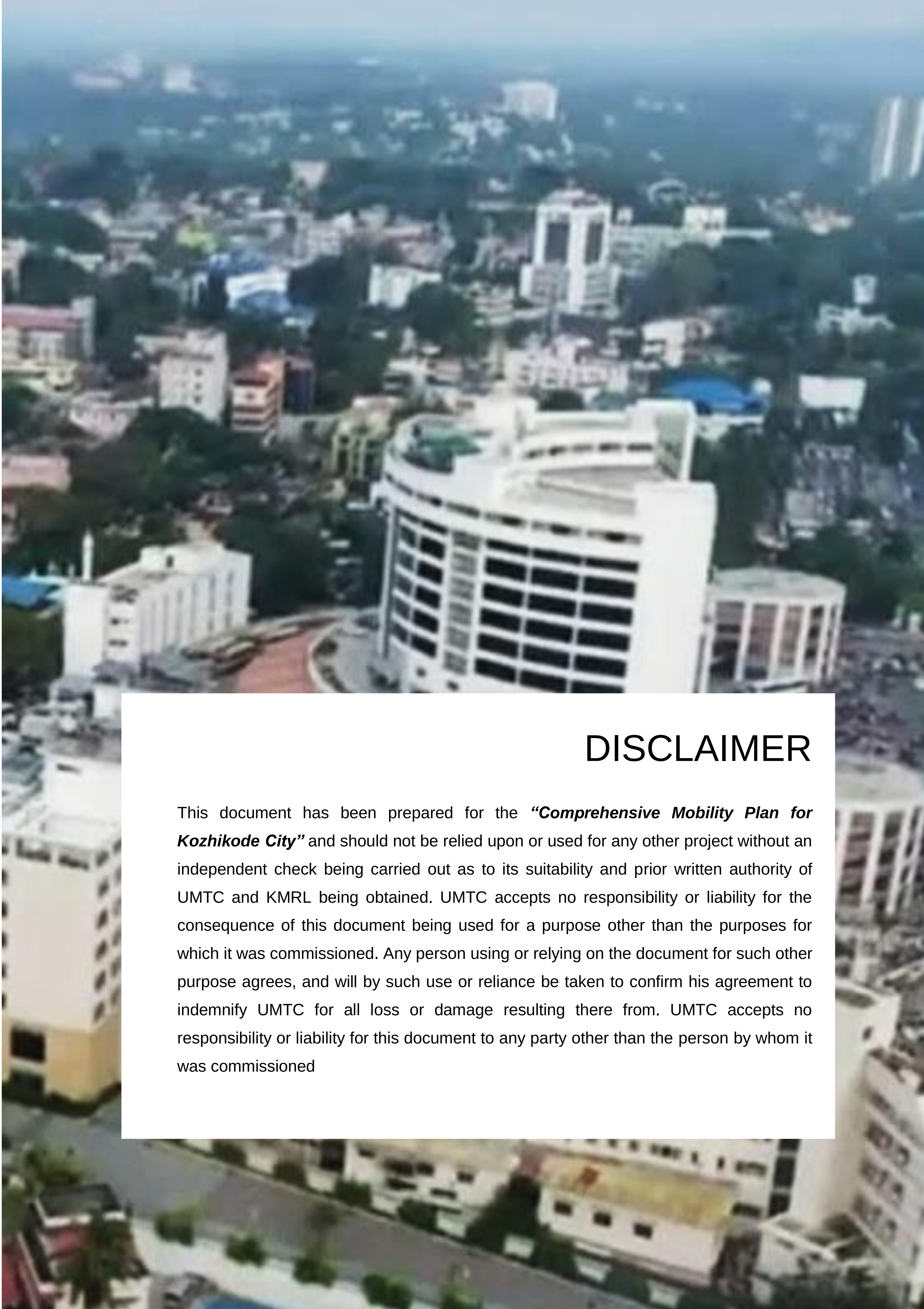
DRAFT CMP REPORT - 2023

COMPREHENSIVE MOBILITY PLAN KOZHIKODE

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited



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ABBREVIATIONS

ATL	Average Trip Length
CMP	Comprehensive Mobility Plan
DPR	Detailed Project Report
ECS	Equivalent Car Space
GIS	Geographical Information System
GoI	Government of India
GoK	Government of Kerala
GHG	Green House Gases
IPT	Integrated Public Transport
IT/ITES	Information Technology and Information Technology Enabled Services
ITS	Intelligent Transport System
JnNURM	Jawaharlal Nehru Urban Renewal Mission
kmph	Kilometres per hour
KMC	Kozhikode Municipal Corporation
MoHUA	Ministry of Housing and Urban Affairs
MoRTH	Ministry of Road Transport and Highways of India
MRTS	Mass Rapid Transit System
KMRL	Kochi Metro Rail Corporation
KSRTC	Kerala State Road Transport Corporation
KURTC	Kerala Urban Road Transport Corporation
NATPAC	National Transport Planning and Research Center
NH	National Highway
NMT	Non-Motorized Transport
PCTR	Per Capita Trip Rate
PCU	Passenger Car Unit
PT	Public Transport
PHPDT	Peak Hour Peak Direction Traffic
RNI	Road Network Inventory
SH	State Highway
UMTC	Urban Mass Transit Company


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EXECUTIVE SUMMARY

KOCHI METRO RAIL LIMITED

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EXECUTIVE SUMMARY

Kozhikode is one of the fastest growing economic centres of north Kerala. The city's cultural and economic characteristics can be traced down to the ancient times where Kozhikode acted as a prominent port on the Arabian Sea which was a prominent international trade route. The city has undergone transformation in many aspects, especially in transportation network and landuse pattern, However, the supporting infrastructure and urban services provision have been unable to match this transformation. To solve the traffic and transportation issues, it is proposed to conduct a comprehensive transportation study to prepare long-term urban transport strategy for an improvement of people's mobility and to identify specific proposals for upgradation of transport infrastructure / facilities to ease the congestion level. The study is designed to provide the broad parameters for the long term development of transport infrastructure setting objectives for the next three decades.

Figure 0-1 Kozhikode Ariel View

In this regard, Kochi Metro Rail Corporation Limited (KMRL) has appointed Urban Mass Transit Company (UMTC) to prepare a Comprehensive Mobility Plan (CMP) to provide comprehensive transportation strategies and policy measures for Kozhikode. The Comprehensive Mobility Plan (CMP) recommended by Ministry of Housing and Urban Affairs (MoHUA) is a long-term vision for desirable mobility patterns in the city and provides comprehensive and integrated transportation strategies and policy measures. CMP document is a roadmap for the transport infrastructure development and its investments in line with the Sustainable Urban Transportation principles.

With a vision to strengthen transportation system of this rapidly urbanizing city in a sustainable manner while catering to the horizon year mobility needs, the study aims to provide the users in Kozhikode a roboust road and public transportation network providing inclusive sustainable travel mode choices for all users and through a safe, comfortable and seamless travel experience in the study area. The study time for the study is considered as 30 years, in line with the MoHUA CMP toolkit Guidelines.

STUDY AREA PROFILE

Kozhikode is situated on the South-West coast of India. The district is bordered on the North by Kannur district, on the East by Wayanad district, on the South by Malappuram district and on the West by the Arabian sea. The city is situated in latitudes 11°15' N and longitudes 75° 46' E. The core city has Korappuzha as its North boundary; Olavanna, Kakkodi, Kunnamangalam and Peruvayal panchayats on the East; Chaliyar river on the South and Lakshadweep Sea on the West. Kozhikode Corporation is the headquarters of Kozhikode District, covering an area of 2344 Sq.km on an undulating terrain with ground level varying from 2 m to 1339 m from the mean sea level. Kozhikode has a dense and broad road network that connects it to locations in neighbouring states. Kozhikode is linked to all of India's main cities through road, rail, and air.

The study area is well connected to other urban centres via National and State Highways, regional railways and by domestic airways.

- City can be accessed from the North South Corridor National Highway (NH) 66, via NH 766 (Wayanad Road) at Salem, and at Kochi via NH 66. NH-66 passes to the centre of the study area, which is the main spine of city’s road network. The city is also connected by the Mavoor Road and SH 38, Balusserri Road.
- Kozhikode central station and six stations that serve the study area catering to 25 thousand passengers daily (Refer Section 2.10).

Title: Comprehensive Mobility Plan for Kozhikode	KOCHI METRO RAIL LIMITED Urban Mass Transit Company Limited
Name: Horizon Year Population	

Figure 0-2 Map Showing Major Nodes and Linkages for Regional Connectivity

- While air connectivity to domestic[1] and international[2] urban centres is cater by over 400 weekly operations (Refer Section 2.9 for further details).
- Kerala State Road Transportation Corporation (KSRTC) and various other private players operate sub-urban and regional services in the study area. There are 365 city services plying in the city.

STUDY AREA DELINEATION, DEMOGRAPHIC AND ECONOMIC PROFILE

Considering the pattern of urbanization, and demographic trends in the region, it is observed that a rapid and continuous urbanization has observed towards the south of the Municipal Corporation and towards the west along the National highway, with the emergence of a number of institutions along it. Therefore, the study area delineated for the study is proposed to include the following:

1. Kozhikode Municipal Corporation
2. Ramanattukara Municipality
3. Feroke Municipality
4. Kadalundi Grampanchayat
5. Olavanna Grampanchayat
6. Kunnamangalam Grampanchayat

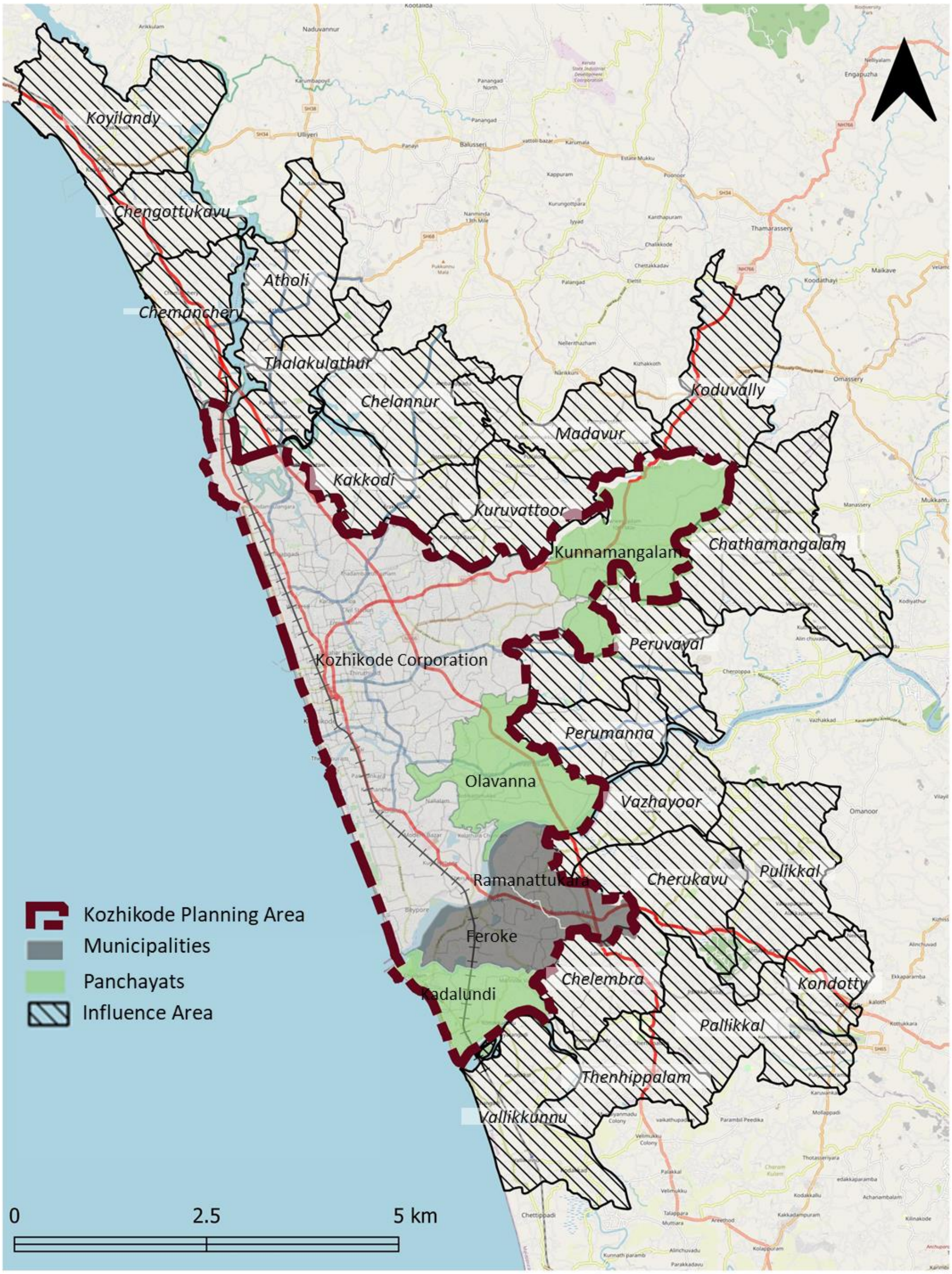
Table 0-1 CMP Kozhikode Study Area Details

KOZHIKODE PLANNING AREA			
S. No.	Subdivisions	Area (in sq. km)	Population (2011) in Lakhs
1	Kozhikode Corporation (75 Wards)	118	6.08
Municipality			
2	Feroke	15	0.54
3	Ramanattukara	12	0.36
Panchayat			
4	Kadalundi	12	0.43
5	Kunnamangalam	30	0.47
6	Olavanna	23	0.68
Total	Kozhikode Planning Area	210	8.57

The study area delineation is in line with the Urban Agglomeration of Kozhikode according to the 2001 census, which extends up to Kunnamangalam in the east, Ramanattukara in the south, and Elathur in the north.

[1] Offering connectivity to Chennai, Hyderabad, Mumbai, Daman, Bengaluru, Kochi, Delhi, Kannur, and Trivandrum.

[2] Kuwait, Doha, Dubai. Abu Dhabi, Bahrain, Colombo, Sharjah, Singapore and Muscat.



Title: Comprehensive Mobility Plan Kozhikode	KOCHI METRO RAIL LIMITED / Urban Mass Transit Company Limited
Name: Study Area	

Figure 0-3 CMP Kozhikode, Study Area

Although the planning boundary comprises of the above mentioned areas, during the discussions with the key stakeholders, it was identified that there are other outgrowths beyond the planning boundary, which are influenced by the planning area in terms of their dependency for various industry workers, educational and work facilities to name a few. To cater to this, the municipalities of Koyilandy, Tenhipalam (Universities) and Kondotty (Calicut Airport) along with the panchayats of Chemancheri, Chengottukavu, Atholi, Thalakulathur, Kakkodi, Kuruvattur, Peruvayal, Perumanna, Vazhayoor, Pulikkal, Cherukavu, Vallikkunnu, Chelembra, Pallikkal are considered as the planning influence area.

- The State Urbanisation Report (SUR) has assumed that urban clusters identified as per urban profile for 2021 grow along corridors identified and finally form urban corridors, by clubbing nearest clusters along major national highways.
- Being a coastal city, Kozhikode has been growing around Palayam, which is the nodal point of trade and commerce and other major linkages that emerged over time. The city has been seen to be growing towards the south, east and towards the north.
- The Kozhikode Municipal Corporation (KMC) has an area of 118 sq.km. As per the 2011 census, the delineated study area had a population of 8.56 lakh. The study area excluding the corporation is 92 sq.km. As per the 2011 census, the municipal corporation boundary has recorded a total population of 6.0.8 lakhs. The Population density in the corporation area is 6532 persons/Sq.km.
- Linear population growth is considered for the base year projections in line with the draft proposed Master Plan -2040.

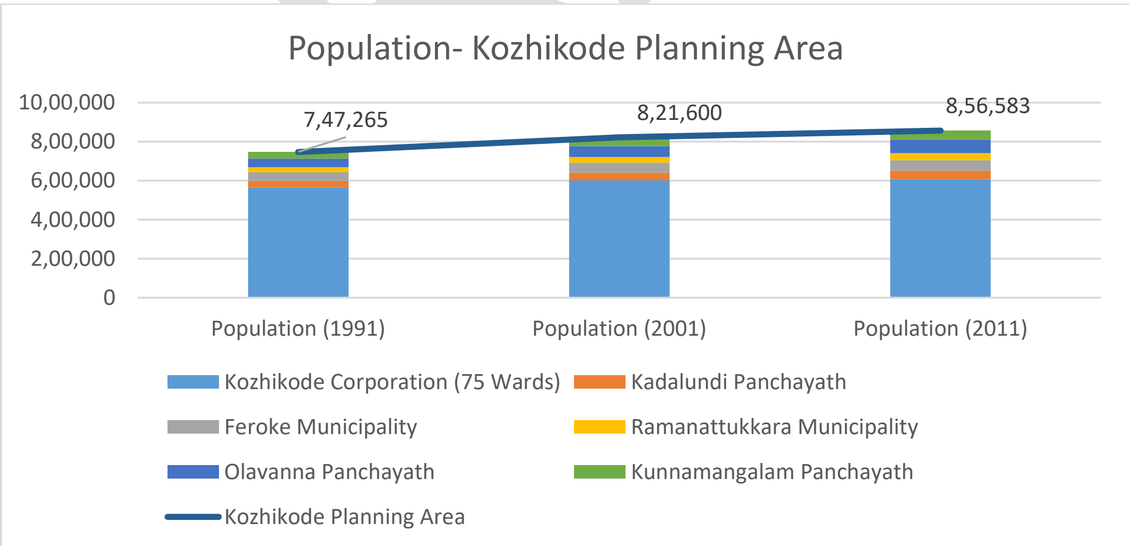


Figure 0-4 Growth Pattern [3]

[3] Source: National Remote Sensing Center, ISRO

- The population density of the study area is observed to be 3630.60 pp sqkm for the base year 2023, accounting to be third dense urban area in the state followed by Kochi and Kozhikode. The average household size in Kozhikode is 4[4].
- In Kozhikode Corporation, the commercial land uses are concentrated in the city core – Valiyangadi-Palayam- Mavoor road areas, and industrial uses are concentrated in Cheruvannur – Nallalam and West Hill areas. Public and Semi-public uses are distributed all over the Corporation area. The share of transportation accounts to about only 1% in the total area.
- The propose master plan has prioritized High Density Residential use constitute the highest share, with 44.52% of the area of proposed land uses for the Corporation area followed by 16.60% mixed use zone.
- Workers in Kozhikode Corporation in 2011 constitute 20.36% of the total workers' in Kozhikode District. Studies carried out reveal that there is decrease in participation rate in primary and secondary sector and increase in participation in tertiary sector activities.

Table 0-2 Total Resident Workers in the Study Area5

Area	2011
Kozhikode Corporation	31.77%
Ramanattukara Municipality	30.26%
Feroke Municipality	28.89%
Olavanna Panchayat	32.94%
Kadalundi Panchayat	29.42%
Kunnamangalam Panchayat	29.66%

- The central business district in the study area houses the Palayam, Manachira, SM Street etc The secondary business centres house areas such as West Hill and adjacent industries. etc and the peripheral business centres which area recent and upcoming business centres include Beypore, Ramanattukara, Pantheerankavu, Kunnamangalam and so on.

[4] Primary Survey Analysis

[5] Census 2011

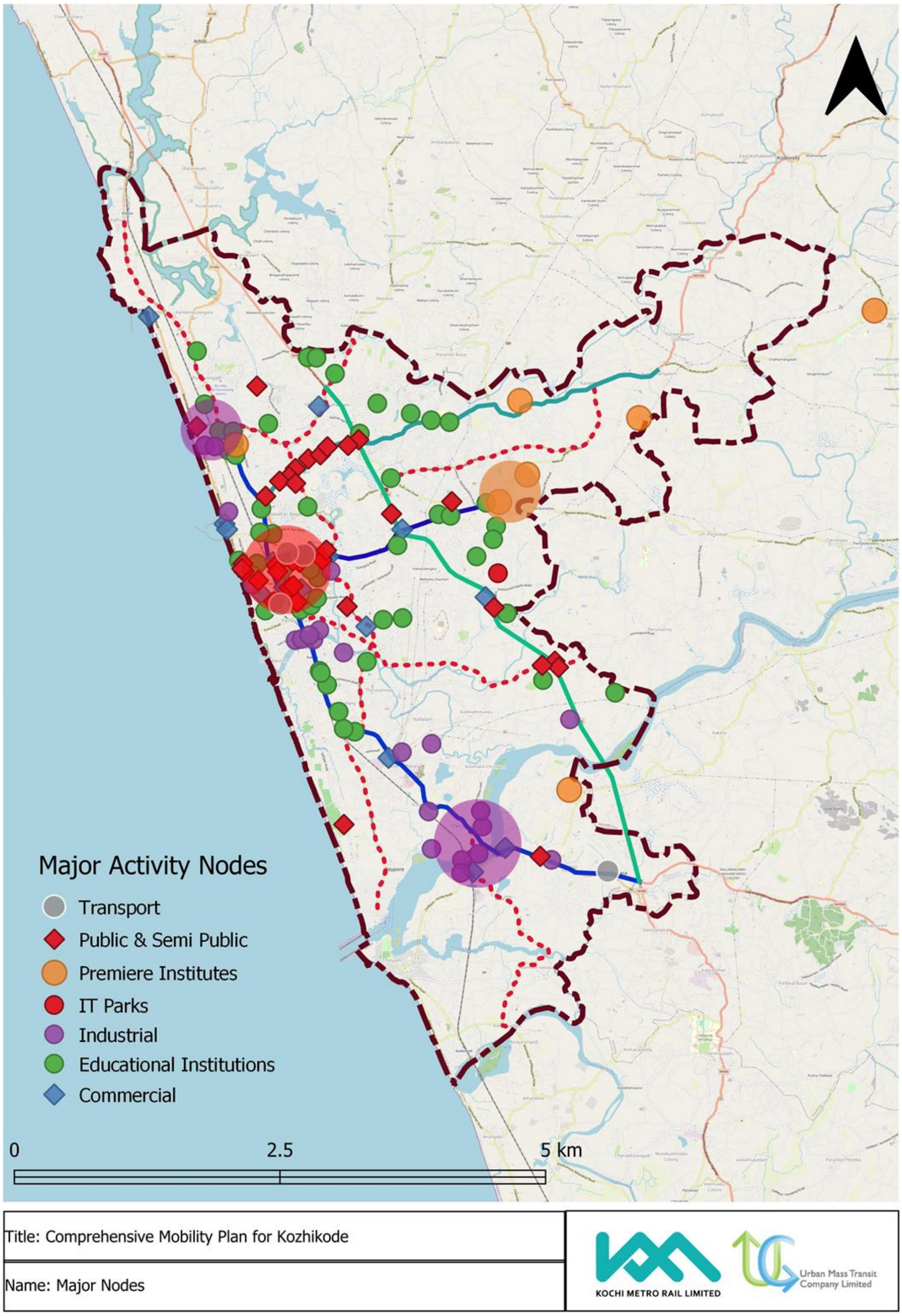


Figure 0-5 Map Showing the clustering of economic activity nodes in the study area (Source: Primary and Secondary Data Assessment, 2022)

EXISTING TRANSPORTATION SYSTEMS

- The city has a distorted grid iron pattern in the center with a few radials emerging from it. The major roads are: NH-66 passing through the eastern boundaries of the city covering important traffic generating points like Thondayad, Pantheerankavu, Ramanattukara etc, Kannur Road, Mavoor Road, SH 28, Calicut Road, NH 966, Kozhikode-Palakkad Highway, Wayanad Road, Beach Road (major recreational spot in the city)

- **VEHICLES REGISTERED:** The registered vehicle in Kozhikode is about 6.3 lakhs[6]. The cumulative annual growth rate (CAGR) of registered vehicles is 6% with Two-wheelers constituting the highest share of vehicles registered in Kozhikode7.

- AIR BASED PUBLIC TRANSPORTATION (REGIONAL) The airport is approximately 25 kilometers towards west from the city center Kondotty Airport offers direct flights to the Middle East, Singapore, Malaysia, Maldives, Sri Lanka and many other Indian cities. The Regional Airport of Kozhikode has an average daily passenger flow of 8600 passengers with 62 flights daily.

- RAIL BASED PUBLIC TRANSPORTATION Rail transport system caters mainly to the needs of inter-city passenger and goods traffic. A Broad-Gauge railway line running almost parallel to and west of NH-17 connects Shornur and Mangalore Junctions of Southern Railways. The Kozhikode railway station handles more than 50,000 passengers a day.

[6]https://vahan.parivahan.gov.in/vahan4dashboard/vahan/dashboardview.xhtml;jsessionid=837CC726DE236F40E6F0CAE69CC15083

[7] MoRTH Data

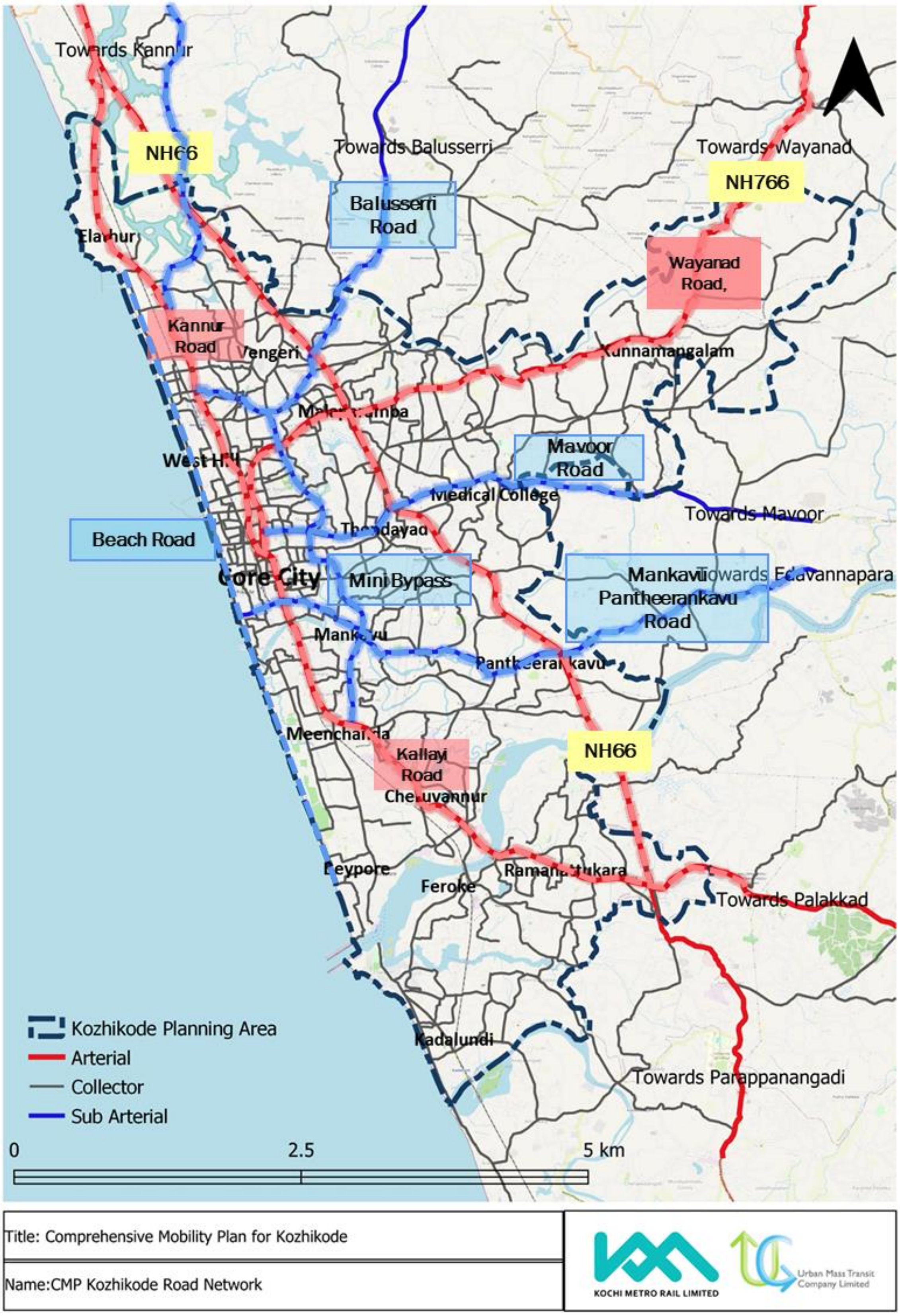


Figure 0-6 Road Network showing Major Roads (Primary Surveys, 2022)

- BUS BASED PUBLIC TRANSPORTATION: Kozhikode being a major economic node and employment generator of the district, is well connected to other parts of the state using public transport. The major portion of the city's public transit system is held by its private bus operators and a few portion of the regional transport is held by the KSRTC (Kerala State Regional Transport Corporation). The major corridors are observed to be aligning towards:

  1. Along the cost: West Hill- Palayam- Meenchanda
  2. As Radials emerging from Palayam- a) Palayam- Medical College, b) Palayam Mavoor, c) Palayam Ramanattukara

- Currently there are 365 private bus permits issued by the Kozhikode RTO, out of which about 250 services cater within the study area limits during the peak hour.

- INTERMEDIATE PUBLIC TRANSPORTATION: Auto-rickshaws and Taxis are the inter-mediated public transport modes in Kozhikode that provide door to door connectivity. Currently, there are 5540 auto city permits issued in for the city by the RTO in Kozhikode. The average number of passengers carried per trip is 2.9 for Auto and 1 for Taxi.
- NON-MOTORIZED MODES: The pedestrian and bicycle infrastructure and facilities in the city are inadequate. The physical infrastructure facilities for pedestrians are observed along the arterial and sub arterial network. In many arterial and sub arterial roads, footpaths are not maintained and have undulation while walking.

- PARKING: Though there where several off street parking facilities available in different parts of the city, they are often underutilised as there are no restrictions on parking along the streets in the city. One such example is the unregulated parking around Mananchira Square and the underutilised off street parking facility which is available within a few metres away from Mananchira.

- FREIGHT TRANSPORT: Freight focal points in the city can be seen to be scattered in the north to south direction in the city, mostly towards the coastal side. While the north and central freight generating areas mostly consists of agricultural and fisheries related products, southern areas consists of timber, oil and other small and medium scale industrial products. The goods vehicles are largely parked on either side of the roads due to lack of frieght terminals in the city.
- SEA PORT: Beypore is an ancient port town in Kozhikode district in the state of Kerala, India. It is currently a notified port between Kadalundi and Puthiyappa. It is situated at the mouth of River Chaliyar directly facing to the Arabian Sea. Beypore port has a 300m wharf

with adequate cargo handling gears like Mobile Harbour Crane, Reach stacker, Stationary cranes and 3200 sqm storage facility.

- ROAD SAFETY: The number of fatalities per lakh population in the study area has increased from 14.3 in 2016 to 19 in 2022, indicating an alarming value and the need to improve the road safety in the study area.

EXISTING TRAVEL CHARACTERISTICS

- ROAD NETWORK CHARACTERISTICES: The surveyed network indicates that on 16% of the corridors have Right of Way (ROW) availability over 18m. The distribution of ROW on the surveyed network in presented in the below figure. The exiting surveyed corridors constitute carriageway between 6m to 12m indicating the unavailability of reasonable road space in terms of lane configurations on major corridors. However, only 36% of the survey network had ROW over 12m.10% of the major network has footpath availability in the study area. And only 4% of the network has footpaths over 2m widths indicating the need to improve pedestrian infrastructure in the study area. The analysis indicates that about 30% of the major network has on-street parking hindering the road space allocated for traffic flow and pedestrian movement.
- NETWORK SPEED: The average journey speed in the study area, in core areas is 20.4kmph, while the journey speed in the non-core areas is 28.3kmph. The peak hour speeds of the selected locations in the city are as given below: The average delay of 9.6 minutes is observed in the study area during peak hours on major corridors. The major reasons for Delay is largely due to traffic and signals.
- TRAFFIC VOLUMES: It is observed that highest outer cordon traffic volumes are observed on NH-66- Kozhikode Bypass road followed by Palakkad – Kozhikode Highway, NH 966. About 55% of the vehicle composition at outer cordons in constituted by two-wheeler and about 27% is constituted by Goods. The highest traffic volumes at screen line locations are observed on Kundanamkadavu followed by Arapuzzha bridge and CH Overbridge. The least volume was observed over Kaipurath Bridge. About 71% of the vehicle composition at screen lines in constituted by two-wheeler and about 16% is constituted by car. The highest traffic volumes at intersection locations are observed at Thondayad Junction, followed by Eranjippalam, Palayam and Malaparamba. This indicates that the high volumes are observed along the NH 66 and city core and there is a need to address and decongest the core area and the corridor. It is observed that about 58% of the vehicle composition at intersections in constituted by two-wheeler and about 22% is constituted by car.

- PUBLIC TRANSPORTATION (PT) PASSENGER VOLUMES: The primary survey assessment shows a daily footfall of nearly 50 thousand passengers at the major public transportation terminals in the study area. It is seen that Calicut Railway Station and the KSRTC Bus Stand are the major terminals with high passenger footfalls. The primary survey assessment shows a daily footfall of nearly 24 thousand passengers at the major bus stops in the study area with an average passenger occupancy of 28 persons per bus. It is seen that Feroke bus stop has the highest footfall due to its proximity to various educational institutions and activity centres followed by Karanthur and Medical College bus stops.

- PARKING: The parking assessment was carried out at major locations in the study area, it indicated that highest on-street parking accumulation in Beach Road and Calicut Road near Kallayi The average parking density at major location in the study area is about 229 with an average parking duration of 78 mins. The maximum accumulation observed during the Off Street parking analysis is at KSRTC Pay & Park and the overall average parking duration was observed to be around 5 hours.
- SOCIO-ECONOMIC CHARACTERISTICS: The average household size is observed to be 4 with average number of 1.1 earning members per household. The classification based on the category of vehicles owned indicates that 5% of the households own no vehicle while, 72% of the households own on two-wheelers.

- The Per Capita Trip Rate (PCTR) was observed to be 1.01 including the walk trips and 0.94 excluding the walk trips. The PCTR for motorized trips is about 0.92.

- The major modes of travel are observed to be two wheelers with a modal share of 49% while the share of bus based public transport accounts to only 25%, clearly indicating that private mode dominance mode over public buses.

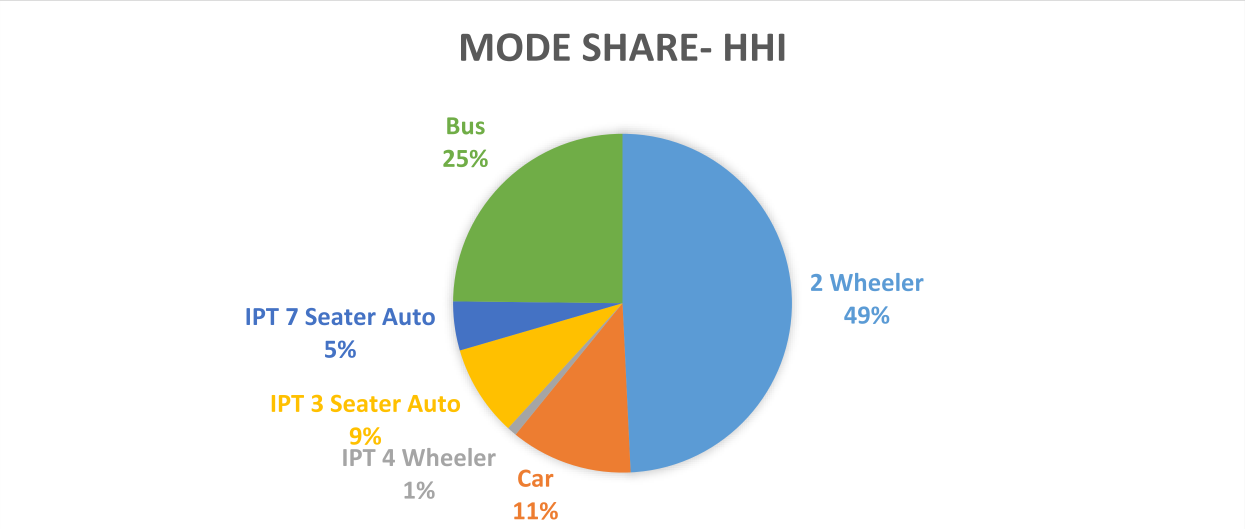


Figure 0-7 Mode Share (Primary Surveys-2022-23)

- The observed average trip length in is observed to be 5.78 Km including the walk trips and 6.02 km excluding the walk trips.
- GOODS VEHICLE CHARACTERISTICES: About 52% of the trips are observed on occasional basis, indicating predominant intra-city interactions. The survey indicated that majority (56%) of the operators have parking facilities available within their premises. Other operators often park their vehicles on the streets. The major issues expressed by the goods operators are,
  - Lack of Parking facilities
  - Lack general facilities and terminals
  - Lack of Narrow Roads

The average number of trips made by goods vehicles is 34 Trips per month. It is observed that majority of the heavy goods vehicles ply through NH-66, Beach Road, Wayanad Road etc.

SERVICE LEVEL BENCHMARKING

Benchmarking helps to establish baseline measures of performance, and helps monitor the agency's individual performance over time, and also how it compares with the other organizations, and also improving performance by sharing of lessons learnt from different entities. The service level benchmarks (SLB) issued by MoHUA specify parameters to measure the effectiveness of existing land use-transport planning in the study area and set benchmarks for achieving the same.

SUMMARY OF SLB INDICES:

The summary of the indices is as presented below:

Table 0-3 Summary of SLB Indices

SN	BENCH MARK	OVERALL LOS	INFERENCE AS PER MOUD GUIDELINES
1	Public Transport Facilities	**2**	The study area indicates the availability of good public transportation services. However, integration of the services and developing a high capacity PT system would further enhance and cater to the growing travel demand in the state capital city
2	Pedestrian infrastructure facilities	**2**	The city has minimal pedestrian facilities which need immediate improvements especially at intersections and unobstructed footpaths it.
3	Non-Motorized Transport Facilities	**3**	The city has minimal NMT facilities which needs considerable improvements as many parts of the study area are not served by it.
4	Level of usage of Intelligent Transport System (ITS) Facilities	**4**	The study needs improvement in adequate ITS facilities.
5	Travel speed (Motorized and Mass transit)	**3**	The study area has considerable travel speeds for the existing but with small increase in flow may cause substantial increases in approach delay and hence decrease in arterial speed in the horizon years.
6	Availability of Parking places	**3**	The authorities need to initiate immediate actions with respect of providing paid parking spaces and demand management for parking.
7	Road safety	**3**	Need considerable improvements in road design and available road infrastructure, traffic management and other such reasons which contribute significantly to road safety.
8	Pollution levels	**1**	Level of pollution in a study area is not alarming, however the quality can be improved by encouraging and introduction the usage of public modes rather than the private modes.
9	Integrated land use Transport system	**4**	Need to improve the coherence between study area structure and public transport system.

Note: The LOS 1 represents the highest performance level whereas LOS 4 represents the Lowest.

SUSTAINABLE URBAN TRANSPORT MEASURES

In line with the NUTP principles, the mobility goals for Kozhikode have been addressed through a multipronged approach. Solutions for complex transport improvements cannot be achieved by a single strategy.

The following strategies have been adopted in tandem to meet the various goals set for the study area.

- Land Use and Transport Strategy
- Road Network Development Strategy
- Public Transit Improvement Strategy
- Intermediate Public Transit Improvement Strategy
- Non-Motorized Transport Strategy
- Freight Management Strategy
- Traffic Engineering and Travel Demand Management Strategy
- Technological Transition Strategy

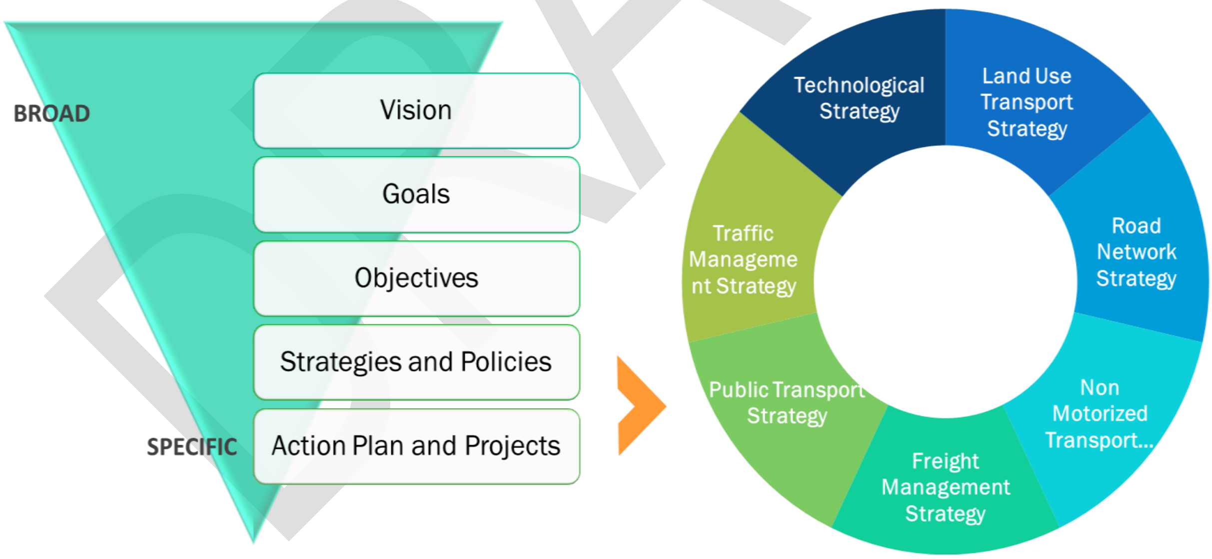


Figure 0-8 Kozhikode CMP Urban Transport Strategies

LAND USE AND TRANSPORT PLAN

The land-use transport strategy developed focuses on accessibility, connectivity, and mixed land use developments to minimize private vehicle trips, encourage transit-oriented development. In the long term, the transport strategy should be based on the urban growth envisaged for the city.

MULTI NODALURBAN FORM DEVELOPMENT CONCEPT

Multi-Nodal development structure recommended Kozhikode would decongest the core area and for efficient and equitable distribution of transport demand throughout the city, it is imperative to develop sub-city centre in different places of the city. These growth centres or sub-centres shall be connected through efficient city public transportation systems strengthen by high density growth corridors on either sides.

Multiple sub-centres are recommended based on the proximity to the main city centre, i.e. within immediate, medium proximity and Low proximity for development as shown in the table below.

Table 0-4 Proximity of Core and Sub-Centres

CENTRE AND SUB- CENTRES	AREA NAMES	DESCRIPTION
CORE AREA	Palayam, Railway Station	Constitute the core areas of the study area and major activity attraction nodes housing commercial, government offices, heritage zones, transit stations, etc. These areas constitute to high travel demand are require to be connected by high quality of public transport and NMT infrastructure, Parking and Traffic management strategies. The same has been proposed in the following sections.
IMMEDIATE PROXIMITY SUB-CENTERS	Nadakkavu, Meenchanda, Mananchira, Malaparamba	These are major development node within the study area with considerable travel demand owing to the educational and governmental institutional, Commercial centres, Transit stations, etc. These areas have the maximum potential for immediate development owing to the proximity. These areas require high quality of public transport and NMT infrastructure, Traffic management strategies for the ease of vehicles and passengers. The same has been proposed in the following sections.
MEDIUM PROXIMITY SUB-CENTERS	Mankavu, Beypore, Ramanattukara, Thondayad, Medical college, West Hill, Kunnamangalam	These are the newly developing growth centre with potential economic activity to act as strong growth anchoring nodes in the study area. These areas house, IT Parks, Seaport, Tourism centres, industries and commercial zones. These high employment generations nodes require strong and seamless connectivity to the city centre, thus, provision of high quality public transportation system and improved road connectivity for passenger vehicles and goods are considered.
LOW PROXIMITY SUB-CENTERS	Elathur, Vengeri, Kadalundi, Feroke, Chruvannur	These are there important satellite towns of the city. However, owing the growth pattern towards the south, Ramanattukara has significant trip interaction with the city centre. The linear growth between these towns and core area requires improved connectivity, thus, provision of high quality public transportation system and improved road connectivity are considered.

It is vital to develop and strengthen these areas with activity generators such as colleges, industries, employments hubs and so on as part of the land use strategies in Master Plan.

GROWTH CORRIDORS AND TRANSIT ORIENTED DEVELOPMENT CONCEPT

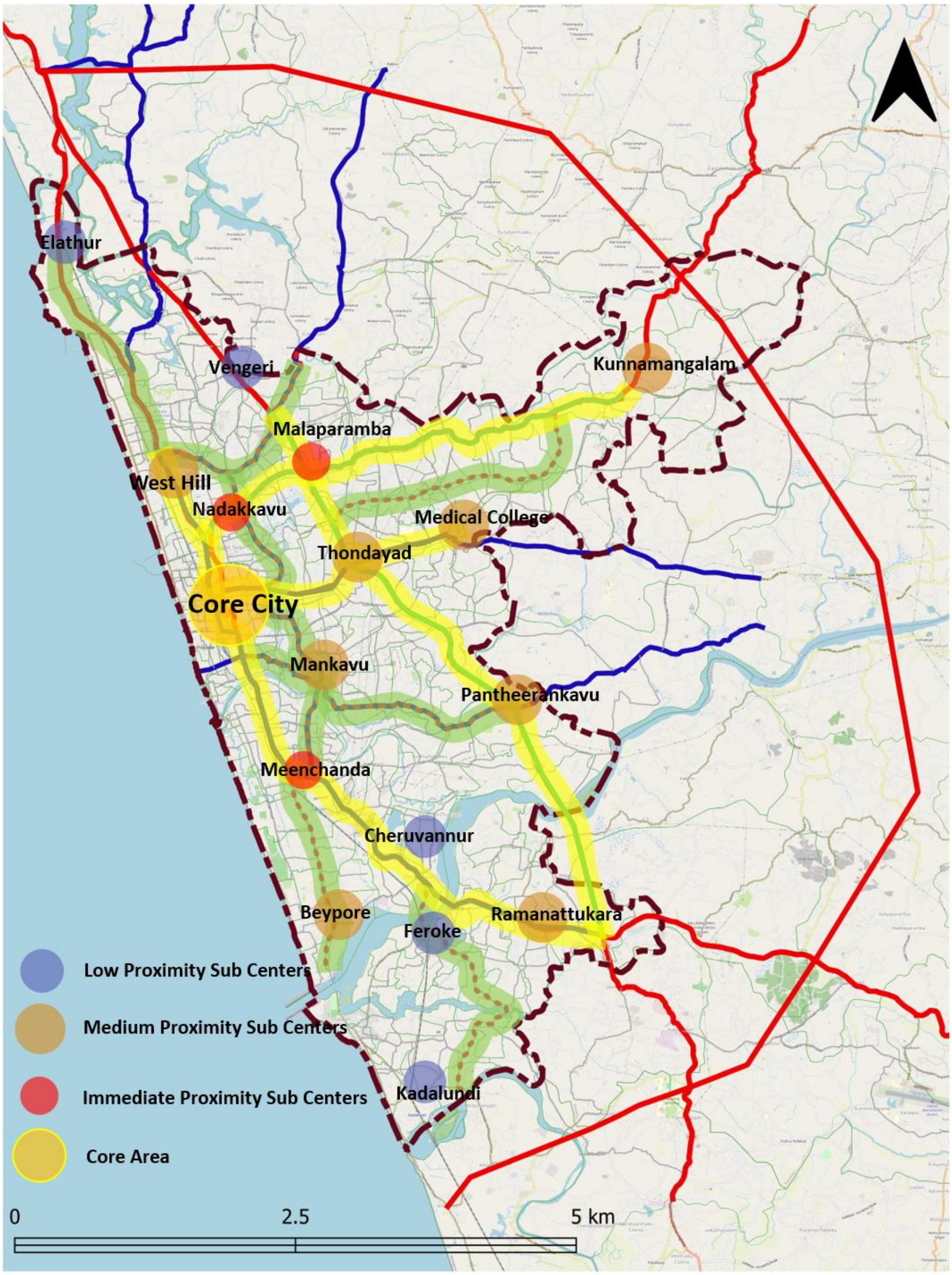
To maximize the passenger throughput, these corridors should be developed on the concepts of high density, mixed land use must the developed along the major mobility corridors in the city.

- Mixed use development that is cognizant of the low-income users of the transit system is important. It is necessary to create environments where walking and transit are viable transportation options by making it easier to go from one transportation mode to another, the connection between community and development is enhanced ensuring that a community is accessible to all.
- Resilient neighbourhoods will provide the needs of daily living, within walking distance (1/2 to 1 km radius) as shown in the figure below.

The recommend corridors are as follows,

Table 0-5 Recommended TOD and Growth Corridors

SN	NAME OF THE CORRIDOR	LINK NAME	LENGTH (KM)	TYPOLOGY
1	West- Hill to Ramanattukara	Calicut Kannur Road	19	TOD Corridor
2	Mananchira- Medical College	Mavoor Road	6.8	TOD Corridor
3	Vengeri to Ramanattukara	NH 66	17.2	TOD Corridor
4	Nadakkavu to Kunnamangalam	NH 766	13.1	TOD Corridor
5	West Hill Chungam to Bypass Junction	Mini Bypass Road	11.6	Growth Corridor
6	Meenchanda to Beypore	Beypore Road	5.7	Growth Corridor
7	Mankavu to Pantheerankavu	Mankavau Pantheerankavu Road	9.2	Growth Corridor
8	Cheruvannur to Kottakadavu	Calicut- Feroke Kadalundi Road	8	Growth Corridor
9	Thondayad to Karanthur	Mayanad Bypass	9	Growth Corridor
10	West Hill to Elathur	Kannur Road	6.6	Growth Corridor
11	Karaparamba to Kakkodi	Balusserri Road	4.3	Growth Corridor



Title: Comprehensive Mobility Plan Kozhikode	KOCHI METRO RAIL LIMITED / Urban Mass Transit Company Limited
Name: TOD Corridors & Growth Corridors	

Figure 0-9 Recommended TOD and Growth Corridors With growth centers

ROAD NETWORK STRATEGY

NETWORK STRUCTURE

The road network spatially displays topologic and geometric variations in their structure. This strategy aims at defining a clear network pattern and hierarchy of roads. Considering the proposed land use, semi-ring and radial network structure has been proposed.

Table 0-6 Recommended Semi-Radial Network

SN	NAME OF THE CORRIDOR	LENGTH (KM)	ROW (M)	TYPOLOGY
1	Atholi Kunnamangalam Athhanikkal Outer Ring Road	52	60	Outer Ring
2	NH-66	38.1	24	Ring
3	Mini-Bypass	11.6	24	Inner Ring
4	NH-766	27.0	24	Major Radial
5	Mankavu Pantheerankavu Road	4.2	24	Major Radial
6	Beypore Ramanattukara	6.4	30	Radial
7	Beypore Kadalundi Kottakadavu	42.0	30	Radial
8	Mavoor Road	20.0	30	Radial

UPGRADATION OF EXISTING ROAD NETWORK CAPACITIES

The study recommends 87 km of network widening after considering the functional hierarchy and development need. The widening of roads is proposed for upgradation of existing lane capacities, provision or improvement of NMT facilities. The proposal is phased out into three considering the importance of the road and its connectivity. In Phase I, which is the priority one, a total of 14 km of road widening. Whereas in Phase II a total of 24.4 km road will be widened and in Phase 3, 48 km road will be widened. The corridors suitable for upgradation of lane capacities or widening based on the horizon year demand in the study area are as follows,

Table 0-7 Recommended Roads for capacity upgradation

Road Name	Lane	Class	Length
	Phase 1		
Thondayad Puthiyara Road	4 Lane	Collector	2.18
Madhuravanam Road	4 Lane	Collector	0.55
Cherooty Road	4 Lane	Collector	1.15

Road Name	Lane	Class	Length
Bhatt Road	4 Lane	Collector	0.66
Mini Bypass	4 Lane	Sub Arterial	7.19
Rajaji Road	4 Lane	Collector	0.88
MM Ali Road	4 Lane	Sub Arterial	1.16
Phase 2			
Mankavu Pantheerankavu Road	4 Lane	Sub Arterial	5.07
Wayanad Kommery Road	4 Lane	Collector	3.16
Mankavu Pantheerakkavu Road	4 Lane	Sub Arterial	3.37
Kommery Kulangarapeedika Road	4 Lane	Collector	2.06
Olavanna Road	4 Lane	Collector	5.9
Kayattiyil Road	4 Lane	Collector	2.07
Kunduparamba Road	4 Lane	Sub Arterial	2.84
Phase 3			
Pallithara- Kadalundi RoadÂ	4 Lane	Sub Arterial	1.33
Beypore Road	4 Lane	Sub Arterial	5.89
Francis Road	4 Lane	Collector	1.21
Mankavu Mooriyad Road	4 Lane	Collector	2.34
Kovoor Vellaadikunnu Road	4 Lane	Collector	2.72
Kunduparamba Rd	4 Lane	Collector	2.21
Pavangad Atholi Rd	4 Lane	Collector	4.07
Calicut Road	4 Lane	Sub Arterial	4.16
Gandhi Road- Balan K Nair Road	4 Lane	Sub Arterial	2.74
Beypore Cheruvannur Road	4 Lane	Sub Arterial	5.84
Red Cross Road	4 Lane	Collector	1.16
Kadalundi Kottakadavu	4 Lane	Sub Arterial	6.4
Railway Station Road	4 Lane	Collector	1.05
Mavoor Road	4 Lane	Sub Arterial	7.4

DEVELOPMENT OF MISSING LINKS/NEW LINKS

In order to decongest the existing roads and to foster the ease of commuting new roads or missing links have been identified and recommended in the study area. The details of the same are as presented below,

Table 0-8 Recommended New Links

S. NO.	NAME OF THE CORRIDOR	PROPOSED ROAD LENGTH (M)	PHASE
1	Outer Ring Road	52	III
2	Chembra Link	0.544	I
3	Puthiyappa Link	0.747	I

4	Beypore Feroke Link	3.3	II
5	Beypore NH 66 Freight Bypass	7.38	III
6	Kunduparamba Bypass	2.45	III
7	Kalandithazham Road	2.21	III
8	Mampuzha- Korapuzha	0.449	III

DEVELOPMENT OF GRADE SEPARATORS

As the study area is physically segregated by the Railway track and canals, road bridges are proposed to enable smooth flow across the study area. The study recommends 7 crossing which includes 3 railway crossings and 4 canal crossings. The locations are presented below.

Table 0-9 Recommended Upgradation of Grade Separators

S. NO.	NAME OF THE CORRIDOR	TYPOLOGY	PHASE
1	Bhatt Road	ROB	I
2	Feroke New Bridge	ROB	III
3	Puthiyappa Bridge	ROB	III
4	Mampuzha ROB	ROB	III
5	Korapuzha ROB	ROB	III
6	Kadalundi Kottakadavu ROB	ROB	III
7	Feroke ROB	ROB	III

PUBLIC TRANSPORT STRATEGY

Public transport is one of the most environmentally sustainable forms of transport. The public transport improvement strategy includes service improvements for buses, trams and para-transit, appropriate Mass Rapid Transit (MRT) Options and infrastructure development plans and intermodal integration plans.

MASS TRANSIT SYSTEMS

A Mass Transit System is designed to move large numbers of people at one time. Mass Rapid Transit system usually runs in special guideways which will lead to lower travel time, and decreased congestion. The suitable corridor has been identified based PHPDT however, a detailed study has to be carried out assess the feasibility of these corridors based on other screening criteria.

Table 0-10 Proposed MRTS Routes

SN	NAME OF THE CORRIDOR	LENGTH (KM)	PHASE
1	West Hill to Ramanattukara	19	I
2	Beach to Medical College	8.1	I
3	Nadakkavu to Kunnamangalam	12.8	III
4	Vengeri to Ramanattukara	17.2	III

CITY BUS RATIONALIZATION

Currently there 365 Bus permits in Kozhikode. It is recommended to retain the cap on the private bus permits. Further, it is recommended to rationalise 17 routes which are observed to be overlapping with the Proposed MRTS Corridor from West Hill to Ramanattukara by re-outing from alternative corridors.

Table 0-11 Route Rationalization Proposals

RATIONALIZATION OF ROUTES	2027
Total No. of Routes	345
Total No. of Routes for Curtailed/Modified	17

The details of the routes are as follows,

Table 0-12 Recommended Private Bus routes for Rationalization

SN	NAME OF THE CORRIDOR	NATURE OF OVERLAP	RECOMMENDATION	PHASE
1	Elathur Kunnamangalam	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
2	Meenchanda- Beypore	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
3	Kunnamangalam- Narikunni	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II

SN	NAME OF THE CORRIDOR	NATURE OF OVERLAP	RECOMMENDATION	PHASE
4	Meenchanda-Perumanna	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
5	Eranjipalam-Karapparamba- Mukavoor	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
6	Vengeri- Puthiyangadi	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
7	Medical College-Kunnamangalam	Overlap with Proposed Transit Corridor	Re-routing the overlap section	Phase II
8	Chaliyam-Feroke	Overlap with City Services	Re-routing the overlap section	Phase II
9	City-Palayam	Overlap with City Services	Re-routing the overlap section	Phase II
10	Feroke- Azhinjilam	Overlap with City Services	Re-routing the overlap section	Phase II
11	Vengeri-Purakkatteri	Overlap with City Services	Re-routing the overlap section	Phase II
12	Madhavan Nair Rd	Overlap with City Services	Re-routing the overlap section	Phase II
13	Railway Station-Palayam	Overlap with City Services	Re-routing the overlap section	Phase II
14	Golf Link Road	Overlap with City Services	Re-routing the overlap section	Phase II

SN	NAME OF THE CORRIDOR	NATURE OF OVERLAP	RECOMMENDATION	PHASE
15	Canoli Link	Overlap with City Services	Re-routing the overlap section	Phase II
16	Mayanad Bypass	Overlap with City Services	Re-routing the overlap section	Phase II
17	Parambil Bazaar Thadambattuthaazham	Overlap with City Services	Re-routing the overlap section	Phase II

PUBLIC TRANSPORT FLEET AUGMENTATION

The existing assessment of Public Transport bus routes in the study area indicate that there are around 365 buses plying with the study area decicated unser city (parly sub-urban) operations. Fleet requirement is over the years is estimated based on various norms and demand and is presented in the Table below

Table 0-13 Fleet Requirement Over The Years[8]

YEAR	POPULATION	EXISTING FLEET	RECOMMENDED FLEET SIZE	BUSES TO BE SCRAPPED	ADDITIONAL FLEET REQUIRED
2023	10,63,218	365	532		167
2027	11,43,467		572	57	97
2031	12,30,193		615	62	105
2041	14,78,985		739	74	198
2051	17,81,441		891	89	241

CMP suggests a standing bus fleet of 891 by 2051 with 80% fleet being Electric by 2051.

NEW CITY BUS ROUTES

On assessment have been 6 corridors have identified as new city bus corridors as secondary corridors to the primary proposed High demand Transit corridors in addition to the existing bus routes. These routes are dedicated for city based bus operations. The details of the same are as presented below,

[8] The proposed fleet size includes the fleet required on the proposed new routes.

Table 0-14 New City bus Routes recommended for Kozhikode[9]

ROUTE	LENGTH (KM)	SUT_2027	SUT_2031	SUT_2041	SUT_2051	BUS TECHNOLOGY
Elathur Kunnamangalam	7.3	5	9	16	24	ELECTRIC BUS
Kunnamangalam-Narikunni	14	4	7	13	20	ELECTRIC BUS
Meenchanda-Perumanna	9.8	9	13	18	35	ELECTRIC BUS
Medical College-Kunnamangalam	7.5	4	6	13	19	ELECTRIC BUS
Mayanad Bypass	8.4	3	6	11	16	ELECTRIC BUS
Parambil Bazaar Thadambattuthaazham	8	4	7	13	20	ELECTRIC BUS
Total		28	47	84	134	

On assessment have been 11 corridors have identified as feeder routes to bus and MRT corridors as secondary corridors to the primary proposed MRTS corridors in addition to the existing bus routes.

INLAND WATER TRANSPORT

Inland Waterways are recommended on 4 routes of 52 km in the study area and the details of the same are as presented below,

Table 0-15 Inland Water Transport Routes

SN	ROUTES	LENGTH (KM)	PHASE
1	Elathur to Kallai via Canoli Canal	17.2	Phase I
2	Kallayi to Kolathara via Korappuzha	10.1	Phase I
3	Palazhi to Azheekkal via Mambuzha	12.3	Phase II
4	Azhinjillam to Beypore via Chaliyar River	12.3	Phase II

11 Inland Waterways Station and terminals are recommended the details of the same are as presented below,

Table 0-16 Inland Water Transport Stations

SN	Stops	Routes	Typology	PHASE
1	Padannakalam, Elathur	Canoli Canal	Terminal	Phase I

[9] The proposed fleet size includes the fleet required on the proposed new routes.

SN	Stops	Routes	Typology	PHASE
2	Eranjikkal	Canoli Canal	Station	Phase I
3	Kaipurath	Canoli Canal	Station	Phase I
4	Kunduparamba Road	Canoli Canal	Station	Phase I
5	Karaparamba	Canoli Canal	Station	Phase I
6	Eranjippalam	Canoli Canal	Terminal	Phase I
7	Sarovaram	Canoli Canal	Station	Phase I
8	Mavoor Road	Canoli Canal	Station	Phase I
9	Mooriyad Bridge	Canoli Canal	Terminal	Phase I
10	Kothi Bridge	Kallayi River	Terminal	Phase II
11	Mooriyad Bridge	Kallayi River	Station	Phase II
12	Mankavu	Kallayi River	Station	Phase II
13	Kinasserry	Kallayi River	Station	Phase II
14	Kunnathupalam	Kallayi River	Terminal	Phase II
15	Karuvanthiruthy	Chaliyar River	Station	Phase II
16	Beypore	Chaliyar River	Station	Phase II
17	Cheruvannur	Chaliyar River	Station	Phase II
18	Kolathara	Chaliyar River	Station	Phase II
19	Feroke	Chaliyar River	Station	Phase II

PUBLIC TRANSPORT TERMINALS

The CMP also recommends the de-centralization of KSRTC sub-urban services and private sub-urban services from the city centre- Kozhikode, Mavoor Road Junction. The KSRTC services operate in Hub and spoke model between major hubs and minor hubs for city and sub-urban services. The current terminal may be shifted to Thondayad which is a suitable location to cater internal- internal trips, internal-external trips and external external trips.

Table 0-17 Bus Terminal Usage

SN	TERMINAL	AREA (Acres)	TYPOLOGY
1	Kozhikode City	1	City Services / limited sub-urban
2	Thondayad	3	Major Sub-urban Services (north-east)
3	Kunnamangalam	1	Sub-urban Services (north-east)

SN	TERMINAL	AREA (Acres)	TYPOLOGY
4	Elathur	2.44	Sub-urban Services (north)
5	Beypore	2.85	City Services
6	Ramanattukara	2.05	Sub-urban Services (South-east)
7	Medical College	1	Sub-urban Services (north-east)
8	Palayam	1	City Services / limited sub-urban

MULTI – MODAL MOBILITY HUBS

At the intersection of each mobility corridor/ transit corridor with the inner ring road/ outer ring road of the city, a transfer terminal should be facilitated. The transfer terminal is technically called as Multi – Modal Mobility Hubs (MMMH)

Multi-modal mobility Hubs are also recommended for easing out the transfers across various transit modes. The details are as presented below,

Table 0-18 Proposed Multi-modal Hubs

SN	MMI	TYPOLOGY	MODES	CATEGORY	PHASE
1	Kozhikode Railway Station- Palayam Bus Stand	City and Sub-urban and regional interchanges, Feeder to Railway	MRTS, Bus and Rail, IPT	Major	Phase I
2	Thondayad	City and Sub-urban and regional interchanges	MRTS, Bus, IPT	Major	Phase I
3	Medical College	City and Sub-urban and regional interchanges	MRTS, Bus, IPT	Major	Phase I
4	Ramanattukara	City and Sub-urban and regional interchanges	Bus, MRTS, IPT	Major	Phase I
5	Kunnamangalam	City and Sub-urban and regional interchanges	Bus and MRTS	Minor	Phase II
6	West Hill	City and Sub-urban and regional interchanges	MRTS, Bus and Rail	Major	Phase II
7	Beach Road	City and Sub-urban and regional interchanges	MRTS, Bus, NMT	Minor	Phase II

SN	MMI	TYPOLOGY	MODES	CATEGORY	PHASE
8	Kozhikode City	City and Sub-urban and regional interchanges	MRTS, Bus, NMT	Major	Phase I

INTERMEDIATE PUBLIC TRANSPORT STRATEGY

The study recommends provision of infrastructure facilities for the operation of IPT. The allocation of IPT will be governed by Corporation or ULB or Smart City in ordination with RTA and Traffic Police Departments. The infrastructure facilities shall include,

The stops are recommended at all the major activity nodes with considerable distance from the bus-stands to avoid chaos. These stops are recommended to be locate at a minimum distance of 250m from the junctions. The capacity of these stop will be demand based assessed by the traffic police with a minimum holding capacity of 3.

Table 0-19 Proposed Halt and Go Stops with Electric Vehicle charging facilities

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
1	Kunnamangalam	5	1
2	Malaparamba	5	1
3	Parolamala Junction	3	2
4	Pooladikkunnu Junction	3	2
5	Irangadanpalli Junction	3	2
6	Vengeri Junction	5	1
7	Karaparamba Junction	5	1
8	Kovoor Junction	3	1
9	Vellamadikkunnu Junction	3	1
10	Thondayad Junction	8	1
11	Cyberpark Junction	5	1
12	Mankavu Junction	3	2
13	Chalapuram Cross Junction	3	2
14	G Tec Junction	3	1
15	Stadium Junction	3	1
16	Rajaji Junction	5	1
17	Arayidathupalam Junction	5	1
18	Puthiyara Junction	5	1
19	Kalluthankadavu Junction	3	2
20	Chalapuram Cross Junction	3	1
21	Cherumanasserri Road Junction	3	2

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
22	Kovoor Junction	3	1
23	Puthiyangadi Junction	3	1
24	Ramanattukara Flyover Junction	5	1
25	Chevarambalam Junction	3	2
26	Gandhi Road Junction	5	1
27	West Hill Chungam	5	1
28	Vandipetta Junction	5	1
29	Fish Market	3	1
30	Kannur Road Kunduparamba Junction	3	2
31	Homeo College Karaparamba	3	2
32	Wayanad Road	3	2
33	Sales Tax Office Road	3	2
34	CWRDM Road	3	2
35	Balan K Nair Road	3	1
36	KP Chandran Road	3	2
37	Kannur Road	5	1
38	Beach Road	8	1
39	Nadakkavu	5	1
40	Corporation Office	5	1
41	Railway Station	5	1
42	Kozhikode New Bus Stand	5	1
43	Court Road	3	2
44	HiLite	5	1
45	Kolattu Road	2	1
46	Karad Road	3	2
47	Ramanattukara	8	1
48	Feroke	5	1
49	Mavoor Road	3	1
50	Goshalikunnu Road	3	2
51	Cheruvannur	5	1
52	Beypore	8	1
53	Vattakinar	8	1
54	Pantheerankavu	8	1
55	Kundayithode	3	1
56	Olavanna Road	5	1
57	Mananchira	8	1
58	Chintavalappu Junction	5	1
59	Puthiyapalam Junction	5	1
60	Pottammal Junction	5	1
61	Medical College Junction	5	1

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
62	Mankavu Govindapuram Road	3	2
63	Manadravil Padam Road	3	2
64	Gear Junction	3	2
65	KOdinattumukku	3	2
66	Meitra Hospital	8	1
67	Sobha Junction	5	2
68	Karanthur	5	1
69	Moozhikkal	5	2
70	Chelavoor	3	2
71	Kunduparamba Road	3	2
72	West Hill Railway Station	3	1
73	Eranjipalam Juma Masjid	5	1
74	Vellayil Railway Station	3	1
75	YMCA	3	1
76	Rajendra Hospital	5	1
77	Kayamkulam Junction	3	1
78	Valayanad Kommery Road	3	2
79	Areekad Junction	5	2
80	Kolathara Junction	5	2
81	Malaparamba Post Office	3	2
82	Kottooli Post Office	3	2
83	Golf Link Road	3	2

NON-MOTORISED TRANSPORTATION STRATEGY

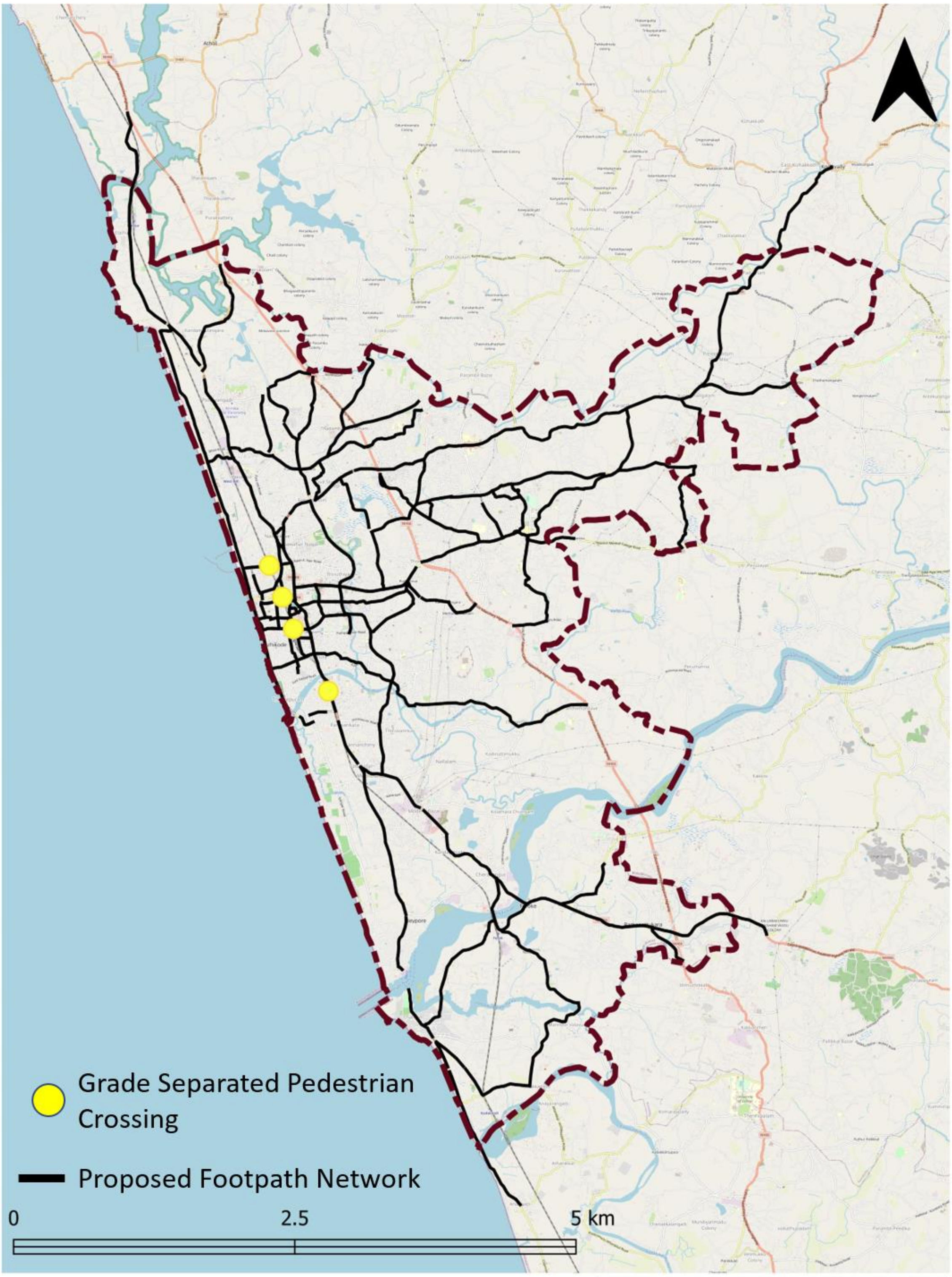
Non-Motorized Transport (NMT) strategy is a key element in successfully encouraging clean urban transport. It can be a very attractive mode of transport for relatively short distances, it makes up the largest share of trips.

PEDESTRIAN NETWORK

This strategy identifies a pedestrian network within the road network, this network is recommended to house pedestrian infrastructure facilities such as continuous footpath, safe pedestrian crossings at mid-blocks, junctions, priority to pedestrian movements in junction and corridor designs.

The study identifies 145 Km of network to be developed with dedicated pedestrian infrastructure (footpath). The proposed network covers about 100% of the major road network in the study area.

The details of the network recommended for improvement is as presented below.



Title: Comprehensive Mobility Plan for Kozhikode	KOCHI METRO RAIL LIMITED; Urban Mass Transit Company Limited
Name: Pedestrian Infrastructure Proposals	

Figure 0-10 *Proposed Pedestrian Network*

BICYCLE NETWORK

Cycling is increasingly recognized as a clean, sustainable mode of transport and an essential part of an inter-modal plan for sustainable urban travel. The bicycle network for Kozhikode has been identified targeting two major supply end parameters, which are,

1. Provision of Bicycles lanes connecting the core area of the city.
2. Provision of Bicycle lanes connecting major tourist attractions, heritage gates and universities.

The study proposes 36 Km of dedicated bicycle network. The network is mainly concentrated along the beach and the flat terrain in the city, towards south west. It is recommended to maintain a minimum of 2m wide dedicated bicycle track for bi-directional sections and a minimum of 3m for uni-directional tracks.

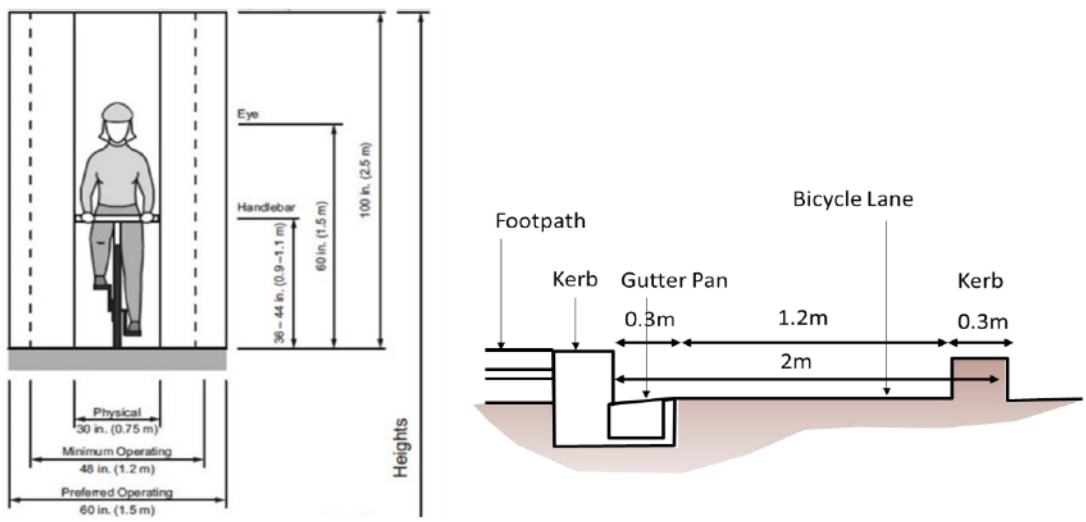


Figure 0-11 *Proposed Bicycle Operating Widths*

In case of Kozhikode, Non-Motorized Vehicles (NMV) lane typology 2 is suggested.

Table 0-20 *Types of NMV Lanes*

S. No.	Type of NMV Lane	Cross Section
1	NMV lanes shared with MVs and designated by signs	

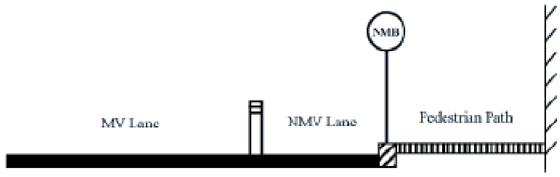
S. No.	Type of NMV Lane	Cross Section
2	NMV lanes designated by lane markings (e.g., striping) and within the highway right-of-way	
3	NMV-exclusive lanes physically separated from MVs by barriers (e.g. concrete blocks, steel railing, raised curb) and within the highway right-of-way	
4	NMV-exclusive lanes within an independent right-of-way (often referred to as NMV paths)	

Table 0-21 *Proposed Corridors for Bicycle Infrastructure*

S. NO.	NAME	LENGTH	TYPOLOGY
1	Kozhikode Beach	11.6	2
2	Sarovaram	8.8	2
3	Valiyangadi	1.8	2
3	Thondayad	4.6	2
4	Beach Road	3.5	2
5	Kadalundi	5.8	2

SAFE ROUTES TO SCHOOL

Safe Routes to School (SRTS) is an approach that promotes walking and bicycling to school through infrastructure improvements, enforcement, tools, safety education, and incentives to encourage walking and bicycling to school.

The pilot areas identified are as presented below.

Table 0-22 *Pilot Areas Identified for SRTS Kozhikode*

S. No.	Code	Name
1	PP1	Mananchira
2	PP2	Nadakkavu

S. No.	Code	Name
3	PP3	Beypore
4	PP4	Malaparamba

It is recommended to take up pilot projects for SRTS in these areas in light with the consideration and elements suggested above.

PUBLIC BIKE SHARING SYSTEM

Public bike sharing systems allow users to rent bicycles for short-term use and provide a sustainable solution to reduce traffic congestion, improve air quality, and promote active and healthy lifestyles.

Public bike sharing systems play a vital role in promoting sustainable transportation and improving urban mobility. By providing affordable and accessible bicycles, these systems offer an environmentally friendly alternative to traditional modes of transportation. The public bike sharing systems will be provided near all the major tourist attraction points and other attraction centres.

Table 0-23 *Proposed PBS Locations*

S. NO.	LOCATION	PBS TYPE	CYCLES PER STATION
1	SM Street (North)	Low Capacity	10
2	Stadium Road	Low Capacity	10
3	Mankavu	Low Capacity	10
4	Karaparamba	Low Capacity	10
5	Eranjippalam	Low Capacity	10
6	Puthiyangadi Beach	Medium Capacity	15
7	Kadalundi Beach	Medium Capacity	15
8	Beypore Beach	Medium Capacity	15
9	Nadakkavu	Medium Capacity	15
10	West Hill	Medium Capacity	15
11	Civil Station	High Capacity	25
12	Kozhikode Beach (North)	High Capacity	25
13	Kozhikode Beach (South)	High Capacity	25
14	SM Street (South)	High Capacity	25

NON-MOTORISED TRANSPORT OUT-REACH PROGRAMS

It is essential to promote public awareness and revive the bicycling culture and reducing the dependency on private modes. Thus, an outreach and education strategy for promoting the system is recommended. The outreach and education goals need to be defined at the planning stage of the system itself to focus the efforts of the implementation. Following strategies can be adopted for an effective public outreach

- Create a network of allies and provide platforms for them to actively participate as disseminators of benefits
- Use proactive and creative communication media to promote key messages. Communication media can be print, broadcasts, short films, event marketing etc.
- Programmes can be conducted in schools and colleges advocating the need for Non-Motorized Transport. Events like Car Free Day, Happy Streets, Cycle Day can also be promoted.
- Encourage various university and school students to use bicycles under Safe Routes School or Pedal to School programs.
- Conduct Heritage Bicycle rides, etc.
- Encourage Bicycling as a recreational activity by creating Bicycle tracks along the lakes and further connecting them. Call for weekly bicycle competitions etc.

TRAFFIC MANAGEMENT MEASURES

Traffic demand measures aims at achieving safe and efficient movement of people and goods on roadways. It focusses on road geometry, sidewalks, crosswalks, cycling infrastructure, traffic signs, road surface markings, traffic signals, traffic flow, area improvements etc.

The proposals under public transport improvement strategy are:

- Junction Improvements
- Area Improvements
- Pavement Markings and Signage's
- Parking Management Plan

JUNCTION IMPROVEMENTS

It is noticed that traffic accident rates are usually higher at intersections. Many factors affect accident occurrence at intersections, including traffic volume, traffic control, and frequency of access points, the number of arms, the speed limit, the median type and width, the number of traffic lanes, the existing turn lanes and the lighting level.

List of junctions proposed for improvement in their geometry are given below.

Table 0-24 *Identified Junctions for Improvement*

Sl No	Junction Names	Phase
1	Kunnamangalam	1

Sl No	Junction Names	Phase
2	Malaparamba	1
3	Parolamala Junction	2
4	Pooladikkunnu Junction	2
5	Irangadanpalli Junction	2
6	Vengeri Junction	1
7	Karaparamba Junction	1
8	Kovoor Junction	1
9	Vellamadikkunnu Junction	1
10	Thondayad Junction	1
11	Cyberpark Junction	1
12	Mankavu Junction	1
13	Chalapuram Cross Junction	2
14	G Tec Junction	1
15	Stadium Junction	1
16	Rajaji Junction	1
17	Arayidathupalam Junction	1
18	Puthiyara Junction	1
19	Kalluthankadavu Junction	1
20	Chalapuram Cross Junction	2
21	Cherumanasserri Road Junction	2
22	Kovoor Junction	2
23	Puthiyangadi Junction	1
24	Ramanattukara Flyover Junction	1
25	Chevarambalam Junction	1
26	Gandhi Road Junction	1
27	Vattakinar Junction	1
28	Bypass Junction	1
29	Palayam Junction	1
30	Eranjippalam Junction	1
31	West Hill Chungam Junction	1
32	Pantheerankavu Junction	1
33	Chaliyam Angadi Junction	1
34	Kadalundi Kottakadavu Road Junction	1
35	Cheruvannur Junction	1
36	Pottammal Junction	1
37	Feroke City Road Junction	1
38	Beypore Road Junction	1
39	Olavanna Junction	1
40	Modern Bazaar Junction	2

Geometric improvements and signalization serve only for short term duration. The traffic level at few junctions reaches the 10000 PCU mark during peak hours as shown below. The situation will deteriorate considerably with growing population of private modes in the city.

Table 0-25 *Improvements Proposed at Identified Junctions Phase I*

S. NO.	JUNCTION	TYPOLOGY
1	Puthiyangadi	Signalized
2	Thondayad	Grade Separator
3	Cyberpark Junction	Grade Separator
4	Arayidathupalam Junction	Grade Separator
5	Ramanattukara Flyover Junction	Grade Separator
6	Gandhi Road Junction	Signalized

AREA IMPROVEMENT PLAN

Mobility Improvement Around Palayam

Palayam being a major commercial and institutional area has a variety of activities distributed around it. However, the mobility of people and vehicles around Palayam has a lot of hindrances in the form of Railway track, insufficient Right of way or pedestrian infrastructure etc.

Figure 0-12 *Contextual Map of Palayam & Valiyangadi Area*

ISSUES IDENTIFIED

- Pedestrian facilities are provided in some of the roads, but due to high amount of traffic and on-street parking, the safety for the pedestrians is compromised.
- Barrier on pedestrian movement across the railway line

Figure 0-13 *Existing At Grade Pedestrian Crossing*

- NMT facilities in the entire area is not available which makes people hesitate to use NMTs.
- The area on the road opposite to railway Station is acting as a bus stand for private buses. Buses used to stop and hold at this area for longer time, which creates a chaotic situation to the through traffic.
- There is no integration between the railway station and the Palayam bus stand, which hesitates people to use public transportation and tends to avail IPT and personal vehicles.

PROPOSED INTERVENTIONS AND IMPROVEMENTS

- Segregation of Passenger access at either side of the railway station by providing batter link access to private vehicles and improved PT and IPT bays for PT vehicles.

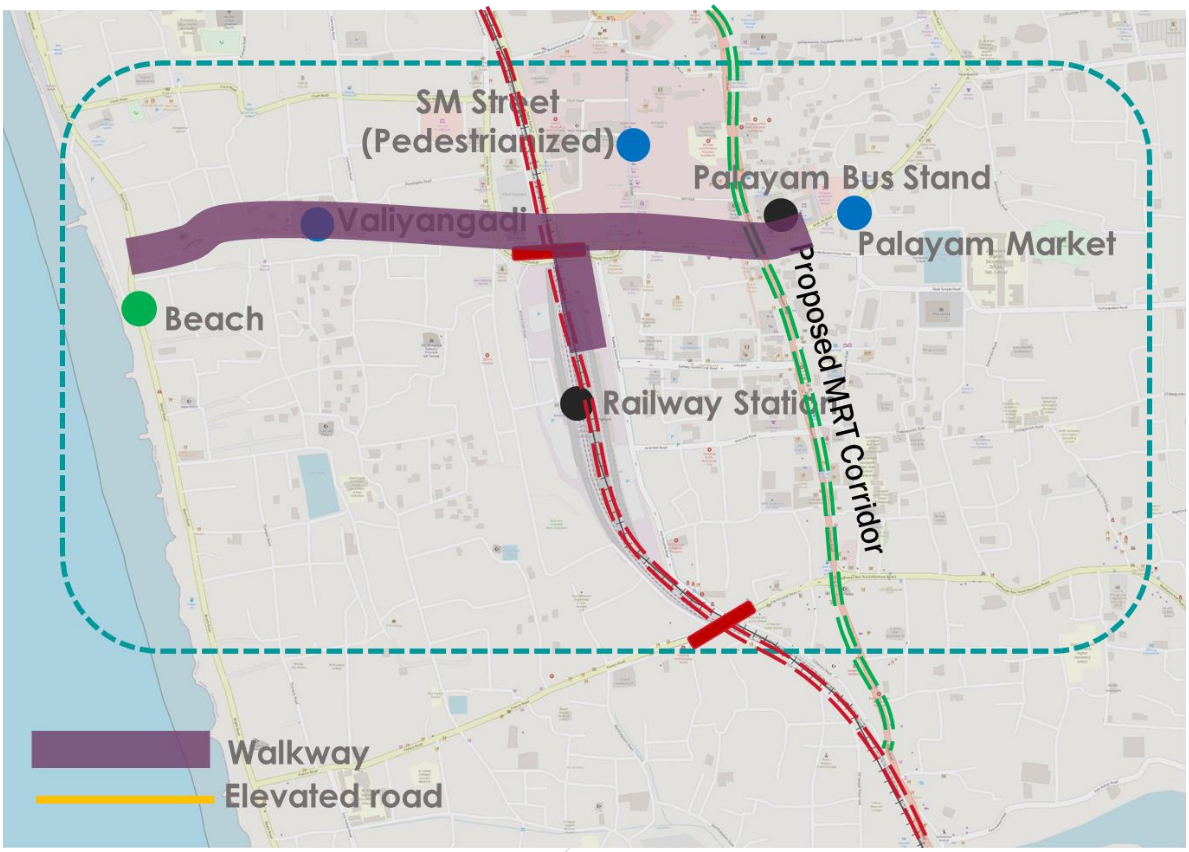


Figure 0-14 *Conceptual Map for Railway Station Access & Elevated Walkway*

- Wide footpath has been proposed on all the major roads identified in the area.
- Cycle track is proposed on the major road identified for enhancing the sustainable and safe mobility.
- 1.3 km and 800m long skywalk is proposed between Valiyangadi, Palayam bus stand and railway station to improve the pedestrian and bicycle access.

Figure 0-15 *Reference Image of Walkway*

PARKING MANAGEMENT STRATEGY

Similar to other cities in the country and state, the city experiences intense on-street parking and under-utilized off-street parking. The other parking issues are:

- Inadequate information for motorists on parking availability and price.
- Inadequate user options in terms of off-street parking, paid and convenient parking versus free and inconvenient parking.
- Concerns over spill over parking congestion in nearby areas if parking supply is inadequate.
- Inadequate or lack of Parking Pricing methods along the commercial streets such as at MM Ali Road, Ramanattukara, etc.
- Lack of convenient Parking Pricing methods, such as mechanical meters at designated parking spaces especially at terminals, etc.
- Inefficient use of existing off street parking capacity especially in Kozhikode Corporation parking spaces.

DESIGNATED ON-STREET PARKING SPACES

Designated On-Street Parking is recommended on the following locations with optimum lengths for to be effective use of the available parking bays. It is suggested to restrict free On-Street Parking on the other stretches around these corridors. In addition to the motorized parking, some minimum number bicycle parking spaces have also been provided at each location to encourage the use on Non-Motorized Transport in the study area.

Table 0-26 *Proposed On-street Parking Spaces Capacities*

Location	Effective Length (m)	Parking Capacity (ECS)								
		LHS			RHS			Total		
		2W	4W	Cycle	2W	4W	Cycle	2W	4W	Cycle
Mananchira Square	240	70	6	3	0	0	0	70	12	3
Wayanad Road	500	17	75	0	74	17	0	34	149	0

Location	Effective Length (m)	Parking Capacity (ECS)								
		LHS			RHS			Total		
		2W	4W	Cycle	2W	4W	Cycle	2W	4W	Cycle
Eranjipalam Junction	1000	100	70	13	92	71	12	192	141	23
Mankavu Junction	1700	170	120	17	100	65	17	270	185	34
Kesari Junction, Mankavu Mooriyad Road	400	20	15	9	34	39	9	54	54	18
Francis Road	1000	70	30	4	115	34	4	185	64	8
Kallayi Road	1500	170	67	7	170	67	7	339	134	14

DESIGNATED OFF-STREET PARKING SPACES

Designated Off-Street Parking is recommended on the following locations with optimum area for effective use of the available parking bays. It is suggested to restrict free On-Street Parking on the other stretches around these areas. In addition to the motorized parking, some minimum number of bicycle parking bays have also been provided at each location to encourage the use on Non-Motorized Transport in the study area.

Table 0-27 *Proposed Off-street Parking/MLCP Spaces Capacities*

Location	Area (m^2)	ECS (Proposed)	Composition			Bays			Type	Phase
			2W	4W	Cycle	2W	4W	Cycle		
Palayam Market	1050	84	40%	40%	20%	168	34	10	MLCP	I
Civil Station	1200	96	25%	75%	5%	43	35	15	MLCP	I
Ramanattukara	1450	116	54%	40%	6%	250	54	10	MLCP	II
Stadium	700	53	27%	48%	25%	75	20	10	MLCP	I

Location	Area (m^2)	ECS (Proposed)	Composition			Bays			Type	Phase
			2W	4W	Cycle	2W	4W	Cycle		
Kallayi	2525	202	15%	26%	7%	23	15	19	Surface	II
Link Road, Beach	800	400	20%	80%	0%	400	320	0	MLCP	II

CONCEPT - PARKING POLICY

PARKING PRICING

Parking pricing and time limits are important parking management mechanisms in order to promote short-term parking enhance turnover of parking bays at proposed designated locations and ensure access to limited on-street parking in high parking demand areas. For the study area, the following pricing methods are suggested to be implemented.

DISTANCE FROM OFF-STREET PARKING FACILITY

The parking on streets adjacent to off-street parking facilities should be priced higher since they are more convenient to access. This would consider off-street prices as benchmark and ensure an optimum usage of the facilities provided. Thus, parking around all the designated parking should be priced higher based on the land use values of those locations.

TIME-OF-THE DAY / OCCUPANCY BASED PRICING

Dynamic pricing is suggested to be incorporated to achieve higher parking turn-over rates. For Kozhikode Time and Occupancy based pricing methods are recommended.

The occupancy-based pricing is based on either a target average occupancy on street at the locations known to saturate easily. The following locations can be considered for occupancy-based parking pricing:

- Mananchira
- M M Ali Road
- Palayam
- Stadium Road
- Kozhikode Road, Kadalundi
- Beypore Road
- Near Feroke Railway Station

The Time-of the Day pricing can be adopted on stretches where the demand rises and then reduces over peak and off-peak hours of the day respectively. The following locations can be considered for Time-based parking pricing:

- Cyber Park
- Beach Road
- Hilite Mall

DISTANCE FROM TRANSIT

High parking charges should be levied on parking in places that are well-connected with transit facilities. This should be done in order to discourage private vehicle use. The On-Street Parking locations around the following locations are suggested to have higher parking price,

- Central Railway Station
- West Hill Railway Station
- KSRTC Bus Stand
- Feroke Railway Station

The tentative parking prices based on the demand and willing to pay is as shown below.

Table 0-28 *Peak Hour Parking Fees*

Vehicle Type	Morning/ Evening Peak Hours (3-4 Hrs Each)			
	Up to 1 hr	2 hr	3 hr	4 hr
Two-Wheeler	5	10	15	20
Private Car	15	30	45	60
Large Car/ SUV	25	45	65	85

Table 0-29 *Short Term Parking Fees*

Vehicle Type	Day (8AM to 8PM)												Night (8PM to 8AM	Full Day
	Up to 1 hr	Up to 2 hrs	Up to 3 hrs	Up to 4 hrs	Up to 5 hrs	Up to 6 hrs	Up to 7 hrs	Up to 8 hrs	Up to 9 hrs	Up to 10 hrs	Up to 11 hrs	Up to 12 hrs		
Two-Wheeler	5	5	5	10	10	10	15	15	15	20	20	20	5	25
Private Car	12	25	40	50	60	75	100	115	120	120	120	120	8	120
Large Car/ SUV	20	32	44	56	68	80	90	104	104	104	104	104	16	120

Table 0-30 *Long Term Parking Fees*

Vehicle Type	Daily Charges			Subsidised Charges	
	Day 12 hrs (8AM to 8PM)	Night 12 hrs (8PM to 8AM)	24 hrs Day + Night	Quarterly	Annually
Two-Wheeler	180	45	225	225	900
Private Car	1100	80	1200	900	3900
Large Car/ SUV	1200	180	1300	1100	4000

A detailed Parking Policy Study should be carried out capturing the land values and dynamic parking conditions to identify feasibility of the locations and the parking fees at proposed locations.

ENFORCEMENT

Enforcement is the most crucial tool of Parking Management Strategy. The success and failure of the parking strategy is dependent of the extent of the enforcement. In Kozhikode, especially along the major transit corridors and activity areas the parking enforcement shall be carried out through the mechanisms like installation of signages, clear demarcation of No Parking areas, restriction of un designated on street private vehicle parking. For enforcing parking near schools, hospitals, educational institutes and other facilities, authorities can facilitate and encourage them to involve volunteers, traffic police or others to manage parking.

PARKING STANDARDS NEAR TRANSIT STATIONS

Reduced parking standards near transit within a buffer zone of 300 m around the transit line. All Public Transit corridors, the high mobility corridors and proposed metro corridors need not provide the same amount of parking that is required elsewhere. Parking standards could be reduced by 50% around transit facilities.

PARKING PERMITS

Restricted parking zones can be created to help ease parking congestion in residential areas around major demand generators. Parking Permits are provided for residents, business and visitors with Resident Parking Zone (RPZ) where On-Street parking is controlled. This mitigated the un-intended effects of non-resident parking in the zone.

Table 0-31 *Types of Parking Permits*

Permit Type	Description
Residents	Allows residents to park their vehicles in an available resident's bay in the zone where the permit is valid
Business	Allows owners/partners of the business to park their vehicles in a resident's bay, in the zone where the business is situated
Visitors	Allows you to activate the permit for a visitor's vehicle when they arrive at resident's home

Potential areas where RPZ can be implemented are:

- West Hill area
- Malaparamba area
- Palayam area

TECHNOLOGICAL TRANSITIONS

PASSENGER INFORMATION SYSTEMS (PIS)

PIS refers to an information system, which provides real-time, dynamic information for passengers. This may include both predictions about arrival and departure times, and information about the nature and causes of disruptions. The system utilizes vehicle location data from AVL systems to disseminate information on the current location of the bus to passengers and predict arrival times at bus stops (Green City Streets n.d.). This is particularly useful on low-frequency routes and when buses deviate from scheduled times due to unforeseen circumstances[10].

In case of Kozhikode, the initiative has been made by KSRTC to implement PIS system inside all the buses, all terminals and bus stops.

VECHICLE TECHNOLOGY

As a green initiative to move towards Sustainable urban transport, technological transformations in terms of public transport vehicles are suggested. With efforts to reduce carbon emissions the CMP suggests the used of electric vehicles.

ELECTRIC BUSES AND AUTO RICKSHAWS:

India is in the process of tackling its ambitious objective of having a 100 per cent zero-emissions, electric vehicle fleet by 2030, as envisaged by NITI Aayog. Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles (FAME Scheme) is one of said initiatives. FAME provides subsidies as a financial incentive to buyers of electric vehicles. The scheme allocated approximately INR155

[10] Source: Bus Karo 2.0

crore for demand incentives in 2015-2016 and around INR340 crores between 2016-2017. As a result, each mode of transport has experienced some acceleration towards electrification.

