochi, since the NH 47 Bypass (Aroor – Edappally), NH 17 from Mangalore to Kochi and NH 47 from Kanyakumari to Salem via Ernakulam meet at Edappally. Though Edappally was known a few decades ago as the location of government sector milk plant, specialty hospital, shopping mall etc. located at Edappally are the recent other attractions of Edappally.

(x) Thrikkakara:

Thrikkakara is well known throughout Kerala as the seat of an ancient Vishnu temple. This is the only temple in Kerala where Vamana is the presiding deity. It is recorded that in the early history of Kerala, princes and chieftains assembled at Thrikkakara to celebrate Onam festival. This celebration under the 'Kulasekharas', the early rulers, was considered as a festival of religious fervor and national solidarity. This made Thrikkakara a place of unique cultural importance to the people of Kerala. Thrikkakara is even now considered as part of the Onam celebrations in the state. There is an underground passage called 'Mudikuzhi' at a place 3 km of Thrikkakara temple. It is believed that the Pandavas made their escape through this passage when the 'arakkillam' (house of wax) was set on fire.

Kakkanad in Thrikkakara was elevated to be part of Kochi city life when the district administration was shifted to this place to the Civil Station. This prompted the State Housing Board (KSHB) to undertake housing development activities here. However, it was during the last decade that Thrikkakara shot into the economic life of Kochi and the State of Kerala, when the famed 'Infopark' (the I.T. Park) was established here. Quite substantial I.T. related developments, biotechnology parks, Export Processing Zone (EPZ), Special Economic Zone (SEZ), major oil companies etc. are all established here. Discussions are on to develop Smart City also at Kakkanad. These developments have submerged the historical and architectural quality of the bygone days.

(xi) Varapuzha:

Varapuzha area forming part of the Kochi City Region and located on the north of Kochi was the seat of the Carmelite order of the Roman Catholic Church. The Carmelite Church here dates from 1673. In 1682 the Carmelites founded here a seminary for both

Syrian and Latin Clerics. Parur town, on the NH 17, is about 12 km from Varapuzha. Varapuzha has a place in the history of Christianity in Kerala. The diocese itself was earlier known as “Verapoly Diocese’.

Conclusion:

The State of Kerala does not have heritage legislation. Though there are insufficient provisions for heritage conservation in the Kerala Municipal Building Rules, an Arts and Heritage Commission was constituted under the Rules. Conservation / development issues of heritage structures, which do not come under the purview of Archaeological Monuments, are referred to a Sub Committee constituted by the above Commission. It is imperative to bring out heritage legislation in Kerala. It is necessary to undertake related studies in Kochi, list the identified heritage structures and to develop necessary conservation and development regulations.

Meanwhile, it is recommended that as a follow up of this Development Plan for Kochi City Region, documentation of the natural and manmade heritage structures and precincts may be done by a State agency with the participation of interest groups.

CHAPTER 7

IMPLEMENTATION PLAN

7.1 Development Plan and Implementation – From Policy to Project

The Development Plan for Kochi City Region is a plan prepared as a comprehensive long range development plan to guide the future development of the city region in such a way that the desired development objectives are achieved. The desired objectives are expressed in the Development Plan as policies and strategies. These policies and strategies relate to a vast number of sectors like:

- Urban Land Utilisation;
- Development strategies for the different areas of the city region;
- Road Development and Transportation;
- Water Supply, Sewerage, Waste Management and Sanitation;
- Housing and Slum Improvement;
- Conservation and Heritage; and
- Urban Environment

In order to lead to the desired goals in the Plan period of the Development Plan for KCR which is 20 years, the Development Plan has also proposed Development Regulations to be enforced in the development activities within the city region.

The indicative sectoral programs relating each of the sectors like road development, transportation improvements, water supply or any other sector need to be discussed by the agencies responsible for carrying out augmentation works / improvements / new works of the respective infrastructure components .This include the broad development programs of that component, preparation of phasing plans for executing the improvement plans, preparation of project reports, arranging for financing project implementation and executing implementation of the project. Project implementation may take place in a number of stages in a phased manner. This process has to be undertaken for all the project proposals included in the Development Plan. Each of the infrastructure components may be the responsibility of a different agency. However a number of such components may be interrelated. Therefore

successful implementation of the Development Plan may depend on the actions of many agencies including Central Government Agencies/Departments such as Ministry of Road Transport and Highways, NHAI, Ministry of Railways, Ministry of Shipping etc., State Government Departments like State Public Works Department, Water Resources Department etc, Parastatalslike Kerala Water Authority, Kerala State Electricity Board etc., Local Self Government Institutions like Kochi Municipal Corporation, Municipality, Grama Panchayat etc. and private sector developers like Corporate investments, individual developers etc. The actions of these various agencies need to be coordinated and guided using the Development Plan as a development tool.

For each of the urban infrastructure component, the process to be detailed out from Policy Guidelines given in the Development Plan for Kochi City Region to individual projects to be implemented in phases is as follows:

POLICIES IN THE DEVELOPMENT PLAN

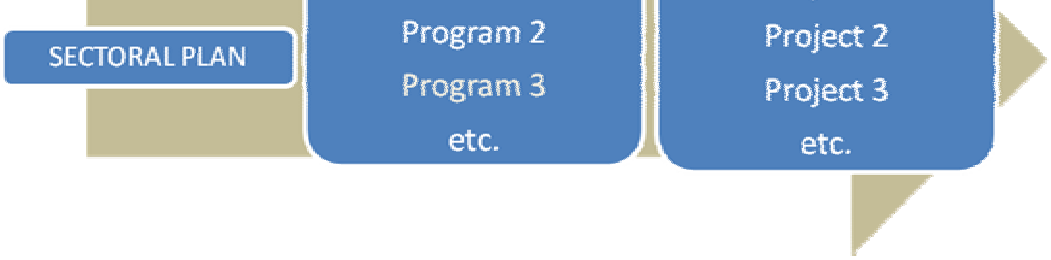
TECHNICAL EVALUATION AND ELABORATION OF THE POLICIES

STUDY AND IMPROVEMENT / ENLARGEMENT OF SECTORAL POLICY

SECTORAL DEVELOPMENT POLICY TO BE SPLIT INTO DEVELOPMENT PROGRAMS AND PHASING OF THE PROGRAMS

PRIORITISED PHASING PLAN TO BE SPLIT INTO PROJECTS

IMPLEMENTATION OF PROJECTS (AT ONE STRETCH OR IN PHASES)



The above process of study, interpretation and detailing of the Development Plan proposals has to go on during the whole of the Planning Period of 2010 – 2031. The Development Plan for Kochi City Region has been prepared with a farsighted and shared vision to meet the immediate and long term physical, infrastructural and social needs. All development agencies are expected to adopt this shared vision that overrides the interest of individual authorities. Encouraging public participation at local levels is an essential strategy in the implementation policies. Flexibility and responsiveness to changing needs, circumstances, aspirations and demands necessitate regular review of the development strategies proposed in the Development Plan. In the process, working hand in hand with the private sector is imperative. The process requires that the Development Plan for Kochi City Region shall be considered as a "Living Document".

The study, interpretation and translation of the Development Plan in a technical and participatory process require a systematic review mechanism.

7.2 Plan Monitoring and Review Mechanism

A dedicated monitoring unit with modern data processing facilities should be set up to be responsible for collection of primary and secondary data, analysis and bringing the important changes to the notice of the authorities. This unit should also monitor implementation processes and effect coordination between the various agencies responsible for development activities. This unit shall also develop and establish an 'urban spatial information system' for Kochi City Region so that the process of review and revision of the Development Plan becomes easier and regular.