In case of Kozhikode, newly formed service buses are provided with Electrical buses, which needs to be further expanded. Whereas, E-rickshaws are highly recommended in the city. As a part of the old city rejuvenation, only E-Rickshaws shall be allowed to ply in the core are to provide connectivity during the restricted vehicle hours to provide connectivity.

PROPOSED EV CHARGING STATIONS

The CMP proposes 70 new charging stations to establish a good coverage for Electric vehicle charging facilities. The following are the locations for the same.

Table 0-32 *Proposed EV Charging Stations*

S.NO.	NAME	PHASE	COMMENTS
1	Thondayad Junction	I	Existing
2	Balan K Nair Road	I	Existing
3	Fish Market	I	Existing
4	West Hill Chungam	I	Existing
5	Nadakkavu	I	Existing
6	Corporation Office	I	Existing
7	Railway Station	I	Existing
8	Kozhikode New Bus Stand	I	Existing
9	HiLite	I	Existing
10	Kolattu Road	I	Existing
11	Ramanattukara	I	Existing
12	Feroke	I	Existing
13	Mavoor Road	I	Existing
14	Cheruvannur	I	Existing
15	Beypore	I	Existing
16	Beach Road	I	Existing
17	Kunnamangalam	I	Proposed
18	Malaparamba	I	Proposed
19	Vengeri Junction	I	Proposed
20	Karaparamba Junction	I	Proposed
21	Kovoor Junction	I	Proposed
22	Vellamadikkunnu Junction	I	Proposed
23	Cyberpark Junction	I	Proposed
24	G Tec Junction	I	Proposed
25	Stadium Junction	I	Proposed
26	Rajaji Junction	I	Proposed

S.NO.	NAME	PHASE	COMMENTS
27	Arayidathupalam Junction	I	Proposed
28	Puthiyara Junction	I	Proposed
29	Chalapuram Cross Junction	I	Proposed
30	Kovoor Junction	I	Proposed
31	Puthiyangadi Junction	I	Proposed
32	Ramanattukara Flyover Junction	I	Proposed
33	Gandhi Road Junction	I	Proposed
34	Vandipetta Junction	I	Proposed
35	Kannur Road	I	Proposed
36	Vattakinar	I	Proposed
37	Pantheerankavu	I	Proposed
38	Kundayithode	I	Proposed
39	Olavanna Road	I	Proposed
40	Mananchira	I	Proposed
41	Chintavalappu Junction	I	Proposed
42	Puthiyapalam Junction	I	Proposed
43	Pottammal Junction	I	Proposed
44	Medical College Junction	I	Proposed
45	Meitra Hospital	I	Proposed
46	Karanthur	I	Proposed
47	West Hill Railway Station	I	Proposed
48	Eranjipalam Juma Masjid	I	Proposed
49	Vellayil Railway Station	I	Proposed
50	YMCA	I	Proposed
51	Rajendra Hospital	I	Proposed
52	Kayamkulam Junction	I	Proposed
53	Kannur Road Kunduparamba Junction	II	Existing, Proposed additional infrastructure
54	Homeo College Karaparamba	II	Existing, Proposed additional infrastructure
55	Wayanad Road	II	Existing, Proposed additional infrastructure
56	Sales Tax Office Road	II	Existing, Proposed additional infrastructure
57	CWRDM Road	II	Existing, Proposed additional infrastructure
58	KP Chandran Road	II	Existing, Proposed additional infrastructure
59	Court Road	II	Existing, Proposed additional infrastructure

S.NO.	NAME	PHASE	COMMENTS
60	Karad Road	II	Existing, Proposed additional infrastructure
61	Goshalikunnu Road	II	Existing, Proposed additional infrastructure
62	Parolamala Junction	II	Proposed
63	Pooladikkunnu Junction	II	Proposed
64	Irangadanpalli Junction	II	Proposed
65	Mankavu Junction	II	Proposed
66	Chalapuram Cross Junction	II	Proposed
67	Kalluthankadavu Junction	II	Proposed
68	Cherumanasserri Road Junction	II	Proposed
69	Chevarambalam Junction	II	Proposed
70	Mankavu Govindapuram Road	II	Proposed
71	Manadravil Padam Road	II	Proposed
72	Gear Junction	II	Proposed
73	KOdinattumukku	II	Proposed
74	Sobha Junction	II	Proposed
75	Moozhikkal	II	Proposed
76	Chelavoor	II	Proposed
77	Kunduparamba Road	II	Proposed
78	Valayanad Kommery Road	II	Proposed
79	Areekad Junction	II	Proposed
80	Kolathara Junction	II	Proposed
81	Malaparamba Post Office	II	Proposed
82	Kottooli Post Office	II	Proposed
83	Golf Link Road	II	Proposed

SMART CITY BUS SHELTER

Smart city bus shelters are modernized and technologically advanced bus shelters that aim to enhance the overall experience for commuters and improve the efficiency of public transportation systems. These bus shelters incorporate various features and technologies to provide a more convenient, comfortable, and connected environment for passengers

The identified locations for implementing the smart bus shelters in Kozhikode is provided below.

Figure 0-16 *Smart City Bus Shelters*

S. No.	Smart Bus Shelters
PHASE I	
1	Mananchira Bus Stop

S. No.	Smart Bus Shelters
2	Nadakkavu Bus Stop
3	Medical College Bus Stop
4	Meenchanda Bus Stop
5	Railway Station Bus Stop
6	Civil Station Bus Stop
PHASE II	
1	West Hill Chungam Bus Stop
2	Feroke Bus Stop
3	Cheriya Mankavu Bus Stop
4	Mavoor Junction Bus Stop
5	Christian College Bus Stop
6	Pantheerankavu Bus Stop
7	Vengeri Bus Stop
8	Hilite Mall Bus Stop
9	Cheruvannur Bus Stop
10	Chelavoor Bus Stop
11	Law College Bus Stop
12	Eranjipalam Bus Stop
13	Jail Road Bus Stop
14	Stadium Junction Bus Stop
15	Azhinjillam Bus Stop
16	Pottammal Bus Stop
17	Chevayoor Bus Stop
18	Mayanad Bus Stop

ADAPTIVE TRAFFIC CONTROL SYSYTEM (ATCS)

The Adaptive Traffic Control System (ATCS) is an advanced traffic management technology that uses real-time data and intelligent algorithms to optimize traffic flow and improve the efficiency of signalized intersections. It is designed to adapt to changing traffic conditions dynamically and provide optimal signal timings for different traffic volumes and patterns. Here are some key aspects of the Adaptive Traffic Control System:

1. **Real-Time Traffic Monitoring**
2. **Intelligent Signal Optimization**
3. **Traffic Responsive Operation**

4. **Coordination of Multiple Intersections**
5. **Emergency Vehicle Pre-emption**
6. **Data Analysis and Performance Monitoring**

Table 0-33 *Proposed Intersection for ATCS*

S. No	Location of Junctions for ATC Placements
1	Karaparamba Junction
2	Eranjippalam Jn
3	Medical College Junction
4	Vattakinar Jn
5	Meenchanda Jn
6	Palayam Junction
7	West Hill Chungam Jn
8	Puthiyangadi Jn
9	Thondayad Junction
10	Vengeri Junction
11	Malaparamba junction
12	CH Fly Over Jn
13	Paloramala Junction
14	Pooladikunnu Jn
15	Panniyankara Over bridge
16	Stadium Jn
17	Rajaji Jn
18	Puthiyara Junction
19	Kalluthankadavu Junction
20	Kovoor Jn
21	MCC West
22	MCC East
23	Gandhi Road Jn
24	Pushpa Junction
25	Mankavu Junction
26	Iringadan Palli Jn
27	Chevarambalam Jn
28	Ramanattukara Jn
29	Nisari Jn
30	Mukkom Jn KMG
31	Vellimadukunnu Jn

FREIGHT STRATEGY

Freight movement in indicates the level of economic activities in the city. The location of economic nodes decides the movement of goods traffic and managing the goods traffic movement is vital to maintain the acceptable level of congestion during peak hours within the city.

Restricting the heavy goods vehicle movement in major mobility corridors during peak hours is the long-term strategy that need to be considered to avoid excess congestion caused by goods traffic during peak hours. A freight traffic deviation is proposed at the main arterial roads and a bypass connectivity for freight vehicles is proposed between NH 66 and Beypore. Beach road shall carry freight between 10 pm and 5 am, but the traffic shall be restricted during all other times due to the recreational activities on the link.

Table 0-34 *Proposed Freight Terminals with Capacity*

S. NO.	LOCATION	TRUCKS	AREA REQUIRED (SQ. M.)	PHASE
1	Beypore	350	98000	II
2	Beach Road	200	56000	I
3	11th Mile	150	42000	II
4	Puthiyappa Harbour	100	28000	I
5	Kunnamangalam	100	28000	III

PROJECT IMPACT ASSESSMENT

Projects evolved in CMP will help to achieve sustainable development goals by means of reducing private mode share and travel time. This chapter presents the impact of the proposed strategies under Sustainable Urban Transport scenario in comparison to the Business as Usual scenario. The impact assessment is based on the following parameters as suggested in the CMP – Toolkit 2014.

The anticipated impacts of proposed projects on travel characteristics are assessed based on the following parameters,

- **Mode Share** - Variations in the composition of trips made by various modes (users).
- **Average Trip Lengths** - Average travel Time of users of various mode in the study area
- **Average Travel Time** – Average travel Time of users of various mode in the study area
- **Accessibility to Public Transport** – Share of Population Having Access to PT in Kozhikode.

The impact on the above are as presented in the table below.

Table 0-35 Impact Assessment for Travel Characteristics.

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Impact on Network Characteristics					
1	**Passenegr Modal Share (%)-Motorized Modes**				
	Private Modes	% of trips made by private motorized modes (two-wheelers, car)	60%	70%	56%
	Public Modes	% of trips made by public transport modes	25%	14%	32%
	IPT Modes	% of trips made by intermediate public transport modes (auto-rickshaws, shared auto-rickshaws)	15%	16%	12%

Table 0-36 Vehicle Fuel Transition Impacts of Proposed Projects

NAME OF THE IMPACT	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Percent of public transport fleet in compliance with Indian emissions standards	40%	60%	80%

Table 0-37 Availability of Traffic Surveillance

PARAMETER	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Availability of Traffic Surveillance – CCTV	Share of Stations with CCTV on Terminals, Stations and Signalized Intersections	10%	50%	80%

Table 0-38 Passenger Information System

PARAMETER	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Passenger Information System (PIS) for Public Transport	Share of Terminals, Stations having PIS	0%	50%	100%

Table 0-39: Global Positioning System

PARAMETER	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Global Positioning System / GPRS	Share of Public Transport Vehicles and IPT with on-board GPS/GPRS which are connected to common control center	50%	50%	**100%**

IMPLEMENTATION PLAN

The projects proposed are to be implemented in three phases.

- Phase I - To be implemented between 2023 and 2031
- Phase II – To be implemented between 2031 and 2041

- Phase III - To be implemented between 2041 and 2051

Table 0-40: Categorisation of Proposals

SN	SHORT TERM PROPOSALS	MEDIUM-TERM PROPOSALS	LONG TERM PROPOSALS
1	Junction, Corridor Improvements	Upgradation of Existing Roads / Development of New Links	Development of New Links
2	Pedestrian Network Improvements	Flyover / ROBS / RUBS/ Canal Crossings	Upgradation of Existing Roads
3	Bicycles Corridors Improvements	Dedicated Cycle Tracks	Flyover / ROBS / RUBS/ Canal Crossings
4	Area Improvement Plans	Pedestrian Network Improvements	Improved Bus System
5	Parking Management Plan	New PT Terminals/ MMI Hubs	Truck Terminals
6	Improved Public Transportation System (Bus, Waterways & Transit System), Route Rationalization	Improved PT System, New Routes	
7	Electric Vehicle Charging Stations	Off-Street Multi-Level Parking	
8	Network Structure Improvements	ITS Systems	
9	Smart Bus Stops		

PROJECT COSTING

The overall short-term project cost is estimated to be **1995** crores. All junction improvement schemes, footpath implementation, cycle track network development, removal of encroachment will fall into this category. While the approximate cost of medium-term projects is **2269** crores and **1501** crores for Long term measures.

Table 0-41: Estimated Project Costs

Sl.No	Projects	Total Cost (in Crores)	Phasing Rs (in Crores)		
			2023-2027	**2027-2041**	**2041-2051**
1	Improvement of Road Network	1184.82	149.82	114.16	920.8
2	Improvement of Non-Motorised Transport Facilities	241.52	163.17	78.35	0.00
3	Improvement of Public Transport System	3980.01	1598.0	1970.4	411.4
4	Improvement of Freight Transportation System	343.71	115.82	70.82	157.0
5	Intelligent Transportation System Facilities	49.37	13.45	23.90	12.02

6	Improvement of Parking Facilities	6.53	2.01	4.52	0.00
	Overall CMP Proposals	**5805.9**	**2042.3**	**2262.2**	**1501**

FINANCING OPTIONS

The financing of the projects can be taken up under PPP or under government funding, exploring viability gap funding or dedicated urban transport fund.

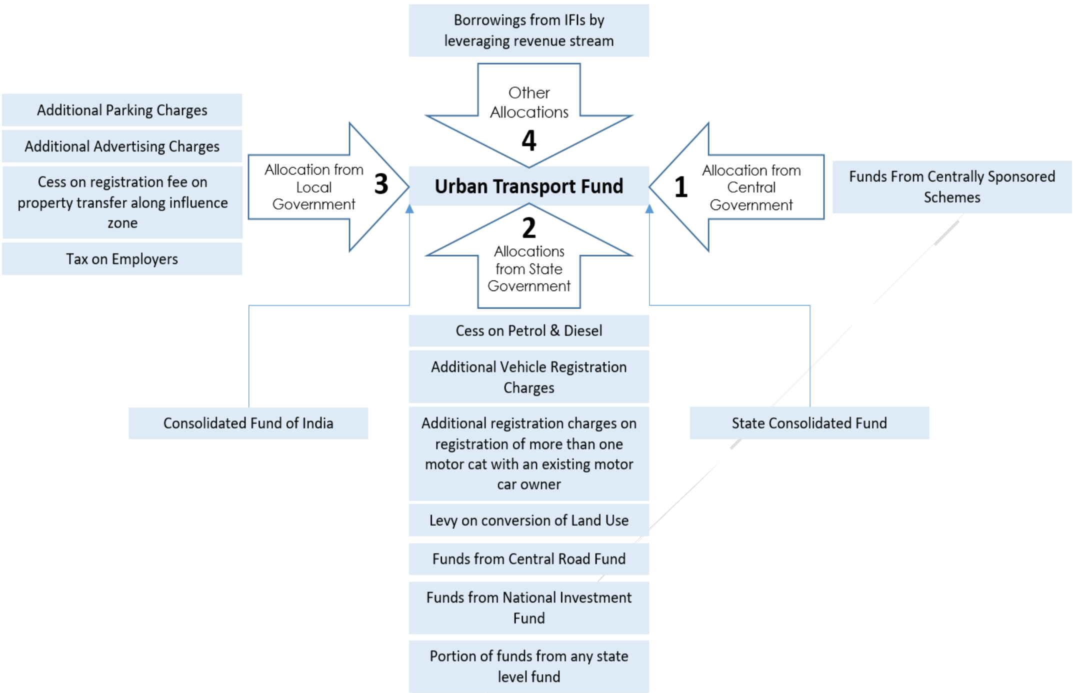


Figure 0-17 Sources of Funds For Urban Transport Fund

IMPLEMENTING AGENCIES

Based on roles and responsibilities of various institutions, the agencies responsible for implementing the proposed projects in the CMP are as follows-

Table 0-42: Details of Implementation Agency

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
Improvement of Road Network				
1	Upgradation of Existing Roads	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private
2	New Links	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
3	Flyover upgradation (2-Lane)	PWD/NHAI	PWD/ NHAI / Private	PWD / NHAI / Private
4	ROB/ Canal Crossing Upgradation (2-Lane)	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private
5	Flyover (4-Lanes)	PWD / KMC / State Govt. / NHAI	State Govt. / KMC	PWD / NHAI / Private
6	Junction Improvements	PWD / KMC / State Govt. / NHAI	State Govt. / KMC	PWD / NHAIs
Improvement of Non-Motorised Transport Facilities				
1	Footpath	KMC / PWD	KMC / PWD	KMC / PWD/ Traffic Police
2	NMT Only Lanes	KMC / PWD	KMC / PWD	KMC / PWD/ Traffic Police
3	Shared Cycle Tracks	KMC / PWD	KMC / PWD	KMC / PWD/ Traffic Police
4	Dedicated Cycle Tracks	KMC / PWD	KMC / PWD	KMC / PWD/ Traffic Police
5	Public Bike Sharing Stations	KMC/ Private	KMC / Private	KMC / Private
6	Public Bike Sharing Cycles	KMC/ Private	KMC / Private	KMC / Private
7	Public Education and Awareness program	KMC / Private / NGOs /State Govt.	KMC / NGOs	KMC / Private /NGOs
Improvement of Public Transport System				
1	Bus Fleet Augmentation	KSRTC, RTO+ Private Operators	State Govt.	KSRTC
2	Improvement of Bus Terminals / Multi Modal Mobility Hubs	KSRTC/ KMC	KSRTC/KMC / Private	KSRTC/KMC / Private
3	New Public Transportation Station	KSRTC/ SPV /KMC	KSRTC/SPV/ KMC / Private	KSRTC/KMC / Private /SPV
4	In Land Water Ways System	KSRTC/ SPV /KMC	KSRTC/SPV/ KMC / Private	KSRTC/KMC / Private /SPV
5	Transit System (BRT/LRT)	KSRTC/ SPV /KMC	KSRTC/SPV/ KMC / Private	KSRTC/KMC / Private /SPV
Improvement of Freight Transportation System				
1	Proposed New Truck Terminals	State Govt. / KMC / Traffic Police	State Govt. / Private	Private
Technological and Intelligent Transportation System Facilities				
1	New Signal Installations	KMC/ Traffic Police	KMC/ Traffic Police	KMC/ Traffic Police
2	Adaptive Traffic Control System	KMC/ Traffic Police	KMC/ Traffic Police	KMC/ Traffic Police

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
3	Smart City Bus Shelters	KSRTC/ KMC/ Traffic Police	KSRTC/ KMC/ Traffic Police / Private	KSRTC/ KMC/ Traffic Police / Private
4	ITS control Centre, PIS, GPS, Mobile phone Applications and Surveillance Cameras)	KMC/ Traffic Police	KMC/ Traffic Police	KMC/ Traffic Police
5	Electric Charging Stations - 2w and 3w	KMC / KSEB / Private	KMC / KSEB / Private	KMC / KSEB / Private
Improvement of Parking Facilities				
1	On street Parking	KMC/ Traffic Police	KMC/ Traffic Police / Private	KMC/ Traffic Police / Private
2	Off street Parking (MLCP)	KMC/ Traffic Police	KMC/ Traffic Police / Private	KMC/ Traffic Police / Private
3	Off street Parking (Surface))	KMC/ Traffic Police	KMC/ Traffic Police / Private	KMC/ Traffic Police / Private

INSTITUTIONAL FRAMEWORK

City transport system generally involves several organizations that look after various forms and aspects of the transport system and network and have overlapping functions and areas of work. Therefore, to delineate areas and to remove ambiguity of functions the institutional framework has been proposed.

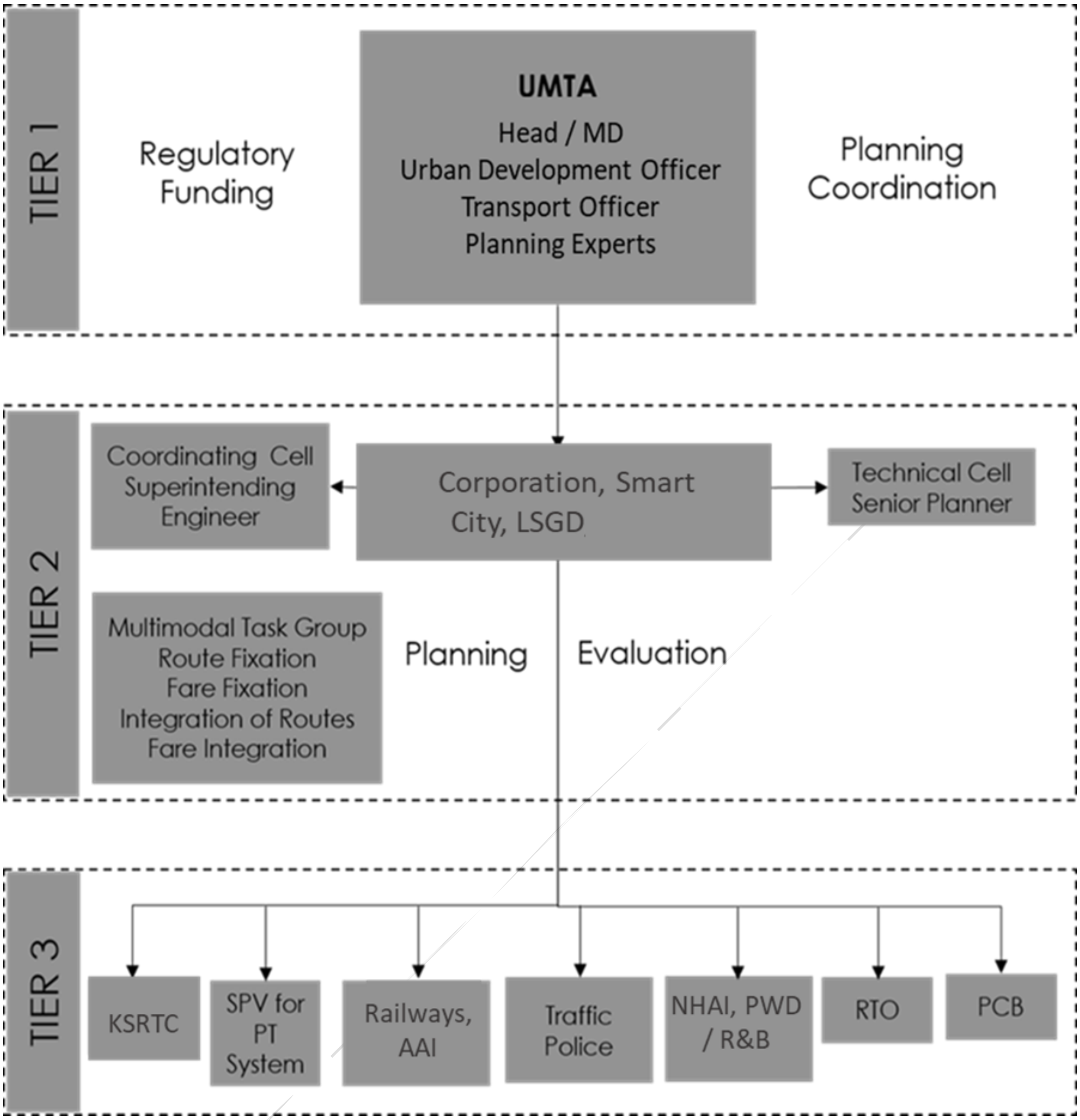


Figure 0-18 Recommended Structure for UMTA Setup

01

INTRODUCTION

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited


COXSWAIN

1 INTRODUCTION

Kozhikode is one of the fastest growing economic centres of north Kerala. The city's cultural and economic characteristics can be traced down to the ancient times where Kozhikode acted as a prominent port on the Arabian Sea which was a prominent international trade route. The city has undergone transformation in many aspects, especially in transportation network and landuse pattern, However, the supporting infrastructure and urban services provision have been unable to match this transformation. To solve the traffic and transportation issues, it is proposed to conduct a comprehensive transportation study to prepare long-term urban transport strategy for an improvement of people's mobility and to identify specific proposals for upgradation of transport infrastructure / facilities to ease the congestion level. The study is designed to provide the broad parameters for the long term development of transport infrastructure setting objectives for the next three decades.

Figure 1-1 Image of Kozhikode City (Source: Images.Unsplash.Com)

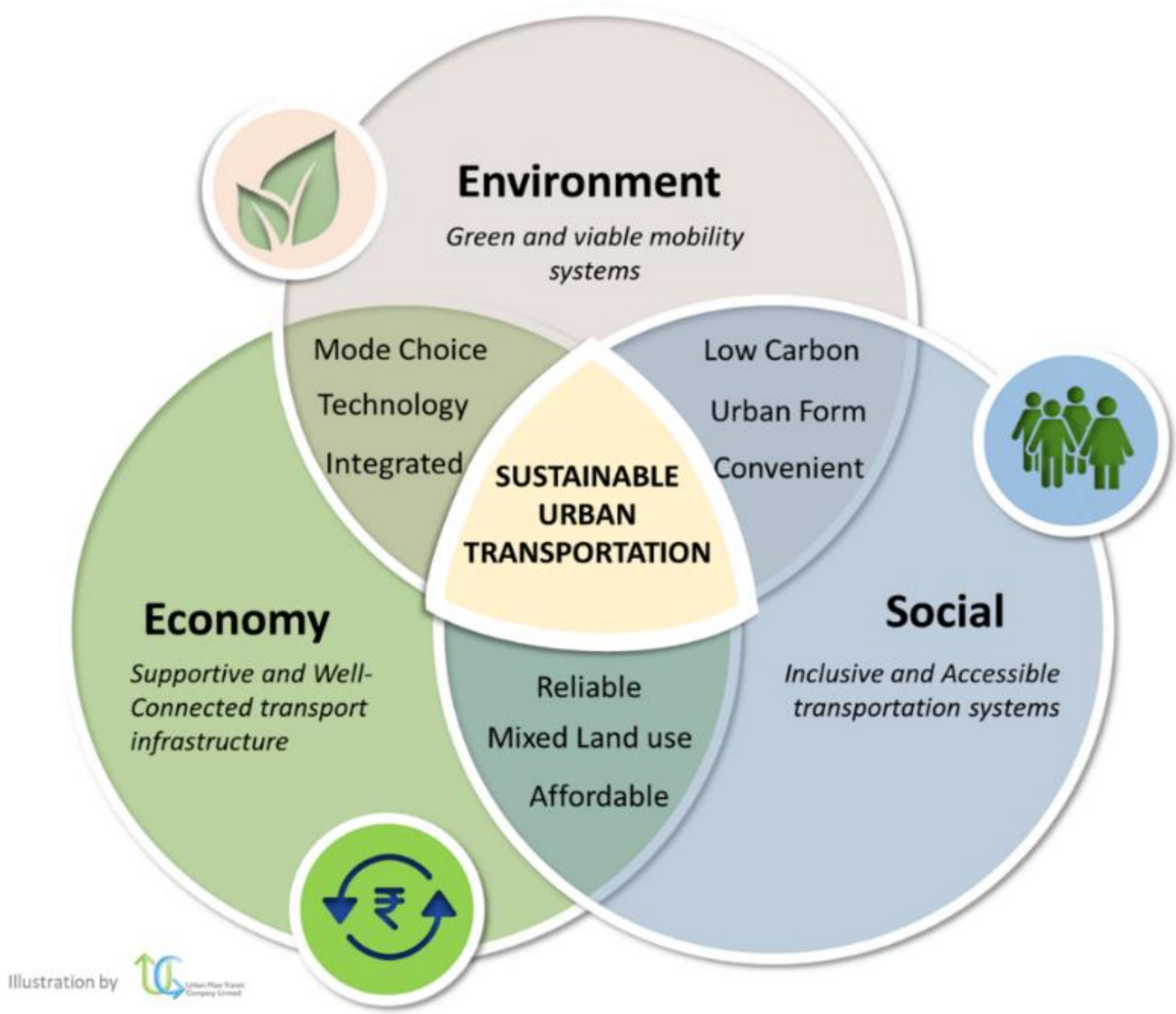


Figure 1-2 Concept of Sustainable Urban Transportation

A sustainable transportation is an integrated system which facilitates mobility in a way that preserves the social, environmental and economic interests of the city. Sustainable Urban Transportation planning has proven to gauge numerous comprehensive socio-economic and in environmental benefits.

These benefits include improved access to opportunities, supporting the urban growth, improved health, affordability, energy and environmental conservation, road safety, reduced parking costs, travel times, congestion and so on.

In this regard, Kochi Metro Rail Corporation Limited (KMRL) has appointed Urban Mass Transit Company (UMTC) to prepare a Comprehensive Mobility Plan (CMP) to provide comprehensive transportation strategies and policy measures for Kozhikode.

1.1 COMPREHENSIVE MOBILITY PLAN

The Comprehensive Mobility Plan (CMP) recommended by Ministry of Housing and Urban Affairs (MoHUA) is a long-term vision for desirable mobility patterns in the city and provides comprehensive and integrated transportation strategies and policy measures.

Figure 1-3 Graphics representing Comprehensive Urban Transportation Modes

CMP document is a roadmap for the transport infrastructure development and its investments in line with the Sustainable Urban Transportation principles.

1.2 IMPACT OF NATIONAL / REGIONAL FRAMEWORK

The Comprehensive Mobility Plans (CMP) is planned in cognizance with the national and regional frameworks and guidelines to enhance mobility, promote user safety.

1.2.1 NATIONAL FRAMEWORK

The National Urban Transport Policy (NUTP) Guidelines suggested by the Ministry of Housing and Urban Affairs (MoHUA) focus is on the following Sustainable Transportation principles:

1. Focus on the mobility of people rather than that of vehicles
2. Focus on improvement and promotion of Public Transport, NMVs and pedestrians as important city transport modes
3. Focus on integrating Land use and Transport Planning

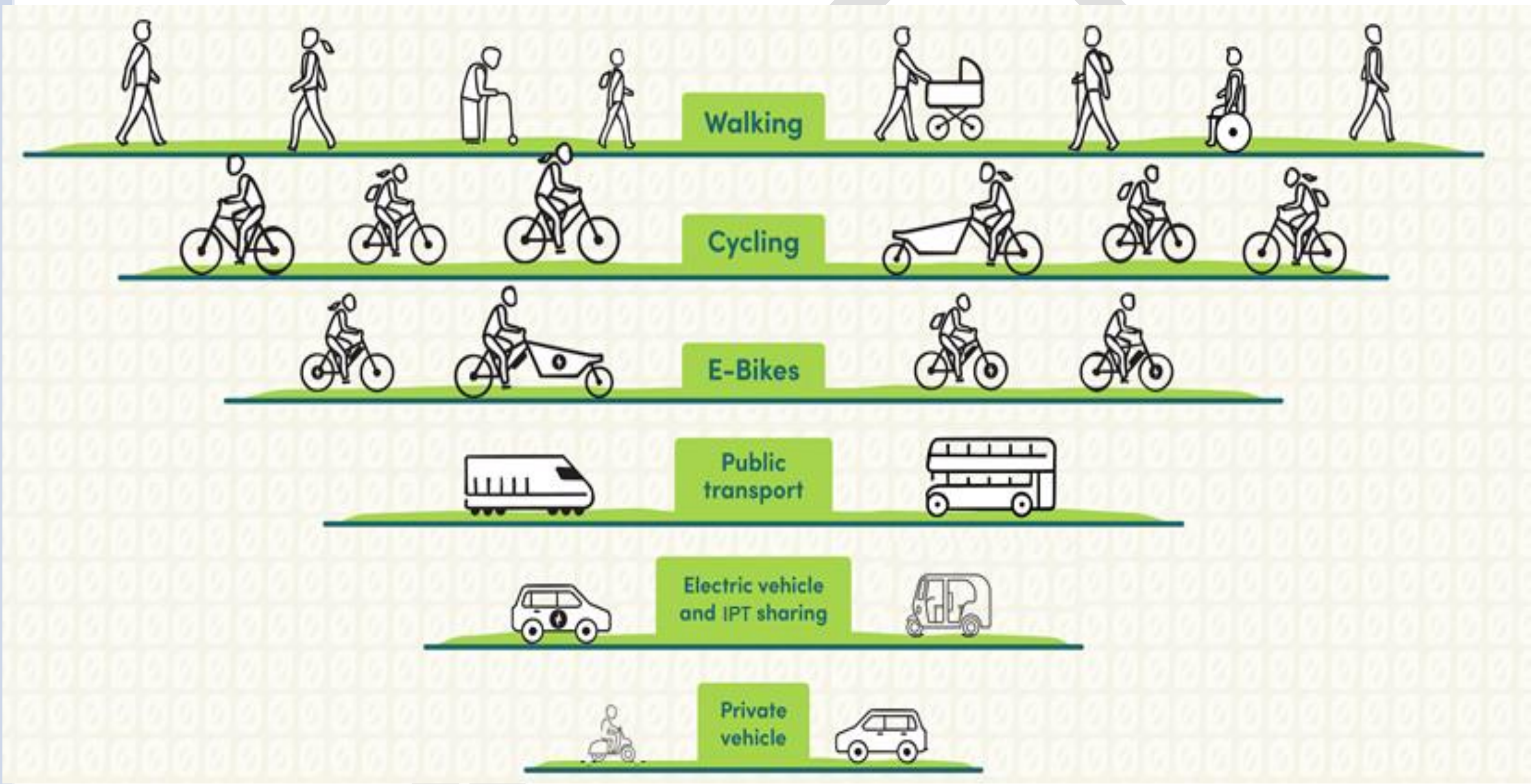
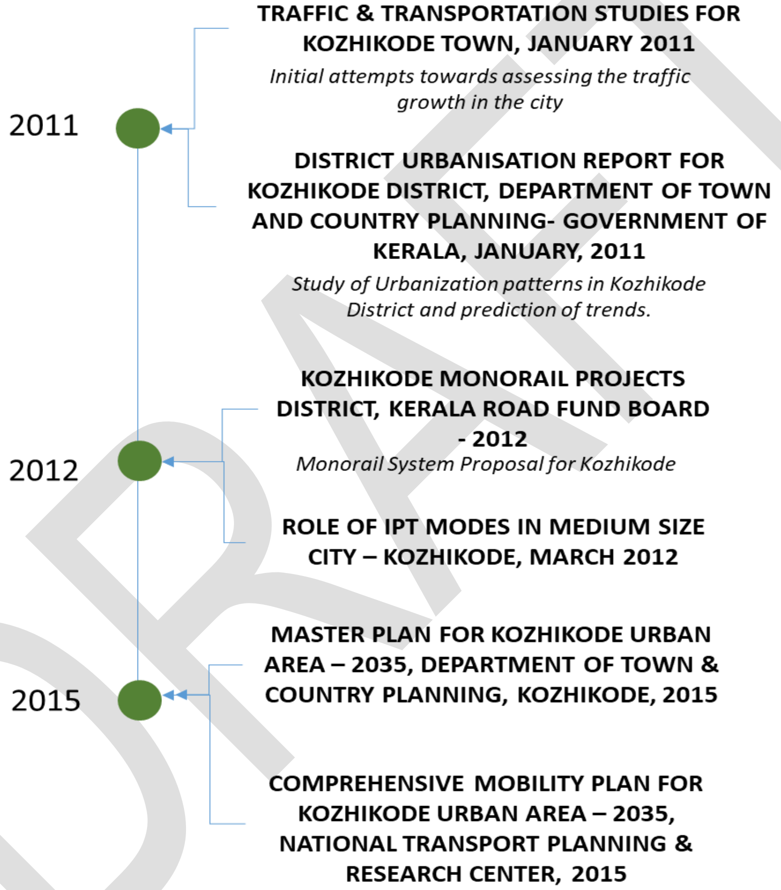


Figure 1-4 Hierarchy of Urban Transportation System

The thrust of NUTP is, “Moving people not vehicles” thus, outlaying a hierarchy of urban transportation system priority (Refer Figure 1-4). The transportation strategies and policies are recommended to prioritize infrastructure and action plans development to promote safe and convenient movement of Non-Motorised Transportation Users, followed by Public transportation systems. The CMP Kozhikode is prepared on similar lines focusing on equitable road space usage for users as the core of the CMP vision (Refer Chapter 8).

1.2.2 REGIONAL FRAMEWORK

The vision of the Local Self Government Department (LSGD), Government of Kerala is to promote, “Vibrant and clean cities through inclusive, sustainable and integrated urban development, good governance and efficient service delivery” and sustainable urban transportation is one of the critical pillars of urban development to ensure ease of moving around and support the economic growth of city. In line with the State and LSGD and Urban Local Bodies (ULBs) vision, various past studies (Refer Chapter 2 and Annexure) conducted for Kozhikode.



These previous studies emphasis predominantly on the following principles:

1. Integrating Urban growth with Transport Planning.
2. Improvement of Road network connectivity.
3. Improving and promotion of shared mobility (Public Transport, IPT), NMVs and pedestrians.
4. Developing efficient Rapid Public Transportation System to cater to the future needs.

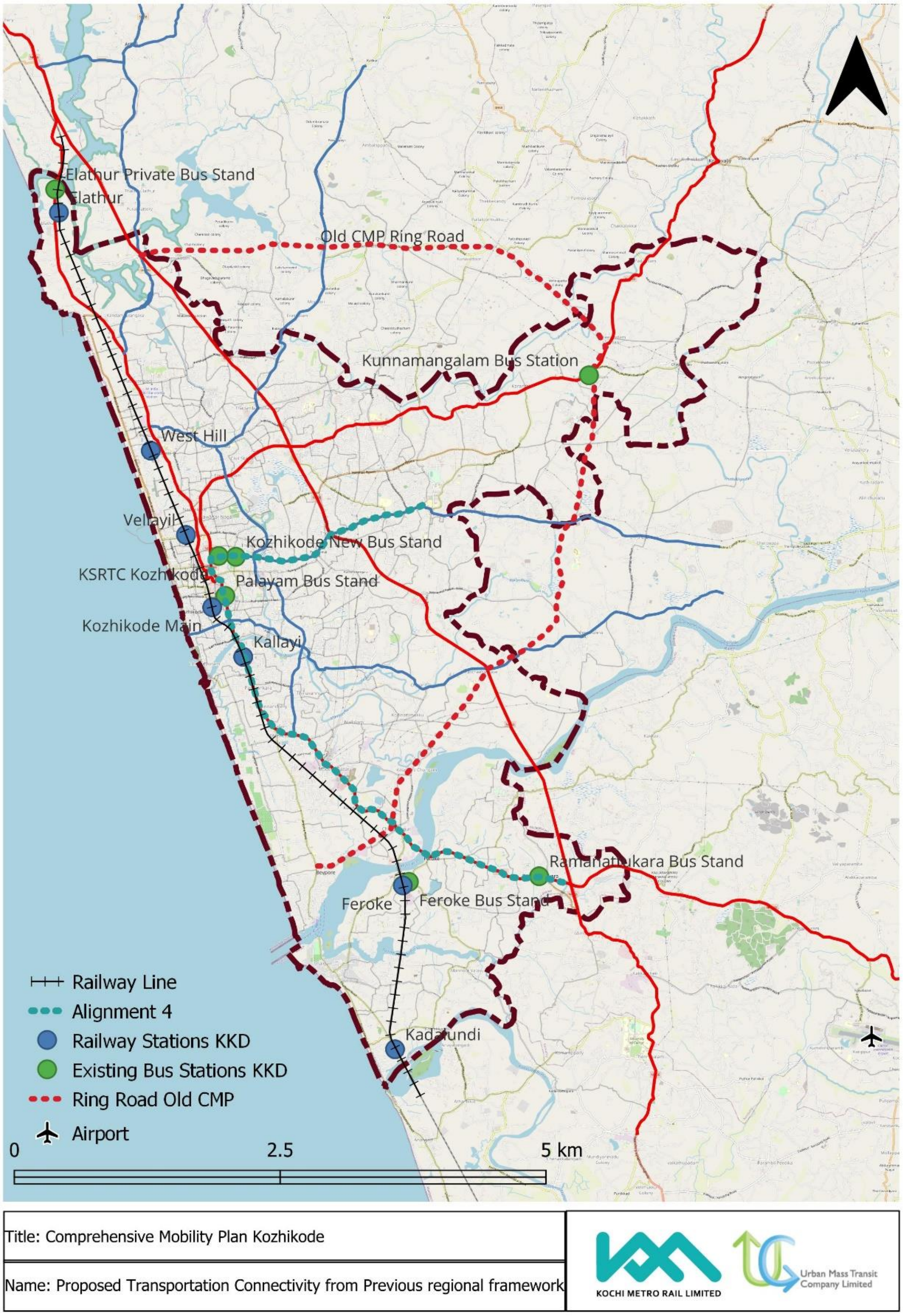


Figure 1-5 Proposed Transportation Connectivity from Previous Regional Framework, Kozhikode

Thus, considering the overall traffic and transportation perspectives, both regional and national level guidelines and approaches promote sustainable urban transport framework for 20 to 30-year horizon period. Thus, CMP Kozhikode is a necessary strategic vision document highlighting the national and regional framework for Urban Transportation.

1.3 STUDY AIM

With a vision to strengthen transportation system of this rapidly urbanizing city in a sustainable manner while catering to the horizon year mobility needs, the study aims to provide the users in Kozhikode a robust road and public transportation network providing inclusive sustainable travel mode choices for all users and through a safe, comfortable and seamless travel experience in the study area.

Figure 1-6 Kozhikode CMP Study Aim

1.4 STUDY OBJECTIVES

The proposed objectives for the project are as follows,

To provide a sustainable transportation system which is accessible within 500m from the activity generating areas like workplaces, educational institutes etc.

To ensure significant increase in public transportation share while supplying highly reliable and sophisticated PT system

To improve safety on roads for Non-Motorised Transport users by providing appropriate infrastructure for cyclists and pedestrians which ultimately help boost the public transport.

To reduce vehicular emissions by usage of alternative fuel options like E-Vehicles and streamlining their usage into the city's public transport as well as intermediate public transport system.

Figure 1-7 Kozhikode CMP Study Objectives

1.5 STUDY TIME-FRAME

The study time for the study is considered as 30 years, in line with the MoHUA CMP toolkit Guidelines. The horizon years for implementation of proposed strategies and investment plan is as follows-

- Short-Term: 2027
- Medium Term: 2031
- Long term: 2041, 2051

1.6 APPROACH

The approach proposed for the project is the 4Ds approach, which represents **Define, Diagnose, Design and Develop (4Ds)** for designing the unique methodology for assignment accomplishment. This approach aims at developing holistic proposals by addressing the transportation needs of all modes in detail.

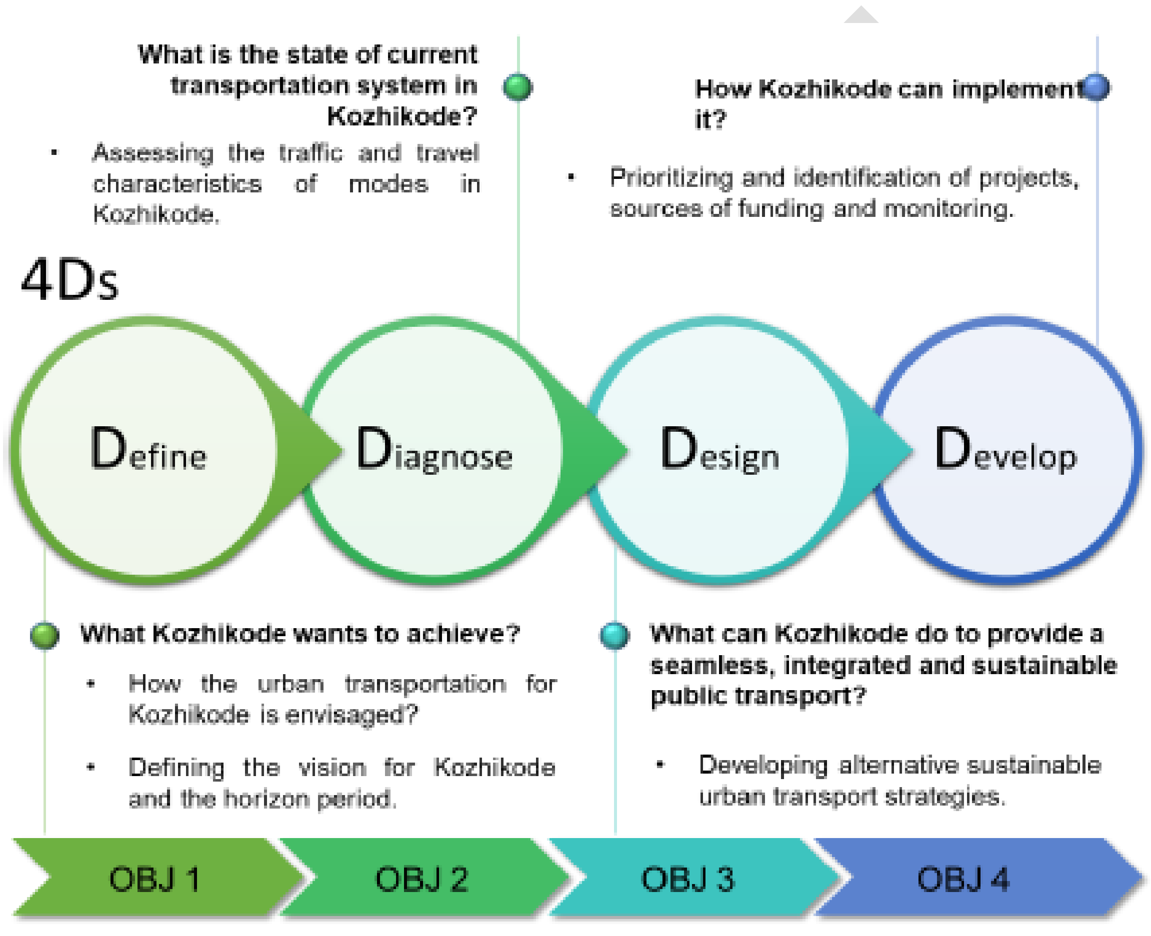


Figure 1-8 Proposed 4Ds Approach for the study

1.7 METHODOLOGY

The methodology proposed for the study is as presented below.

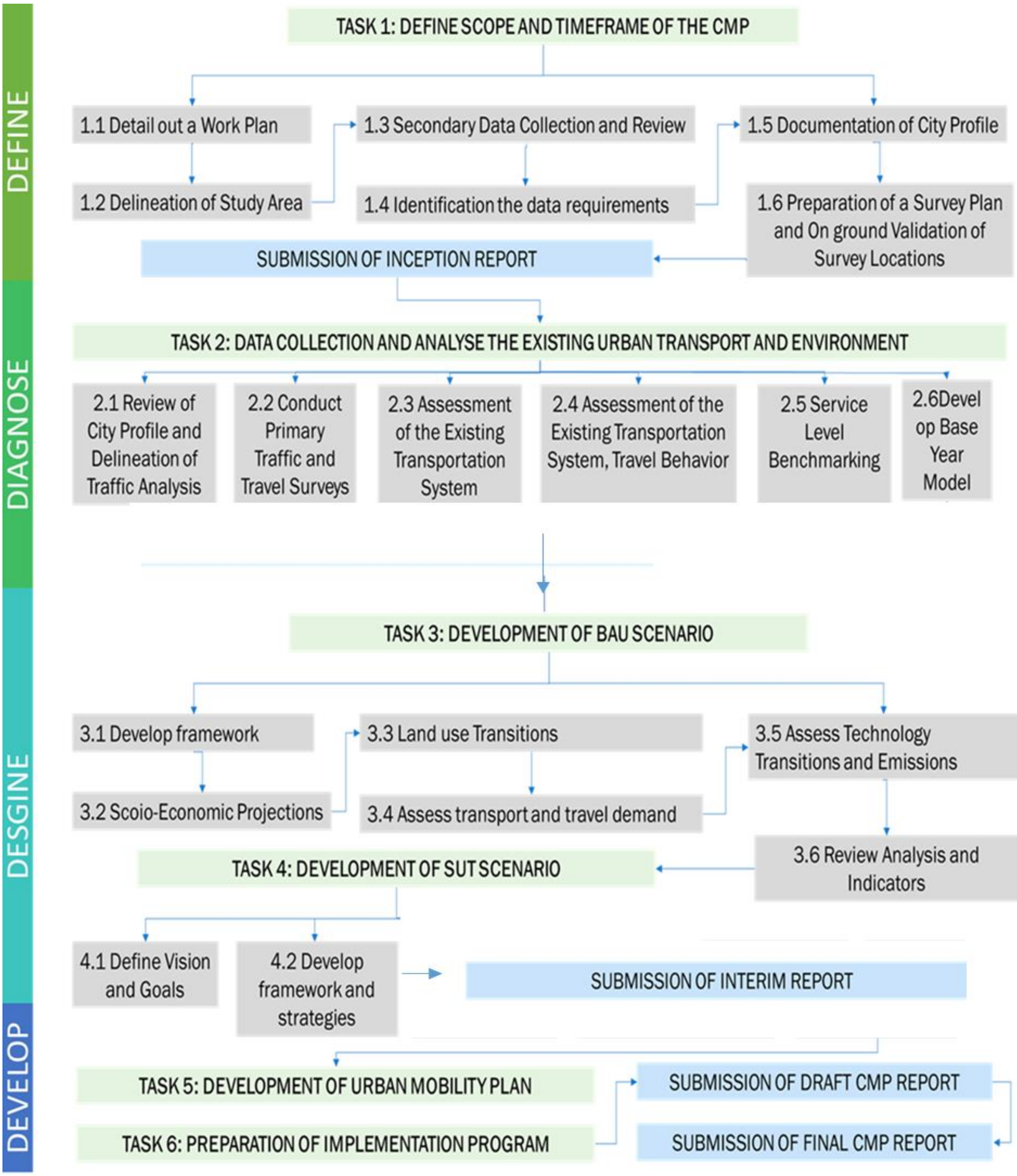


Figure 1-9 Methodology for CMP Kozhikode

2. STUDY AREA PROFILE

KOCHI METRO RAIL LIMITED

Urban Mass Transit
Company Limited


COXSWAIN

2 STUDY AREA PROFILE

Kozhikode is situated on the South-West coast of India. The district is bordered on the North by Kannur district, on the East by Wayanad district, on the South by Malappuram district and on the West by the Arabian sea. The city is situated in latitudes 11°15' N and longitudes 75° 46' E. The core city has Korappuzha as its North boundary; Olavanna, Kakkodi, Kunnamangalam and Peruvayal panchayats on the East; Chaliyar river on the South and Lakshadweep Sea on the West. Kozhikode Corporation is the headquarters of Kozhikode District, covering an area of 2344 Sq.km on an undulating terrain with ground level varying from 2 m to 1339 m from the mean sea level. Kozhikode has a dense and broad road network that connects it to locations in neighbouring states. Kozhikode is linked to all of India's main cities through road, rail, and air.


Krishna Menon Museum


Backwaters


SM Market


KIRTAADS


CSI Church

Figure 2-1 Images depicting the diverse profile of the Kozhikode City

2.1 GEOGRAPHIC LOCATION

Geographical situated on the southernmost tip of the country at 8.5241° N, 76.9366° E Latitude and longitude coordinates. Located in the southern State of Kerala, it is the administrative capital of the Kozhikode District.

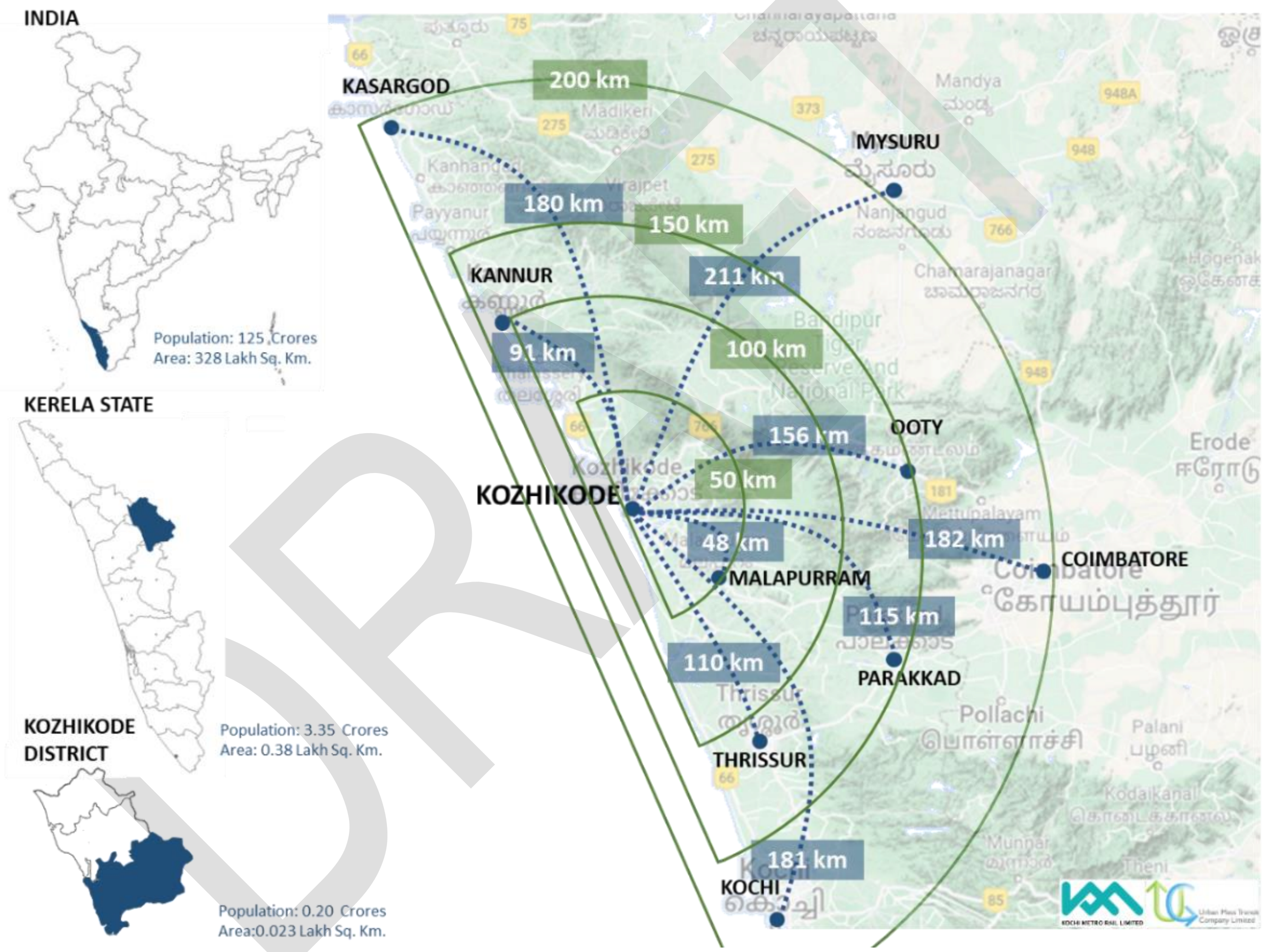


Figure 2-2 Location Map of Kozhikode

It is located within a distance of 200km from the major cities and towns in the southern region (Refer Figure 2-2). Physiography of Kozhikode region changes from plane coastal to highly undulating highland making a varied topography.

Title: Comprehensive Mobility Plan for Kozhikode	
Name: Major Linkages and Nodes	

Figure 2-3 Map Showing Major Nodes and Linkages for Regional Connectivity

2.2 REGIONAL CONNECTIVITY

The study area is well connected to other urban centres via National and State Highways, regional railways and by domestic airways.

Figure 2-4 Photographs of Major Nodes and Linkages for Regional Connectivity

- City can be accessed from the North South Corridor National Highway (NH) 66, via NH 766 (Wayanad Road), and at Kochi via NH 66. NH-66 passes to the centre of the study area, which is the main spine of city's road network. The city is also connected by the Mavoor Road and SH 38, Balusserri Road.

- Kozhikode central station and six stations that serve the study area catering to 25 thousand passengers daily.
- While air connectivity to domestic[11] and international[12] urban centres is cater by over 400 weekly operations (Refer Section 2.10 for further details).
- Kerala State Road Transportation Corporation (KSRTC) and various other private players operate sub-urban and regional services in the study area. There are 365 city services plying in the city.

2.3 STUDY AREA DELINEATION AND ADMINISTRATIVE BOUNDARIES

Considering the pattern of urbanization, and demographic trends in the region, it is observed that a rapid and continuous urbanization has observed towards the south of the Municipal Corporation and towards the west along the National highway, with the emergence of a number of institutions along it. Therefore, the study area delineated for the study is proposed to include the following:

1. Kozhikode Municipal Corporation
2. Ramanattukara Municipality
3. Feroke Municipality
4. Kadalundi Grampanchayat
5. Olavanna Grampanchayat
6. Kunnamangalam Grampanchayat

Table 2-1 CMP Kozhikode Study Area Details

KOZHIKODE PLANNING AREA			
S. No.	Subdivisions	Area (in sq. km)	Population (2011) in Lakhs
1	Kozhikode Corporation (75 Wards)	118	6.08
Municipality			
2	Feroke	15	0.54
3	Ramanattukara	12	0.36
Panchayat			
4	Kadalundi	12	0.43
5	Kunnamangalam	30	0.47
6	Olavanna	23	0.68
Total	Kozhikode Planning Area	210	8.57

[11] Offering connectivity to Chennai, Hyderabad, Mumbai, Daman, Bengaluru, Kochi, Delhi, Kannur, and Trivandrum.

[12] Kuwait, Doha, Dubai. Abu Dhabi, Bahrain, Colombo, Sharjah, Singapore and Muscat.

The study area delineation is in line with the Urban Agglomeration of Kozhikode according to the 2001 census, which extends up to Kunnamangalam in the east, Ramanattukara in the south, and Elathur in the north.

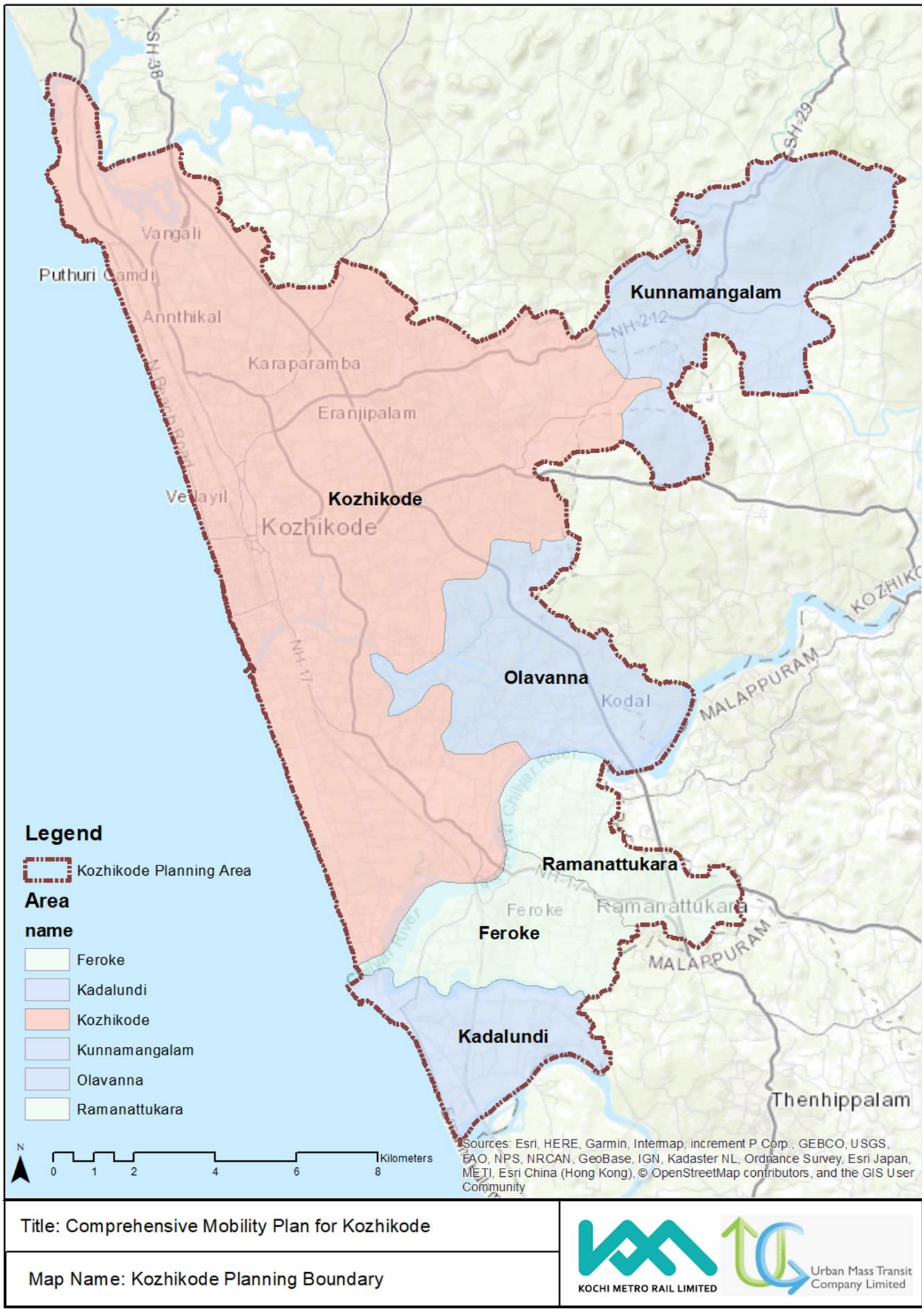


Figure 2-5 CMP Kozhikode, Study Area

2.3.1.1 KOZHIKODE MUNICIPAL CORPORATION

Kozhikode city is administered by the Local Civil body- Kozhikode Municipal Corporation (KMC). The city retains its regional importance for being the first formed Municipal Corporation of Northern Kerala, the District Head Quarters, largest commercial centre and the most important transportation hub for the whole of North Kerala. Kozhikode Corporation with an extent of 84.23 Sq.km was formed in 1962 annexing adjacent Gram panchayats, as per the Kozhikode City Municipality Act 1961. Today, the Kozhikode Municipal Corporation (KMC) is a Class A municipal corporation (as defined by Government of Kerala) governing an area of 118 square kilometres and has 75 electoral wards, the Figure 2-6 shows the ward delineation in the Corporation.

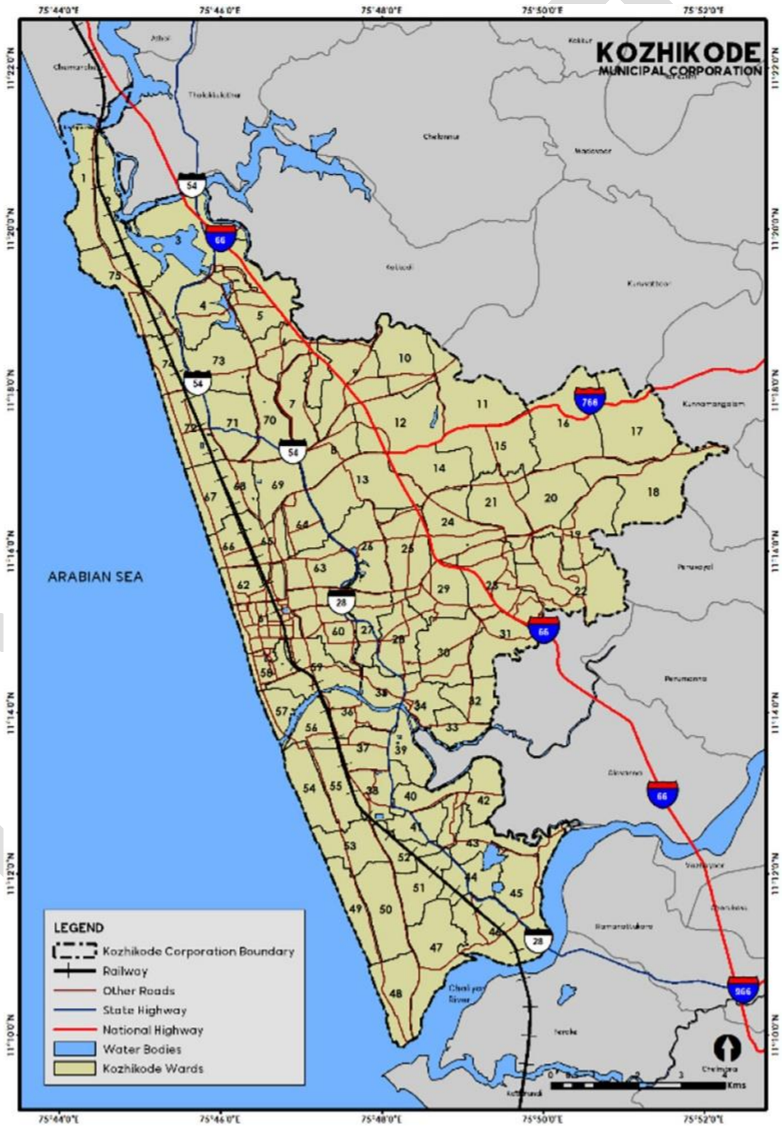


Figure 2-6 Administrative Boundary of Kozhikode City Municipal Corporation with Wards[13]

[13] Source: Resilience master plan as the pathway to actualize sustainable development goals – A case of Kozhikode, Kerala, India, www.sciencedirect.com

2.3.1.2 MUNICIPALITIES AND PANCHAYATS IN THE STUDY AREA

As seen in the sections above, apart from the corporation, the study area comprises 2 municipalities - Feroke and Ramanattukara - located to the south of the municipal corporation, and 3 gram panchayats – Kadalundi and Olavanna - located to the south and Kunnamangalam – located to the east of the municipal corporation.

Feroke municipality is situated in the banks of the Chaliyar river and has a rich industrial history and was a major centre for the timber industry during the British colonial era. Today, it is a bustling urban centre that is home to many small-scale industries and businesses, on the other hand Ramanattukara municipality is a religious and institutional hub and also a major transportation, since two major arterial links intersect at Ramanattukara. The main activities at Olavanna and Kadalundi are agriculture, textile weaving and coir manufacture. Kadalundi is also a major base for fisheries towards the southern bank of Chaliyar River due to its proximity to the Arabian sea. The urbanization of Kunnamangalam Panchayat can be attributed to the presence of major educational institutions and the Wayanad road, which passes through the area on its way to Bangalore

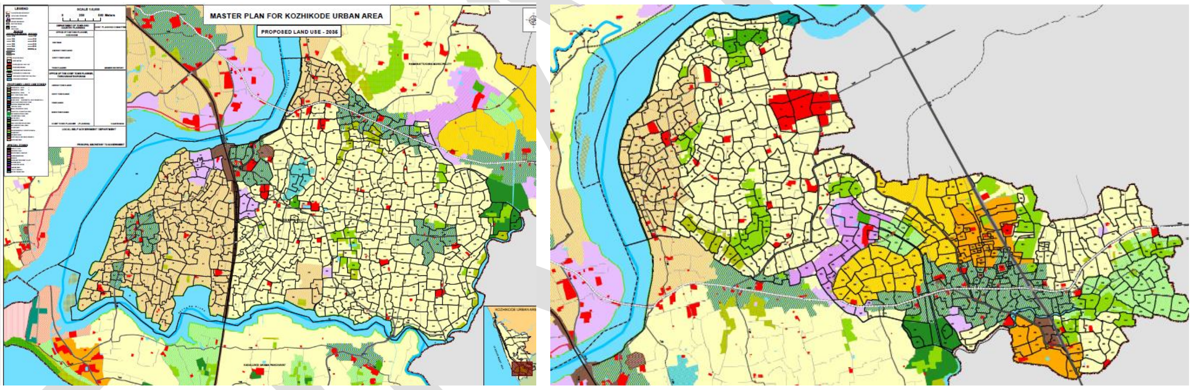
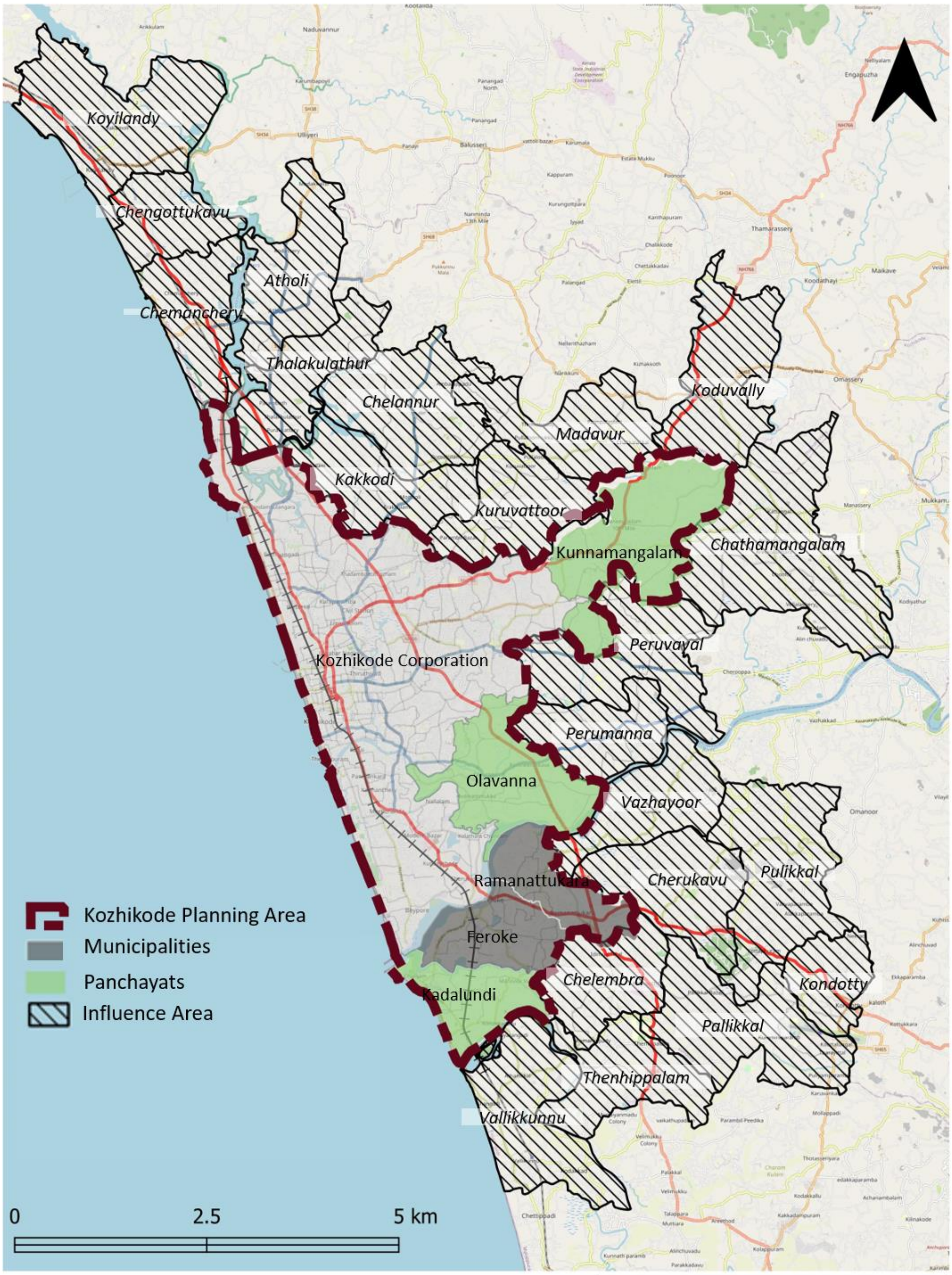


Figure 2-7 Feroke and Ramanattukara Municipalities

2.3.2 CMP KOZHIKODE – INFLUENCE AREA

Although the planning boundary comprises of the above mentioned areas, during the discussions with the key stakeholders, it was identified that there are other outgrowths beyond the planning boundary, which are influenced by the planning area in terms of their dependency for various industry workers, educational and work facilities to name a few. To cater to this, the municipalities of Koyilandy, Tenhipalam (Universities) and Kondotty (Calicut Airport) along with the panchayats of Chemancheri, Chengottukavu, Atholi, Thalakulathur, Kakkodi, Kuruvattur, Peruvayal, Perumanna, Vazhayoor, Pulikkal, Cherukavu, Vallikkunnu, Chelembra, Pallikkal are considered as the planning influence area.



Title: Comprehensive Mobility Plan Kozhikode	KOCHI METRO RAIL LIMITED Urban Mass Transit Company Limited
Name: Study Area	

Figure 2-8 Administrative Boundary of Kozhikode Study Area with Influence Area

2.4 URBAN GROWTH PATTERN

As per the District Urbanization Report of 2011, Kozhikode Corporation falls in first order functional hierarchy. The service area of the first order settlement is the entire district[14]. Kozhikode city alone accounts for nearly 40% of the urban population in the District and is experiencing a rapid growth in urban population. The agricultural activity is predominantly concentrated in the midland region of the district.

The State Urbanisation Report (SUR) has assumed that urban clusters identified as per urban profile for 2021 grow along corridors identified and finally form urban corridors, by clubbing nearest clusters along major national highways. Physical development as well as proximity of urban clusters and other urban areas were taken in to account while delineating the urban corridors. The SUR has proposed an urban corridor (Malappuram-Kozhikode Corridor) passing through the city of Kozhikode which foresees major development projects, a major portion of the city falls on the mentoned urban corridor. Figure 2-9 and Figure 2-10 shows the urban growth pattern in Kozhikode.

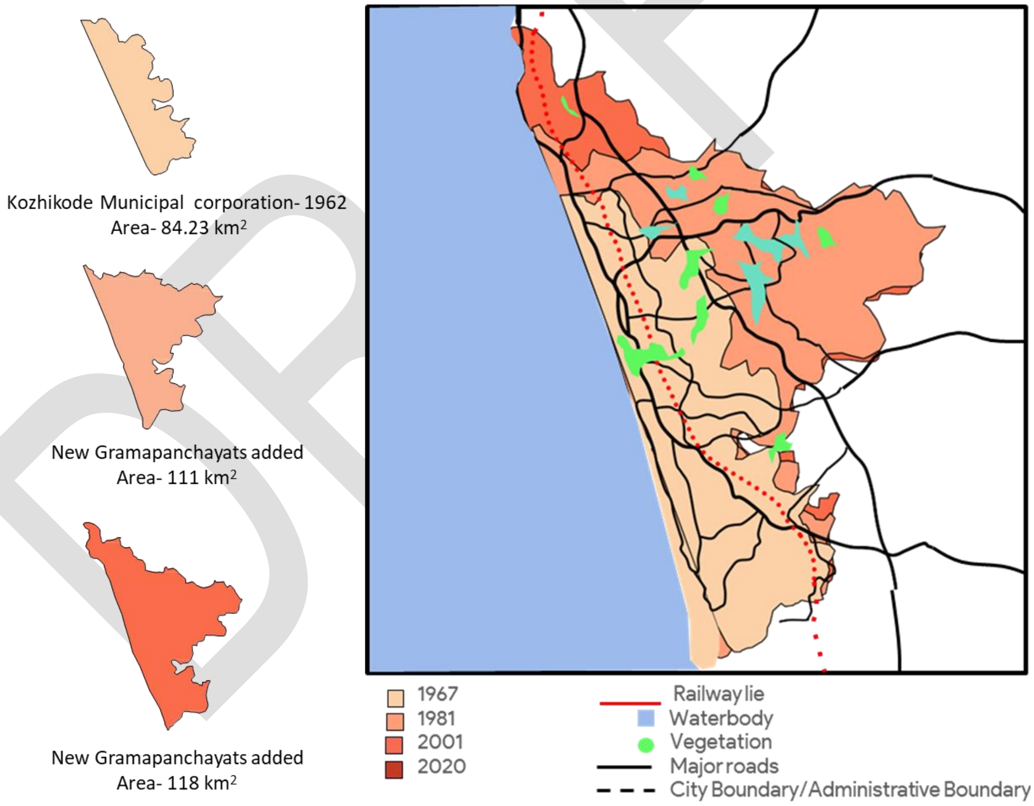


Figure 2-9 Growth Pattern of Kozhikode Urban Area [15]

14 Draft Master Plan for Kozhikode City 2040.

15 Source: National Remote Sensing Center, ISRO

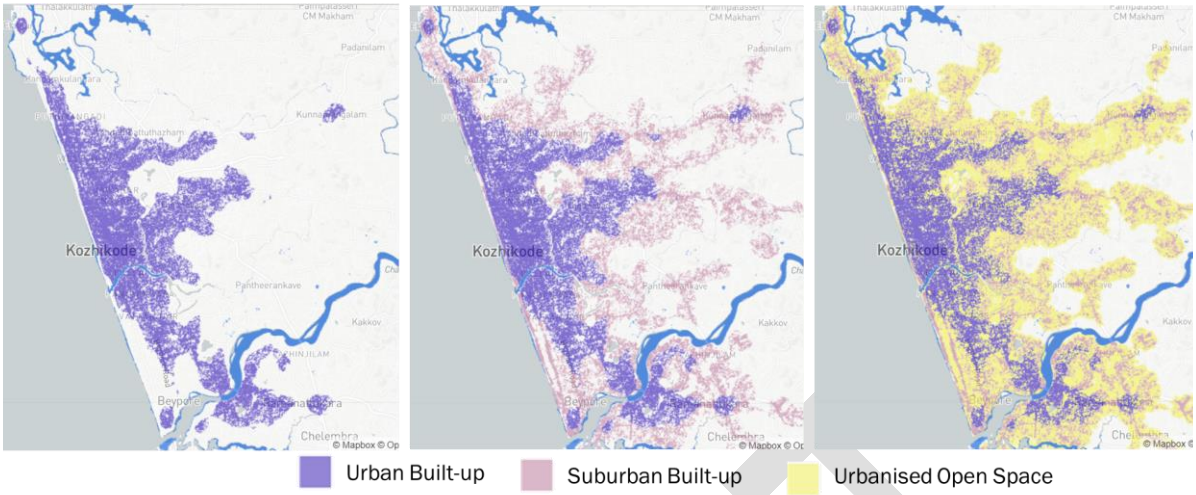


Figure 2-10 Urban Growth Pattern in Kozhikode[16]

Being a coastal city, Kozhikode has been growing around Palayam, which is the nodal point of trade and commerce and other major linkages that emerged over time. The city has been seen to be growing towards the south, east and towards the north.

2.5 DEMOGRAPHIC PROFILE

The Kozhikode Municipal Corporation (KMC) has an area of 118 sq.km. As per the 2011 census, the delineated study area had a population of 8.56 lakh.

The study area excluding the corporation is 92 sq.km. As per the 2011 census, the municipal corporation boundary has recorded a total population of 6.0.8 lakhs. Corporation area is home to 20% of the district's population as per census 2011. The Population density in the corporation area is 6532 persons/Sq.km.

Table 2-2 Population of Kozhikode Municipal Corporation Area[17] and 4 Panchyats

S. No.	Sub Divisions	Population in Lakhs (1991)	Population in Lakhs (2001)	Population in Lakhs (2011)	CAGR (2001-11)
1	Kozhikode Corporation (75 Wards)	5.63	6.01	6.08	0.11%
2	Kadalundi Panchayat	0.35	0.39	0.43	0.84%
3	Feroke Municipality	0.44	0.50	0.54	0.73%
4	Ramanattukara Municipality	0.26	0.30	0.36	1.67%
5	Olavanna Panchayat	0.44	0.55	0.68	2.13%
6	Kunnamangalam	0.34	0.45	0.47	0.54%
Total	Kozhikode Planning Area	7.47	8.22	8.57	0.42%

[16] www.atlasofurbanexpansion.org

[17] Respective year's census

Linear population growth is considered for the base year projections in line with the draft proposed Master Plan -2040.

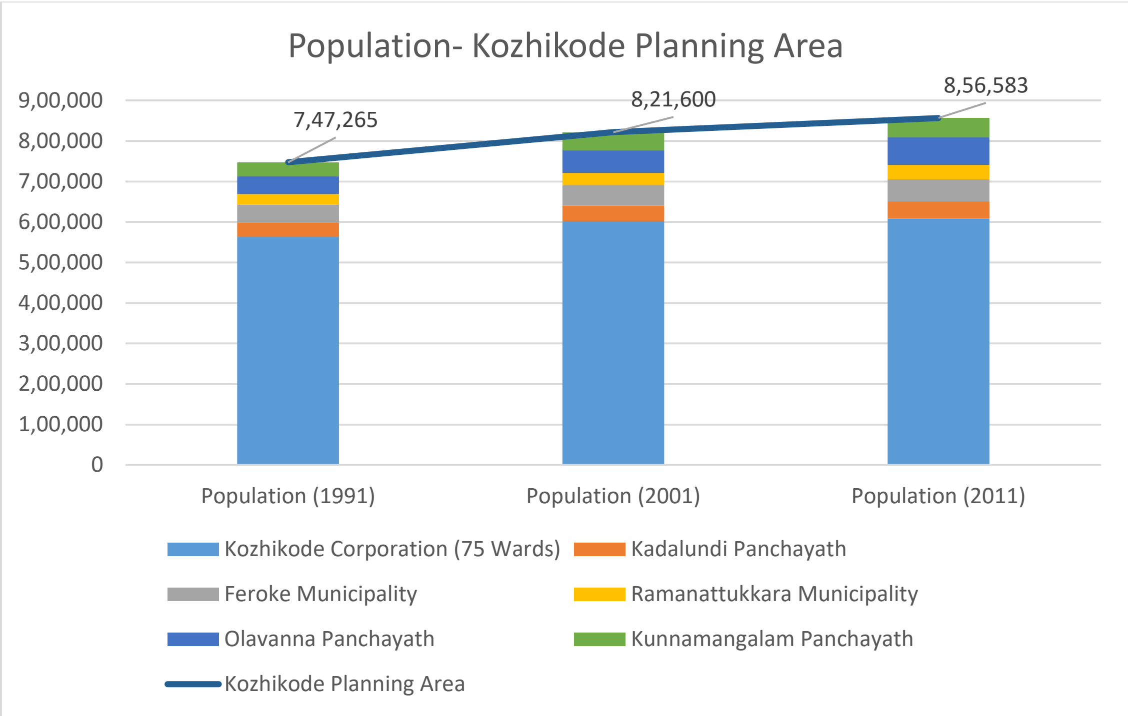


Figure 2-11 Graphical Representation of Kozhikode Growth Pattern [18]

Table 2-3 Population Density in the Study Area

S. No.	Sub Divisions	Area in sqkm	2023 (persons per sqkm)
1	Kozhikode Corporation (75 Wards)	118.59	6532
2	Rest of the Study Area	92	3050
Total	Kozhikode Planning Area	210.59	3630

The population density of the study area is observed to be 3630.60 pp sqkm for the base year 2023[19], accounting to be third dense urban area in the state followed by Kochi and Thiruvananthapuram. The average household size in Kozhikode is 4[20].

[18] Source: National Remote Sensing Center, ISRO

19 Master Plan 2041

20 Primary Survey Analysis

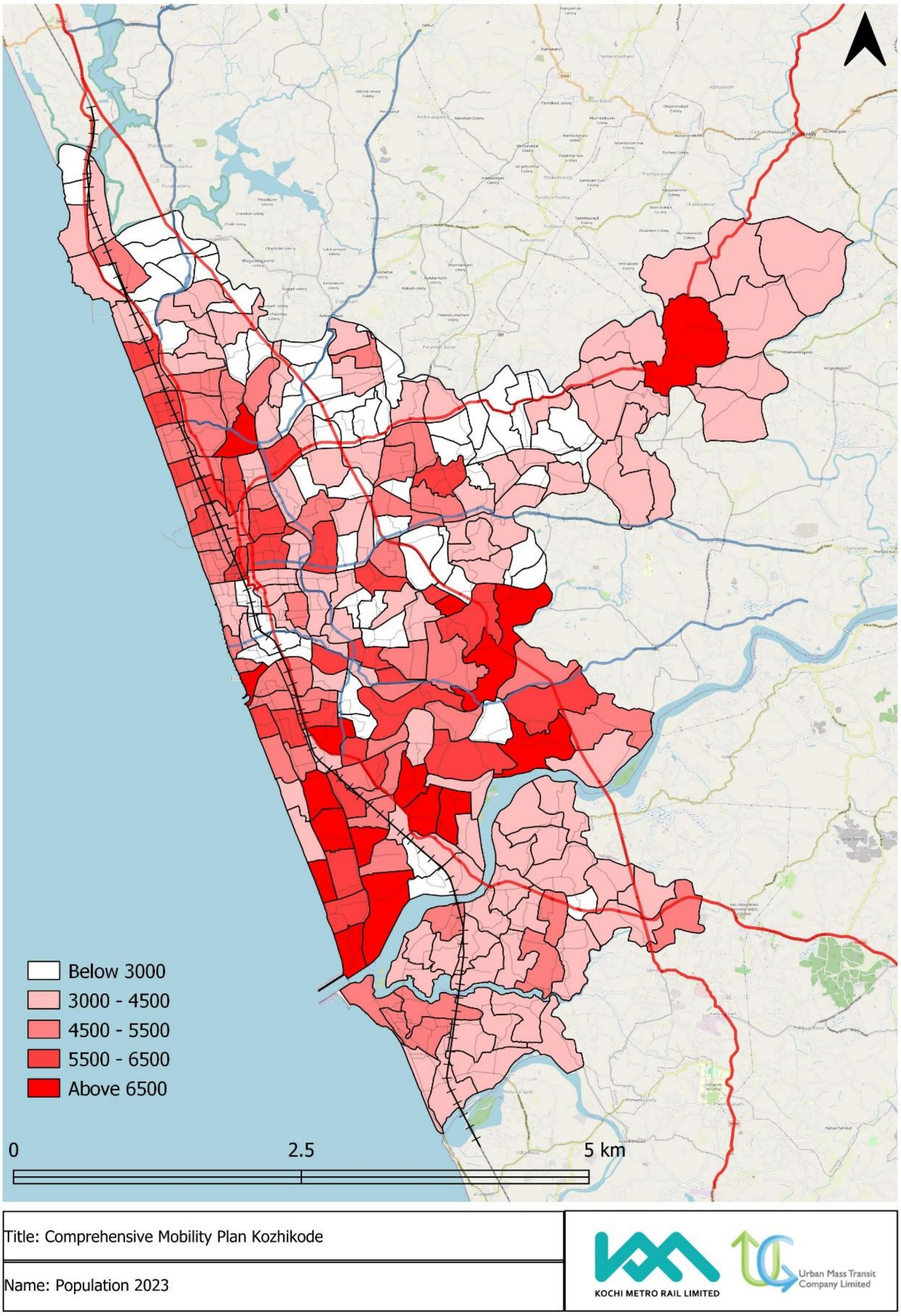


Figure 2-12 Population Density Distribution in Kozhikode, 2023

2.6 LANDUSE

In Kozhikode Corporation, the commercial land uses are concentrated in the city core – Valiyangadi-Palayam- Mavoor road areas, and industrial uses are concentrated in Cheruvannur – Nallalam and West Hill areas. Public and Semi-public uses are distributed all over the Corporation area. The share of transportation accounts to about only 1% in the total area.

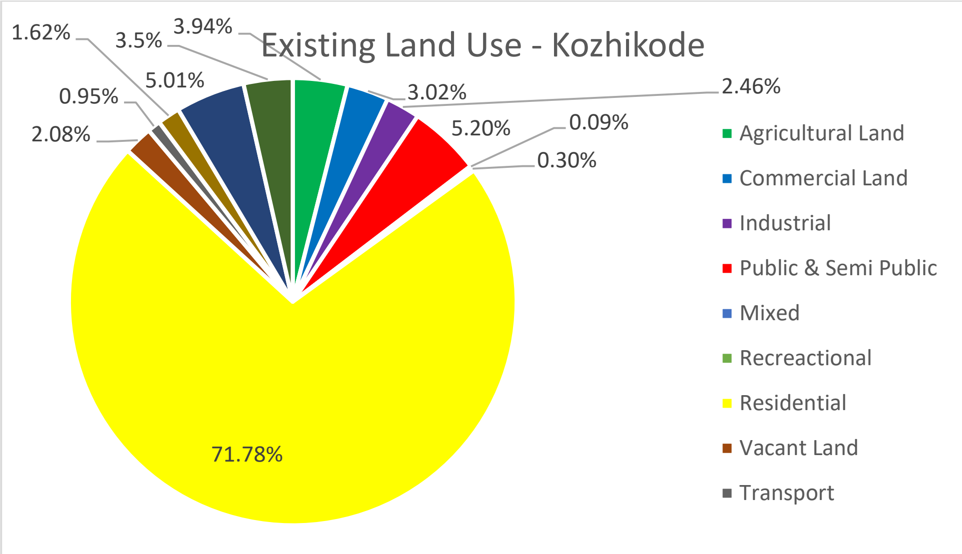


Figure 2-13 Existing Landuse, Kozhikode, 2019

Table 2-4 Existing Land Use Distribution (2040 Draft Master Plan for Kozhikode)[21]

[21] Detailed extract of the same has been given in the annexure.LAND USE- 2012

Land Use 2012 (Master Plan for Kozhikode Corporation 2035)

Land Use	Area in Sq Km	% Area
Commercial	3.36	1.88%
Residential	120.53	67.63%
Industrial	3.26	1.83%
Public & Semi Public	7.17	4.03%
Religious	1.85	1.04%
Roads & Transportation	9.53	5.35%
Environmentally Sensitive	7.47	4.19%
Water Body	11.57	6.50%
Parks & Open Spaces	0.32	0.18%
Agriculture	11.41	6.40%
Vacant	1.73	0.97%
Total	178.21	100.00%

Land	Area in Sq Km	Percentage Share
Agricultural Land	4.53	3.87%
Commercial Land	3.469	2.97%
Industrial	2.821	2.41%
Public & Semi Public	0.499	0.43%
Mixed	0.103	0.09%
Recreational	0.349	0.30%
Residential	82.434	70.49%
Vacant Land	1.388	1.19%
Transport	1.091	0.93%
Road	4.064	3.48%
Water Bodies	5.752	4.92%
Others	14.502	12.42%
Total	116.938	100%

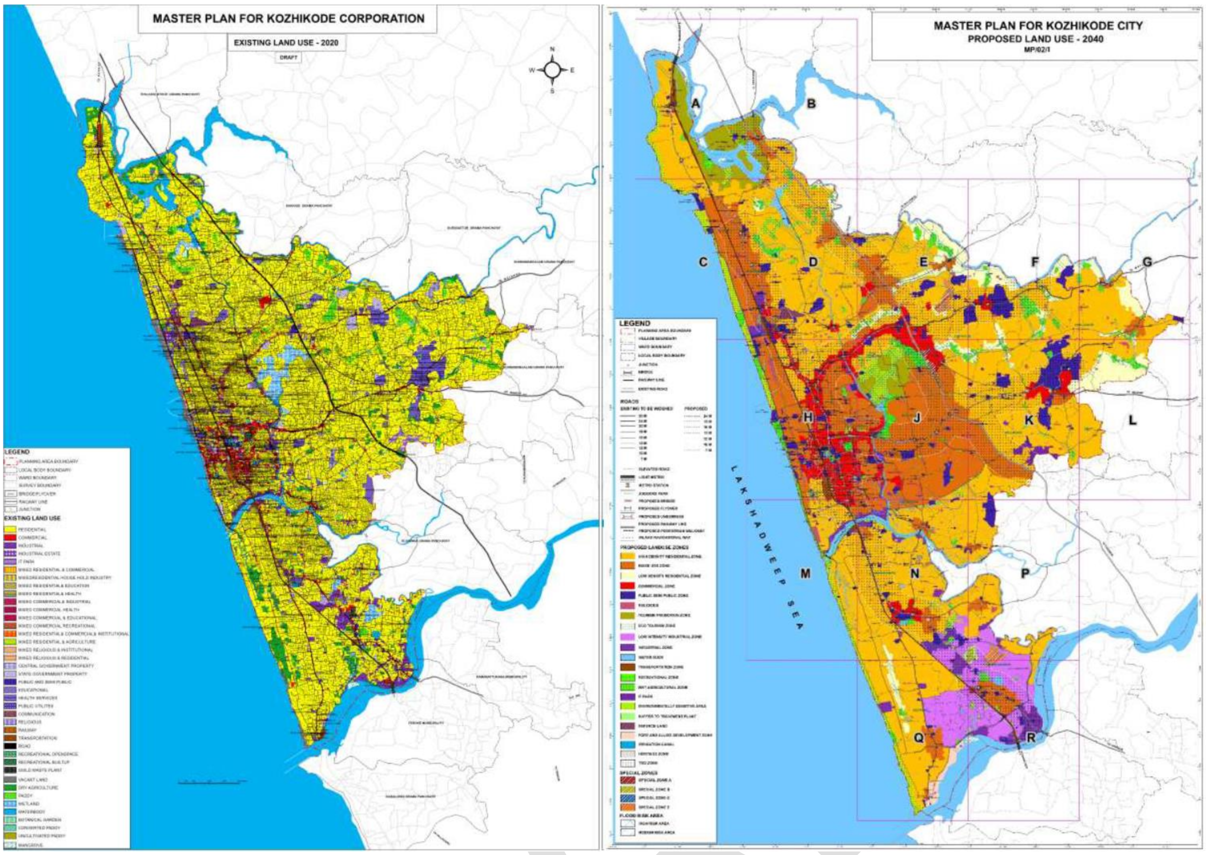


Figure 2-14 Existing Land Use, land use survey 2019 for, Kozhikode Corporation (left) & Proposed Land Use 2040, Kozhikode Corporation (right)

The proposed master plan has prioritized High Density Residential use constitute the highest share, with 44.52% of the area of proposed land uses for the Corporation area followed by 16.60% mixed use zone. Pucca Commercial land use constitutes about 4.25% and more commercial is envisaged under mixed use and other zones. Industrial uses constitute 8.39 %, public – semipublic 4.88 % and transportation along with roads around 4.43% of the Corporation area. Around 4.70% is water bodies, suggesting the possibilities for waterfront development, water based recreation, tourism and water ways development.

2.7 ECONOMIC PROFILE

Workers in Kozhikode Corporation in 2011 constitute 20.36% of the total workers' in Kozhikode District. Studies carried out reveal that there is decrease in participation rate in primary and secondary sector and increase in participation in tertiary sector activities.

Figure 2-15 Kozhikode Corporation

The significantly high growth of workers in the district in last decade could be mainly attributed to development of tertiary sector. Work Participation Ratio (WPR) for Kozhikode Corporation is 31.77% percent as per census 2011, which increased from 30.6% percent as per 2001 census. The WPR of the city is observed to be lower than the state average ratio of 34%.

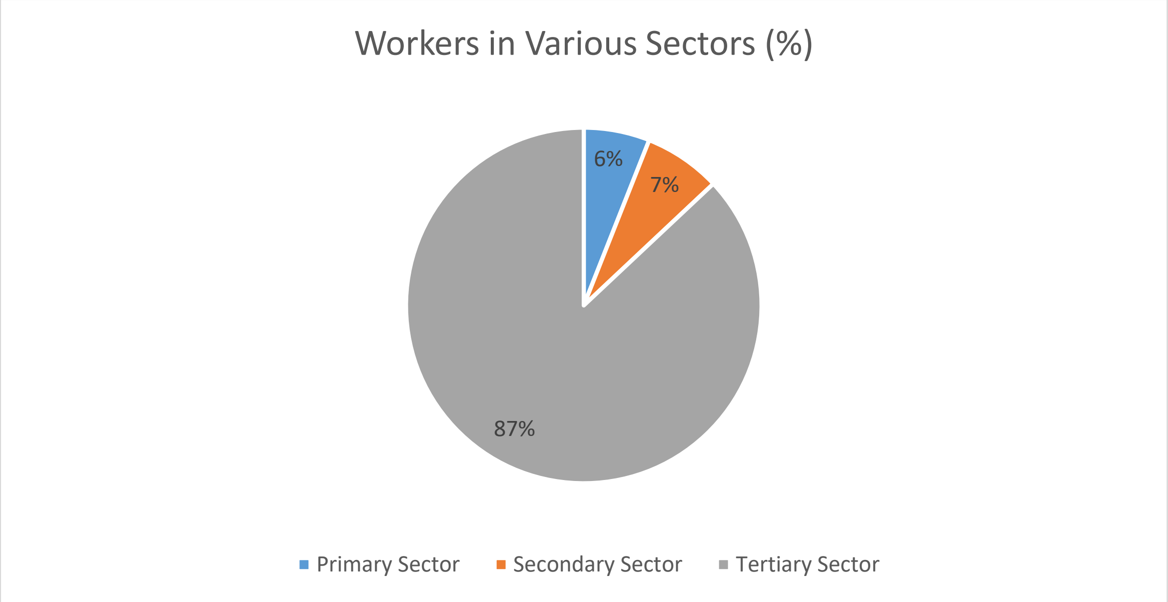


Figure 2-16 Workers Distribution Across various sectors, (Socio Economic Survey, Kozhikode- 2019-20)

Table 2-5 Total Resident Workers in the Study Area22

Area	2011
Kozhikode Corporation	31.77%

[22] Census 2011

Ramanattukara Municipality	30.26%
Feroke Municipality	28.89%
Olavanna Panchayat	32.94%
Kadalundi Panchayat	29.42%
Kunnamangalam Panchayat	29.66%

As per the socio-economic survey conducted in Kozhikode Corporation by the Town and Country Planning Department in 2019-20, 12.78% of the population are unemployed About 22.21% of the population works in the private sector while 5.2% works under the public sector. It is observed that 10.21% of the population is self-employed in the Corporation area.

As per the records of Directorate of Industries and Commerce (DIC), Government of Kerala there are about 1078 industrial units in Kozhikode Corporation. Large and medium industries employ around 5000 people[11].

Figure 2-17 Major Industries in Kozhikode

Kozhikode Corporation is the single first order commercial node in the district, major commercial nodes in the study area are Big Bazaar & Palayam markets, which forms the CBD. The portion of the NH 66, which traverses through the CBD, forms a major commercial corridor and houses both wholesale and retail activities. Each road stretch has a distinct character based on the type of commodities sold. Automobile related trading activities are located in the Nadakkavu area. The proximity of transit hubs, commercial areas selling food and electronic gadgets in the road stretch from Pottammal junction to Mavoor road, makes it a significant commercial stretch. SM Street is a major commercial area selling textiles. The Kammath lane located nearby is famous for the trading of Gold and brass utensil. The precincts of Palayam market is occupied by shops selling various commodities. Also, the NH bypass stretch from Pantheerankavu to Malaparamba houses various commercial buildings along it.

The other major employment generators which has developed along the fringes of the corporation area are:

1. Kinfra Advanced Technology Park, Ramanattukara
2. Cyber Park, Olavanna
3. Govt Medical College Kozhikode
4. IIM and NIT, Kozhikode
5. Beypore Port and Wood Industry

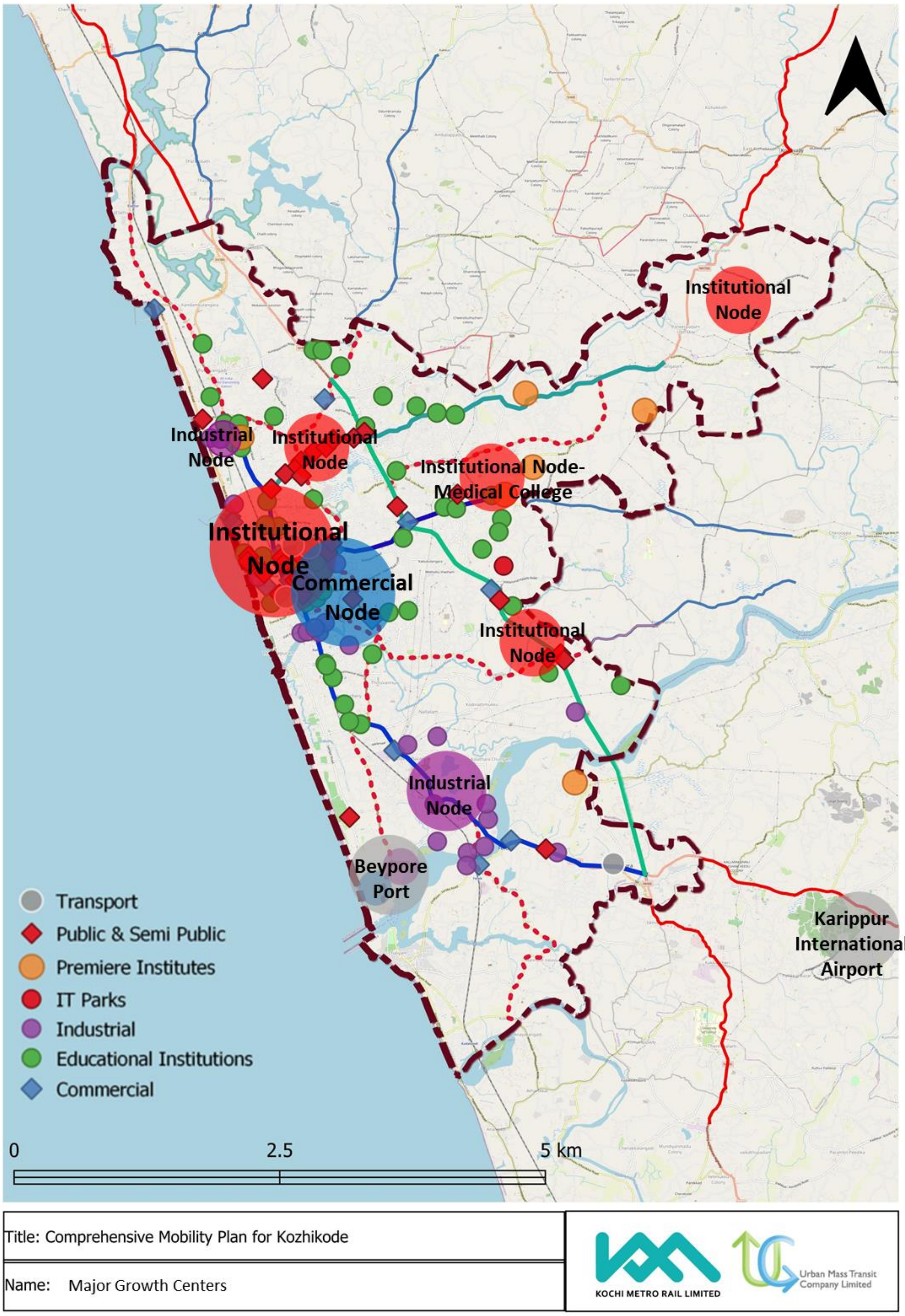


Figure 2-18 Major Employment Generators in the Study Area.

Figure 2-19 Photographs of Major Commercial and Trade Centres in Valiyangadi (Up), Palayam Market(Down)

Thus, the central business district in the study area houses the Palayam, Mananchira, SM Street etc The secondary business centres house areas such as West Hill and adjacent industries. etc and the peripheral business centres which area recent and upcoming business centres include Beypore, Ramanattukara, Pantheerankavu, Kunnamangalam and so on.

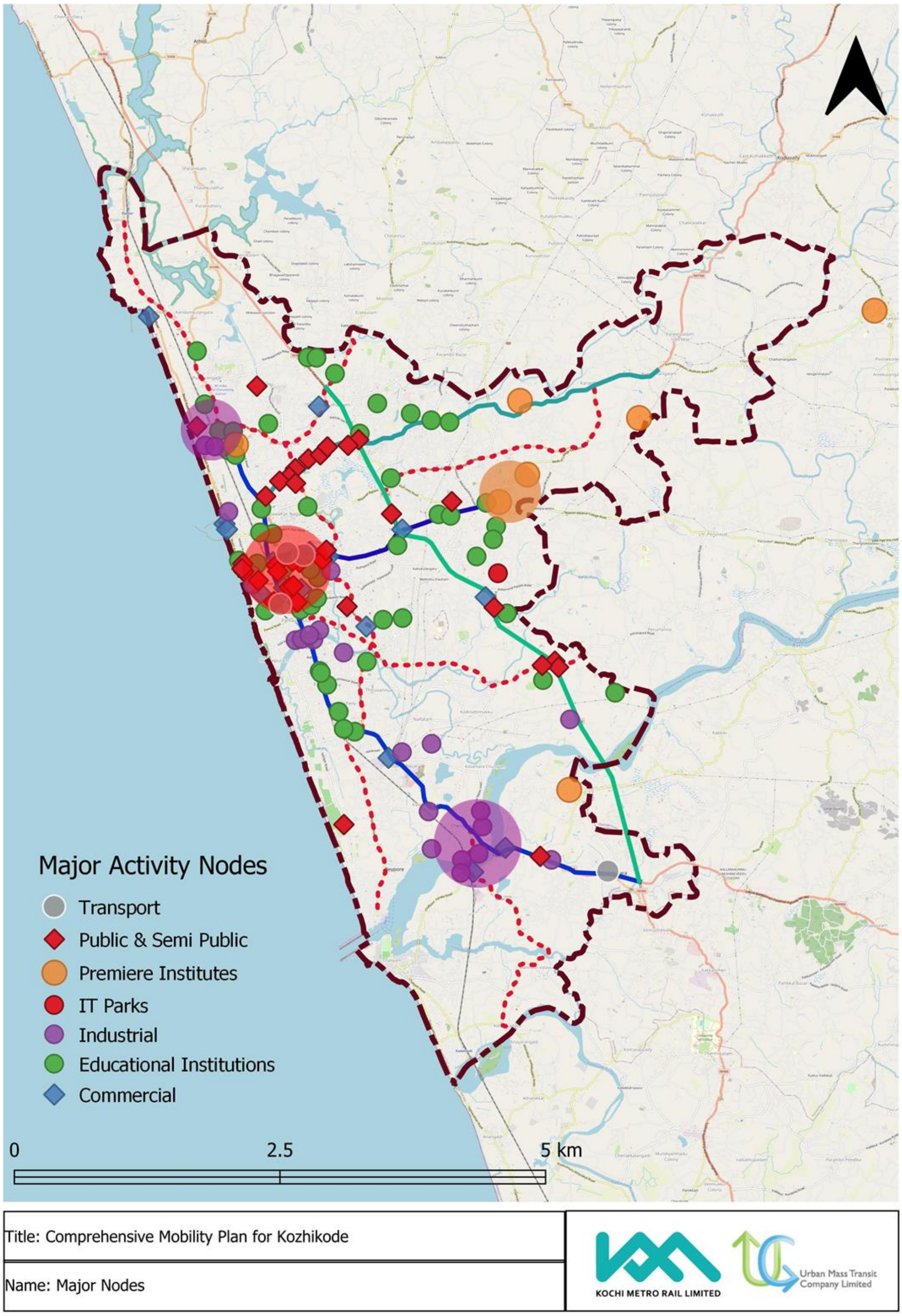


Figure 2-20 Map Showing the clustering of economic activity nodes in the study area (Source: Primary and Secondary Data Assessment, 2022)

2.8 ROAD NETWORK

The city has a distorted grid iron pattern in the center with a few radials emerging from it.

- NH-66 passing through the eastern boundaries of the city covering important traffic generating points like Thondayad, Pantheerankavu, Ramanattukara etc.
- Kannur Road
- Mavoor Road
- SH 28, Calicut Road, NH 966, Kozhikode-Palakkad Highway
- Wayanad Road
- Beach Road

Beach road is a major recreational spot in the city which is rich with various recreational activities and SM Street is a pedestrianized street in the city.

Table 2-6 List of major roads in the city

S NO.	CORRIDORS	FROM	TO	LENGTH (KM)
1	Nh-66	Eranjikkal	Arapuzzha Bridge	22
2	Kannur Road	Vengalam	Mananchira	18
3	Mavoor Road	Mavoor Road Junction, City	Ummalathoor Meethal	8
4	NH 766, Wayanad Road	Nadakkavu	Nedumala	18
5	Beach Road	Vengali	Thekkepuram	11
6	SH 28, NH 966, Calicut Road	Mananchira	Ramanattukara	17
7	Balusserri Road	West Hill	Koduvally	7
8	Mini Bypass	West Hill Chungam Junction	Bypass Junction	11.7
Total				**101**

However, it is observed that a well-defined and clear hierarchy of road network needs to be developed in study area as the current major roads in the city are National and State Highways.

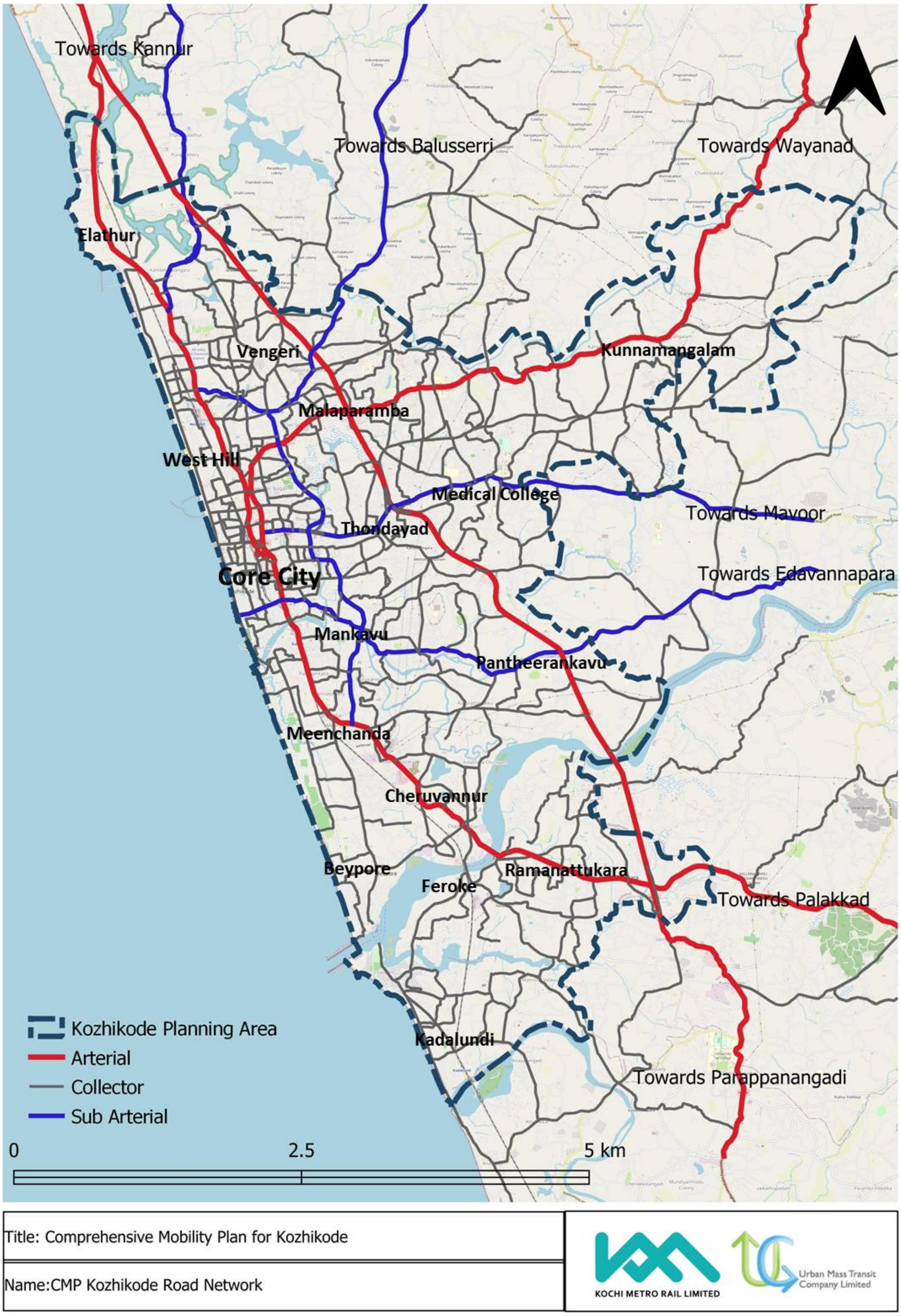


Figure 2-21 Road Network showing Major Roads (Primary Surveys, 2022)

2.9 VEHICLES REGISTERED

The registered vehicle in Kozhikode is about 6.3 lakhs[23]. The cumulative annual growth rate (CAGR) of registered vehicles is 6% with Two-wheelers constituting the highest share of vehicles registered in Kozhikode[24].

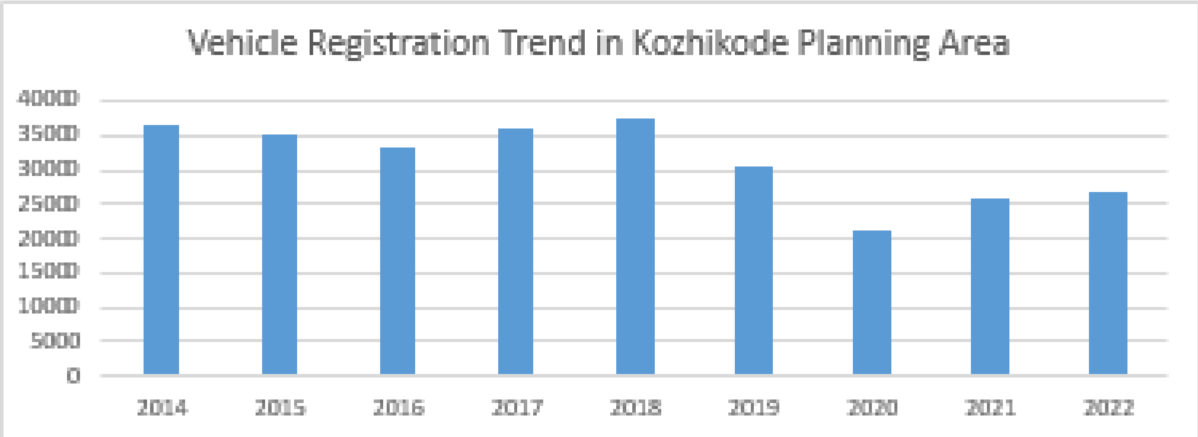


Figure 2-22 Annual Vehicle Registrations in Kozhikode

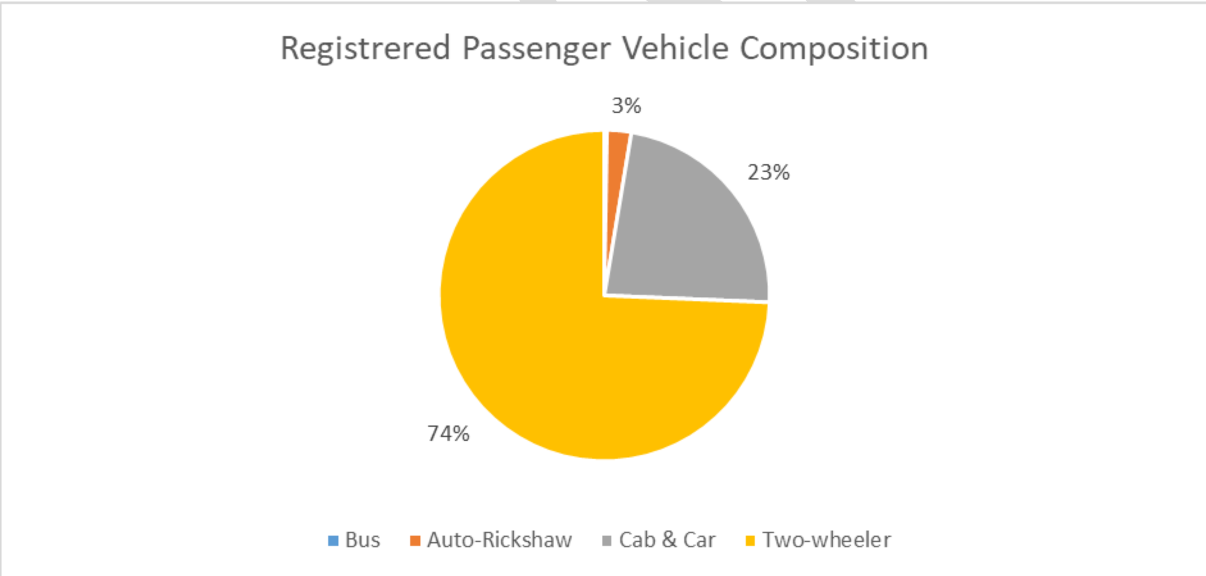


Figure 2-23 Bifurcation of Passenger Modes

[23] https://vahan.parivahan.gov.in/vahan4dashboard/vahan/dashboardview.xhtml;jsessionid=837CC726DE236F40E6F0CAE69CC15083

[24] MoRTH Data

Inclination towards private/passenger modes is largely observed through its highest registration as seen in figure 2-23.

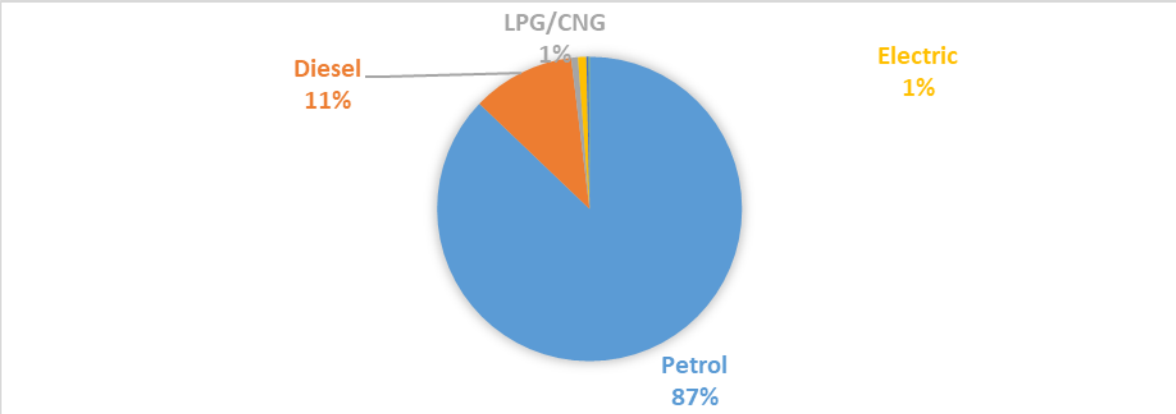


Figure 2-24 Fuel Type in Vehicle Registrations in Kozhikode

The recent years have shown a considerable increase in the electric vehicle registrations in the city. Hybrid and Solar vehicle registrations are still observed to be on a lower side.

2.10 AIR BASED PUBLIC TRANSPORTATION (REGIONAL)

The airport is approximately 25 kilometers towards west from the city center Kondotty Airport offers direct flights to the Middle East, Singapore, Malaysia, Maldives, Sri Lanka and many other Indian cities.

The details of the of the regional airport of Kozhikode is as follows[25],

- Daily passengers – 8600 (Arrival & Departure passengers including Domestic and International)
- Number of flights-daily – 62 (Arrival & Departure flight movements including Domestic and International)
- Parking spaces - 12484 sqm
- Integration of with other of modes of transport – Road connectivity
- Goods volume daily - The average cargo tonnage handled per day is 50 MT

[25] Source: Karippur International Airport

Figure 2-25 Images of Kozhikode Airport

2.11 RAIL BASED PUBLIC TRANSPORTATION

Rail transport system caters mainly to the needs of inter-city passenger and goods traffic. A Broad-Gauge railway line running almost parallel to and west of NH-17 connects Shornur and Mangalore Junctions of Southern Railways. The Kozhikode railway station handles more than 50,000 passengers a day. It is one of the major railway stations in Kerala with trains connecting the city to other major cities in India such as Kozhikode, Kochi, Kollam, Coimbatore, Chennai, Mumbai, New Delhi, Bangalore, Mangalore, Pune, etc.

The details of the of the regional rail system in Kozhikode is as follows,

- The city has one major railway station known Kozhikode Main (Calicut) and other are halting station in the city known as Feroke (code: FK), Kallayi Kozhikode South (code: KUL), Vellayil railway station (code: VLL), Kadalundi Station (code:KN) and West Hill railway station (code: WH).
- The railway station at Feroke is having 2 platforms with more than 30 trains halting at the station in a day.

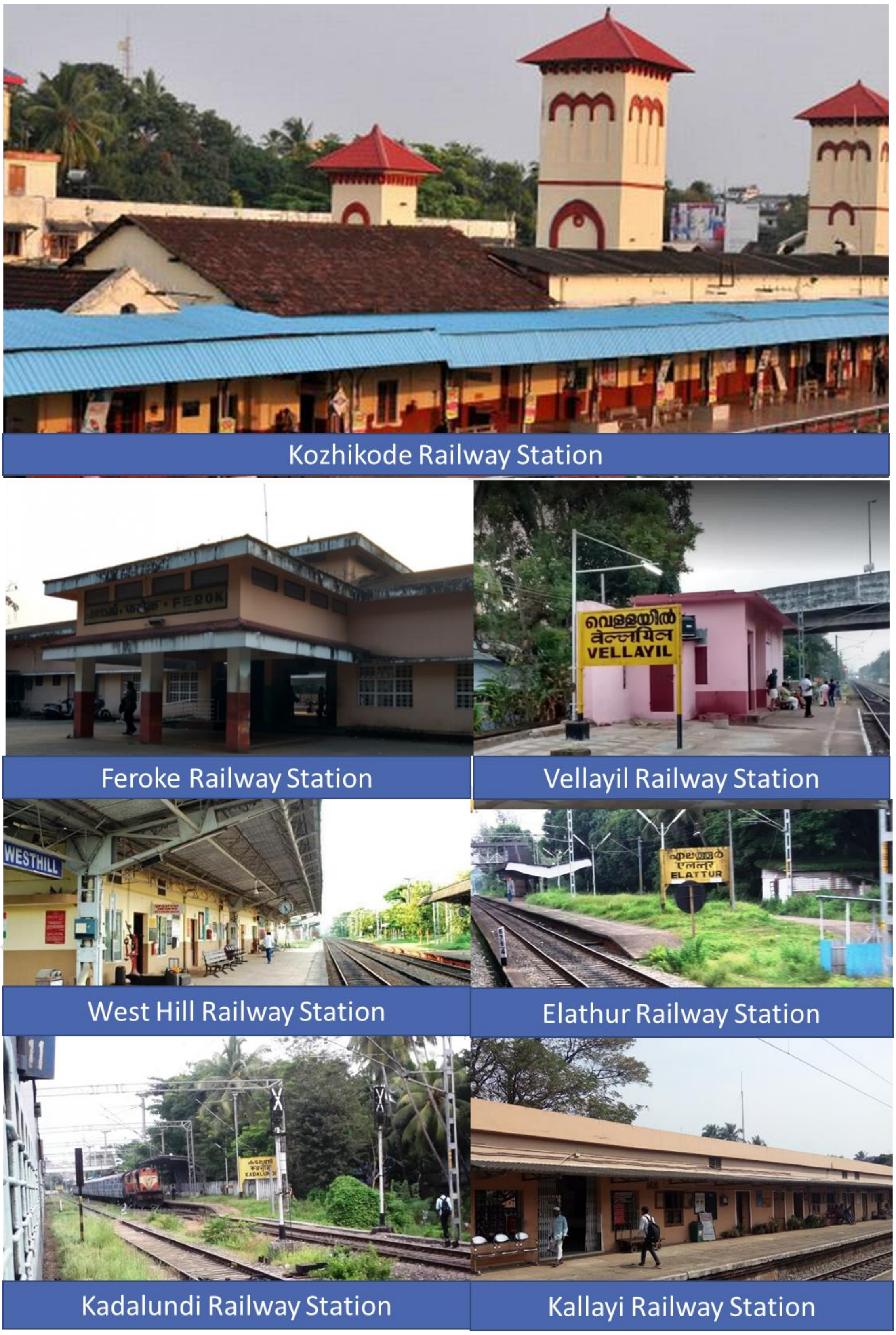
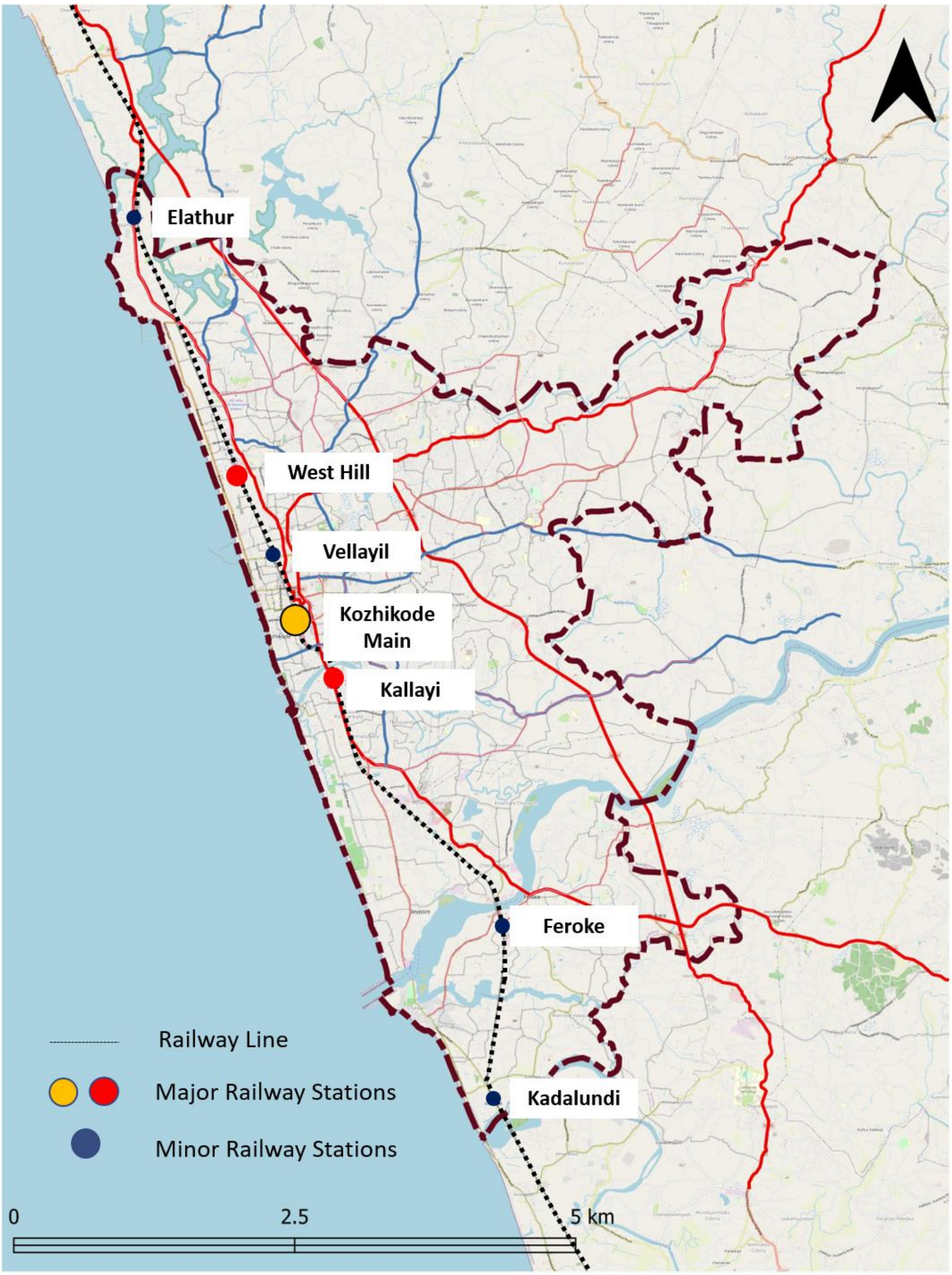


Figure 2-26 Railway Stations in Kozhikode



Title: Comprehensive Mobility Plan for Kozhikode
Name: Rail network Kozhikode

Figure 2-27 Railway Map of the Study Area

2.12 BUS BASED PUBLIC TRANSPORTATION

Kozhikode being a major economic node and employment generator of the district, it is well connected to other urban and rural centers through bus based public transportation system operated by various private operators and the state owed KSRTC (Kerala State Regional Transport Corporation).

However, at city level, the city bus operations are solely dominated by various private players with KSRTC operating only on the suburban routes.

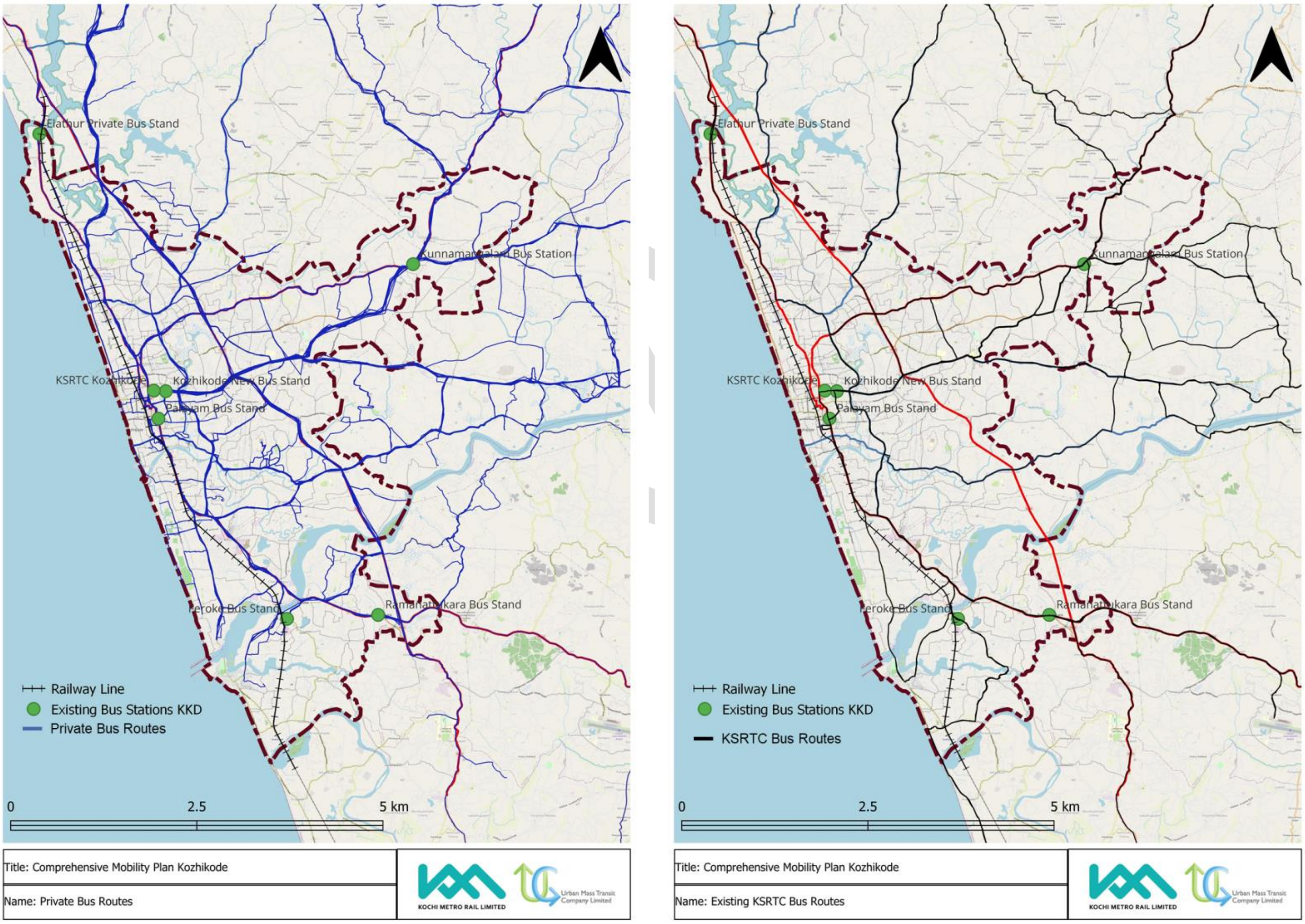


Figure 2-28 Bus Route Map, Private(left), KSRTC (right)

Currently there are 365 private bus permits issued by the Kozhikode RTO, out of which about 250 services cater within the study area limits during the peak hour.[26]

The major corridors are observed along

1. West Hill- Palayam- Meenchanda
2. Palayam/City - Medical College
3. Palayam/City - Nadakkavu - Kunnamangalam,
4. Palayam/City-Ramanattukara

Major Transportation Corridors are represented in the figure given below.

Figure 2-29 Public Transport Routes in the City

[26] Source: RTO Kozhikode

The Stage wise fare of private bus operations are as give below:

Table 2-7 Stage-Wise Fare of Private Buses[27]

Stage	Fare	Distance (Km)
1	10	2.5
2	13	5
3	15	7.5
4	18	10
5	20	12.5
6	23	15
7	25	17.5
8	28	20
9	30	22.5
10	33	25
11	35	27.5
12	38	30
13	40	32.5
14	43	35
15	45	37.5
16	48	40

Figure 2-30 Major Bus Stands Kozhikode

[27] Source: RTO

There are large number of private bus operators in Kozhikode. However due to poor infrastructure and lack of bus service facility people preferred to travel 2wheelers or auto. People prefer buses only while traveling to nearby towns.

There are 247 fleet under the KSRTC Kozhikode majority of which caters to regional bus services. The public transport network formed together by the KSRTC and the private buses, covers 80 percent of the major roads indicating a strong presence of public transport services.

Table 2-8 Bus Services Details (Source: KSRTC 2022 Revised fare notification)

TYPE OF SERVICE	MINIMUM FARE (INR)
Ordinary	10
City Fast	12
Fast Passenger	15
Super-fast passenger	22
Super express	28
Low Floor Non-AC	35
Low Floor AC	40

Figure 2-31 Photographs of KSRTC Suburban Fleet

2.13 INTERMEDIATE PUBLIC TRANSPORTATION

Auto-rickshaws and Taxis are the inter-mediated public transport modes in Kozhikode that provide door to door connectivity. Currently, there are 5540 auto city permits issued in for the city as per RTO 2022 records in Kozhikode.

Auto rickshaws are seen as a preferred mode of shared transport in the absence of organised city bus system. The fare of the system is regulated by the RTO and all the auto rickshaws ply with metered rates.

Figure 2-32 Intermediate Public Transport in Kozhikode City

Some of the characteristics of the intermediate Public Transport system are as follows:

- The average number of passengers carried per trip is 2.9 for Auto and 1 for Taxi.
- The base fare of auto-rickshaw is INR 30.
- The private auto-rickshaw trips costs around INR 30 to INR 75.
- About 20-30 trips are carried out within the city daily.
- Electric auto rickshaws have been rolled out in the city in the recent years with considerable vehicle registrations, however as per RTO records 1800 electric auto permits are still vacant.

- The halting infrastructure in terms of dedicated spaces needs major attention in the study area to regulate the traffic flow hindrances.

2.14 NON-MOTORIZED MODES

The pedestrian and bicycle infrastructure and facilities in the city are inadequate. The physical infrastructure facilities for pedestrians are observed along the arterial and sub arterial network. In many arterial and sub arterial roads, footpaths are not maintained and have undulation while walking. Similar to every other city, NMT challenges such as lack of clear walk-able space, safety and prioritization issues at intersections and crossings, inaccessibility due to encroachments and haphazard on street parking etc. are seen.

Figure 2-33 Condition of Footpath in Kozhikode City

Many people avoid using footpaths for walking in core city due to unsignalized junction and chaos in traffic, and prefer IPT's or private mode like 2wheeler for travelling <2km. However only few areas, mostly found along the mavoor road, footpaths follow the standard of ITDP but maximum footpaths in areas are less than 1.2m.

Figure 2-34 Unmaintained or No Footpath

Though the footpath is less in width also there are many hindrances such as light poles, electric meters, signages, 2wheeler making it more difficult for people to walk.

Lack of footpaths on highways and in outskirts of the city where there are many colleges, schools, hospital, and large institutes also on the roads that connects to IIM Kozhikode and NIT Calicut.

Figure 2-35 Existing Improved Safety Measure for Pedestrian

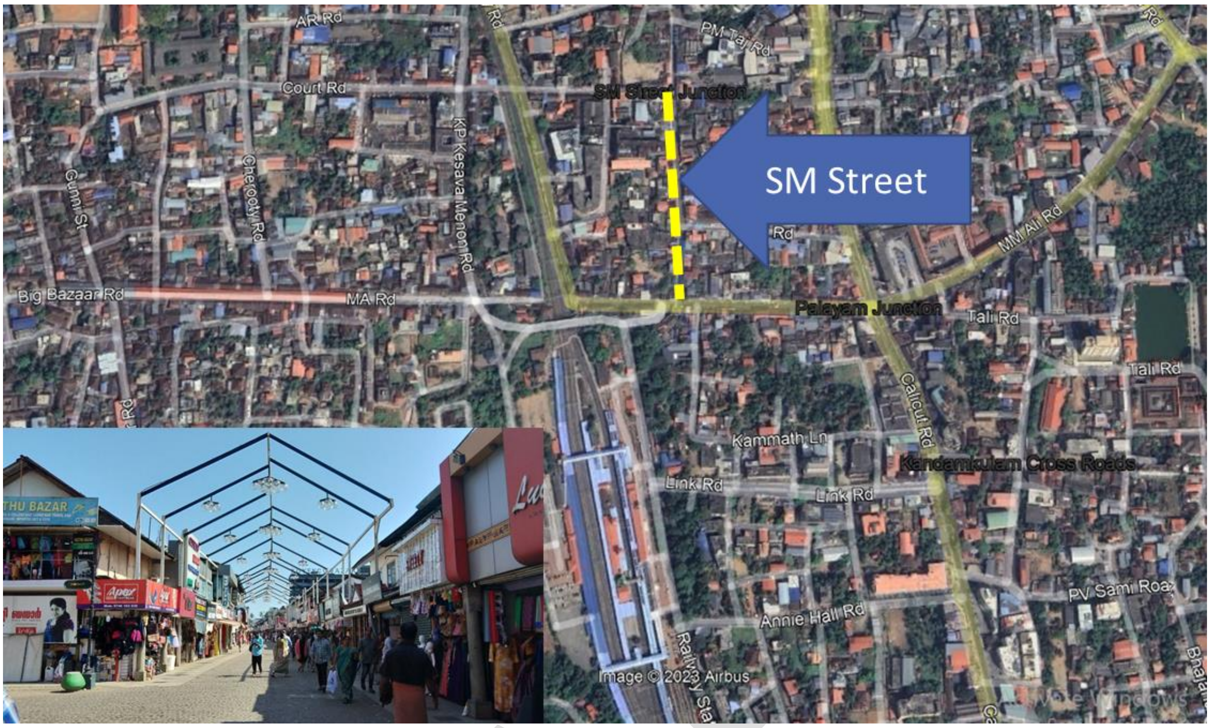


Figure 2-36 Existing pedestrian network in the core area – SM Street

However, the NMT network and infrastructure is currently inadequate to support the existing demand and safety. The details of the assessment are presented in the Chapters 4 and 5.

Similar to every other city, NMT challenges such as lack of clear walk-able space, safety and prioritization issues at intersections and crossings, inaccessibility due to encroachments and haphazard on street parking etc. are seen.

2.15 PARKING

Parking in the city was found to be clearly unorganised. Though there where several off street parking facilities available in different parts of the city, they are often underutilised as there are no restrictions on parking along the streets in the city. One such example is the unregulated parking around Mananchira Square and the underutilised off street parking facility which is available within a few metres away from Mananchira.

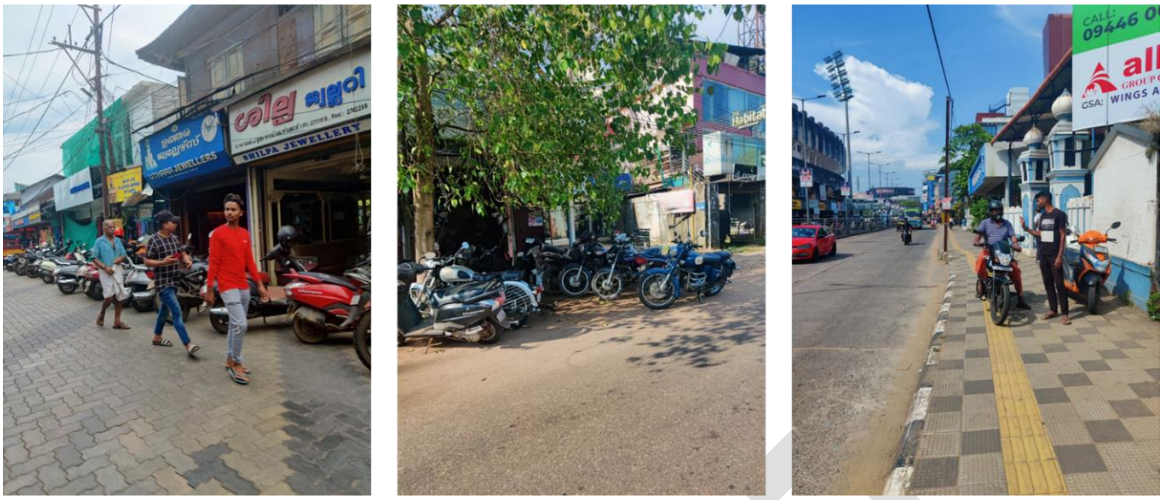


Figure 2-37 Unorganised Parking in the city

Figure 2-38 On Street Parking Encroachment and Underutilised Off Street Parking near Mananchira

2.16 FREIGHT TRANSPORT

Freight focal points in the city can be seen to be scattered in the north to south direction in the city, mostly towards the coastal side. While the north and central freight generating areas mostly consists of agricultural and fisheries related products, southern areas consists of timber, oil and other small and medium scale industrial products.

Title: Comprehensive Mobility Plan Kozhikode	KOCHI METRO RAIL LIMITED Urban Mass Transit Company Limited
Name: Existing Freight Generators and Parking	

Figure 2-39 Freight Focal Points in the City

Figure 2-40 Freight Parking & Loading & Unloading Activities Observed in the city

The goods vehicles are largely parked on either side of the roads due to lack of fright terminals in the city. With increased activities in Industries and more industries being setting up in the city, there is a need to study the freight movement and plan for its needs without hindering the traffic flow of the city.

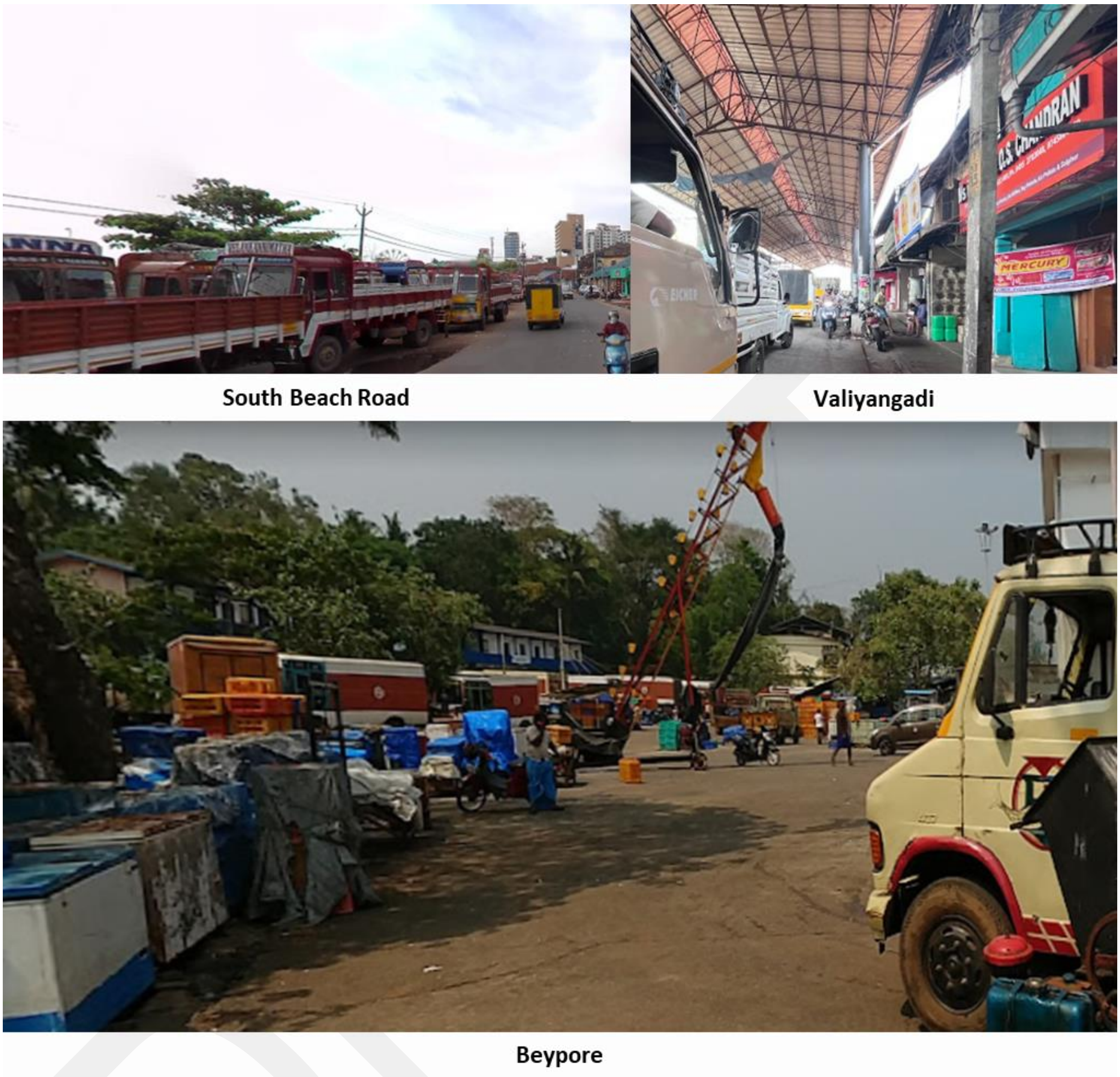


Figure 2-41 Existing Freight Generators

2.17 SEAPORT & HARBOUR[28]

Beypore is an ancient port town in Kozhikode district in the state of Kerala, India. The place was formerly known as Vaypura / Vadaparappanad. Tipu Sultan, ruler of Mysore, named the town"Sultan Pattanam". The Beypore Port is located on the south western coast of India (latitude 11°10' 0" N & longitude 75° 47' 59" E), which is midway between the two major ports of Cochin and New Mangalore, 193 km North of Cochin, 391 km North of Trivandrum and 246 km South of

[28] http://kmb.kerala.gov.in/en/ports/beypore-port

Mangalore. It is situated at the mouth of River Chaliyar directly facing to the Arabian Sea. Beypore was well known for its crafting of huge wooden boats called “Uru”.

Figure 2-42 Beypore Port

Beypore port has a 300m wharf with adequate cargo handling gears like Mobile Harbour Crane, Reach stacker, Stationary cranes and 3200 sqm storage facility.

2.18 ROAD SAFETY

Road safety is a crucial factor considering the increasing number of vehicles on Kozhikode roads. The fatality shares of accidents in 2012 was around 17.2 which increased to 18.4 in 2022 as per traffic police records. The number of fatalities per lakh population in the study area has increased from 14.3 in 2016 to 19 in 2022, indicating an alarming value and the need to improve the road safety in the study area.

Table 2-9 Types of Road Accidents in Kozhikode City (Source: DCRB - 2022)

Year	Total No. of Accident (nos)	Fatal Accident (nos)	Non-Fatal Accident (nos)	Non-Injury cases (nos)
2016	1543	138	1231	174
2017	1467	168	1150	149
2018	1423	144	1171	108
2019	1597	172	1298	127
2020	1003	90	855	58
2021	1377	123	1162	92
2022	2054	186	1728	140

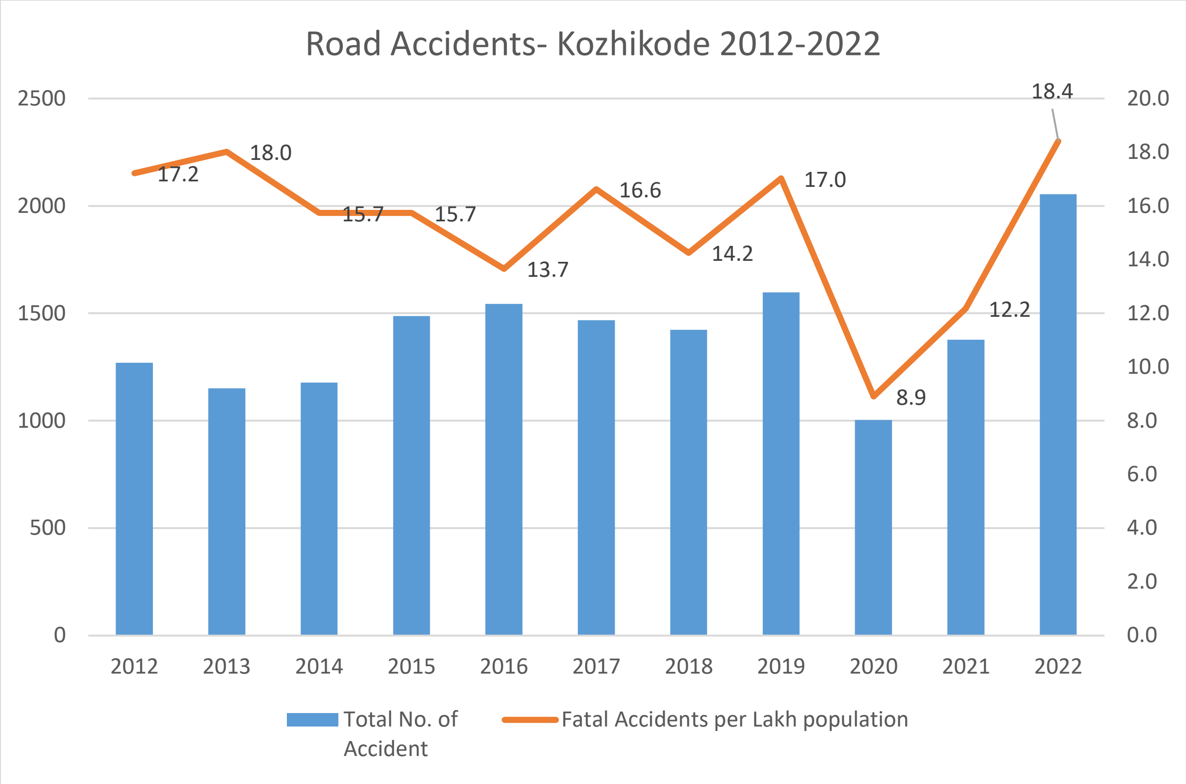


Figure 2-43 Total Accidents between 2012- 2022[29]

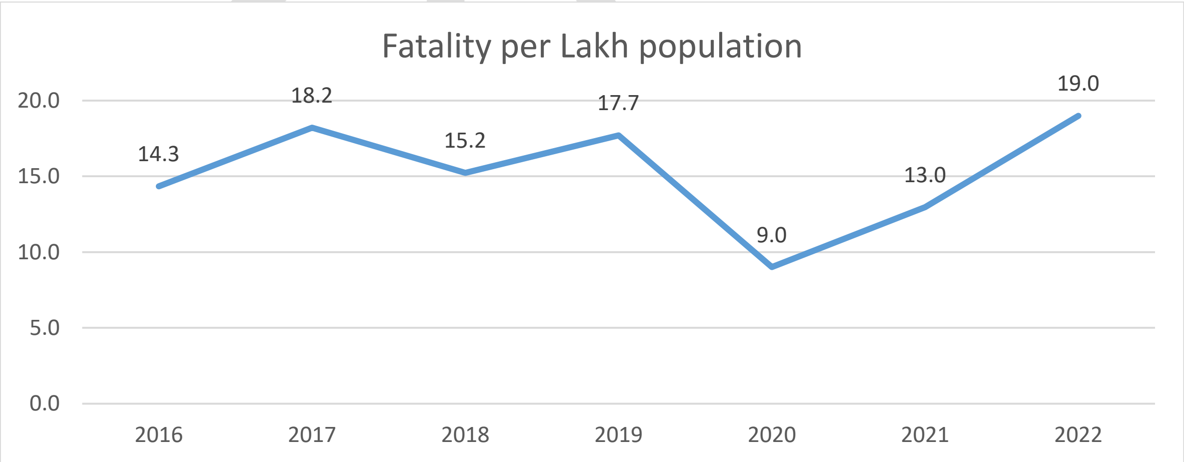


Figure 2-44 Fatalities per Lakh Population between 2016- 2022[30]

[29] DCRB
[30] DCRB & UMTC Analysis

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3. PREVIEW OF PREVIOUS STUDIES

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited

3 PREVIEW OF PREVIOUS STUDIES

The review of pervious land use and transportation studies are as presented in the following sections -

The review of pervious land use and transportation studies are as presented in the following sections –

3.1 MASTER PLAN FOR KOZHIKODE URBAN AREA – 2035, DEPARTMENT OF TOWN AND COUNTRY PLANNING, KOZHIKODE, 2015

The Development Plan for Calicut Urban Area (1981-2001), the plan in operation, was enforced in 1994 and reached its horizon period in 2001. The spatial and economic character of the city has changed significantly from that envisaged in the above plan.

The administrative jurisdiction of Kozhikode Corporation was extended in 2010 to include a few of these, namely, Elathur, Beypore and Cheruvannur – Nallalam. The absence of timely interventions in these areas pose various threats like environmental degradation, decline in the quality of living, wastage of funds, wasteful use of the limited and valuable land resources, increased disaster vulnerability and many other vices of an organically evolving urban area. In consequence, extending the planning controls to these areas has become the need of the hour.

Transport related recommendations of the plan were as follows

1. **Road Widening, Traffic Segregation and Geometric Improvements:** The immediate measure for reducing the congestion in study area is the widening of roads and geometric improvements. Continuous unobstructed footpath of minimum 2m. Similarly, dedicated and segregated bicycle tracks with a width of 2.5m, on the right of way 24m or more.
2. **Mobility Hub with Road, Rail, Water and Air connectivity at Malaparamba:** A new transportation terminal, a Mobility Hub, is proposed at Malaparamba along the NH 66 By-pass, an area where all the vehicles from North, East and South can easily approach without traversing the commercial core. The existing Moffusil bus stand is proposed to be reserved for city services.
3. **Loop Bus Services and Dedicated Bus Corridors for Public Transport:** Dedicated bus lanes and circular bus routes are proposed. The proposed dedicated bus routes are

- Hub – Malaparamba – Moozhikkal - Kunnamangalam

- Hub – Thondayad – Medical College.
- Hub – Thondayad - Ramanattukara – Airport.
- Hub – Malaparamba – Eranjippalam – Nadakkavu – Palayam Railway Station.
- Railway Station – Cherooty Road – Gandhi Road – Nadakkavu – Hub.

4. **Inland Waterway Network with Connectivity to Hub:** This can be easily connected to hub by developing a canal from Sarovaram area to hub through existing waterlogged area. This canal can also be used as a water ambulance route in the case of emergency. Minimum width of this canal shall be kept as 15m.

Figure 3-1 Proposed Inland Waterway Network in the Master Plan

Few focus points of proposed waterway are,

- **Cargo movement:** Cheapest mode of transport through the city to suburbs with added scope due to port development and Vadakara – Mahe Canal in implementation
- **Passenger traffic:** Speedy passenger movement from Malappuram, Vadakara, Koyilandy to mobility hub and to Medical College. Passenger boats can ply economically from Feroke to Elathur.
- **Flood Control:** The waterway will act as a major drainage channel

- **Tourism Circuit:** Continuous water-based network connecting Focal Points – Elathur waterfront development – dream city – Beypore – Kadalundi bird sanctuary

5. **Mass Transit Options: Light Metro and High-Speed Rail:** the first phase of light metro-rail corridor, from Medical College to Meenchanda. In second phase, it is proposed to be extended to Airport and Civil Station. The High-speed rail project is in its planning stage and the station is planned at Malaparamba opposite to proposed Mobility Hub.
6. **Seven Bus Terminals at Periphery and Bus Routing:** Few bus terminals are proposed at peripheral area of city, from where all city buses should start and end their service. No city buses have halts at city core. Bus terminals are proposed at Elathur, Medical College, Meenchanda, Feroke, Pantheerankavu, Ramanattukara and Kadalundi.
7. **Parking Plazas at Major Nodes:** The identified parking plaza locations are
    - Palayam Bus Stand and Vegetable Market area.
    - DD office complex area.
    - Multi-tier parking at Moffusil Bus Stand
    - Near Mobility Hub
    - Near Sarovaram Bio park
    - Near Beypore port
8. Flyovers: The following flyovers are proposed at the following junctions:

    Ramanattukara, Pantheerankavu, Pooladikkunnu, Eranjippalam, Cheruvannur, Karaparamba, Puthiyara- Stadium Junction, Beypore, Railway Station Road to Oyitty Road

9. Junction Improvement Plans: Different major intersection improvement needs to be done for the better movement of pedestrian, bicycles, and vehicles.
10. Auto and Taxi Stands: Auto/ taxi stands are usually located along the side of the main road, mainly on public land. Presently the queue extends up to the main roads, thereby causing in convenience to the free flow of other traffic.

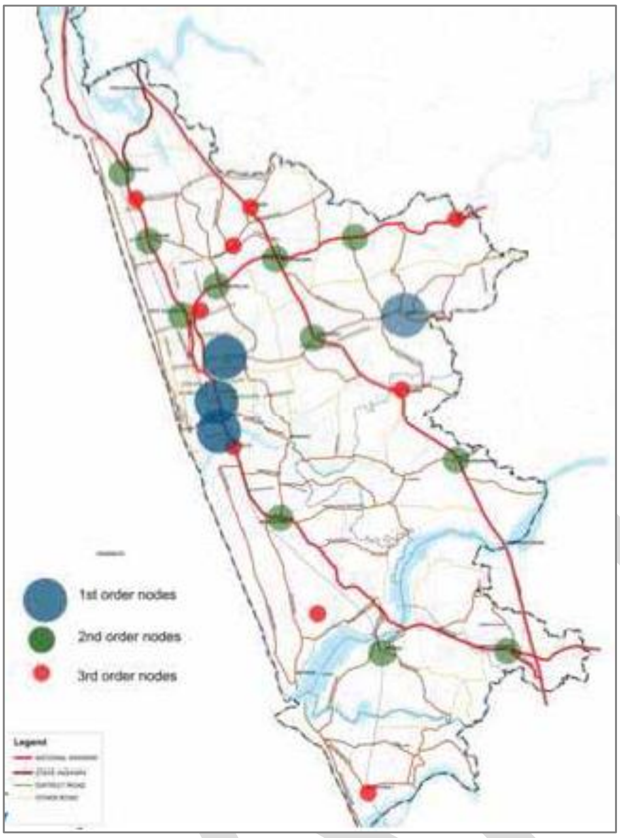


Figure 3-2 Location of different Activity Nodes

Along with these, proposals of bus bays, green corridors and development of walkable community has also been listed with detailed study of each proposal. Also, with the implementation plan and measures to be followed.

3.2 COMPREHENSIVE MOBILITY PLAN FOR KOZHIKODE URBAN AREA – 2035, NATIONAL TRANSPORT PLANNING AND RESEARCH CENTER, 2015

3.2.1 PROPOSED MASS TRANSIT SYSTEM

The major corridors proposed for implementing higher order public transport system includes Karanthur to Ramanattukara stretch, Ramanattukara to Malaparamba stretch (NH 66 Bypass), Wayanad Road, and Kannur Road. LRT between Medical College and Meenchanda by the year 2034.

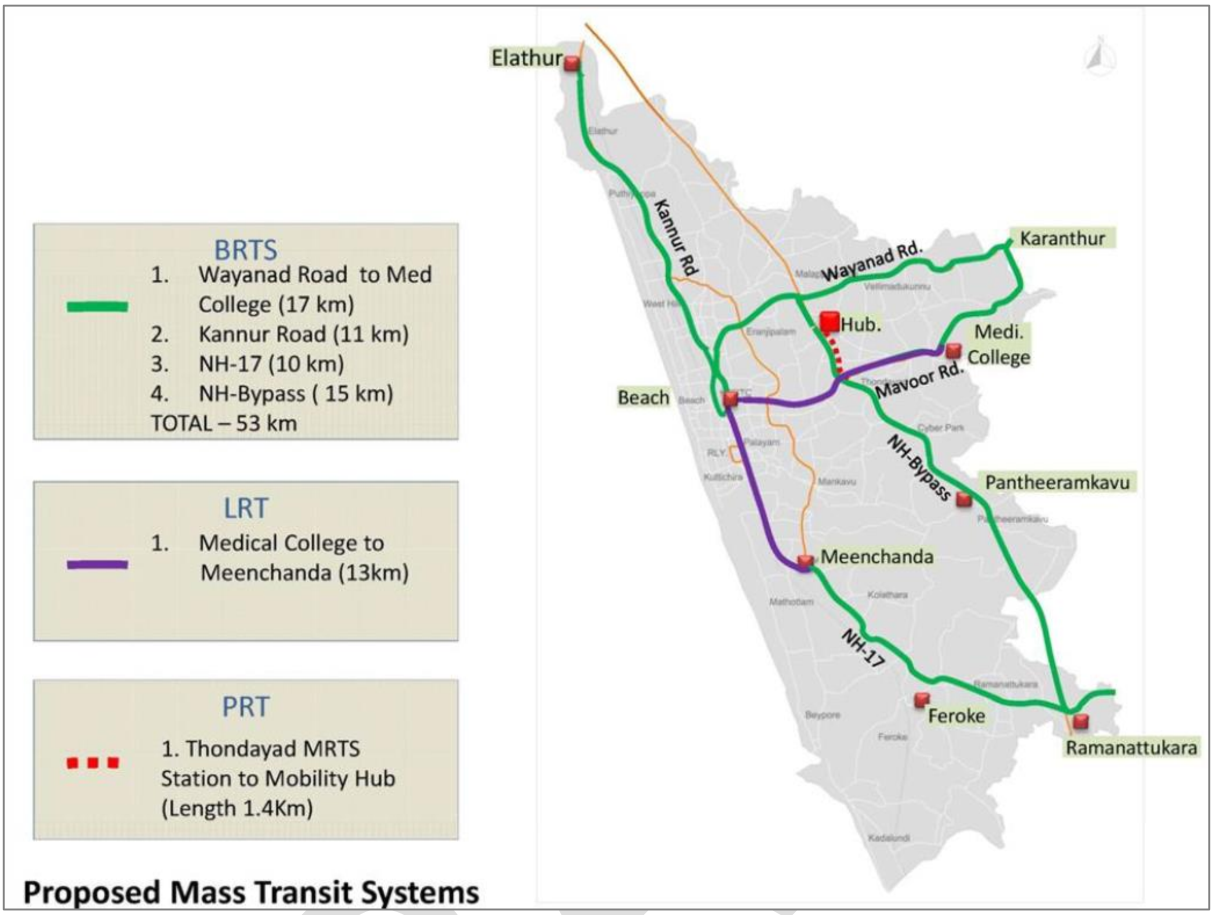
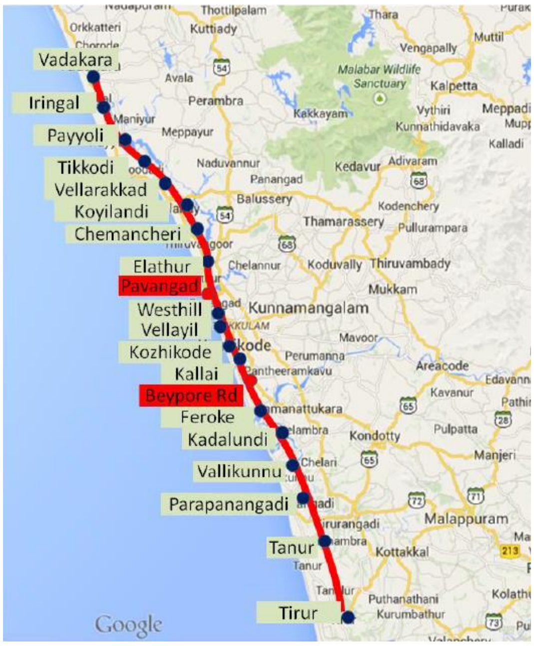


Figure 3-3 Proposed Mass Transit Systems and Alignments

Rest of the mobility corridors are proposed for BRT system. For seamless travel between the proposed mobility hub and Thondayad MRTS Station, an elevated Personal Rapid Transit System (PRTS) is proposed on NH 66 Bypass. The proposed Higher Order Public Transport System corridors are shown in the figure.



3.2.2 PROPOSED COMMUTER RAIL

Commuter rail system of around 88 km stretch can be considered for the movement of people between Vadakara and Tirur.

Figure 3-4 Proposed Commuter Rail

3.2.3 PROPOSED TKMC LOCATION

For achieving the modal integration, the concept of developing Traffic and Transit Management Centres (TKMC) has been proposed at critical locations in Kozhikode. The proposed TKMCs will act as transfer point for feeder routes and will also act as terminating points for the higher order PT systems.

Figure 3-5 Proposed Traffic and Transit Management Center Location

3.2.4 TRANSPORT HUB:

Transport Hub is proposed at Thondayad, which will act as a transfer station for all PT modes in addition to parking facility and NMT main docking station. As an alternative, one more location has been chosen for the proposed Mobility Hub, near the NH 66 Bypass, near Mallikkadavu in between Pooladikkunnu and Vengeri Junction.

3.2.5 INLAND WATERWAYS:

Proposed inland waterways would help to develop water transport routes connecting Chaliyar River, Kallayi River/Mampuzha and Canoli Canal, for a total length of 58 km.

Road Network Development Plan

3.2.6 CONSTRUCTION OF RING ROAD:

Ring Road from Beypore to Pooladikkunnu Junction via Pantheeramkavu, Kunnamangalam is proposed for bypassing all the regional traffic which is at present passing through the Kozhikode city.

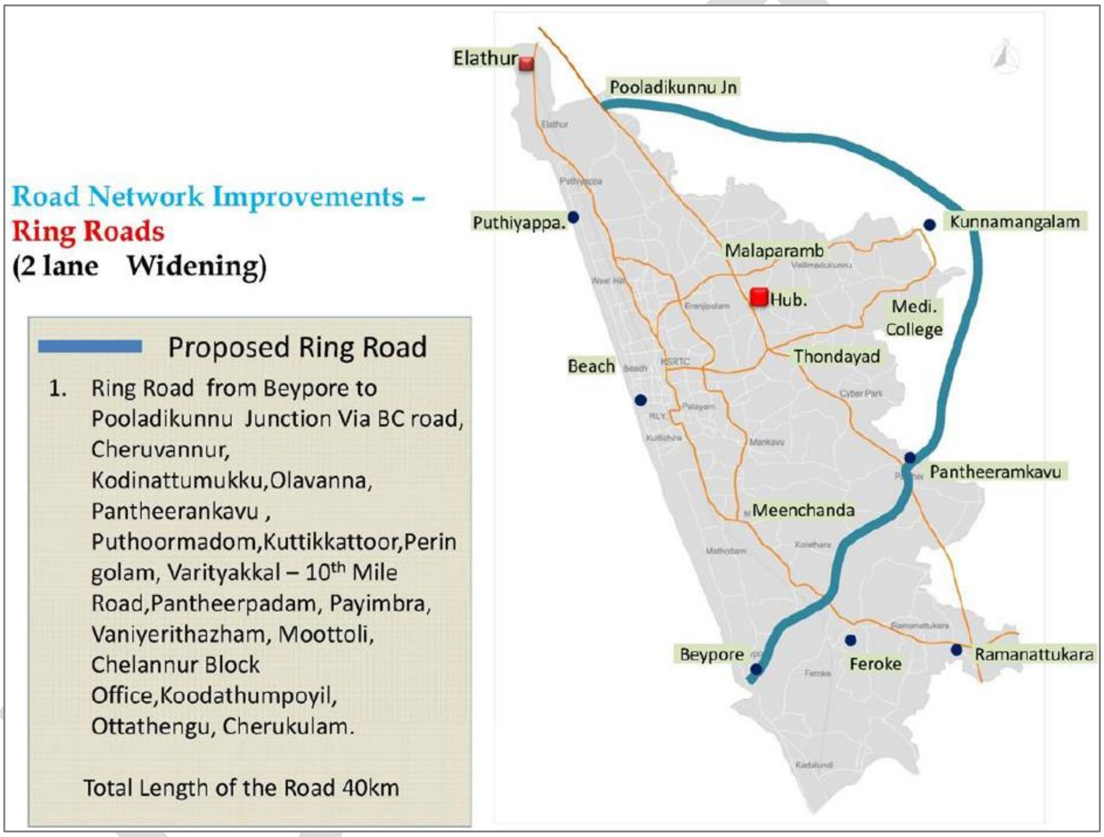


Figure 3-6 Proposed Ring Road in the Study Area

3.2.7 CONSTRUCTION OF FLYOVERS

Flyovers are proposed at Karaparamba, Eranjippalam, and Ramanattukara. It is also proposed to construct elevated road between Thondayad and Malaparamba, and between Sarovaram bio park junction and Kottooli junction.

3.2.8 NON-MOTORIZED TRANSPORT STRATEGY AND PROPOSALS

Recommendation of Foot over-bridges at New Bus Stand, Bank Road Junction, Palayam, and East Nadakkavu is given.

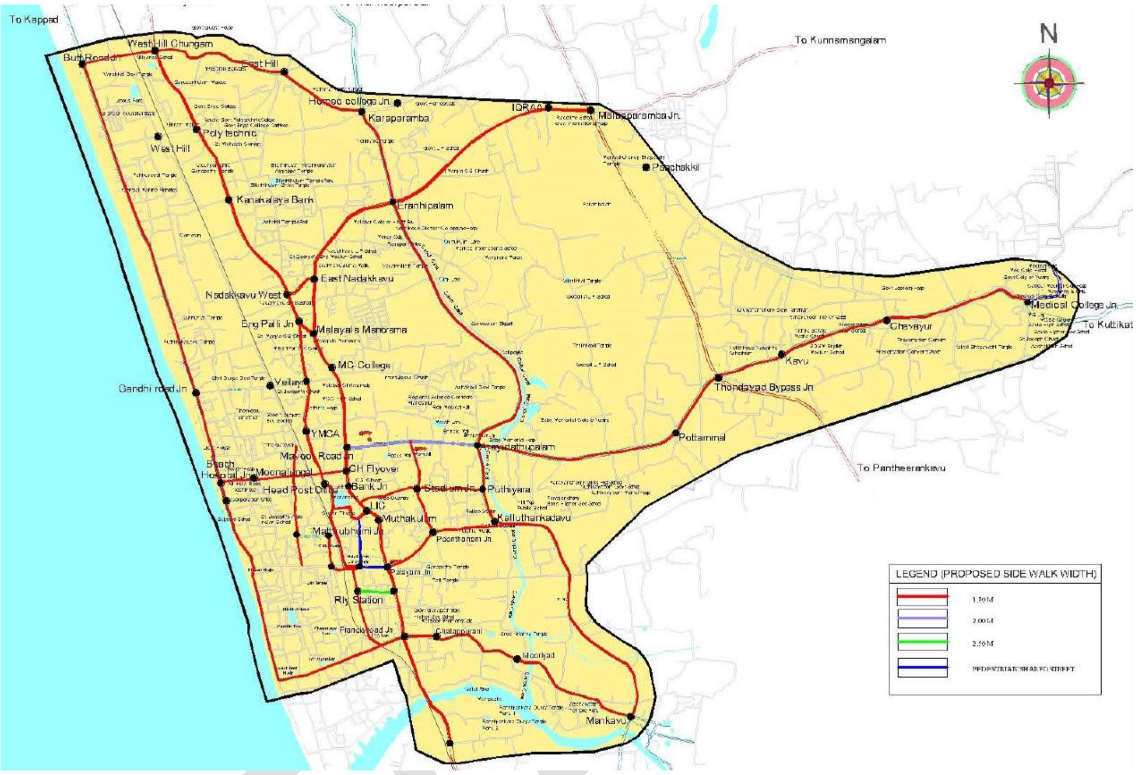


Figure 3-7 Proposed Footpath in the Study Area

It also proposed to provide a cycle track of 2.5 m width on all major roads and new roads. Proper parking facilities for the bicycle users and bicycle on rent services are also recommended in the proposal.

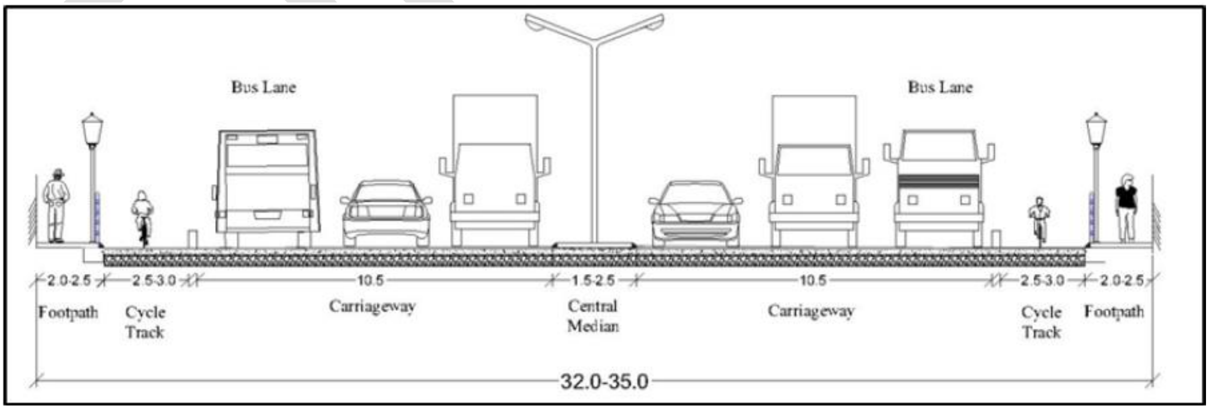


Figure 3-8 Proposed Road Cross Section with Cycle Tracks (Six Lanes)

3.2.9 FREIGHT MANAGEMENT STRATEGY

Due to lack of terminal facilities for trucks and multi-axle vehicles. The potential locations for truck terminals are

- Puthiyappa (Mini)
- Big Bazar (Mini)
- Beypore
- Pantheeramkavu
- Kunnamangalam

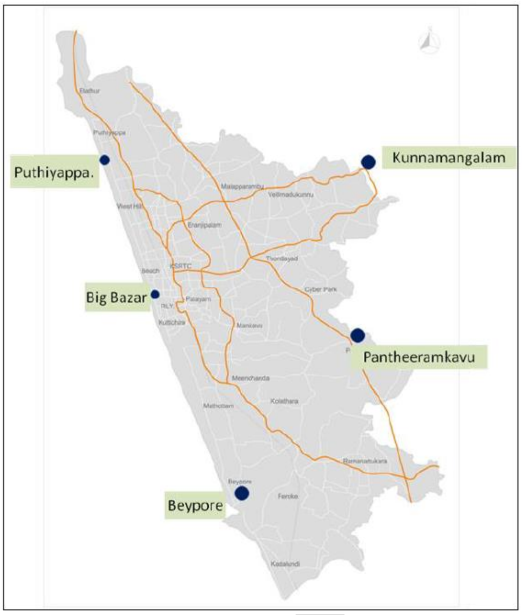


Figure 3-9 Proposed Truck Terminals in the Study Area

3.2.10 OFF STREET PARKING FACILITIES

Peripheral Parking lots are proposed at the following locations in the outer cordon of the city.

- Meenchanda
- Elathur
- Karanthur

Multi-Level Car Parking (MLCP) facilities are proposed at the following locations

- Palayam
- DD Office
- Comtrust (near Mananchira)
- Moffussil Bus stand
- Sarovaram Bio-Park
- Beypore
- Near proposed mobility hub at Thondayad
- Railway Station Link Road

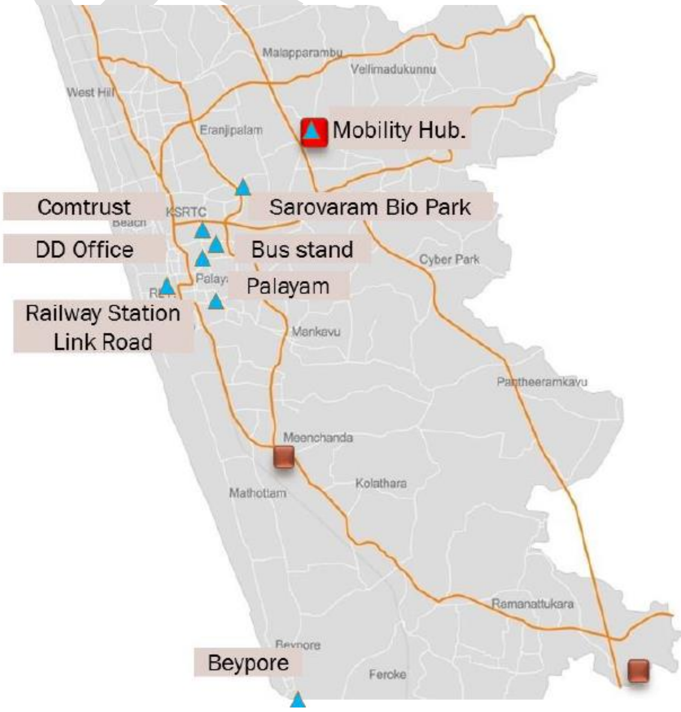


Figure 3-10 Proposed MLCPs in the Study Area

3.3 DISTRICT URBANISATION REPORT FOR KOZHIKODE DISTRICT, DEPARTMENT OF TOWN AND COUNTRY PLANNING - GOVERNMENT OF KERALA, JANUARY 2011

A transportation network combining existing road networks, suggestions for new highways, up grading of existing ones, and a rail network parallel to the coast from the city center to Beypore harbour in the District is proposed to support the anticipated development until 2021.

3.3.1 PROPOSED ROAD NETWORK

The settlements are to be connected through important nodes located in between. In most of the cases there are existing roads. Kozhikode Corporation, Vadakara and Koyilandy Municipalities are connected by the National Highway 17. Mukkam, Balusserri, Perambra and Nadapuram are connected with State Highways.

However out of these only 4settlements are in kozhikode planning area that are Feroke Kunnamangalam, Koyilandy, Chelannur. Feroke Kunnamangalam, Koyilandy have existing National Highway, only Chelannur needs to be upgraded to State Highway for the seamless connectivity between the Kozhikode district corridor.

3.3.2 PROPOSED TRANSPORTATION NETWORK

In addition to the proposed road network from Kozhikode city, a rail network parallel to the coast from the city centre to Beypore harbour in the district is also proposed. The purpose of this rail network is to improve freight transit from the industrial sector to the rest of the state and world.

3.4 KOZHIKODE MONORAIL PROJECTS DISTRICT, KERELA ROAD FUND BOARD – 2012[31]

Firstly, NATPAC had recommended an MRTS. However later due to high infrastructure cost in MRTS, the city of Kozhikode was suggested for a consideration of Light Rapid Transit system. The proposed corridor is connecting Meenchanda to the Kozhikode Medical College Hospital via the city's core.

The proposed railway is span for 13.3 kilometres and 15 stops, from Medical College Hostel to Meenchanda. Mono rail will be fully elevated. Platform will be on top of road conveniently access from road outside the ROW. The suggested location for the car depot was around 500 meters

[31] Kozhikode Monorail DPR

(1,600 feet) east of the Medical College Hostel station on 5.20 hectares (12.8 acres) of government-owned unoccupied property.

During proposals for LRTS it was intended that the monorail be constructed in two phases. First from Medical College to Mananchira, then from Mananchira to Meenchanda.

Figure 3-11 LRT Alignment for Kozhikode

In addition, the government intended to expand the monorail to Civil Station and West Hill. It will link the 6-kilometer (3.7-mile) distance between Malaparamba and Civil Station.

Each train will have three coaches. The length and width of the cars will be 18 meters and 2.8 meters, respectively. Each train can accommodate around 800 people. The capacity of the metro is 30,000 people per hour.

3.5 ROLE OF IPT MODES IN MEDIUM SIZE CITY -KOZHIKODE, MARCH 2012[32]

As part of the study program for 2011-2012, NATPAC conducted IPT mode studies for the city of Kozhikode, examining the role of auto rickshaws and taxis in the para transit.

The report describes Kozhikode's IPT system and the role of automobiles.

Rickshaws and taxis provide as Para transportation. The paper focuses on the role of taxis in inter-city travel and auto rickshaws for both intra-city and inter-city passenger travel. The study was conducted to assess the utility of auto rickshaws and taxis as modes of transportation (alternative mode).

3.6 K-RAIL PROPOSAL

The proposed 529.45 km Silver Line corridor connecting Kasaragod and Thiruvananthapuram, with an operating speed of 200 kmph, eases the transport between North and South ends of the state and reduces the total travel time to less than 4 hours, compared with the present 10 to 12 hours., Ernakulam and Kochi Airport are two of the major intermediate station on the Silver Line. The proposed alignment of K Rail falls on the western side of greater Kochi, and has two stops in the study area, one at Cochin International Airport and another at Kakkanad.

32 The summary of the study has been extracted from CMP- Kozhikode 2014

Figure 3-12 K Rail Alignment, Kozhikode

3.7 TRAFFIC AND TRANSPORTATIONS STUDIES FOR KOZHIKODE TOWN, JANUARY 2011

In January 2011, NATPAC conducted traffic and transportation studies for Kozhikode Town on behalf of the Government of Kerala's Department of Town and Country Planning.

The research contributed baseline traffic and transportation data for the construction of the Master Plan for Kozhikode, which comprises Kozhikode Municipal Corporation, and also 4 panchayats as Feroke, Olavanna, Ramanattukara, and Kadalundi. The report includes as major inputs the link volume and capacity utilization of major roads in the city, peak hour traffic volume handled by major intersections, parking and pedestrian activities in the study area, inter-city passenger and freight movements, and traffic projections for various horizon years.

The current status of the previous studies discussed above are as follows:

Table 3-1: Review of Previous Studies (Public Transport Proposals)

STUDY NAME	PROPOSALS	OBSERVATIONS
MASTER PLAN FOR KOZHIKODE 2035	**Loop Bus Services and Dedicated Bus Corridors for Public Transport:** Dedicated bus lanes and circular bus routes are proposed. The proposed dedicated bus routes are • Hub – Malaparamba – Moozhikkal - Kunnamangalam • Hub – Thondayad – Medical College. • Hub – Thondayad - Ramanattukara – Airport. • Hub – Malaparamba – Eranjippalam – Nadakkavu – Palayam Railway Station. • Railway Station – Cherooty Road – Gandhi Road – Nadakkavu – Hub.	The proposed corridors are the major spines of the city however, the project has not been implemented.
	Inland Waterway Network with Connectivity to Hub: This can be easily connected to hub by developing a canal	The proposed corridors are the major spines of the city

STUDY NAME	PROPOSALS	OBSERVATIONS
	from Sarovaram area to hub through existing waterlogged area. This canal can also be used as a water ambulance route in the case of emergency. Minimum width of this canal shall be kept as 15m. **Mobility Hub with Road, Rail, Water and Air connectivity at Malaparamba:** A new transportation terminal, a Mobility Hub, is proposed at Malaparamba along the NH 66 By-pass, an area where all the vehicles from North, East and South can easily approach without traversing the commercial core. The existing Moffusil bus stand is proposed to be reserved for city services. **Road Widening, Traffic Segregation and Geometric Improvements:** The immediate measure for reducing the congestion in study area is the widening of roads and geometric improvements. Continuous unobstructed footpath of minimum 2m. Similarly, dedicated and segregated bicycle tracks with a width of 2.5m, on the right of way 24m or more.	however, the project has not been implemented.
	Mass Transit Options: Light Metro and High-Speed Rail: the first phase of light metro-rail corridor, from Medical College to Meenchanda. In second phase, it is proposed to be extended to Airport and Civil Station. The High-speed rail project is in its planning stage and the station is planned at Malaparamba opposite to proposed Mobility Hub.	The proposed corridors are the major spines of the city however, the project has not been implemented.

STUDY NAME	PROPOSALS	OBSERVATIONS
	Seven Bus Terminals at Periphery and Bus Routing: Few bus terminals are proposed at peripheral area of city, from where all city buses should start and end their service. No city buses have halts at city core. Bus terminals are proposed at Elathur, Medical College, Meenchanda, Feroke, Pantheerankavu, Ramanattukara and Kadalundi.	To be developed
	Parking Plazas at Major Nodes: The identified parking plaza locations are • Palayam Bus Stand and Vegetable Market area. • DD office complex area. • Multi-tier parking at Moffusil Bus Stand • Near Mobility Hub • Near Sarovaram Bio park • Near Beypore port	Currently ether are only surface parking available at these locations.
	Flyovers: The following flyovers are proposed at the following junctions: Ramanattukara, Pantheerankavu, Pooladikkunnu, Eranjippalam, Cheruvannur, Karaparamba, Puthiyara- Stadium Junction, Beypore,	Ramanattukara Flyover is currently operational

STUDY NAME	PROPOSALS	OBSERVATIONS
	Railway Station Road to Oyitty Road	
COMPREHENSIVE MOBILITY PLAN FOR KOZHIKODE URBAN AREA – 2035	PROPOSED MASS TRANSIT SYSTEM The major corridors proposed for implementing higher order public transport system includes Karanthur to Ramanattukara stretch, Ramanattukara to Malaparamba stretch (NH 66 Bypass), Wayanad Road, and Kannur Road. LRT between Medical College and Meenchanda by the year 2034. Other major corridors have BRT and PRTS proposal.	The proposed corridors are important roads in the city however, the project has not been implemented.
	PROPOSED COMMUTER RAIL Commuter rail system of around 88 km stretch can be considered for the movement of people between Vadakara and Tirur.	Yet to be developed
	PROPOSED TKMC LOCATION For achieving the modal integration, the concept of developing Traffic and Transit Management Centres (TKMC) has been proposed at critical locations in Kozhikode. The proposed TKMCs will act as transfer point for feeder routes and will also act as terminating points for the higher order PT systems.	Yet to be developed
	TRANSPORT HUB: Transport Hub is proposed at Thondayad, which will act as a transfer station for all PT modes in addition to parking facility and NMT main docking station. As an alternative, one more location has been chosen for the proposed Mobility Hub, near the NH 66 Bypass, near Mallikkadavu in between Pooladikkunnu and Vengeri Junction.	Yet to be developed

STUDY NAME	PROPOSALS	OBSERVATIONS
	INLAND WATERWAYS: Proposed inland waterways would help to develop water transport routes connecting Chaliyar River, Kallayi River/Mampuzha and Canoli Canal, for a total length of 58 km.	Yet to be developed
	CONSTRUCTION OF RING ROAD: Ring Road from Beypore to Pooladikkunnu Junction via Pantheeramkavu, Kunnamangalam is proposed for bypassing all the regional traffic which is at present passing through the Kozhikode city.	Yet to be developed
	CONSTRUCTION OF FLYOVERS Flyovers are proposed at Karaparamba, Eranjippalam, and Ramanattukara. It is also proposed to construct elevated road between Thondayad and Malaparamba, and between Sarovaram bio park junction and Kottooli junction.	Ramanattukara Flyover is operational, rest are yet to be developed
	NON-MOTORIZED TRANSPORT STRATEGY AND PROPOSALS Recommendation of Foot over-bridges at New Bus Stand, Bank Road Junction, Palayam, and East Nadakkavu is given.	Foot over Bridge at New Bus Stand is developed, rest are yet to be developed.
	PARKING Peripheral Parking lots are proposed at the following locations in the outer cordon of the city. • Meenchanda • Elathur • Karanthur	Yet to be developed
	FREIGHT MANAGEMENT STRATEGY Due to lack of terminal facilities for trucks and multi-axle vehicles. The	Yet to be developed

STUDY NAME	PROPOSALS	OBSERVATIONS
	potential locations for truck terminals are • Puthiyappa (Mini) • Big Bazar (Mini) • Beypore • Pantheeramkavu • Kunnamangalam	
	Multi-Level Car Parking (MLCP) facilities are proposed at the following locations • Palayam • DD Office • Comtrust (near Mananchira) • Moffussil Bus stand • Sarovaram Bio-Park • Beypore • Near proposed mobility hub at Thondayad • Railway Station Link Road	Yet to be developed
DISTRICT URBANISATION REPORT FOR KOZHIKODE DISTRICT, DEPARTMENT OF TOWN AND COUNTRY PLANNING	Upgradation of Cheranallur to Highway & Introduction of rail via the cost from city center to Beypore	Yet to be developed
KOZHIKODE MONORAIL PROJECTS DISTRICT, KERELA ROAD FUND BOARD – 2012	The proposed monorail is span for 14.2 kilometres and 15 stops, from Medical College Hostel to Meenchanda.	Yet to be developed
KOZHIKODE - KASARGOD HIGH SPEED RAIL (SILVER LINE PROJECT)	Kozhikode – Kasaragod (Kerala) Silver Line corridor is a 530.6 km approved semi high-speed rail line connecting Kozhikode (Kozhikode) and Kasargod in Kerala through 11 stations.	In 2020, the Kerala state government's cabinet approved the Detailed Project Report (DPR) with a minor change to the alignment. The line is expected to be extended to Mangalore (Mangalore) in Karnataka in the future. The work is yet to be started.

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4. EXISTING TRAVEL AND TRAFFIC CHARACTERISTICS

Urban Mass Transit Company Limited


COXSWAIN

4 EXISTING TRAVEL AND TRAFFIC CHARACTERISTICES

The existing travel and traffic characteristics are analysed using the primary data collected through various traffic surveys, base year travel demand model developed to replicate the on ground traffic and transportation scenario in the study area.

4.1 PRIMARY SURVEYS

On the basis of the preliminary field visits and scope of the study extensive on ground surveys were carried out, between the month of December, 2022 and February, 2023 excluding the public holidays. The surveys were initiated on 13th December, 2022 and were completed by 27th February, 2023.