Effective implementation of plan needs resorting to action planning, management information system and monitoring and performance assessment. Urban management should spearhead these aspects and innovations should catalyze planned development. Priority areas should be worked out to deliver the services in the shortest possible time with healthy competition between the public and private sectors. Coordination of different agencies for convergence of actions of industry, business and government should be the basis of demand driven development creating a new dimension of relationship of co-operation and competition in the pursuit of planned development.

7.3 Suggested Further Planning Actions

This Development Plan for Kochi City Region is not the 'one stop solution' to all the planning requirements of the Kochi City Region. The Development Plan can be considered as the Plan to provide a futuristic direction to the development of the city region. Such a

Development Plan needs to be studied in depth and further detailed out. The second level of Planning Tasks involved in that process are indicated below.

(1) The Planning Area of Kochi City Region is divided for planning and development purposes into 11 Planning Divisions. It is presumed and so proposed in the Development Plan that each of the above Planning Divisions shall be self-sufficient in most of the primary requirements. In such a case, it may be possible to avert to a large extent the need for intra-city trips. If this objective is to be achieved, detailed Master Plan shall be prepared for each of the Planning Divisions.

(2) Planning Division 3 is comprised of the mainland of the city (2009) area on the east side of the Wellington Island. Since this area has the most intense development activities and since this area is the core of the city region, the Development Plan proposes to divide this area of Planning Division – 3 into 13 Planning Sub-divisions. The concept of self-sufficient planning unit that is recommended for the other 9 Planning Divisions (except Planning Divisions 3 & 8) shall be made applicable for each of the 13 Planning Sub-Divisions of Planning Division 3. It is proposed that the Municipal Corporation of Kochi shall take lead role in preparing detailed Master Plan for the 13 Planning Sub-Divisions; such detailed Master Plans shall be prepared on land cadastral maps so that Master Plans and Zoning and Development Regulations can be interpreted specifically.

Similar is the case with Planning Division 8 which is Kalamassery-Thrikkakara having two Planning Sub divisions viz. Kalamassery Municipality and Thrikkakara Panchayat for which separate detailed Plans have to be prepared.

(3) Attaining self sufficiency in primary requirements for the residents within the Planning Division and enabling reduction of intra-city travel needs are the basic objectives of the Planning Division–wise approach of the Development Plan. These basic objectives are proposed to be achieved through the following means:

- To develop mass transportation corridors preferably all around the Planning Division / Planning Sub-division so that one can avail of the mass transport facility that extends around the planning unit (at times passing through the planning unit), the mass transportation corridors shall be prioritized based on, the priority to be given in the development of the Planning Division / Planning Sub-division and the development impetus to be induced in the planning unit (based on the economic role, the proposals in the Development Plan for increasing the population density/intensification of development activities – proposed with inducement of higher F.A.R., based on the future development potential that needs to be tapped on priority or based on the development problems in the planning unit).

- To improve the mass transport facilities – the preferred mode depending on the width of right of way and the connectivity to sub-arterial or arterial roads;

- To plan and to provide the primary basic needs of the residents within the Planning Division /Planning Sub-division in a phased manner – this may be mostly the Local Government task – the list of identified primary requirements are discussed elsewhere, the wish list can be further improved;

- **A central city region level multi-modal Transit Node** is proposed to be developed near Vyttila, near the NH 47 Bypass. It is proposed that the future Kochi City Railway terminal would be developed near the Road transport terminal being developed there. It is proposed that a circular railway would be operated through this transit node linking the north, north-west, west, south and south-east of the city area. It is also proposed that the city region water transport facility would also be operated through this transit node on the north-east of Vyttila. About 100 hectares of land is proposed to be developed for the multi modal transit node and for the related activities. Perhaps, in such a context it is necessary to prepare detailed Master Plan on priority for this transit zone (Planning Division-6) and to propose road, rail and water transport corridors development on priority. The succeeding priority in relation to this would be to finalise the alignment of the road, rail and water transport corridors which converge to Vyttila Transit Zone. Since the alignments of these three modes may pass through different Planning Divisions, it may be required to prioritise preparation of detailed Master Plans for those Planning Divisions.

- A few of the Planning Divisions are expected and elevated to provide major city region level economic and other functions – Thrikkakara as a Soft Industry Zone, Kalamassery as a major Industrial Service Node (between Eloor, Aluva and Thrikkakara), Cheranallur – Varapuzha as a city level regional recreational node, Kumbalangi – Chellanam as a State level rural tourism destination etc. Based on such identification and prioritization, the Planning Divisions shall be given importance in the preparation of detailed Master Plans.

(4) The detailed Master Plans so prepared with plot level details on land cadastral maps and approved shall become part of the Development Plan for Kochi City Region approved by Government and shall be statutory documents to be read and interpreted as Development Plan.

(5) Once the detailed Master Plan for a particular Planning Division is prepared and approved as Annexure to the sanctioned Development Plan for Kochi City Region, it shall be the mandatory responsibility of the Local Self Government Institution comprised within the Planning Division to associate with the Greater Cochin

Development Authority (GCDA) and the State Department of Town and Country Planning, to translate the Plan proposals in to different implementation programmes – agency wise, prioritise based on phasing of the required project actions and to cause discussions with the respective agencies to move towards implementation.

(6) There are subjects, dealt with in the Development Plan for Kochi City Region, which need further studies and detailing. This activity shall also be undertaken on priority basis as is done for identification and prioritising Planning Divisions. One subject may be Housing and Slum Improvement.

- A major percentage of the housing stock in Kochi is produced by the private sector. Kochi City region has witnessed unprecedented increase in land values. Since land market is totally operated by the private sector, those who are not able to compete in the open land market and afford to buy land at the exorbitant prices are pushed out and are forced to procure land outside the city and immediate surrounding areas and build houses. Their daily commutation into the city and heavy dependence on the city services increase stress on the city transportation systems and on the city level services. The principle of equity in planning and of inclusive growth demands that there should be government intervention to provide land at affordable prices to all.

- There are many households which move to the city region for short stays for a period of one to three years due to employment reasons. The households move back to their home towns/villages after their employment tenure. They need housing accommodation only for a short period. Housing units need to be provided for these households.

The above two issues lead us to give more importance for public housing in Kochi. Various options for public intervention in housing need to be studied and measures to increase public housing stock need to be devised. In addition the following scenario also leads us to prioritise a study on Housing and Slum Improvement.

- There is no clear picture on the slums in the Kochi city and surrounding areas. Though substantial expenditure is made during the last few decades for slum improvements (under central and state sponsored schemes, through Kudumbashree programs, through LSGI Plans, through BSUP – Basic Services for Urban Poor under JNNURM and through CIF (Community Infrastructure Fund) and PSF (Poverty Social Fund) under ADB assisted KSUDP, we still do not have a comprehensive study on Urban Slums in Kochi. Land tenure is a component in slum improvement, which is insisted upon in Government of India schemes, but is yet to be studied for adoption.