Table 4-1 Primary Data Collection – Travel and Traffic Surveys

SN	PARTICULARS OF SURVEY
1	Classified Volume count at cordon locations
2	Classified Volume counts surveys at Screen Line locations and vehicle occupancy
3	Classified Volume counts surveys at Mid-Block locations and vehicle occupancy
4	Classified Turning Volume Counts at Junctions
5	RSI at Screen Line location (10% sample size of daily vehicle volumes)
6	RSI at Cordon locations (10% sample size of daily vehicle volumes)
7	Passenger Terminal Counts
8	Passenger Terminal Origin and Destination Surveys (10 % sample of the daily passenger count)
9	Public Transport (PT) Stop Waiting, Boarding and Alighting (B/A) survey – Bus/ Metro/ Ferry
10	Public Transport (PT) Stop Passenger Origin and Destination Surveys (10 % sample size of the daily B/A) at PT stops -– Bus/ Metro/ Ferry
11	Stated Preference Surveys for PT, IPT, Private Users (2W and Car) and NMT (cycle and walk) users along major activity centres
12	Pedestrian Volume Counts at critical junctions
13	Speed and Delay Study at peak and off-peak hours
14	IPT Operator Survey (Taxi/auto)
15	Parking Survey -On street with inventory
16	Parking Survey -off street with inventory
17	House Hold Interview with opinion survey
18	Road Network Inventory
19	Vehicles Survey at Petrol Pump
20	Establishment and Workplace survey
21	Goods Operator Survey

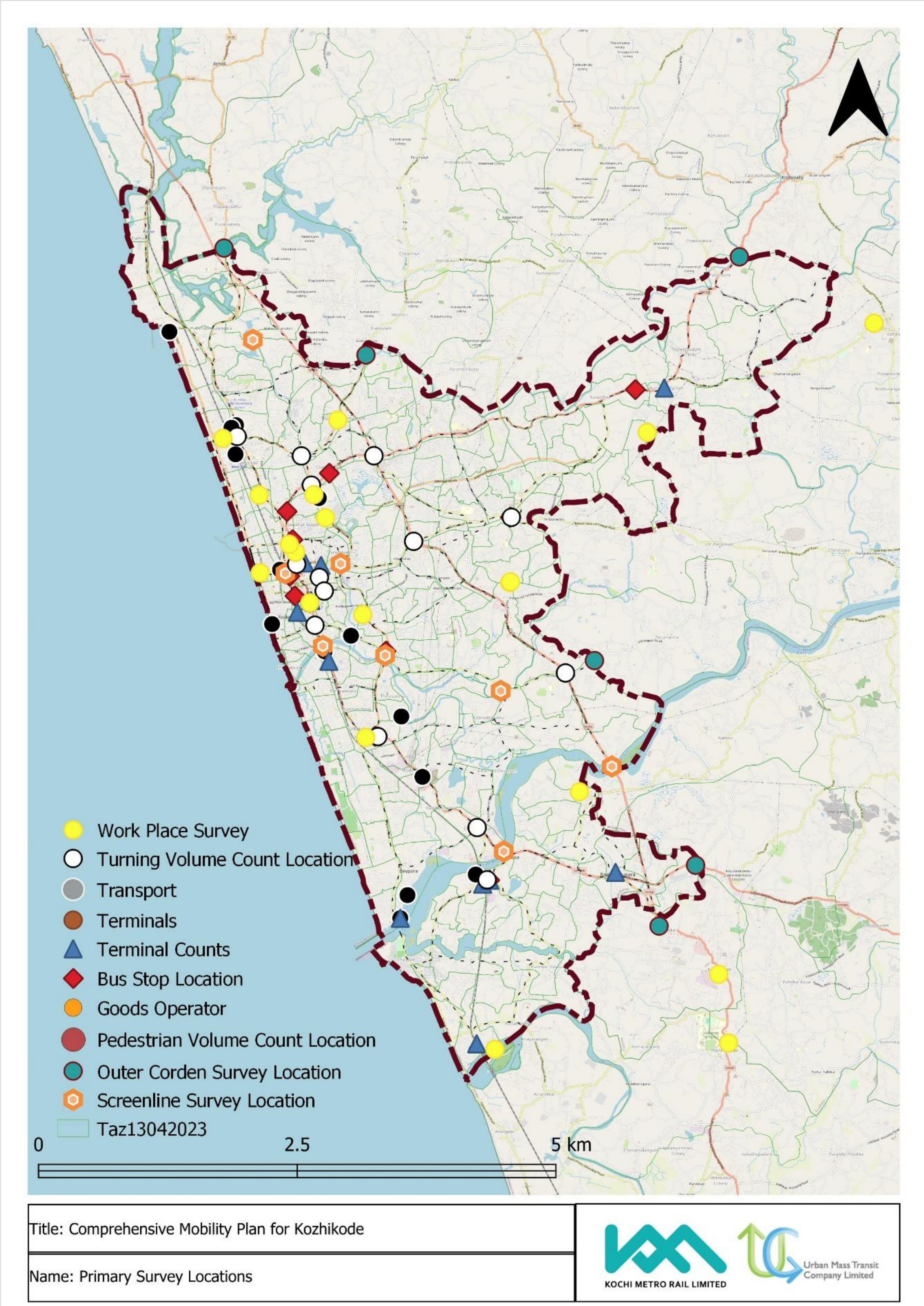


Figure 4-1 Map showing the locations of various Primary Surveys

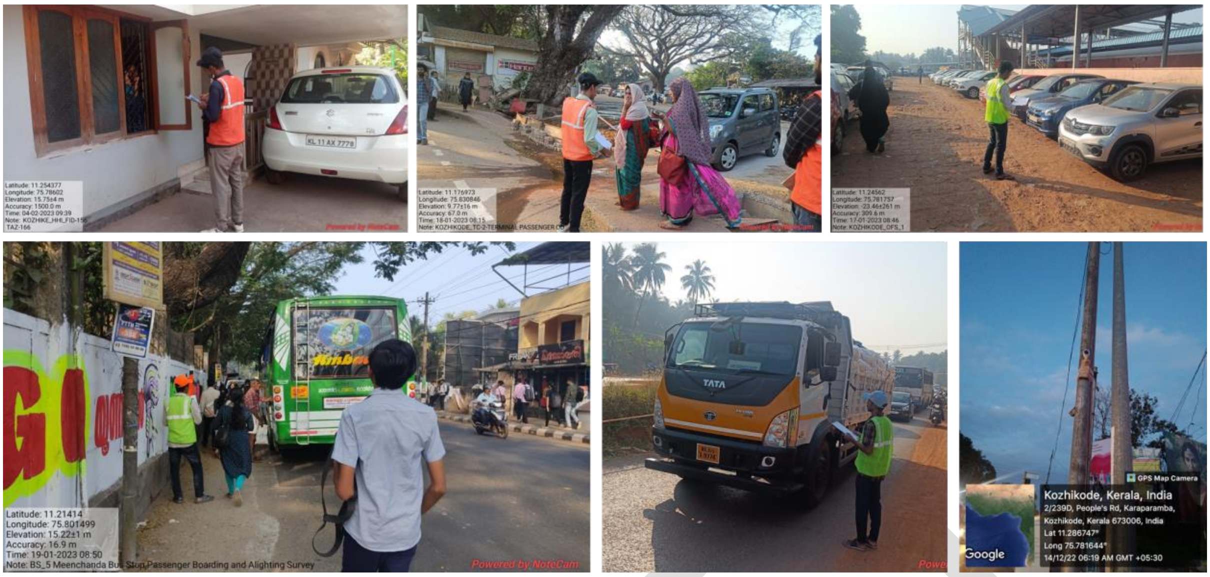


Figure 4-2 Photographs while capturing passenger travel and vehicle characteristics (Primary Surveys-2022-23)

The methodology adopted for the surveys and the details of the summary is presented in the Annexure. The summary of the assessment is presented in this section.

4.1.1 ROAD NETWORK CHARACTERISTICES

The percentage distribution of various road categories is as shown below. The share of arterial and sub-arterial roads is very less compared to the share of the collectors in the city, which shows that proportionate road class distribution which ensures a smooth flow of traffic is poor.

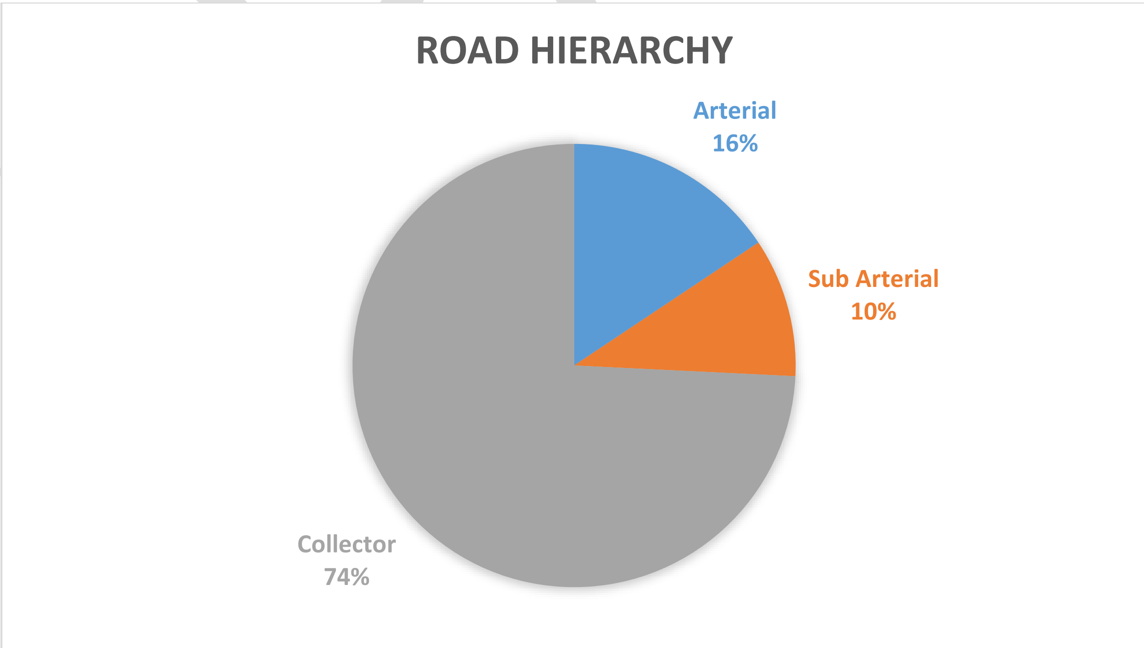


Figure 4-3 Road Hierarchy (Primary Surveys-2022-23)

- The surveyed network indicates that on 16% of the corridors have Right of Way (ROW) availability over 18m. The distribution of ROW on the surveyed network in presented in the below figure.
- The exiting surveyed corridors constitute carriageway between 6m to 12m indicating the unavailability of reasonable road space in terms of lane configurations on major corridors. However, only 36% of the survey network had ROW over 12m.
- 97% of the surveyed network has 2-lane and above configuration. 1 lanes constitute about 16% of the total network, which is largely along the Mini-bypass, NH 66, the Kozhikode Bypass is currently functioning as a two lane link however, it is being widened to a 6 Lane link.
- The share of network with divided carriage is about 4%. Majority of the links were observed to be divided when they are closer to an intersection for the purpose of channelizing the traffic.
- 10% of the major network has footpath availability in the study area. And only 4% of the network has footpaths over 2m widths indicating the need to improve pedestrian infrastructure in the study area.
- The analysis indicates that about 30% of the major network has on-street parking hindering the road space allocated for traffic flow and pedestrian movement.

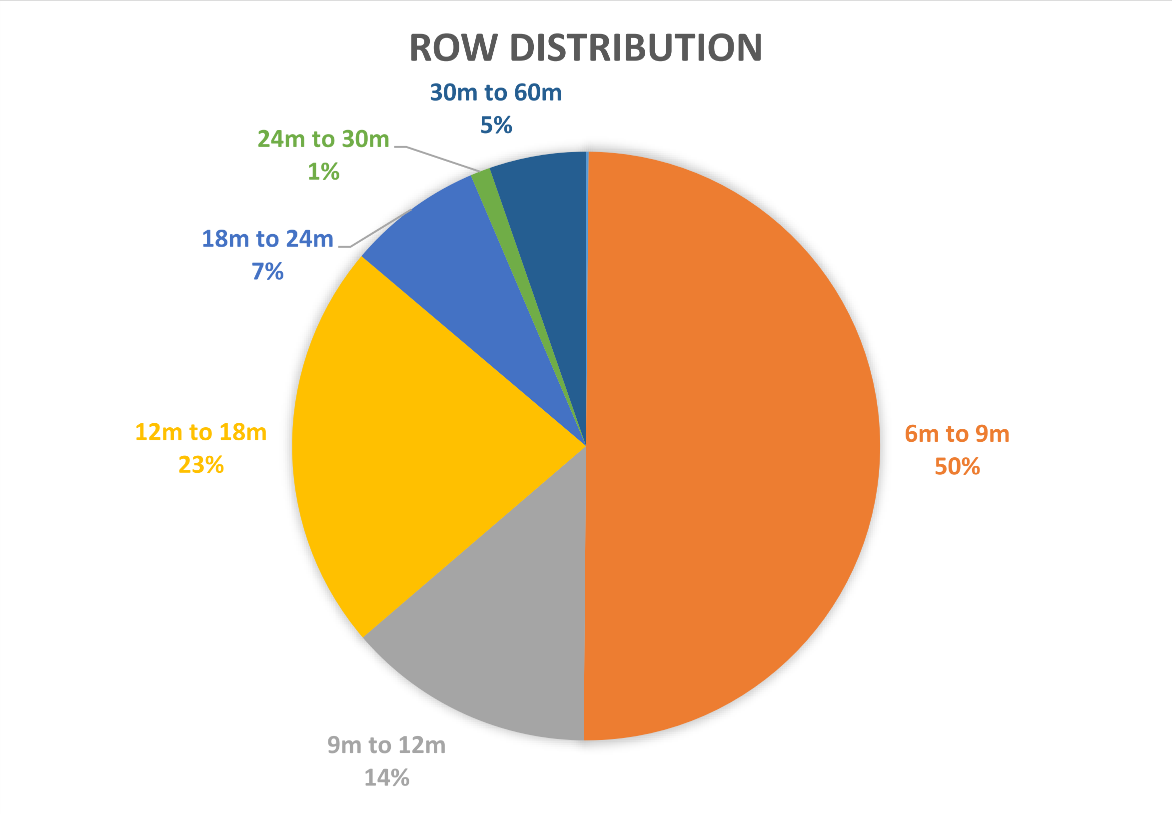


Figure 4-4 RoW Distribution (Primary Surveys-2022-23)

Table 4-2 Network Characteristics of Major Roads in the Study Area

NAME OF THE ROAD	LENGTH (KM)	PAVEMENT TYPE	PAVEMENT CONDITION	NO. OF LANES	DIVIDED/ UNDIVIDED	ONE WAY/ TWO WAY
Nh-66	22	Flexible	Good	4	Divided	Two Way
Kannur Road	18	Flexible	Good	2	Undivided	Two Way
Mavoor Road	8	Flexible	Good	2	Undivided	Two Way
NH 766, Wayanad Road	18	Flexible	Fair	2	Undivided	Two Way
Beach Road	11	Flexible	Good	2	Undivided	Two Way
SH 28, NH 966, Calicut Road	17	Flexible	Good	2	Undivided	Two Way
Kozhikode Balusserri Road	6	Flexible	Good	4	Undivided	Two Way
Feroke City Road	4	Flexible	Good	4	Undivided	Two Way

Mini- Bypass Road	12	Flexible	Good	2	Undivided	Two Way

- The average journey speed in the study area, in core areas is 20.4kmph, while the journey speed in the non-core areas is 28.3kmph.
- The peak hour speeds of the selected locations in the city are as given below:

Table 4-3 Peak Hour Speeds in the Major Roads of the Study Area (Primary Surveys-2022-23)

Sl	Name of The Road	Length	Area Type	Peak Hour Journey Speed (KMPH)
1	Nh-66	22	Core	27.6
2	Kannur Road	18	Core	21.7
3	Mavoor Road/Medical College Road	8	Core	21.2
4	NH 766, Wayanad Road	18	Core	20
5	Beach Road	11	Core	25.2
6	SH 28, NH 966, Calicut Road	17	Core	25.5
7	Mini Bypass Road	12	Core	17.7
8	Kozhikode- Balusserri Road	6	Core	15.4

- The average delay of 9.6 minutes is observed in the study area during peak hours on major corridors. The major reasons for Delay is largely due to traffic and signals.

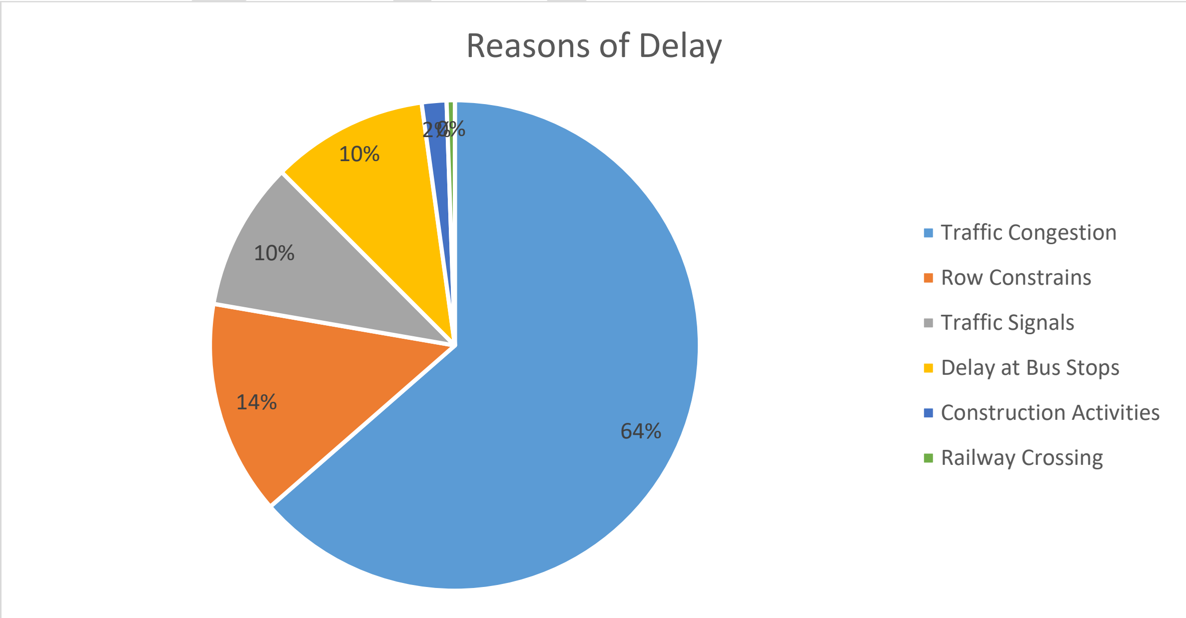


Figure 4-5 Causes of Delay in Travel Time (Primary Surveys-2022-23)

4.1.1.1 TRAFFIC VOLUME AT OUTER CORDONS

- It is observed that highest outer cordon traffic volumes are observed on NH-66- Kozhikode Bypass road followed by Palakkad – Kozhikode Highway, NH 966.
- It is observed that about 55% of the vehicle composition at outer cordons in constituted by two-wheeler and about 27% is constituted by Cars.

Table 4-4 Vehicular Volumes at Outer Cordon Locations (Primary Surveys-2022-23)

LOCATION	NAME	DAILY (VEHICLES)			DAILY (PCUS)
		INBOUND	OUTBOUND	TOTAL	TOTAL
OC_1	Kakkodi River Cross Bridge	22447	20864	43311	38913
OC_2	Kunnamangalam	12518	12263	24781	25072
OC_3	Perumanna Road	14790	13868	28658	26030
OC_4	Purakkattiri Bridge on Atholi Road	13232	13523	26755	25176
OC_5	Airport Road Near District Boundary	22866	22775	45641	46761
OC_6	Idimuzhikkal	23412	22987	46399	48611

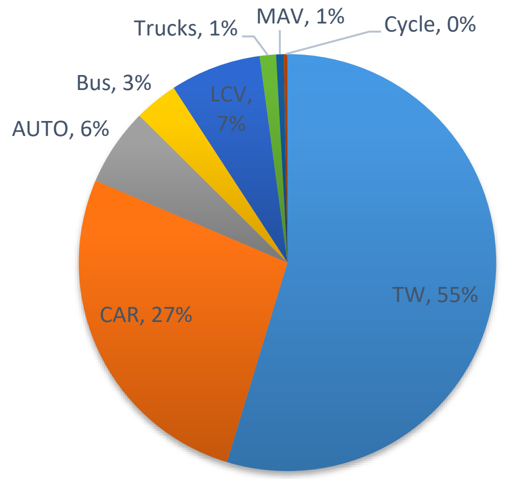


Figure 4-6 Vehicular Composition at Outer Cordons

4.1.1.2 TRAFFIC VOLUME AT SCREENLINE

- It is observed that highest traffic volumes at screen line locations are observed on Kundanamkadavu followed by Arapuzzha bridge and CH Overbridge. The least volume was observed over Kaipurath Bridge.
- It is observed that about 71% of the vehicle composition at screen lines in constituted by two-wheeler and about 16% is constituted by car.

Table 4-5 Vehicular Volumes at Screen Line Locations (Primary Surveys-2022-23)

LOCATION	NAME	DAILY (VEHICLES)			DAILY (PCUS)
		INBOUND	OUTBOUND	TOTAL	TOTAL
SC_1	Arayedathupalam Canoly Canal Cross	21869	20583	42452	41413
SC_2	Kallayi River Bridge	39452	39750	79202	76157
SC_3	Mankavu River Bridge	33723	31480	65203	59513
SC_4	Kunnathupalam River Bridge	19001	19062	38063	33290
SC_5	Kaipurath Bridge	1316	1401	2717	2178
SC_6	Feroke New Bridge (Chaliyar River)	23173	22498	45671	45681
SC_7	CH Overbridge	24075	31899	55974	55327
SC_8	Arapuzzha Bridge	26977	27497	54474	55825
SC_9	Kadalundi Kadavu Bridge	6696	6415	13111	12979

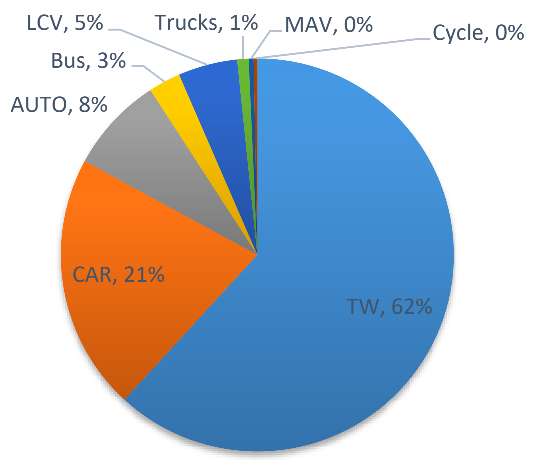


Figure 4-7 Vehicular Composition at Screen Lines

4.1.1.3 TRAFFIC VOLUME AT INTERSECTIONS

- It is observed that highest traffic volumes at intersections locations are observed at Thondayad Junction, followed by Eranjippalam, Palayam and Malaparamba. This indicates that the high volumes are observed along the NH 66 and city core and there is a need to address and decongest the core area and the corridor.
- It is observed that about 58% of the vehicle composition at intersections in constituted by two-wheeler and about 22% is constituted by car.

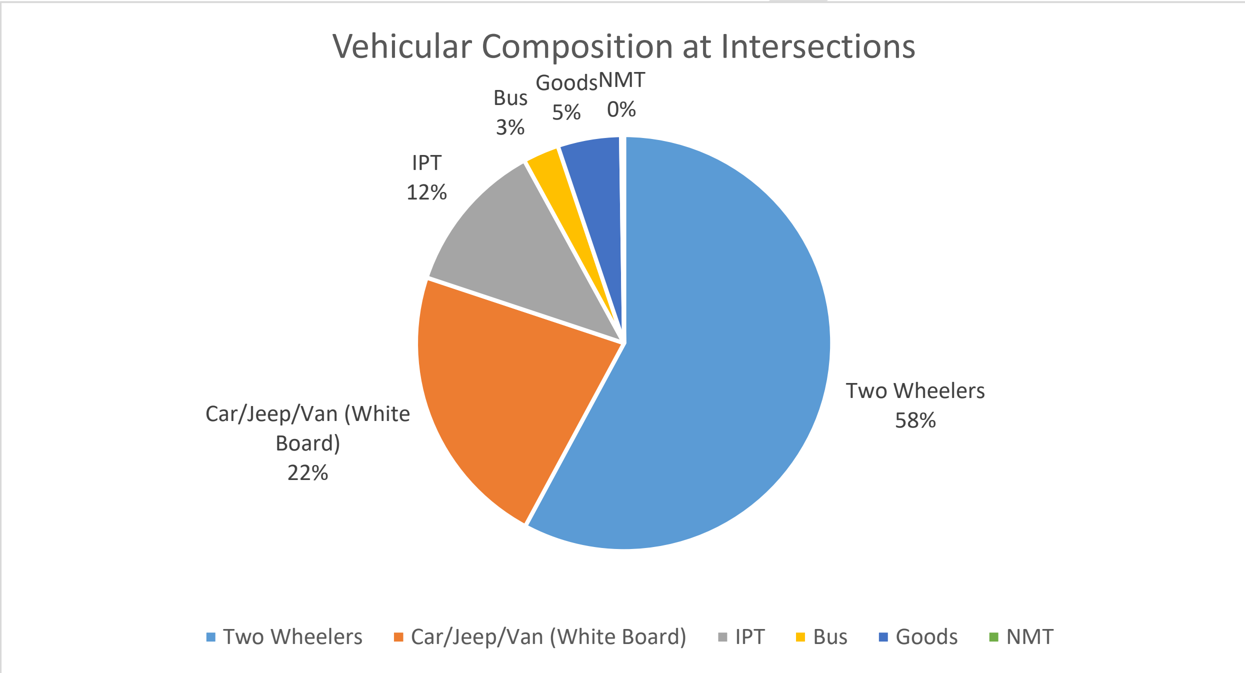


Figure 4-8 Vehicular Composition at Intersections

Table 4-6 Vehicular Volumes at Major Intersections (Primary Surveys-2022-23)

LOCATION	NAME	DAILY (VEHICLES) TOTAL	DAILY (PCUS) TOTAL
TMC 1	Stadium Junction	76404	82813
TMC 2	Palayam Junction	86800	93458
TMC 3	Francis Road Junction	79400	79914
TMC 4	Eranjippalam Junction	106386	103879
TMC 5	Karaparamba Junction	68957	67380
TMC 6	Thondayad Junction	111894	110444
TMC 7	Medical College Junction	60026	58570
TMC 8	Malaparamba Junction	85669	84772
TMC 9	Bank Junction	77647	74747
TMC 10	Cheruvannur Juma Masjid Junction	67490	65092

LOCATION	NAME	DAILY (VEHICLES) TOTAL	DAILY (PCUS) TOTAL
TMC 11	Feroke Town Junction	36846	34643
TMC 12	Pantheerankavu Junction	73511	73229
TMC 13	Poonthanam Junction	57812	58786
TMC 14	Vattakinar Junction	69008	65978
TMC 15	West Hill Chungam Junction	44373	44052
TMC 16	Kozhikode Bypass, Vengalam	31158	33109

4.1.2 PUBLIC TRANSPORTATION (PT) PASSENGER VOLUMES

The primary survey assessment shows a daily footfall of nearly 10 to 12 thousand passengers at the major public transportation terminals in the study area. It is seen that Calicut Railway Station and the KSRTC Bus Stand are the major terminals with high passenger footfalls. The quantum of passenger flow is as presented in the table below.

Table 4-7 Passenger Volumes at the Major PT Terminals (Primary Surveys-2022-23)[33]

LOCATION	NAME	PASSENGERS		TOTAL PASSENGERS
		IN	OUT	
TC 1	Calicut Main Railway Station	6541	5960	12501
TC 2	Feroke Railway Station	535	503	1038
TC 3	Kallayi Railway Station	332	304	636
TC 4	Kadalundi Railway Station	273	387	660
TC 5	KSRTC Bus Stand	5713	5164	10877
TC 6	Moffussil New Bus Stand	3898	3805	7703
TC 7	Palayam Bus Stand	1878	1845	3723
TC 8	Feroke Bus Stand	2235	2880	5115
TC 9	Ramanattukara Bus Stand	2053	1813	3866
TC 10	Beypore Port	826	1223	2208
TC 11	Calicut Airport	2157	2889	5046

[33] A daily footfall of about 50000 is observed at all the major public transport terminals in the study area (Rail and Bus) based on the primary survey data.

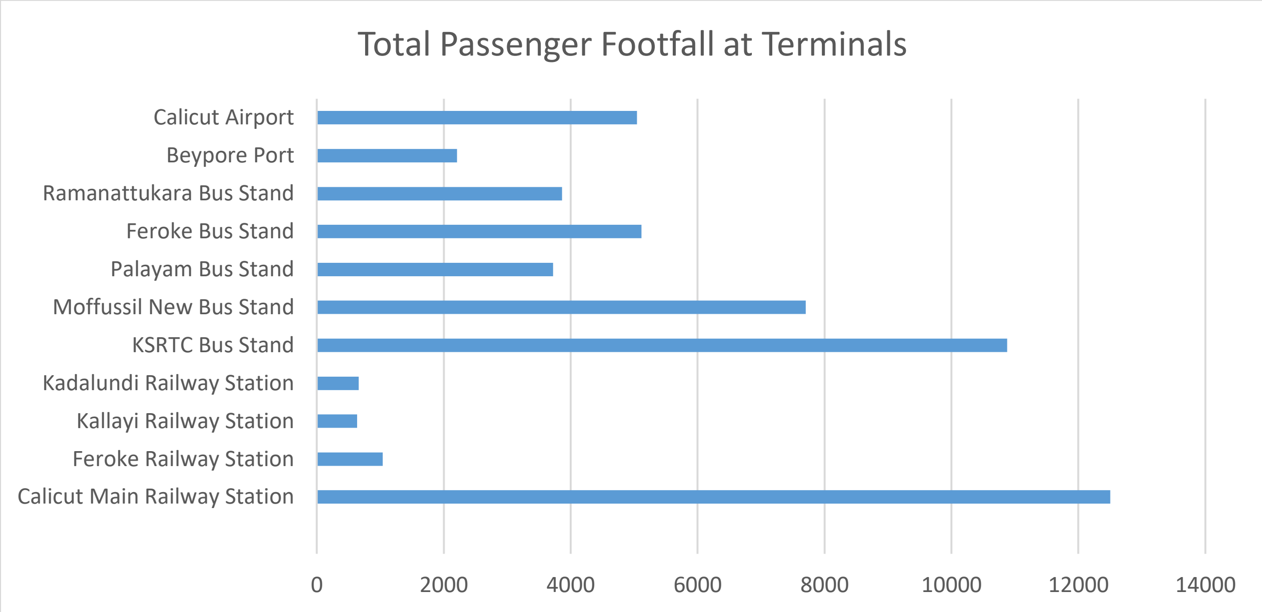


Figure 4-9 Total Passenger Footfall at Terminals

The primary survey assessment shows a daily footfall of nearly 24 thousand passengers at the major bus stops in the study area with an average passenger occupancy of 28 persons per bus. It is seen that Feroke bus stop has the highest footfall due to its proximity to various educational institutions and activity centres followed by Karanthur and Medical College bus stops. Mananchira and City bus stops are also observed to cater to nearly 2,000 passengers daily. The volumes indicated the presence of significant demand for public transportation services.

Table 4-8 Passenger Volumes at the Major Bus Stops (Primary Surveys-2022-23)

LOCATION	NAME	TOTAL PASSENGERS	AVERAGE PASSENGER LOAD PER BUS
BS-1	Mananchira Post Office	1769	25
BS-2	City Stand	1712	23
BS-3	Christian College Bus Stop	1401	28
BS-4	Nadakkavu East Bus Stop	824	28
BS-5	Meenchanda Bus Stop	966	41
BS-6	Cheriya Mankavu Bus Stop	994	40
BS-7	Mavoor Junction Bus Stop	1293	21
BS-8	Medical College Bus Stop	2646	24
BS-9	Civil Station Bus Stop	1702	31
BS-10	West Hill Bus Stop	1448	30
BS-11	Karanthur Bus Stop	4247	26
BS-12	Feroke Bus Stop	5368	24

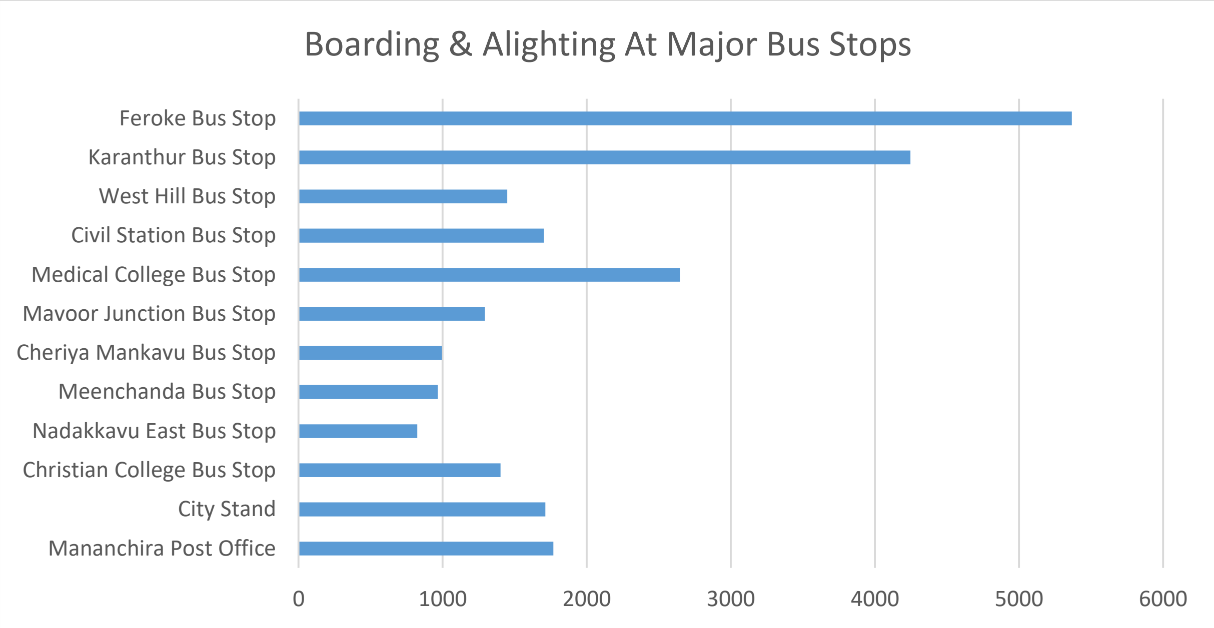


Figure 4-10 Total Boarding & Alighting At Bus Stops

4.1.3 PEDESTRIAN VOLUMES

The surveys indicate that highest pedestrian footfall at Medical College followed by Bank Road Junction due the adjoining activity nodes such as hospitals, colleges, transportation terminals, commercial areas, etc. This also indicates the need to improve the pedestrian facilities in areas with high footfall to improve their safety and promote the walking behaviour in the city.

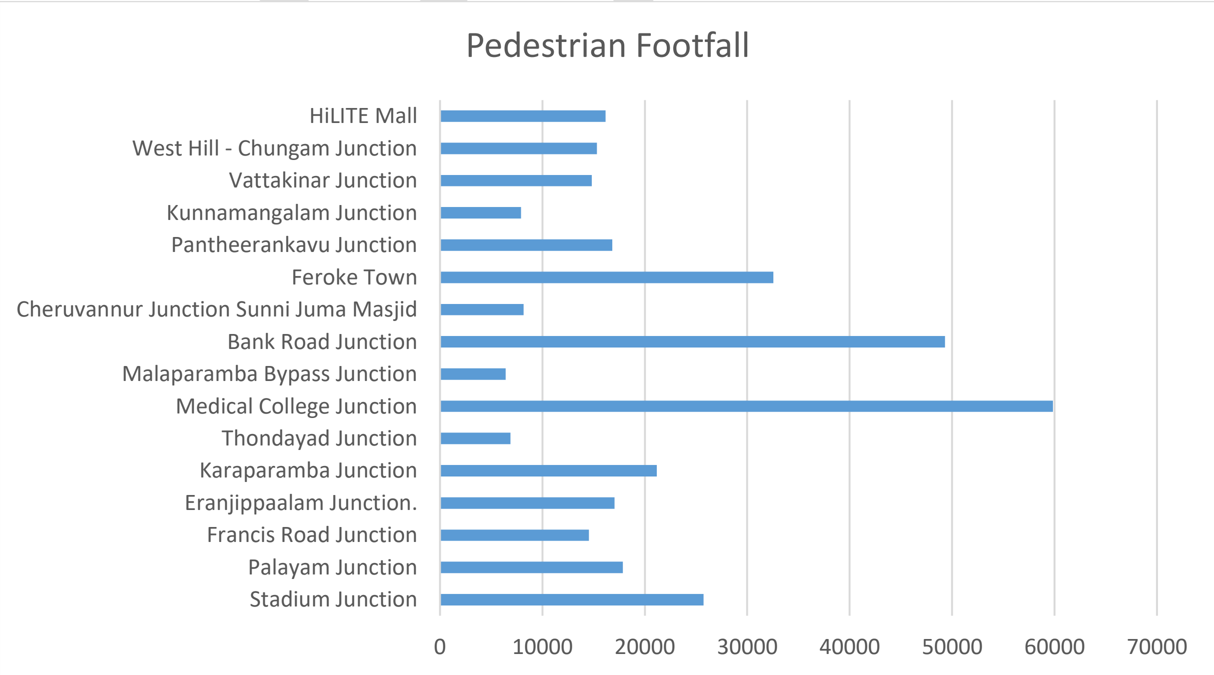


Figure 4-11 Pedestrian Volumes at Major Intersections

The degree of conflict between the vehicles and pedestrian was assessed at major intersections in the study area. The assessment resulted that Palayam, Stadium Junction and Medical College have highest degree of conflicts and which require immediate measures to ensure pedestrian safety.

Table 4-9 Degree of Pedestrian Conflicts at Intersections (Primary Surveys-2022-23)

LOCATION	NAME	DEGREE OF CONFLICT (PV^2x10^8)
PC1	Stadium Junction	56.2
PC2	Palayam Junction	26.4
PC3	Francis Road Junction	30.1
PC4	Eranjippaalam Junction.	45.6
PC5	Karaparamba Junction	10.5
PC6	Thondayad Junction	12.4
PC7	Medical College Junction	58.5
PC8	Malaparamba Bypass Junction	13.1
PC9	Bank Road Junction	22.8
PC10	Cheruvannur Junction Sunni Juma Masjid	21.7
PC11	Feroke Town	8.1
PC12	Pantheerankavu Junction	13.8
PC13	Kunnamangalam Junction	30.0
PC14	Vattakinar Junction	6.2
PC15	West Hill - Chungam Junction	6.8
PC16	HiLITE Mall	56.1

4.1.4 ON-STREET PARKING

The parking assessment was carried out at major locations in the study area, it indicated that highest on-street parking accumulation in Beach Road and Calicut Road near Kallayi The average parking density at major location in the study area is about 229 with an average parking duration of 78 mins.

This indicates high intensity of parking on major corridors for longer time periods and need for parking action in the study area.

Table 4-10 Parking Accumulation Along Major Roads (Primary Surveys-2022-23)

CODE	LOCATION	PEAK PARKING DENSITY (ECS/KM)	AVERAGE PARKING DURATION
ONSP 1	Calicut Road (Kadalundi Road)	269	71
ONSP 2	Francis Road	78	81
ONSP 3	Kesari Junction	236	54
ONSP 4	Kaloor Junction to Mankavu Junction	264	57
ONSP 5	Eranjippalam Junction	272	129
ONSP 6	Wayanad Road	165	80
ONSP 7	Indira Gandhi Road	208	64
ONSP 8	Mananchira Square	29	60
ONSP 9	MM Ali Road	137	70
ONSP 10	Ashokapura Junction to MCC Cross Road	147	89
ONSP 11	Kannur Road	74	91
ONSP 12	Beach Road	374	79
ONSP 13	Near Ramanattukara Bus Stand	218	40

ONSP 14	Near Feroke Railway Station	130	110

Further, it is observed that highest composition of vehicles parked are four-wheeler with a share over 27%.

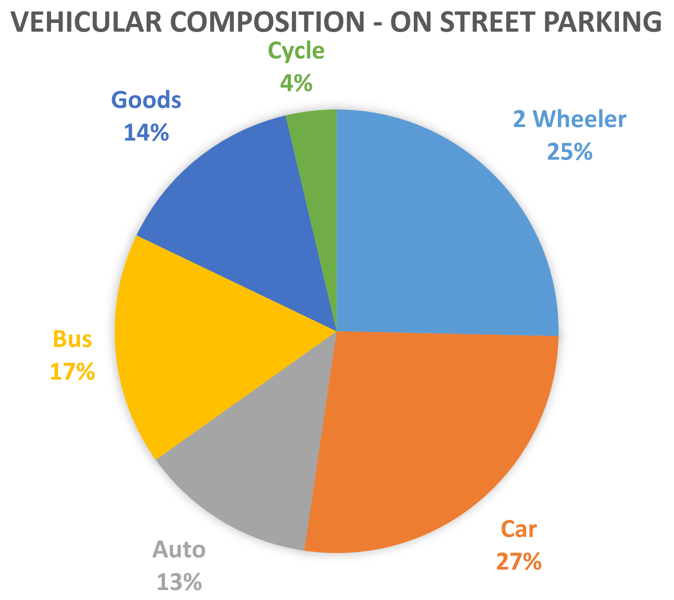


Figure 4-12 On Street Parking Modal Composition (ECS)

4.1.5 OFF-STREET PARKING SURVEY

The maximum accumulation observed during the Off Street parking analysis is at KSRTC Pay & Park and the overall average parking duration was observed to be around 5 hours.

Table 4-11 Parking Accumulation and Average parking duration at major off street parking locations(Primary Surveys-2022-23)

Location	ECS	Average Parking Duration (hrs)
Railway Station	251	5.54
Indira Gandhi Road Paid Parking	538	4.76
Pay & Park KSRTC	910	8.56
Mittayi Theruvu	408	7.29
KC Group Pay & Park	470	6.32
Paid Parking Ramanattukara	111	4.59

Sky High Info-tech Parking	393	2.52

48% of the vehicles parked were observed to be two wheelers followed by 42 % of cars.

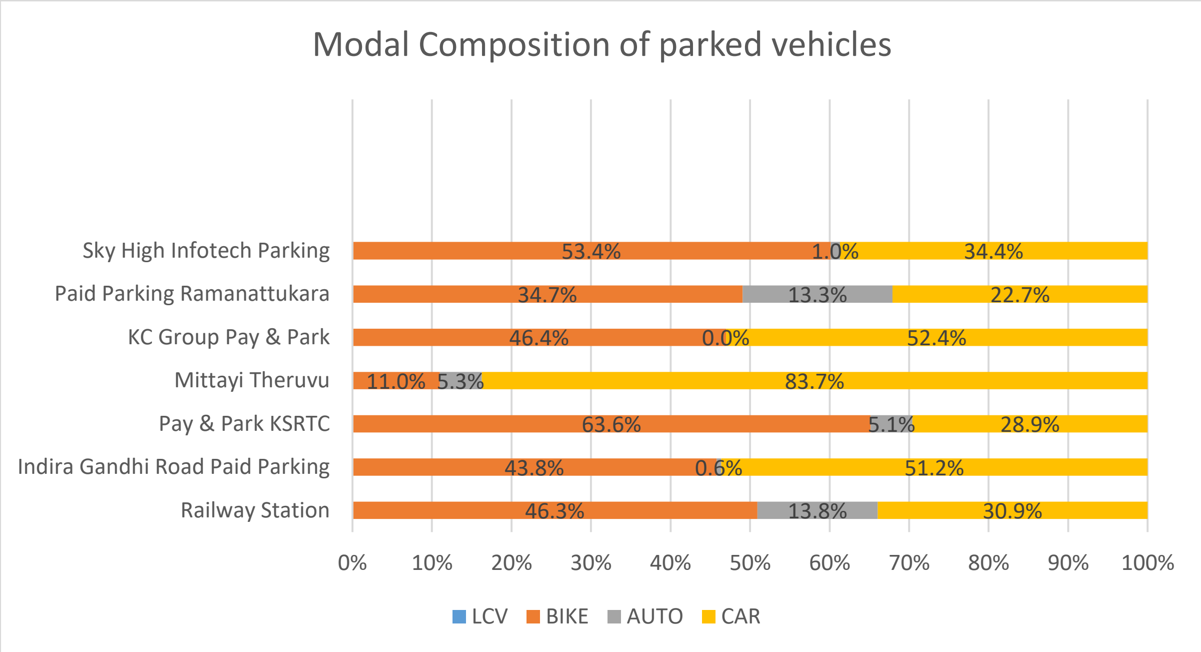


Figure 4-13 Off Street Parking Modal Composition (ECS)

4.1.6 SOCIO-ECONOMIC CHARACTERISTICS

- The sex ratio derived from the house hold survey is the sex ratio is 1064 females per 1000 males.

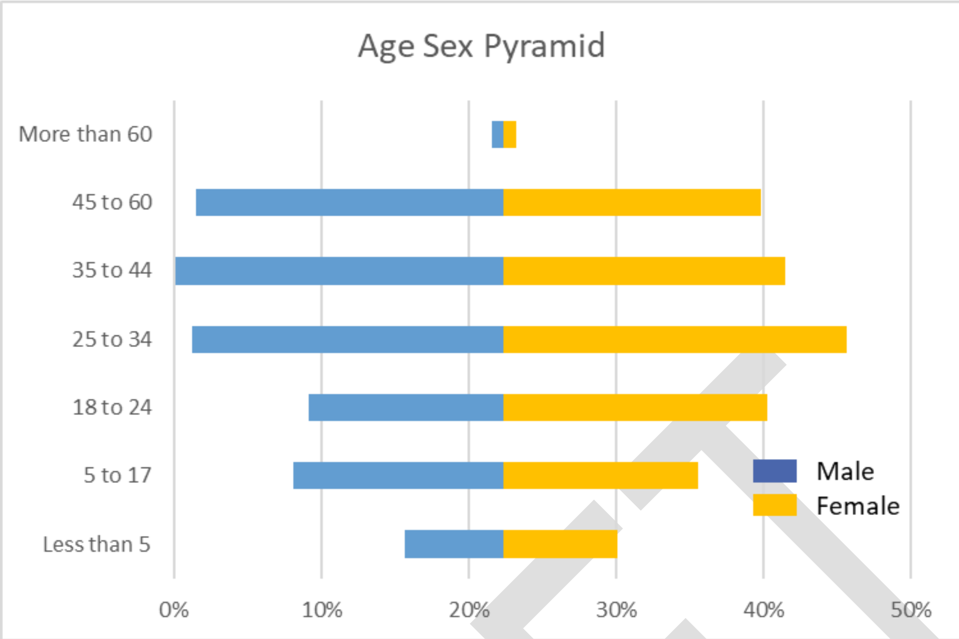


Figure 4-14 Age-Sex Pyramid (Primary Surveys-2022-23)

- The average household size is observed to be 4 with average number of 1.1 earning members per household.
- The average number of students per household is about 1.2 with an average of 1.3 members making trips on regular basis.
- The average monthly income as per the Household survey is about INR 31,159.
- The classification based on the category of vehicles owned indicates that 5% of the households own no vehicle while, 72% of the households own on two-wheelers.

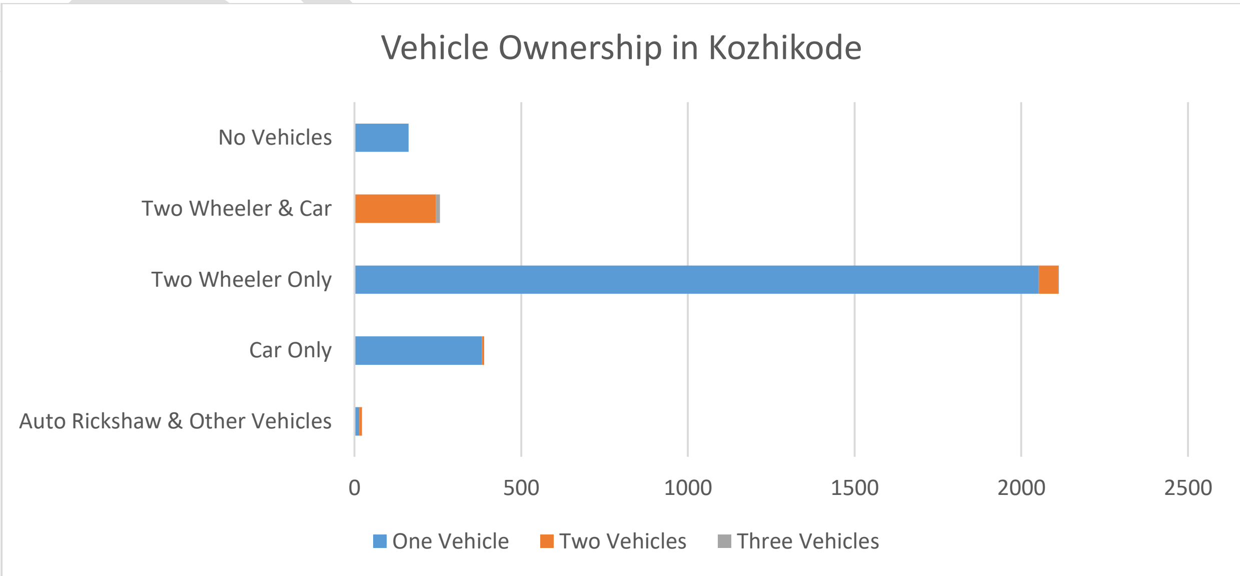


Figure 4-15 Distribution Households Based on Vehicle Ownership (Primary Surveys-2022-23)

4.1.7 EXISTING TRAVEL CHARACTERISTICS:

- The Per Capita Trip Rate (PCTR) was observed to be 1.01 including the walk trips and 0.94 excluding the walk trips. The PCTR for motorized trips is about 0.92.
- The major modes of travel are observed to be two wheelers with a modal share of 49% while the share of bus based public transport accounts to only 25%, clearly indicating that private mode dominance mode over public buses.

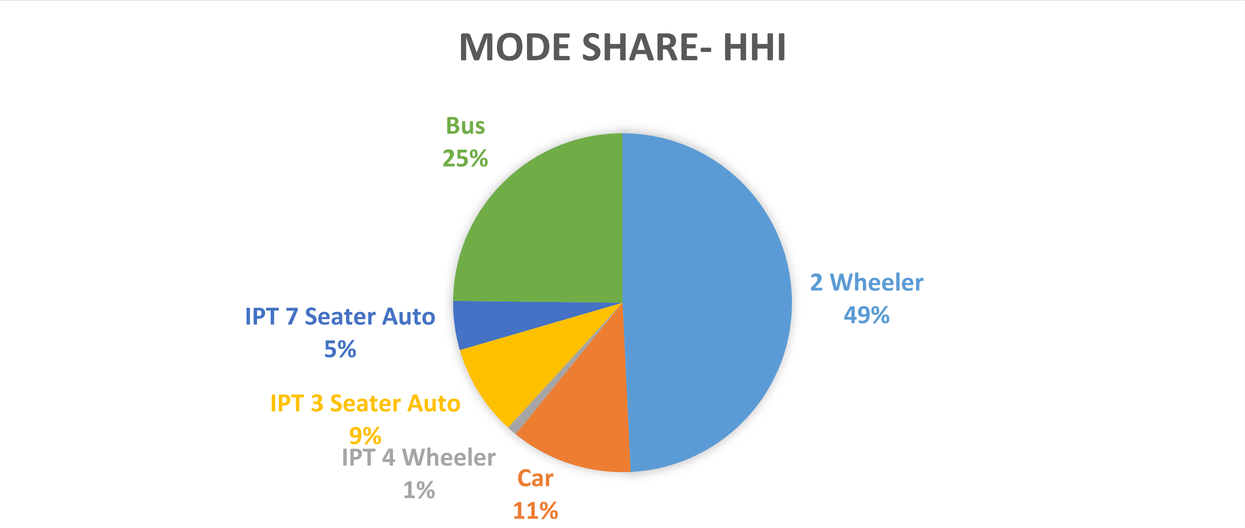


Figure 4-16 Mode Share (Primary Surveys-2022-23)

- The observed average trip length in is observed to be 5.78 Km including the walk trips and 6.02 km excluding the walk trips.

Table 4-12 Average Trip Lengths from the House Hold Surveys (Primary Surveys-2022-23)

AVERAGE TRIP LENGTHS	ATL (km)
Total	5.9
Ex. Walk	5.78
Motorized	6.02

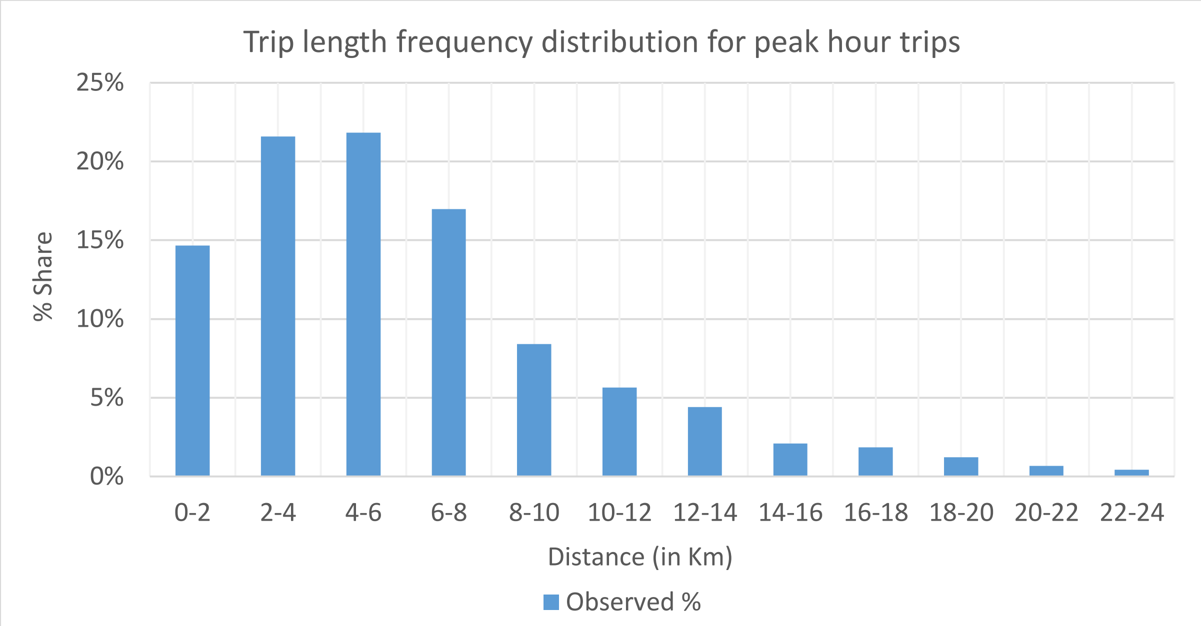


Figure 4-17 Trip Length Frequency Distribution (Primary Surveys-2022-23)

- The major mode of access and dispersal modes is walk with a share of 80% of the total access and dispersal modes.
- The average trip length of access and dispersal trips is observed to be 0.7 km including walk trips and 1.6km for trips excluding walk.

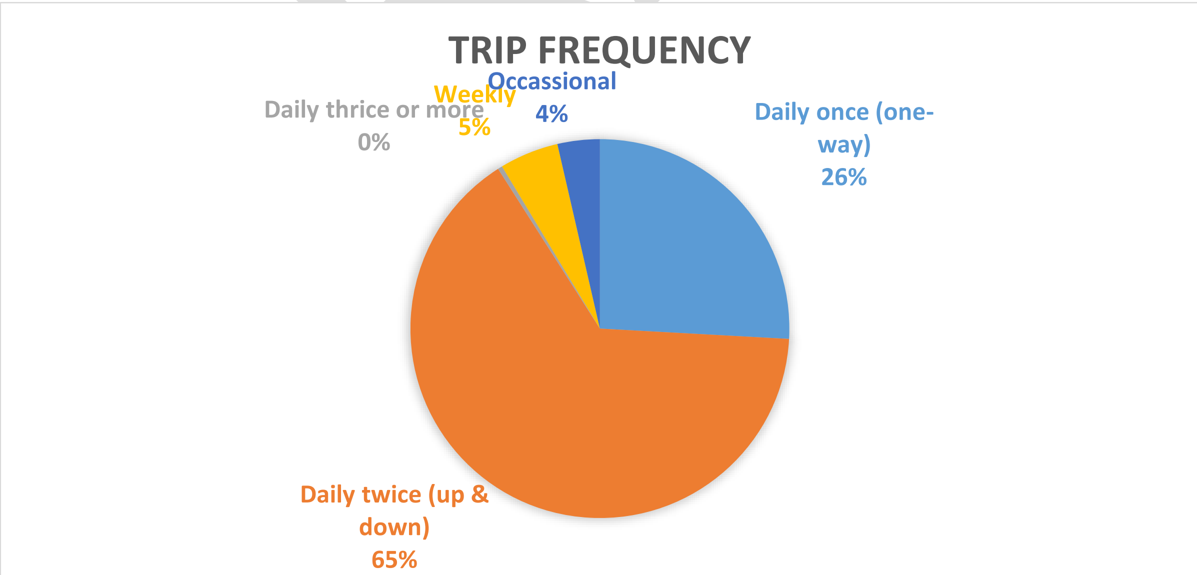


Figure 4-18 Trip Frequency Composition (Primary Surveys-2022-23)

- The survey indicated that over 90% of the trips are made daily.

- Nearly 61% of the trips made are work-based trips and about 23% of the trips are made for educational purposes. This indicates that nearly 80% of the trips being made are regular and daily trips in the study area.

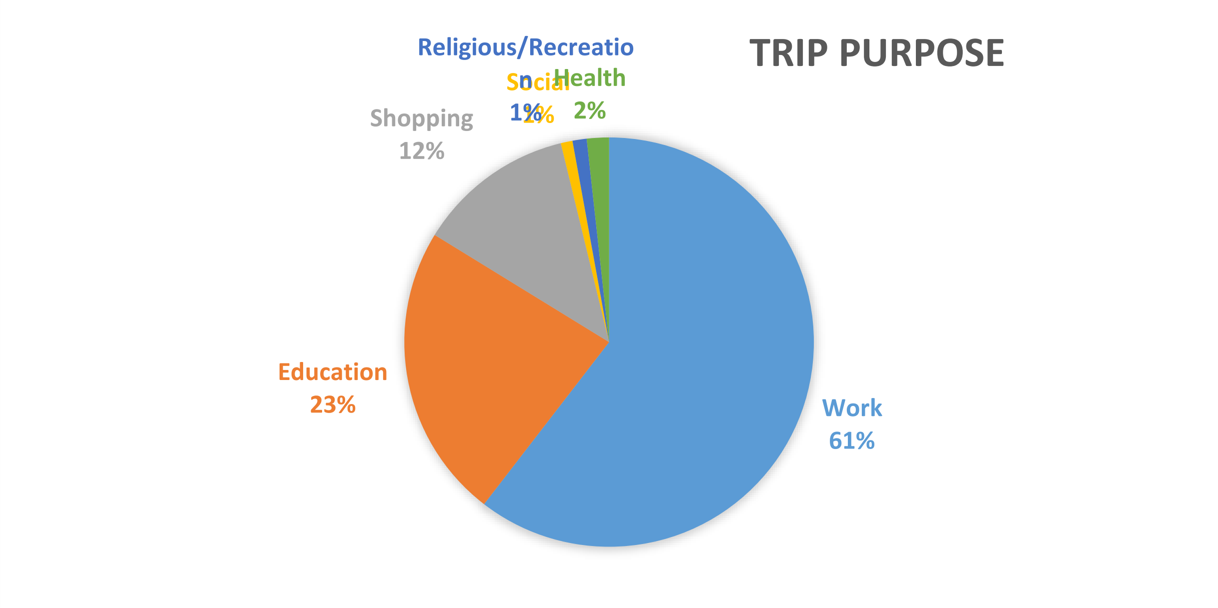


Figure 4-19 Trip Purpose Composition (Primary Surveys-2022-23)

- The average waiting time for public transport services is observed to 8.2 minutes. The longest waiting time is observed for buses with a wait time of 20 minutes.

- The household's access to the nearest PT or IPT stop is 9.8 km which is considered as a non-comfortable walking distance.

4.1.8 INTEMEDIATE PUBLIC TRANSPORT CHARACTERISTICS:

- About 86.5% of the intermediate public transport vehicles plying in the city are self-owned.
- The average number of operational hours is 10 hours with about 35 trips at an average.
- These are observed to travel at an average of 120 km daily with an average route length of 7.8 kms.

- The average daily expenditure of IPT is INR 756, while the average daily revenue is INR 949.

4.1.9 VEHICLE TECHNOLOGY AT SURVEYS PETROL PUMPS:

- It is observed that majority of the vehicles in the study area run on petrol owing to 91% of the total composition.

Table 4-13 Fuel Distribution Across Vehicle Types (Primary Surveys-2022-23)

FUEL TYPE	2WHEELER	3WHEELER	CAR	SUV	TRUCK
Diesel	0.00%	60.00%	16.67%	75.00%	100.00%
LPG	0.00%	20.00%	0.00%	0.00%	0.00%
Petrol	100.00%	20.00%	83.33%	25.00%	0.00%

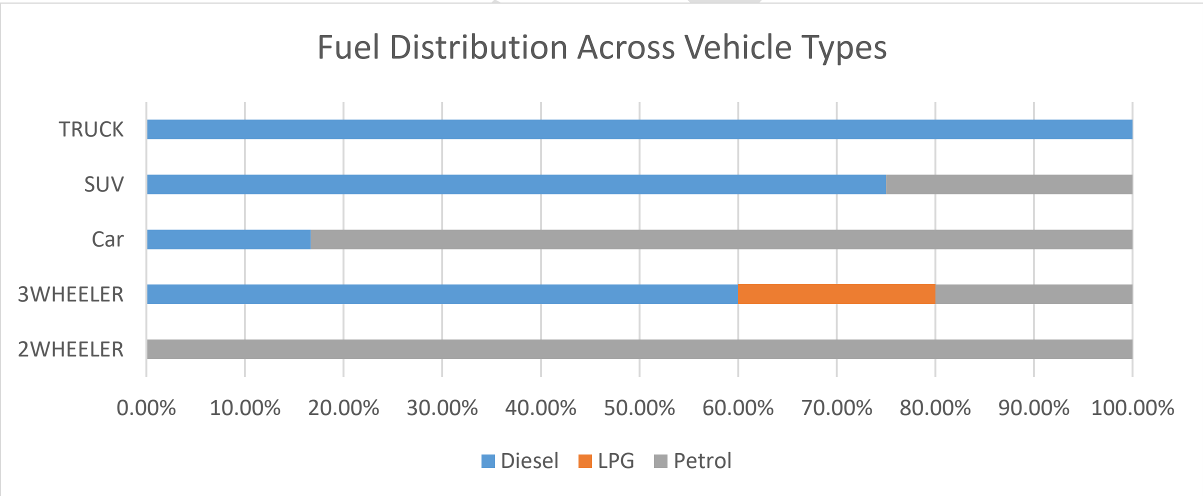


Figure 4-20 Fuel Distribution Across Vehicle Types

4.1.10 GOODS VEHICLE CHARACTERISTICES:

- About 52% of the trips are observed on occasional basis, indicating predominant intra-city interactions.
- The survey indicated that majority (56%) of the operators have parking facilities available within their premises. Other operators often park their vehicles on the streets. The major issues expressed by the goods operators are,
    - Lack of Parking facilities

- Lack general facilities and terminals
- Lack of Wide Roads

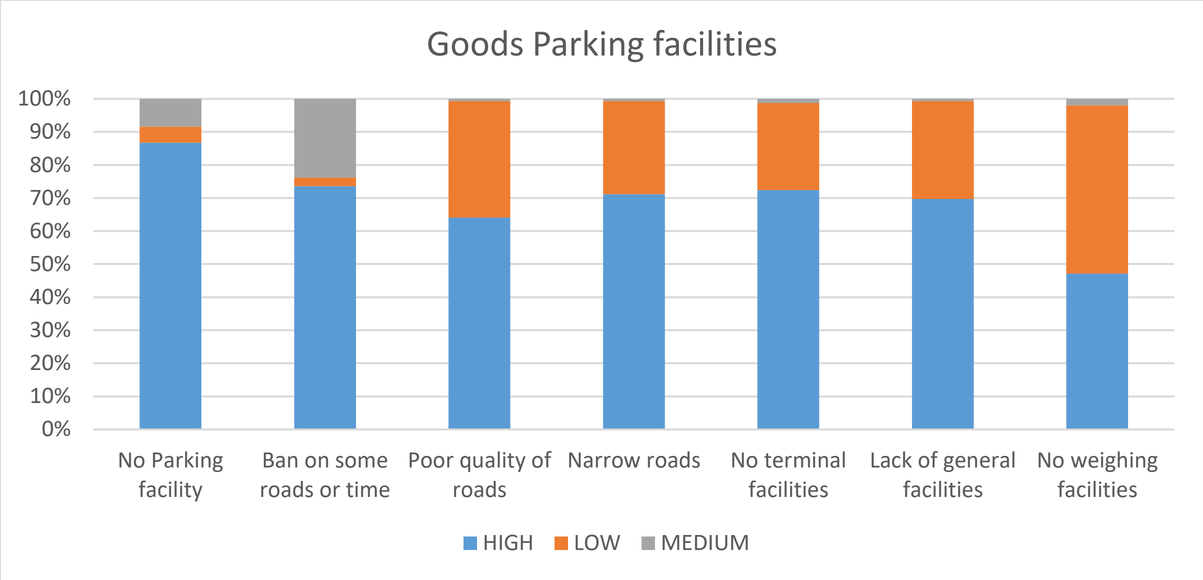


Figure 4-21 Intensity of Challenges faced by Goods Operators (High/ Medium/ Low)

- The average number of trips made by goods vehicles is 34 Trips per month.
- It is observed that majority of the heavy goods vehicles ply through NH-66, Beach Road, Wayanad Road etc.

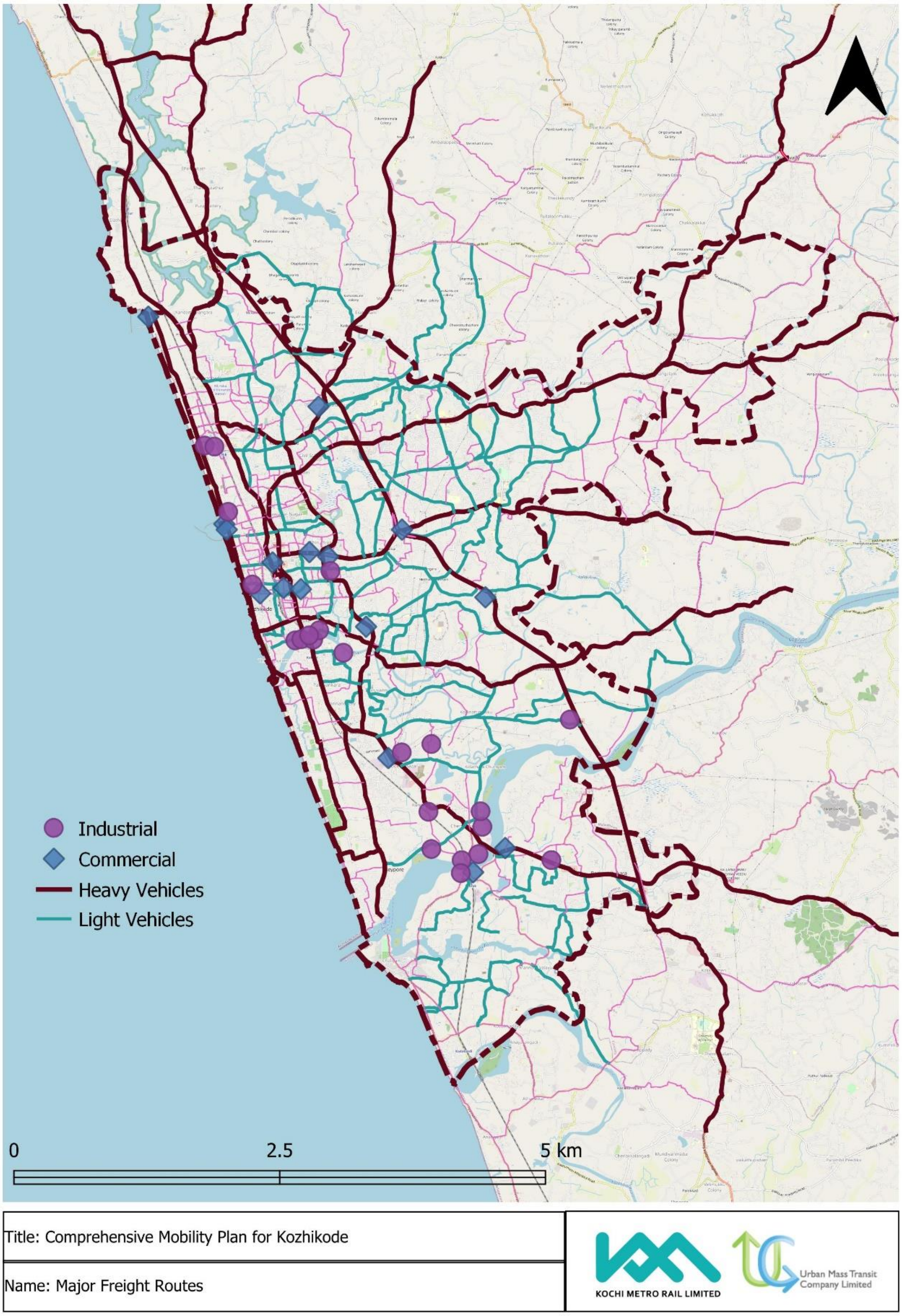


Figure 4-22 Map showing the major routes used by goods vehicles (Primary Surveys-2022-23)

4.2 KEY OBSERVATION IN THE CITY

This section summarizes the key observations related to transportation sector in the study area:

1. Ribbon development can be observed in the city, which limits the possibility of expansion on the main roads, landuse fluctuation, high utilization of land parcels on the major mobility corridors. An integrated planning approach towards the land use and transportation can be strategized to convert such development of growth corridors or transit –oriented corridors.

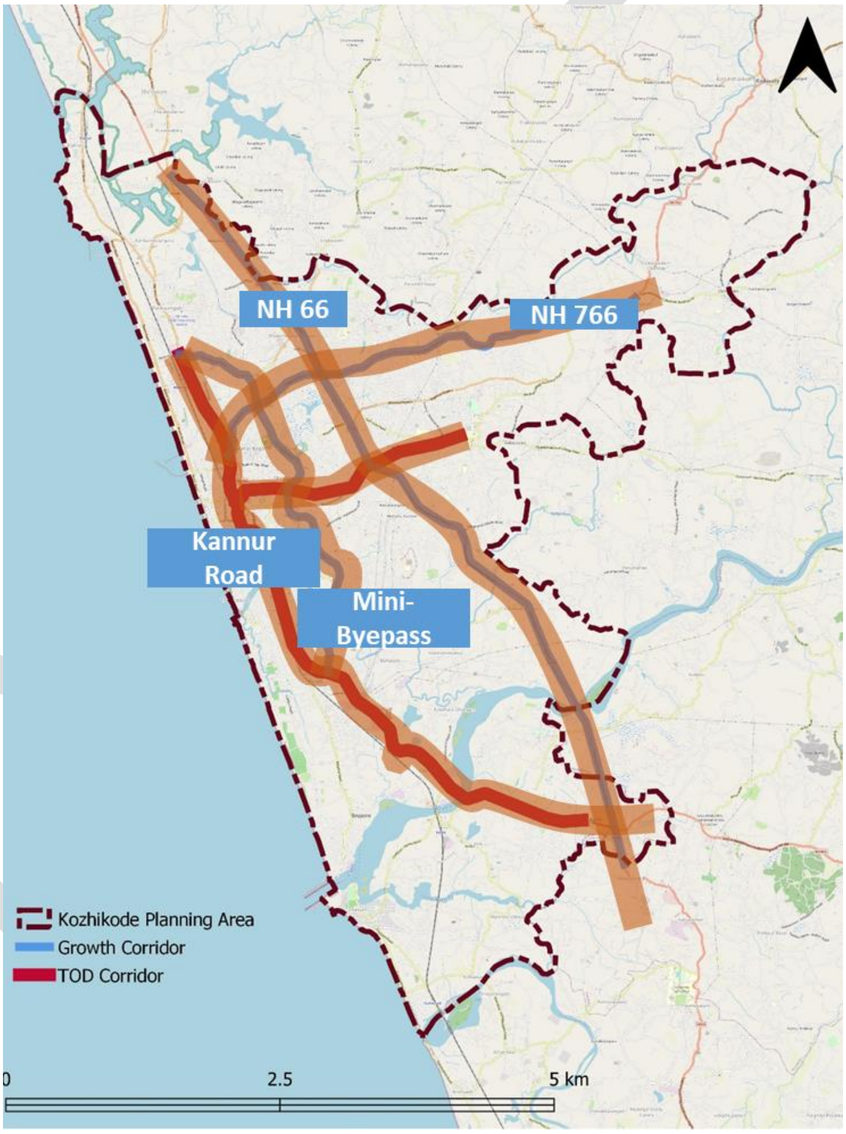


Figure 4-23 Development along the Main Transit Corridors

- The landuse in the area have been evolving over time from predominantly residential to public and commercial, generating pressure on existing transport infrastructure. The major densification is observed within the NH66, Kannur Road, NH 766- Wayanad Road.
- In the core city area, there is no clear demarcation of activities or road spaces leading to a lack of equitable distribution of the road space.

Figure 4-24: Mananchira Junction inn peak hours after schools and offices are dispersed

Figure 4-25: Eranjippalam Bus Stop Photos

- Poor pedestrian infrastructure in areas like Palayam, which are major commercial hubs with high pedestrian influx. Due to narrow streets, lack of pedestrian infra, the areas are not safe to walk. 10% of the major network has footpath availability in the study area.

As these streets lack organization of road space in addition to lack of pedestrian infrastructure, the comfort and safety of pedestrian is often compromised. The streets with a good RoW availability also are not equipped with cycle tracks.

- Major roads and junctions have footpaths. Though they have footpath it has less in width, poor condition, also there are many hindrances such as light poles, electric meters, signages making it more difficult for people to walk.

Figure 4-26: NMT Infrastructure

- Major corridors are often encroached by on street parking, due to which the access to footpaths is hindered, leading pedestrians to move on to the vehicular lanes adding to safety concerns. The average parking density at major location in the study area is about 180 with an average parking duration of 40mins.

Figure 4-27 Traffic Congestion along the Major Roads

- Unorganized and haphazard parking on streets hinders the traffic flow due to encroachment of the road space.
- The average congestion level on the major mobility corridors in the study area is 1.06 indicating the utilization is over 90%.

Figure 4-28 Ramanattukara Bus Stand

- Bus Terminals at Ramanattukara being a major terminal lack proper bus bays and dedicated boarding alighting spaces, leading to an added congestion on the road due to already present heavy traffic.

- Lack of provisions for goods movement and infrastructure accessing the industrial areas causes hindrance in the traffic flow, especially in areas like West Hill and Feroke.

Figure 4-29 Loading and Unloading during traffic and peak hours

Figure 4-30 Bus Boarding At Nadakkavu, near educational institutions.

- Crucial junctions like Medical College and Nadakkavu, due to presence of heavy traffic throughout the day, still lacks additional pedestrian infrastructure for proper crossing for the pedestrians. The degree of conflict of pedestrian with the vehicular volume at peak hours on major corridors is over 58 (PV^2x10^8) [34] indication highest value of critically and the need to develop pedestrian safety infrastructure.

Figure 4-31 Intersections with no channelizers

4.3 BASE YEAR TRAVEL DEMAND ASSESSMENT

The assessment of travel condition in the study area is carried thorough an urban transport model. The details of the same are presented in the following sections.

4.3.1 URBAN TRANSPORT MODEL - INTRODUCTION

An urban transport model to replicate the Kozhikode transportation system (roads, Congestion delays, transit system, etc.) was developed. This model would be used for forecasting, using altered model inputs to reflect future year scenarios. By simulating roadway conditions and travel demand on those roadways, deficiencies in the system would be assessed. Potential major future network enhancements such as introduction of an MRTS or land use modifications would be analysed using this tool. The model is planned at an aggregated level and its efficacy can be established at a planning level.

The model is based on a conventional 4-stage transport model approach, which includes:

[34] Ideal value for degree of conflict is $2x10^8$.

Trip Generation

↓

Trip Distribution

↓

Modal Split

↓

Traffic Assignment

⇐

- ✓ **Land Use Data**
- ✓ **Travel Generation Function**
- ✓ **Calibration Functions**
- ✓ **Transportation Networks**

Figure 4-32 Four stage modelling approach

- Trip Generation — It is computed by calibrating a regression equation that relates the total trip generations observed from each zone to demographic data of the zone (such as population and employment places contained within the zone). This equation helps in calculating the number of origins and destinations for each zone in the future years where the population or employment would be altered by the forecasted values. This is the critical stage of the transport model that links between the forecasted demographics to the model.

- Trip Distribution — The trips generated in the Trip generation stage are then distributed to places of attraction such as an office complex or an IT park or schools etc. The distribution is carried out by a Gravity Model which would distribute more trips to larger employment zones but will also bear in mind the costs of travel. A higher cost of travel between a zone pair would naturally reduce its attractiveness in the distribution function. This stage attaches the origins and destinations for complete trips.

- Mode Choice — This stage determines the selection of mode for each of the trips to obtain the number of cars, two wheelers. Auto rickshaws and bus trips that run between a zone pair. This is being calibrated in this model by the use of a Combined Distribution and mode choice function (Tanner Function).

- Assignment — This stage consists of 2 distinct processes, the highway assignment and the public transport assignment. The highway assignment uses an algorithm to determine the exact route on which a particular trip is made. To achieve this a Wardrop Equilibrium assignment that works on the principle that the cost of travel between alternate routes tend to be equal, has been used. The Public Transport Assignment on the other hand assigns passenger to buses and metros. The assignment uses a multi path assignment process.

Following steps were involved in developing the transport model.

- Step 1: Development of Traffic Zone System
- Step 2: Development of Transport Network
- Step 3: Population and Employment Distribution (Based on Prior Model)
- Step 4: Development of OD Matrices
- Step 5: Calibration of new and fresh functions and Validation
- Step 6: Base Year Travel Characteristics
- Step 7: Updating Network and Forecasting Traffic for future years

Build Network

We built the Network and zone system

Synthesize Base year Matrices

We built the OD matrices by using HHI and RSI data

Prepare Observed Matrices

Employing counts at various points in the city (Freshly collected) balanced the matrices by using “Most Likely Trip Matrix estimation from Counts”.

Calibrate Model Functions

Validate model

Prepared Demographic projections

We forecatsed the population and employment for the future years

Obtain Forecast Ridership

We coded on all important corridors, a mass transit system and ran the model to establish forecast demand on corridors for the years 2027, 2031, 2041 and 2051

The data that would affect the travel patterns are changes in the transportation system (e.g., new roads, wider roads, Metro etc.); changes in the land use (e.g., more residential development, more employment, SEZ etc.); and changing demographics (satellite towns, increasing per capita income, access to certain vehicle modes, etc.). The base network is developed in GIS using current roadway inventory data. Socio-economic data such as population, workers, employment data and other census data are also utilized.

Once the transport model, with reasonable confidence, replicates the base year i.e., existing conditions of the study area, it can then be used for forecasting purposes using altered model inputs to reflect future year conditions. By simulating roadway conditions and travel demand on those roadways, deficiencies in the system can be assessed. Potential major future network enhancements such as introduction of MRTS or land use modifications can be analysed by this tool and its efficacy can be established at planning level. Governments around the world want to build projects which will give them the maximum utility. So, they rank alternative project schemes so as to give the best value for public money. Without the help of such travel demand models, it would be difficult to assess the need and utilization of each project without which policy makers will not be able to make effective decisions.

This chapter of the report discusses the development and validation/calibration efforts for developing the base year travel demand model.

4.3.2 NETWORK DEVELOPMENT

Transport network developed for the model comprises of two components,

- Highway Network for vehicles
- Transit Network for public transport system i.e. Buses, MRTS etc.

Each of the networks is described in detail below:

- Modes: The modes that are modelled under the study includes Two-wheeler, Private Cars, Intermediate Public Transport, Public Transport i, e. Bus.
- Zoning: The trip patterns were evaluated in relation to the study area zoning to better understand the primary travel patterns on the corridor and the major origin attraction zones.
- Network: The highway (road) network considered all the Key arterials, sub arterials and collectors. The transit system considered with the existing public transport system in all its forms, i.e., bus with their routes, frequency, fare structure etc.
- Planning Period: Year 2023 is considered as the base year, 2027, 2031, 2041 and 2051 has been set as the horizon year for the estimation of Demand.

4.4 PRE-MODELLING ANALYSIS

4.4.1 STUDY AREA AND ITS DELINEATION

The study area comprises of total 287 zones that includes internal, external and main transit terminals.

4.4.1.1 Internal Zones

The city is divided into 251 internal zones as per prevailing demarcation of natural boundaries and wards as shown in figure below. The main transit terminals such as railway station, major bus terminals and airport have been considered as separate TAZs, which are included in the 251 zones.

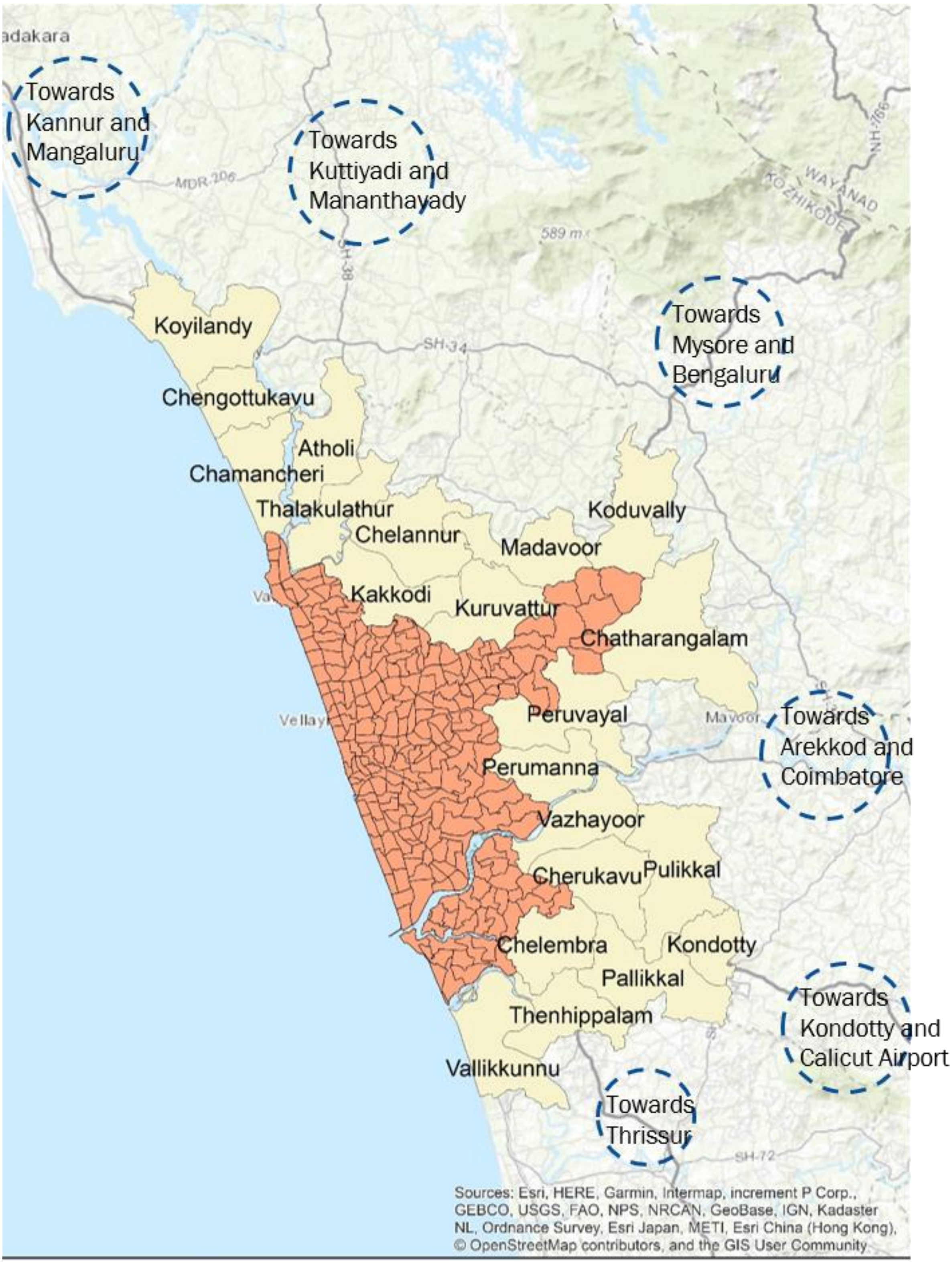


Figure 4-33 Traffic Analysis Zones – Internal & External Zones

4.4.1.2 External Zones

Regions beyond the city have been delineated into external zones based on the catchment of the existing transport links feeding into the study area. A total of 28 external zones comprising of urban centres in the immediate vicinity of Kozhikode, Major Urban Nodes of Kerala, Rest of India.

4.4.1.3 Plan Period

Year 2023 is considered as Base Year. As per Terms of Reference (TOR) travel demand forecasts are to be prepared up to 2043. Therefore, for the purpose of sequential planning and design of the systems, these travel demand forecasts are presented for short, medium and long -term durations i.e., for the years 2027, 2031, 2041 and 2051.

4.4.2 PREPARATION OF BASE DATA BASE

Data required for the analysis of travel demand can be categorized into three types:

- Planning variables
- Transport network
- Travel Demand and Characteristics

The base year data is summarized in the following sections:

4.4.2.1 Planning Variables

Planning variables i.e., population and employment are some of the important data required for estimating the travel demand generated at zonal level. Base year demographic data is obtained from the Census and Masterplan database. Zone wise employment is collated from various published reports.

4.4.2.2 Transport Network

The transport network in the study area includes road network and public transport network. All the characteristics of the road links are collected by network inventory and, speed and delay surveys. Link characteristics collected include length, carriageway type (divided/ undivided), type of operation (one-way/ two-way), number of lanes, average speed, capacity, Road Tolls etc.

Public Transport Network includes all roads on which bus operate. In addition, in this study, the road network is properly connected to all zone centroids by means of dummy links called connectors.

4.4.2.3 Travel Demand and Characteristics

Various traffic surveys are conducted to assess the base year traffic and travel characteristics in the study area. Home Interview Survey (HIS) is conducted to obtain the socioeconomic and travel characteristics of resident population. Outer cordon O-D and Public Transport terminal surveys are conducted to assess the intercity travel demand and its characteristics.

4.4.3 GENERATION OF O-D PERSON TRIP MATRICES AND CALIBRATION

Table below provides the summary for the sources for the estimation of intra city and intercity trip matrices. The OD matrices for the intra city trips are obtained from the household survey and are expanded using the four-stage modelling process discussed in the next section. The matrices for Inter-city trips are estimated by expanding the sample OD matrices by using count data on the Outer cordon locations.

Table 4-14: Data Sources for Generation of O-D Person Trip Matrices

Intra/Intercity Trips	Category	Data Source
Intra-city Trips	Home based trips	Home Interview Survey
Inter-city Trips	Internal – External	Outer Cordon O-D surveys
	External – Internal	Outer Cordon O-D surveys
	External – External	Outer Cordon O-D surveys

4.4.3.1 HIGHWAY NETWORK

The process involved in the highway network development is as below.

- Export Road network i.e., Node-link file as shape file
- Build Highway Network from Line Shape File
- Export zone shape file
- Add Automatic centroids
- Revise Centroids
- Add Automatic centroid connector
- Update link node database

The coded highway network for the study area represents the nodes (intersections), linkages between them and characteristics of the street and highway system to support estimation of traffic volumes, speeds, and vehicle travel times on individual links of the system plus zone-to-zone travel times. Connectivity between the network and zones is provided through centroid connectors. The functional characteristics of different kinds of roads has been coded and analysed to divide it into functional classes. Accordingly, the roads in study area have been divided into the following classes. The current model has 2854 links and 1088 nodes as input.

Table 4-15 Lane Configuration

ROADWAY CLASS	LANE DETAILS
1	2L- UD- 2W-Collector Road
2	2L-UD-2W-Sub Arterial Road
3	2L –UD- 2W – Arterial Road
4	4L – D – 2W-Arterial
5	2L – 2W – UD-State Highway
6	2L – 2W – D-National Highway
7	4L – 2W – D-National Highway

L: Lane, 1W: One Way, 2W: Two Way, UD: Undivided, D: Divided

A user-equilibrium multi-modal assignment procedure based on generalized cost is used for loading matrices in PCU values. The mode wise trip matrices developed from the primary surveys have been converted into PCUs by applying the equivalent passenger conversion factors as per IRC 106-1990. The occupancy and PCUs considered for different modes are presented in table below.

Table 4-16 Mode Wise Occupancy and PCU conversion factors

Private Vehicles & IPT, PT	Modes	Occupancy	PCU Values
	2-wheeler	1.39	0.5
	Car	2.24	1.0
	IPT	2.19	1.2
	Bus	27.3	2.2
Commercial Vehicles	Good Auto/LCV		1.5
	Trucks (2 Axle, 3 Axle)		2.2
	MAV		4.5

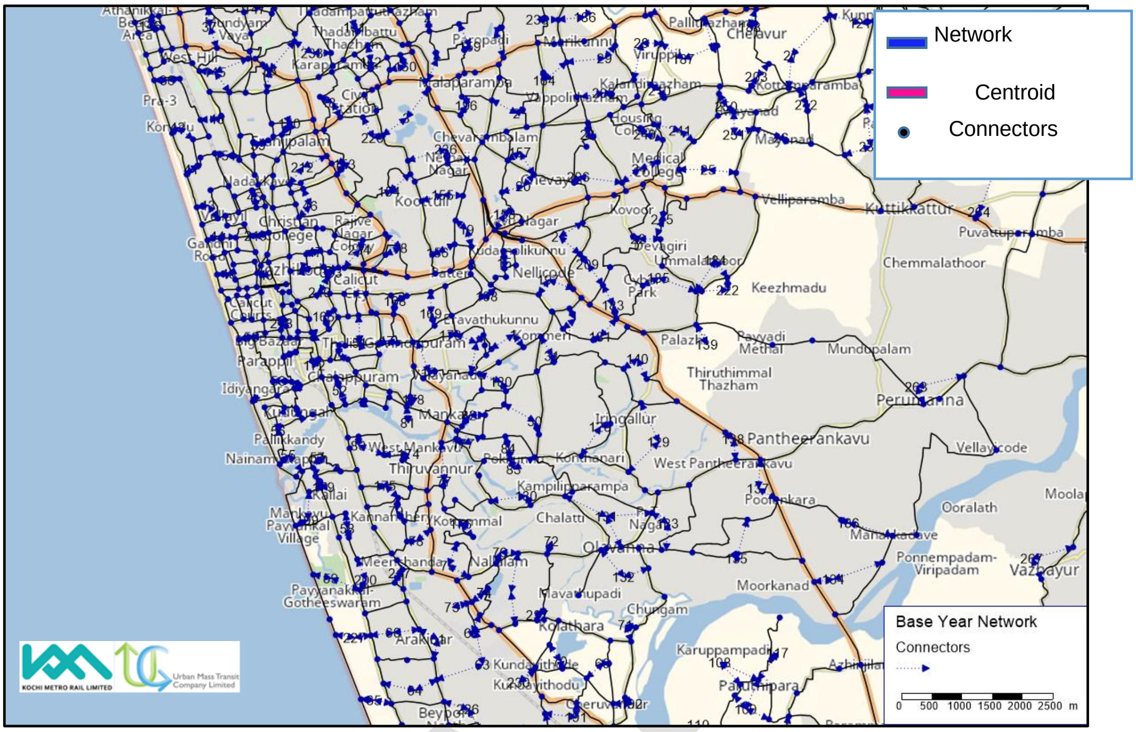


Figure 4-34 Highway Network along with centroid connect

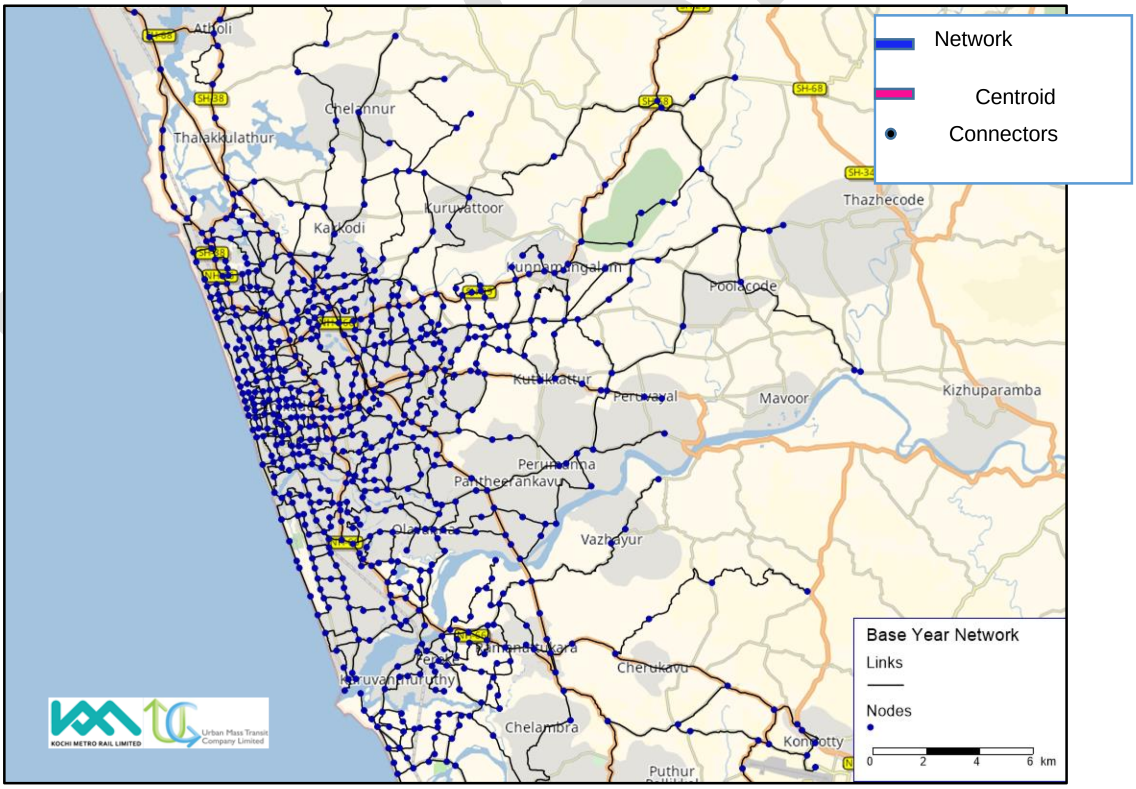


Figure 4-35 Highway Network with Link Attributes

4.4.3.2 TRANSIT NETWORK

The transit network represents the connectivity, headways, speeds, and accessibility of the Public Transport. The transit routes are specified as those using the transport links and having stops/stations at determined locations. The access to the stops/stations from zone centroids and other nodes is provided by defining exclusive walk links. The access and egress links (walk, transfer) were generated automatically through the "Generate" command in the software.

Public Transport Assignment

PT Routes (.LIN file)

- Route name
- Mode Number
- Identifier
- Headway

PT System (.PTS file)

- Mode Number
- Connectors (walk, auto)
- Name
- Initial Wait curve

PT NET LEG (.NTL file)

- From node to node
- Mode
- Distance

PT Fare System (.FAR file)

- Identifier
- Name
- Structure (Distance, Zone based)

PT Costs (.FAC file)

- Identifier
- Mode (auto, walk)
- Transfers
- Penalty

Outputs

- On\Off
- Sectional Loading

Figure 4-36 Transit Network input files

Public Transport Network includes all roads on which public transport buses operate. Details of bus routes, frequencies, seating capacities, maximum load factor, and fares have been collected and coded. In addition, in this study, the road network is properly connected to all zone centroids by means of dummy links called connectors. Currently, about 345 city bus permits are operational in the Kozhikode Urban Area.

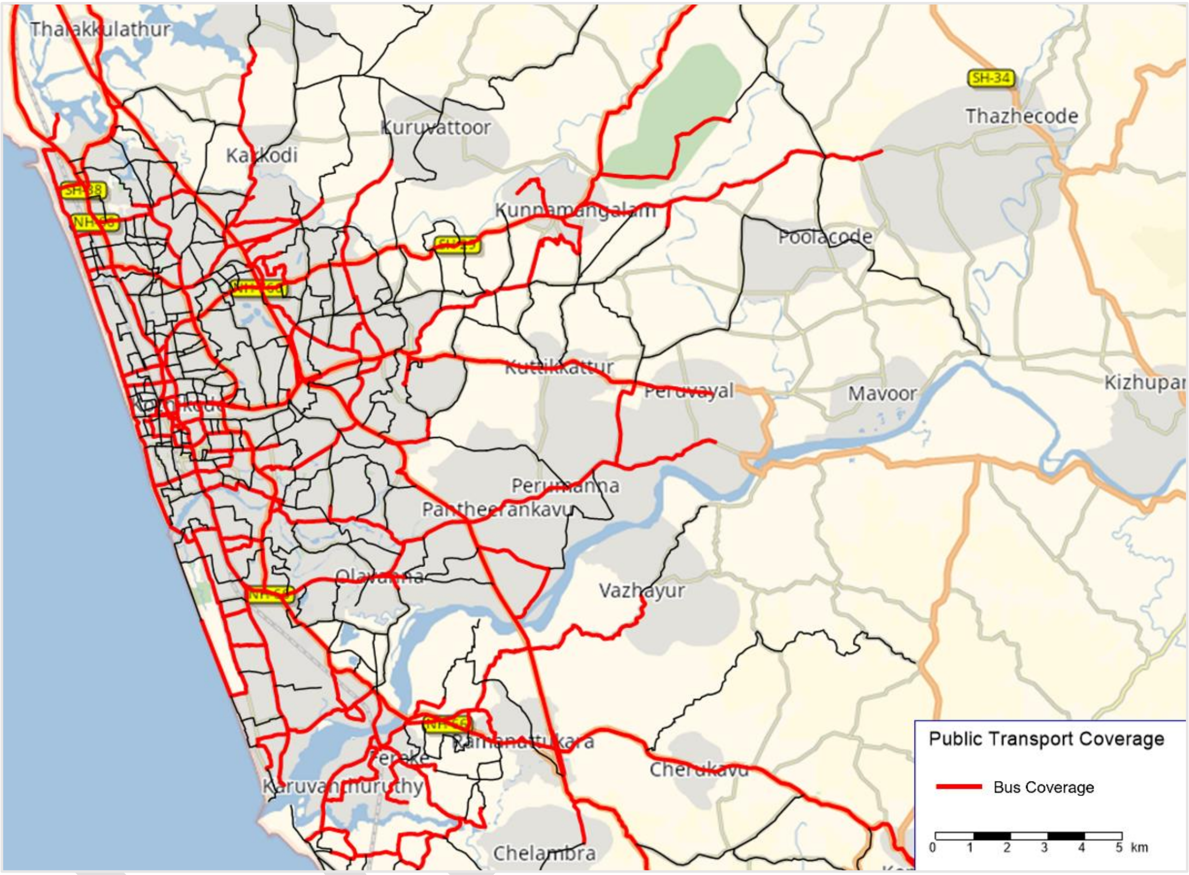


Figure 4-37 Transit Network in the study area showing Coded PT bus routes

4.4.4 ZONING

The study area considered is expanded Planning area that is Study area of 210 Sq.km. and an influence area. The study area is subdivided into a number of zones. For the study purpose the zoning system was adopted consisting of 279 zones, in that 1 to 251 are internal zones and 251 to 279 are external zones. The internal and external zones are shown in figure below respectively.