In addition to taking up “Housing and Slum Improvement in KCR” as a priority study area, the following subjects also deserve consideration for in depth study:

- Detailed Road Alignment Plans
- Detailed Plans for Transportation Networks
- Master Plan for Surface Water Drainage
- Sewerage Master Plan
- Plan for Conservation and Development of Water bodies and Wetland and water front development
- Plan for promoting Intra-city Water Transport
- Plan for parks, open spaces and play grounds
- Master Plan for development of Cheranallur – Varapuzha area (considered as detailed Master Plan for Planning Division)
- Detailed master Plans for Commercial Sub- Centres

7.4 Implementation Tools

It is imperative that the modern plan implementation tools are adopted for the implementation of various proposals included under this Development Plan. Adoption of one or the other method may depend on the local situation, the nature of proposal and the result envisaged. Land is the primary requirement for any development activity and in a situation where land is at a premium and attracts great affinity in Kochi, it is necessary to adopt innovative techniques to mobilize land required for different development needs.

Some of the plan implementation tools and techniques are discussed below.

7.4.1 Land reconstitution/Plot reconstitution

Land reconstitution/Plot reconstitution is a regulatory arrangement imposed on landowners that is designed to facilitate the development of land but which requires the owners to contribute land and cash. Land remains in separate ownership and partial cost recovery is achieved through betterment tax.

7.4.2 TDR – Transferable Development Right:

This is a land assembly technique utilized to make urban land easily available for public purposes without money compensations. In this concept the potential of a plot of land identified as intensity of built space guided by FSI or FAR, has been separated from the land itself and made available to the land owner in the form of Transferable Development Right (TDR) to be utilized by him from an inner zone (originating area) to an outer-zone (receiving area) specified by regulations. Road development projects, parks, play grounds, civic amenities etc. proposed in the plan can be materialized by this technique. TDR shall be made applicable within one local body itself and each local body shall be responsible to issue and maintain registers regarding these.

7.4.3 Accommodation Reservation

The concept of Accommodation Reservation (AR) allows the land owners to develop the sites reserved for an amenity in the Master Plan using full permissible FSI/FAR on the plot subject to agreeing to entrust and hand over the built up area of such amenity to the local authority free of all encumbrances and accept the full FSI/FAR as compensation in lieu thereof. The area utilized for the amenity shall not form part of FAR/FSI calculation.

In case of reservation like shopping centres, industrial estates, etc. the owner can be allowed to develop them on his agreeing to give at least up to 25% of the shops to the local authority for the purpose of rehabilitation of the displaced persons from sites reserved for public purposes or amenities in the development plan, on payment of cost of construction. The remaining shops are allowed to be taken care of by the land owner.

In case of road widening and construction of new roads, the local authority can grant additional FSI on 100 percent of the area required for road widening or for construction of new roads proposed under Master Plan, provided the owner surrenders the land for widening or construction of new roads to the local authority free of all encumbrances and accept the additional FAR/FSI as the compensation in lieu thereof. Huge expenses incurring for the purpose of land acquisition can be avoided using this mechanism.

7.4.4 Land acquisition

Land acquisition can be done for different public purposes under Land Acquisition Act 1894. Here compensation has to be given to the aggrieved and it causes huge expenses and so this method is least preferred nowadays.

7.4.5 Negotiated Purchase

This method is also a type of land acquisition giving compensation. Here the compensation amount is arrived after different discussions with the aggrieved and the negotiated amount is given as compensation. In this case also cash compensation is necessary.

7.4.6 Floating Zone

In content, the floating zone is same as a conventional zone. It describes permitted uses, set back requirements, and other standards to be applied in the planning area. Unlike conventional zoning, however, the floating zone is not designated in the zoning map. Once enacted into law it 'floats' over the community until, upon approval of an application, it is 'brought down to earth' to be affixed to a particular parcel through an amendment to the zoning map.

The floating zone is particularly useful in situations where a community wishes to permit a limited number of specific uses (large shopping centres for example) but does not wish to map their locations in advance. It also allows for locating use types which cannot be anticipated but which the plan would like to provide. For instance, a community may have an anti-industry policy and no industrial zone in its local ordinance. It may, however, be

amenable to a high technology, low-impact industry under certain conditions. The floating zone allows this kind of control and flexibility. Reclaimed land of GIDA and other reclaimed lands of Cochin Port etc. can be grouped under this type of floating zone.

Large scale development proposals in an area not less than 2ha, exceeding an investment of Rs. 50 crores, which provide direct employment (after commissioning of the project) to the tune of not less than 500 may be permitted in agricultural and developed land use zones, subject to the recommendation of a committee to be constituted by Government for this purpose. In this case any use can be permitted in any zone if the project satisfies the provisions stipulated in the Master Plan. This also provides the benefit of a floating zone.

7.4.7 Land Pooling

In this technique, Town Planning Schemes are prepared at micro level for smaller areas of about 100 hectares particularly in those pockets which need priority attention. The scheme is conceptualized as a joint venture between the local authority and the owners of land, who voluntarily agree to pool their land, redistribute the reconstituted plots of land among themselves and share the development cost for preparation of scheme. Land parcels with common ownership are marked with original survey number/ plot number on a map. All such original plots form one area for planning purpose. In the layout plan taking out the area for roads and streets and public and semipublic spaces the remaining area is planned in regular plots known as final plots. The final plots though reduced in size, better in shape, buildable and accessible are allocated to the land owners preferably in close proximity to their original plots. The owner also gets compensation for the area reduced for public spaces and roads. Since the reconstituted plots have better accessibility and good potential for development, its value gets enhanced.

ANNEXURE – A

CLASSIFICATION OF INDUSTRIES BASED ON THEIR SUITABILITY FOR THE PROPOSED ZONING

Several classifications of industries are in vogue in different countries. These classifications are meant to serve specific purpose and are not quite suitable for zoning of industrial land use. It has, therefore, been thought fit to divide the industrial establishments into 5 categories as given below.

Type of industries and their definitions

Category	Type of industries		Definitions
I	Service industries & Light industries of service type	See Appendix 1	Service industries are those, which cater to the immediate needs of the community and are mainly concerned with repair, maintenance, servicing and/or job work. They can also include light industries on a mini scale.
II	Light industries or small scale industries	See Appendix 2	Light industries are defined as those, which do not employ more than 100 workers and not use more than 100 HP except in the case of foundries and smithies.
III	Medium industries	See Appendix 3	Medium Industries are those which employ more than 100 workers, but not exceeding 500 workers.
IV	Heavy industries	See Appendix 4	Such industries are highly capital intensive and also land-extensive in character. They generally function as self-contained and independent units.

V	a) Obnoxious and Hazardous industries	See Appendix 5	These are industries, which are associated with such features as excessive smoke, noise, vibration, stench, unpleasant or injurious fumes, effluents, explosives, inflammable material etc. and other hazards to the health or safety of the community.
	b) Extractive industries		These are industries connected with excavation of land such as brick kilns, quarries, stone crushing, lime kilns, refractories etc.

ILLUSTRATIVE LIST OF INDUSTRIES

Lists of industries of the different categories mentioned above have been attached. Every attempt has been made to make each list as exhaustive as possible but it is desirable to treat these as illustrative lists only. The classification should not be taken too rigidly; it would be desirable to treat the groupings as somewhat flexible, particularly in marginal cases. Each individual case will have to be studied on its own merits for purposes of location in an appropriate zone, keeping in view its function requirements, its performance characteristics and its compatibility with other industries.