4.4.5 STRENGTHENING OF MATRICES

4.4.5.1 DEVELOPMENT OF OD MATRICES

To begin with we built the OD data from Household Interview Survey and to strengthen matrices we have replaced the cells in the OD from RSI OD which we built it from Road Side Interview Survey to validate it to ground traffic condition.

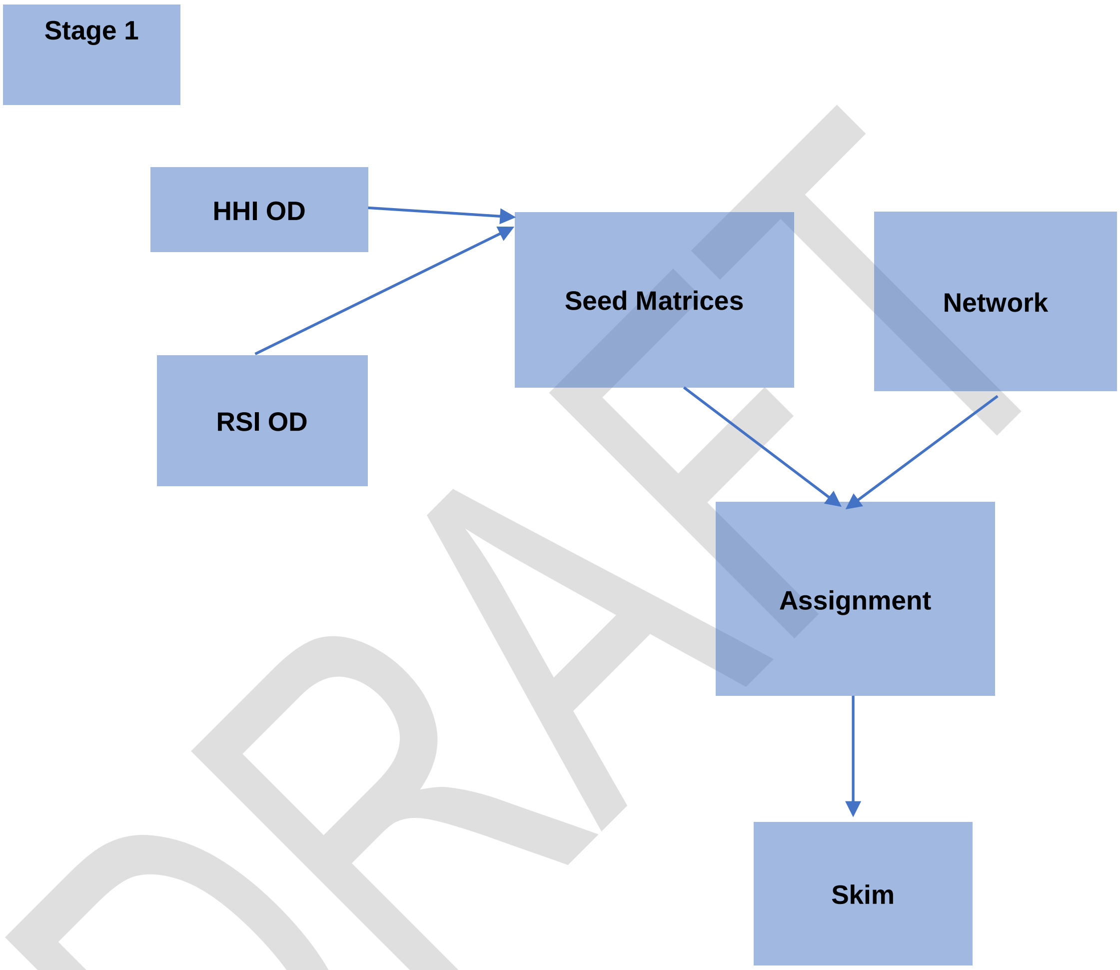


Figure 4-38: Highway Assignment

These matrices have been validated across screen lines to prove that they are reflecting ground conditions and are called as the observed matrices as they are balanced to observed data. The mode wise matrices were developed for morning peak hour. From the primary surveys it has been observed that the morning peak is during 9:00 AM to 10:00 AM. The model was built for the morning peak as this represents the journey to work period which is the most suitable time to build the transportation model for planning purposes These are to be used in the next stage to calibrate fresh model functions.

4.4.6 VALIDATION AND CALIBRATION OF BASE YEAR TRANSPORT NETWORK AND MATRICES

4.4.6.1 ASSIGNMENT

The process of allocating OD matrices to the network is called Assignment. This is carried out in two parts in the software. The first is the Highway Assignment which assigns traffic in terms of passenger car units (PCU) through a multiuser class, capacity restrained equilibrium assignment. First truck traffic and NMT are assigned (preloads) and Bus traffic data from bus route data is attached as fixed flows and then the PCU matrices are loaded.

The second part is the public transport assignment which assigns Trips (People not PCU'S) to the public Transport network (Buses/ Metro's etc).

The assignment includes multi path and crowd modelling features. These features in the modelling software have proved to provide much more accurate results in congested networks as the capacity of each of the public transport system is also defined. The crowd model simply deters people from getting into overcrowded public transport systems.

Fare Structure Adopted

Table 4-17 Public Transport Fare Structure Considered

PUBLIC TRANSPORT FARE STRUCTURE ADOPTED IN THE MODEL							
Cost Per Km (Paisa)		**103**	**100**	**108**	**105**	**175**	**100**
Minimum Fare (Rs)		**12**	**10**	**22**	**15**	**26**	**10**
Minimum Km (Km)		**2.5**	**2.5**	**10**	**5**	**5**	**2.5**
SERVICE TYPE		CITY FAST	ORDINARY/ MOFUSSIL SERVICES INCLUDING CITY/ TOWN/ CITY CIRCULAR/ CITY SHUTTLE/ JNNURM NON-AC SERVICES	SUPER-FAST SERVICES	FAST PASSENGER/ LIMITED STOP FAST PASSENGER SERVICES	LOW FLOOR AIR CONDITIONED (JNNURM A/C SERVICES)	PRIVATE BUS
Stage	Distance (Km)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)
1	2.5	12	10	22	15	26	10
2	5	15	13	22	15	26	13
4	10	20	18	22	21	36	18
6	15	25	23	28	26	44	23
8	20	31	28	33	31	54	28
10	25	36	33	39	36	62	33
12	30	41	38	44	42	70	38
14	35	46	43	49	47	80	43
16	40	51	48	55	52	88	48
18	45	56	53	60	57	96	
20	50	61	58	66	63	106	
22	55	67	63	71	68	114	
24	60	72	68	76	73	124	
26	65	77	73	82	78	132	

PUBLIC TRANSPORT FARE STRUCTURE ADOPTED IN THE MODEL							
Cost Per Km (Paisa)		**103**	**100**	**108**	**105**	**175**	**100**
Minimum Fare (Rs)		**12**	**10**	**22**	**15**	**26**	**10**
Minimum Km (Km)		**2.5**	**2.5**	**10**	**5**	**5**	**2.5**
SERVICE TYPE		CITY FAST	ORDINARY/ MOFUSSIL SERVICES INCLUDING CITY/ TOWN/ CITY CIRCULAR/ CITY SHUTTLE/ JNNURM NON-AC SERVICES	SUPER-FAST SERVICES	FAST PASSENGER/ LIMITED STOP FAST PASSENGER SERVICES	LOW FLOOR AIR CONDITIONED (JNNURM A/C SERVICES)	PRIVATE BUS
Stage	Distance (Km)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)	Fare (INR)
28	70	82	78	87	84	140	
30	75	87	83	93	89	150	
32	80	92	88	98	94	158	
34	85	97	93	103	99	166	
36	90	103	98	109	105	176	
38	95	108	103	114	110	184	
40	100	113	108	120	115	194	
42	105	118	113	125	120	202	
44	110	123	118	130	126	210	
46	115	128	123	136	131	220	
48	120	134	128	141	136	228	
50	125	139	133	147	141	236	
52	130	144	138	152	147	246	
54	135	149	143	157	152	254	
56	140	154	148	163	157	264	
58	145	159	153	168	162	272	
60	150	164	158	174	168	280	
62	155	170	163	179	173	290	
64	160	175	168	184	178	298	
66	165	180	173	190	183	306	
68	170	185	178	195	189	316	
70	175	190	183	201	194	324	
72	180	195	188	206	199	334	
74	185	200	193	211	204	342	
76	190	206	198	217	210	350	
78	195	211	203	222	215	360	
80	200	216	208	228	220	368	
120	300	319	308	336	325	544	
160	400	422	408	444	430	718	
200	500	525	508	552	535	894	

4.4.7 TRIP GENERATION

Trip generation is the first stage of the travel demand estimation process. Trip Generation modelling aims at predicting the total number of trips generated by and attracted to each internal zone of the study area. Thus, the two components of trip generation modelling are:

Trip Production: This is defined as the home end of a home-based trip. It thus gives the total trips produced by a zone.

Trip Attraction: This is defined as the non- home end of a home- based trip or as the destination of a non- home-based trip. It thus, gives the total trips attracted to a zone.

The factors that typically affect Trip Generation can be categorized into following categories:

- Land Use Factors: Population, Indicators of Intensity of Residential Activity, Intensity of Employment Opportunities, Land Values etc.
- Household Factors: Household Income, Vehicle Ownership, Family Size, Family Structure etc.
- Urbanization Factors: Degree of Urbanization, Distance from CBD, Accessibility etc.

Trip Generation equations

Two types of trip generation analysis normally are carried out which are referred to as Trip Production and Trip Attraction. Trip Production/Attraction are derived from the relationship between dependent and independent variables.

The general form of the work trip production equation developed is

$$Ti = a + b^*(IVi)$$

Where, Ti = Trips produced from zone i or attracted to zone j

a = constant (unexplained part of the relationship)

b = parameter explaining the dependency on the independent variable & representing the Trip Rate

IVi = Independent Variable in zone i,

The general form of the trip attraction equation developed is

$$Tj = a + b^*(IVj)$$

Where, Tj = Trips attracted to zone j

a = constant (unexplained part of the relationship)

b = parameter explaining the dependency on the independent variable

IVi = Independent Variable in zone j.

For the preparation of model

The independent variables selected should not have co-linearity and should be capable of interpretability and be measurable. The independent variables should be capable of explaining the variability of dependent variable. The relation or the equation should satisfy the statistical requirements for its goodness of fit and the coefficient should have logical sign for acceptability.

Trip Generation outputs

The linear regression analysis was used to develop the trip production and trip attraction equations. A zonal regression model was used in which each traffic zone is treated as one observation. The aggregated analysis has been applied for developing the model which is based on the assumption that contiguous households exhibit a certain amount of similarity in travel characteristics. This assumption allows the data in a zone to be grouped and the mean value of the independent variable used in further calculations. With the available data, the dependent and independent variables considered are shown below

Table 4-18 : Dependent and independent variables

Independent Variables	Dependent Variable
Population	Production
Employment	Attraction

The trip generation equation for study area population and trip production are found statistically significant as shown in table below.

Table 4-19 : Production equation estimation results for peak hour

	Coefficients	*p-value*
Population	0.1954	7.1E-14

The co-relation between dependent and independent variables considered is observed to be 0.9009 (R^2). The linear regression model between population and production trips is shown in figure below.

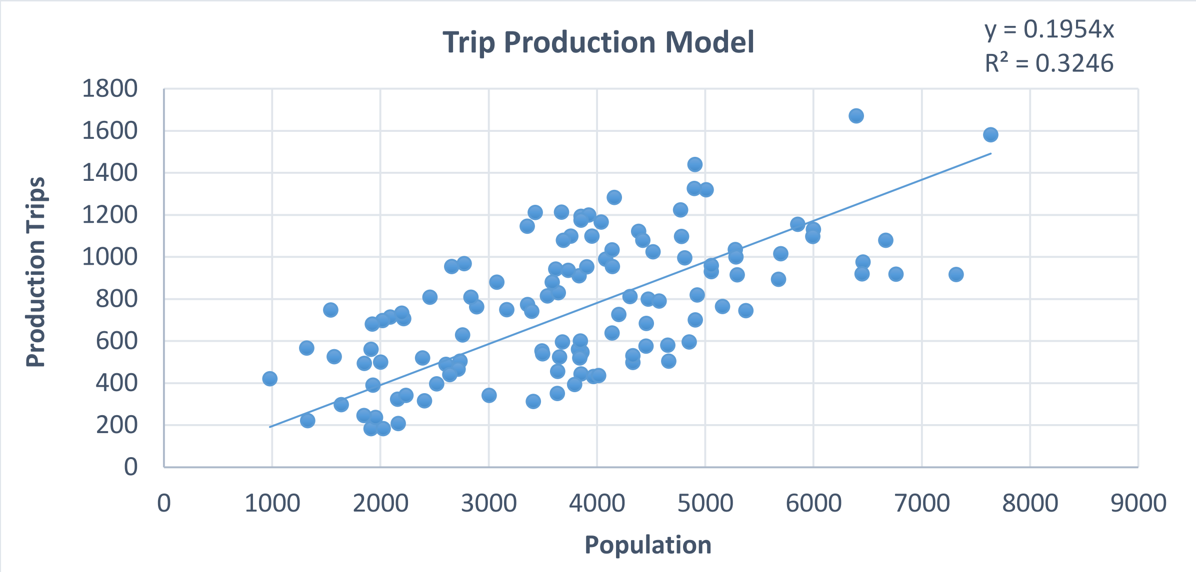


Figure 4-39 Trip Production Model for peak hour

Trip Production = 0.1954 Population*

The trip generation equation for study area with employment and trip attraction are found statistically significant as shown in table below.

Table 4-20 : Attraction equation estimation results for peak hour

	Coefficients	***P-value***
Employment	0.2878	1.65E-.6

The co-relation between dependent and independent variables considered is observed to be 0.7701 (R^2). The linear regression model between employment and attraction is shown in figure below.

Trip Attraction = 0.2878 employment*

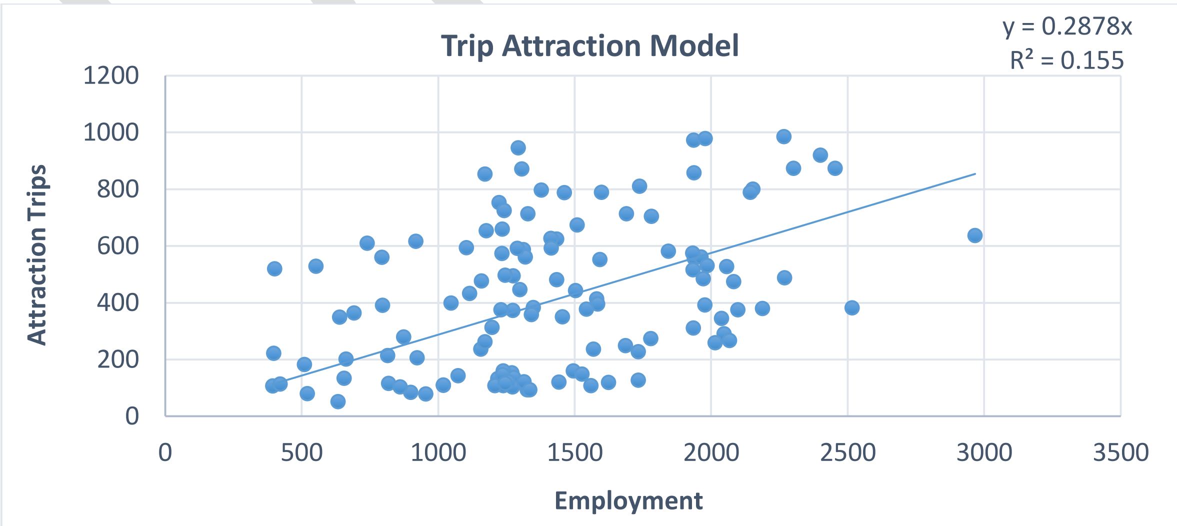


Figure 4-40 Trip Attraction Model for peak hour

Table below provides summary of the estimated results.

Table 4-21 : Summary of estimated results

Variable	Values for Year 2023 (Peak hour)
Total Production	2,00,689
Total Attraction	2,00,689

The above given table provide the estimated trip ends for the base year.

4.4.8 TRIP DISTRIBUTION MODEL FOR INTRA-CITY TRIPS

After determining the trip productions (T_i) and trip attraction (T_j), the next stage is to link the productions with attractions in order to quantify how the trips are produced in a zone and are distributed among or attracted to all other zones (T_{ij}). In trip distribution stage, the demand matrices for each purpose are generated by considering the base sample matrix which is derived from the house hold survey data. In the present study travel distance impedance matrices have been generated for study area. The trip distribution stage comprises of the following steps:

a) Calculation of travel impedance matrices
b) Generation of OD matrix

There are number of methods which explains and predicts the distribution of trips. These are:

- Gravity Models
- Growth Factor Models
- Opportunity Models
- Stochastic Behavioural Models

Of the above four types of models developed for trip distribution stage of Travel Demand Modelling, Gravity model has been used for the present study due to data availability and its better applicability in the future. The Gravity Model is a heuristically derived expression for synthesizing trip interchanges. The basic premises of Gravity Model is trip magnitude between two zones i and j is directly proportional to the number of trips produced in zone i.e., number of trips attracted to zone j, and inversely proportional to some function of the spatial separation of the two zones.

The basic philosophy is to relate productions and attractions of different zones with quantum of trip modelling between individual zone pairs.

$$T_{ij}=R_iC_j\,P_i\,A_j\,f\,(\,W_{ij}\,)$$

Where, Tij= Trips between zonal pairs i and j

Pi=Trip Production at zone i = ∑i Tij

Aj= Trip Attractions at zone j = ∑j Tij

f (Wij) = A function that separates zonal pairs i and j typically known as Friction Factor

Ri and Cj = Constants of proportionality

For this study the Gravity models has been used of the production constrained type. **Production Constrained Gravity Model** is of the form

Tij= {Pi Aj f (Wij)} / {Aj f (Wij)}

This ensures that when summed across the rows of the model T_{ij} matrix, the individual zone trip origin totals equal the corresponding observed trip totals.

Determination of each of the constants in the distribution model is termed as calibration. To estimate the calibration parameters of the gravity model, purpose wise Trip Length Frequency Distribution (TLFD) are extracted from OD matrix's generated from the House hold Survey. The Calibration process includes comparison of observed and modelled mean trip lengths as well as shapes of the trip length frequency distribution curves. Figures below shows the comparison between TLFD of work, education and other trips as observed and modelled. The calibrated parameter for the logit function in gravity equation are outlined in table below

Table 4-22: Calibrated Paratmerters for Gravity Equation

Peak Hour trips	Calibrated Parameter (c)
	-0.24096

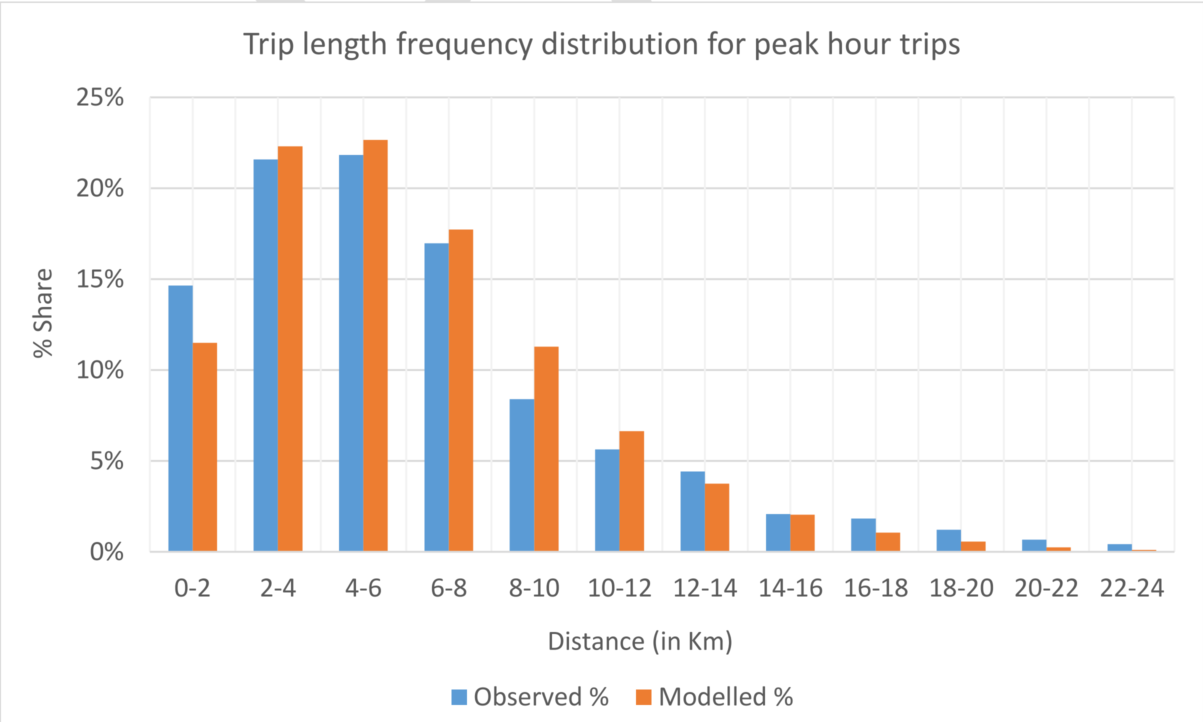


Figure 4-41: Trip Length Frequency Distribution for peak hour trips

Table below shows values of observed and modelled trip length frequency distribution for all trips

Table 4-23: Observed and modelled trip length frequency distribution for peak hour trips

Distance (in Km)	Observed %	Modelled %
0-2	15%	11%
2-4	22%	22%
4-6	22%	23%
6-8	17%	18%
8-10	8%	11%
10-12	6%	7%
12-14	4%	4%
14-16	2%	2%
16-18	2%	1%
18-20	1%	1%
20-22	1%	0%
22-24	0%	0%

To understand the spatial and temporal distribution of zone-to-zone trips desire line diagram in terms of trips has been plotted for each mode. This desire line diagram is the graphical representation of the all origin- destination pairs on the background of the road network including the zone centroids. Below figure shows the desire line diagram for top 500 OD pairs.

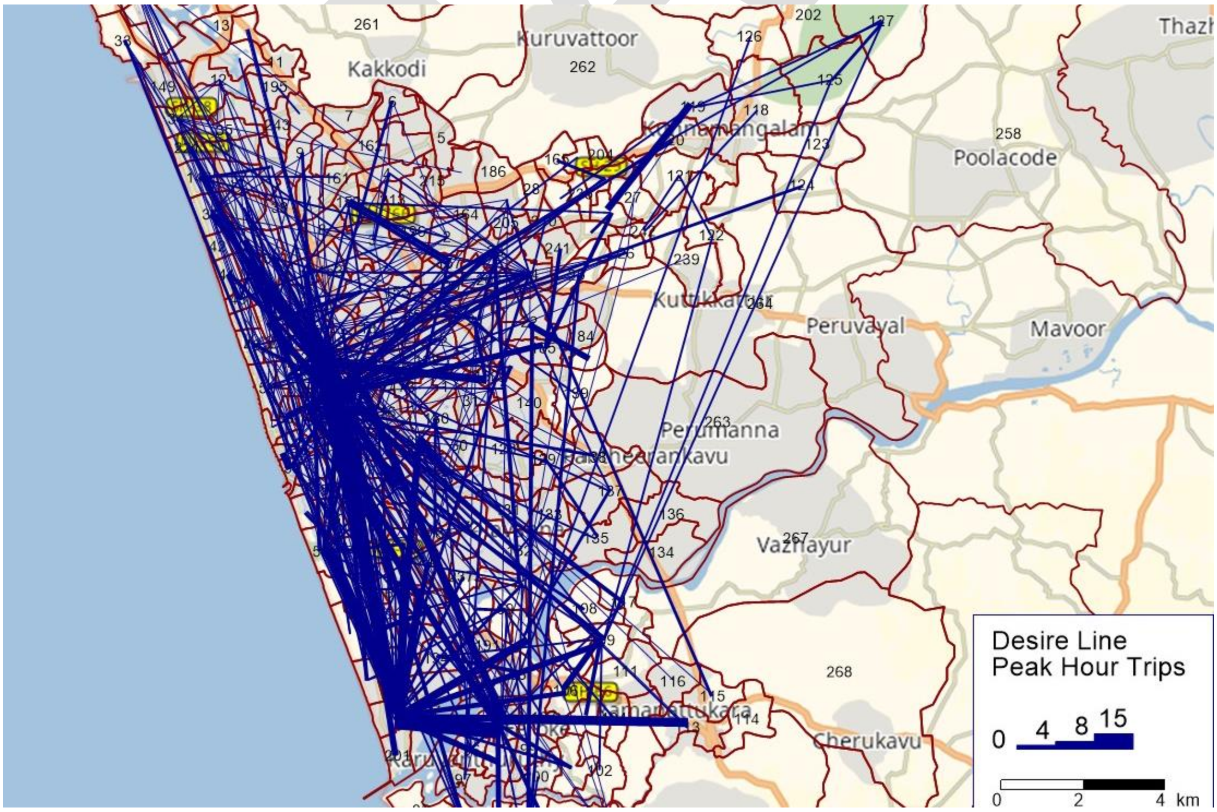


Figure 4-42: Desire Travel Pattern for peak hour trips (top 500 pairs)

4.4.9 MODE CHOICE MODEL FOR INTRA-CITY TRIPS

A multinomial mode choice model of the following form had been developed in order to split the trips among the modes, car, two-wheeler, auto, public transport, cycle and walk. For each mode *m* the utility is calculated as a linear combination of the impedance parameters.

$$U_{ijm} = \sum_{g} \beta_g c_{ijmg}$$

Cijmg - The impedance of the cost type *g* for the trip from zone *i* to zone *j* by mode *m*.

Probability calculation for the Logit model is as given below.

$$P_{ijm} = \frac{e^{c \cdot U_{ijm}}}{\sum_k e^{c \cdot U_{ijk}}}$$

$$T_{ijm} = P_{ijm} T_{ij}$$

whereby T_{ij} is the total number of trips of the demand stratum in the relation *i-j*, T_{ijm} is the number of trips made by mode *m* and *c* is a procedure parameter.

The cost skims that are obtained in the assignment are used to calibrate the mode choice model. From the home interview survey data, a choice-based sample is produced containing information on the mode chosen, travel time and travel cost for each individual. Table below provides the model results of the MNL model for all purpose trips. The coefficients for both cost and time are negative indicating negative impact on utility.

Table 4-24 Model Choice Estimation Result for peak hour trips

	Mode share Results	
	Coefficient	**p - value**
Total Time – T	-0.03661	.0794
Cost - c	-0.00249	.6228
Constants		
Car	-0.77013105	0.0000
Two-wheeler	0.65783122	0.0000
IPT	-0.55711256	0.0001
	Reference mode is Bus	

Table below provides the comparison between the observed and modelled modal shares for the city purpose wise. It is observed that modelled modal shares closely match the observed data.

Table 4-25: Model Choice Observed and Modelled (peak hour)

Mode	% Trips Observed	% Trips Modelled
Two-Wheeler	52.0%	51.6%
Car	11.8%	12.0%
IPT	14.2%	14.6%
Bus	22.0%	21.7%

Figures below illustrates desire line graph for private vehicle (top 500 trips).

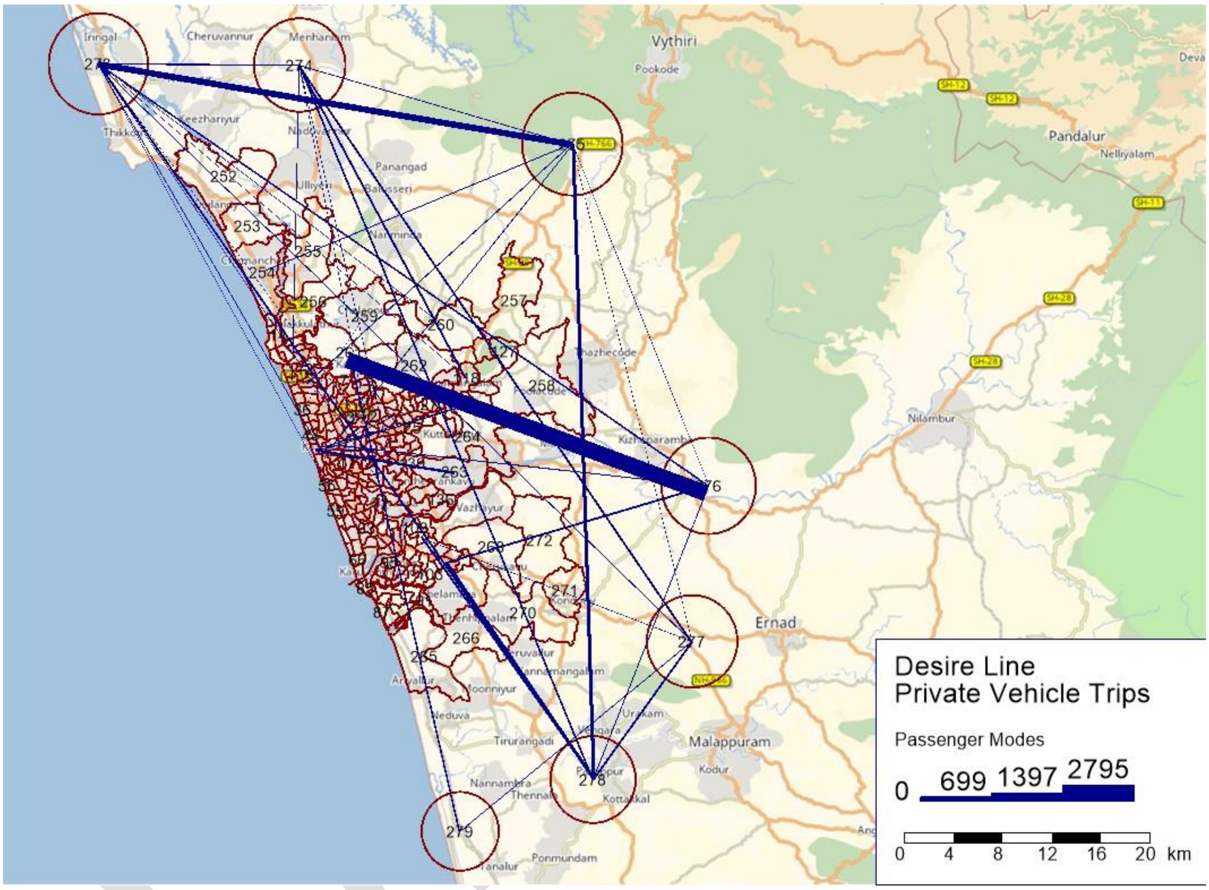


Figure 4-43: Desire Travel Pattern for private vehicle trips – Peak Hour (top 500 pairs)

4.4.10 TRIP ASSIGNMENT

Trip assignment is the stage in the transport planning process wherein the trip interchanges are allocated to different parts of the network forming the transport system. In this stage the route to be travelled is determined and the inter-zonal flows are assigned to the selected routes. All assignment techniques are based on route selection. The choice of the route is made on the basis of number of criteria such as journey time, length, cost comfort, convenience, and safety.

The purposes of trip assignment are:

- To assess the deficiencies of the existing transportation system by assigning distributing trips to the existing system.

- To evaluate the effects of improvements and extensions to the existing transportation system by assigning estimated trips to the network which included these improvements.
- To develop system development priorities by assigning estimated future trips for intermediate years to the transportation system proposed for these years
- To test alternative transportation system proposals by systematic and readily acceptable procedures.
- To provide design hours' volumes and turning movements.

The road network is assigned the road capacity based on the available lane widths as per IRC 106-1990.

From the OD survey conducted at cordon points, the matrices for the external trips are added to the internal trip matrices estimated from four stage modelling process. These matrices have used for assignment

Model validation was undertaken by comparing the observed data collected from the traffic volume count surveys with their equivalent synthesized results.

After assignment of each mode matrix, the network speeds are updated based on the volume-delay functions. After assigning of all modes on to the network, the assigned traffic streams will be compared with those observed on ground along the screen lines. The model will be Validated based on the GEH parameter. The GEH Statistic is a formula used in traffic modelling to compare two sets of traffic volumes. It is an empirical formula that has proven useful for a variety of traffic analysis purposes.

$$GEH = \sqrt{2 * (M - O)^2 / (M + O)}$$

Where,

M - Modelled Volume

O - Observed Volume

Using the GEH Statistic avoids some pitfalls that occur when using simple percentages to compare two sets of volumes. This is because the traffic volumes in real- world transportation systems vary over a wide range. For traffic modelling work in the "baseline" scenario, for 85% of the values a GEH of less than 10.0 is considered a good match between the modelled and observed flows.

Table below represents the observed and modelled volume count at screen line and OC locations along with GEH values.

Table 4-26: Observed and modelled volume count at screen line and OC locations (Passenger vehicles – Peak Hour)

Location	Direction	Two-Wheeler			Car			IPT			Bus		
		Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
OC_1	Inbound	665	674	0	170	194	2	88	120	3	39	2	8
OC_1	Outbound	2160	1551	14	318	360	2	176	105	6	44	45	0
OC_2	Inbound	578	531	2	307	275	2	36	25	2	28	15	3
OC_2	Outbound	430	507	4	244	306	4	32	37	1	34	34	0
OC_3	Inbound	1198	1398	6	142	157	1	66	60	1	29	28	0
OC_3	Outbound	638	621	1	92	68	3	39	31	1	27	30	1
OC_4	Inbound	425	486	3	148	131	1	41	41	0	33	34	0
OC_4	Outbound	1270	1268	0	284	276	0	66	63	0	36	48	2
OC_5	Inbound	1097	1067	1	544	474	3	146	133	1	51	52	0
OC_5	Outbound	797	795	0	290	469	9	104	90	1	47	48	0
OC_6	Inbound	760	731	1	449	491	2	116	102	1	59	61	0
OC_6	Outbound	1155	1158	0	591	322	13	142	119	2	49	53	1
SL_1	East Bound	466	471	0	167	167	0	96	75	2	92	92	0
SL_1	West Bound	1704	1584	3	461	346	6	104	52	6	90	67	3
SL_2	North Bound	1438	2007	14	148	372	14	208	413	12	72	142	7
SL_2	South Bound	3589	3624	1	301	285	1	318	304	1	71	49	3
SL_3	North Bound	2930	2257	13	434	300	7	180	63	11	62	0	11
SL_3	South Bound	1347	1326	1	256	266	1	144	132	1	59	3	10
SL_4	East Bound	919	935	1	82	95	1	92	97	0	34	50	2
SL_4	West Bound	1756	1891	3	132	144	1	124	136	1	32	17	3
SL_5	North Bound	193	250	4	3	47	9	4	15	4	0	45	9
SL_5	South Bound	50	87	4	1	9	4	2	16	5	0	56	11

Location	Direction	Two-Wheeler			Car			IPT			Bus		
		Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
SL_6	North Bound	1292	1463	5	370	393	1	129	204	6	62	94	4
SL_6	South Bound	909	876	1	234	228	0	74	76	0	51	25	4
SL_7	East Bound	796	693	4	197	127	5	291	293	0	19	0	6
SL_7	West Bound	1496	1128	10	307	174	9	445	151	17	16	0	6
SL_8	North Bound	1419	1399	1	652	683	1	110	121	1	23	13	2
SL_8	South Bound	973	1095	4	452	519	3	71	128	6	36	61	4

Table 4-27: Observed and modelled volume count at screen line and OC locations (Goods vehicles – Peak hour)

Location	Direction	LCV and Goods Auto			2 axle and 3 Axle Trucks			MAV		
		Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
OC_1	Inbound	55	70	2	2	1	1	1	0	1
OC_1	Outbound	69	42	4	0	0		3	3	0
OC_2	Inbound	48	42	1	6	2	2	1	1	0
OC_2	Outbound	56	68	2	12	9	1	0	7	4
OC_3	Inbound	58	52	1	1	2	1	2	0	2
OC_3	Outbound	51	0	10	3	0	2	2	2	0
OC_4	Inbound	37	23	2	0	0		1	0	1
OC_4	Outbound	46	48	0	2	2	0	1	0	1
OC_5	Inbound	113	113	0	17	5	3	4	6	1
OC_5	Outbound	140	140	0	15	11	1	4	6	1
OC_6	Inbound	97	110	1	23	9	4	2	3	1
OC_6	Outbound	132	132	0	11	10	0	3	4	1
SL_1	East Bound	22	20	0	4	4	0	0	1	2
SL_1	West Bound	32	0	8	0	0		1	0	1
SL_2	North Bound	86	100	1	15	12	1	0	5	3
SL_2	South Bound	134	126	1	30	0	8	2	0	2
SL_3	North Bound	90	46	5	10	0	4	2	0	2
SL_3	South Bound	82	33	6	2	0	2	2	0	2

Location	Direction	LCV and Goods Auto			2 axle and 3 Axle Trucks			MAV		
		Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
SL_4	East Bound	79	112	3	2	0	2	0	5	3
SL_4	West Bound	83	84	0	0	0	1	0	0	
SL_5	North Bound	2	0	2	0	0		0	0	
SL_5	South Bound	1	0	1	0	0		0	0	
SL_6	North Bound	88	86	0	25	0	7	2	0	2
SL_6	South Bound	97	80	2	21	14	2	3	0	2
SL_7	East Bound	26	25	0	1	0	1	0	0	
SL_7	West Bound	49	0	10	0	0		1	0	1
SL_8	North Bound	115	163	4	9	14	2	17	9	2
SL_8	South Bound	111	145	3	23	11	3	16	10	2

Table below indicates the percentage of count locations with the acceptable GEH ranges.

Table 4-28: Synthetics Validation of Base Year Network

GEH Range	Two-Wheeler	Car	IPT	Bus	Goods Auto, LCV	2 Axle, 3 Axle	MAV
< 10	86%	93%	89%	89%	93%	100%	100%
>10	14%	7%	11%	11%	7%	0%	0%

Overall, nearly 85% of the counts are within GEH value of 10 indicated a good model fit. Traffic assignment has been done for all the modes for the base year. The figures below show the traffic assignment for all trips including private vehicle trips and public transport trips.

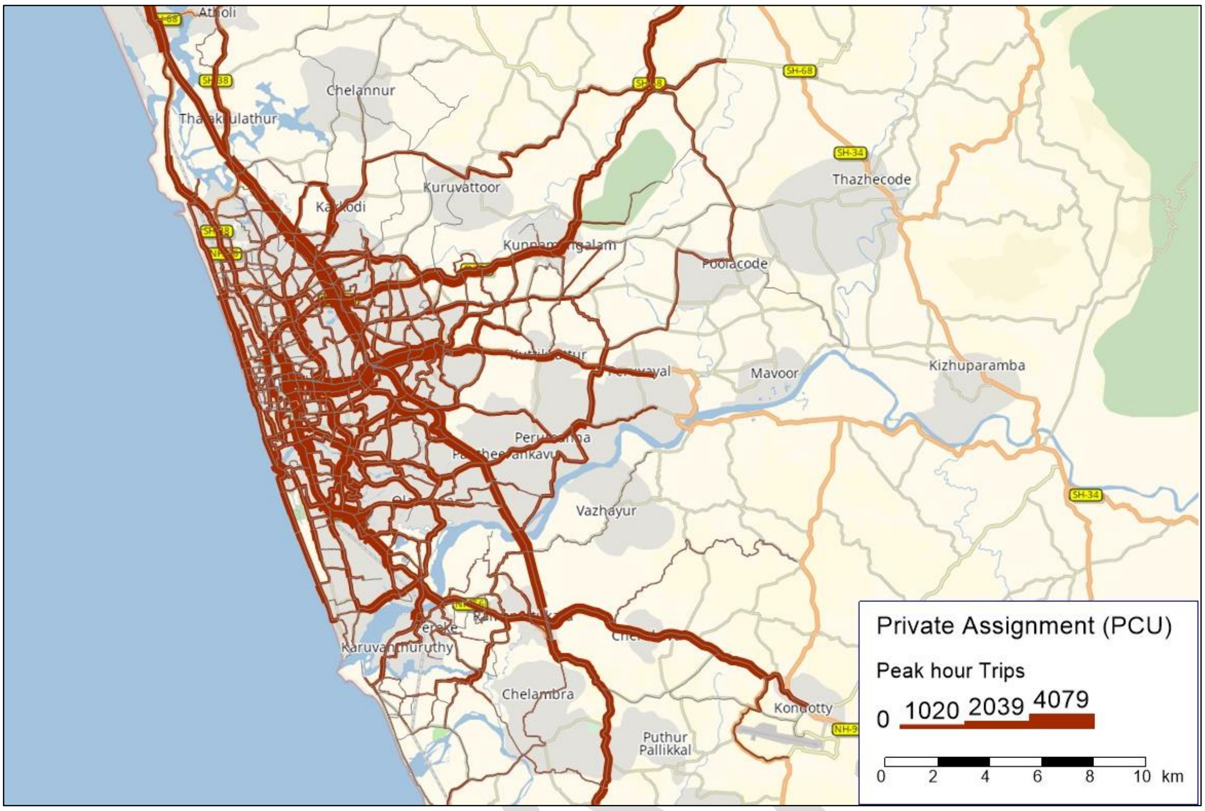


Figure 4-44: Private Traffic Assignment (Peak hour)

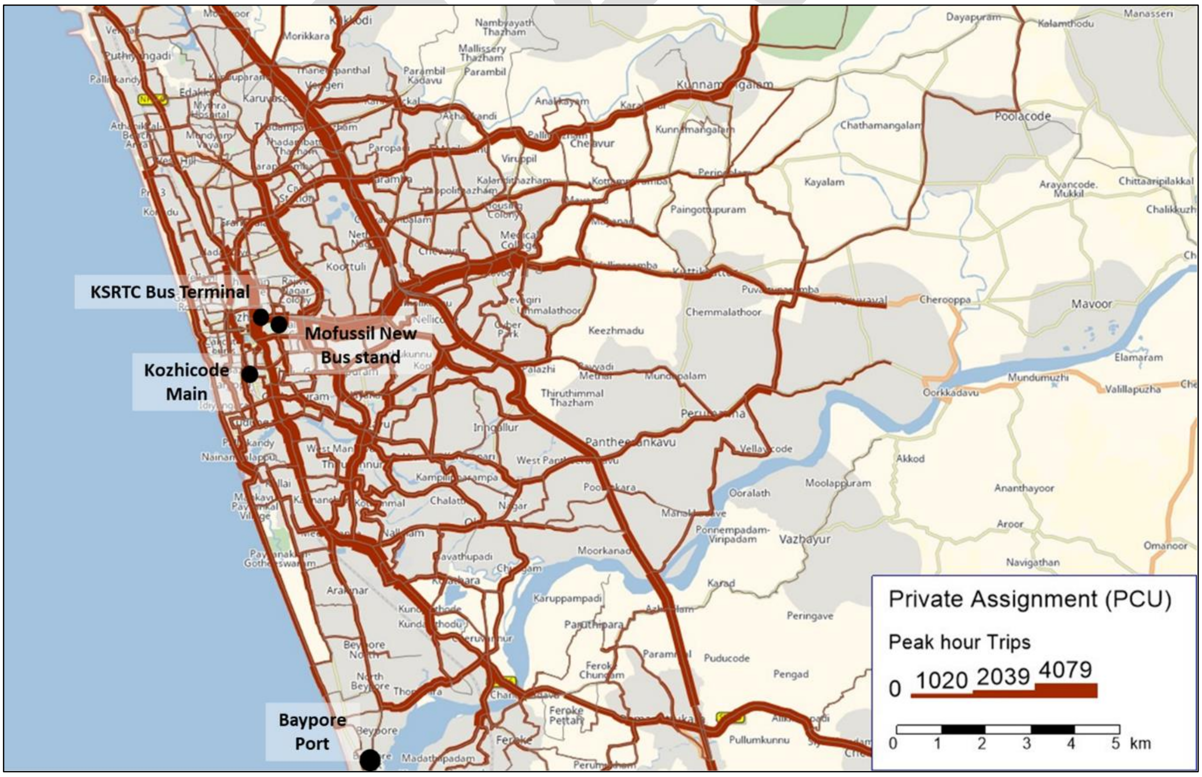


Figure 4-45: Private Traffic Assignment (Peak Hour)

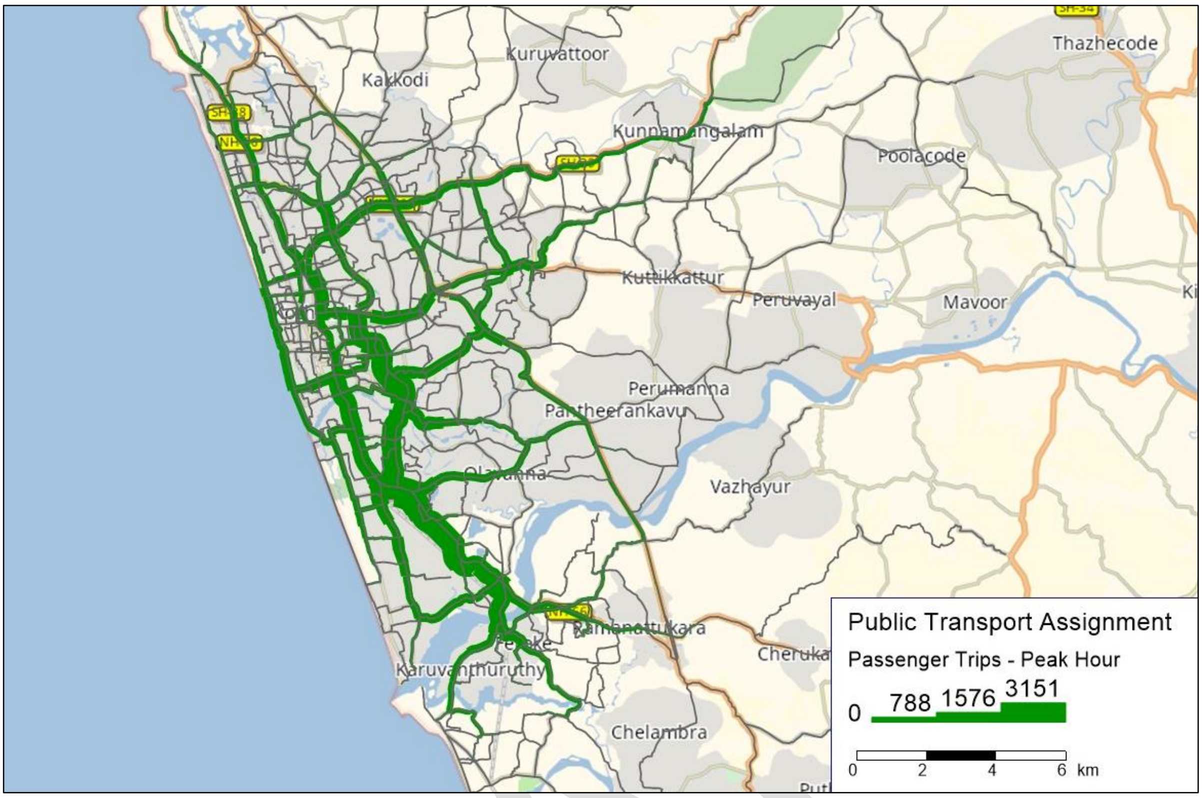


Figure 4-46: Public Transport Assignment (Peak Hour)

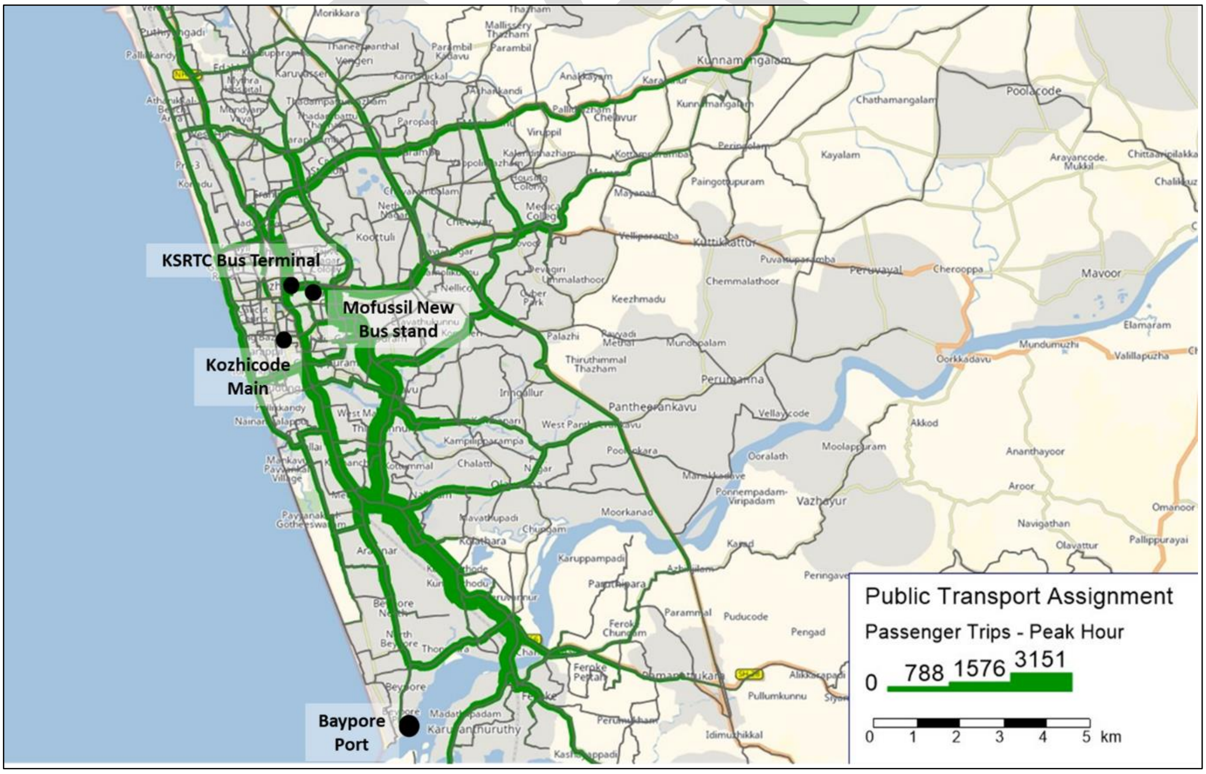


Figure 4-47: Public Transport Assignment (Peak Hour)

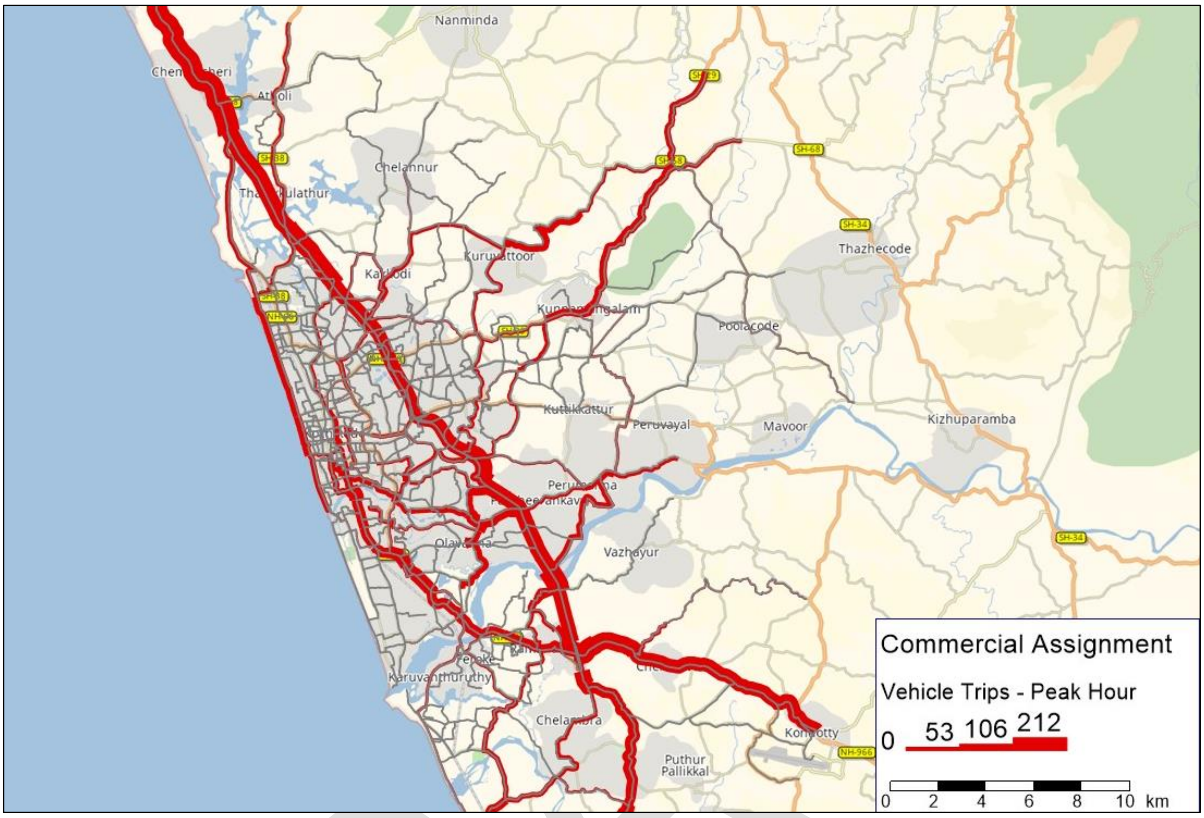


Figure 4-48: Commercial Vehicle Assignment (Peak Hour)

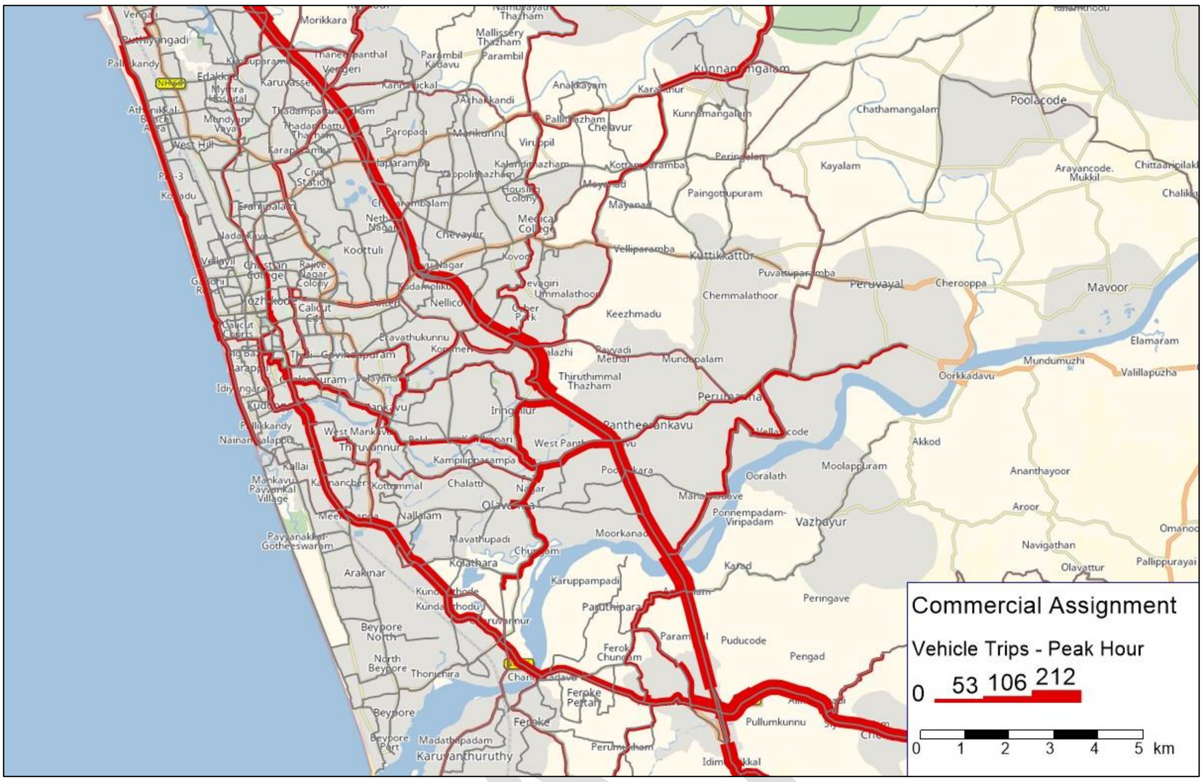


Figure 4-49: Commercial Vehicle Assignment (Peak Hour)

Figures below shows the volume by capacity ratio map for the base year assignment.

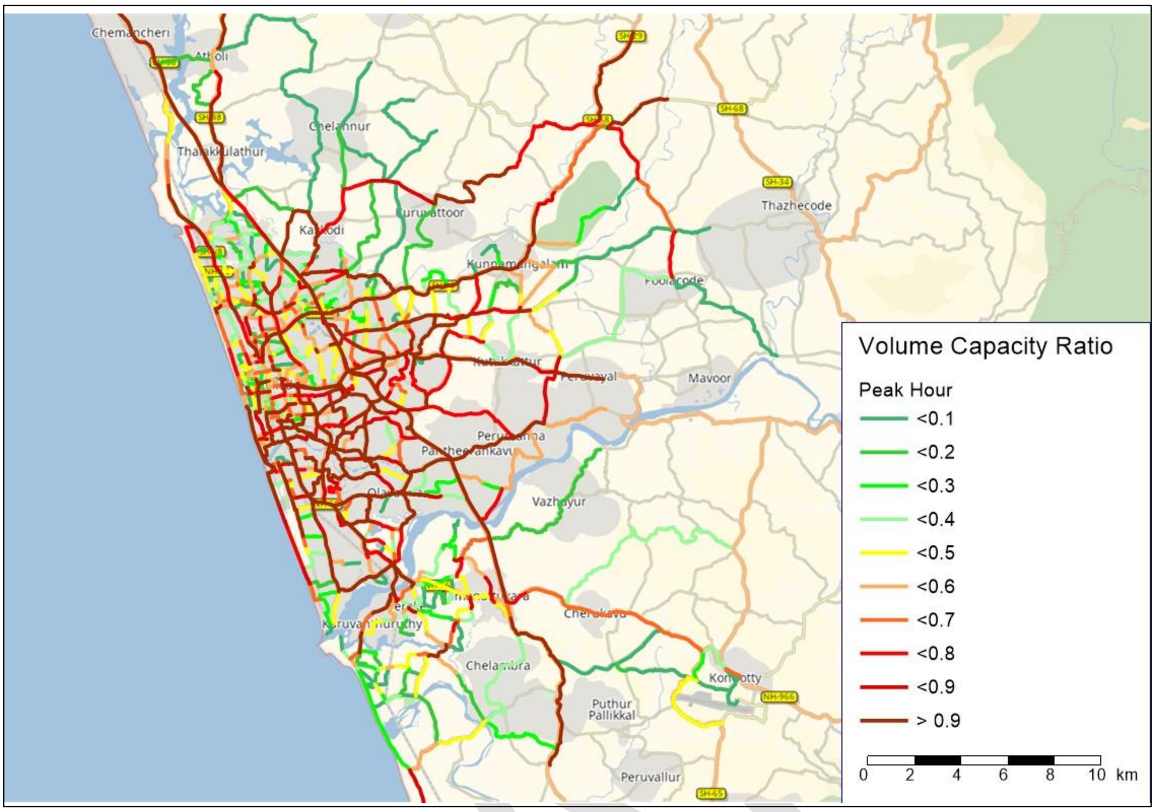


Figure 4-50: V/C ratio base year (Peak Hour)

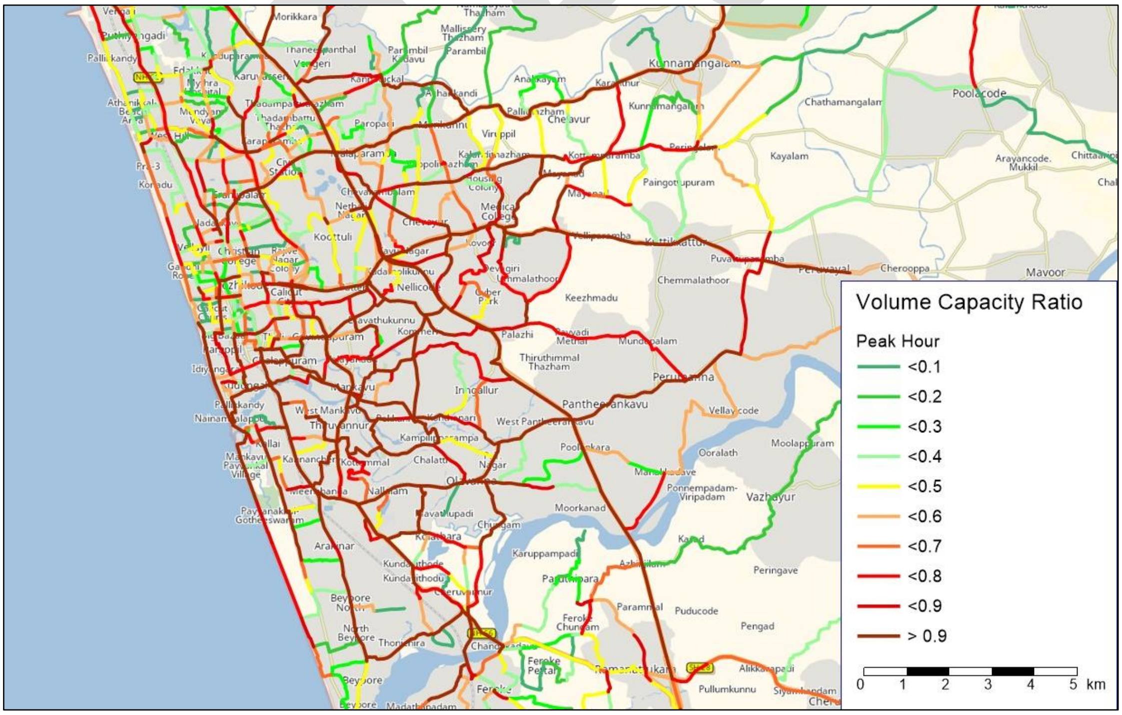


Figure 4-51: V/C ratio base year (Peak Hour)

4.5 TRAVEL CONDITION ASSESSMENT INDICATORS

The below mentioned indicators derived from the CMP Toolkit, 2014 by MoHUA will be used for assessing the travel conditions in the study area. The data extracted from the primary surveys and the outputs of travel demand model are presented against the indicators as presented in the Table below.

Table 4-29 Travel Condition Assessment Indicators

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR
i) Mobility and Accessibility			
1	**Passenger Modal Share (%)-Motorized Modes**		
	Private Modes	% of trips made by private motorized modes (two-wheelers, car)	60%
	Public Modes	% of trips made by public transport modes	25%
	IPT Modes	% of trips made by intermediate public transport modes (auto-rickshaws, shared auto-rickshaws)	15%
2	**Trip Length (Km)**		
	Trip Length (Pvt. Modes)	Average Trip Length of the Two-wheeler, Car and Auto users in the study area	5.9
	Trip Length (PT Modes)	Average Trip Length of the Public Transport users in the study area	6.13
ii) Infrastructure and Land use			
1	**Infrastructure Quality**		
1.1	**Average Speed (Kmph) (All Modes)**	**Average speed of all modes**	**22.5**
	Average Speed (Kmph) (Pvt.)	Average speed of private modes	20.2
	Average Speed (Kmph) (PT)	Average speed of public transport modes	17.2
2	**Land use parameters**		
2.1	**Land use mix intensity**		
	Land use mix intensity	Job and housing balance (employment / residing population)	0.4
iii) Safety			
1	**Safety**		

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR
1.1	Quality of footpath infrastructure	% of roads with more than 2m footpath	2.0%
iv) Environmental Impacts			
1	**Emissions**		
1.1	Local Emissions (Tonnes/day)		1.85
1.2	GHG Emissions (micro grams per day)		113.16
2	**Depletion of land resource**		
2.1	Consumption of land for transport activity	Percentage of total land used in transport for different type of transport infrastructure – road, parking bus lanes, railways, etc.	4%
iv) Technology			
1	**Vehicle Fuel Technology**		
1.1	Vehicle Fuel Technology	Percent of public transport fleet in compliance with Indian emissions standards	40%

5. SERVICE LEVEL BENCHMARKING

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited


coxswain

5 SERVICE LEVEL BENCHMARKING

Benchmarking helps to establish baseline measures of performance, and helps monitor the agency's individual performance over time, and also how it compares with the other organizations, and also improving performance by sharing of lessons learnt from different entities. The service level benchmarks (SLB) issued by MoHUA specify parameters to measure the effectiveness of existing land use-transport planning in the study area and set benchmarks for achieving the same.

In Service Level Benchmark, four levels of Service (LoS) have typically been specified. They are LOS1, LOS2, LOS3 and LOS4. The LOS1 represents the highest performance level whereas LOS4 represents the Lowest.

5.1.1 PUBLIC TRANSPORT FACILITIES

This benchmark indicates the city-wide level of services provided by public transport systems during peak hours.

Table 5-1 Level of Service for PT Facilities

LOS	PRESENCE OF ORGANIZED PUBLIC TRANSPORT SYSTEM IN URBAN AREA (%)	EXTENT OF SUPPLY/ AVAILABILITY OF PUBLIC TRANSPORT	SERVICE COVERAGE OF PUBLIC TRANSPORT IN THE CITY	AVG WAITING TIME FOR PUBLIC TRANSPORT USERS	LEVEL OF COMFORT IN PUBLIC TRANSPORT	% OF FLEET AS PER URBAN BUS SPECIFICATION
1	>= 60	>= 0.6	>= 1	<= 4	<= 1.5	75 – 100
2	40-60	0.4-0.6	0.7- 1	4—6	1.5 - 2	50 – 75
3	20-40	0.2-0.4	0.3 - 0.7	6—10	2 - 2.5	25 – 50
4	<20	<0.2	< 0.3	> 10	> 2.5	< 25
Indicator LoS	**1**	**3**	**3**	**3**	**1**	**2**
LOS VALUE:12 (LOS -2)						
OVERALL: LOS1 <12, LOS2: 12-16, LOS3:17-20, LOS4 21-24						

Based on the above indicators, the overall score of the benchmark computes to 12 with LOS for the parameter "Public Transport Facilities" being 2. Thus, indicating a reasonably good city bus services which can be further improved.

Though the overall level of service is 2, the city bus system in the study area needs immediate intervention in the extent of supply of public transport, service coverage and average waiting time, which define the reliability and efficiency of the system,

5.1.2 PEDESTRIAN INFRASTRUCTURE FACILITIES

This benchmark indicates the percentage of road length along arterial and major road network, Public Transport corridors, and intersections, having adequate pedestrian facilities.

Table 5-2 Pedestrian Infrastructure Facilities

LEVEL OF SERVICE (LOS)	SIGNALIZED INTERSECTION DELAY (%)	STREET LIGHTING (LUX)	% OF CITY COVERED
1	<25	> = 8	> = 75
2	25 – 50	06-Aug	50 - 75
3	50 – 75	04-Jun	25 - 50
4	> = 75	< 4	<25
Indicator LoS	1	1	4
LOS VALUE : 6 (LOS:2)			
OVERALL - LOS1: 3-5, LOS2: 6-8, LOS3: 9-10, LOS4 11-12			

Based on the above indicators, the overall score of the Benchmark for pedestrian infrastructure facilities computes to 6 with a level of service of 2. Thus, indicating that the city lacks adequate Pedestrian facilities and requires major improvements/investments in this category.

5.1.3 NON-MOTORISED TRANSPORT (NMT) FACILITIES

This benchmark indicates the percentage of dedicated cycle track/lane along the arterial and major road network, and public transport corridors, with a minimum of 2.5 m width. It is characterized by continuous length, encroachment on NMT lanes, and parking facilities.

Table 5-3 Non-Motorised Transport Facilities

LOS	% OF NETWORK COVERED	ENCROACHMENT ON NMT ROADS BY VEHICLE PARKING (%)	NMT PARKING FACILITIES AT INTERCHANGES (%)
1	> = 50	< = 10	> = 75
2	50 – 25	10 – 20	50 - 75
3	25 – 15	20 – 30	25 - 50
4	< 15	> 30	<25

Indicator LoS	4	4	2
LOS VALUE: 10 (LOS 3)			
OVERALL - LOS1: 3-5, LOS2: 6-8, LOS3: 9-10, LOS4 11-12			

Based on the above indicators, the overall score of the Benchmark for computes to 10, with a LOS of 3. Thus, indicating poor performance in the provision of Non-Motorized Transport facilities.

5.1.4 LEVEL OF USAGE OF ITS FACILITIES

This benchmark indicates the efforts to add information technology to transport infrastructure and vehicles in an effort to manage factors that are typically at odds with each other.

Table 5-4 ITS Facilities

LOS	AVAILABILITY OF TRAFFIC SURVEILLANCE (%)	PASSENGER INFORMATION SYSTEM (PIS) (%)	GLOBAL POSITIONING SYSTEM / GPRS (%)	SIGNAL SYNCHRONIZATION (%)	INTEGRATED TICKETING SYSTEM (%)
1	>=75	>=75	>=75	>=75	>=75
2	50 - 75	50 – 75	50 – 75	50 - 75	50 - 75
3	25 - 50	25 – 50	25 – 50	25 - 50	25 - 50
4	< 25	< 25	< 25	< 25	< 25
Indicator LoS	**4**	**4**	**4**	**4**	**4**
LOS VALUE: 20 (LOS 4)					
OVERALL - LOS1: 5-7, LOS2: 8-10, LOS3: 11-15, LOS4 16-20					

Based on the above indicators, the overall score of this Benchmark computes to 20, with a LOS of 4. This throws light on the need further improvements in terms of synchronized signals, PIS facilities at all bus stops in the city.

5.1.5 TRAVEL SPEEDS

This benchmark provides an indication of effective travel time or speed of public or private vehicles by considering indications of congestion or traffic density.

Table 5-5 Travel Speeds

LoS	AVERAGE TRAVEL SPEED OF PERSONAL VEHICLES	AVERAGE TRAVEL SPEED OF PUBLIC TRANSPORT
1	> =30	< =20
2	25 – 30	**15 - 20**
3	**15 – 25**	**Oct-15**

4	< 15	> 10
Indicator LoS	**3**	**2**
LOS value : 5 (LOS 3)		
OVERALL - LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4 7-8		

The LOS for Travel speeds in the city computes to LoS 3 with a score of 5, indicating the need for improving the network conditions in the study area.

5.1.6 AVAILABILITY OF PARKING SPACES

This benchmark indicates the restrictions on free parking spaces for all vehicles in Kozhikode region.

Table 5-6 Availability of Parking Spaces

LOS	AVAILABILITY OF ON STREET PAID PUBLIC PARKING SPACES (%)	RATIO OF MAXIMUM AND MINIMUM PARKING FEE IN THE CITY
1	> =75	> 4
2	50 – 75	2 – 4
3	25 – 50	**1 – 2**
4	**< 25**	1
Indicator LoS	**4**	**2**
LOS VALUE: 6 (LOS 3)		
OVERALL LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4: 7-8		

Based on the above indicators, the overall score of the Benchmark for computes to 5, with a LOS level of 3. The excessive availability of free on-street parking needs to be controlled by the authorities to regulate heavy vehicular traffic. The on-street parking facilities shall need to be charged, and the same may be used to provide for improved NMT infrastructure in the city.

5.1.7 ROAD SAFETY

This benchmark monitors the extent to which road users, and especially vulnerable road users, are impacted within the overall set of road users.

Table 5-7 Road Safety

LOS	FATALITY RATE PER LAKH POPULATION	FATALITY RATE FOR PEDESTRIAN AND NMT (%)
1	< =2 persons	< =20
2	2 -4 persons	20 -40
3	4 - 6 persons	40 - 60

4	> 6 persons	> 60
Indicator LoS	**4**	**1**
LOS Value: 5 (LOS 3)		
OVERALL LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4: 7-8		

Based on the above indicators, the overall score of the Benchmark computes to 7. The overall LoS for the parameter "Road Safety" is 3. NMT and pedestrians are hence observed to be unsafe on the streets.

5.1.8 POLLUTION LEVELS

This benchmark indicates the Level of air Pollutants in the city i.e. average level of pollution

Table 5-8 LOS Range for Pollution Levels

LOS	ANNUAL MEAN CONCENTRATION OF SULPHUR DIOXIDE (SO2)	ANNUAL MEAN CONCENTRATION RANGE OF OXIDES OF NITROGEN (NO2)	ANNUAL MEAN CONCENTRATION OF SUSPENDED PARTICULATE MATTER(SPM)	ANNUAL MEAN CONCENTRATION OF RSPM (SIZE LESS THAN 10 MICRONS)
1	**0 – 30**	**0 – 30**	**0 – 70**	0 - 40
2	30 – 60	30 – 60	70 – 140	**40 – 80**
3	60 – 90	60 – 90	140 – 210	80 – 120
4	> 90	> 90	> 210	> 210
Indicator LoS	**1**	**1**	**1**	**2**
LOS VALUE :5 (LOS 1)				
OVERALL LOS1: <=5, LOS2: 6-9, LOS3: 10-13, LOS4: 14-16				

Based on the above indicators, the overall score of the Benchmark computes to 9 with a LOS of 1. This indicates the city is doing good in keeping emission standards, and should adopt and encourage public transport use to keep pollution in check.

5.1.9 INTEGRATED LAND USE TRANSPORT SYSTEM

This benchmark indicates the effectiveness of land use and transport arrangements and identifies the level of integrated land use transport system expected to result in overall trip reduction and mode shift in favour of public transit.

Table 5-9 Integrated Land Use & Transport System

LOS	POPULATION DENSITY	MIXED LAND USE ZONING	INTENSITY OF DEVELOPMENT-CITYWIDE (FSI)	INTENSITY OF DEVELOPMENT ALONG TRANSIT CORRIDOR	ROAD NETWORK PATTERN & COMPLETENESS	% OF AREA UNDER ROADS	% NETWORK WITH EXCLUSIVE ROW FOR TRANSIT
1	> =175	> = 30	> = 2	> = 3	Clear pattern (ring-radial or grid-iron) and complete network	> = 15	>=30
2	150-175	15-30	1.5 - 2.0	2 – 3	**Somewhat clear pattern (ring-radial or grid-iron) but somewhat incomplete network**	12 – 15	20 – 30
3	125-150	**5 – 15**	**1.0 - 1.5**	**1.5 – 2**	somewhat unclear pattern and incomplete network	10 – 12	10 – 20
4	**< 125**	<5	<1	<1.5	no clear pattern incomplete / sparse network	**< 10**	**< 10**
Indicator LoS	**4**	**4**	**3**	**4**	**2**	**4**	**4**
LOS VALUE :25 (LOS 4)							
LOS1: <=8, LOS2: 9-15, LOS3: 16-22, LOS4: 23-28							

5.1.10 SUMMARY OF INDICES:

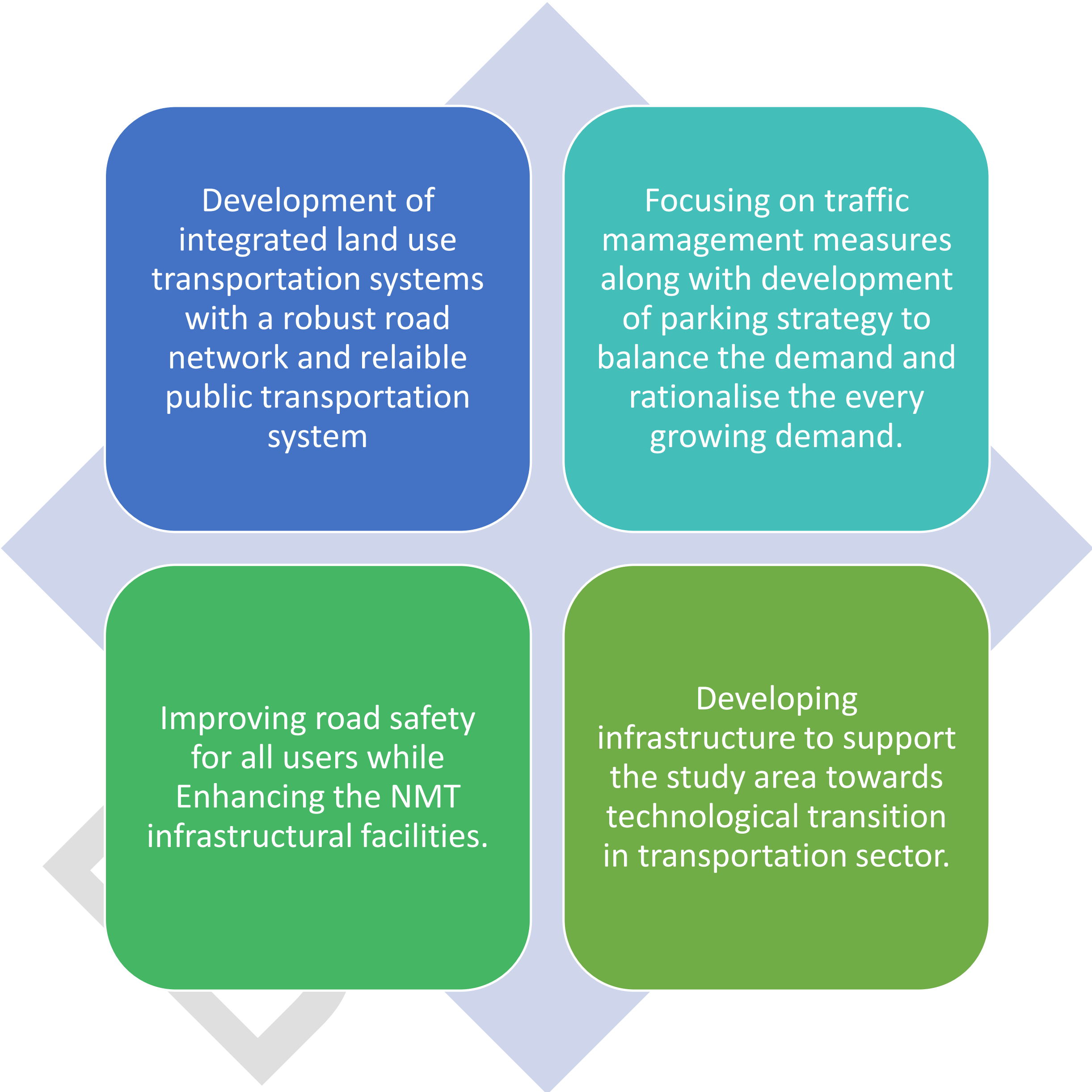
The summary of the indices is as presented below:

SN	BENCH MARK	OVERALL LOS	INFERENCE AS PER MOUD GUIDELINES
1	Public Transport Facilities	**2**	The study area indicates the availability of good public transportation services. However, integration of the services and developing a high capacity PT system would further enhance and cater to the growing travel demand in the state capital city

SN	BENCH MARK	OVERALL LOS	INFERENCE AS PER MOUD GUIDELINES
2	Pedestrian infrastructure facilities	**2**	The city has minimal pedestrian facilities which need immediate improvements especially at intersections and unobstructed footpaths it.
3	Non-Motorized Transport Facilities	**3**	The city has minimal NMT facilities which needs considerable improvements as many parts of the study area are not served by it.
4	Level of usage of Intelligent Transport System (ITS) Facilities	**4**	The study needs improvement in adequate ITS facilities.
5	Travel speed (Motorized and Mass transit)	**3**	The study area has considerable travel speeds for the existing but with small increase in flow may cause substantial increases in approach delay and hence decrease in arterial speed in the horizon years.
6	Availability of Parking places	**3**	The authorities need to initiate immediate actions with respect of providing paid parking spaces and demand management for parking.
7	Road safety	**3**	Need considerable improvements in road design and available road infrastructure, traffic management and other such reasons which contribute significantly to road safety.
8	Pollution levels	**1**	Level of pollution in a study area is not alarming, however the quality can be improved by encouraging and introduction the usage of public modes rather than the private modes.
9	Integrated land use Transport system	**4**	Need to improve the coherence between study area structure and public transport system.

Note: The LOS1 represents the highest performance level whereas LOS4 represents the Lowest.

Based on the above the order priority of immediate improvements required in the study area is as follows,



6. BUSINESS AS USUAL SCENARIO

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COXSWAIN

6 BUSINESS AS USUAL SCENARIO

BAU Scenario for future patterns of activity, growth and travel assumes that there will be no significant change in passenger's preferences with no major changes in infrastructure, technology, economics, or policies, such that current (base) circumstances can be expected to continue unchanged. This scenario represents the future based on the continuation of past trends and is often used as a reference point or benchmark for assessing the need for policy interventions. The BAU scenario extrapolates existing trends and assumes no radical policy interventions for sustainable development and emission mitigation.

However, it does incorporate infrastructure development on the on-going projects and projects to be implemented in the immediate years. Future transport demand is based on the preferences of different socio-economic groups in the base year.

The BAU scenario predicts increased private vehicle ownership with higher demand for motorization. In terms of technologies, the scenario foresees continued reliance on fossil fuel vehicles.

6.1.1 LANDUSE TRANSITIONS

The land use transitions for BAU scenario considers the current growth pattern on assessing growth. The growth pattern is observed to be concentrated along the along the national highways, NH 66 and NH 766 and densification in the core area and Mini Bypass and along Kallayi Road.

Table 6-1 Land use Distribution (Source: Master Plan 2031, Draft Proposed Master Plan-2040)

LAND USE	LAND USE (2012)	EXISTING LAND USE (2019)
Developed Area (excld. Transportation)	136.17	94.798
Roads	9.53	4.064
Transportation		1.091
Undeveloped Area	32.5	16.985
Total	178.2	116.9
Developed Area (excld. Transportation)	76.4%	81.1%
Roads	5.3%	3.5%
Transportation		0.9%

Undeveloped Area	18.2%	14.5%
Total	100%	100%

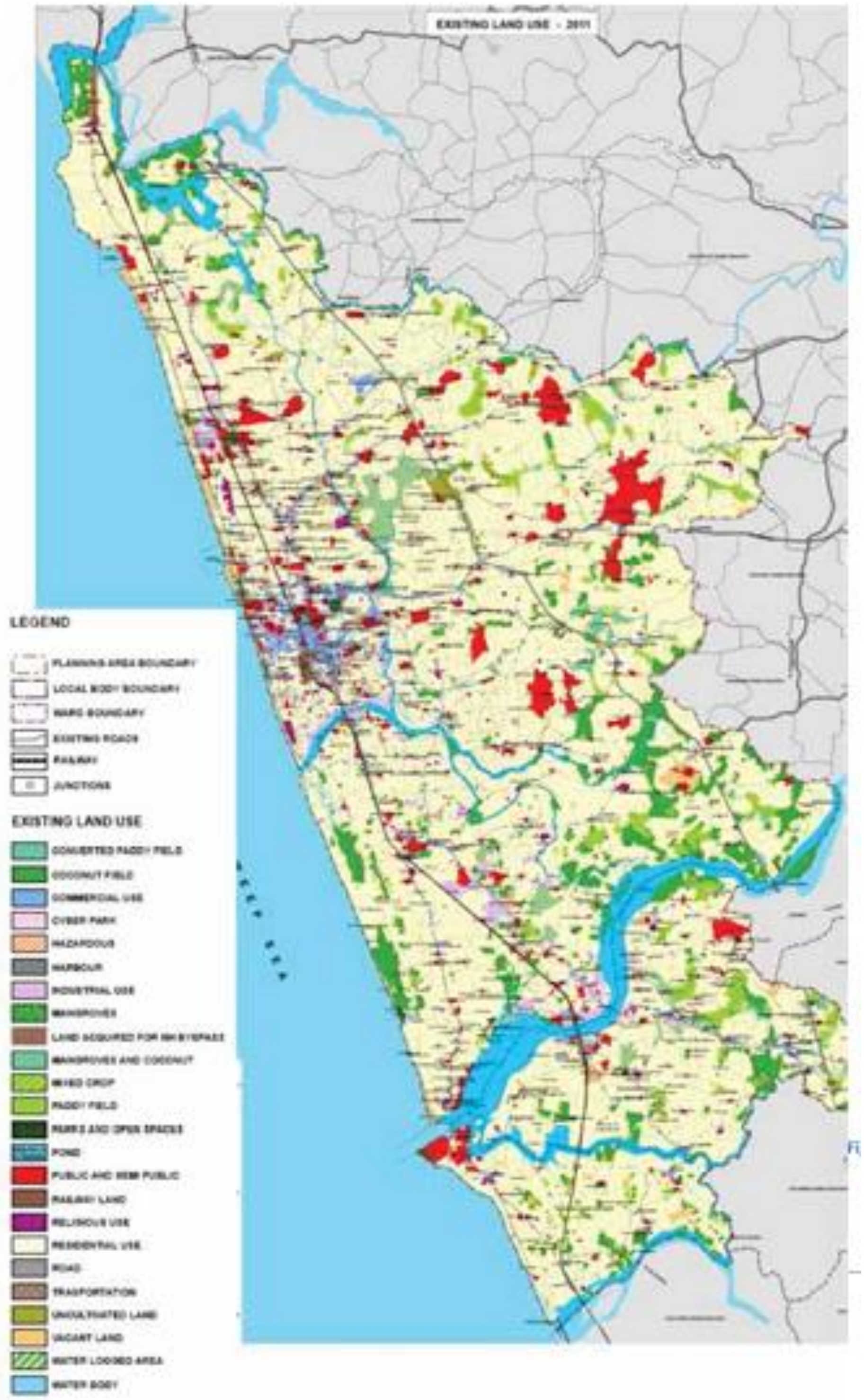


Figure 6-1 Existing Land use of City-2035 (source- Master Plan,2035)

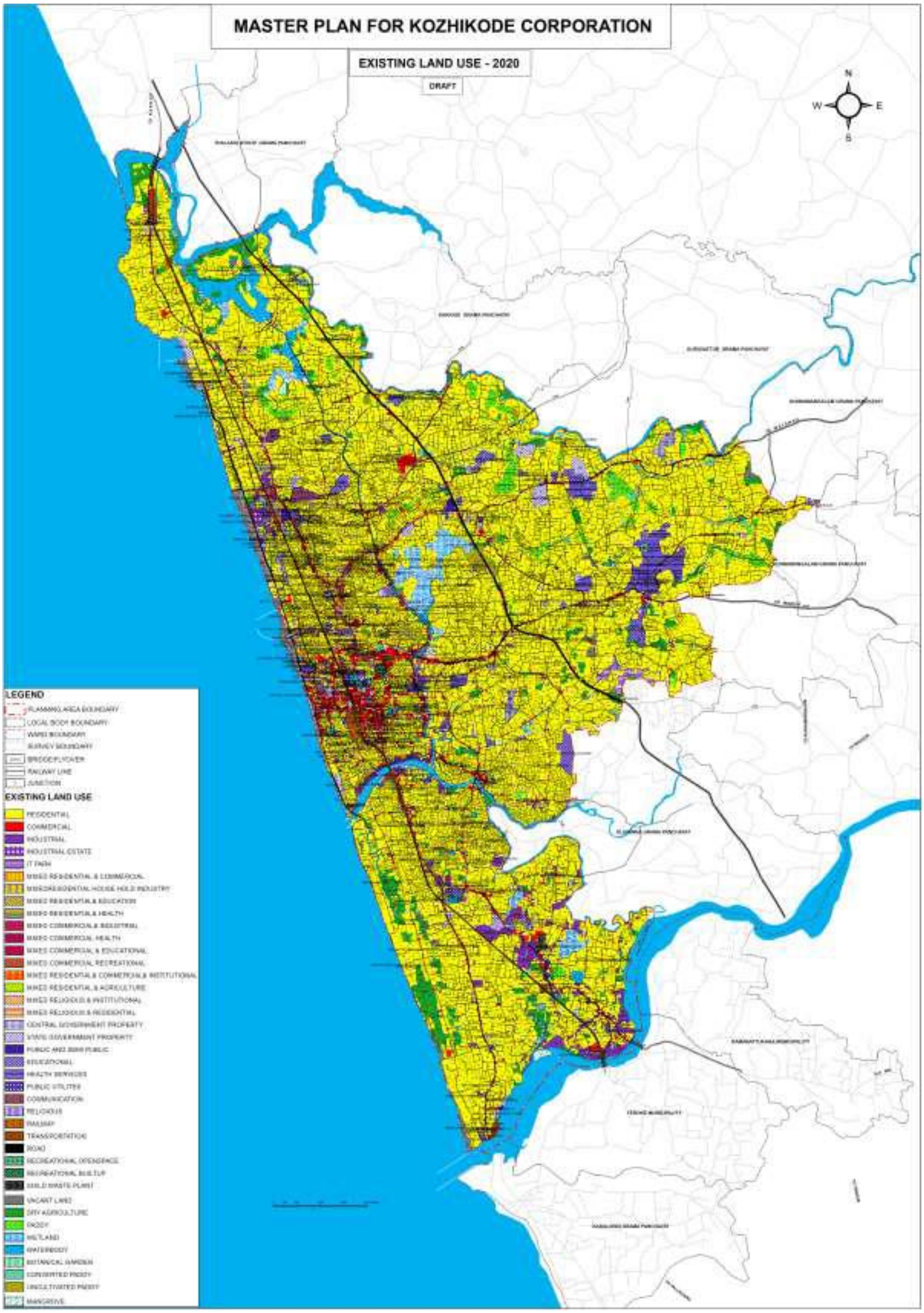


Figure 6-2 Existing Land use of City-2019 (source- Draft Proposed Master Plan,2040)

6.1.2 SOCIO-DEMOGRAPHIC DISTRIBUTION

On comparing the results of the projection method with the growth pattern, envisioned master plans in the study area, linear method has been considered for socio economic projections are considered for the study. Thus, projected population for the study area is 17 lakhs in 2051, the same has been presented below-

Thus, projected population for the study area is 17.81 lakhs in 2051, the same has been presented below-

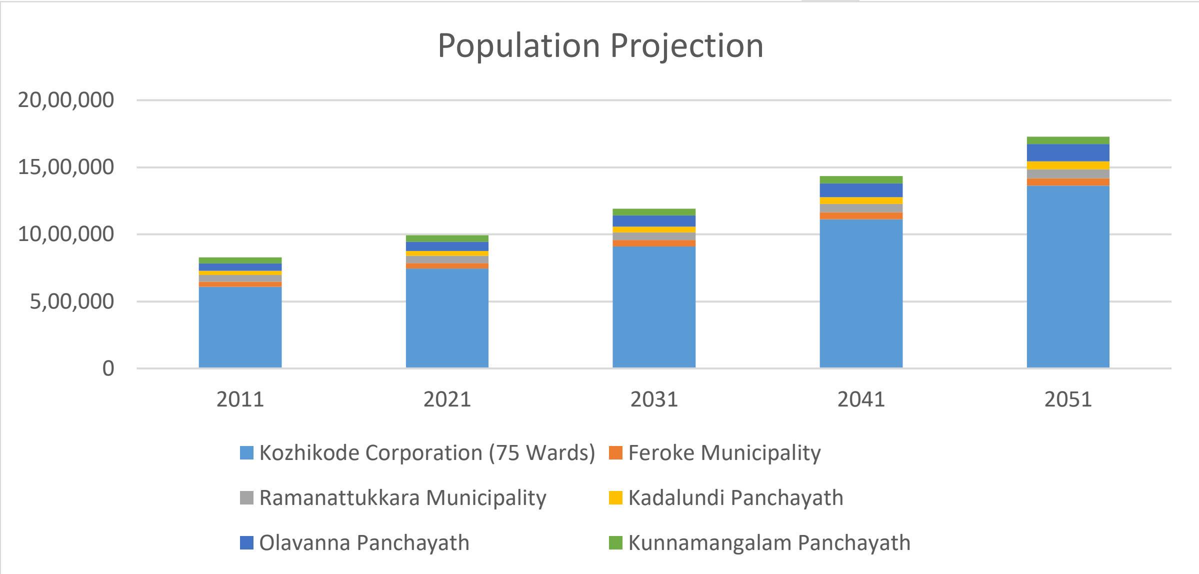


Figure 6-3 Projected Population

Table 6-2 Projected Population (in lakhs)

Study Area	2011	2021	2031	2041	2051
Kozhikode Corporation (75 Wards)	6.08	7.75	9.10	11.13	13.62
Feroke Municipality	0.54	0.43	0.50	0.55	0.59
Ramanattukara Municipality	0.36	0.55	0.63	0.67	0.72
Kadalundi Panchayat	0.43	0.37	0.50	0.59	0.70
Olavanna Panchayat	0.68	0.71	1.04	1.29	1.59
Kunnamangalam Panchayat	0.47	0.48	0.53	0.56	0.59
Kozhikode Planning Area	8.56	10.29	12.30	14.79	17.81

Similarly, the employment projection for the same considering the population influx in the city considering the proposed land use. Thus, projected employment for 6.03 lakhs in 2053, the same has been presented below-

Table 6-3 Projected Employment (in lakhs)

Projected Employment	2021	2031	2041	2051
Kozhikode Corporation	2.68	3.14	3.84	4.70
Ramanattukara Municipality	0.12	0.15	0.17	0.20
Feroke Municipality	0.17	0.20	0.21	0.23
Olavanna Panchayat	0.28	0.35	0.43	0.53
Kadalundi Panchayat	0.14	0.16	0.17	0.19
Kunnamangalam Panchayat	0.12	0.12	0.13	0.14
Study Area	3.51	4.11	4.96	5.98

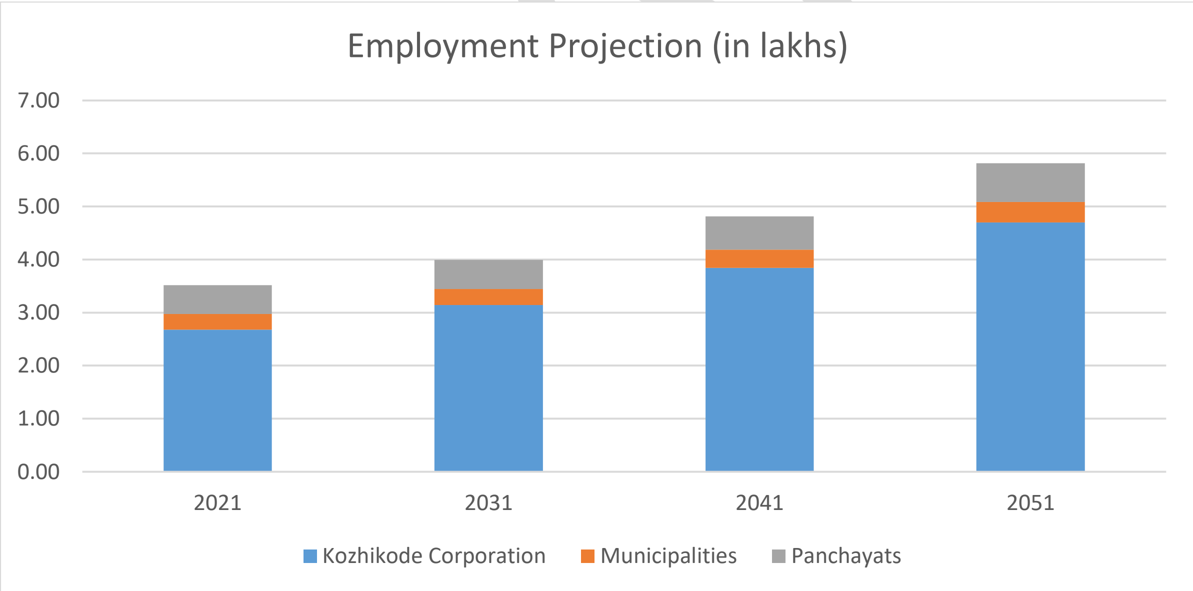


Figure 6-4 Projected Employment

Based on the land use transitions the projected population and employment has been distributed across the traffic analysis zones in the city. The distribution of population based on the on-going or business as usual trend using historic data collected from census and projection population from the draft report of the Master Plan 2040. Which is as presented in the Figures below.