APPENDIX – 1
LIST OF "SERVICE" INDUSTRIES

1. Atta chakkies
2. Rice hullers
3. Groundnut decorticating, cashew nut processing and dal manufacturing
4. Printing (including lithography) and book binding
5. Rubber stamps
6. Embroidery and lace manufacturing, shawl repairing
7. Tailoring
8. Hay cutting
9. Gold and silver smithy
10. Electroplating, mica plating and repairing
11. Watch repairing, pen and spectacles repairing
12. Black smithies
13. Laundry, dry cleaning and dyeing
14. Photo and picture framing
15. Apparel (cap making, hat and turban making etc.)
16. Musical instruments manufacturing and repairing
17. Photographs and printing including signboard painting
18. General jobbing and machining
19. Metal polishing

20. Tin smithy and repairing of utensils
21. Vulcanizing and tyre re-treading
22. Shoe repairing and manufacturing
23. Automobile scooter and cycle repairing and servicing
24. Radio servicing and repairing Cotton and silk printing

LIST OF LIGHT INDUSTRIES ON A MINI SCALE AND OF A SERVICE TYPE

1. Small bakeries (including biscuit-making)
2. Confectionaries (including lozenges, toffee, candies etc.)
3. Ice cream, ice etc.
4. Cold-storage (small scale)
5. Aerated waters and fruit beverages
6. Dal manufacturing, groundnut decorticating etc.
7. Manufacturing of beedi and tobacco products
8. Wedding (narrow fabrics), embroidery and lace manufacturing, shawl repairing
9. Tailoring and garment making
10. Apparel making (cap making, hat & turban making etc.)
11. Cotton and woolen hosiery
12. Handloom weaving
13. Shoe-lace manufacturing
14. Cotton & silk cordages (thread and threat-ball making)
15. Gold and silver thread and ‘zari’ work
16. Gold and silver smithy (including making of jewellery and ornaments)
17. Leather foot-wear, repairing and manufacturing
18. Velvet embroidered shoes
19. Electroplating, mica plating and engraving
20. Watch, repairing, pen and spectacles repairing
21. Laundry, dry cleaning and dyeing
22. Photo and picture framing
23. Manufacture of mirror and photo frames
24. Musical instruments, manufacturing and repairing
25. Photographs and printing including signboard painting
26. General jobbing and machining
27. Metal polishing
28. Radio servicing and repairing
29. Umbrella assembly
30. Sports goods
31. Bamboo and cane products
32. Leather goods (other than foot wear)
33. Cardboard box and paper products including cartons.
34. Stationery items
35. Scientific and mathematical instruments (simple types)

36. Survey and drawing instruments
37. Furniture making (wooden and steel)
38. Domestic electrical appliances
39. Optical lense grinding
40. Rubber stamps
41. Manufacture of steel trunks and suit cases
42. Paper pins and gem clips
43. Metal polishing
44. Radio assembling and manufacture of radio parts (small scale)
45. Electric lamp shades, fixtures etc.
46. Automobile, scooter and cycle servicing and repairing
47. Brushes and brooms
48. Rings and eyelets
49. Travel goods of canvas and water proof materials
50. Laboratory porcelain and dental porcelain
51. Toy making
52. Fruit and vegetable canning and preservation
53. Cork products
54. Block making for printing
55. Fountain pens
56. Plastic goods
57. Wood carving
58. Ivory carving
59. Surgical instruments
60. Optical frames
61. Rope making (vegetable fibre)
62. Surgical gauges and bandages
63. Wooden packing cases and boxes
64. Creamery (butter, ghee, cheese)
65. Edible oils (non hydrogenated)
66. Wooden electrical accessories
67. Arts and crafts
68. Toilet soap making
69. Sorting gum Arabic
70. Spectacles
71. Basket making
72. Glass cutting, decorating and engraving

APPENDIX – 2
LIST OF SMALL INDUSTRIES

1. Washing soap
2. Aluminium utensils
3. Copper, brass/bell metal utensils
4. Cycle parts and accessories
5. Torches (flashlights)
6. Steel slates
7. Tin products (including containers tin buttons and tin printing)
8. Oil stoves and pressure lamps
9. Tricycles and prams
10. Buttons (all kinds)
11. Hair oils and cosmetics
12. Electric motors (fractional horse power)
13. Zip fasteners
14. Shoe grindery
15. Animal shoe nails
16. Wax polishes and wax products
17. Precipitated chalk
18. Upholstery springs and other springs
19. Hoofs and box strapping
20. Die and tool room shop
21. Small foundries (ferrous & non ferrous)
22. Sprayers (hand and foot)
23. Watch and clock parts
24. Chalk crayons and artists colours
25. Builders hardware
26. Drugs and medicines
27. Sewing machines (assembly)
28. Sanitary fittings
29. Wire nails, panel pins and wood screws
30. Machine screws, bolts, nuts, rivets
31. Hand tools
32. Measuring tapes (metallic & non metallic)
33. Writing and marking inks

34. Wooden industrial goods
35. Padlocks and pressed locks
36. Plastic jigs and fixtures
37. Glass cutting, etching and polishing
38. Scientific glass instruments
39. Costume jewellery and novelties
40. Decorated glassware
41. Steel wire products
42. Blower fans
43. Television parts
44. Electrical condensers (paper)
45. Optical instruments
46. Buckets and metal containers
47. Animal feed
48. Manufacture of miscellaneous food products such as baking powder, flavoring essence, edible silver paper etc.
49. Carpet and duree weaving
50. Paper coating and glazing
51. Cleaning and polishing preparations
52. Phenyl and insecticides (not obnoxious in character)
53. Sheet metal works
54. Metal stamping, coating and engraving
55. Laboratory re agents
56. Flood lights, reflectors and studio equipments
57. Auto transformers
58. Essential oils and aromatic oils
59. Clinical thermo Meters
60. Torch bulbs and automobile bulbs
61. Gramophone parts
62. Storage batteries and accessories
63. Wire netting
64. Vacuum flasks
65. Saw milling
66. Umbrella ribs
67. Aluminium wares
68. Collapsible gates
69. Railings and grills
70. Expanded metals
71. Toys and other similar products
72. Power looms
73. Oil seeds crushing (non edible)
74. Lawn movers
75. Hand pumps

76. Electrical equipments for auto cycles and motor cycles
77. Bakelite electrical accessories
78. Automobile leaf springs
79. Furniture and wood working
80. Metal small wares
81. Dummy rifles
82. Wood wool
83. Agricultural implement (small scale)
84. Fibres from banana stalk and pineapple leaves
85. Rolling shutters
86. Toilet soaps
87. Lead pencils
88. Cutlery (including kitchen and table cutlery)

N.B: - Manufacturing units exceeding the limits in respect of employment, site area and horsepower prescribed for this category of industries should be allotted to the “extensive industry” zone.

APPENDIX – 3
LIST OF MEDIUM INDUSTRIES

The following list includes industries, which employ more than 100 workers and require more than 0.8 hectares (2 acres) of site area. In the case of units in these industries, which employ less than 100 workers and also require less than 0.8 hectares (2 acres) of site area, it will be appropriate to treat them as light industries for purpose of zoning.