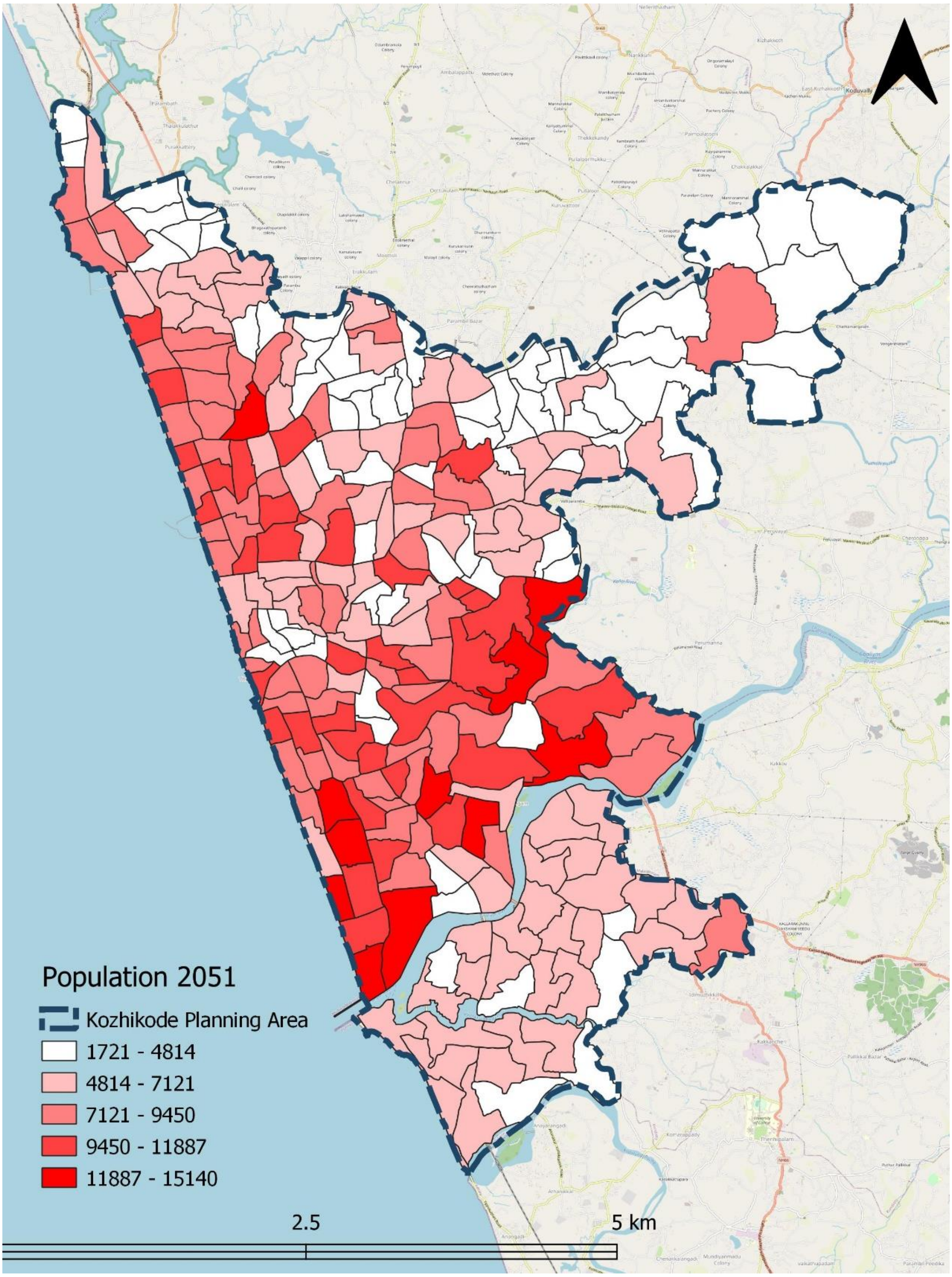


Figure 6-5 Population Distribution -2051

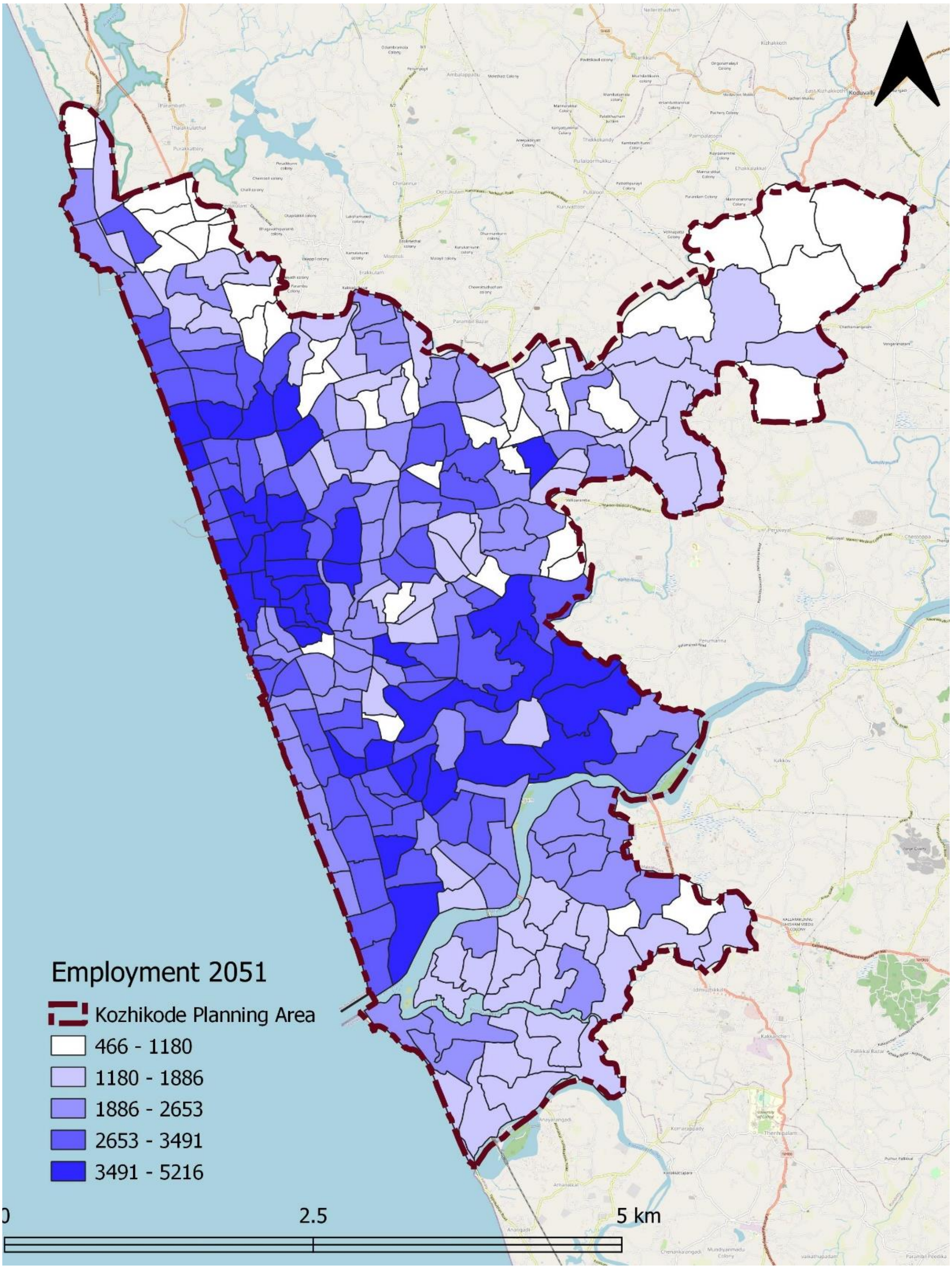


Figure 6-6 Employment Distribution -2051

6.1.3 NETWORK TRANSITIONS

The network transitions for BAU scenario considered the ongoing and committed road network and public transport projects. The following on-going projects and improvements are considered[35],

- Widening of NH 66, Kozhikode Bypass to 6 Lane
- Kunnamangalam-Cherinchal-Kottamparamba road
- Arayidathupalam-Karanthur Road Stretch
- Pottammal - Palazhi - Puthoormatam Road Widening
- Mullapally-Chaliyam Road Widening

6.1.4 TECHNOLOGY TRANSITIONS

The existing transport sector in the study relies primarily on fossil fuels (Petrol and diesel). The CMP-Toolkit 2014 indicates that the aggregate fuel efficiency is expected to improve in the BAU scenario where India will achieve the 4.5 lit per 100 km global target in 2051. Considering the current vehicle technologies and initiatives the following fuel mix is considered for BAU.

The estimated mix of vehicle in terms of their fuel usage for base year is obtained from the sampling of vehicles during house hold surveys and for horizon year similar trend of fuel mix is linked to the BAU scenario.

Table 6-4 Fuel Mix For BAU Scenario[36]

VEHICLE TYPE	% FUEL TYPE - 2051			
	PETROL	DIESEL	ELECTRICITY	TOTAL
Cars	31.00%	39.00%	20.00%	100.00%
2Ws	65.00%	0.00%	35.00%	100.00%
3Ws	0.00%	60.00%	40.00%	100.00%
Buses	0.00%	60.00%	40.00%	100.00%

[35] NHAI and PWD.

[36] Based on current trends

6.1.5 HORIZON YEAR RESULTS

The demographic and network considerations are used to assess the horizon travel characteristics in the study. The impact on the network and travel characteristics are as presented in this following section.

However, in the absence of strengthening the public transportation through high capacity PT network and NMT facilities the travel demand on the major corridors will be served by private and auto-rickshaws. The projected mode share for Horizon year is as presented below.

Table 6-5 Mode Share for Horizon Year under BAU Scenario

NAME OF THE INDICATOR	BASE YEAR (2023)	BAU (2051)
Private Transport (PVT) Trips	60%	70%
Public Transport Trips	25%	14%
IPT Modes	15%	16%

The increased dependency on private modes on roads reflects the increased congestion levels on roads which is as depicted in the table below.

Table 6-6 Horizon Year Congestion Levels

SN	NAME OF THE ROAD	FROM NODE	TO NODE	DISTANCE (KM)	V/C (Base Year)	V/C (2051)
1	NH-66	Vengeri Jn	Thondayad Jn	5.04	1.1	1.76
2	NH-66	Thondayad Jn	Ramanattukara	12.4	1.3	1.24
3	Kannur Road	Mananchira	West Hill	3.8	0.63	1.35
4	Kannur Road	West Hill	Elathur	4.4	0.92	1.09
5	Mavoor Road	Mavoor Road Jn	Thondayad	3.7	1.01	4.86
6	Mavoor Road	Thondayad	Kunnamangalam	8.2	1.19	5.66
7	NH 766, Wayanad Road	Kunnamangalam	Malaparamba Jn	11.8	1.2	1.30
8	NH 766, Wayanad Road	Malaparamba Jn	Mananchira	5.5	0.99	0.00
9	Beach Road	Bhatt Road	Gandhi Road	3.4	0.7	2.89
10	Beach Road	Gandhi Road	East Kallayi Road	4	0.89	2.34
11	SH 28, NH 966, Calicut Road	Ramanattukara	Meenchanda	9.7	1.12	1.50
12	SH 28, NH 966, Calicut Road	Meenchanda	Mananchira	5.2	1.23	1.58

SN	NAME OF THE ROAD	FROM NODE	TO NODE	DISTANCE (KM)	V/C (Base Year)	V/C (2051)
13	**Karaparamba Road, Kozhikode Balusserri Road**	Kakkodi	Karaparamba	4.2	0.81	2.38
14	**Mini- Bypass Road**	West Hill Chungam	Eranjippalam	3	0.9	0.67
15	**Mini- Bypass Road**	Eranjippalam	Arayadathu Paalam Junction	2.9	1.2	1.06
16	**Mini- Bypass Road**	Arayadathu Paalam Junction	Bypass Junction	5.8	1.4	1.09
17	**Beypore Road**	Meenchanda	Beypore Port	6	1.2	4.81
18	**Feroke City Road**	Cheruvannur	Kottakadavu Bridge	8	0.8	2.35
19	**Pavamani, Puthiyara Road**	Mananchira	Canoli Canal	1.16	0.69	2.59
20	**Puthiyara Road**	Canoli Canal	Pottammal Jn	1.9	1.13	2.74
21	**Oyitty Road**	Palayam Junction	Mananchira	1	0.6	2.28
22	**MM Ali Road, Jail Road**	Palayam Junction	Mini Bypass	1.4	0.75	1.34

The average volume to capacity ratio (V/C) along major corridors is about 1.06 for base year and 2.1 for BAU 2051 respectively, with service level of service, LOS- D[37], which indicates that the traffic volume has approached an unstable flow and needs immediate interventions.

6.1.6 ASSESSMENT OF ENERGY AND ENVIRONMENT - EMISSIONS

The impacts of travel conditions in the based year on environment is represented through carbon emission- Green House Gases and Local emissions. The local and GHG / CO2 emission for the base year has been extracted from the secondary data collected form Pollution Control Board and Vehicle kilometres travelled and projected to the horizon year.

Table 6-7 Carbon Emissions in Horizon Year (BAU 2051)

SN	INDICATOR TYPE	DESCRIPTION	BAU (2051)
1	GHG Emissions	Equivalent CO2 emissions per passenger Km	113.16 micro gram per day
2	Local Emissions	Equivalent CO2 emissions per passenger Km	1.85 tonnes per day

[37] Based on Indo-HCM standards

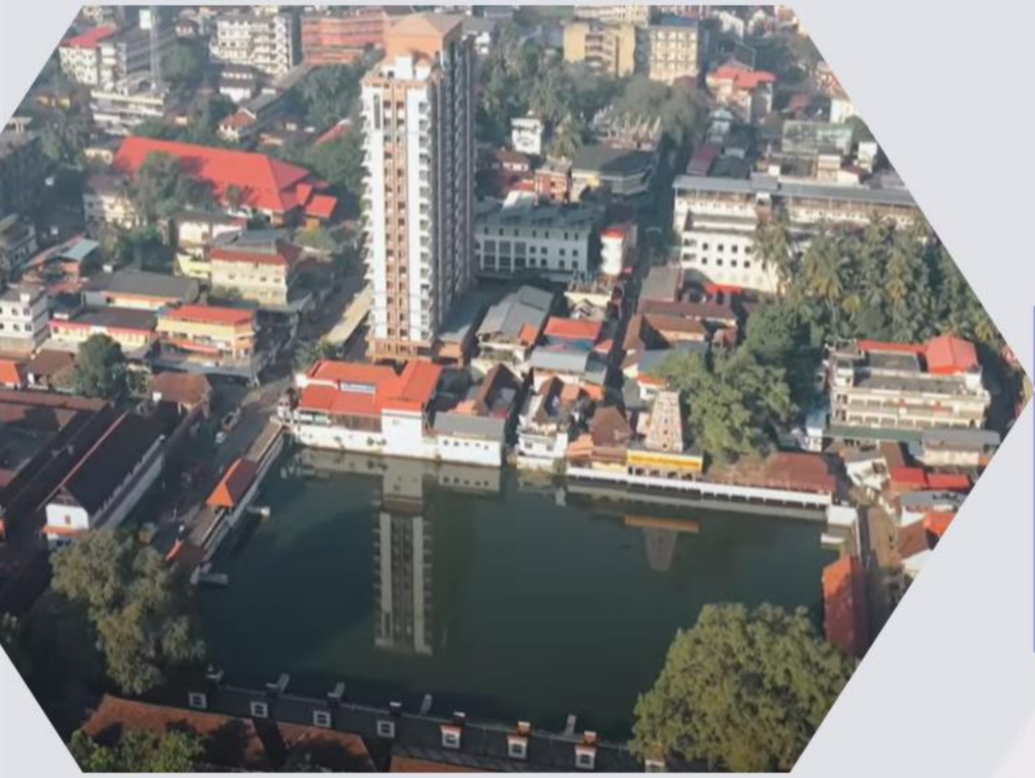
The below mentioned indicators derived from the CMP Toolkit, 2014 by MoHUA will be used for assessing the travel conditions for horizon years. The outputs of travel characteristics for the horizon year are presented against the indicators as presented in the below

Table 6-8 Outputs of Travel Characteristics

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR	BAU 2051
i) Mobility and Accessibility				
1	**Passenger Modal Share (%)-Motorized Modes**			
	Private Modes	% of trips made by private motorized modes (two-wheelers, car)	60%	70%
	Public Modes	% of trips made by public transport modes	25%	14%
	IPT Modes	% of trips made by intermediate public transport modes (auto-rickshaws, shared auto-rickshaws)	15%	16%
2	**Trip Length (Km)**			
	Trip Length (Pvt. Modes)	Average Trip Length of the Two-wheeler, Car and Auto users in the study area	5.9	6.4
	Trip Length (PT Modes)	Average Trip Length of the Public Transport users in the study area	6.13	4.8
ii) Infrastructure and Land use				
1	**Infrastructure Quality**			
1.1	**Average Speed (Kmph) (All Modes)**	**Average speed of all modes**	**20.2**	**14**
	Average Speed (Kmph) (Pvt.)	Average speed of private modes	22.5	18
	Average Speed (Kmph) (PT)	Average speed of public transport modes	17.2	10
2	**Land use parameters**			
2.1	**Land use mix intensity**			
	Land use mix intensity	Job and housing balance (employment / residing population)	0.4	0.4
iii) Safety				
1	**Safety**			

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR	BAU 2051
1.1	Quality of footpath infrastructure	% of roads with more than 2m footpath	2.0%	20%
iv) Environmental Impacts				
1	**Emissions**			
1.1	Local Emissions (Tonnes/day)		1.85	2.2
1.2	GHG Emissions (micro grams per day)		113.16	120
2	**Depletion of land resource**			
2.1	Consumption of land for transport activity	Percentage of total land used in transport for different type of transport infrastructure – road, parking bus lanes, railways, etc.	4%	7%
iv) Technology				
1	**Vehicle Fuel Technology**			
1.1	Vehicle Fuel Technology	Percent of public transport fleet in compliance with Indian emissions standards	40%	60%

It is observed that in the absence of an integrated and comprehensive planning approach, the share of private modes has increased owing to increased congestion levels reduced travel speeds in the study area. The increase congestion level indicates complete exhaustion of the carrying capacity of the major mobility corridors in the peak hours.



7. SUSTAINABLE MOBILITY VISION & GOALS

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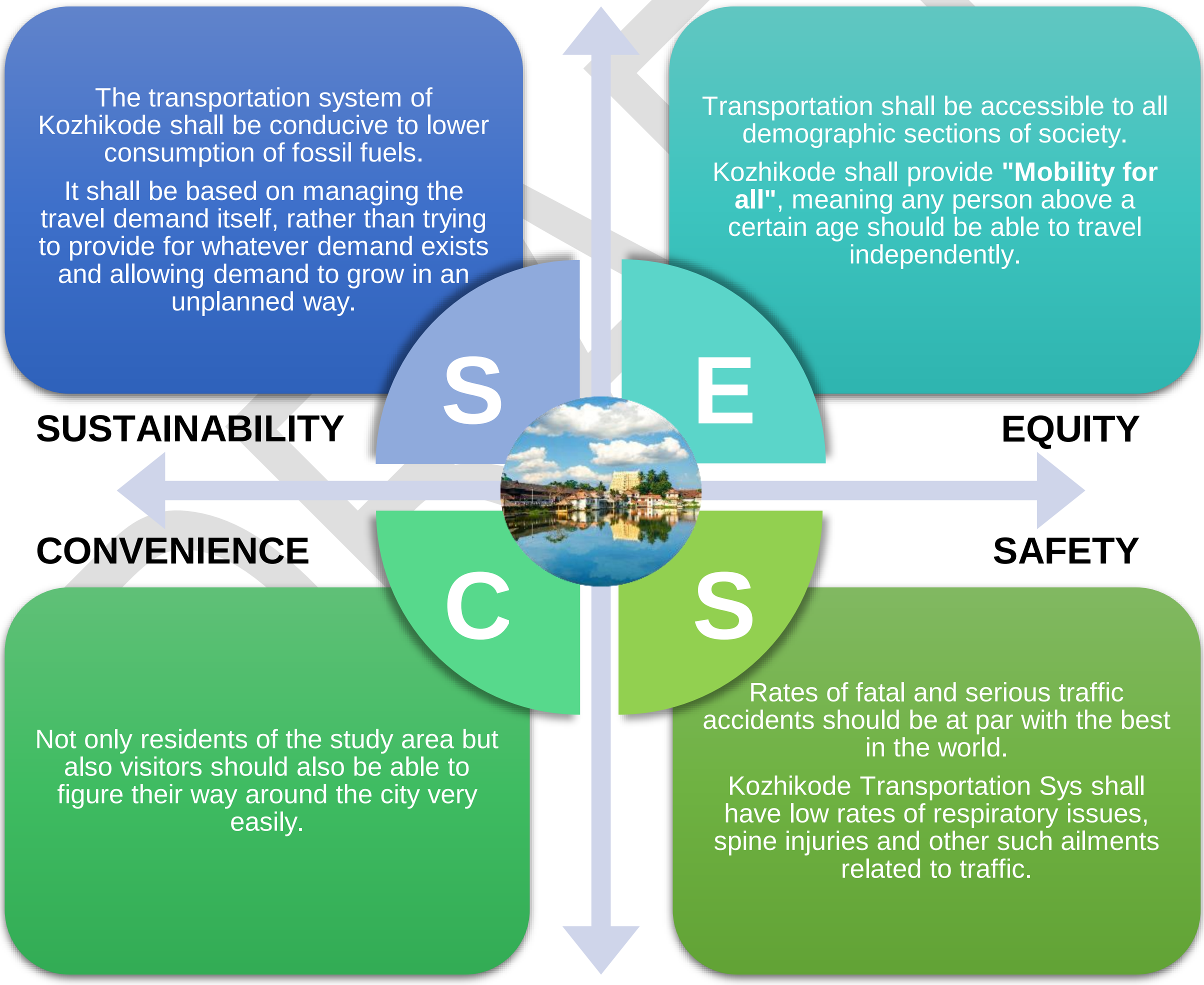
7 SUSTAINABLE MOBILIY VISION & GOALS

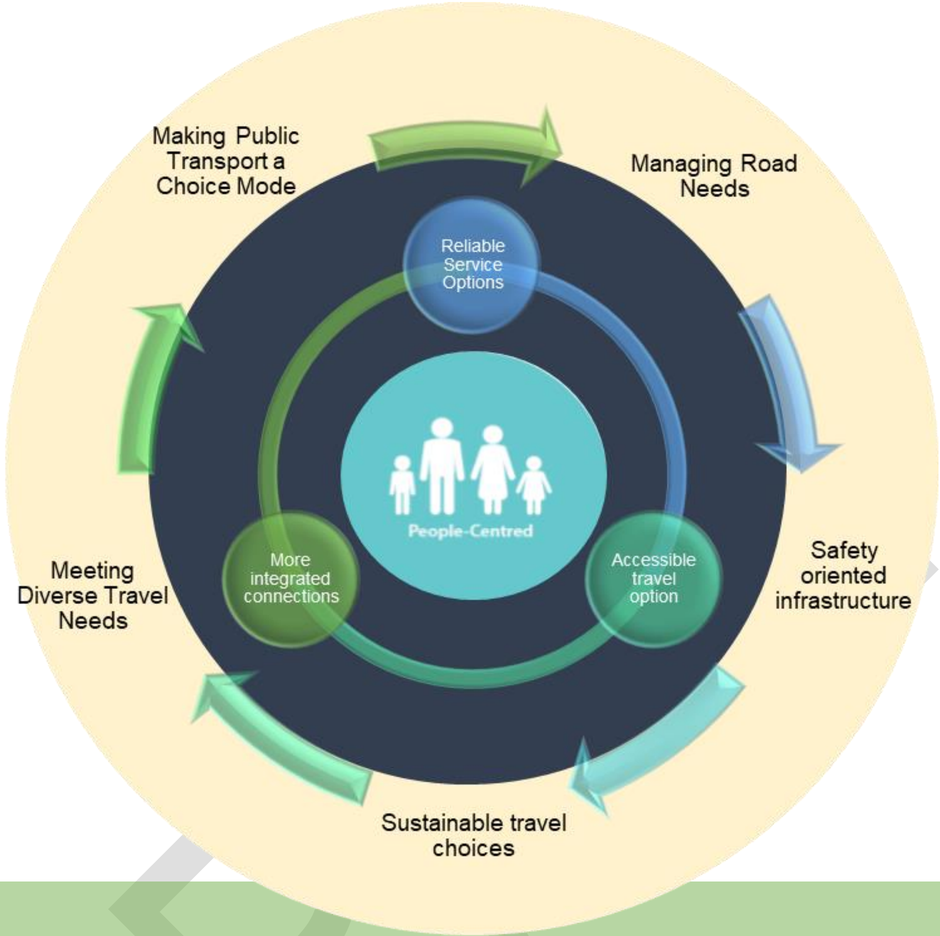
7.1 VISION

The study envisions desirable accessibility and mobility pattern for people and goods in the study area of Kozhikode to provide safe, secure, efficient, reliable and seamless connectivity that supports and enhance economic, social and environmental sustainability.

The four major elements that outline the vision for Kozhikode are:



In order to provide a sustainable transportation system for the residents of the study area



"People Centric Sustainable, Efficient and World Class Urban Transport System that provides the residents of Kozhikode, safe, comfortable reliable and convenient mobility options while catering to their affordability, and providing them with seamless integration"

Figure 7-1 Kozhikode CMP Study Aim

Thus, the focus of the study is to develop a robust Transportation System for Kozhikode in a sustainable and resilient manner by developing a range of non-motorised and public transportation modes or options, complementing one another within a safe environment.

7.2 GOALS

To ensure urban transport solutions are sustainable and in conformity with vision for Kozhikode, following goals have been formulated:

GOAL 1

Ensure safety and mobility of pedestrians and cyclists by designing streets and areas that make a more desirable, liveable city for residents and visitors and support the public transport system.

GOAL 2

Develop public transit system in conformity with the land use that is accessible, efficient and effective.

GOAL 3

Develop traffic and transport solutions that are economically/ financially viable and environmentally sustainable for efficient and effective movement of people and goods

GOAL 4

Develop a Parking System that reduces the demand for parking and need for private mode of transport and also facilitate organized parking for various types of vehicles.

The Vision and Goals set for Kozhikode Transportation System have been translated into mobility targets for the horizon year under sustainable scenarios in comparison with the Business as Usual Scenario.

The following Table shows the goals set to be achieved in the horizon year by implementing all the proposals recommended in this study (Chapter 8).

Table 7-1 Goals Set for Mobility System for Kozhikode for 2051

NAME OF THE INDICATOR	BASE YEAR	BAU (2051)	HORIZON YEAR (2052) – TARGET
Private Transport (PVT) Trips	60%	70%	<50%
Public Transport Trips	25%	14%	>25%
IPT Modes	14%	16%	<15%
Avg. Network Speed (kmph)	**22.5**	**19.2**	>22
% of city covered with Footpaths (Arterial and Sub-Arterial)	5.0%	22%	100%
% of city covered with Cycle Tracks (Arterial and Sub-Arterial)	0%	10%	>50%
Local Emissions (tonnes per day)	1.85	2.2	Reduce by 30% of BAU
GHG Emissions (micro gram per day)	113.16	120	Reduce by 30% of BAU

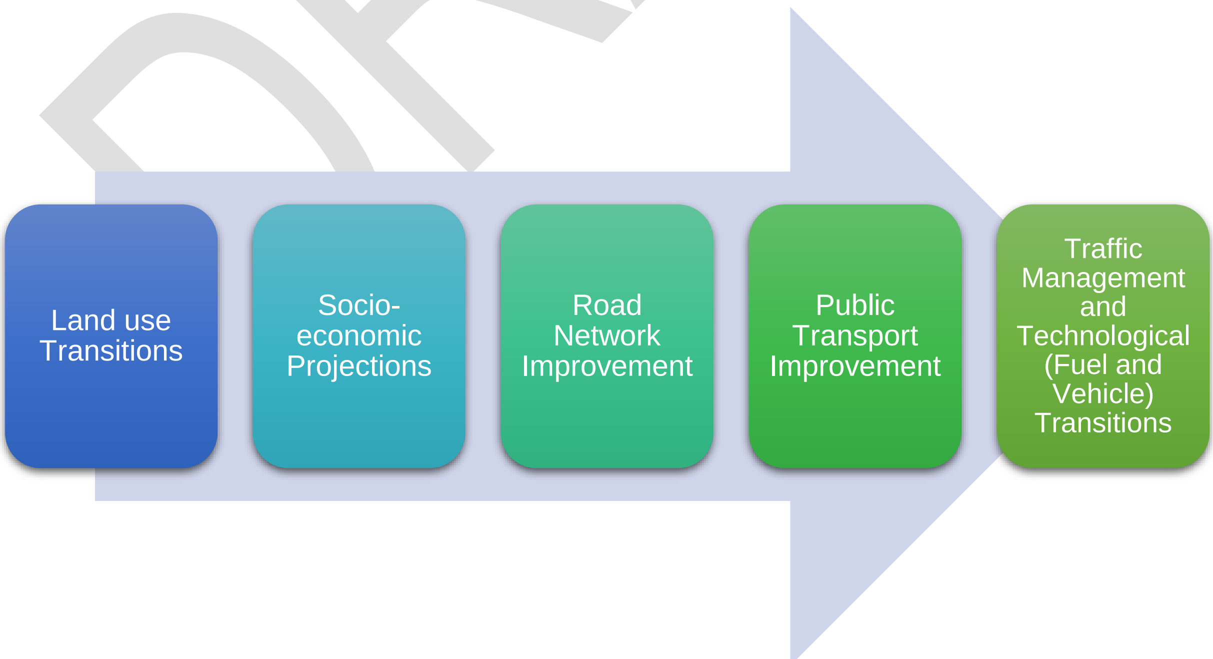
These goals and objectives set for the transportation needs of the study area can be achieved by formulating a series of strategies as per CMP Toolkit – 2014 and NUTP -2006 guidelines. Each of the strategies were evaluated to see their suitability and applicability for the study area.

7.3 DEVELOPMENT OF SUSTAINABLE URBAN TRANSPORT (SUT) SCENARIO

The sustainable urban transport scenario visualizes social, economic, environmental and technological transitions through which societies respond to climate change, local environment and mobility challenges. The scenario assumes the following:

- Deep emission cuts using low carbon energy sources (such as renewable's, natural gas, nuclear power)
- Use of highly efficient technologies (e.g., improved vehicle efficiency)
- Adoption of behavioural and consumption styles consistent with sustainable development
- Changes in urban development
- Enhanced use of non-motorized and public transport infrastructures.

Thus, to assess the suitable sustainable urban transport strategies for Kozhikode alternate sustainable scenarios have been developed. The strategies and alternate proposals developed for Kozhikode were assessed in various permutations to recommend the most suitable combination scenario and strategies. The transitions considered in developing the scenarios is as follows,



7.3.1 LANDUSE TRANSITIONS

The land use transitions for SUT scenario considers the growth pattern on assessing growth and variation of the existing land use plan of 2012 and 2019 with proposed Master Plan proposal for 2040.

The proposed Master Plan has put forward about 84% of the land area for built-up use enabling availability of ample land for all kinds of development activities in the city. It is proposed to adopt a mixed development scenario in most of the development zones, other than for those zones dedicated for specific purposes.

Table 7-2 Land use Distribution (Source: Master Plan 2035, Draft Proposed Master Plan-2040)[38]

LAND USE	EXISTING LAND USE (2019)	PROPOSED LAND USE (2040)
Residential	70.9%	48.7%
Mixed Use	0.1%	16.6%
Public & Semi Public	5.1%	6.2%
Commercial	3.0%	4.2%
Industrial	2.4%	5.8%
Roads & Transportation (including port & harbour)	4.4%	4.9%
Environmentally Sensitive	1.8%	2.9%
Water Body	4.9%	5.2%
Parks & Open Spaces	0.3%	3.8%
Agriculture	3.9%	1.6%
Utility & Special Zone	1.6%	0.1%
Vacant	1.5%	0.0%

[38] Detailed description of the same has been given in the annexure.PROPOSED LAND USE-2040

The development objectives are as follows:

- To increase the amenity value of cities by developing greenery and well maintained open Spaces
- To strengthen the economic base of the city as multifunctional which promotes development in productive and service sectors (especially trade and commerce, tourism, health and education with special emphasis on new age industries)

The steps proposes to Reinforce the role as commercial capital of Northern Kerala, Facilitate development of the city as a Health, Education and Tourism hub, Attract investments by demarcating Special Investment Zones, planning tools and incentives, Ensure superior quality infrastructure to support large scale developments like Beypore Port, IT parks, Marine Park, etc, Facilitate urban agriculture, Pitch in for smart manufacturing and promote entrepreneurship, Streamline the investment potential in commercial sector through hierarchical, organised and more attractive commercial development and opening up of old commercial core.

- To increase the amenity value of cities by developing greenery and well maintained open Spaces
- To preserve environmentally sensitive areas and heritage structures.
- To strengthen available infrastructure for flood management.

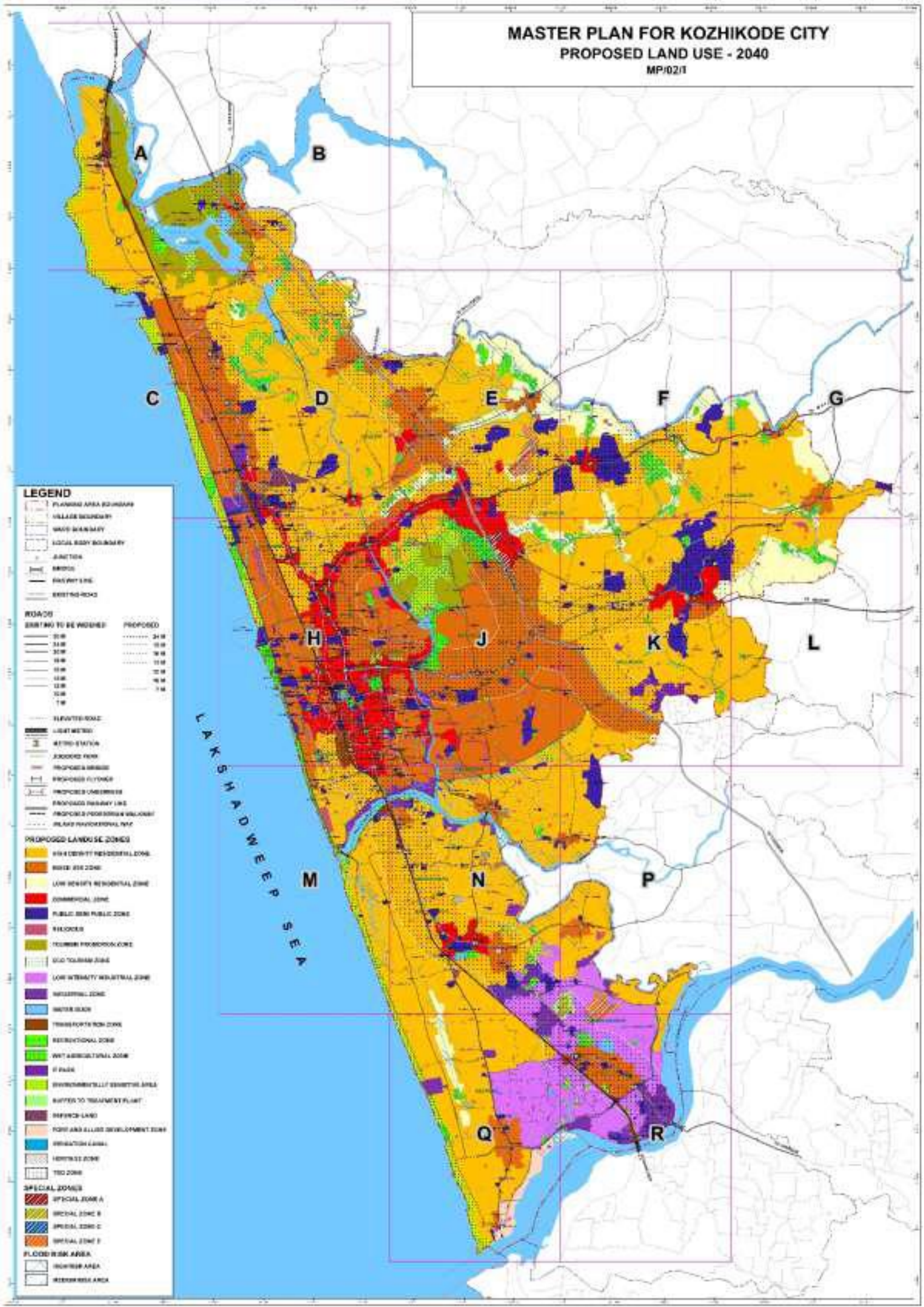
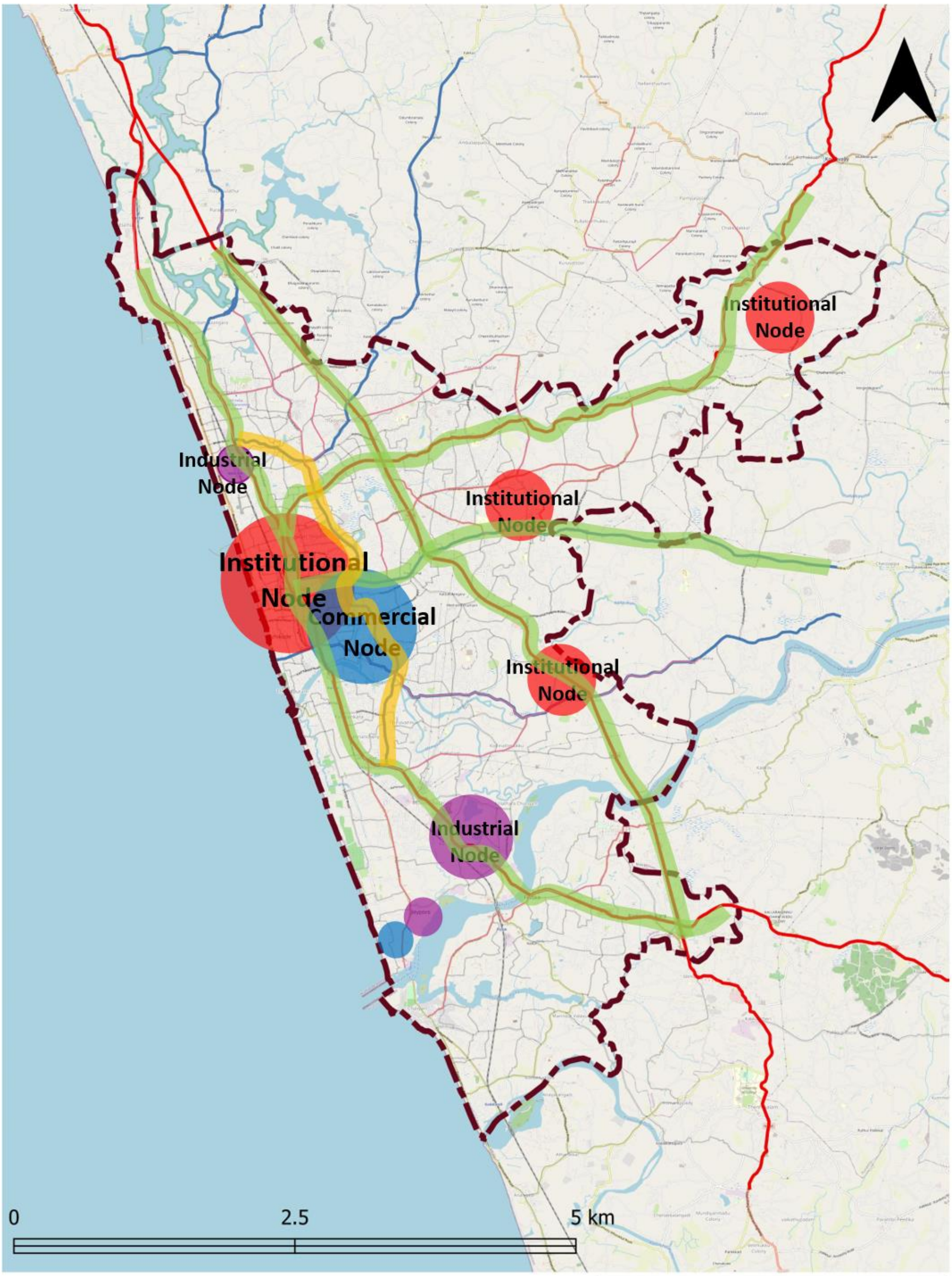


Figure 7-2 Proposed Land use of City-2041 (source- Master Plan,2040)



Title: Comprehensive Mobility Plan for Kozhikode	KOCHI METRO RAIL LIMITED Urban Mass Transit Company Limited
Name: Horizon Year Population	

Figure 7-3 Proposed Land use Transitions Nodes

7.3.2 SOCIO-DEMOGRAPHIC DISTRIBUTION

On comparing the results of the projection method with the growth pattern, envisioned master plans in the study area, linear method has been considered for socio economic projections for Business as usual scenario. The Draft Master Plan Report for 2041 has presumed that 2.4% growth rate would be sustained in the coming years and a constant growth was used to predict the future population. It is also assumed that most of the population will reside in the TOD zone.

While the population increase is considered same for Business as Usual and SUT scenario, complete functioning of employment generators proposed by the land use proposed for 2040 has been considered for SUT scenario

Table 7-3 Comparison of Projected Population and Employment Scenario (in Lakhs)

	2031	2041	2051
Population	12.5	14.7	17.8
Employment	4.9	5.9	7.2

The Sustainable Urban Transportation scenario considers population growth distribution in the TOD corridors and functioning of the proposed employment generators as planned in the Draft Master Plan 2022.

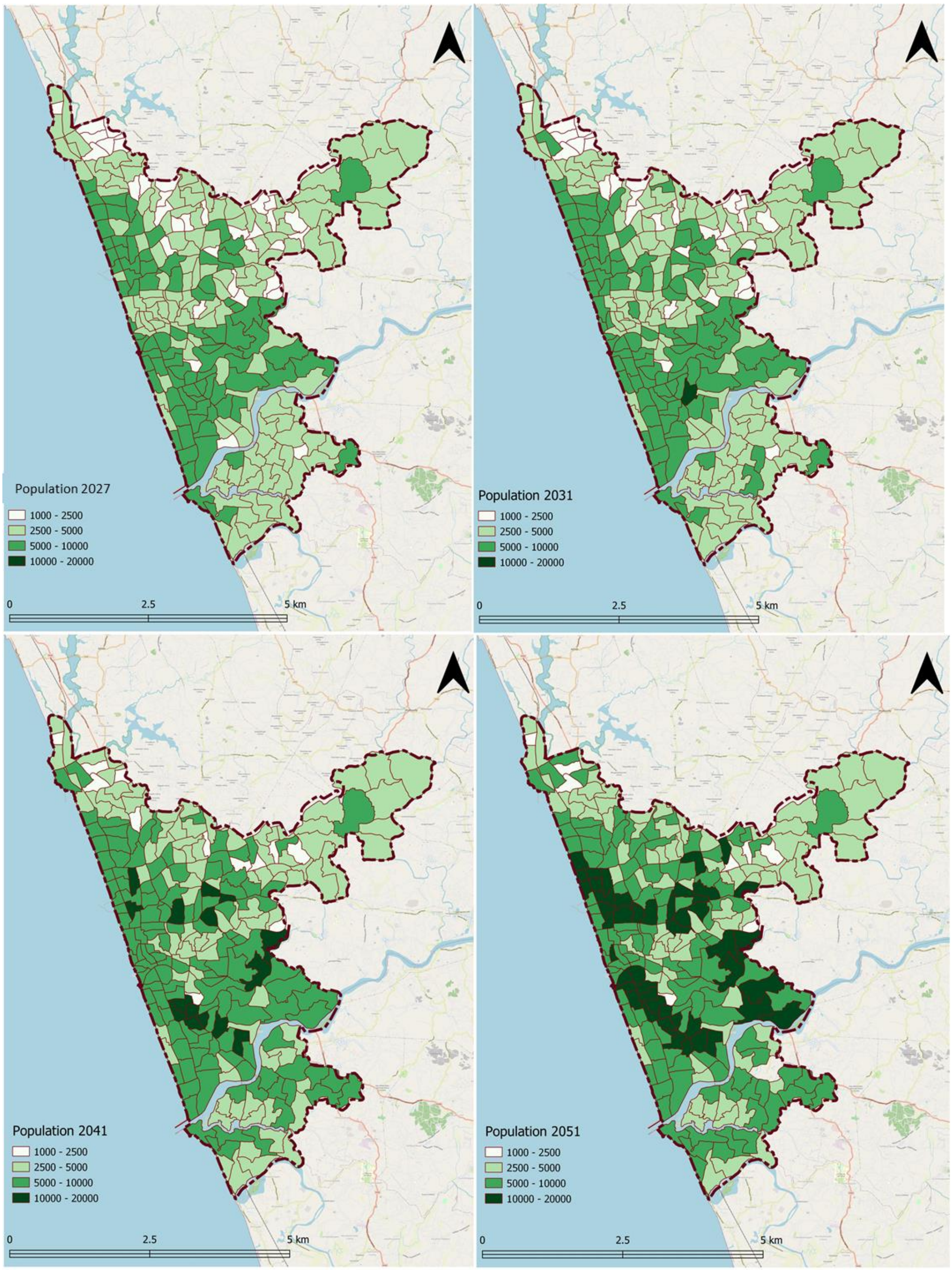


Figure 7-4 Projected Population SUT scenario

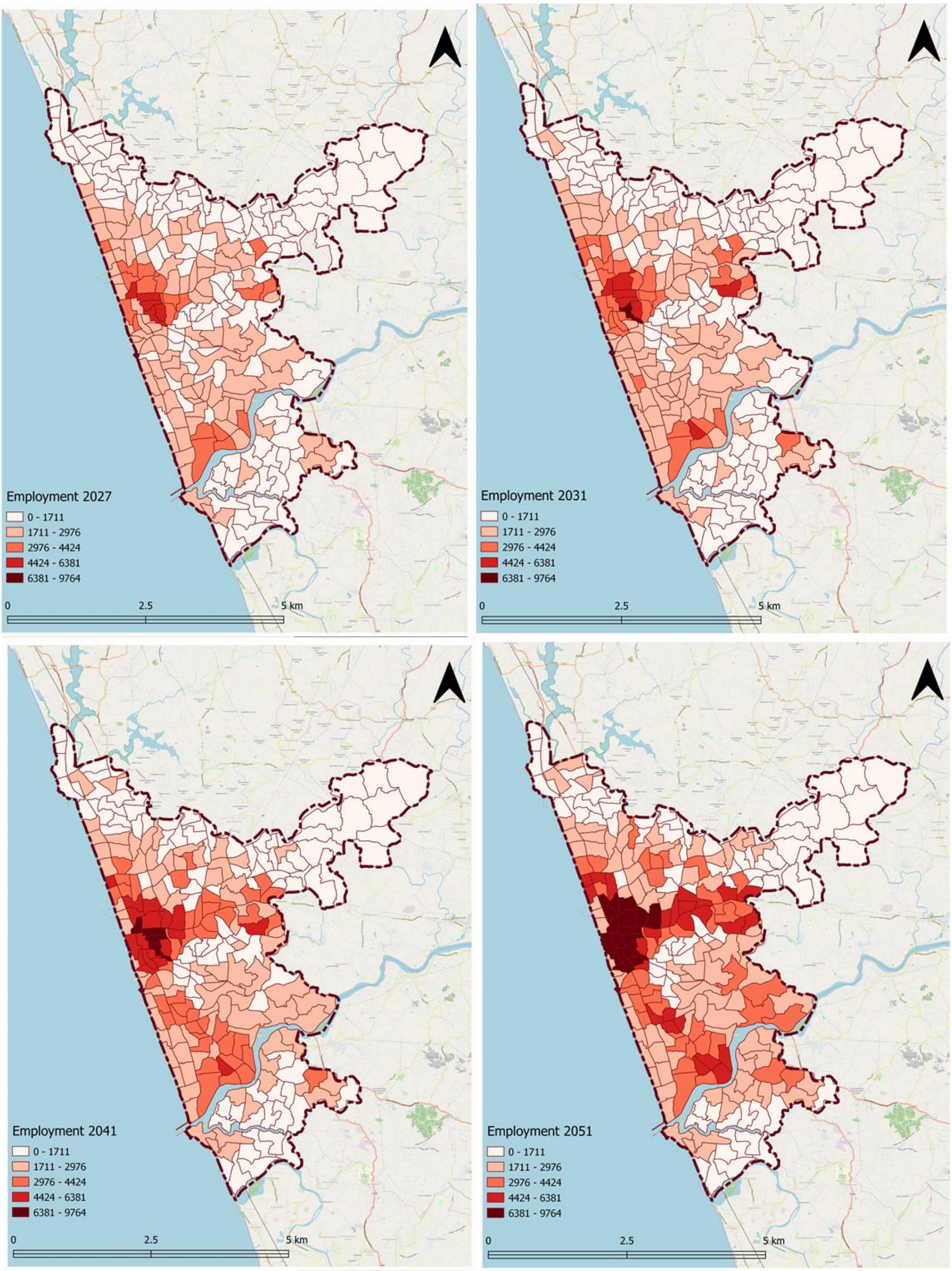


Figure 7-5 Projected Employment SUT scenario

Based on the land use transitions the projected population and employment has been distributed across the traffic analysis zones in the city.

7.3.3 NETWORK TRANSITIONS

The network transitions for considered the ongoing and committed road network and public transport projects along with Road Network and Public Transportation proposals recommended in Chapter 8. The following improvements are considered,

Road Network Improvement (Refer Section 8.2) –

- Development of clear network pattern -190km of the network is recommended for strengthening the semi- ring and radial pattern, strengethened by a grid iron pattern.
- Upgradation of existing road network capacities – 26.3 km of the major corridors are recommended for capacity upgradations.
- Development of new links -5 new linages are recommended.
- Development of River bridges, ROBs, RUBs wherever necessary – 6 grade separator are recommended for improving the capacities and linkages.

Public Transport Network Improvement (Refer Section 8.3) –

- Development of a high demand public transport system -39 km.
- City Bus Rationalization and Augmentation - 17 overlapping routes are recommended for rationalization, 5 corridors of 39km are recommended as high bus demand routes, 1 out of 2 bus depots are recommended for decentralization of city and sub-urban operations,
- Inland Water Ways – 3 inland waterway corridors have been recommended.
- Development of PT Terminals – Development of 2 Multi-modal integration nodes with 4 city bus terminal improvements have been recommended.

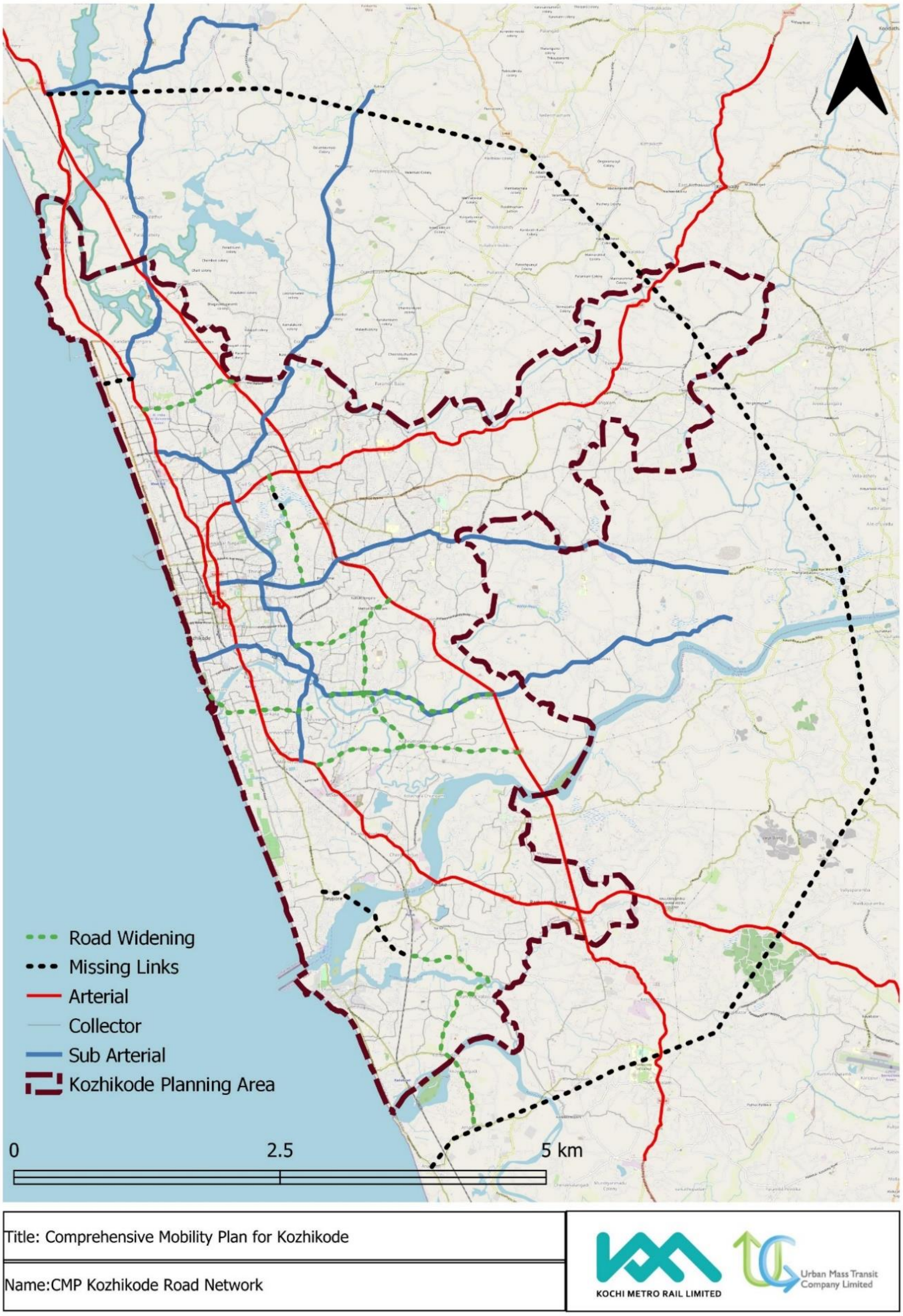


Figure 7-6 Proposed Road Network Transitions

7.3.4 TECHNOLOGY TRANSITIONS

The existing transport sector in the study relies primarily on fossil fuels (Petrol and diesel). The CMP-Toolkit 2014 indicates that the aggregate fuel efficiency is expected to improve in the BAU scenario where India will achieve the 4.5 lit per 100 km global target in 2051. Considering the current vehicle technologies and initiatives the following fuel mix is considered for SUT.

The estimated mix of vehicle in terms of their fuel usage for base year is obtained from the sampling of vehicles during house hold surveys and for horizon year the initiatives taken by the State Government, Smart city, KSEB have been considered to equate the following trend of fuel mix linked to the SUT scenario.

Table 7-4 Fuel Mix for SUT Scenario

VEHICLE TYPE	% FUEL TYPE - 2051			
	PETROL	DIESEL	ELECTRIC	TOTAL
Cars	35.00%	15.00%	50.00%	100.00%
2Ws	25.00%	0.00%	75.00%	100.00%
3Ws	0.00%	15.00%	85.00%	100.00%
Buses	0.00%	0.00%	100.00%	100.00%

7.3.5 SUT SCENARIO OUTCOMES

The holistic and integrated implementation of proposals indicate a trend towards the sustainable growth. The share of public is expected to increase to 32% by 2051 (share of trips excluding walk).

Table 7-5 *Mode Share for Horizon Years –Excluding NMT trips*

MODE	2023	2051
TW	50.6%	45.3%
Car	11.8%	10.6%
IPT	13.6%	12.1%
PT	24.0%	32.0%
Total	100%	100%

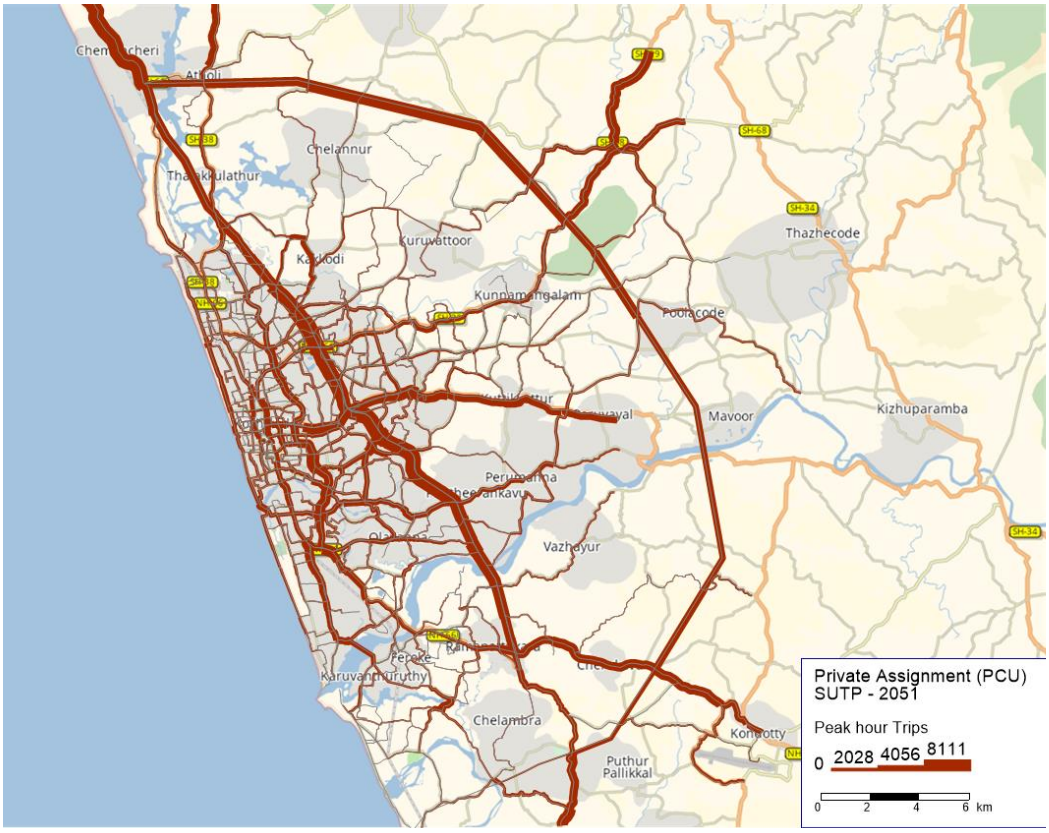


Figure 7-7: Private Transport Assignment for Horizon Year (2051)

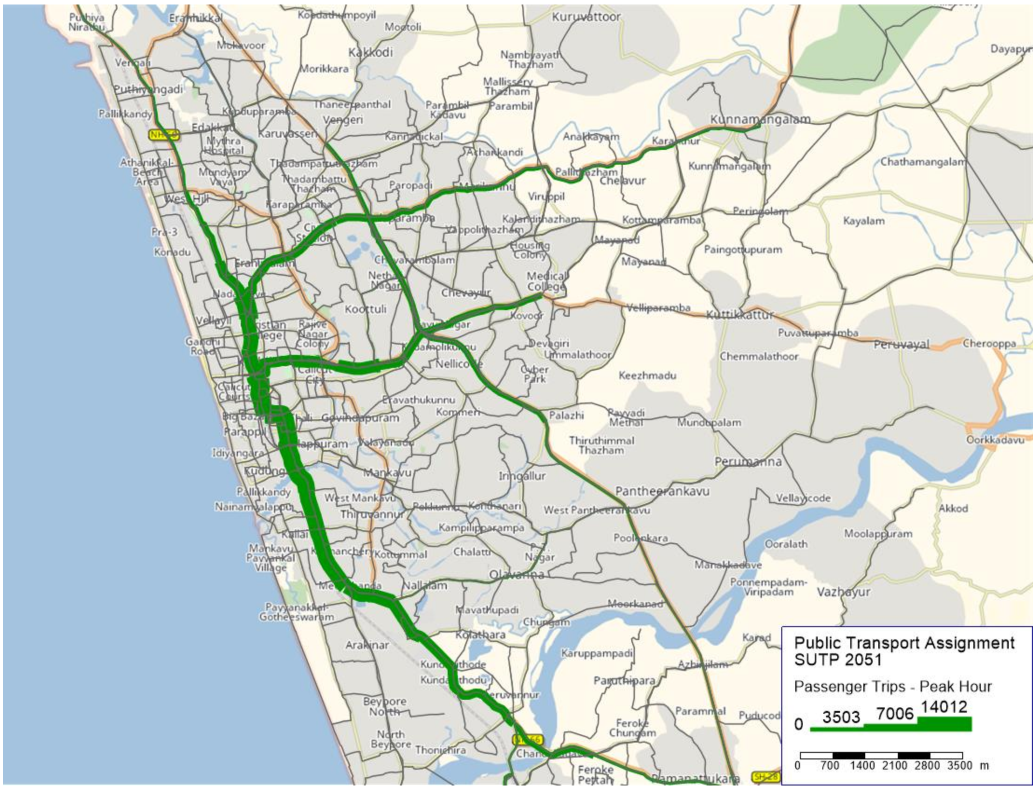


Figure 7-8: Public Transport Assignment for Horizon Year (2051)

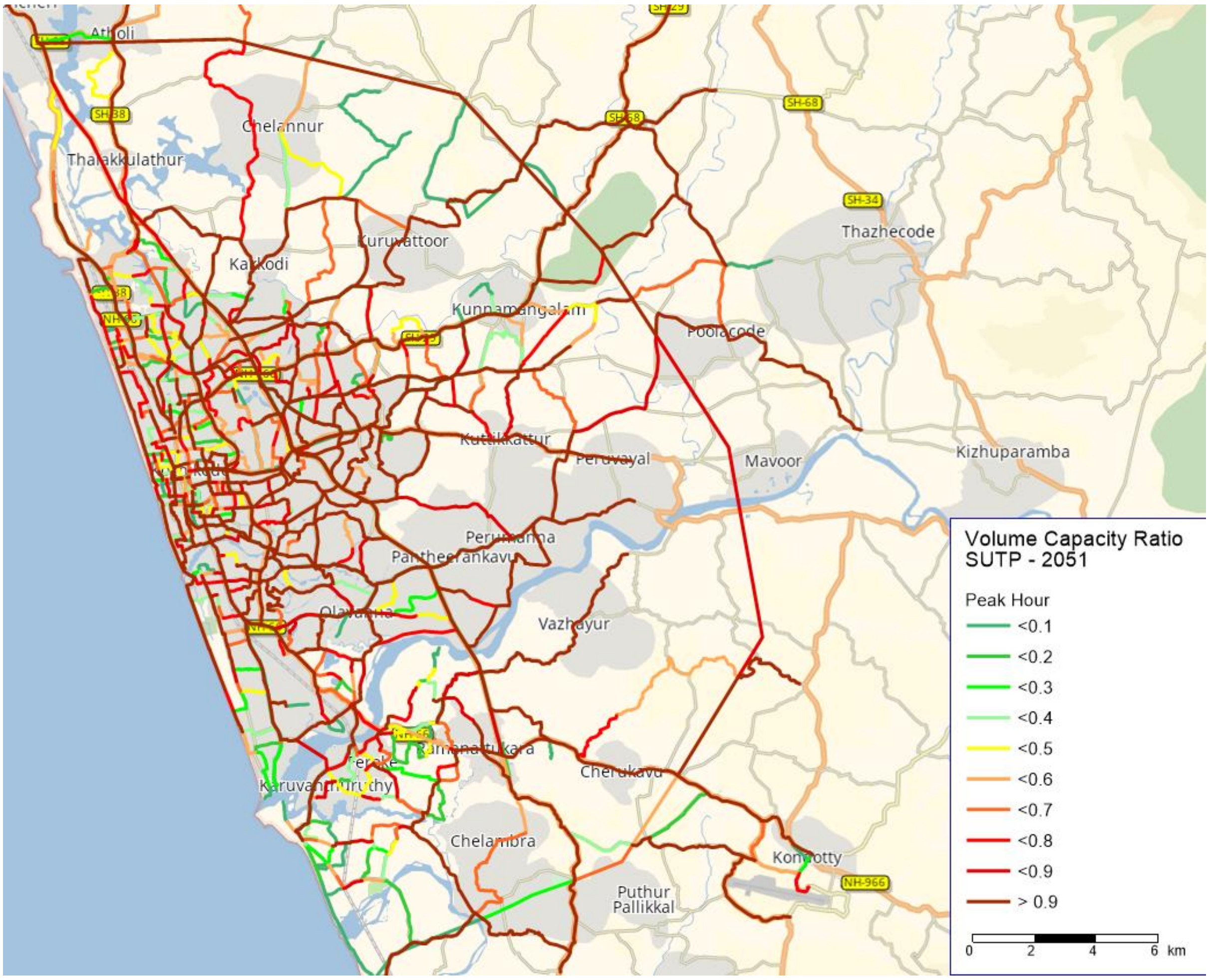


Figure 7-9: Network Congestion Map for Horizon Year (2051)

9. SUSTAINABLE URBAN MOBILITY MEASURES

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8 SUSTAINABLE URBAN MOBILITY MEASURES

Various transportation policies at National level such as the National Urban Transport Policy, Transportation Policies and Strategies recommended by MoHUA and other global cities identify the following as the guiding principle for planning and implementing sustainable urban transportation systems. The principles of Sustainable Urban Transportation are as presented in Figure 8-1.

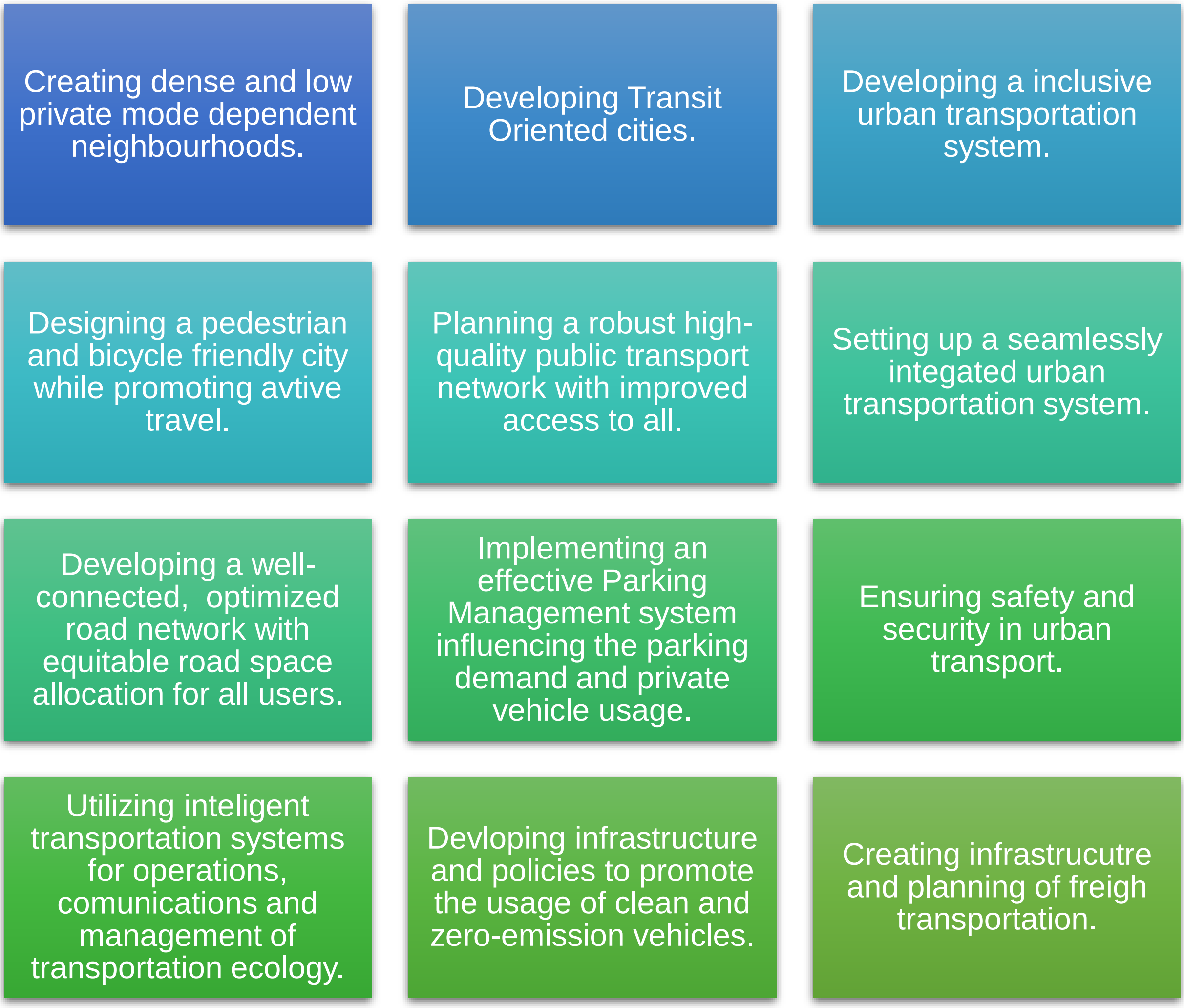


Figure 8-1 Principles of Sustainable Urban Transportation

In line with theNUTP policies recommended by MoHUA, the mobility goals for Kozhikode have been addressed through a multipronged approach. Solutions for complex transport improvements cannot be achieved by a single strategy.

The following strategies have been adopted in tandem to meet the various goals set for the study area.

- Land Use and Transport Strategy
- Road Network Development Strategy
- Public Transit Improvement Strategy
- Intermediate Public Transit Improvement Strategy
- Non-Motorized Transport Strategy
- Freight Management Strategy
- Traffic Engineering and Travel Demand Management Strategy
- Technological Transition Strategy

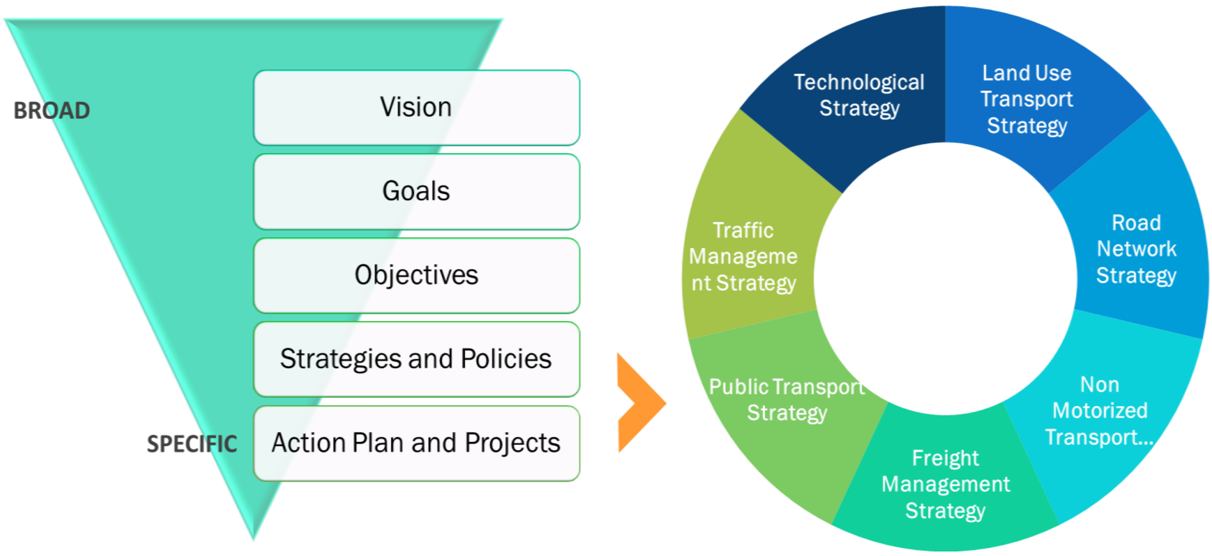


Figure 8-2 Kozhikode CMP Urban Transport Strategies

It is important to note that each of the above strategies are equally important and the order of listing does not imply priority. Each of the broad strategies includes sub strategies of immense importance. The strategies when implemented through specific projects shall fulfil the goals and objectives of the CMP. The sections below discuss these strategies.

All the proposals identified in the master plan has been analysed in this study and proposals which caters to the sustainable development of the city, along with the improved public transport system, has been adopted into the below mentioned stratgies.

8.1 LAND USE AND TRANSPORT PLAN

The transport network of city is dependent on its land use. Land use and the transport network strategy development must go hand in hand. Connectivity helps in the realization of the land use planned. The land-use transport strategy developed focuses on accessibility, connectivity, and mixed land use developments to minimize private vehicle trips, encourage transit-oriented development. In the long term, the transport strategy should be based on the urban growth envisaged for the city. Transport network strategy, therefore, enables the city to take an urban form that best suits the geographical constraints of its location and also one that best supports the key social and economic activities of its residents. Integrated land use and transport development promotes balanced regional growth in line with regional development strategies, with the objective of:

- Promoting balanced spatial growth
- Minimizing land requirements for private transport
- Promoting transit-oriented growth
- Reducing the need to travel
- Encouraging walkable/ bicycling neighbourhoods

8.1.1 MULTI NODALURBAN FORM DEVELOPMENT CONCEPT

The urban form and its spatial structure are articulated by two structural elements, Nodes and Linkages. Nodes are reflected in the centrality of urban activities - can be related to the spatial accumulation of economic activities or to the accessibility to the transport system. Nodes have a hierarchy related to their importance and contribution to urban functions, such as production, management, retailing and distribution. The lowest level of linkages includes streets, which are the defining elements of the urban spatial structure.

Various development concepts are established worldwide and have been implemented across the world.

- The Multi nodal transit network is one such concept where the major transit corridors and economic activity nodes are dispersed around the main city Centre.
- Another concept is the compact development observed in cities like Barcelona, Curitiba where the development of the city region is restricted up to certain limits.

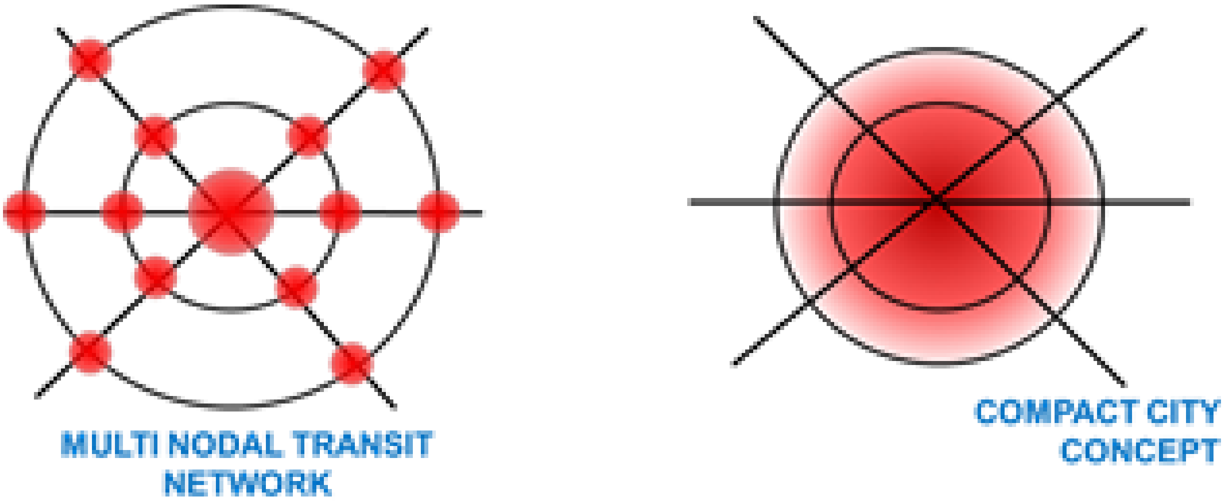


Figure 8-3 Urban Form Development Concepts

The structure of the study area resembles a compact node in the core Palayam area with growth centres emerging around it such as Ramanattukara, Beypore, Pantheerankavu, Thondayad, Malaparamba, West Hill, Elathur etc. **Thus, a multi-nodal development concept is recommended for Kozhikode in in semi-ring radial structure at the macro level and grid iron structure at the block level.**

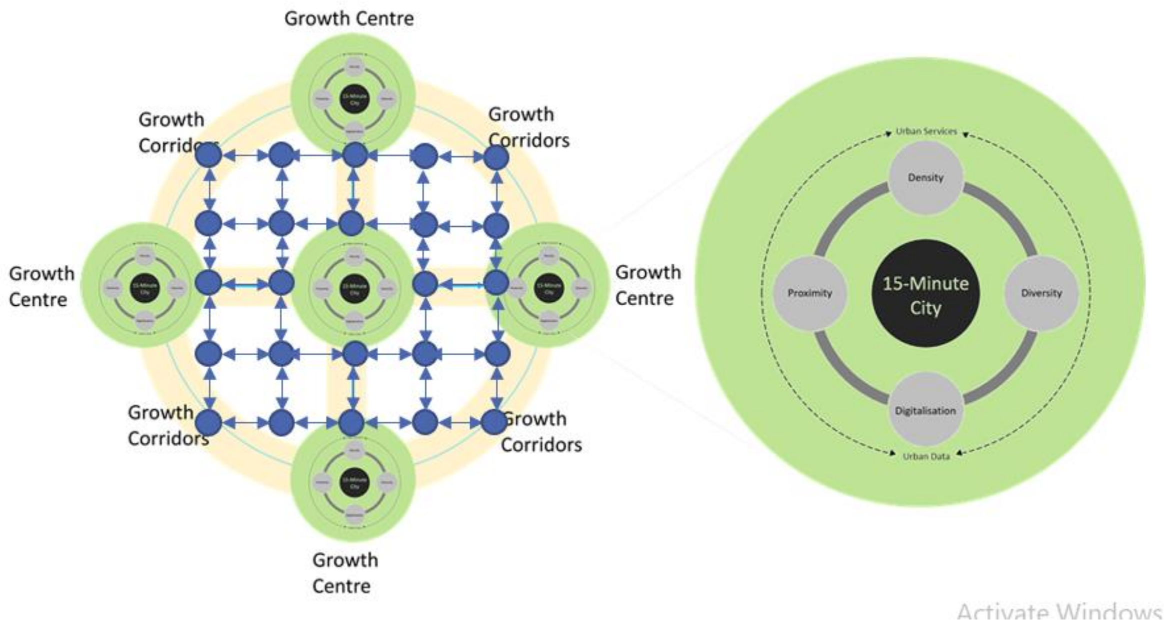


Figure 8-4 Multi-Nodal Urban Form Development Concept for Kozhikode

Multi-Nodal development structure recommended Kozhikode would decongest the core area and for efficient and equitable distribution of transport demand throughout the city, it is imperative to develop sub-city centre in different places of the city. These growth centres or sub-centres shall be connected through efficient city public transportation systems strengthen by high density growth corridors on either sides.

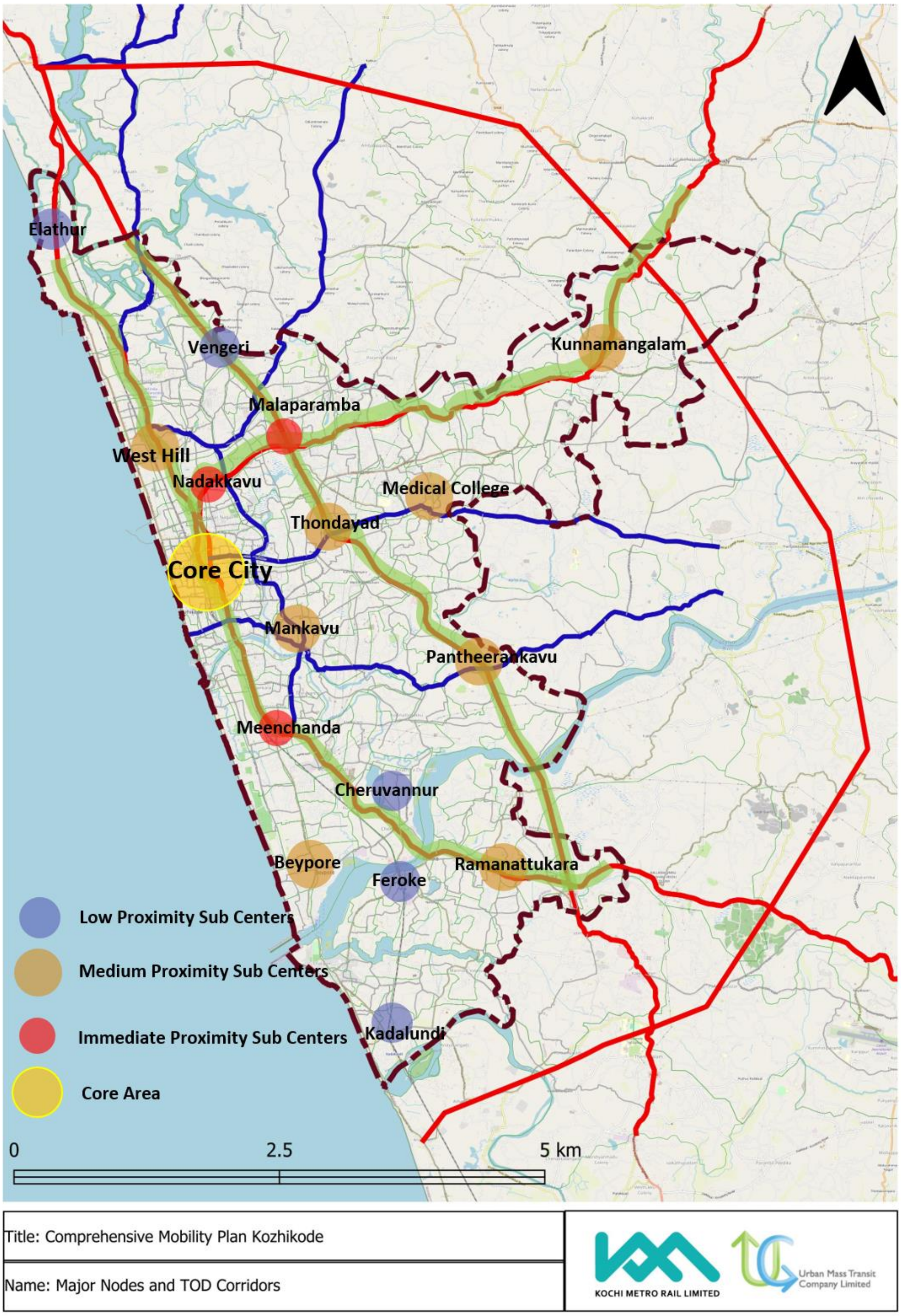


Figure 8-5 Multi-Nodal Urban Form Development for Kozhikode

Multiple sub-centres are recommended based on the proximity to the main city centre, i.e. within immediate, medium proximity and Low proximity for development as shown in the table below.

Table 8-1 Proximity of Core and Sub-Centres

CENTRE AND SUB- CENTRES	AREA NAMES	DESCRIPTION
CORE AREA	Palayam, Railway Station	Constitute the core areas of the study area and major activity attraction nodes housing commercial, government offices, heritage zones, transit stations, etc. These areas constitute to high travel demand are require to be connected by high quality of public transport and NMT infrastructure, Parking and Traffic management strategies. The same has been proposed in the following sections.
IMMEDIATE PROXIMITY SUB-CENTERS	Nadakkavu, Meenchanda, Mananchira, Malaparamba	These are major development node within the study area with considerable travel demand owing to the educational and governmental institutional, Commercial centres, Transit stations, etc. These areas have the maximum potential for immediate development owing to the proximity. These areas require high quality of public transport and NMT infrastructure, Traffic management strategies for the ease of vehicles and passengers. The same has been proposed in the following sections.
MEDIUM PROXIMITY SUB-CENTERS	Mankavu, Beypore, Ramanattukara, Thondayad, Medical college, West Hill, Kunnamangalam	These are the newly developing growth centre with potential economic activity to act as strong growth anchoring nodes in the study area. These areas house, IT Parks, Seaport, Tourism centres, industries and commercial zones. These high employment generations nodes require strong and seamless connectivity to the city centre, thus, provision of high quality public transportation system and improved road connectivity for passenger vehicles and goods are considered.
LOW PROXIMITY SUB-CENTERS	Elathur, Vengeri, Kadalundi, Feroke, Cheruvannur	These are there important satellite towns of the city. However, owing the growth pattern towards the south, Ramanattukara has significant trip interaction with the city centre. The linear growth between these towns and core area requires improved connectivity, thus, provision of high quality public transportation system and improved road connectivity are considered.

It is vital to develop and strengthen these areas with activity generators such as colleges, industries, employments hubs and so on as part of the land use strategies in Master Plan.

8.1.2 GROWTH CORRIDORS AND TRANSIT ORIENTED DEVELOPMENT CONCEPT

To maximize the passenger throughput, these corridors should be developed on the concepts of high density, mixed land use must the developed along the major mobility corridors in the city.

- Mixed use development that is cognizant of the low-income users of the transit system is important. It is necessary to create environments where walking and transit are viable transportation options by making it easier to go from one transportation mode to another, the connection between community and development is enhanced ensuring that a community is accessible to all.
- Resilient neighbourhoods will provide the needs of daily living, within walking distance (1/2 to 1 km radius) as shown in the figure below.

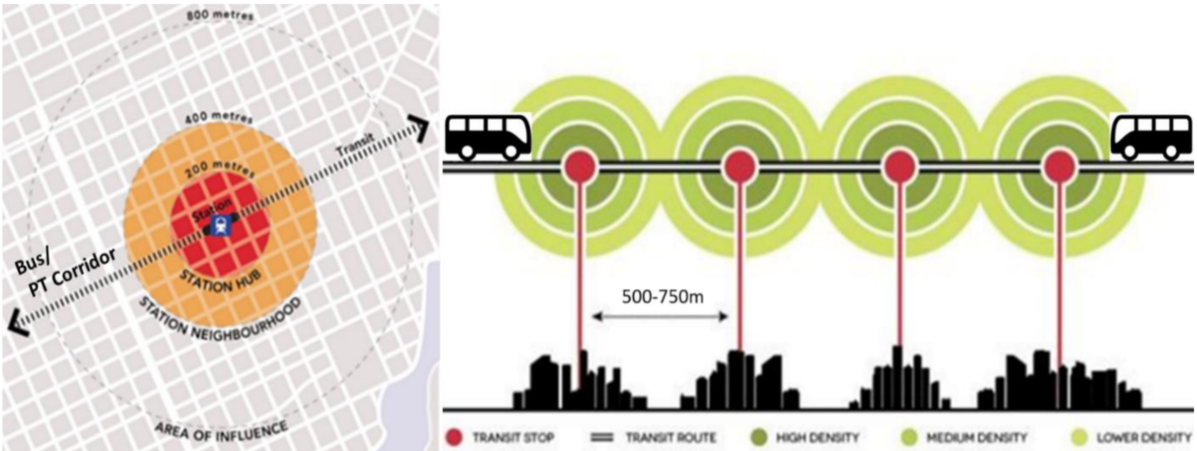


Figure 8-6 Concept of Public Transit Oriented Urban Land Use Development[39]

This planning process includes:

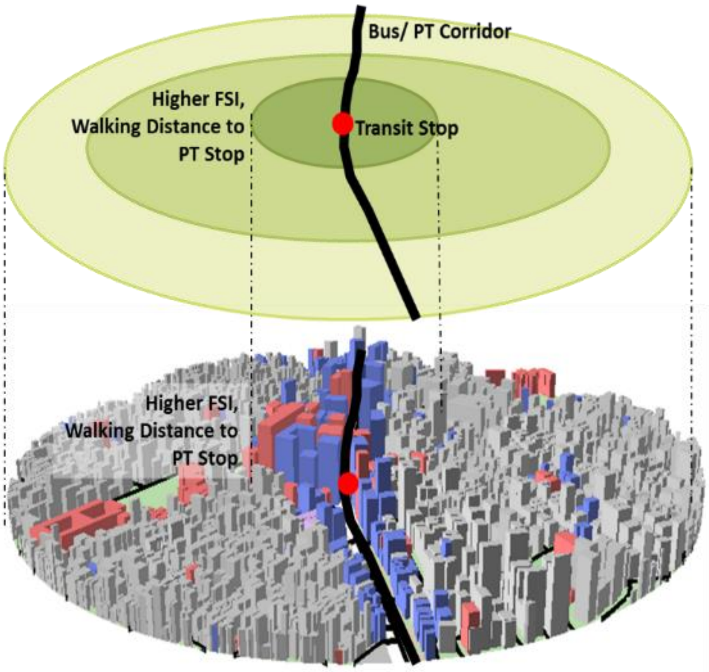
1) **TRAVEL CONNECTIONS**: Convenient and direct pedestrian connections, pedestrian scale blocks, interconnected street network including bicycle circulation and parking.
2) **BUILDING SCALE AND ORIENTATION**: Building placement is a powerful tool in reinforcing streets as public amenities. The quality of “out of vehicle” experiences is influenced by the placement of buildings in relation to the street and other buildings, as well as their height and scale.
3) **ENGAGE PRIVATE SECTOR:** Encourage private sector participation in the planning and implementation process specifically in real estate development.

[39] *www. Wordpress.org accessed on 27th September 2016*

4) **BARRIER FREE ENVIRONMENT:** Build and retrofit the pedestrian environment to meet or exceed accessibility guidelines and standards and create a walkable neighbourhood. This would include pedestrian-friendly streets including adoption of traffic calming measures, parks and Plazas as community gathering spaces to enable social interaction, quality facilities for transit users

Figure 8-7 Walkable neighbourhood (source: TOD institute, U.S), multimodal integration (source: ITDP)

5) **HIGH QUALITY TRANSIT SYSTEM:** Encourage high-quality transit system design and provide customers transport amenity and information



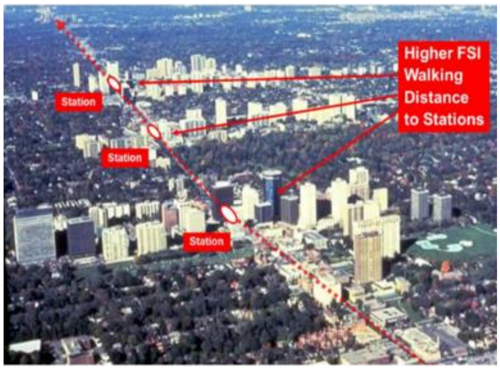


Figure 8-8 Building Height and Scale Along the Mobility Corridors

6) **Land Value Capture:** Implement land value capture as a financing mechanism for upgrading infrastructure.

7) **GREEN BUILDINGS & INFRASTRUCTURE:** Prioritize and implement sustainable building practices
8) **RIGHT SIZE INFRASTRUCTURE:** Gauge the carrying capacities of existing infrastructure and accordingly propose increased densities in station areas or upgrade infrastructure
9) **TECHNOLOGY INTEGRATION:** Employing integration of innovative technologies within zones area; such as smart parking, fare integration, information integration etc.
10) **SAFETY AND SECURITY:** Incorporate design principles that optimize natural surveillance with strategies such as adequate street lighting and active frontages and ensuring safety by introducing 24X7 CCTV surveillance.
11) **PARKING**: Parking structures/shared parking lots are two ways to reduce the amount of space occupied by parking facilities.

Kozhikode being the economical center of the state and its increasing eminence as an educational, commercial and Industrial in its region it has high potential to attract rural-urban migration. Thus, considering the same and the Master Plan-2040, it is recommended to develop Growth Corridors (GC) under the concept of Transit Oriented Development (TOD).

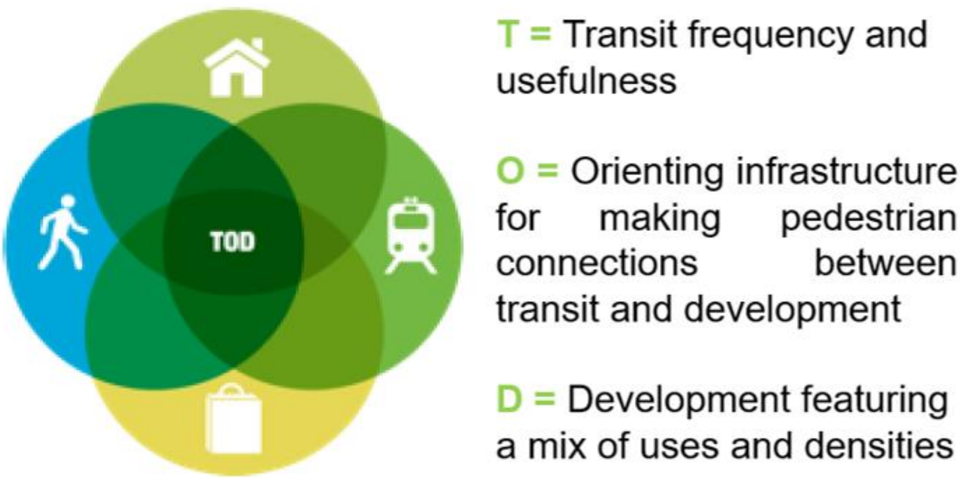


Figure 8-9 *Concept Of TOD – Work, Residence, Transit In Proximity*[40]

Under the Land Use Transport Plan, 4 TOD corridors with an influence area of 112 sqkm along the 56km of identified corridors and 7 Growth corridors influence area of 54 sqkm along the 54km of identified corridors are recommended. The major TOD Corridors and Growth Corridors are proposed with 1km and 500m influence area.

[40] Source: www.completecommunitiesde.org

The recommend corridors are as follows,

Table 8-2 Recommended TOD and Growth Corridors

SN	NAME OF THE CORRIDOR	LINK NAME	LENGTH (KM)	TYPOLOGY
1	West- Hill to Ramanattukara	Calicut Kannur Road	19	TOD Corridor
2	Mananchira- Medical College	Mavoor Road	6.8	TOD Corridor
3	Vengeri to Ramanattukara	NH 66	18	TOD Corridor
4	Nadakkavu to Kunnamangalam	NH 766	13	TOD Corridor
5	West Hill Chungam to Bypass Junction	Mini Bypass Road	11.6	Growth Corridor
6	Meenchanda to Beypore	Beypore Road	5.7	Growth Corridor
7	Mankavu to Pantheerankavu	Mankavu Pantheerankavu Road	9.2	Growth Corridor
8	Cheruvannur to Kottakadavu	Calicut- Feroke Kadalundi Road	8	Growth Corridor
9	Thondayad to Karanthur	Mayanad Bypass	9	Growth Corridor
10	West Hill to Elathur	Kannur Road	6.6	Growth Corridor
11	Karaparamba to Kakkodi	Balusserri Road	4.3	Growth Corridor

The salient features of the proposed corridors are as follows,

- The TOD Corridors with 1km and Growth Corridors with 500m influence area are proposed and of mixed-use development band. The plots along these corridors will be encouraged with higher floor space index.

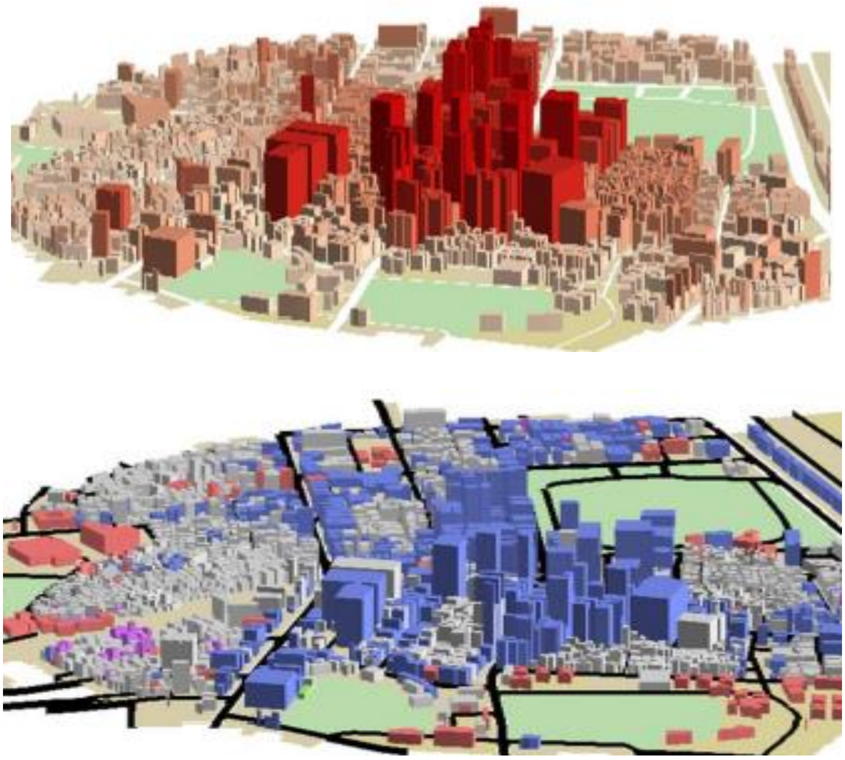


Figure 8-10 *Representation Of High Density (above) And Mixed Use Zones (Below) Around The Transit Zones.*

- These are recommended for higher densification with used and activity generators using Floor Space Index as a vital tool. Currently the FSI value in the city is 1.5. It is recommended to increase.
    - A FSI up to 3-4 for TOD corridors and about 2 for Growth corridors with mixed residential and commercial zone is recommended.
- This zones are recommended to provide high quality highway access suitable for industry, logistic infrastructure, educational and skill development institutions, business facilities, residential and other support social infrastructure.

- These corridors would provide access to public transport with 5mins of walk form the trip origins.

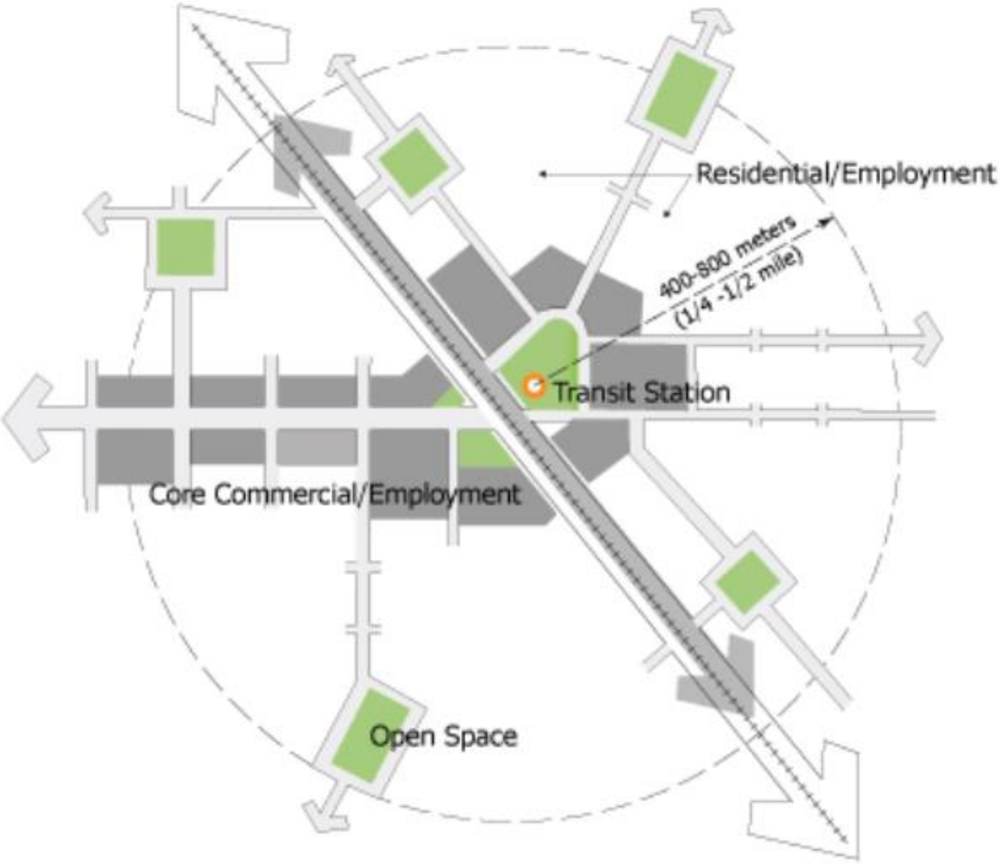


Figure 8-11 *Walkable Core Transit Area (500m) Around A Transit Station*[41]

- These corridors would foster Non-Motorised Transport users through well-defined and seamless design pedestrian and bi-cycle infrastructure.

[41] Source: The Neat American Metropolis – Ecology, Community, and the American Dream – Peter Calthrope

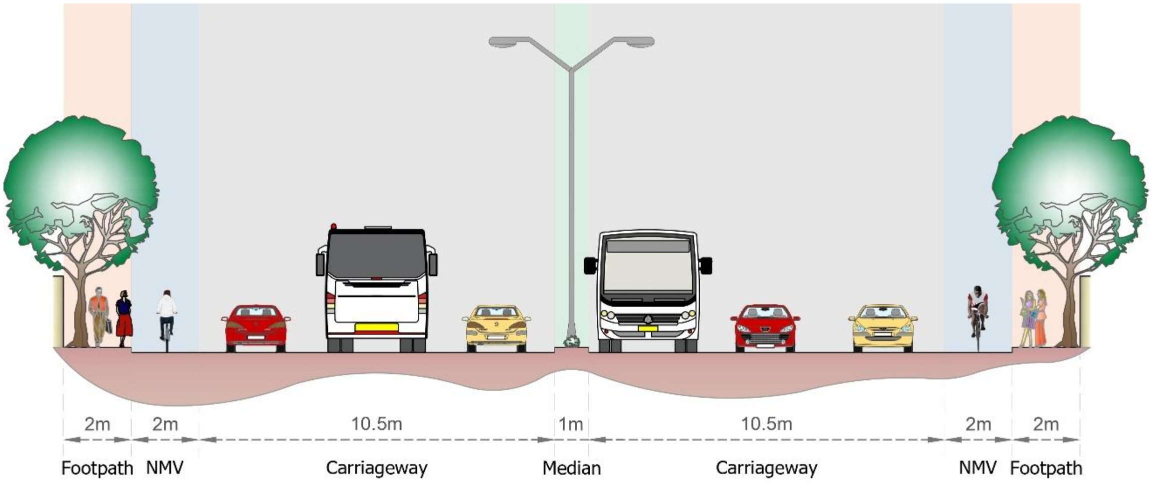
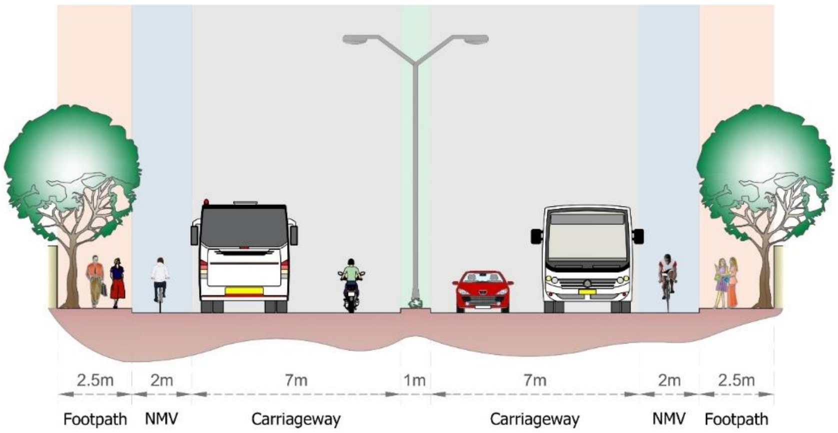
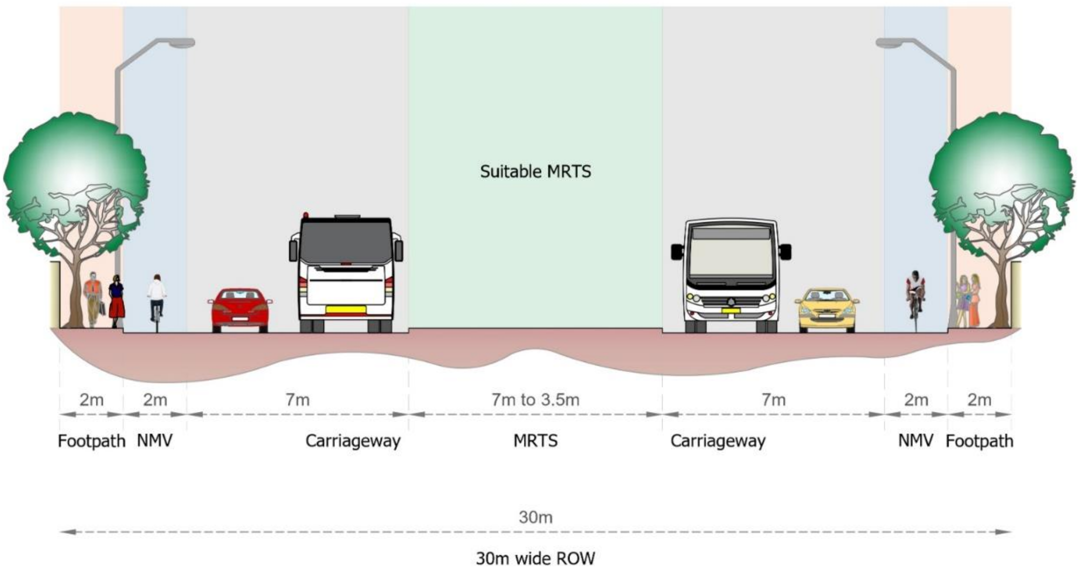


Figure 8-12 Typical Cross Section of 30m Wide Road for TOD / Growth corridors





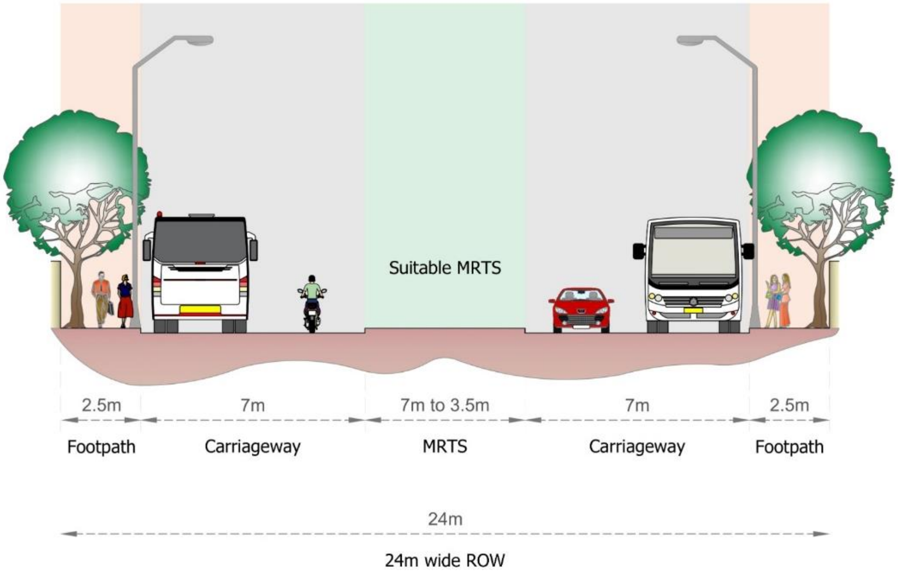


Figure 8-13 Typical Cross Section of 24m Wide Road (without MRTS Provision)-Top , 30m and 24m wide Road (With MRTS Provision)-middle and Bottom for TOD / Growth Corridors

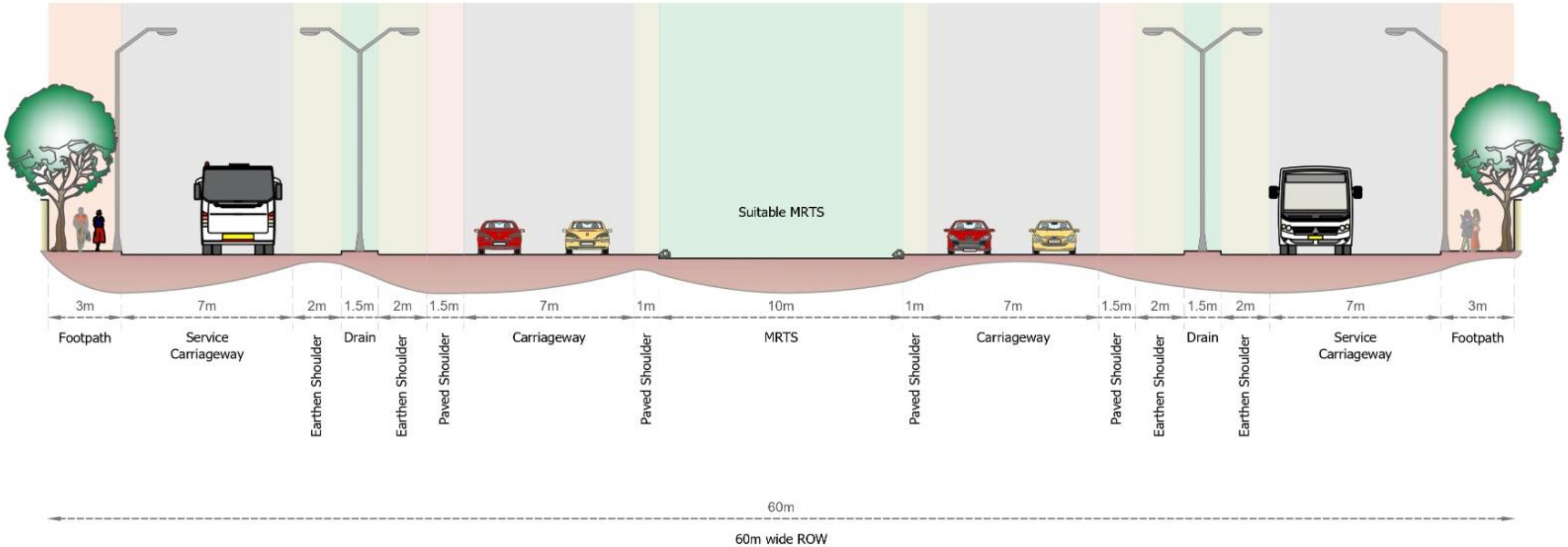
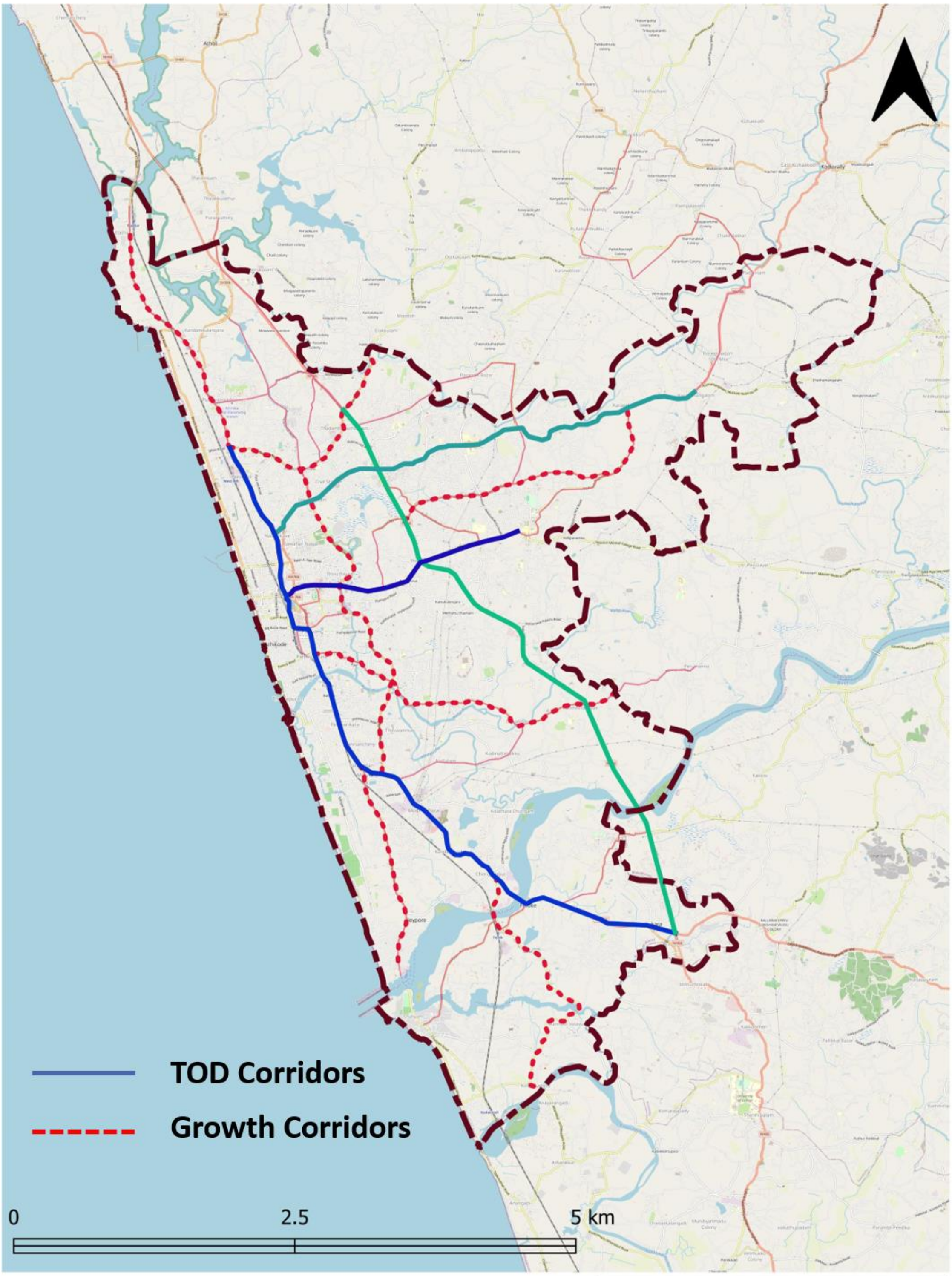


Figure 8-14 Typical Cross Section of 60m wide Road (With MRTS Provision) for TOD/ Growth Corridors



Title: Comprehensive Mobility Plan for Kozhikode	
Name: TOD & Growth Corridors	

Figure 8-15 Recommended TOD and Growth Corridors

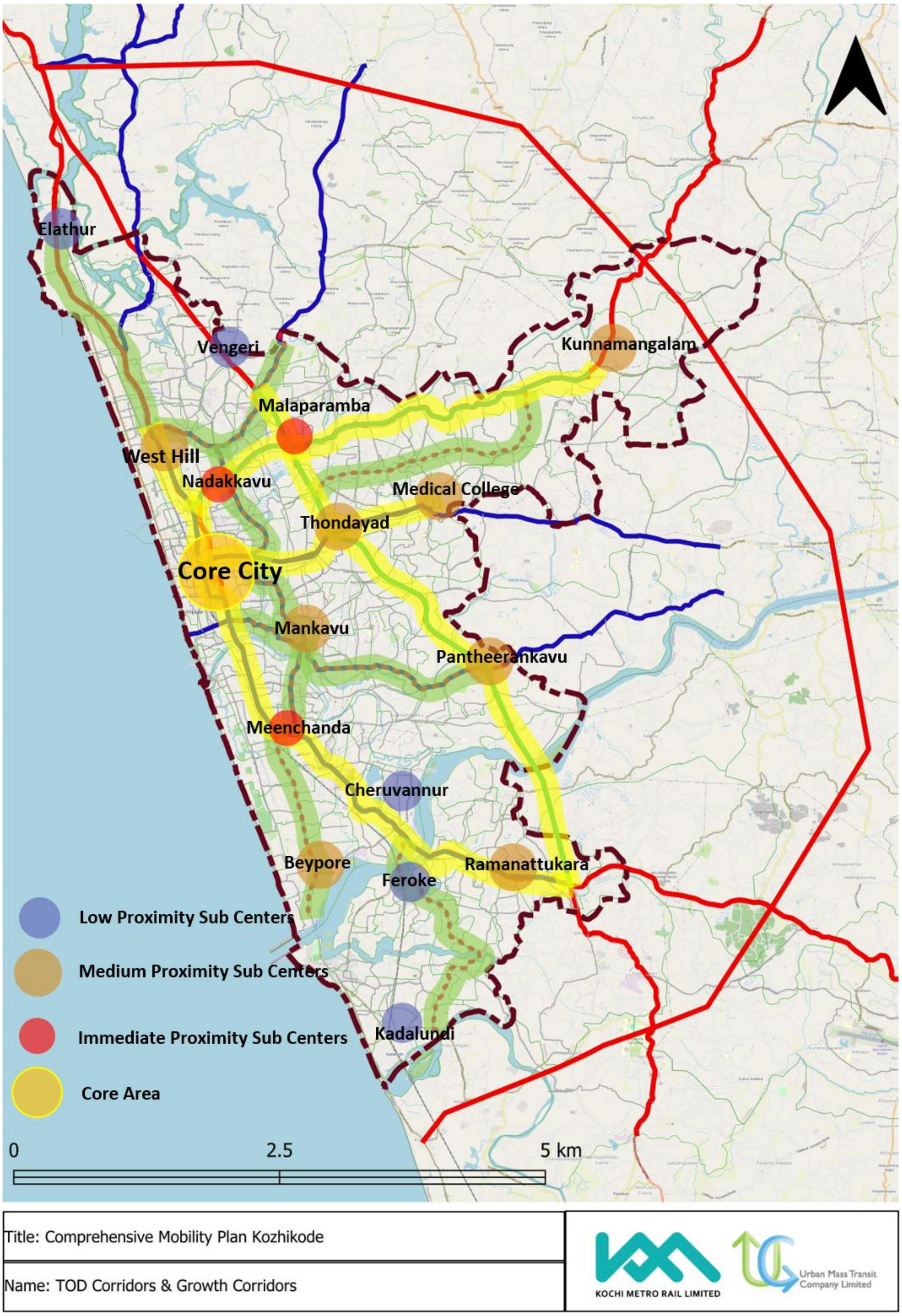


Figure 8-16 Recommended TOD and Growth Corridors With growth centers

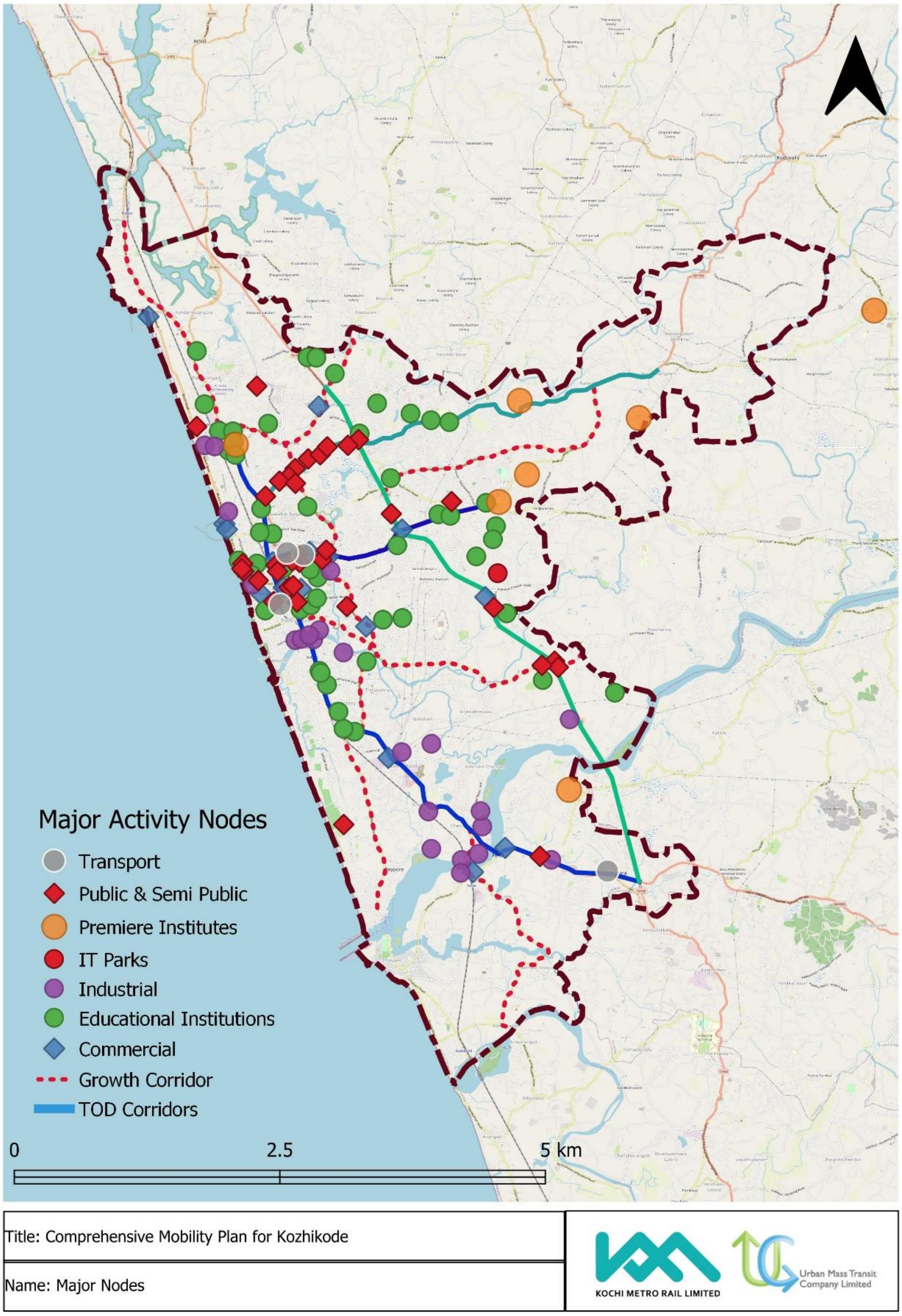


Figure 8-17 Map showing various existing activity nodes along the TOD and Growth Corridors

8.2 ROAD NETWORK STRATEGY

Road network is a system of interconnected paved carriageways which are designed to carry buses, cars, goods vehicles or any other moving travel mode and also include infrastructure facilities to move non-motorized transportation users. The road network generally forms the most basic level of transport infrastructure with urban areas. It is the backbone of any form of mobility. In order to provide mobility solutions for the Study Area. it is vital that there is effective integration between land use and transport in the entire region.

The Road network strategy includes:

- Development of clear network pattern.
- Upgradation of existing road network capacities.
- Development of new links.
- Development of River bridges, ROBs, RUBs wherever necessary.

8.2.1 NETWORK STRUCTURE

The road network spatially displays topologic and geometric variations in their structure. This strategy aims at defining a clear network pattern and hierarchy of roads. Considering the proposed land use, semi-ring and radial network structure has been proposed.

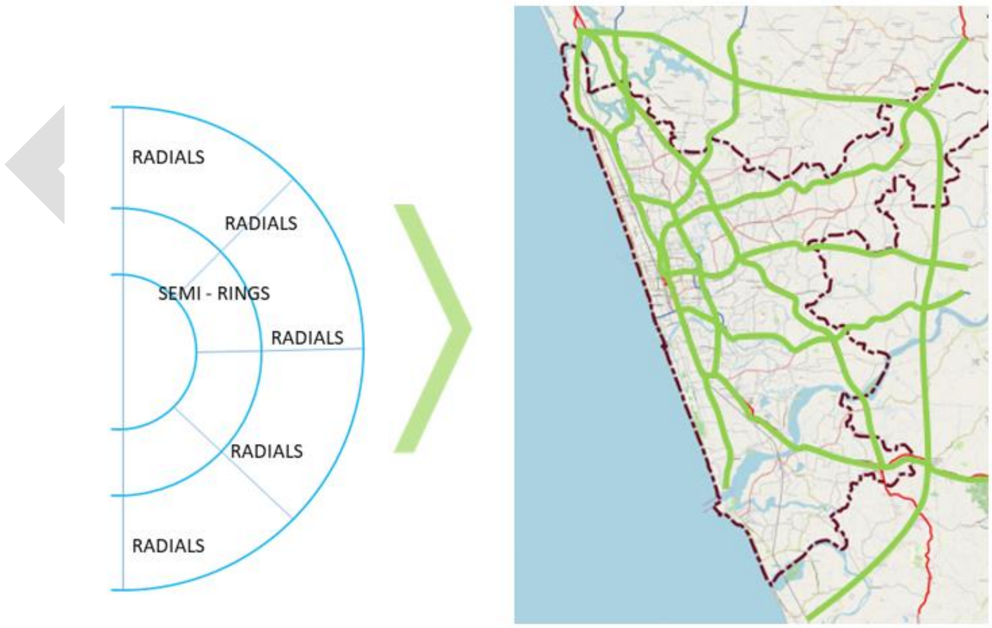
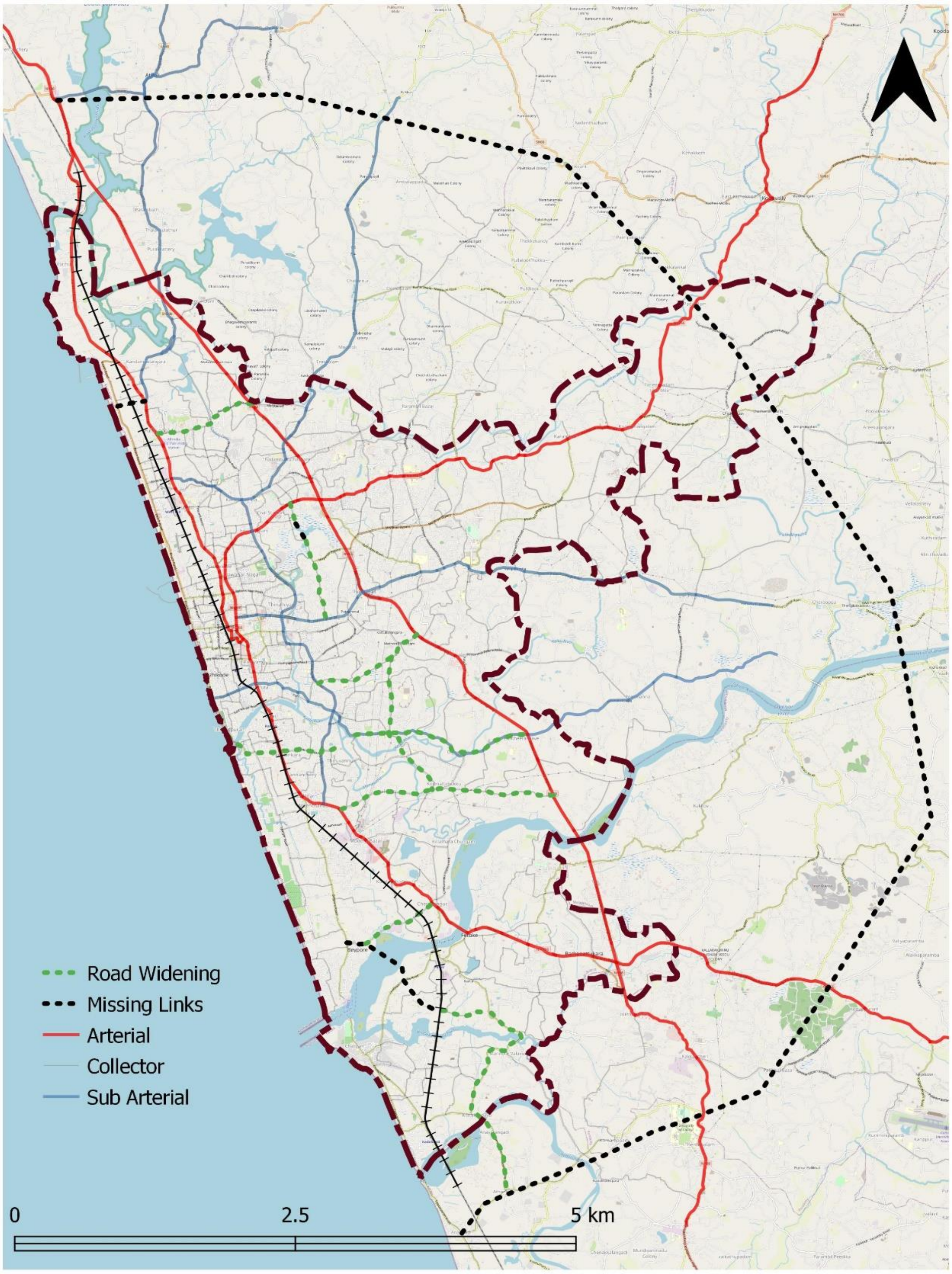


Figure 8-18 Conceptual Representation of Recommended Semi-Radial Network



Title: Comprehensive Mobility Plan Kozhikode	KOCHI METRO RAIL LIMITED / Urban Mass Transit Company Limited
Name: Road Widening Proposals and Missing Links	

Figure 8-19 Recommended Semi-Radial Network

Semi-Ring and Radial Roads area recommended for developing a clear network pattern in the study area is as follows,

Table 8-3 Recommended Semi-Radial Network

SN	NAME OF THE CORRIDOR	From	To	LENGTH (KM)	ROW (M)	TYPOLOGY
1	Atholi Kunnamangalam Athhanikkal Outer Ring Road	Thiruvangoor	Angadi	52	60	Outer Ring
2	NH-66	Eranjikkal	Ramanattukara	38.1	24	Ring
3	Mini-Bypass	West Hill Chungam Junction	Bypass Junction	11.6	24	Inner Ring
4	NH-766	Nadakkavu	Kunnamangalam	27.0	24	Major Radial
5	Mankavu Pantheerankavu Road	Nainanvalappu Beach	Perumanna	4.2	24	Major Radial
6	Beypore Cheruvannur Road	Beypore	Ramanattukara	6.4	30	Radial
7	Beypore Kadalundi Kottakadavu	Beypore	Vallikkunnu	42.0	30	Radial
8	Mavoor Road	Mavoor Road Junction	Mavoor	20.0	30	Radial

About 248 km of the network is recommended for developing a clear network pattern in the study area. Since these corridors include all the major spines within the study area, thus should be designed based on the standards.

Kozhikode can take up the project to develop such Street Design Standards, which can be further used for other streets as well.

Some portions of these networks need to be widened to function as a mobility corridor. These corridors would be expected to have the following cross-sectional elements:

- Uniform carriage way

- Continuous kerb, footpath and bi-cycle lanes
- Service roads where feasible
- Restriction or preferably prohibition of parking on the carriageway/shoulders
- At-grade/grade-separated public transport systems as per the public transport/mass transport master plan

The typical cross-sections for these mobility corridors are as depicted in the Figures Below.

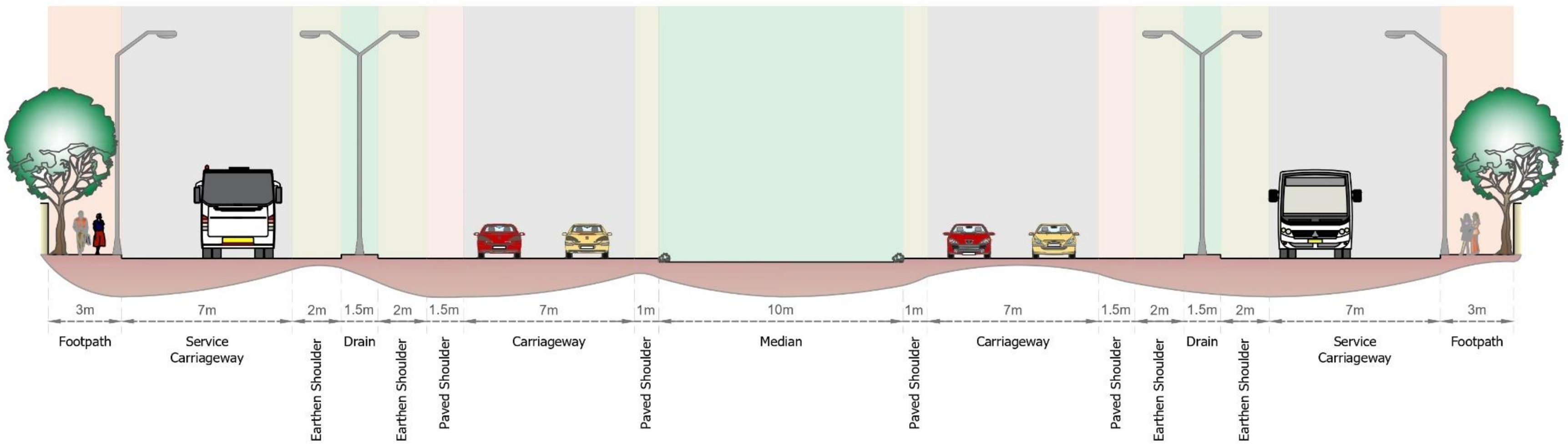


Figure 8-20 Typical Cross Section of 60m Wide Road

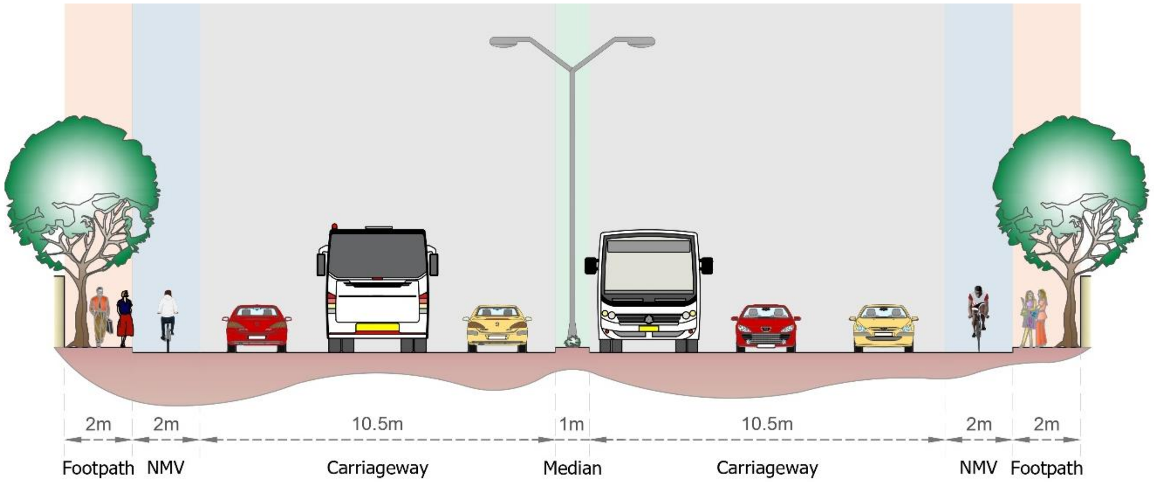


Figure 8-21 Typical Cross Section of 30m Wide Road

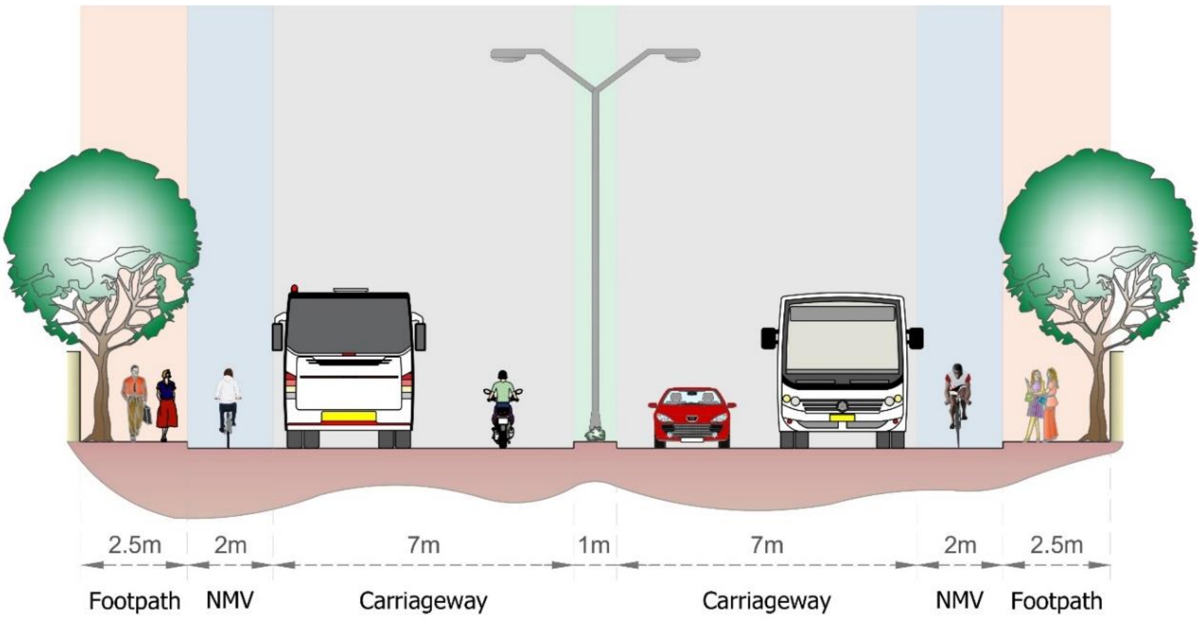


Figure 8-22 Typical Cross Section of 24m Wide Road

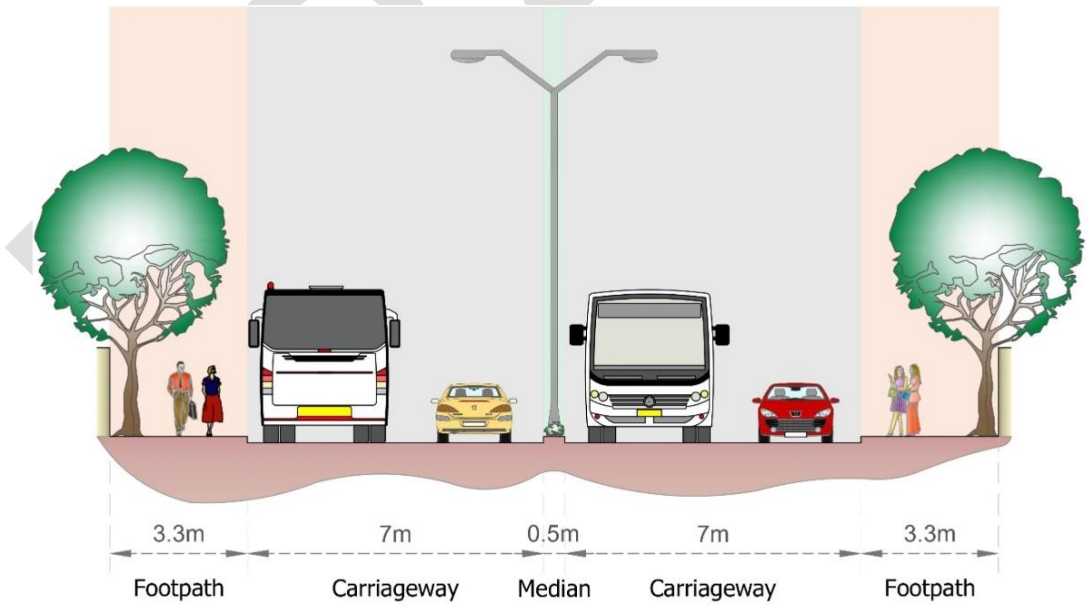


Figure 8-23 Typical Cross Section of 21m Wide Road

8.2.2 UPGRADATION OF EXISTING ROAD NETWORK CAPACITIES

The study recommends 87 km of network widening after considering the functional hierarchy and development need. The widening of roads is proposed for upgradation of existing lane capacities, provision or improvement of NMT facilities. The proposal is phased out into three considering the importance of the road and its connectivity. In Phase I, which is the priority one, a total of 14 km of road widening. Whereas in Phase II a total of 24.4 km road will be widened and in Phase 3, 48 km road will be widened. The corridors suitable for upgradation of lane capacities or widening based on the horizon year demand in the study area are as follows,

Table 8-4 Recommended Roads for capacity upgradation

Road Name	Lane	Class	Length
	Phase 1		
Thondayad Puthiyara Road	4 Lane	Collector	2.18
Madhuravanam Road	4 Lane	Collector	0.55
Cherooty Road	4 Lane	Collector	1.15
Bhatt Road	4 Lane	Collector	0.66
Mini Bypass	4 Lane	Sub Arterial	7.19
Rajaji Road	4 Lane	Collector	0.88
MM Ali Road	4 Lane	Sub Arterial	1.16
	Phase 2		
Mankavu Pantheerankavu Road	4 Lane	Sub Arterial	5.07
Wayanad Kommery Road	4 Lane	Collector	3.16
Mankavu Pantheerakkavu Road	4 Lane	Sub Arterial	3.37
Kommery Kulangarapeedika Road	4 Lane	Collector	2.06
Olavanna Road	4 Lane	Collector	5.9
Kayattiyil Road	4 Lane	Collector	2.07
Kunduparamba Road	4 Lane	Sub Arterial	2.84
	Phase 3		
Pallithara- Kadalundi RoadÂ	4 Lane	Sub Arterial	1.33
Beypore Road	4 Lane	Sub Arterial	5.89
Francis Road	4 Lane	Collector	1.21
Mankavu Mooriyad Road	4 Lane	Collector	2.34
Kovoor Vellaadikunnu Road	4 Lane	Collector	2.72
Kunduparamba Rd	4 Lane	Collector	2.21
Pavangad Atholi Rd	4 Lane	Collector	4.07
Calicut Road	4 Lane	Sub Arterial	4.16
Gandhi Road- Balan K Nair Road	4 Lane	Sub Arterial	2.74
Beypore Cheruvannur Road	4 Lane	Sub Arterial	5.84
Red Cross Road	4 Lane	Collector	1.16
Kadalundi Kottakadavu	4 Lane	Sub Arterial	6.4
Railway Station Road	4 Lane	Collector	1.05

Road Name	Lane	Class	Length
Mavoor Road	4 Lane	Sub Arterial	7.4

8.2.3 DEVELOPMENT OF MISSING LINKS/NEW LINKS

In order to decongest the existing roads and to foster the ease of commuting new roads or missing links have been identified and recommended in the study area. The details of the same are as presented below,

Table 8-5 Recommended New Links

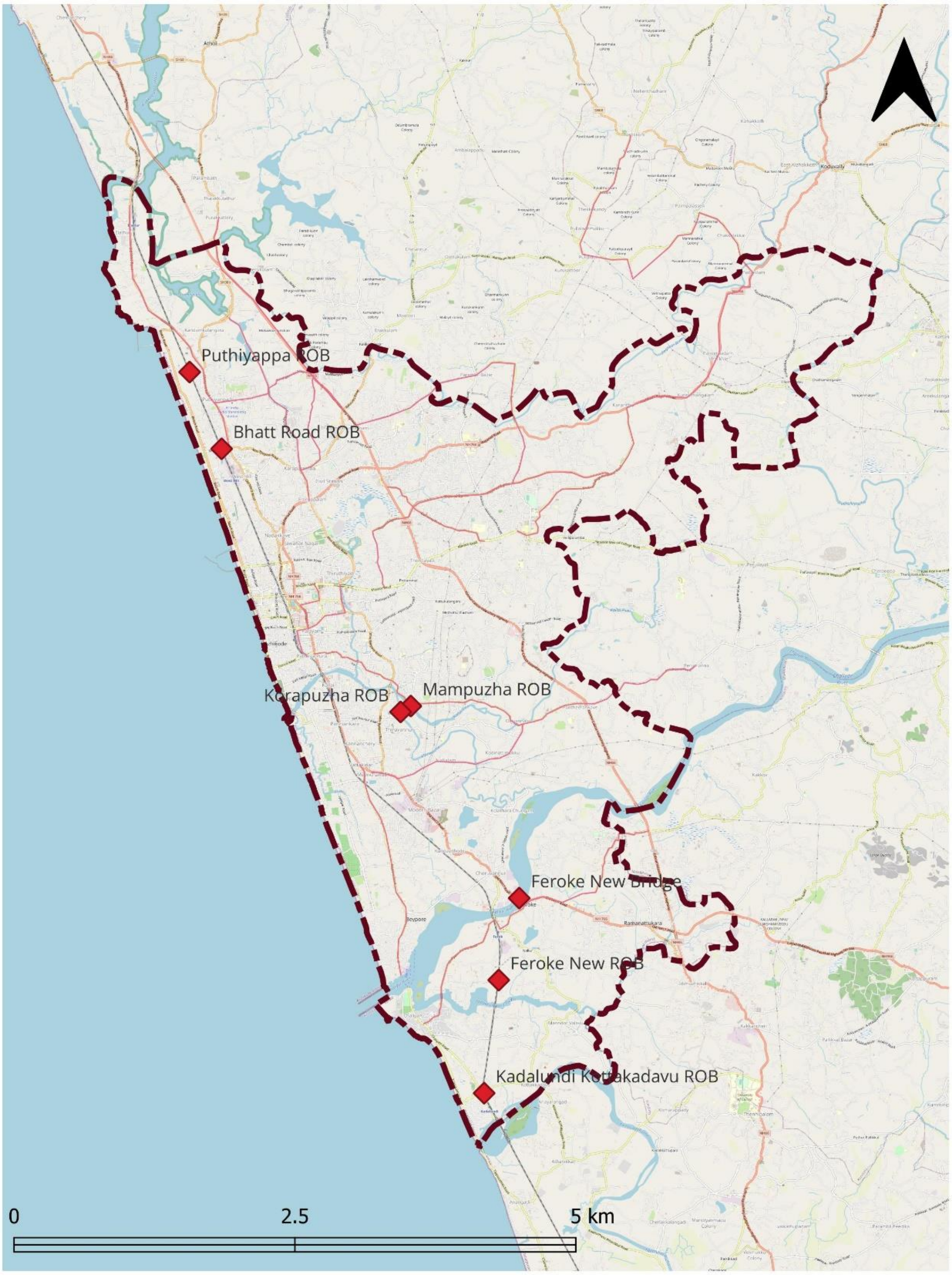
S. NO.	NAME OF THE CORRIDOR	PROPOSED ROAD LENGTH (KM)	PHASE
1	Outer Ring Road	52	III
2	Chembra Link	0.544	I
3	Puthiyappa Link	0.747	I
4	Beypore Feroke Link	3.3	II
5	Beypore NH 66 Freight Bypass	7.38	III
6	Kunduparamba Bypass	2.45	III
7	Kalandithazham Road	2.21	III
8	Mampuzha- Korapuzha	0.449	III

8.2.4 DEVELOPMENT OF GRADE SEPARATORS

Adequate road infrastructure and completeness of network structure is always necessary to support smooth flow of passengers. More efficient infrastructure will enable better mobility for people and goods as well as provide better connection between regions. As the study area is physically segregated by the Railway track and canals, road bridges are proposed to enable smooth flow across the study area. The study recommends 7 crossing which includes 3 railway crossings and 4 canal crossings. The locations are presented below.

Table 8-6 Recommended Upgradation of Grade Separators

S. NO.	NAME OF THE CORRIDOR	TYPOLOGY	PHASE
1	Bhatt Road	ROB	I
2	Feroke New Bridge	ROB	III
3	Puthiyappa Bridge	ROB	III
4	Mampuzha ROB	ROB	III
5	Korapuzha ROB	ROB	III
6	Kadalundi Kottakadavu ROB	ROB	III
7	Feroke ROB	ROB	III



Title: Comprehensive Mobility Plan for Kozhikode	
Name: Grade Seperators	

Figure 8-24 Recommended Upgradation of Grade Separators

Figure 8-25 Recommended for construction of Grade Separators At Bhatt Road

8.3 PUBLIC TRANSPORT STRATEGY

Public transport is one of the most environmentally sustainable forms of transport. The public transport improvement strategy includes service improvements for buses, trams and para-transit, appropriate Mass Rapid Transit (MRT) Options and infrastructure development plans and intermodal integration plans.

This strategy deals with development of hierarchy of public transport modes in Study Area, which are integrated with other and avoid competing with each other. The hierarchy of systems aims at improving the efficiency of the public transport system and providing a seamless, integrated public transit services to the users.

The proposals under public transport improvement strategy are:

- Development of Mass Transit System
- City Bus Rationalization and Augmentation
- Inland Water Ways
- Development of PT Terminals

The major mobility corridors in the study have been identified through primary assessment of the traffic and transportation data collected through primary and secondary sources and travel demand model outputs.

Figure 8-26 Available Hierarchy of Public Transit Systems

8.3.1 MASS TRANSIT SYSTEMS

A Mass Transit System is designed to move large numbers of people at one time. Mass Rapid Transit system usually runs in special guideways which will lead to lower travel time, and decreased congestion.

The selection of suitable mass transit system is based on the Passengers per Hour per Direction (PPHPD) and feasibility of implementation, along with other parameters as mentioned below.

SELECTION CRITERIA[42]

A. Effectiveness of mode in meeting demand
B. Cost
C. Right of way availability
D. Environmental Impact
E. Journey Time
F. Safety
G. Comfort
H. Flexibility
I. Reliability
J. Fare
K. Technical Sophistication
L. Implementation Complexities
M. Image

The guidelines for selection of mass rapid transit choice for the city is given as specified by working group on Urban Transport for 12th Five Year Plan of India.

Table 8-7 Selection Criteria of Mass Rapid Transit

MODE CHOICE	DESIRABLE PHPDT	POPULATION (MILLION)	AVERAGE TRIP LENGTH (KM)
Metro Rail (Light, Medium, Heavy)	>15000 for at least 5 km continuous length	>=2	>7-8
LRT Elevated	>15000	>1.5	>7-8
LRT primarily at grade	<=10000	>1	>7-8
Monorail	<=10000	>1	About 5-6
Bus Based Systems (BRTS)	>=4000 and up to 15000	>1	>5
Organized City Bus Service as per urban bus specifications		>1 lac, 50,000 in case of hilly towns	>2 to 3

[42] *UNDP Reference Guide, Vol 2: Public Transport – 2013, MoUD, GoI*

The major mobility corridors in the study area are,

Table 8-8 Major Mobility Corridors in the Study Area

SN	NAME OF THE CORRIDOR	From	To
1	Mavoor Road	Thondayad	Kunnamangalam
2	Mavoor Road	Mavoor Road Jn	Thondayad
3	SH 28, NH 966, Calicut Road	Ramanattukara	Meenchanda
4	NH-66	Vengeri Jn	Thondayad Jn
5	Mini- Bypass Road	Arayadathu Paalam Junction	Bypass Junction
6	SH 28, NH 966, Calicut Road	Meenchanda	Mananchira
7	Kannur Road	Mananchira	West Hill
8	NH-66	Thondayad Jn	Ramanattukara
9	NH 766, Wayanad Road	Kunnamangalam	Malaparamba Jn
10	Mini- Bypass Road	Eranjippalam	Arayadathu Paalam Junction
11	Kannur Road	West Hill	Elathur
12	Feroke City Road	Cheruvannur	Kottakadavu Bridge
13	Beach Road	Bhatt Road	Gandhi Road
14	Mini- Bypass Road	West Hill Chungam	Eranjippalam
15	Beach Road	Gandhi Road	East Kallayi Road
16	Puthiyara Road	Canoli Canal	Pottammal Jn
17	Karaparamba Road, Kozhikode Balusserry Road	Kakkodi	Karaparamba
18	Pavamani, Puthiyara Road	Mananchira	Canoli Canal
19	Beypore Road	Meenchanda	Beypore Port
20	NH 766, Wayanad Road	Malaparamba Jn	Mananchira
21	Oyitty Road	Palayam Junction	Mananchira
22	MM Ali Road, Jail Road	Palayam Junction	Mini Bypass

The assessment resulted in the identification of potential corridors for the development of higher capacity mass transit system. A Mass Transit System is designed to move large numbers of people at one time. Mass Rapid Transit system usually runs in special guideways which will lead to lower travel time, and decreased congestion. The suitable corridor has been identified based PPHPD however, a detailed study has to be carried out assess the feasibility of these corridors based on other screening criteria.

Table 8-9 Proposed MRTS Routes

SN	NAME OF THE CORRIDOR	LENGTH (KM)	PHASE
1	West Hill to Ramanattukara	19	I
2	Beach Road to Medical College	8.1	I

SN	NAME OF THE CORRIDOR	LENGTH (KM)	PHASE
3	Nadakkavu to Kunnamangalam	12.8	III
4	Vengeri to Ramanattukara	17.2	III

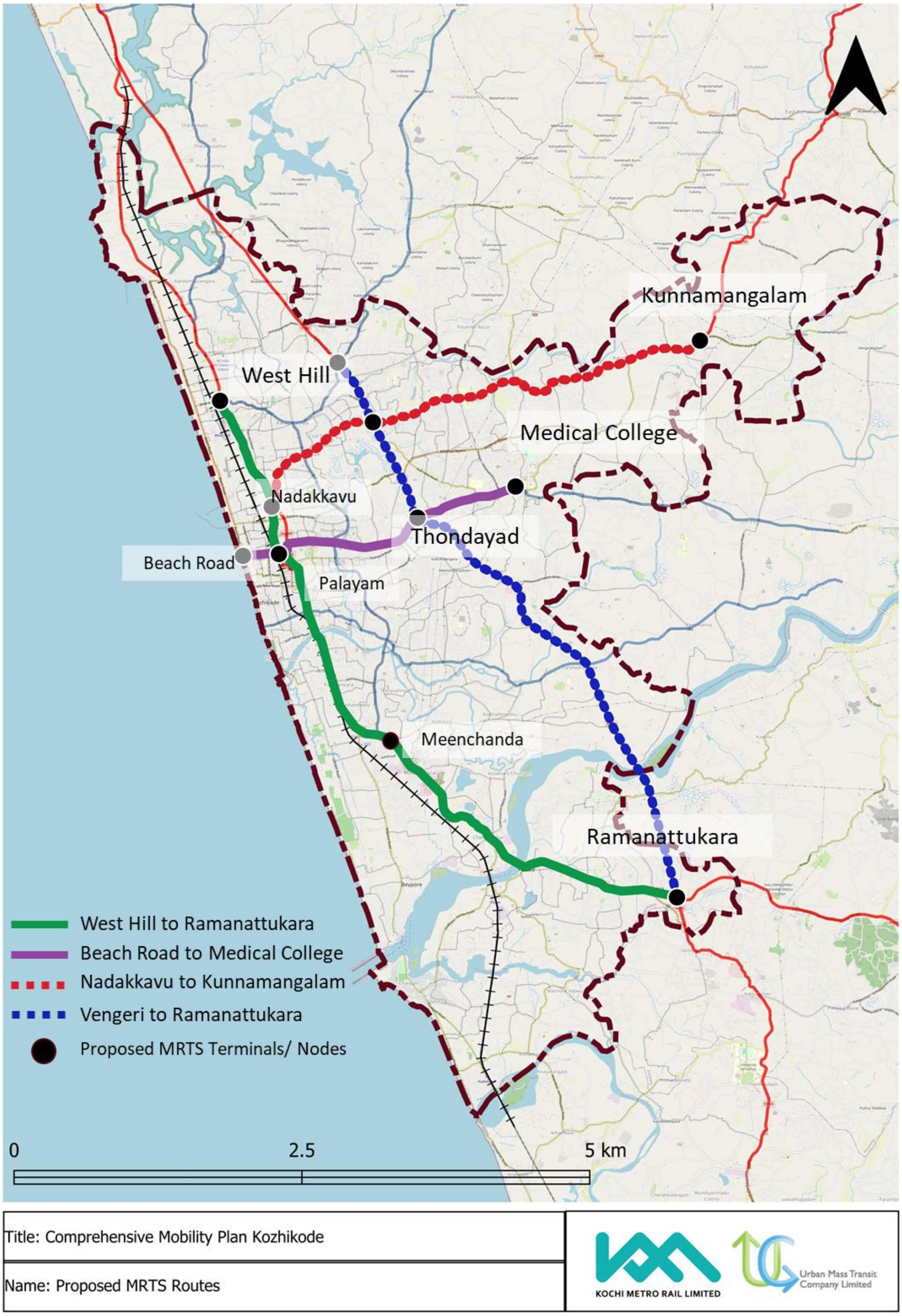


Figure 8-27 Recommended MRTS Corridors

Table 8-10 Proposed MRT Corridors

S.NO	NAME OF THE CORRIDOR	PPHPD 2027	2031	2041	2051
1	West Hill to Ramanattukara	5471	6407	7925	10792
2	Mananchira to Medical College	3985	4682	6021	8097

In case of the Kozhikode about 27 of MRTS corridors have been identified for the initial phase with a based year Max PPHPD of 3000 and nearly over 11000 in the horizon years. Considering the demand on the major mobility corridors the most suitable mass transit modes would be a light rail based or bus based system, the specifics of which would come as a result of the alternate analysis study.

SUT Population & Employment -Alternate Scenario

The master Plan of 2041 has predicted a growth of dependency on the corporation area for employment by the resident population of the vicinity areas in Kozhikode and Malappuram. It is assumed that a major part of this population will not permanently shift to the study area but will rather chose to stay in the city temporarily for employment. Thus in this Scenario, in addition to all the assumptions considered in the Scenario 1, an additional 20% of population is assumed to stay at the proposed TOD zones (based on the past developmental trends in Kochi and Thiruvananthapuram) of the study area.

*Subsequently, estimating a much greater development in the city a radical shift towards public transport in this scenario is anticipated, with an introduction of additional penalties on IPT and private modes, along with a revision in the public transport fares to make public transport more attractive.

Table 8-11 Comparison of Projected Population and Employment Scenario (in Lakhs)

	2031	2041	2051
Population	13.16	16.6	21.1
Employment	5.3	6.7	8.6

The results of the alternate scenario are as follows:

Table 8-12 Proposed MRT Corridors- Results of Alternate Scenario

S.NO	NAME OF THE CORRIDOR	PPHPD 2027	2031	2041	2051
1	West Hill to Ramanattukara	7256	8292	9675	13677
2	Mananchira to Medical College	5224	5887	7547	10711

8.3.2 CITY BUS RATIONALIZATION

City Bus systems play a major role in achieving sustainable mobility. These systems have higher coverage and form a strong base for the development of Mass Transit Systems. Thus, it is crucial to improve, augment, strengthen and integrated the city bus services with the other modes. This study strategizes Route Rationalization for the same.

Further, a route to route overlap analysis has been carried out for bus services in Kozhikode is observed that about 15% of the routes have above 60% average route overlap with the proposed trunk routes or MRTS corridors. Thus, these routes were cross-analysed with the headways, modelled demand and trips per route to improve the efficiency of the bus system though rationalization.

Currently there 365 Bus permits in Kozhikode, of with 70 permits / routes are operational. It is recommended to retain the cap on the private bus permits. Further, it is recommended to rationalise 70 routes which are observed to be overlapping with the Proposed MRTS Corridor from West Hill to Ramanattukara by re-outing from alternative corridors.

Table 8-13 Route Rationalization Proposals

RATIONALIZATION OF ROUTES	2027
Total No. of Routes	345
Total No. of Routes for Curtailed/Modified	17

The details of the routes are as follows,

Table 8-14 Recommended Private Bus routes for Rationalization

SN	NAME OF THE CORRIDOR	NATURE OF OVERLAP	RECOMMENDATION	PHASE
1	Elathur Kunnamangalam	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
2	Meenchanda- Beypore	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
3	Kunnamangalam- Narikunni	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
4	Meenchanda-Perumanna	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
5	Eranjipalam- Karapparamba- Mukavoor	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
6	Vengeri- Puthiyangadi	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
7	Medical College- Kunnamangalam	Overlap with Proposed Transit System	Re-routing the overlap section	Phase II
8	Chaliyam-Feroke	Overlap with City Services	Re-routing the overlap section	Phase II
9	City-Palayam	Overlap with City Services	Re-routing the overlap section	Phase II
10	Feroke- Azhinjilam	Overlap with City Services	Re-routing the overlap section	Phase II
11	Vengeri-Purakkatteri	Overlap with City Services	Re-routing the overlap section	Phase II
12	Madhavan Nair Rd	Overlap with City Services	Re-routing the overlap section	Phase II
13	Railway Station-Palayam	Overlap with City Services	Re-routing the overlap section	Phase II
14	Golf Link Road	Overlap with City Services	Re-routing the overlap section	Phase II
15	Canoli Link	Overlap with City Services	Re-routing the overlap section	Phase II
16	Mayanad Bypass	Overlap with City Services	Re-routing the overlap section	Phase II
17	Parambil Bazaar Thadambattuthaazham	Overlap with City Services	Re-routing the overlap section	Phase II

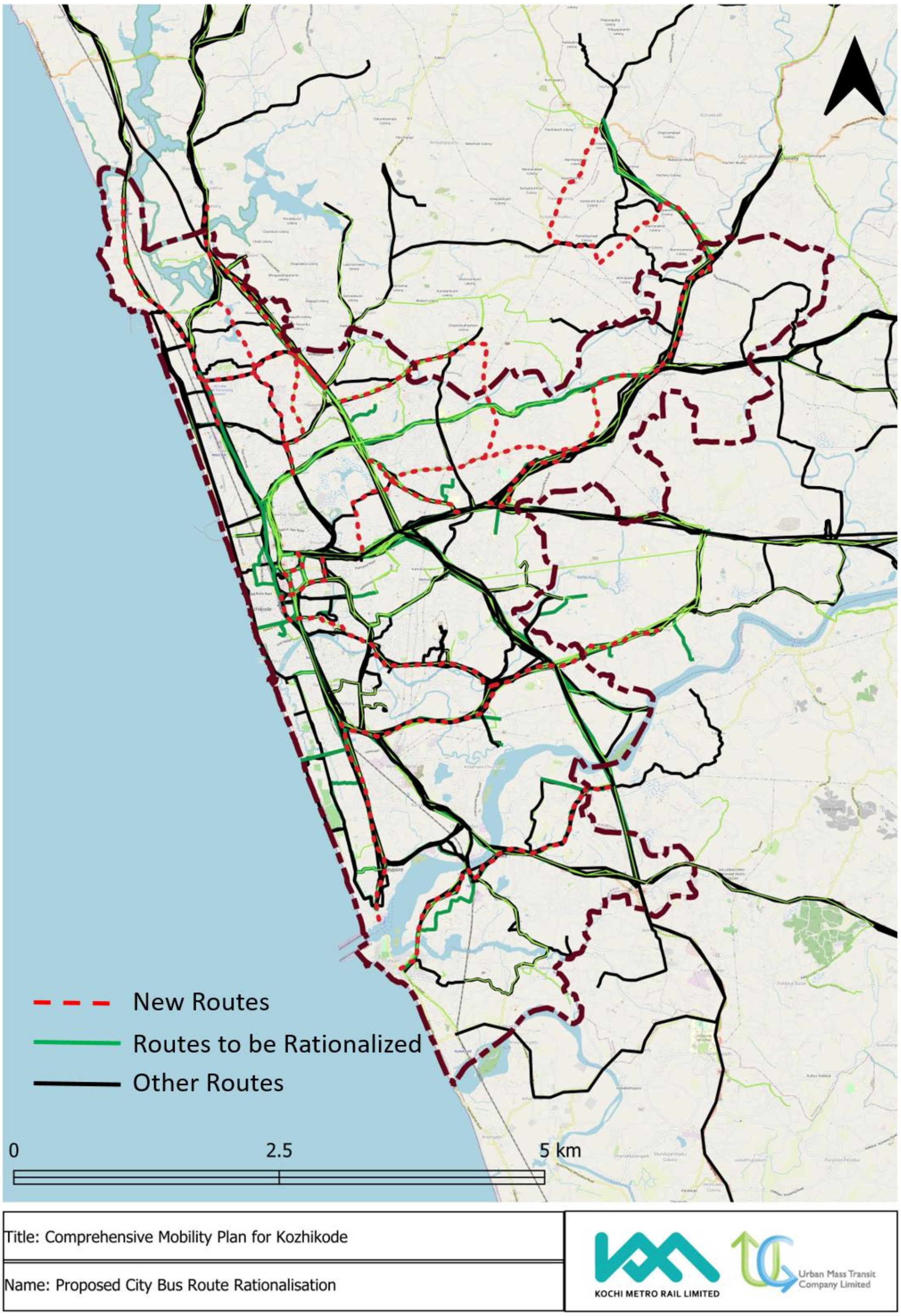


Figure 8-28 Rationalised Private City Bus Routes

8.3.3 PUBLIC TRANSPORT FLEET AUGMENTATION

The existing assessment of Public Transport bus routes in the study area indicate that there are around 365 buses plying with the study area dedicated unser city (partly sub-urban) operations.

Based on the route rationalization plan, Bus Transit Corridors and estimated demand, the number of buses required the study area for the horizon years are computed. Fleet requirement is over the years is estimated based on various norms and demand and is presented in the Table below

Table 8-15 Fleet Requirement Over The Years[43]

YEAR	POPULATION	EXISTING FLEET	RECOMMENDED FLEET SIZE	BUSES TO BE SCRAPPED	ADDITIONAL FLEET REQUIRED
2023	10,63,218	365	532		167
2027	11,43,467		572	57	97
2031	12,30,193		615	62	105
2041	14,78,985		739	74	198
2051	17,81,441		891	89	241

CMP recommends a standing bus fleet of 864 by 2031 and 946 buses with 80% fleet being Electric by 2051.

8.3.4 NEW CITY BUS ROUTES

On assessment have been 6 corridors have identified as new city bus corridors as secondary corridors to the primary proposed MRTS corridors in addition to the existing bus routes. These routes are dedicated for city based bus operations. The details of the same are as presented below,

Table 8-16 New City bus Routes recommended for Kozhikode[44]

ROUTE	LENGTH (KM)	SUT_2027	SUT_2031	SUT_2041	SUT_2051	BUS TECHNOLOGY
Elathur Kunnamangalam	7.3	5	9	16	24	ELECTRIC BUS
Kunnamangalam-Narikunni	14	4	7	13	20	ELECTRIC BUS
Meenchanda-Perumanna	9.8	9	13	18	35	ELECTRIC BUS
Medical College-Kunnamangalam	7.5	4	6	13	19	ELECTRIC BUS
Mayanad Bypass	8.4	3	6	11	16	ELECTRIC BUS
Parambil Bazaar Thadambattuthaazham	8	4	7	13	20	ELECTRIC BUS
Total		28	47	84	134	

[43] The proposed fleet size includes the fleet required on the proposed new routes.

[44] The proposed fleet size includes the fleet required on the proposed new routes.

8.3.5 FEEDER OR MINI BUS ROUTES

On assessment have been 11 corridors have identified as feeder routes to bus and MRT corridors as secondary corridors to the primary proposed MRTS corridors in addition to the existing bus routes. These routes are dedicated for city based bus operations. The details of the same are as presented below,

Table 8-17 New City Bus Routes and fleet in the Study Area

Route	**Length (km)**	**SUT_2027**	**SUT_2031**	**SUT_2041**	**SUT_2051**	**Bus Technology**
Vengeri-Purakkatteri	6.3	6	15	9	16	ELECTRIC MINI BUS/VAN
Madhavan Nair Rd	6.5	5	13	8	14	ELECTRIC MINI BUS/VAN
Meenchanda- Beypore	5.8	4	9	6	10	ELECTRIC MINI BUS/VAN
Eranjipalam-Karapparamba-Mukavoor	5.5	3	8	5	8	ELECTRIC MINI BUS/VAN
Chaliyam-Feroke	5	3	8	5	8	ELECTRIC MINI BUS/VAN
Feroke- Azhinjilam	4.6	3	7	5	8	ELECTRIC MINI BUS/VAN
Vengeri- Puthiyangadi	4.2	0	7	5	8	ELECTRIC MINI BUS/VAN
Golf Link Road	3.2	0	7	5	8	ELECTRIC MINI BUS/VAN
Railway Station-Palayam	2.9	0	7	4	8	ELECTRIC MINI BUS/VAN
Canoli Link	2.9	0	7	4	8	ELECTRIC MINI BUS/VAN
City-Palayam	1.6	0	6	4	7	ELECTRIC MINI BUS/VAN
Total		26	94	59	104	

8.3.6 INLAND WATER TRANSPORT

Inland Waterways are recommended on 4 routes of 52 km in the study area and the details of the same are as presented below,

Table 8-18 Inland Water Transport Routes

SN	ROUTES	LENGTH (KM)	PHASE
1	Elathur to Kallayi via Canoli Canal	17.2	Phase I
2	Kallayi to Kolathara via Korappuzha	10.1	Phase I
3	Palazhi to Azheekkal via Mampuzha	12.3	Phase II
4	Azhinjillam to Beypore via Chaliyar River	12.3	Phase II

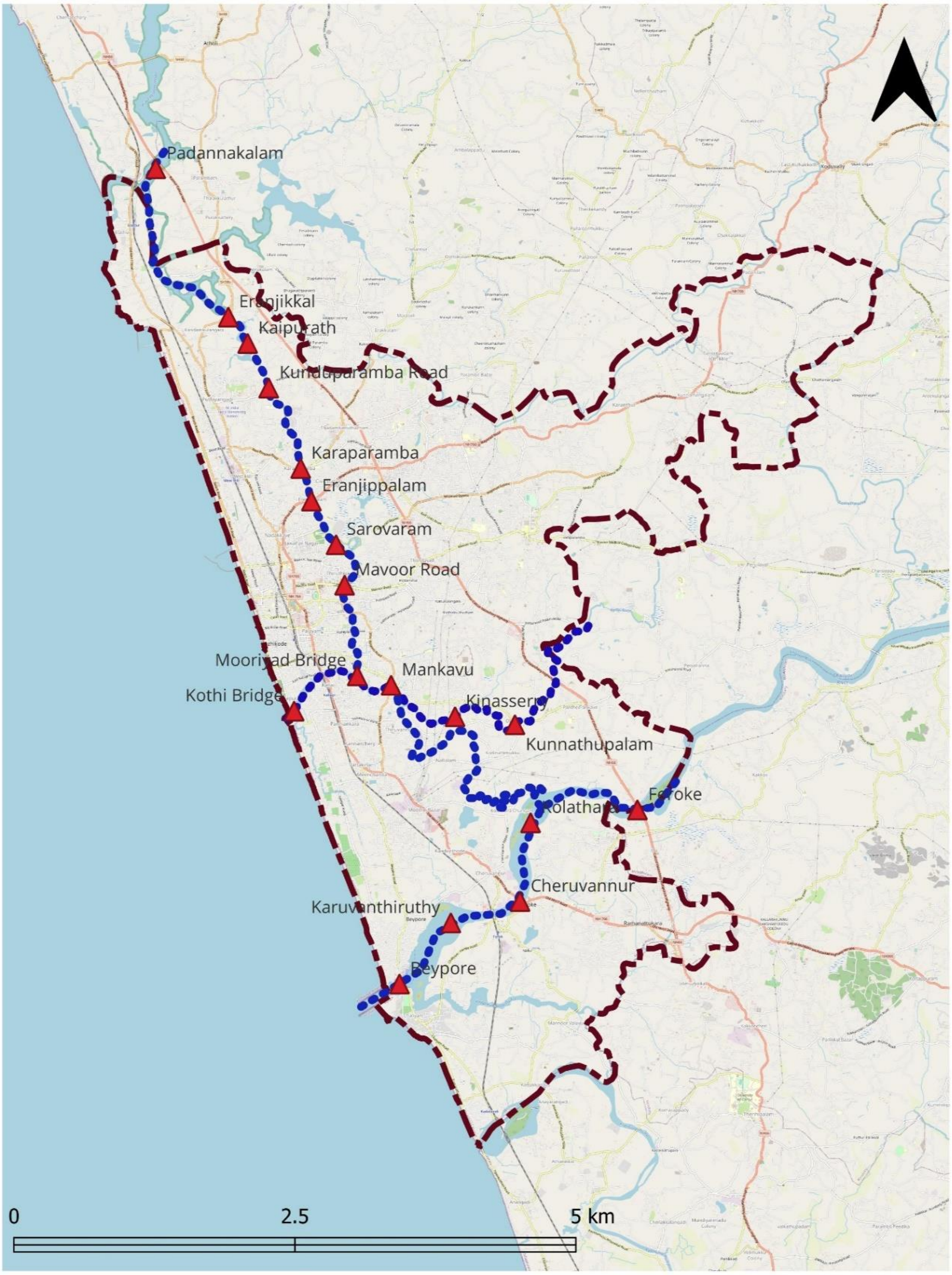
Figure 8-29 Existing Canoli Canal Sections

Electric boats of capacity 25-35 capacity with an operating speed of 14kmph at 15-20 mins headway is recommended. Smaller boats are recommended as majority of the corridors are operate parallel to the mass transit corridors. However, these can be operated under tourism circuit along with daily commuting.

A holistic infrastructure is recommended to be developed, with Stations and Terminals.

Table 8-19 Inland Water Transport Routes and Fleet

SN	ROUTES	LENGTH (KM)	2031	2041	2051
1	Elathur to Kallayi via Canoli Canal	17.2	23	15	26
2	Palazhi to Azheekkal via Mampuzha	12.3	14	9	16
3	Palazhi to Azheekkal via Mampuzha	12.3	-	10	17
4	Kallayi to Kolathara via Korappuzha	10.1	-	5	9



Title: Comprehensive Mobility Plan for Kozhikode	KOCHI METRO RAIL LIMITED / Urban Mass Transit Company Limited
Name: Inland Water Transport	

Figure 8-30 Proposed Inland Water Transport

19 Inland Waterways Station and terminals are recommended the details of the same are as presented below,

Table 8-20 Inland Water Transport Stations

SN	Stops	Routes	Typology	PHASE
1	Padannakalam, Elathur	Canoli Canal	Terminal	Phase I
2	Eranjikkal	Canoli Canal	Station	Phase I
3	Kaipurath	Canoli Canal	Station	Phase I
4	Kunduparamba Road	Canoli Canal	Station	Phase I
5	Karaparamba	Canoli Canal	Station	Phase I
6	Eranjippalam	Canoli Canal	Terminal	Phase I
7	Sarovaram	Canoli Canal	Station	Phase I
8	Mavoor Road	Canoli Canal	Station	Phase I
9	Mooriyad Bridge	Canoli Canal	Terminal	Phase I
10	Kothi Bridge	Kallayi River	Terminal	Phase II
11	Mooriyad Bridge	Kallayi River	Station	Phase II
12	Mankavu	Kallayi River	Station	Phase II
13	Kinasserry	Kallayi River	Station	Phase II
14	Kunnathupalam	Kallayi River	Terminal	Phase II
15	Karuvanthiruthy	Chaliyar River	Station	Phase II
16	Beypore	Chaliyar River	Station	Phase II
17	Cheruvannur	Chaliyar River	Station	Phase II
18	Kolathara	Chaliyar River	Station	Phase II
19	Feroke	Chaliyar River	Station	Phase II

8.3.7 PUBLIC TRANSPORT TERMINALS

The CMP also recommends the de-centralization of KSRTC sub-urban services and private sub-urban services from the city centre- Kozhikode, Mavoor Road Junction. The KSRTC services operate in Hub and spoke model between major hubs and minor hubs for city and sub-urban services. The current terminal may be shifted to Thondayad which is a suitable location to cater internal- internal trips, internal-external trips and external external trips.

Table 8-21 Bus Terminal Usage

SN	TERMINAL	AREA (Acres)	TYPOLOGY
1	Kozhikode City	1	City Services / limited sub-urban
2	Thondayad	3	Major Sub-urban Services (north-east)
3	Kunnamangalam	1	Sub-urban Services (north-east)
4	Elathur	2.44	Sub-urban Services (north)
5	Beypore	2.85	City Services
6	Ramanattukara	2.05	Sub-urban Services (South-east)
7	Medical College	1	Sub-urban Services (north-east)
8	Palayam	1	City Services / limited sub-urban

8.3.8 MULTI – MODAL MOBILITY HUBS

At the intersection of each mobility corridor/ transit corridor with the inner ring road/ outer ring road of the city, a transfer terminal should be facilitated. The transfer terminal is technically called as Multi – Modal Mobility Hubs (MMMH). Commuters can come from their places in personal vehicles to the public transport mode and make use of all the public amenities provided and return to their destinations. They get all their daily requirements at a single place. This will help the city to minimize congestion and also reduce the pollution hazards.

The main objective of these hubs is to provide Urban Transport Infrastructure with several amenities under one roof and encourage the following:

- To meet some of the objectives of the Indian National Urban Transport Policy (NUTP).
- To provide an integrated transport facility with adequate amenities and conveniences to cater to the requirements of all users group.
- To ensure smooth flow of traffic to and from the terminal so that there is no congestion / disturbance caused to the traffic along the main road.
- Minimum / no conflict between passengers, buses, private vehicles and other road users to achieve minimum passenger and vehicle processing time.
- To encourage use of public transport and provide first-last mile connectivity through provision of park and ride facilities in the proposed bus terminal.
- To facilitate commuters to park their personal vehicles & access to public modes of Mass Transport.

MMMH imbibe following civil infrastructure components like:

- Bus Depot / Terminal / stand
- Integrated passenger amenities
- Park & Ride Facilities

Transport related facilities:

- Bus station for bus connectivity to different places
- KSRTC bus reservation counters
- Railway reservation counters
- Air booking / reservation counter
- Counter for Taxi / Auto-rickshaw services
- Counter for Tourism

The Minimum Basic facilities provided at such locations are as follows:

- Clean drinking water facility
- Clean hygienic Toilet facility
- Comfortable rest places for the passengers
- Multi-level 2-wheeler and 4- wheeler parking facility
- Police out post for security and safety of passengers
- 24 Hour Chemist Shop
- Post office counter
- Services bill payment counter
- ATM counters
- Food Court
- Departmental / Retail Stores

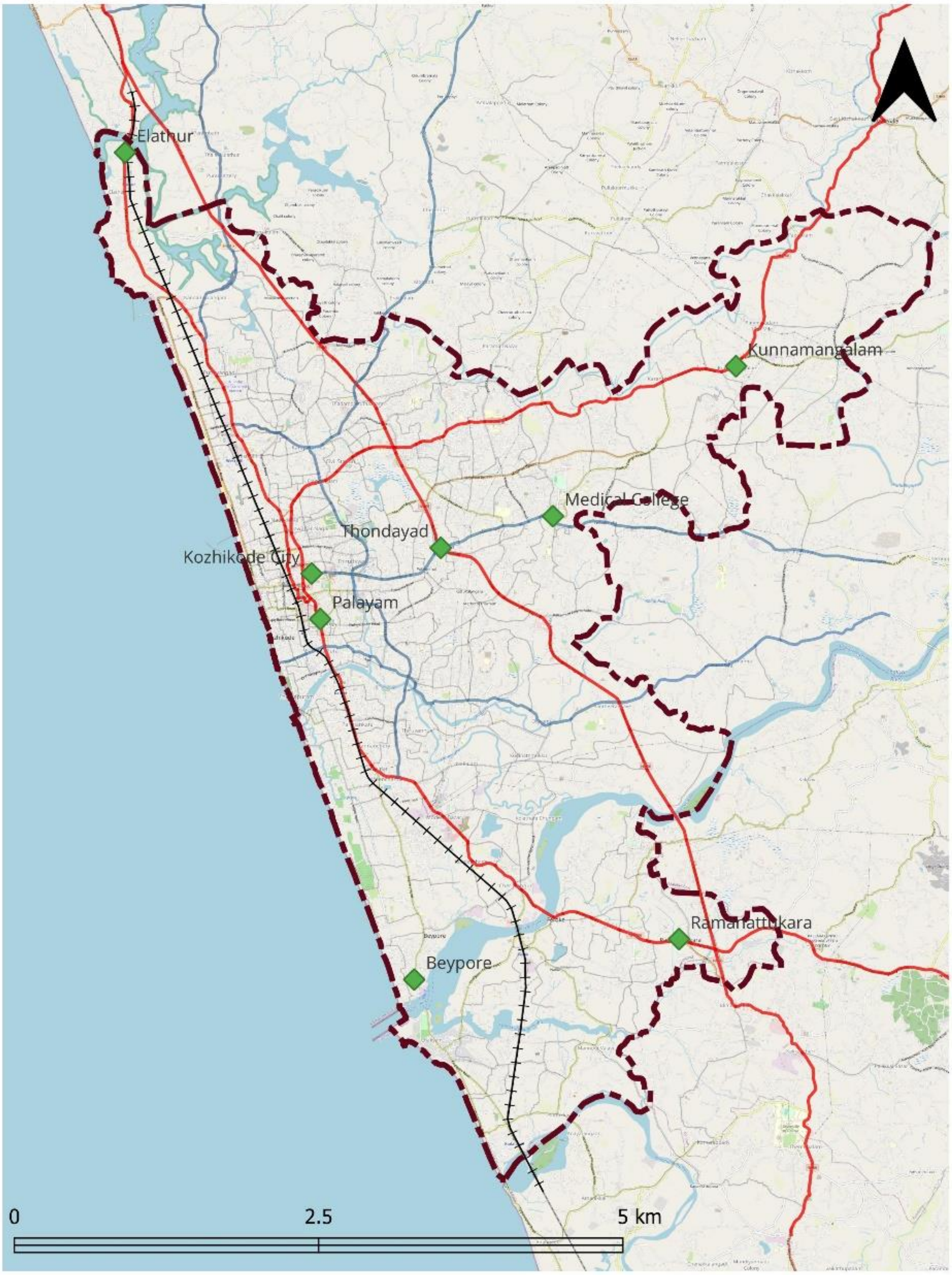
The MMMH are the role models for the transport infrastructure, under which the passengers get maximum benefits related to public transport and are perennial source of revenue, helping in the financial sustainability and development of the public transport systems.

Multi-modal mobility Hubs are also recommended for easing out the transfers across various transit modes. The details are as presented below,

Table 8-22 Multi-modal mobility Hubs

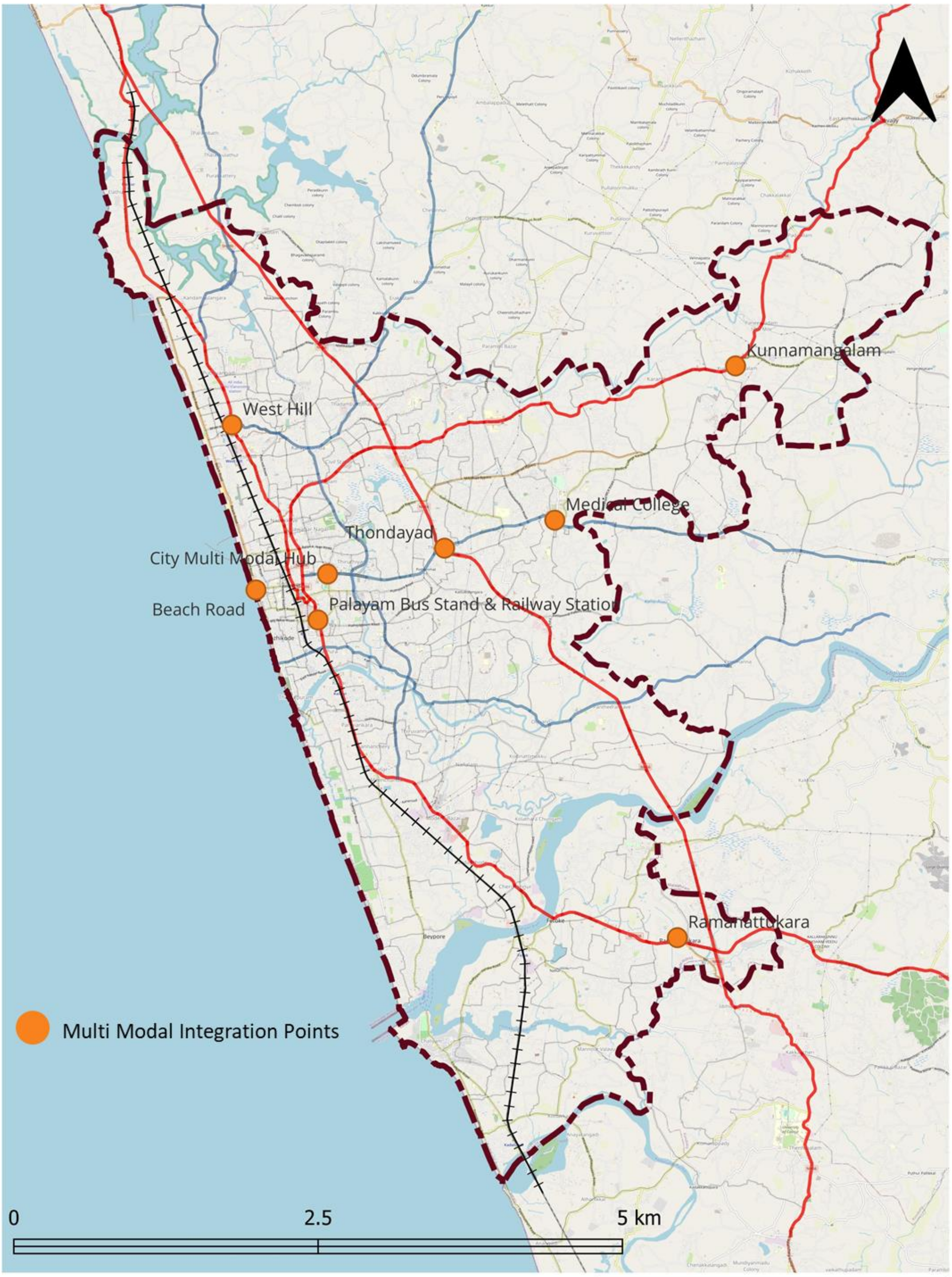
SN	MMI	TYPOLOGY	MODES	CATEGORY	PHASE
1	Kozhikode Railway Station- Palayam Bus Stand	City and Sub-urban and regional interchanges, Feeder to Railway	MRTS, Bus and Rail, IPT	Major	Phase I
2	Thondayad	City and Sub-urban and	MRTS, Bus, IPT	Major	Phase I

SN	MMI	TYPOLOGY	MODES	CATEGORY	PHASE
		regional interchanges			
3	Medical College	City and Sub-urban and regional interchanges	MRTS, Bus, IPT	Major	Phase I
4	Ramanattukara	City and Sub-urban and regional interchanges	Bus, MRTS, IPT	Major	Phase I
5	Kunnamangalam	City and Sub-urban and regional interchanges	Bus and MRTS	Minor	Phase II
6	West Hill	City and Sub-urban and regional interchanges	MRTS, Bus and Rail	Major	Phase II
7	Beach Road	City and Sub-urban and regional interchanges	MRTS, Bus, NMT	Minor	Phase II
8	Kozhikode City	City and Sub-urban and regional interchanges	MRTS, Bus, NMT	Major	Phase I



Title: Comprehensive Mobility Plan Kozhikode	
Name: Bus Terminals	

Figure 8-31 Proposed Bus Terminals



Title: Comprehensive Mobility Plan Kozhikode
Name: Multi Modal Integration Points

Figure 8-32 Proposed Multi Modal Integration Points

8.4 INTERMEDIATE PUBLIC TRANSPORT STRATEGY

IPT modes of transport, such as auto-rickshaws and shared auto-rickshaws serve the mobility the needs users which lack reliable Public Transit (PT) services, they act as feeders to the existing public transport system expanding their coverage. Thus, an integrated system will aid ease of access for users. They play a key role in improving sustainability for urban transport promoting shared transport. There is a need to introduce new models of regulation and reforms that can be adopted for a more efficient and safer system that enable the rickshaw to have an optimal role in the transport mix.

The study recommends provision of infrastructure facilities for the operation of IPT. The allocation of IPT will be governed by Corporation or ULB or Smart City in ordination with RTA and Traffic Police Departments. The infrastructure facilities shall include,

8.4.1 HALT AND GO STOPS

The stops are recommended at all the major activity nodes with considerable distance from the bus-stands to avoid chaos. These stops are recommended to be locate at a minimum distance of 250m from the junctions. The capacity of these stop will be demand based assessed by the traffic police with a minimum holding capacity of 3.

Figure 8-33 Proposed Halt and Go Stops

Table 8-23 Proposed Halt and Go Stops with Electric Vehicle charging facilities

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
1	Kunnamangalam	5	1
2	Malaparamba	5	1
3	Parolamala Junction	3	2
4	Pooladikkunnu Junction	3	2
5	Irangadanpalli Junction	3	2
6	Vengeri Junction	5	1
7	Karaparamba Junction	5	1
8	Kovoor Junction	3	1
9	Vellamadikkunnu Junction	3	1
10	Thondayad Junction	8	1
11	Cyberpark Junction	5	1
12	Mankavu Junction	3	2
13	Chalapuram Cross Junction	3	2
14	G Tec Junction	3	1
15	Stadium Junction	3	1
16	Rajaji Junction	5	1
17	Arayidathupalam Junction	5	1
18	Puthiyara Junction	5	1
19	Kalluthankadavu Junction	3	2
20	Chalapuram Cross Junction	3	1
21	Cherumanasserri Road Junction	3	2
22	Kovoor Junction	3	1
23	Puthiyangadi Junction	3	1
24	Ramanattukara Flyover Junction	5	1
25	Chevarambalam Junction	3	2
26	Gandhi Road Junction	5	1
27	West Hill Chungam	5	1
28	Vandipetta Junction	5	1
29	Fish Market	3	1

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
30	Kannur Road Kunduparamba Junction	3	2
31	Homeo College Karaparamba	3	2
32	Wayanad Road	3	2
33	Sales Tax Office Road	3	2
34	CWRDM Road	3	2
35	Balan K Nair Road	3	1
36	KP Chandran Road	3	2
37	Kannur Road	5	1
38	Beach Road	8	1
39	Nadakkavu	5	1
40	Corporation Office	5	1
41	Railway Station	5	1
42	Kozhikode New Bus Stand	5	1
43	Court Road	3	2
44	HiLite	5	1
45	Kolattu Road	2	1
46	Karad Road	3	2
47	Ramanattukara	8	1
48	Feroke	5	1
49	Mavoor Road	3	1
50	Goshalikunnu Road	3	2
51	Cheruvannur	5	1
52	Beypore	8	1
53	Vattakinar	8	1
54	Pantheerankavu	8	1
55	Kundayithode	3	1
56	Olavanna Road	5	1
57	Mananchira	8	1
58	Chintavalappu Junction	5	1
59	Puthiyapalam Junction	5	1

Sl No	NAME	TSR (three seater auto rickshaw)	PHASE
60	Pottammal Junction	5	1
61	Medical College Junction	5	1
62	Mankavu Govindapuram Road	3	2
63	Manadravil Padam Road	3	2
64	Gear Junction	3	2
65	Kodinattumukku	3	2
66	Meitra Hospital	8	1
67	Sobha Junction	5	2
68	Karanthur	5	1
69	Moozhikkal	5	2
70	Chelavoor	3	2
71	Kunduparamba Road	3	2
72	West Hill Railway Station	3	1
73	Eranjippalam Juma Masjid	5	1
74	Vellayil Railway Station	3	1
75	YMCA	3	1
76	Rajendra Hospital	5	1
77	Kayamkulam Junction	3	1
78	Valayanad Kommery Road	3	2
79	Areekad Junction	5	2
80	Kolathara Junction	5	2
81	Malaparamba Post Office	3	2
82	Kottooli Post Office	3	2
83	Golf Link Road	3	2

Charging Stations for E-Rickshaws: Encouraging the operation of Electric rickshaws over the diesel rickshaw is necessary. The average trip length being under 8 for auto rickshaws it is advised to promote the usage of electric vehicles. These batteries operated vehicle are ideal for short distances and last mile connectivity. Considering the speed of these vehicles it is easier to capture the users' preferences to utilize it for shorter distances over the longer distance trips. E-stations are advised to be provided at major mobility network intersections. The following locations are recommended, though a detail assessment could be carryout while implementation.