1. Chains and gears
2. Automobile parts
3. Concrete pipes
4. Electric fans
5. Refrigerators and air conditioners
6. Water proof textiles
7. Weighing and measuring machines
8. Steel joinery
9. Machine tools
10. Plaster and plaster board
11. Wire drawing
12. Mica and micanite
13. Paints, varnishes and lacquers, (non – obnoxious)
14. Typewriters and parts
15. Hurricane lanterns
16. Veneer and plywood
17. Razor, blades
18. Sewing machines
19. Edible oils and fats (medium scale)
20. Agricultural implements (large scale)
21. Flour mills
22. Re-rolling mills
23. Rubber goods (molded and dipped)
24. Plastic products (large scale)
25. Iron and steel forging (mechanical)
26. Pressure die castings
27. Electric motors (more than 1 HP)
28. Bicycle manufacturing

29. Fume pipe
30. Centrifugal pumps and small turbines
31. Matches
32. Vitreous enameling
33. Hot tinning
34. Asbestos and cement products
35. Glucose manufacturing
36. Printing machinery and parts
37. Lead pencil
38. Industrial leather goods
39. Industrial precision instruments
40. Small tools
41. Electrical precision instruments
42. Printing ink
43. Cigarettes
44. Starch
45. Manufacture of wooden structurals
46. Silk reeling, spinning and weaving
47. Paving and roofing materials
48. Drugs and medicines
49. Glass products
50. Electric wires and cables
51. Steel doors and windows
52. Motor cycles and scooters
53. Timber seasoning
54. Hollow concrete blocks
55. Mosaic tiles
56. Pork products
57. Crockery
58. Fish products
59. Manufacture of salt

APPENDIX – 4
LIST OF HEAVY AND LARGE SCALE INDUSTRIES

1. Heavy structural steel fabrication
2. G.I. malleable pipe fittings
3. Heavy diesel engines
4. Sugar (large scale)
5. Vegetable oils (hydrogenated)
6. Large textile mills
7. Blast furnaces, steel works and rolling mills
8. Primary and secondary smelting refining of non ferrous metals and alloys
9. Automobile and coach building
10. Manufacture of aircraft frames and aero engine
11. Special industrial machinery
12. Sluice gates and gearings
13. Cranes and hoists
14. Steel pipes and tubes
15. Wire ropes
16. Steel chains (conveyors, shipping)
17. Electrical steel sheets and stampings
18. Heavy steam engines
19. Power driven pumps and pumping equipments
20. Tractors and heavy agricultural machinery
21. Metal working machinery
22. Electrical generating transmission, distribution and industrial apparatus
23. Rail-road equipment
24. Industrial trucks, trailers, stackers etc.
25. Earth moving machinery
26. Conveyors and conveying equipment
27. Heavy iron and steel forgings
28. Foundries (heavy)
29. Other primary metal industries (e.g. Cold rolled sheets, alloy, steel etc.)
30. Turbines
31. Shipyards
32. Rayon production
33. Nylon production

34. Jute spinning and weaving
35. Cement
36. Asbestos cement, sheets and pipes
37. Manufacture of locomotives-Electric, diesel and steam
38. Country crafts and hulls for mechanized fishing boats
39. Fermented beverages
40. Pressure cookers and ranges
41. Duplicating machine
42. Packing machinery and equipment
43. Chemical plant
44. Printing machinery
45. Paper and pulp machinery
46. Textile machinery
47. Sugar machinery
48. Ball and roller bearing

APPENDIX – 5

LIST OF OBNOXIOUS AND HAZARDOUS INDUSTRIES

Sl No.	Industrial groups	Noxious characteristic
Chemical Industry		
1	**Inorganic manufacturing industries:**	
(i)	Acids: - Suphuric acid, Nitric acid, acid (Glacial), Picric acid, Hydrochloric acid, Bosphoric acid, Battery, acid, Benzonic acid, carbolic acid, chlorosulphonic acid etc.	Fire hazard, Offensive fumes, and smoke
(ii)	Alkalies: - Caustic soda, caustic potash, soda ash etc.	Fore hazard, corrosive substance
(iii)	Production of mineral salts which involves use of acids	
(iv)	Carbon disulphide, Ultra marine blue, chlorine, Hydrogen	Risk of fire, dust and fumes
2	**Organic manufacturing industries:**	
(i)	Dies and dye stuff intermediate manufacture	Waste water is acidic
(ii)	Synthetic plastics like polyethylene, P.V.C, Resin, Nylon	Distillates from reaction vessels, fire risk also.
(iii)	Synthetic rubber	Liquid influents with unpleasant smell
(iv)	Synthetic detergents	Unpleasant smell and risk of fire
(v)	Insecticide, Fungicides and pesticides	Unpleasant smell and dust, fire hazards.
(vi)	Phenols and related industries based on coal tar distillation	Risk of fire
(vii)	Organic solvents, chlorinated minerals methanol, aldehyde and methylated spirits	Fire hazard, unpleasant smell
(viii)	Manufacture of compressed “permanent” liquefied and dissolved gases	Risk of fire

(ix)	Acetyl ides, Pyridines, Lodoform, Choloroform, B-Nepthol etc.	Risk of fire, smell
3	*Miscellaneous:*	
	Electro-Thermal industries such as manufacture of Calcium carbide, Phosphorous, Aluminium dust, Paste and powder, Copper, Zink etc.	Risk of fire
	I Poisons	
	Amonium Sulphocynide, Arsenic and its compounds, Barium acetate, Barium bromide, Barium carbonate, Barium cyanide, Barium ethyl-sulphate, Barium acetate, Cinnabar, Copper sulphocyanide, Ferrocyanide, Hydrocyanic acid, Potassium cyanide, Prussiate of potash, Pyrogallic acid, Silver cyanide etc.	Contamination if stored on same floor as or on floors above food stuffs (fire hazard in any case)
	Manufacture of Cellulosic products:	
	Rayon fibre, waste products, Rayophane paper etc. Cellulose nitrate, Celluloid articles, scrap solution.	Risk of fire
	Paints, Enalels, Colours, Varnish (other than litho varnish) and varnish removers of all kinds, turpentine and turpentine substitutes	Risk of fire and smell
	Matches	Fire hazard
	Printing ink	Fore hazard
	Industrial alcohol	Unpleasant
	Manufacture of newsprint	Unpleasant smell, enormous quantities of contaminated waste water, fire hazard
	II Petroleum products	
	1 Crude oil refining, processing and cracking, petroleum jelly, petroleum ether, Naphtha cracking including gas cracking for any	Inflammable fumes and noise

	2	Carbon black manufacture & blacks of all kinds	Fire hazard
	3	Petroleum coke usage for Graphite production	Fire hazard
	4	Lubricating and fuel oils and illuminating oils and other oils such as Schist oil, Shale oil etc.	Fire hazard
III		**Rubber Industry**	
		Reclamation of rubber and production of tyres, rubber solutions containing mineral naphtha rubber waste.	Unpleasant smell, dust and fire
IV		**Metallurgical Industries with the following operations**	
	1	Sintering, smelling	Noise, dust, smoke and risk of fire
	2	Blast furnaces	
	3	Recasting of ore sulphate oxides or mixtures	
V		**Manufacture of Radio Active Elements such as**	
		Thorium, Radium and similar isotopes and recovery of rare earth	Radiation hazard
VI		**Paper and paper products**	
		Large scale paper, pulp and board manufacture	Unpleasant smell large quantities of contaminated waste water.
VII		**Leather & other Animal products**	
	1	Leather tanning	Obnoxious smell
	2	Glue and gelatine manufacture from bones and flesh	Obnoxious smell
	3	Bone crist, bone meal, bone powder or storage of bones in the open	Obnoxious smell
	4	Glandular extractions	Obnoxious smell
	5	Animal and fish oils	Risk of fire
VIII		**Manufacture of Explosive Ammunition**	
	1	All types of explosives or their ingredients such as fire works of all kinds, bon-bons, gun cotton, gun powder, flares, flash powders, rockets.	Fire explosion hazards

	2	Industrial gelatine, Nitroglycerine and fulminate	Risk of fire
IX		**Manufacture of Cement and Refractories**	
	1	Portland cement	Dust
	2	Refractories	Smoke and solid waste
	3	Enameling vitrous	Smoke and furnace
	4	Glass furnaces of 3 tonne capacity and above	Fire
	5	Mechanical stone-crushing	Dust slurry noise
X		**Fertilisers**	
		Nitrogenous and phosphatic fertilizer manufacturing on a large scale except mixing of fertilizers for compounding	Fire, noise, atmosphere pollution due to noxious gases and dust.
XI		**Heavy engineering and forging shops**	
		Using steam and power hammers and heavy metal forgings	Noise, vibration and smoke
XII		**Wood and wood products**	
		Distillation of wood	Readily ignitable, obnoxious games.
XIII		**Textiles**	
	1	Oils sheets and water proof clothing	Fire hazard
	2	Wool spinning	Wool washing liquor containing certain impurities.
	3	Clean rags (not including clean textile cutting), oily and greasy rags	Fire hazard
	4	Flax yearn and other fiber	Fire hazard
	5	Textile finishing, bleaching and dyeing	Waste water containing acids etc.
XIV		**Foods**	
	1	Vegetable oils	Noise, unpleasant smell
	2	Abattoirs	Waste water with obnoxious smell
	3	Alcohol distilleries and breweries and potable spirits	Oxygen causing unpleasant smell, noise, fire hazard.
	4	Sugar refining	Unpleasant smell, fire hazard

XV	**Transport**	
	Manufacture of aircraft locomotives, tractors etc.	Smoke and noise.

Annexure B
Major junctions identified for improvement in Kochi City Region

A. Main junctions identified for improvement in Kochi city
   1. Pallimukku Jn
   2. Jose Jn
   3. Maharaja's College Jn
   4. Padma Jn
   5. Madhava Pharmacy Jn
   6. Kacheripady Jn
   7. Pachalam Jn
   8. Ravipuram Jn
   9. Judges Avenue
   10. Manaroma Jn
   11. Ground Jn
   12. By-pass and NH 47 jn
   13. Vytilla Jn
   14. Kadavanthara jn
   15. Kaloor Jn
   16. Fathima Church Jn

B. Other junctions which need improvement in Kochi City Region
   1. HMT Jn (Kalamassery Municipality)
   2. Appolo Jn (Kalamassery Municipality)
   3. Pukattupadi Jn (Kalamassery Municipality)
   4. Carborandum Jn (Kalamassery Municipality)
   5. Factory Jn (Kalamassery Municipality)
   6. Toll Jn (Kalamassery Municipality)
   7. TVS Jn (Kalamassery Municipality)
   8. Kangarappady Jn (Kalamassery Municipality)
   9. Thevakkal Jn (Kalamassery Municipality)
   10. SN jn (Thripunithura Municipality)

11. East Fort Jn (Thripunithura Municipality)
12. Alliance Jn (Thripunithura Municipality)
13. Statue Jn (Thripunithura Municipality)
14. Info Park Jn (Thrikkakkara Panchayat)
15. Collectrate Jn(Thrikkakkara Panchayat
16. Thiruvankulam Jn (Thiruvankulam Panchayat)
17. Karingachira Jn (Thiruvankulam Panchayat)
18. Puthiya road Jn (Thiruvankulam Panchayat)
19. Kundannur Jn (Maradu Panchayat)
20. INTUC Jn (Maradu Panchayat)
21. Kumbalam South (Kumbalam Panchayat)
22. Madavana (Kumbalam Panchayat)
23. NM Jn (Kumbalam Panchayat)
24. Panangad (Kumbalam Panchayat)
25. Puthencruz Jn (Vadavukode-Puthencruz Panchayat)
26. Karimugal Jn (Vadavukode-Puthencruz Panchayat)
27. Vadavukodu Jn (Vadavukode-Puthencruz Panchayat)
28. Hospital Jn (Njarakkal Panchayat)
29. Njarakkal Jn (Njarakkal Panchayat)
30. PerumpillyJn (Njarakkal Panchayat)
31. Goshree Jn (Elamkunnappuzha Panchayat)
32. Nada Jn (Elamkunnappuzha Panchayat)
33. Vallarpadam Jn (Mulavukad Panchayat)
34. Ponjikkara Jn (Mulavukad Panchayat)
35. PonnarimangalamJn (Mulavukad Panchayat)
36. Mulavukad North (Mulavukad Panchayat)
37. Vallarpadam Square (Mulavukad Panchayat)
38. Pathalam Jn (Eloor Panchayat)
39. Puthiya road Jn (Eloor Panchayat)
40. Sree Krishna temple Jn (Eloor Panchayat)
41. Manjummel Bank Jn (Eloor Panchayat)
42. Kacherippady Jn (Cheranallur Panchayat)
43. Manjummel kavala (Cheranallur Panchayat)
44. Shappupady Jn (Cheranallur Panchayat)
45. Kappela Jn (Cheranallur Panchayat)
46. Palli kavala (Cheranallur Panchayat)
47. Thykkavu Jn (Cheranallur Panchayat)
48. Chittoor Temple Jn (Cheranallur Panchayat)
49. SNDP Jn (Varapuzha Panchayat)
50. Shappupady jn (Varapuzha Panchayat)
51. Moolampally Jn (Kadamakkudy Panchayat)
52. Kothad Jn (Kadamakkudy Panchayat)

53. Illickal Jn (Kumbalangy Panchayat)
54. Panangad Jn (Kumbalangy Panchayat)
55. Kandekkadavu Jn (Chellanam Panchayat)
56. Kumbalangyvazhy Jn (Chellanam Panchayat)

Annexure C

PROPOSALS FOR ROADS

Sl.No	Category	Road name	From	To	Existing ROW (Average)	Proposed ROW (m)	Remarks
1	Regional	NH 47 Bypass	Aroor	Thrissur via Kundannur - Vytilla- Edapally - Kalamassery	14	45	Existing road to be widened
2	Regional	NH17	Edapally	Kodungallur via Cheranellur- Varappuzha	8.7	45	Existing road to be widened
3	Regional	NH 49 Byepass	Kundannur	Puthenkurisu	_	45	Proposed
4	Planning division - Planning division	Container Terminal road	Vallarpadam (GIDA Bridge)	NH47at Kalamassery via Bolgatty island - Kadamakkudy- Eloor	22	45	Existing (under implementation)
5	Regional (link road)	Sea Port-Air Port Road	Proposed NH 49 Byepass	Nedumbassey via Karingachira Jn - Irumbanam Jn - Thrikkakara - Kalamassery	10	45	Existing road to be widened
6	Regional (link road)	Old NH	Aroor	Edapally via Edakochi-Thoppumpady - Atlantis Jn- Madhava pharmacy Jn -Kaloor - Palarivattom - Edapally	16.6	27	Existing road to be widened
7	Regional (link road)	NH 47 A	Kundannur	Wellingdon Island	7	27	Existing road to be widened
8	Plng. Division to Plng. Division	Edakochi - Madavana Road	Edakochi	Madavana	_	27	Proposed road

9	Plng. Division to Plng. Division	Marine Drive - GIDA Bridge Road	Ravipuram	Vypeen Munambam Road via Marine Drive - High Court Jn- GIDA Brdige	11	27	Existing road to be widened
10	Link road	High Court Junction to Madhav Pharmacy Jn	High Court Junction	Madhav Pharmacy Jn	14	27	Existing road to be widened
11	Link road	S.A Road	Pallimukku	Vyttila	15	22	Existing road to be widened
12	Link road	Vyttila - Thrippunithura Road	Vyttila	Pettah Jn (Thrippunithura)	10	27	Existing road to be widened
13	Regional	NH49	Kundannur	Muvattupuzha via Pettah Jn(Thrippunithura) - Thiruvankulam - Puthenkurisu	8	27	Existing road to be widened
14	Link road	Eroor Road	Alinchuvadu	S.N Jn (Thrippunithura)	7	15	Existing road to be widened
15	Regional	Vaikom Road	S.N Jn (Thrippunithura)	Vaikom via Puthiyakavu Jn	7	27	Existing road to be widened
16	Link road	East Fort Jn to Karingachira Jn	East Fort Jn (Thrippunithura)	Karingachira Jn (Thiruvankulam)	7	27	Existing road to be widened
17	Link Road	Thiruvankulam Karimugal Road	Irumbanam Jn	Karimugal Jn	10	27	Existing road to be widened
18	Link Road		Muttar Jn(NH 17)	FACT Jn (Eloor)	7	27	Existing road to be widened
19	Link Road		FACT Jn (Eloor)	IAC Jn (Eloor)	7	27	Existing road to be widened
20	Link Road		IAC Jn (Eloor)	Premier Jn (NH 47)	7	27	Existing road to be widened

21	Regional Link Road	HMT Road	NH47	Eastern boundary of Kalamassery	12	27	Existing road to be widened
22	Regional Link Road	Smart City Road	HMT road	NH 49 at Puthenkurisu via Thrikkakara-Karimugal		27	Existing road to be widened
23	Regional Road	Kochi - Perumbavur Road	Toll Jn, Edappally	Perumbavur via Pookkattupadi Jn-	9	27	Existing road to be widened
24	link road	Palarivattom Kizhakkambalam road	Palarivattom	Navodaya Jn via Vazhakkala Jn - Collectorate Jn	9	27	Existing road to be widened
25	link road		IMG Jn	Smart City Road (Behind Mental Hospital, Kusumagiri)		27	Existing road to be widened
26	link road	Kandakadavu-Kumbalangi road	Chellanam	Kumbalangi		15	Existing road to be widened
27	link road	Kumbalangi Road	Near Kacherippady Jn	Alappuzha		22	Existing road to be widened
28	Regional	New Coastal Road	Kalamukku Junction	Munambam	_	22	Proposed Road
29	Link Road	New link Road	Proposed Coastal Road	Container Terminal Road	_	22	Proposed Road
30	Link Road	Thammanam - Pulleppady Road	Marine Drive Road	Eroor Road		22	Existing road to be widened
31	Link Road	Extension of Thammanam - Pulleppady Road upto Smart City road	Eroor Road	Smart City Road	_	22	Proposed Road

32	Link Road		Kaloor Jn	Madavana Jn		22	New link - requires bridge
33	Link Road	Eroor-Kaniyambuzha Road	Vyttila	Eroor Road		22	Existing road to be widened
34	Link Road	Madavana - Panangad Road	Madavana	Panangad South end		18	Existing road to be widened
35	Link Road		Ravipuram	Varappuzha North end		18	Existing road to be widened
36	Link Road		Lissie Jn	Old NH via Perandoor jn - Elamakkara Jn		18	Exisitng - requires bridge
37	Link Road		Kaloor Jn	Perandoor Jn		18	Existing road to be widened
38	Link Road		Gandhinagar jn in Kaloor Kadavanthra Road	Road from Atlantis Jn to Thykkoodam via Amala Bhavan Jn, Chilavannur		18	Existing road to be widened
39	Link Road		Thammanam - Pulleppady Road	Edapally Raghavan Pillai Road via Jawaharlal Nehru Stadium, Elamakkara Jn		18	Existing road to be widened
40	Link Road		Edapally Jn	St James Jn (Cheranellur)		18	Existing road to be widened
41	Link Road		Puthenpally NH 17	Chettibhagom via Mannanthuruthu		18	Existing road to be widened
42	Link Road	Manjummel-Carborandum Road	Manjummel Jn	Carborandum Jn		18	Existing road to be widened
43	Link Road		Toll Jn	Road from IAC Jn to Premier Jn (Kalamassery)		18	Existing road to be widened

44	Link Road	NAD Road	HMT Jn	Eastern boundary of Kalamassery		18	Existing road to be widened
45	Link Road		South Kalamassery Jn	Edapally-Pookkattupady Road		18	Existing road to be widened
46	Link Road		From Ravipuram - Varappuzha Road (Near Muttar Jn)	NH17		18	Proposed
47	Link Road	Mamangalam Pottakuzhi Road	GIDA Bridge	Mamangalam Jn		18	Existing road to be widened
48	Link Road		BPCL KRL	Regional Park		18	Proposed
49	Link Road		Varikkoli Ambalamugal road	Smart city road		18	Proposed
50	Link Road		Varicoli	Refinery Road		18	Existing road to be widened
51	Regional		Puthiyakavu Jn (Thrippunithura)	Chottanikkara		18	Existing road to be widened
52	Regional	Fort Kochi - Chellanam Road	Fort Kochi	Alappuzha	7	15	Existing road to be widened
53	Link road		Fort Kochi-Chellanam Road	Kappalandimukku via Veli Jn		15	Existing road to be widened
54	Link road		Fort Kochi	Veli Jn		15	Existing road to be widened
55	Link road		Mundenveli Jn.	Koovappdam Jn. Via Santhom Jn		15	Existing road to be widened
56	Link road		Thoppumpady	Fort Kochi		15	Existing road to be widened

57	Link road		Soudia Jn	Thoppumpady		15	Existing road to be widened
58	Link road		Manassery	Palluruthy		15	Existing road to be widened
59	Link road		Old NH	Thevara		15	Existing road to be widened
60	Link road		Kumbalam South end	Kumbalam North end		15	Existing road to be widened
61	Link road		Kumbalam South Jn	Eastern side		15	Existing road to be widened
62	Link road	Market Road	Market Road (Thrippunithura)	Puthiyakavu Jn (Thrippunithura)		15	Existing road to be widened
63	Link road		Gandhi square	Kannankulangara PWD road		15	Existing road to be widened
64	Link road		East Fort Jn	North Fort Jn (via Temple)		15	Existing road to be widened
65	Link road		Hill Palace Jn	Chitrappuzha		15	Existing road to be widened
66	Link road		Atlantis Jn	Thykkoodam via Amala Bhavan Jn, Chilavannur		15	Existing road to be widened
67	Link road		Eroor - Manakkappady road from Sea Port Air Port Road	Extension upto Vyttila Thrippunithura Road		15	Existing road to be widened
68	Link road		Childrens Park	Sea Port Air Port Road via Eroor Road		15	Exisitng + part proposed
69	Link road		Vytila	Palarivattom		15	Existing road to be widened
70	Link road		HMT road	Sea Port Air Port Road at Navodaya Jn		15	Existing road to be widened

71	Link road proposed		Eloor Ferry	Fact Jn - Eloor North - Eloor Ferry (ring)		15	Existing road to be widened
72	Link road		Manjummel-Carborandum Road	NH47 (near Premier Jn)		15	Existing road to be widened
73	Regional	Vypeen - Munambam Road	Vypeen	Munambam	8	15	Existing road to be widened
74	Link road	East West linkage No 1	Kumbalangi Road			12	Existing road to be widened
75	Link road	East West linkage No 2	Kumbalangi Road			12	Existing road to be widened
76	Link road					12	Existing road to be widened
77	Link road	East West linkage 3 connecting Panagad and Cheppanam	Panangad	Cheppanam		12	Existing road to be widened
78	Link road	North South linkage 1 in Cheppanam				12	Existing road to be widened
79	Link road		Road from Atlantis Jn to Thykkoodam via Amala Bhavan Jn, Chilavannur	Kundannur		12	Existing road to be widened
80	Link road		Atlantis Jn	Banerjee Road (near Town Hall)		12	Existing road to be widened

81	Link road	Chitrappuzha-Magalium road	Refinery road	Sea Port -Air port Road		12	Existing road to be widened
82	Link road	North South linkage 3	Raod from Smart City Road (Behind Mental Hospital, Kusumagiri)	Extension of Thammanam - Pulleppady Road upto Smart City road		12	Existing road to be widened
83	Link road	North South linkage 4	Edappally Pukkattupady road	Palarivattom Thrikkakara road		12	Existing road to be widened
84	Link road	North South linkage 5	Edappally Pukkattupady road	Palarivattom Thrikkakara road		12	Existing road to be widened
85	Link road	East West linkage No 4	Road from South Kalamassery Jn to Edappally pookkattupady Road	Sea Port Air Port Road		12	Existing road to be widened
86	Link road	East West linkage No 5	Kapella Jn	Cheranellur road via Bhagavati temple		12	Existing road to be widened
87	Link road	East West linkage No 6	NH 17	Manjummel Jn		12	Existing road to be widened
88	Link road	East West linkage No 7	Pathalam Jn	Premier Jn		12	Existing road to be widened
89	Link road	East West linkage No 8	IAC Jn (Kalamassery)	Eastern boundary of Kalamassery		12	Existing road to be widened

Annexure D

Tentative Location of Parking Complexes/ multi level parking and peripheral parking lots

i. Parking complexes / multi level parking

1. MG road between Ravipuram & Pallimukku, 2 Nos
2. MG road between Pallimukku & Jos, 2 Nos
3. MG road between Jos & Ground, 2 Nos
4. MG road between Ground & Madhava pharmacy, 2 Nos
5. Banerji road between High court & Kacheripady
6. Banerji road between Kacheripady & ROB
7. Banerji road between ROB & Kaloor
8. Banerji road between Kaloor & Desabhimani
9. Banerji road between Desabhimani & Palarivattom
10. Marine Drive 4 Nos (Shanmugham road)
11. S.A road between Pallimukku & Valanjambalam
12. S.A road between Manorama & Kadavanthra
13. S.A road between Kadavanthra & Vyttila, 2 Nos
14. Broad way
15. Convent road
16. NH – 47 By pass
17. Kaloor – Kadavanthra road, 4 Nos
18. Kaloor – old NH, 2 Nos
19. Chittoor road near South area, Rajaji road, Padma
20. Kalamassery
21. Thoppumpady
22. Fort Kochi
23. Palarivattom, 2 Nos
24. Thripunithura

B. Peripheral parking lots

1. Edappally on NH – 47
2. Palarivattom on Kakkanad road
3. Vyttila on Thripunithura road
4. Kundannur on Aroor road
5. Mattancherry halt on old NH – 47
6. GIDA bridge on Vypeen road
7. Vaduthala on Chittoor road
8. Fort Kochi

TABLE 3.23 PROPOSED LAND USE

Sl. No	Land use	Thrikkakara			Varappuzha			Eloor			Cheranalloor			Maradu			Thiruvankulam			Thrippunithura		
		1			2			3			4			5			6			7		
		Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)
1	Residential	766.45	27.91	37.09	208.77	26.97	67.57	608.42	42.82	50.87	349.41	32.99	70.65	534.81	43.30	67.55	353.31	33.68	48.61	864.38	46.25	71.07
2	Commercial	97.07	3.54	4.70	6.25	0.81	2.02	47.84	3.37	4.00	19.78	1.87	4.00	45.63	3.69	5.76	36.34	3.46	5.00	60.81	3.25	5.00
3	Public & Semi public	202.70	7.38	9.81	26.86	3.47	8.69	82.43	5.80	6.89	44.51	4.20	9.00	60.41	4.89	7.63	55.35	5.28	7.61	97.14	5.20	7.99
4	Industrial	512.07	18.65	24.78	3.25	0.42	1.05	302.72	21.30	25.31	2.99	0.28	0.60	0.38	0.03	0.05	140.55	13.40	19.34	18.20	0.97	1.50
5	Transportation	200.00	7.28	9.68	40.00	5.17	12.95	70.94	4.99	5.93	43.25	4.08	8.75	95.03	7.69	12.00	84.61	8.07	11.64	90.59	4.85	7.45
6	Park & Open spaces	169.88	6.19	8.22	21.63	2.79	7.00	83.72	5.89	7.00	34.62	3.27	7.00	55.42	4.49	7.00	50.88	4.85	7.00	85.14	4.56	7.00
7	Others (SEZ and Unclassified area)																					
8	Paddy/ Wet land	584.38	21.28		303.45	39.21		147.97	10.41		403.74	38.12		234.92	19.02		261.74	24.95		507.75	27.17	
9	Agriculture (Dry Cultivation)	118.27	4.31	5.72	0.91	0.12	0.29										5.84	0.56	0.80			
10	Water bodies	95.19	3.47		161.56	20.87		76.96	5.42		160.70	15.17		208.40	16.87		60.37	5.76		145.00	7.76	
	Total	2746.00	100.00	100.00	774.00	100.00	100.00	1421.00	100	100	1059.00	100	100	1235.00	100	100	1049.00	100	100	1869.00	100	100

Contd……

TABLE 3.23 PROPOSED LAND USE

Sl.No	Land use	Kalamassery			Kochi			Kumbalam			Kumbalangi			Chellanam			Vadavukodu Puthenkurisu		
		8			9			10			11			12			13		
		Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)	Land area (Ha)	Final % (Gross)	Final % (Net)
1	Residential	695.05	25.74	31.09	4147.56	43.71	60.12	697.59	33.55	73.74	292.69	18.56	71.28	495.41	28.15	84.95	1263.90	34.26	38.82
2	Commercial	89.43	3.31	4.00	344.93	3.64	5.00	37.84	1.82	4.00	20.53	1.30	5.00	11.66	0.66	2.00	90.93	2.46	2.79
3	Public & Semi public	506.94	18.78	22.67	776.10	8.18	11.25	85.14	4.10	9.00	46.20	2.93	11.25	26.24	1.49	4.50	204.60	5.55	6.28
4	Industrial	481.38	17.83	21.53	173.50	1.83	2.51	1.71	0.08	0.18	0.93	0.06	0.23	10.63	0.60	1.82	1209.93	32.80	37.16
5	Transportation	244.44	9.05	10.93	691.98	7.29	10.03	57.51	2.77	6.08	28.70	1.82	6.99	29.05	1.65	4.98	102.03	2.77	3.13
6	Park & Open spaces	195.63	7.25	8.75	362.18	3.82	5.25	66.22	3.19	7.00	14.37	0.91	3.50	10.21	0.58	1.75	159.13	4.31	4.89
7	Others (SEZ and Unclassified area)				397.30	4.19	5.76												
8	Paddy/ Wet land	430.41	15.94		441.02	4.65		281.27	13.53		301.21	19.10		999.24	56.78		284.79	7.72	
9	Agriculture (Dry Cultivation)	22.14	0.82	0.99	5.11	0.05	0.07				7.22	0.46	1.76				203.87	5.53	6.26
10	Water bodies	33.79	1.25		2148.33	22.64		851.71	40.97		865.15	54.86		177.56	10.09		148.28	4.02	
	Total	2700.00	100	100	9488.00	100	100	2079.00	100	100	1577.00	100	100	1760.00	100	100	3689.00	100	100