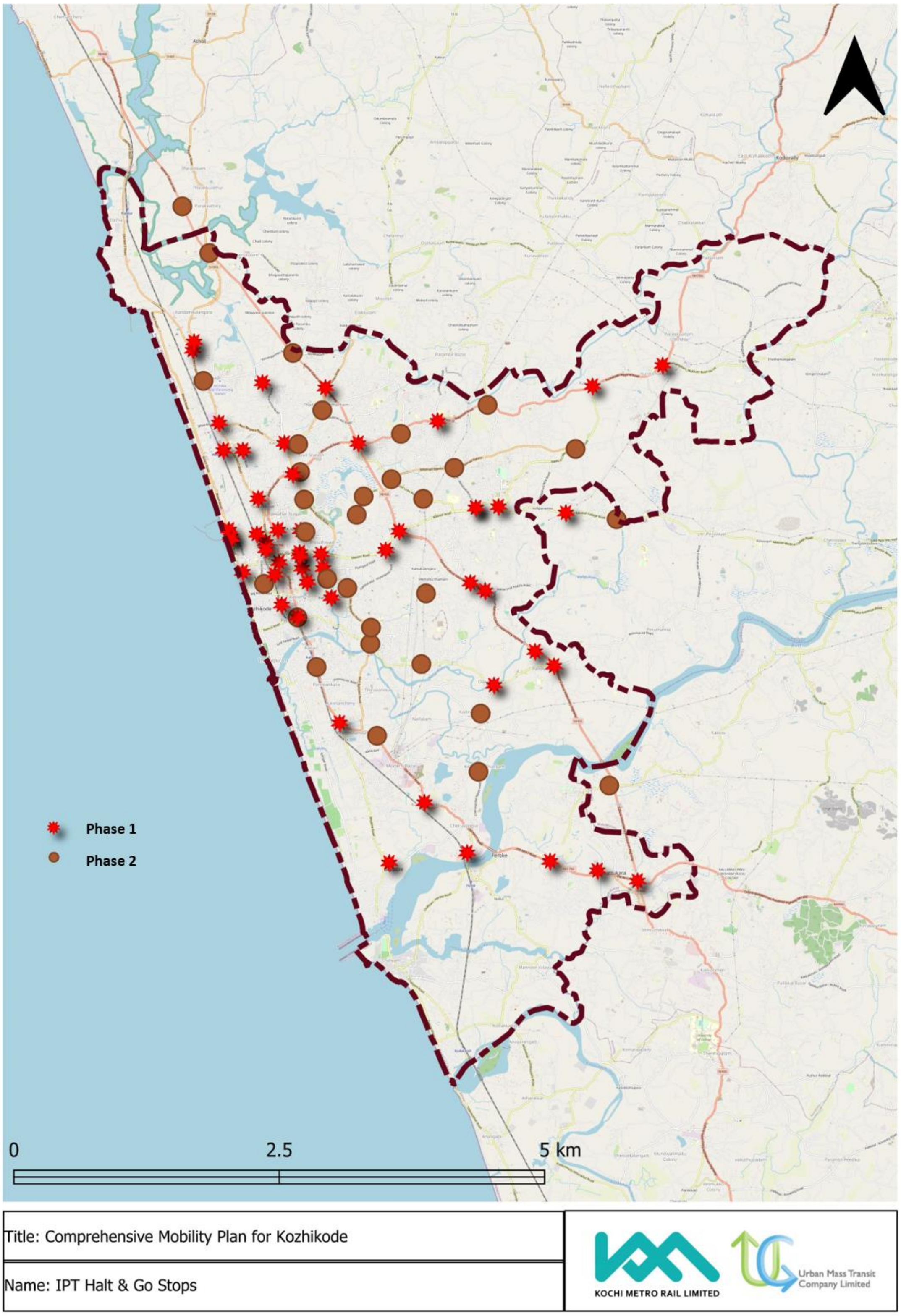


Figure 8-34 Proposed Halt and Go Stops with Electric Vehicle charging facilities

8.5 NON-MOTORISED TRANSPORTATION STRATEGY

Non-Motorized Transport (NMT) strategy is a key element in successfully encouraging clean urban transport. It can be a very attractive mode of transport for relatively short distances, it makes up the largest share of trips.

The key to reversing the trend towards more private vehicle use is making walking and cycling attractive, together with improving public transport. This can be done by a range of activities including construction of sidewalks and bicycle lanes, bicycle sharing programs, urban planning and pedestrian-oriented development. NMT is a highly cost-effective transportation strategy and brings about large health, economic and social co-benefits, particularly for the urban poor.

The strategies framed for improving non-motorized transport infrastructure include:

- Provision a complete footpath network in the city.
- Introduce cycle tracks for safe movement of cyclists in the city.
- Redesign the intersections to ensure better accessibility for pedestrians and bicycles.
- Last and First Mile connectivity
- Encourage NMT through community outreach programs.

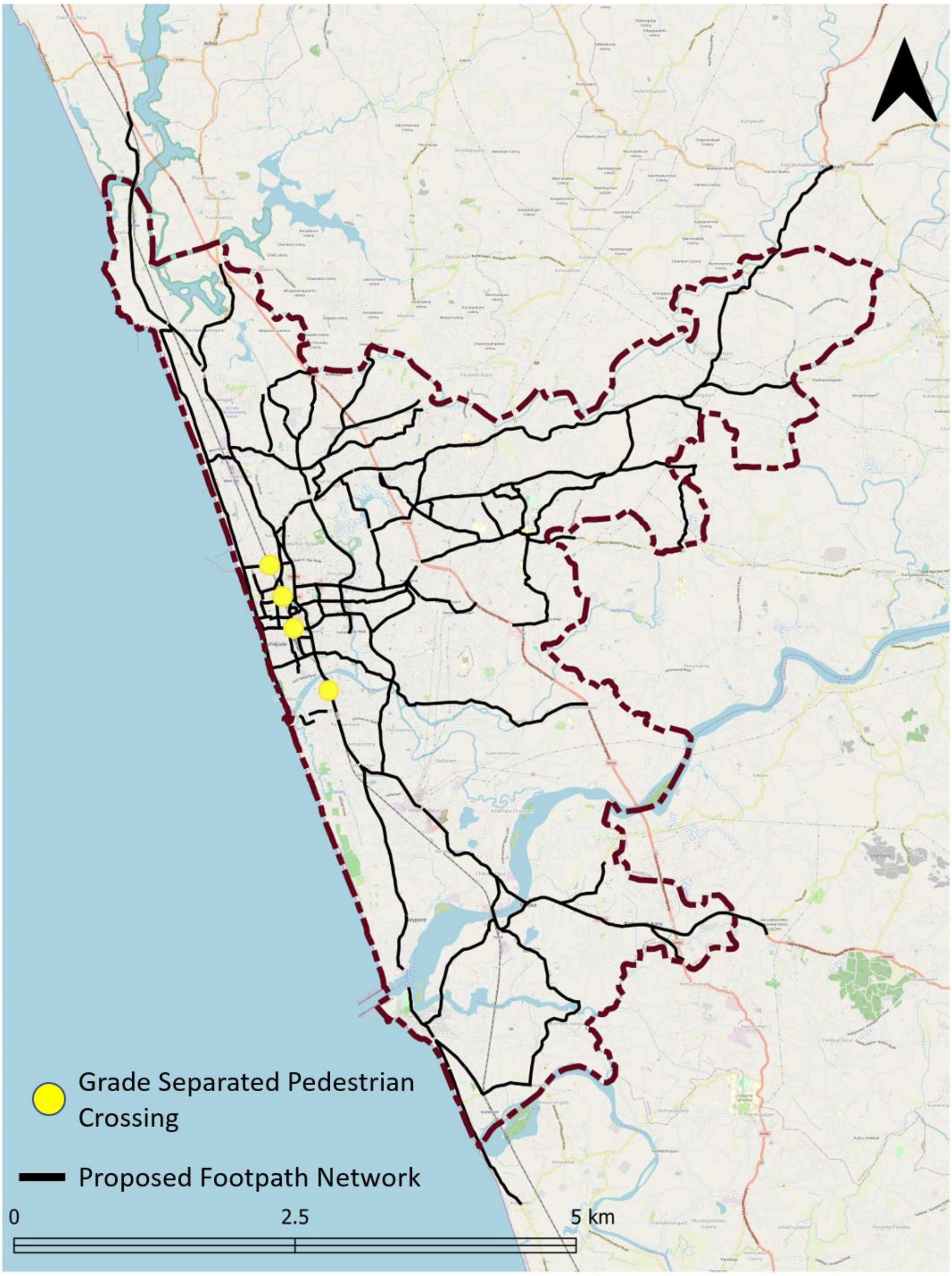
8.5.1 PEDESTRIAN NETWORK

This strategy identifies a pedestrian network within the road network, this network is recommended to house pedestrian infrastructure facilities such as continuous footpath, safe pedestrian crossings at mid-blocks, junctions, priority to pedestrian movements in junction and corridor designs.

The study identifies 145 Km of network to be developed with dedicated pedestrian infrastructure (footpath). The proposed network covers about 100% of the major road network in the study area.

Several pedestrian crossings have been proposed across the railway line in the city, which is a major barrier in the pedestrian movement.

The details of the network recommended for improvement is as presented below.



Title: Comprehensive Mobility Plan for Kozhikode

Name: Pedestrian Infrastructure Proposals

Figure 8-35 *Proposed Pedestrian Network*

Figure 8-36 *Existing Situation of Beach Road Section where Cycle Track is recommended*

8.5.2 CROSS SECTIONS AND GUIDELINES FOR PEDESTRIAN NETWORK

The footpath design should be uniform across the city. Depending on the volume of pedestrians, the area requires footpaths with minimum clear walking width of 1.8m and maximum height of 150mm from the finished road surface. In certain cases, where the available road ROW makes it difficult to provide 1.8 m barrier free space for footpaths, the widths should not be less than 1.2 m. However, the maximum height of 150 mm cannot be compromised in any circumstance. Increasing the footpath height to more than 150 mm makes them unusable by pedestrians, thereby defeating the purpose of providing the footpaths. A minimum width of 2m should be maintained on the major corridors with additional space for multi-utility zones.

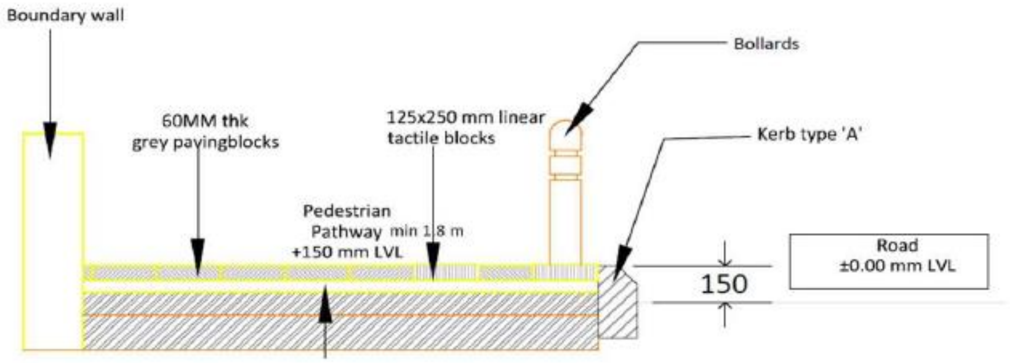


Figure 8-37 *Detailed Cross-Section of Footpath*

The typical cross-sections for of corridors of various right-of-way widths are as presented below.

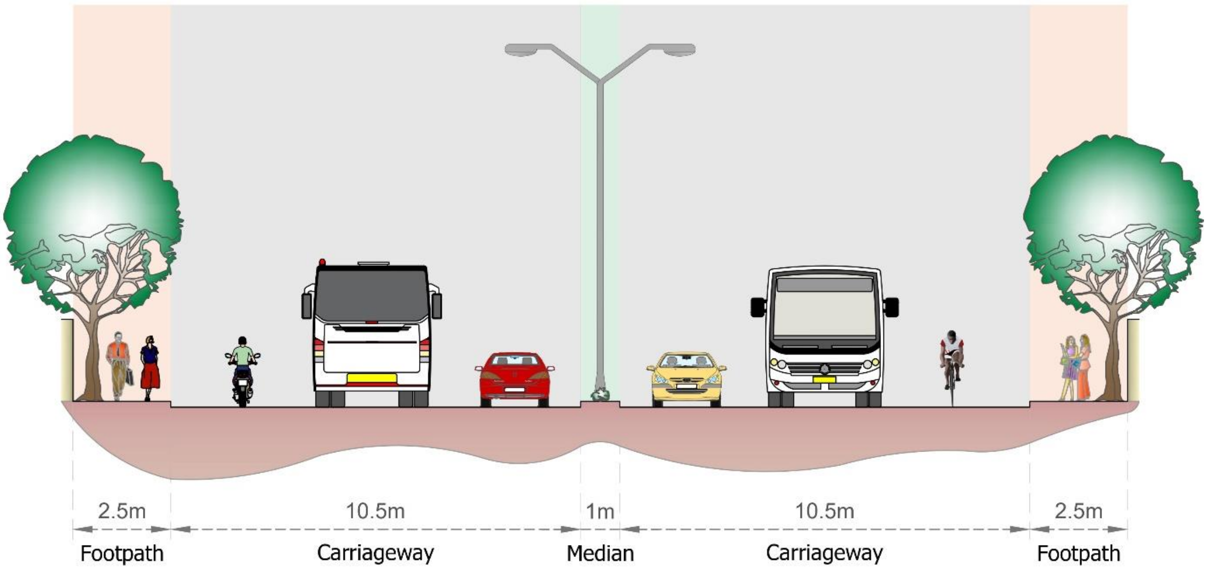


Figure 8-38 *Typical Cross Section of 27m Wide Road with Footpath*

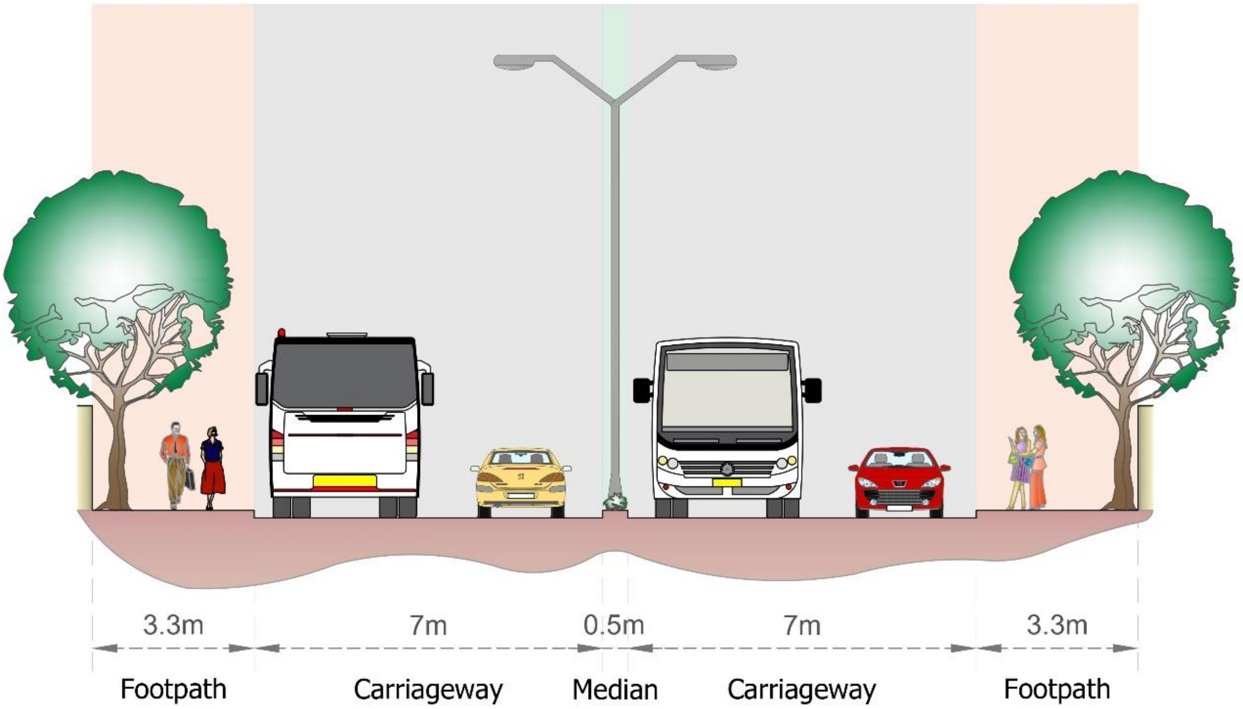


Figure 8-39 *Typical Cross Section of 21m Wide Road with Footpath*

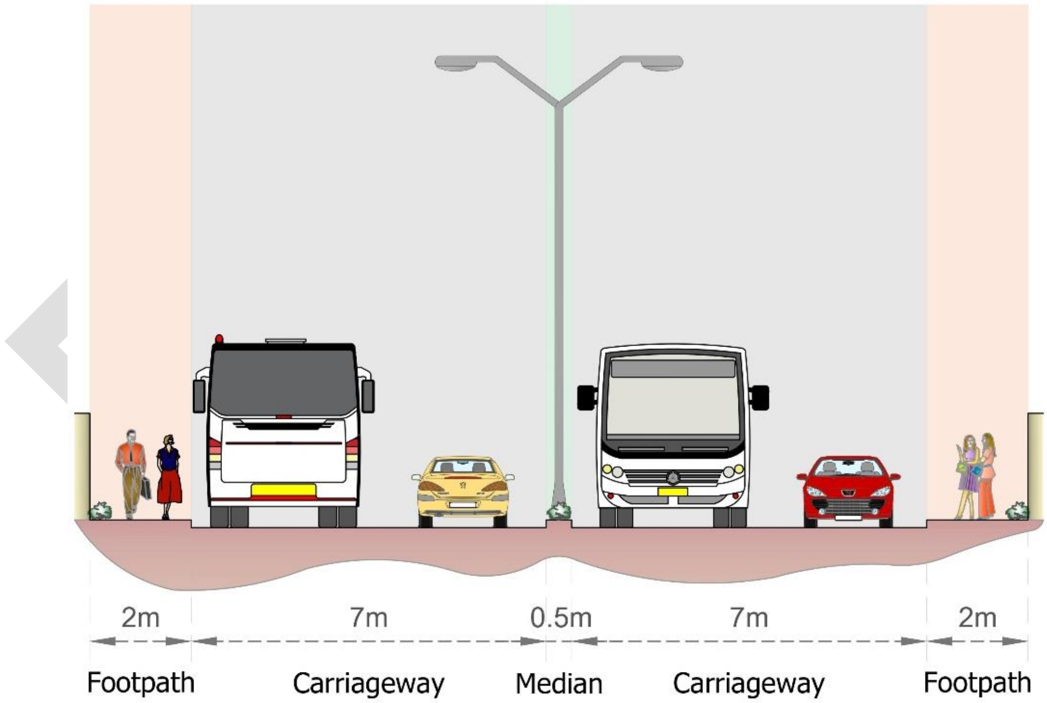


Figure 8-40 *Typical Cross Section of 18.5m Wide Road with Footpath*

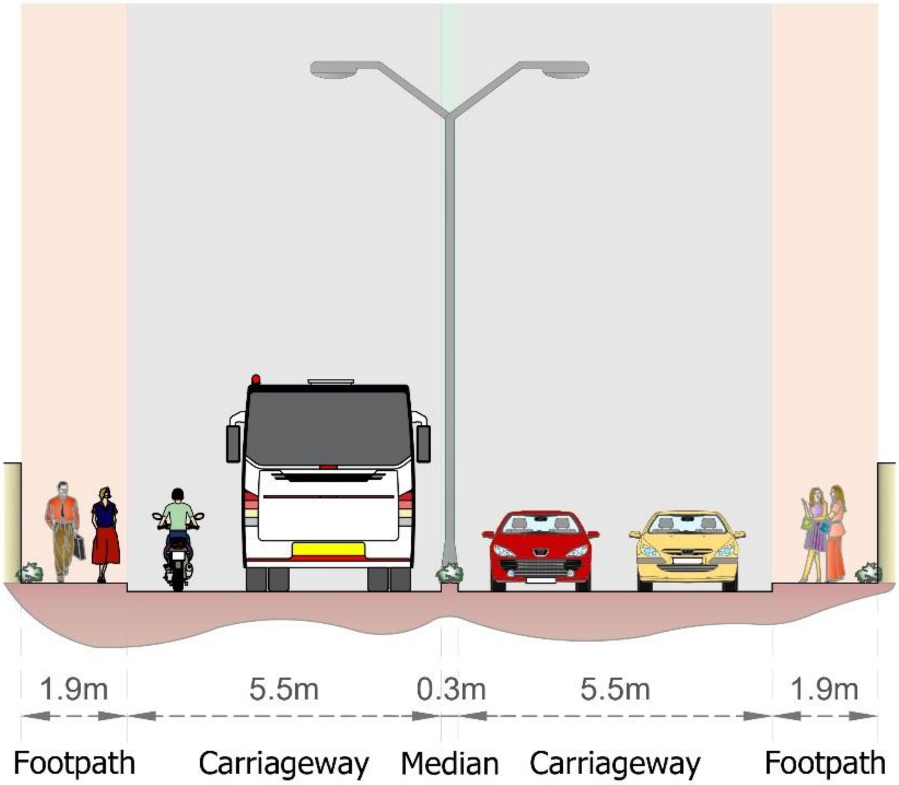


Figure 8-41 *Typical Cross Section of 15m Wide Road with Footpath*

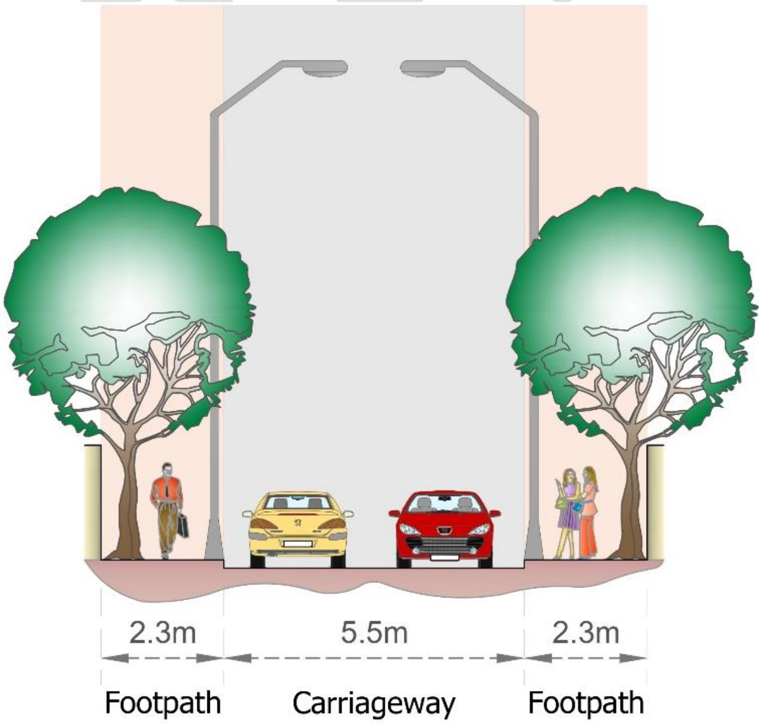


Figure 8-42 *Typical Cross Section of 10m Wide Road with Footpath*

8.5.3 BICYCLE NETWORK

Cycling is increasingly recognized as a clean, sustainable mode of transport and an essential part of an inter-modal plan for sustainable urban travel. More cycling in place of car use could contribute to less energy consumption from travel activity and reduced congestion. Increasing cycling could be a promising way to contribute to the reduction of greenhouse and other emissions. More than capturing the captive users to use the cycles for movement, the development of cycle tracks should attract more uninterested citizens to use cycles. The existing share of bicycle trips in Kozhikode is observed to be decreasing in the horizon years, hence it becomes important it safeguard the interests of these bicycle users and promote the usage of bicycle.

The bicycle network for Kozhikode has been identified targeting two major supply end parameters, which are,

1. Provision of Bicycles lanes connecting the core area of the city.
2. Provision of Bicycle lanes connecting major tourist attractions, heritage gates and universities.

The strategy primarily focuses on developing a network targeting the reactional/ health enthusiasts and tourists. Thus, linking the major corridors with the tourist and recreational places would form a bicycle tourist circuit there by increasing the utility of the infrastructure and promoting bicycle culture amongst the dependent users.

The study proposes 36.12 Km of dedicated bicycle network. The network is mainly concentrated along the beach and the flat terrain in the city, towards south west. It is recommended to maintain a minimum of 2m wide dedicated bicycle track for bi-directional sections and a minimum of 3m for uni-directional tracks.

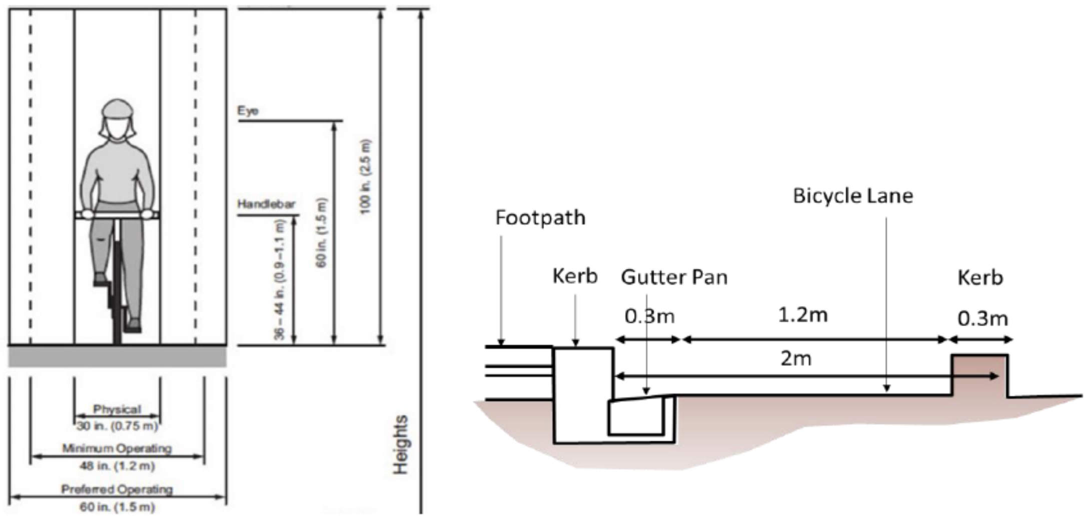
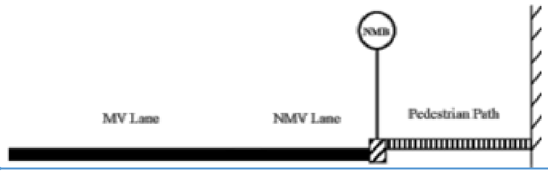
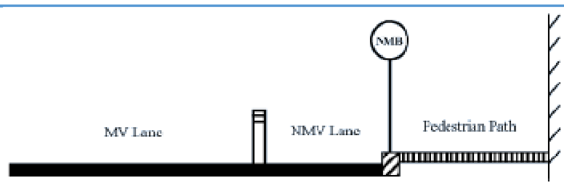


Figure 8-43 *Proposed Bicycle Operating Widths*

Most cities worldwide tend to adopt and develop their own detailed design guidelines; however, the following section provides guidance on the basic design of common measures and can be used as advisory design notes for Kozhikode. Non-Motorized Vehicles (NMV) lanes can generally be classified into four main categories and are listed below. In case of Kozhikode, Non-Motorized Vehicles (NMV) lane typology 2is recommended

Table 8-24 *Types of NMV Lanes*

S. No.	Type of NMV Lane	Cross Section
1	NMV lanes shared with MVs and designated by signs	
2	NMV lanes designated by lane markings (e.g., striping) and within the highway right-of-way	
3	NMV-exclusive lanes physically separated from MVs by barriers (e.g. concrete blocks, steel railing, raised curb) and within the highway right-of-way	

S. No.	Type of NMV Lane	Cross Section
4	NMV-exclusive lanes within an independent right-of-way (often referred to as NMV paths)	

Table 8-25 *Proposed Corridors for Bicycle Infrastructure*

S. NO.	NAME	LENGTH (km)	TYPOLOGY
1	Kozhikode Beach	11.6	2
2	Sarovaram	8.8	2
3	Valiyangadi	1.8	2
3	Thondayad	4.6	2
4	Beach Road	3.5	2
5	Kadalundi	5.8	2

Title: Comprehensive Mobility Plan for Kozhikode	
Name: Proposed Bicycle Network	

Figure 8-44 *Proposed Bicycle Network for Improvement*

Typical cross sections of various right of way for the proposed bicycle network are as shown in below.

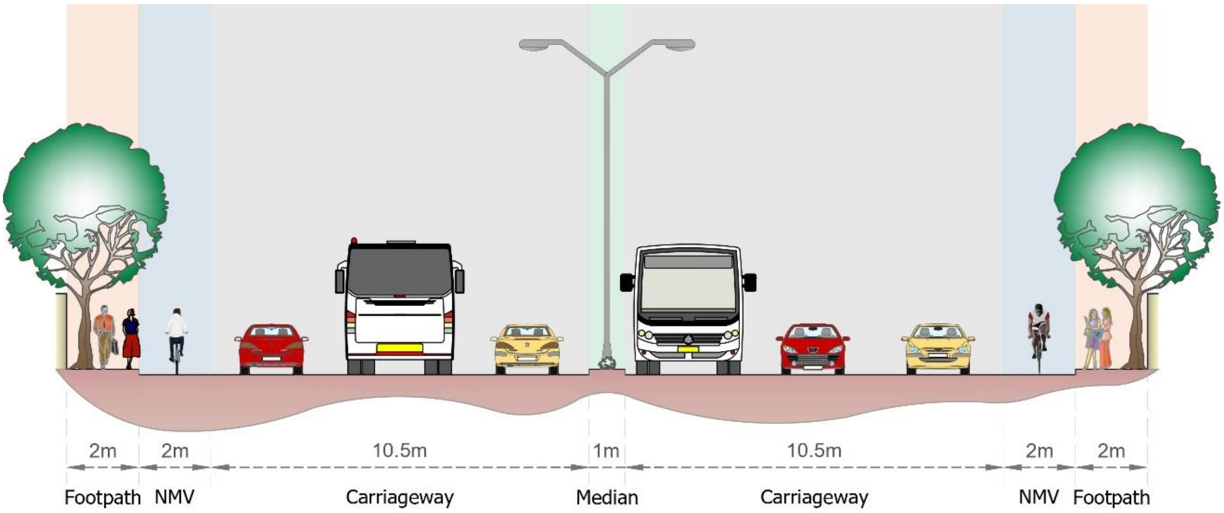


Figure 8-45 *Typical Cross Section of 30m Wide Road with Bicycle Tracks*

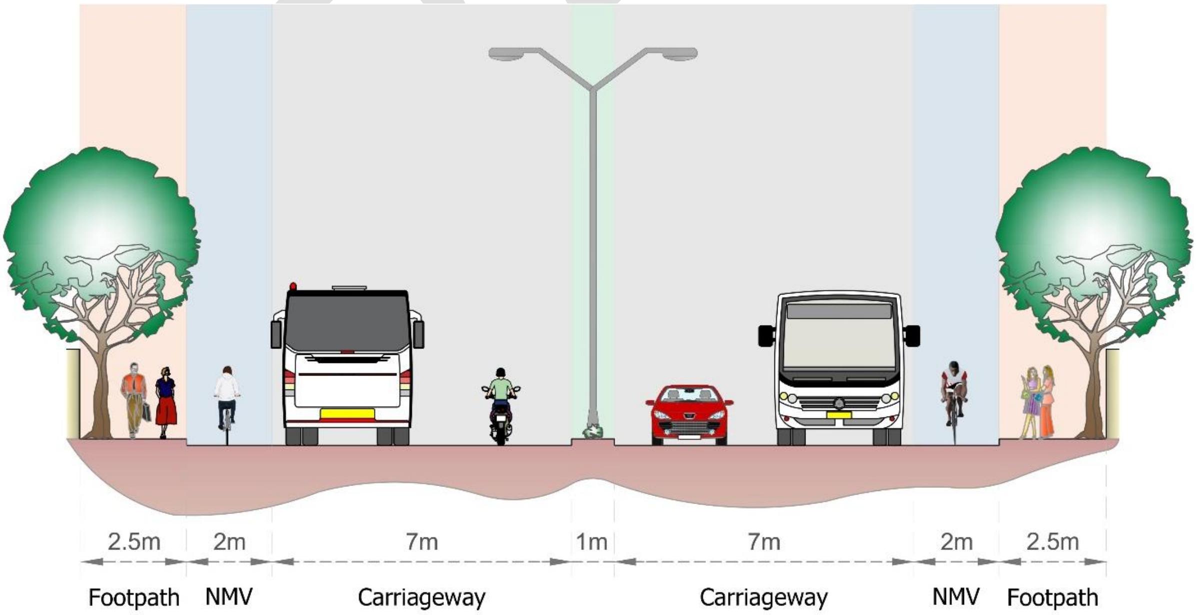


Figure 8-46 *Typical Cross Section of 24m Wide Road with Bicycle Tracks*

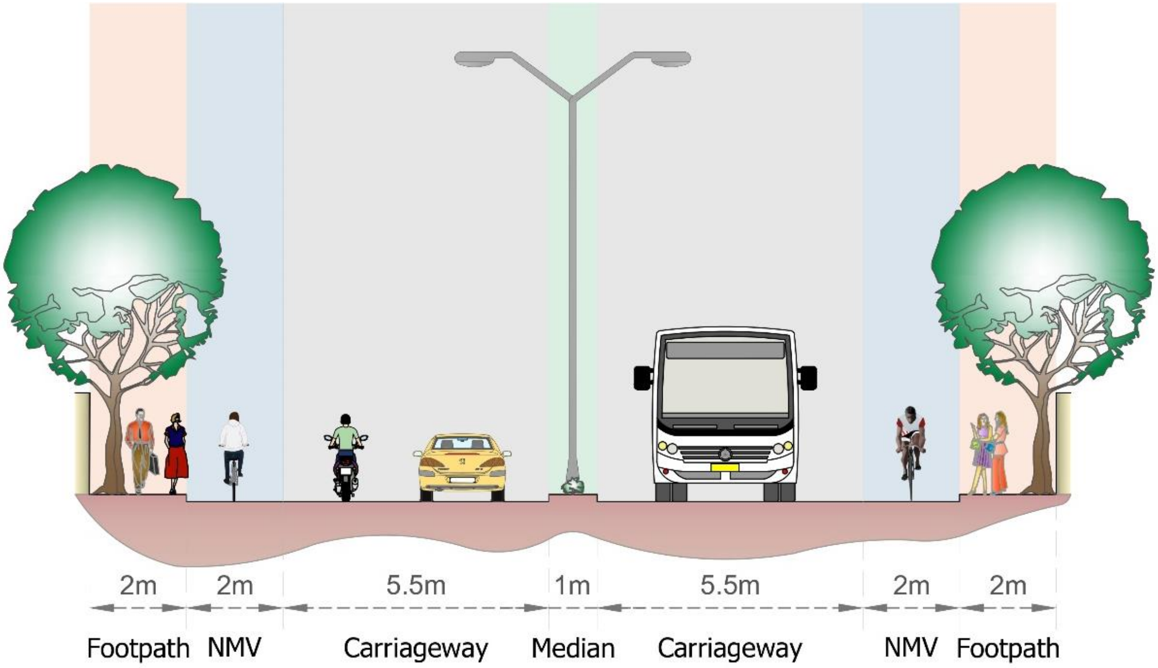


Figure 8-47 *Typical Cross Section of 20m Wide Road with Bicycle Tracks*

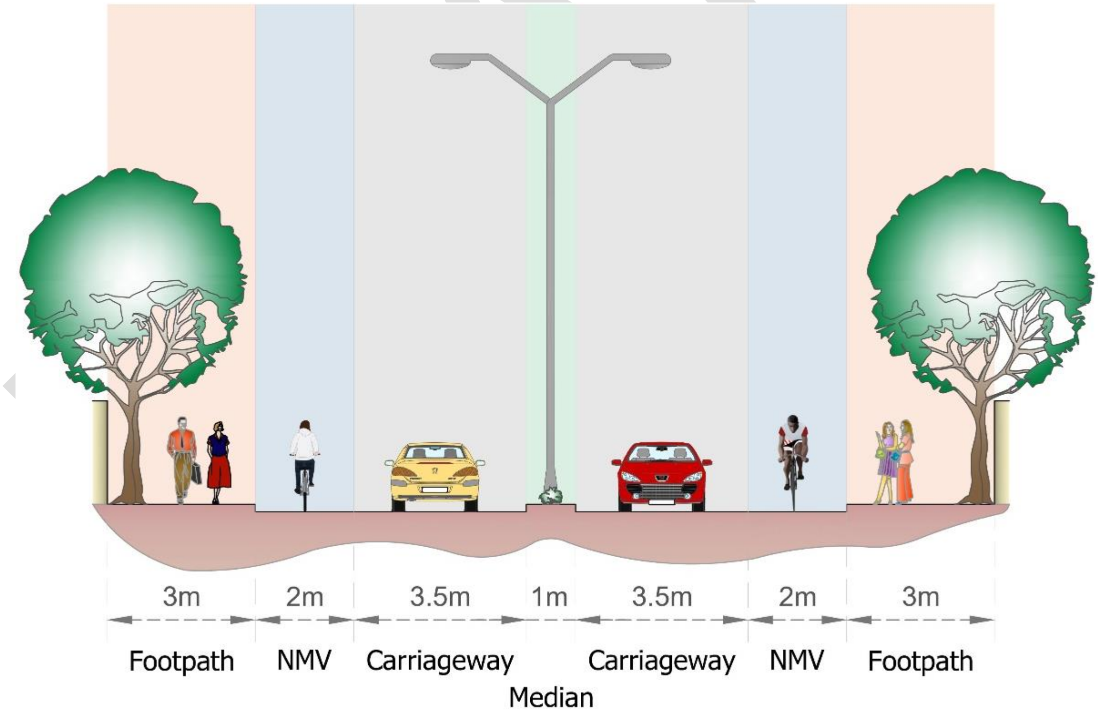


Figure 8-48 *Typical Cross Section of 18m Wide Road with Bicycle Tracks*

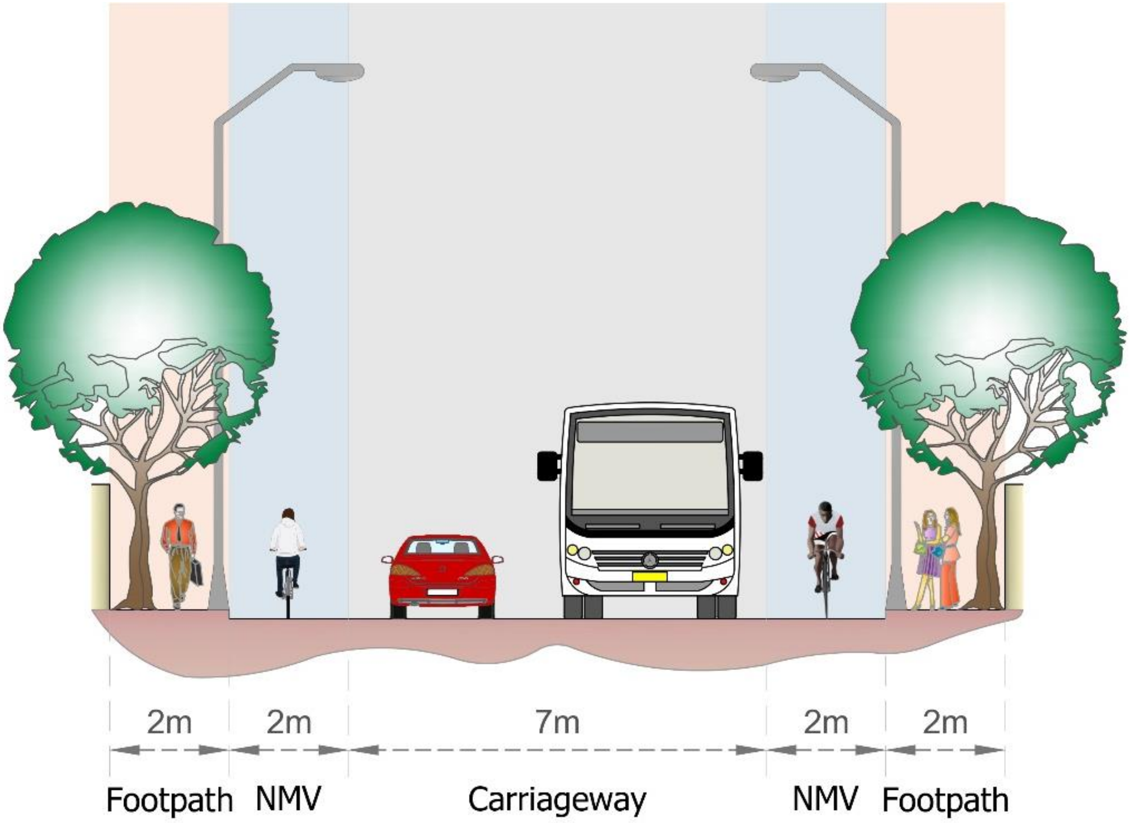


Figure 8-49 *Typical Cross Section of 15m Wide Road with Bicycle Tracks*

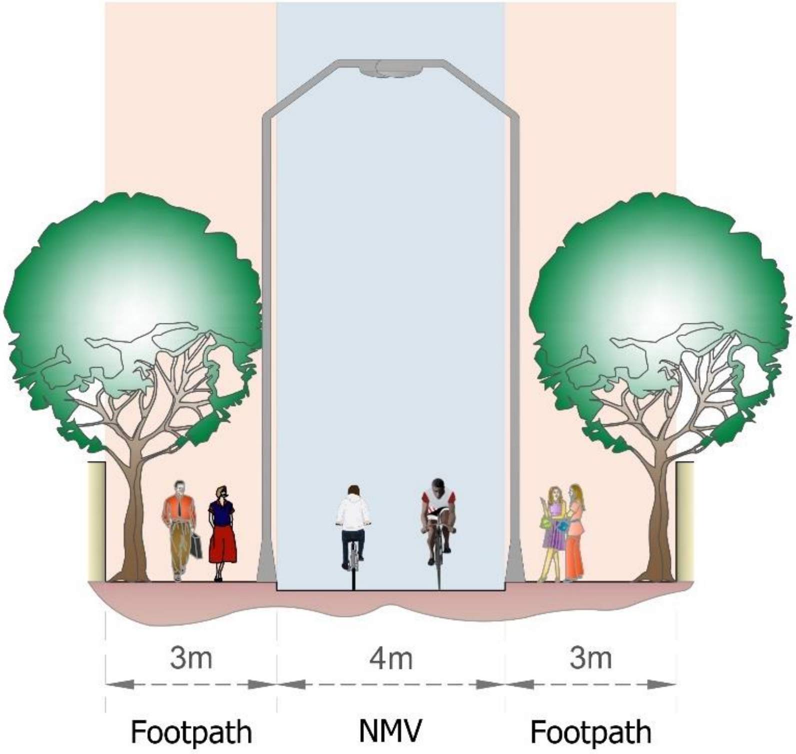


Figure 8-50 *Typical Cross Section of 10m Wide NMT Priority Corridor*

The considerations developing the proposed bicycle corridor are as follows,

- Provision of minimum 2m wide dedicated bicycle track.
- In case of NMT priority streets, the shared NMT and PT space is recommended for bicyclists.
- The dedicated tracks are proposed to have ceramic treatment with colour pigmentation to enable clear visibility.
- It is proposed to provide bicycle parking spaces at every heritage site/ tourist attraction to ease the parking needs of the bicyclists. It is proposed to have about 25 bicycle spaces at every gate and about 100 bicycle spaces at tourist spaces.
- The whole corridor needs to maintain and bicycle track pavement marking stencil.
- Map Kiosks needs to be provided at every kilometre, with area plane, corridor details and major attraction in the area.
- Wayfinding and signages are recommended to be provided as per IRC standards.

Figure 8-51 *Representation of Wayfinding and Map Kiosk used in Various Cities Across the World*[45]

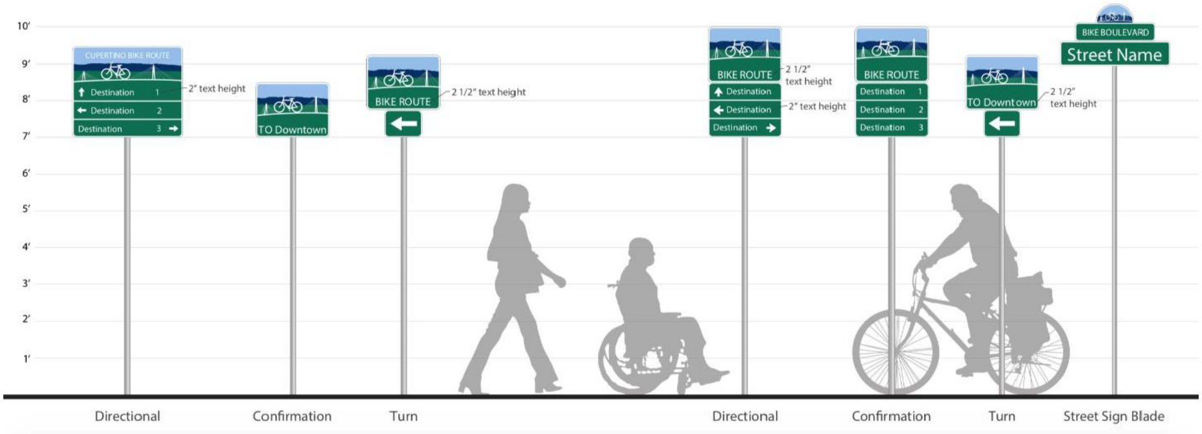


Figure 8-52 *Representation of Wayfinding and Signage Boards Heights*[46]

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45 Image Source: Images extracted from multiple online sites for reference purposes

46 Image Source: Wayfinding Sign Project

8.5.4 SAFE ROUTES TO SCHOOL

Kozhikode city has a large number of educational institutions and considerable population who are largely depended riders. It is important to cater to the needs of these dependent riders who commute on daily basis. The majority of these trips are under 2.5km, which can be catered by NMT modes of transport such as walk and bicycling. This strategy at a conceptual level guide to promote sustainable or green travel conditions for these users under Safe Routes to School strategy.

Safe Routes to School (SRTS) is an approach that promotes walking and bicycling to school through infrastructure improvements, enforcement, tools, safety education, and incentives to encourage walking and bicycling to school.

The components to developed and improved for initiating SRTS in Kozhikode are,

- Designing and implementing complete streets infrastructure in the school zones
- Design and monitor traffic calming measures in the school zones
- Encourage and promote safe bicycling and walking
- Expand bicycle and pedestrian infrastructure
- Conduct and evaluate safety through periodic road safety audits

The key elements of safe routes to school programs are as follows,

- **EDUCATE:** Conducting education activities to target parents, neighbourhoods and other drivers in the community to remind them to yield to pedestrians, to drive safely and take other actions to make it safer for pedestrians and bicyclists.
- **ENCOURAGEMENT:** Conduct special events like Walk and Bike to School Day and ongoing activities like walking school buses and bike trains involving children, parents, teachers, school administrators to generate excitement about walking and bicycling safely to school.
- **ENFORCEMENT:** increase driver awareness of laws, and they also can improve driver behaviour by reducing speeds to pay attention to their environment.

- **ENGINEERING:** Various methods including the recommendation in the above mentions NMT strategy need to be implemented to create safer settings for walking and bicycling while recognizing that a roadway needs to safely accommodate all modes of transportation.

The areas recommended for implementing the pilot projects for SRTS have been identified based on the following,

- Concentration of educational institutions
- Non-motorised footfall of students
- Proximity to residential neighbourhoods
- Degree of safe road infrastructure for NMT users

The pilot areas identified are as presented below.

Table 8-26 *Pilot Areas Identified for SRTS Kozhikode*

S. No.	Code	Name
1	PP1	Mananchira
2	PP2	Nadakkavu
3	PP3	Beypore
4	PP4	Malaparamba

It is recommended to take up pilot projects for SRTS in these areas in light with the consideration and elements suggested above.

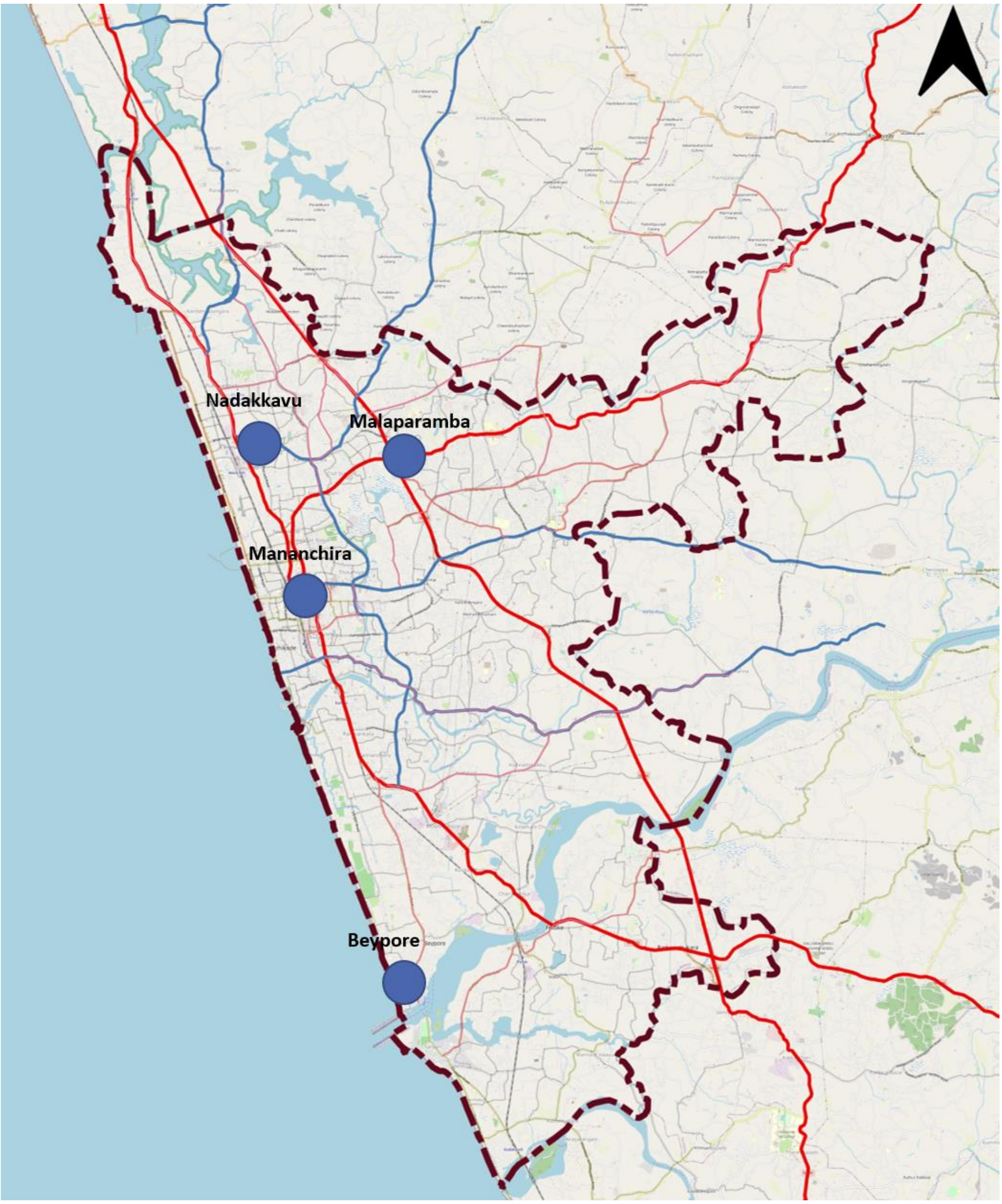


Figure 8-53 *Proposed Pilot Areas for SRTS Kozhikode*

8.5.5 PUBLIC BIKE SHARING SYSTEM

Public bike sharing systems have gained significant popularity in recent years as an eco-friendly and convenient transportation option in urban areas. These systems allow users to rent bicycles for short-term use and provide a sustainable solution to reduce traffic congestion, improve air quality, and promote active and healthy lifestyles.

Key features of the PBS system are as follows:

- **Accessibility:** Public bike sharing systems offer easy access to bicycles for both residents and visitors. Stations are strategically placed throughout the city, providing convenient pick-up and drop-off locations.
- **Rental Process:** Users typically register and pay for bike rentals through mobile apps or kiosks at the stations. The rental process is user-friendly, allowing for quick and efficient transactions.
- **Flexible Membership Options:** Public bike sharing systems offer various membership options, including pay-as-you-go, daily, monthly, and annual subscriptions. This flexibility caters to the diverse needs of users, whether they are occasional riders or frequent commuters.
- **Bike Availability and Tracking:** Real-time information about bike availability and station capacity is crucial for users to plan their trips effectively. Many systems employ GPS technology to track bikes and provide up-to-date information on bike availability through mobile apps or websites.

The benefits of implementing the PBS system in the city are as follows:

- **Bike Distribution and Rebalancing:** Ensuring an adequate supply of bikes at each station can be challenging, especially during peak hours or in densely populated areas. Balancing bike distribution across the network to meet user demand is essential.
- **Parking and Security:** Proper parking infrastructure and security measures are necessary to protect the bikes from theft or vandalism. Stations should have secure locking mechanisms and surveillance systems to ensure the safety of the bikes.
- **Maintenance and Repair:** Regular maintenance and timely repair of bikes are crucial to ensure their optimal performance and user satisfaction. Effective maintenance strategies should be implemented to address issues such as flat tires, broken gears, or faulty brakes promptly.

- **User Education and Safety:** Promoting safe cycling practices and educating users about traffic rules and bike handling techniques are essential. Public bike sharing systems should prioritize user safety by providing helmets, reflective gear, and clear guidelines for riders.

Public bike sharing systems play a vital role in promoting sustainable transportation and improving urban mobility. By providing affordable and accessible bicycles, these systems offer an environmentally friendly alternative to traditional modes of transportation. The public bike sharing systems will be provided near all the major tourist attraction points and other attraction centres.

Table 8-27 *Proposed PBS Locations*

S. NO.	LOCATION	PBS TYPE	CYCLES PER STATION
1	SM Street North	Low Capacity	10
2	Stadium Road	Low Capacity	10
3	Mankavu	Low Capacity	10
4	Karaparamba	Low Capacity	10
5	Eranjippalam	Low Capacity	10
6	Puthiyangadi Beach	Medium Capacity	15
7	Kadalundi Beach	Medium Capacity	15
8	Beypore Beach	Medium Capacity	15
9	Nadakkavu	Medium Capacity	15
10	West Hill	Medium Capacity	15
11	Civil Station	High Capacity	25
12	Kozhikode Beach (North)	High Capacity	25
13	Kozhikode Beach (South)	High Capacity	25
14	SM Street South	High Capacity	25

8.5.6 NON-MOTORISED TRANSPORT OUT-REACH PROGRAMS

It is essential to promote public awareness and revive the bicycling culture and reducing the dependency on private modes. Thus, an outreach and education strategy for promoting the system is recommended. The outreach and education goals need to be defined at the planning stage of the system itself to focus the efforts of the implementation.

- Introduce the concept of the Non-Motorized Transport, its purpose and the benefits to the various stakeholders
- Create profile of the system as a big impact, with incremental steps for achieving the long-term vision for mobility in the city
- Enhance the understanding that Non-Motorized Transport positively impact economic health and environmental stability of the city

- Introduce the concept of specific systems as an important strategy in making the best use of transportation resources
- Establish communication channels for the public to receive information and interact with the implementing agencies

Figure 8-54 *Bicycle Promotional and Out-Reach Programs in India*

Following strategies can be adopted for an effective public outreach

- Create a network of allies and provide platforms for them to actively participate as disseminators of benefits
- Use proactive and creative communication media to promote key messages. Communication media can be print, broadcasts, short films, event marketing etc.
- Programmes can be conducted in schools and colleges advocating the need for Non-Motorized Transport. Events like Car Free Day, Happy Streets, Cycle Day can also be promoted.
- Encourage various university and school students to use bicycles under Safe Routes School or Pedal to School programs.
- Conduct Heritage Bicycle rides, etc.

- Encourage Bicycling as a recreational activity by creating Bicycle tracks along the lakes and further connecting them. Call for weekly bicycle competitions etc.

8.6 TRAFFIC MANAGEMENT MEASURES

Traffic demand measures aims at achieving safe and efficient movement of people and goods on roadways. It focusses on road geometry, sidewalks, crosswalks, cycling infrastructure, traffic signs, road surface markings, traffic signals, traffic flow, area improvements etc. Traffic management includes various strategies adopted to efficiently manage the movement of vehicles like one-way systems, no parking zones, etc.

These measures generally qualify as short-term measures for bringing in immediate relief from traffic problems. A combination of several measures can prove to be effective mean of problem solving. These measures are not very capital intensive and give instant results.

The proposals under public transport improvement strategy are:

- Junction Improvements
- Area Improvements
- Pavement Markings and Signage's
- Parking Management Plan

8.6.1 JUNCTION IMPROVEMENTS

It is noticed that traffic accident rates are usually higher at intersections. Many factors affect accident occurrence at intersections, including traffic volume, traffic control, and frequency of access points, the number of arms, the speed limit, the median type and width, the number of traffic lanes, the existing turn lanes and the lighting level. Junction improvement essentially involves the combination of the following elements:

- Closure of medians at certain intersections, while providing well designated mid-block crossings for pedestrians.
- Prohibition of free right turns
- Provision of adequate sight distance
- Providing adequate corner radii
- Providing sufficient turning radii
- Flaring approaches towards intersections
- Providing channelizers/division islands

- Providing pedestrian and cyclist crossing facilities such as zebra crossings, pelican signals, refuse islands etc.
- Bus stops near junctions to be re-located
- Providing signs/lane-markings/lighting

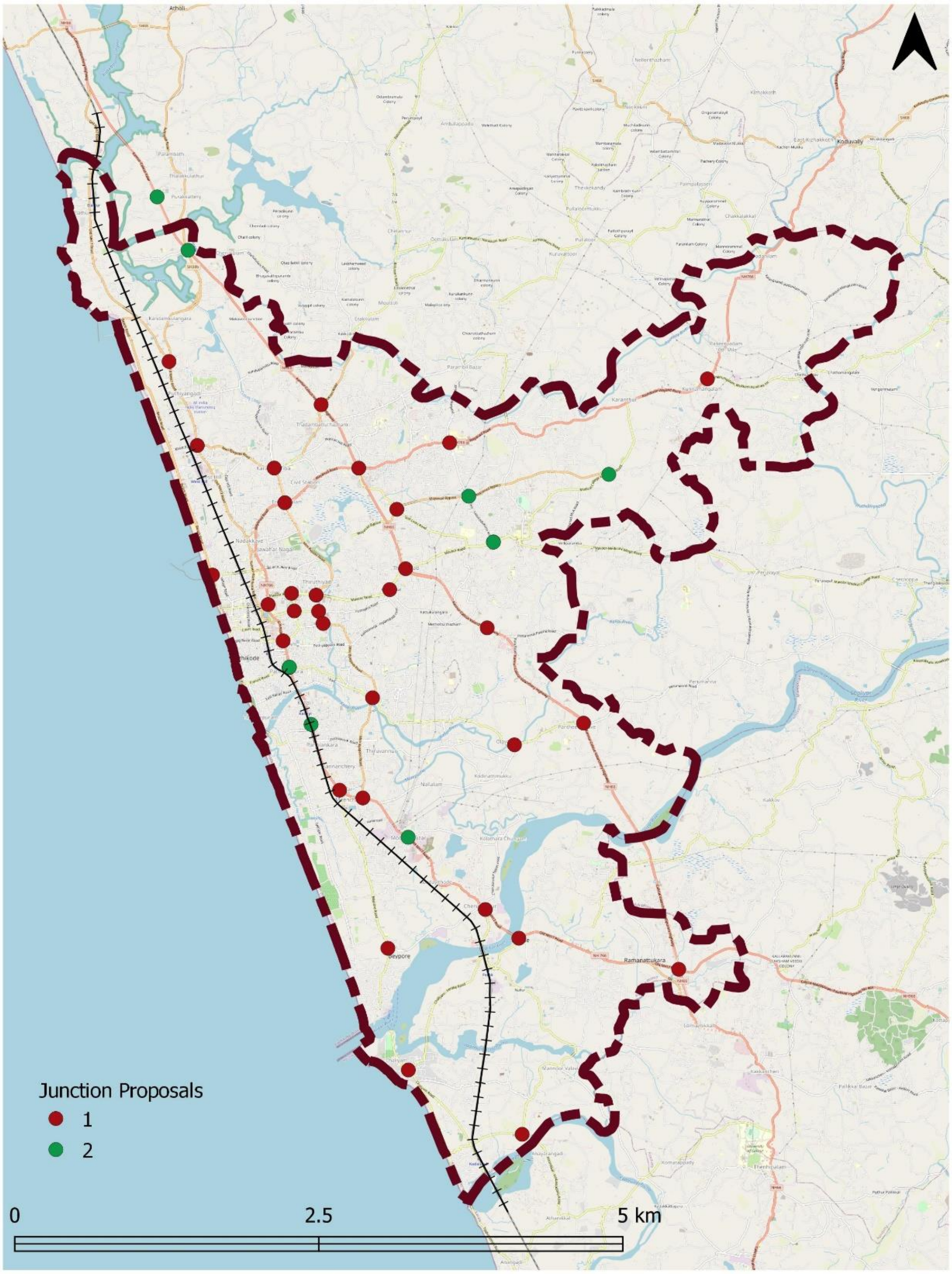
Junctions along the dedicated cycle tracks should be designed accordingly with priority to the cyclists. Pedestrians should be given priority at all the junctions. If it is difficult to channelize the pedestrian movement, it is advised to install pelican signals.

Intersection improvements are recommended to facilitate the movement of public transport, safe movement and crossing of pedestrians at junctions. List of junctions proposed for improvement in their geometry are given below.

Table 8-28 *Identified Junctions for Improvement*

Sl No	Junction Names	Phase
1	Kunnamangalam	1
2	Malaparamba	1
3	Parolamala Junction	2
4	Pooladikkunnu Junction	2
5	Irangadanpalli Junction	2
6	Vengeri Junction	1
7	Karaparamba Junction	1
8	Kovoor Junction	1
9	Vellamadikkunnu Junction	1
10	Thondayad Junction	1
11	Cyberpark Junction	1
12	Mankavu Junction	1
13	Chalapuram Cross Junction	2
14	G Tec Junction	1
15	Stadium Junction	1
16	Rajaji Junction	1
17	Arayidathupalam Junction	1
18	Puthiyara Junction	1
19	Kalluthankadavu Junction	1
20	Chalapuram Cross Junction	2
21	Cherumanasserri Road Junction	2
22	Kovoor Junction	2
23	Puthiyangadi Junction	1
24	Ramanattukara Flyover Junction	1
25	Chevarambalam Junction	1

Sl No	Junction Names	Phase
26	Gandhi Road Junction	1
27	Vattakinar Junction	1
28	Bypass Junction	1
29	Palayam Junction	1
30	Eranjippalam Junction	1
31	West Hill Chungam Junction	1
32	Pantheerankavu Junction	1
33	Chaliyam Angadi Junction	1
34	Kadalundi Kottakadavu Road Junction	1
35	Cheruvannur Junction	1
36	Pottammal Junction	1
37	Feroke City Road Junction	1
38	Beypore Road Junction	1
39	Olavanna Junction	1
40	Modern Bazaar Junction	2



Title: Comprehensive Mobility Plan Kozhikode	
Name: Junction Improvement Proposals	

Figure 8-55 *Identified Junctions for Improvement*

Figure 8-56 *Existing Unsignalised Palayam Junction*

Traffic signals are necessary for safe movement of traffic at a junction. IRC 93:1985 provides the guidelines on designs and installation of road traffic signals. The IRC 93 recommends 5 warrants for the installation of signals at any junction. Traffic control signals should not be installed, unless one or more of the signal warrants specified herein are met. Information should be obtained by means of traffic and engineering studies and compared with the requirements set forth in the warrants. If these requirements are not met, a traffic signal should not be put into operation.

The situation will deteriorate considerably with growing population of private modes in the city. Hence improvements to these junctions need to be considered for signalization/ roundabouts or grade separators. The type of junction has to be suited to the road type, the environment and capacity, in order to maintain good readability both of the road and of the junction, as well as a satisfactory level of safety. According to the above, for example, junctions or roundabouts should not be used on motorways, and signalized junctions need not to be used on rural roads, except in very special cases. The following shows guidelines for the selection of junction type according to traffic flows.

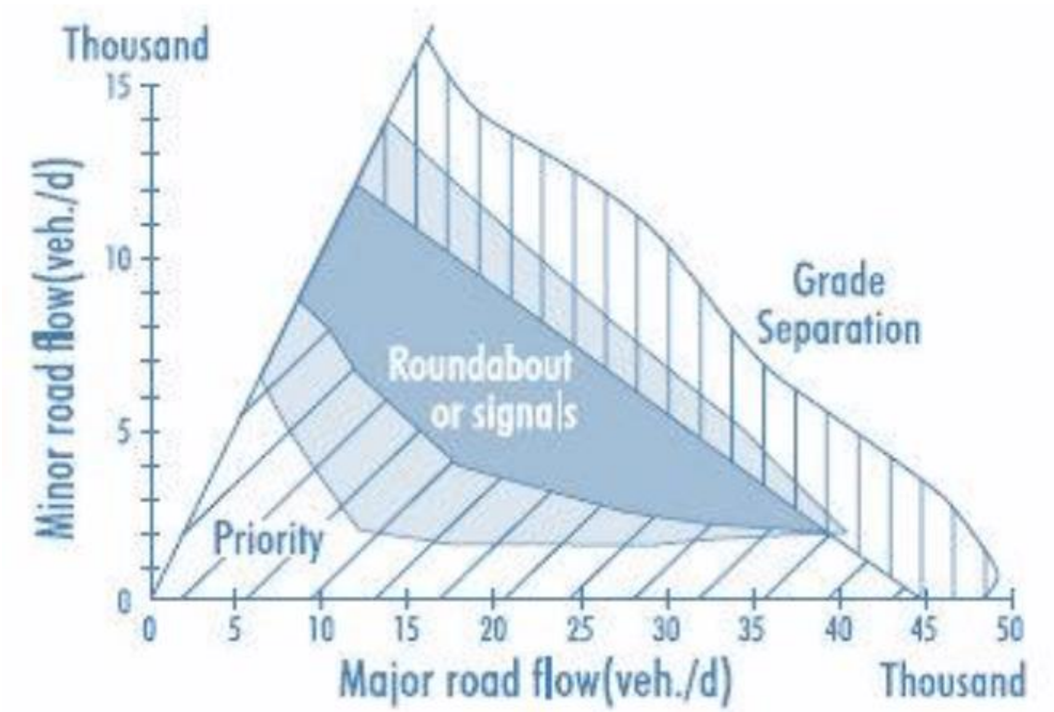


Figure 8-57 *Junction Typology Based on Traffic Flows (IHT)*

Table 8-29 *Improvements Proposed at Identified Junctions Phase I*

S. NO.	JUNCTION	TYPOLOGY
1	Puthiyangadi	Signalized
2	Thondayad	Grade Separator
3	Cyberpark Junction	Grade Separator
4	Arayidathupalam Junction	Grade Separator
5	Ramanattukara Flyover Junction	Grade Separator
6	Gandhi Road Junction	Signalized

8.6.2 PAVEMENT MARKINGS AND SIGNAGES

Even though road signs and markings are provided on major road stretches of Kozhikode, some of the sign boards are not visible and some are not maintained properly. It is recommended that proper signs be installed at all appropriate locations. Road signs are classified in three categories:

a) **Mandatory/Regulatory Signs:** To inform users about certain rules and regulations to improve safety and free flow of traffic. These include all signs such as STOP, GIVE WAY, Speed Limits, No entry etc. The violation of rules and regulations conveyed by these signs is a legal offence.

Figure 8-58 *Mandatory Signs*

b) **Cautionary/Warning Signs:** To caution the road users of certain hazardous condition either on or adjacent to the roadway. Some examples are Hairpin bend, Narrow Bridge etc.

c) **Informatory Signs:** These signs are used to provide information and to guide road users along routes. The information could include name of places, sites, direction to the destinations etc.

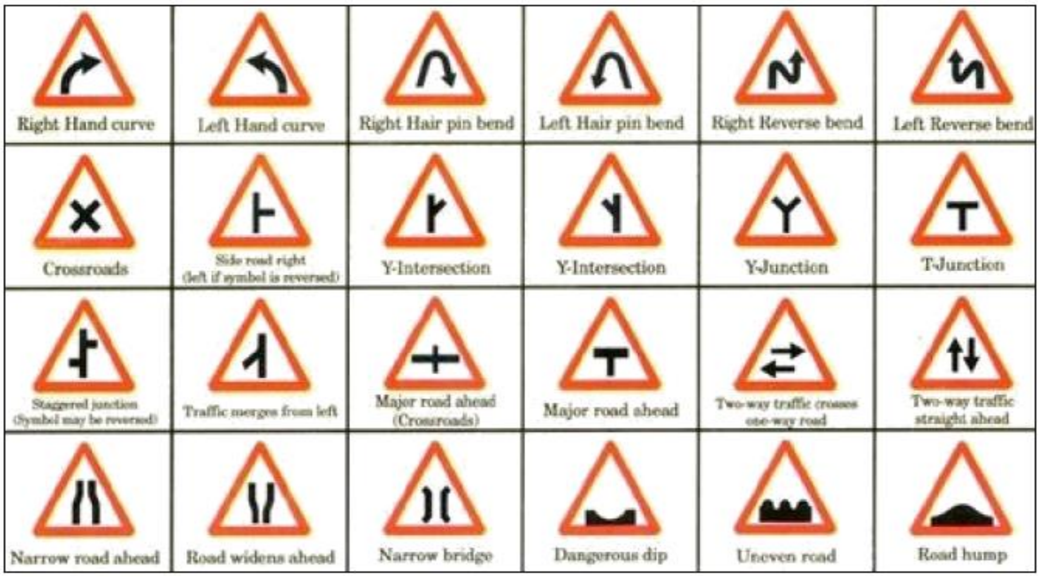


Figure 8-59 Cautionary or Warning Signs

Traffic control devices such as Centre line, Traffic lane lines, stop lines, Pedestrian crossings, Parking space Kerb marking for visibility, Obstruction marking etc. must be provided keeping in view all users of the road and especially for night time driving. All the traffic signs should be facilitated as per the guidelines provided in IRC: 67-2001.

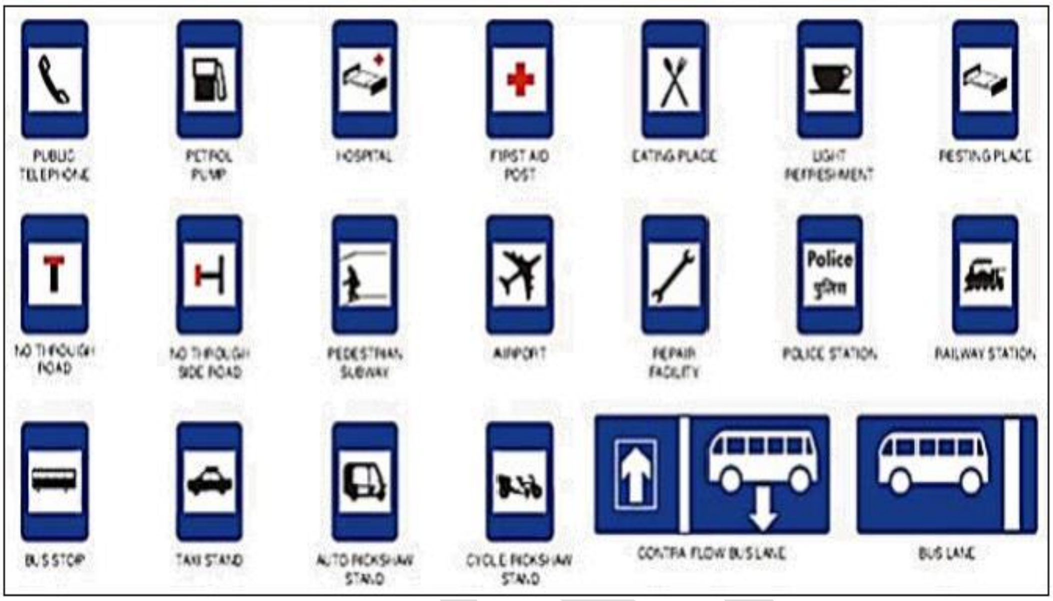


Figure 8-60 *Informatory Signs*

Following are the general Traffic management measures.

- Proper sign boards should be provided at important junctions, arterial/sub arterial roads, entry/exit points of market areas, cordon points, accident prone locations, school/college zones and other commercial areas.
- Zebra crossings, Lane Markings and Stop lines should be marked on all arterials and sub arterial roads.
- Pedestrian crossings should be provided at mid-blocks near school/college zones and major commercial areas. Pelican signals should be installed at such places. An exclusive pedestrian phase should be provided for safe pedestrian crossing with a cycle time no less than 15sec and designed as per IRC.
- Pedestrian refuge islands should be provided at wider junctions.

- Parking should be restricted at least 50-100m near to the junction on all the approach roads.
- Hawkers and Vendors should be restricted at least 50-100m near to the junction on all the approach roads and from using footpaths.
- Bus stop and Auto/Taxi stand has to be shifted 50-100m away from junctions
- Commercial vehicles (except Goods Auto) should not be allowed during peak periods inside the city which should be stopped at all Outer Cordons.
- Before implementation of Traffic Management Schemes, traffic awareness programmers shall be organized.

8.6.3 AREA IMPROVEMENT PLAN

8.6.3.1 Mobility Improvement Around Palayam

Palayam being a major commercial and institutional area has a variety of activities distributed around it. However, the mobility of people and vehicles around Palayam has a lot of hindrances in the form of Railway track, insufficient Right of way or pedestrian infrastructure etc.

Figure 8-61 *Contextual Map of Palayam & Valiyangadi Area*

8.6.3.1.1 ISSUES IDENTIFIED

- Pedestrian facilities are provided in some of the roads, but due to high amount of traffic and on-street parking, the safety for the pedestrians is compromised.
- Barrier on pedestrian movement across the railway line
- NMT facilities in the entire area is not available which makes people hesitate to use NMTs.
- The area on the road opposite to railway Station is acting as a bus stand for private buses. Buses used to stop and hold at this area for longer time, which creates a chaotic situation to the through traffic.

- There is no integration between the railway station and the Palayam bus stand, which hesitates people to use public transportation and tends to avail IPT and personal vehicles.

Figure 8-62 *Existing Site Situation*

PROPOSED INTERVENTIONS AND IMPROVEMENTS

- Segregation of Passenger access at either side of the railway station by providing batter link access to private vehicles and improved PT and IPT bays for PT vehicles.

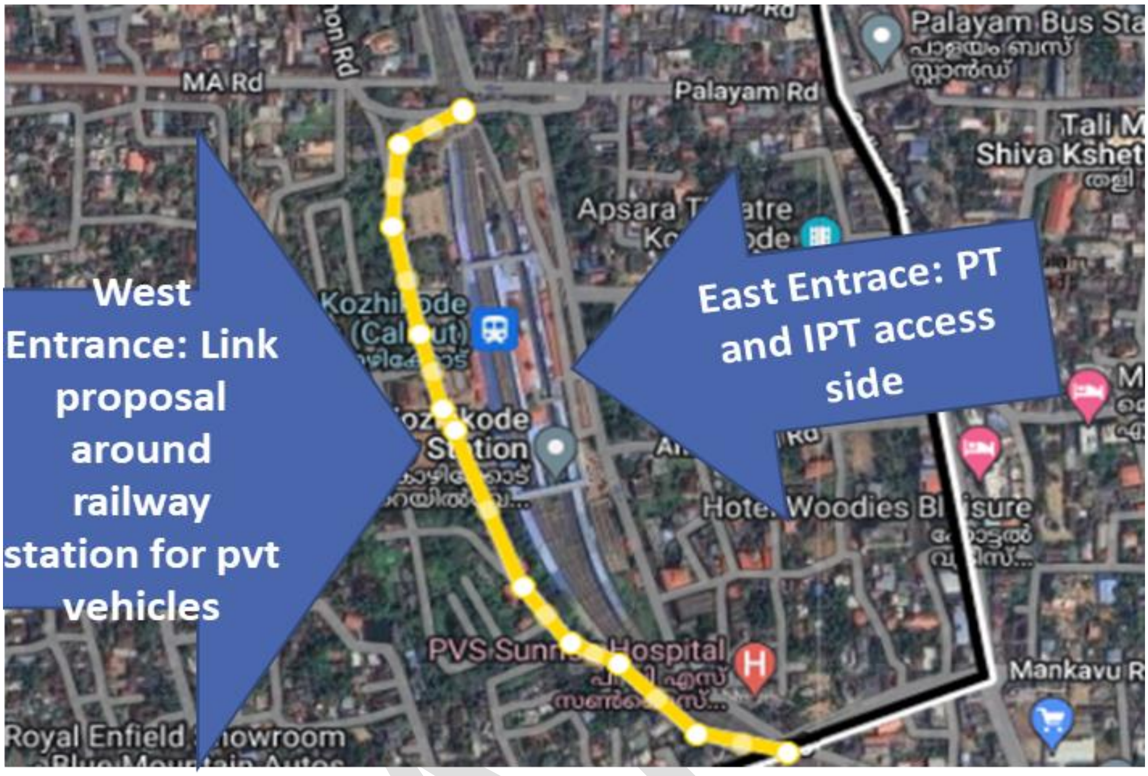


Figure 8-63 *Conceptual Map for Railway Station Access*

- Wide footpath has been proposed on all the major roads identified in the area.
- Cycle track is proposed on the major road identified for enhancing the sustainable and safe mobility.
- 800m long skywalk is proposed between Valiyangadi, Palayam bus stand and railway station to improve the pedestrian and bicycle access.

Figure 8-64 *Conceptual Map for Skywalk Access*

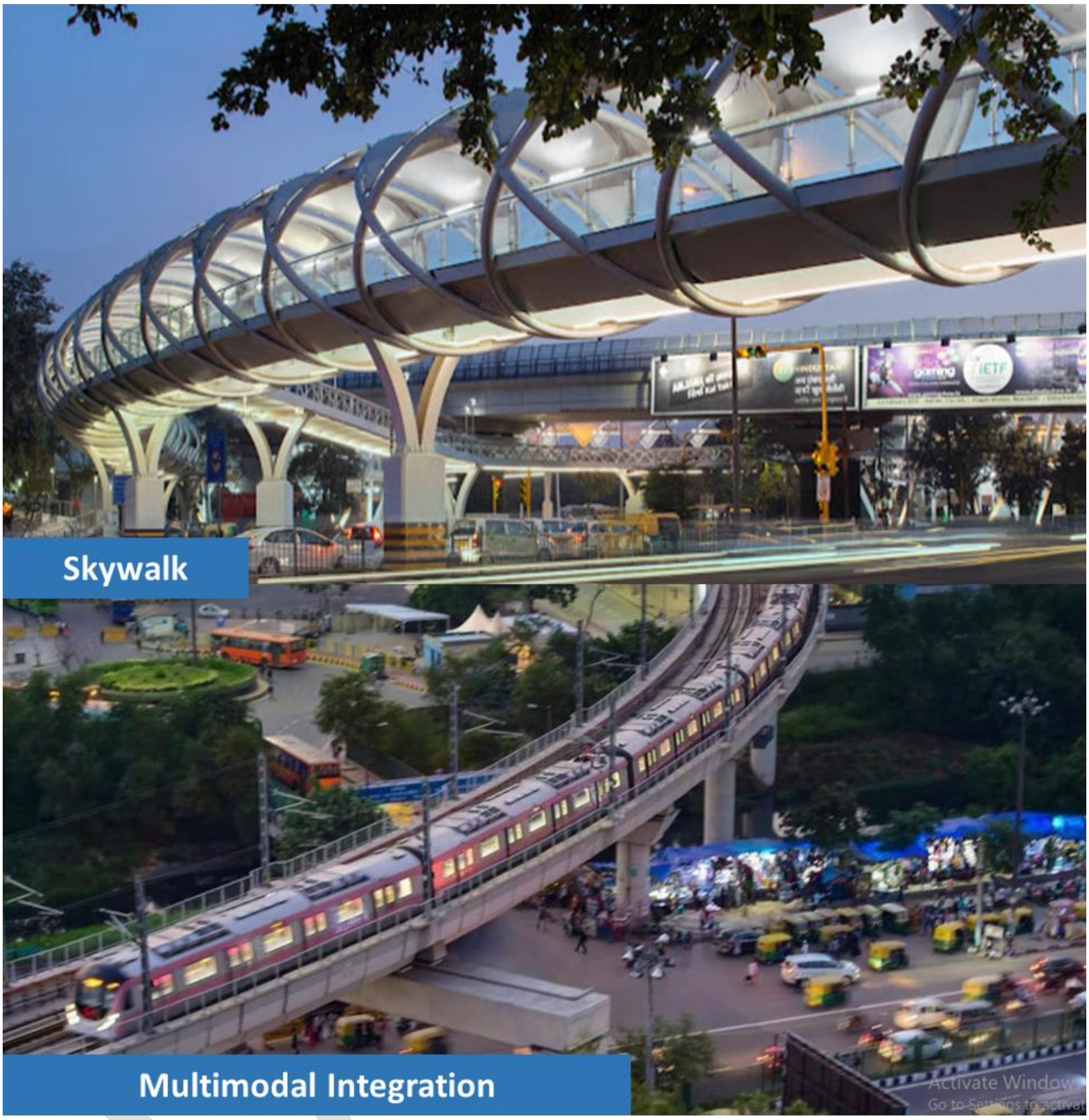


Figure 8-65 *Reference Images for Proposals*

8.7 PARKING MANAGEMENT STRATEGY

Similar to other cities in the country and state, the city experiences intense on-street parking and under-utilized off-street parking. The other parking issues are:

- Inadequate information for motorists on parking availability and price.
- Inadequate user options in terms of off-street parking, paid and convenient parking versus free and inconvenient parking.
- Concerns over spill over parking congestion in nearby areas if parking supply is inadequate.
- Inadequate or lack of Parking Pricing methods along the commercial streets such as at MM Ali Road, Ramanattukara, etc.
- Lack of convenient Parking Pricing methods, such as mechanical meters at designated parking spaces especially at terminals, etc.
- Inefficient use of existing off street parking capacity especially in Kozhikode Corporation parking spaces.

In addition, the excessive use of private modes use has resulted in the dependency on private vehicles and increased demand for parking spaces. Thus, the strategies should supplement the steps being taken to reduce the dependency on private mode and encourage transportation alternatives. Thus, a Parking Management Strategy is proposed for the study area.

Parking Management Strategy includes a variety of strategies that encourage more efficient use of existing parking facilities, improve the quality of service provided to parking facility users and improve parking facility design. An effective management plan can help address a wide range of transportation problems as discussed above and help to achieve a variety of transportation and land use development objectives.

The proposed parking strategies should address these issues which will in turn will increase the parking turnover rate and reduce the spillage of parking activities. The various measures recommended for parking are:

- Designated Parking Spaces (On and Off-Street)
- Parking Pricing: with temporal variations
- Enforcement
- Proof of Parking
- Parking Standards Near Transit Stations

- Shared Parking
- Parking Permits

Based on the survey results of On and Off-Street Parking, some locations have been identified as designated On and Off-Street Parking areas. This section details out the specifications of the identified locations.

8.7.1 DESIGNATED ON-STREET PARKING SPACES

Designated On-Street Parking is recommended on the following locations with optimum lengths for to be effective use of the available parking bays. It is recommended to restrict free On-Street Parking on the other stretches around these corridors. In addition to the motorized parking, some minimum number bicycle parking spaces have also been provided at each location to encourage the use on Non-Motorized Transport in the study area.

Table 8-30 *Proposed On-street Parking Spaces Capacities*

Location	Effective Length (m)	Parking Capacity (ECS)								
		LHS			RHS			Total		
		2W	4W	Cycle	2W	4W	Cycle	2W	4W	Cycle
Mananchira Square	240	70	6	3	0	0	0	70	12	3
Wayanad Road	500	17	75	0	74	17	0	34	149	0
Eranjipalam Junction	1000	100	70	13	92	71	12	192	141	23
Mankavu Junction	1700	170	120	17	100	65	17	270	185	34
Kesari Junction, Mankavu Mooriyad Road	400	20	15	9	34	39	9	54	54	18
Francis Road	1000	70	30	4	115	34	4	185	64	8

Kallayi Road	1500	170	67	7	170	67	7	339	134	14

8.7.2 DESIGNATED OFF-STREET PARKING SPACES

Designated Off-Street Parking is recommended on the following locations with optimum area for effective use of the available parking bays. It is recommended to restrict free On-Street Parking on the other stretches around these areas. In addition to the motorized parking, some minimum number of bicycle parking bays have also been provided at each location to encourage the use on Non-Motorized Transport in the study area.

Table 8-31 *Proposed Off-street Parking/MLCP Spaces Capacities*

Location	Area (m^2)	ECS (Proposed)	Composition			Bays			Type	Phase
			2W	4W	Cycle	2W	4W	Cycle		
Palayam Market	1050	84	40%	40%	20%	168	34	10	MLCP	I
Civil Station	1200	96	25%	75%	5%	43	35	15	MLCP	I
Ramanattukara	1450	116	54%	40%	6%	250	54	10	MLCP	II
Stadium	700	53	27%	48%	25%	75	20	10	MLCP	I
Kallayi	2525	202	15%	26%	7%	23	15	19	Surface	II
Link Road, Beach	800	400	20%	80%	0%	400	320	0	MLCP	II

8.7.3 CONCEPT - PARKING POLICY

8.7.3.1 PARKING PRICING

Parking pricing and time limits are important parking management mechanisms in order to promote short-term parking enhance turnover of parking bays at proposed designated locations and ensure access to limited on-street parking in high parking demand areas. For the study area, the following pricing methods are recommended to be implemented.

8.7.3.2 DISTANCE FROM OFF-STREET PARKING FACILITY

The parking on streets adjacent to off-street parking facilities should be priced higher since they are more convenient to access. This would consider off-street prices as benchmark and ensure an optimum usage of the facilities provided. Thus, parking around all the designated parking should be priced higher based on the land use values of those locations.

8.7.3.3 TIME-OF-THE DAY / OCCUPANCY BASED PRICING

Dynamic pricing is recommended to be incorporated to achieve higher parking turn-over rates. For Kozhikode Time and Occupancy based pricing methods are recommended.

The occupancy-based pricing is based on either a target average occupancy on street at the locations known to saturate easily. The following locations can be considered for occupancy-based parking pricing:

- Mananchira
- M M Ali Road
- Palayam
- Stadium Road
- Kozhikode Road, Kadalundi
- Beypore Road
- Near Feroke Railway Station

The Time-of the Day pricing can be adopted on stretches where the demand rises and then reduces over peak and off-peak hours of the day respectively. The following locations can be considered for Time-based parking pricing:

- Cyber Park
- Beach Road
- HiLITE Mall

8.7.3.4 DISTANCE FROM TRANSIT

High parking charges should be levied on parking in places that are well-connected with transit facilities. This should be done in order to discourage private vehicle use. The On-Street Parking locations around the following locations are recommended to have higher parking price,

- Central Railway Station
- West Hill Railway Station
- KSRTC Bus Stand
- Feroke Railway Station

The tentative parking prices based on the demand and willing to pay is as shown below.

Table 8-32 *Peak Hour Parking Fees*

Vehicle Type	Morning/ Evening Peak Hours (3-4 Hrs Each)			
	Up to 1 hr	2 hr	3 hr	4 hr
Two-Wheeler	5	10	15	20
Private Car	15	30	45	60
Large Car/ SUV	25	45	65	85

Table 8-33 *Short Term Parking Fees*

Vehicle Type	Day (8AM to 8PM)												Night (8PM to 8AM	Full Day
	Up to 1 hr	Up to 2 hrs	Up to 3 hrs	Up to 4 hrs	Up to 5 hrs	Up to 6 hrs	Up to 7 hrs	Up to 8 hrs	Up to 9 hrs	Up to 10 hrs	Up to 11 hrs	Up to 12 hrs		
Two-Wheeler	5	5	5	10	10	10	15	15	15	20	20	20	5	25
Private Car	12	25	40	50	60	75	100	115	120	120	120	120	8	120
Large Car/ SUV	20	32	44	56	68	80	90	104	104	104	104	104	16	120

Table 8-34 *Long Term Parking Fees*

Vehicle Type	Daily Charges			Subsidized Charges	
	Day 12 hrs (8AM to 8PM)	Night 12 hrs (8PM to 8AM)	24 hrs Day + Night	Quarterly	Annually
Two-Wheeler	180	45	225	225	900
Private Car	1100	80	1200	900	3900
Large Car/ SUV	1200	180	1300	1100	4000

A detailed Parking Policy Study should be carried out capturing the land values and dynamic parking conditions to identify feasibility of the locations and the parking fees at proposed locations.

8.7.3.5 ENFORCEMENT

Enforcement is the most crucial tool of Parking Management Strategy. The success and failure of the parking strategy is dependent of the extent of the enforcement. In Kozhikode, especially along the major transit corridors and activity areas the parking enforcement shall be carried out through the following mechanisms:

1. Ensuring that all on-street parking areas and parking lots off-street are clearly marked and easily identified. Specifically, the following standards shall be followed:
   - On street parking spaces shall be designed as per IRC: SP: 12:2015.
   - Boundaries of all on-street parking spaces will be marked by white line as indicated in IRC:35-1997.
   - Signage clearly marking the parking and 'No Parking' areas shall be marked as per IRC:67-2001.
2. Clear demarcation and implementation of 'No Parking' areas. These areas shall include:
   - Prohibition of parking for at least 75 m distance from all junctions.
   - Prohibition of parking at least 10 m distance from all zebra crossings.
   - Prohibition of parking at least 45m on either side of the transit is terminal entry and exit points.
3. Un-designated On-Street private vehicle parking within the immediate vicinity of the transit stations should be restricted, at least during the peak hours.

For enforcing parking near schools, hospitals, educational institutes and other facilities, authorities can facilitate and encourage them to involve volunteers, traffic police or others to manage parking.

8.7.3.6 PARKING STANDARDS NEAR TRANSIT STATIONS

Reduced parking standards near transit within a buffer zone of 300 m around the transit line. All Public Transit corridors, the high mobility corridors and proposed metro corridors need not provide the same amount of parking that is required elsewhere. Parking standards could be reduced by 50% around transit facilities.

8.7.3.7 PARKING PERMITS

Restricted parking zones can be created to help ease parking congestion in residential areas around major demand generators. Parking Permits are provided for residents, business and visitors with Resident Parking Zone (RPZ) where On-Street parking is controlled. This mitigated the un-intended effects of non-resident parking in the zone.

Table 8-35 *Types of Permits*

Permit Type	Description
Residents	Allows residents to park their vehicles in an available resident's bay in the zone where the permit is valid
Business	Allows owners/partners of the business to park their vehicles in a resident's bay, in the zone where the business is situated
Visitors	Allows you to activate the permit for a visitor's vehicle when they arrive at resident's home

Potential areas where RPZ can be implemented are:

- West Hill area
- Malaparamba area
- Palayam area

8.8 TECHNOLOGICAL TRANSITIONS

8.8.1 PASSENGER INFORMATION SYSTEMS (PIS)

In the case of public transit, PIS refers to an information system, which provides real-time, dynamic information for passengers. This may include both predictions about arrival and departure times, and information about the nature and causes of disruptions. The system utilizes vehicle location data from AVL systems to disseminate information on the current location of the bus to passengers and predict arrival times at bus stops (Green City Streets n.d.). This is particularly useful on low-frequency routes and when buses deviate from scheduled times due to unforeseen circumstances[47].

The first generation of PIS involved the use of light-emitting diode (LED) display boards at bus stops to indicate estimated arrival times for the next bus Through the urban bus specifications recommended by the Ministry of Housing and Urban Affairs (MoHUA), this system was used inside buses to announce next-stop information; however general observations (EMBARQ India 2014) indicate that several systems remain unused or non-functional. Few cities experimented with the option of communicating this information via SMS, but with limited success. Current advancements in telecommunications, such as smart phones, create the potential to track buses in real time through mobile phone Apps, which is currently been adopted by BMTC in Bangalore for their city bus systems.

[47] Source: Bus Karo 2.0

Figure 8-66 *PIS System*

In case of Kozhikode, the initiative has been made by KSRTC to implement PIS system inside all the buses, all terminals and bus stops.

8.8.1.1 VECHICLE TECHNOLOGY

As a green initiative to move towards Sustainable urban transport, technological transformations in terms of public transport vehicles are recommended. With efforts to reduce carbon emissions the CMP recommends the used of electric vehicles.

8.8.1.2 ELECTRIC BUSES AND AUTO RICKSHAWS:

India is in the process of tackling its ambitious objective of having a 100 per cent zero-emissions, electric vehicle fleet by 2030, as envisaged by NITI Aayog. Consequently, experiments on the operational feasibility of all vehicle types, including buses, cars, two-wheelers, rickshaws, taxis and goods vehicles, are beginning. The Indian government understood the environmental need to switch to electric vehicles and to ensure it is a success, a number of initiatives are being implemented.

Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles (FAME Scheme) is one of said initiatives. FAME provides subsidies as a financial incentive to buyers of electric vehicles. The scheme allocated approximately INR155 crore for demand incentives in 2015-2016 and around INR340 crores between 2016-2017. As a result, each mode of transport has experienced some acceleration towards electrification.

In case of Kozhikode, newly formed service buses are provided with Electrical buses, which needs to be further expanded. Whereas, E-rickshaws are highly recommended in the city. As a part of the old city rejuvenation, only E-Rickshaws shall be allowed to ply in the core are to provide connectivity during the restricted vehicle hours to provide connectivity.

8.8.2 PROPOSED EV CHARGING STATIONS

The CMP proposes 67 new charging stations to establish a good coverage for Electric vehicle charging facilities. The following are the locations for the same.

Table 8-36 *Proposed EV Charging Stations*

S.NO.	NAME	PHASE	COMMENTS
1	Thondayad Junction	I	Existing
2	Balan K Nair Road	I	Existing
3	Fish Market	I	Existing
4	West Hill Chungam	I	Existing
5	Nadakkavu	I	Existing
6	Corporation Office	I	Existing
7	Railway Station	I	Existing
8	Kozhikode New Bus Stand	I	Existing
9	HiLite	I	Existing
10	Kolattu Road	I	Existing
11	Ramanattukara	I	Existing
12	Feroke	I	Existing
13	Mavoor Road	I	Existing
14	Cheruvannur	I	Existing
15	Beypore	I	Existing
16	Beach Road	I	Existing
17	Kunnamangalam	I	Proposed
18	Malaparamba	I	Proposed
19	Vengeri Junction	I	Proposed
20	Karaparamba Junction	I	Proposed
21	Kovoor Junction	I	Proposed
22	Vellamadikkunnu Junction	I	Proposed
23	Cyberpark Junction	I	Proposed
24	G Tec Junction	I	Proposed
25	Stadium Junction	I	Proposed
26	Rajaji Junction	I	Proposed
27	Arayidathupalam Junction	I	Proposed
28	Puthiyara Junction	I	Proposed

S.NO.	NAME	PHASE	COMMENTS
29	Chalapuram Cross Junction	I	Proposed
30	Kovoor Junction	I	Proposed
31	Puthiyangadi Junction	I	Proposed
32	Ramanattukara Flyover Junction	I	Proposed
33	Gandhi Road Junction	I	Proposed
34	Vandipetta Junction	I	Proposed
35	Kannur Road	I	Proposed
36	Vattakinar	I	Proposed
37	Pantheerankavu	I	Proposed
38	Kundayithode	I	Proposed
39	Olavanna Road	I	Proposed
40	Mananchira	I	Proposed
41	Chintavalappu Junction	I	Proposed
42	Puthiyapalam Junction	I	Proposed
43	Pottammal Junction	I	Proposed
44	Medical College Junction	I	Proposed
45	Meitra Hospital	I	Proposed
46	Karanthur	I	Proposed
47	West Hill Railway Station	I	Proposed
48	Eranjippalam Juma Masjid	I	Proposed
49	Vellayil Railway Station	I	Proposed
50	YMCA	I	Proposed
51	Rajendra Hospital	I	Proposed
52	Kayamkulam Junction	I	Proposed
53	Kannur Road Kunduparamba Junction	II	Existing, Proposed additional infrastructure
54	Homeo College Karaparamba	II	Existing, Proposed additional infrastructure
55	Wayanad Road	II	Existing, Proposed additional infrastructure
56	Sales Tax Office Road	II	Existing, Proposed additional infrastructure
57	CWRDM Road	II	Existing, Proposed additional infrastructure
58	KP Chandran Road	II	Existing, Proposed additional infrastructure

S.NO.	NAME	PHASE	COMMENTS
59	Court Road	II	Existing, Proposed additional infrastructure
60	Karad Road	II	Existing, Proposed additional infrastructure
61	Goshalikunnu Road	II	Existing, Proposed additional infrastructure
62	Parolamala Junction	II	Proposed
63	Pooladikkunnu Junction	II	Proposed
64	Irangadanpalli Junction	II	Proposed
65	Mankavu Junction	II	Proposed
66	Chalapuram Cross Junction	II	Proposed
67	Kalluthankadavu Junction	II	Proposed
68	Cherumanasserri Road Junction	II	Proposed
69	Chevarambalam Junction	II	Proposed
70	Mankavu Govindapuram Road	II	Proposed
71	Manadravil Padam Road	II	Proposed
72	Gear Junction	II	Proposed
73	Kodinattumukku	II	Proposed
74	Sobha Junction	II	Proposed
75	Moozhikkal	II	Proposed
76	Chelavoor	II	Proposed
77	Kunduparamba Road	II	Proposed
78	Valayanad Kommery Road	II	Proposed
79	Areekad Junction	II	Proposed
80	Kolathara Junction	II	Proposed
81	Malaparamba Post Office	II	Proposed
82	Kottooli Post Office	II	Proposed
83	Golf Link Road	II	Proposed

Figure 8-67 *EV Charging Station at Kozhikode*

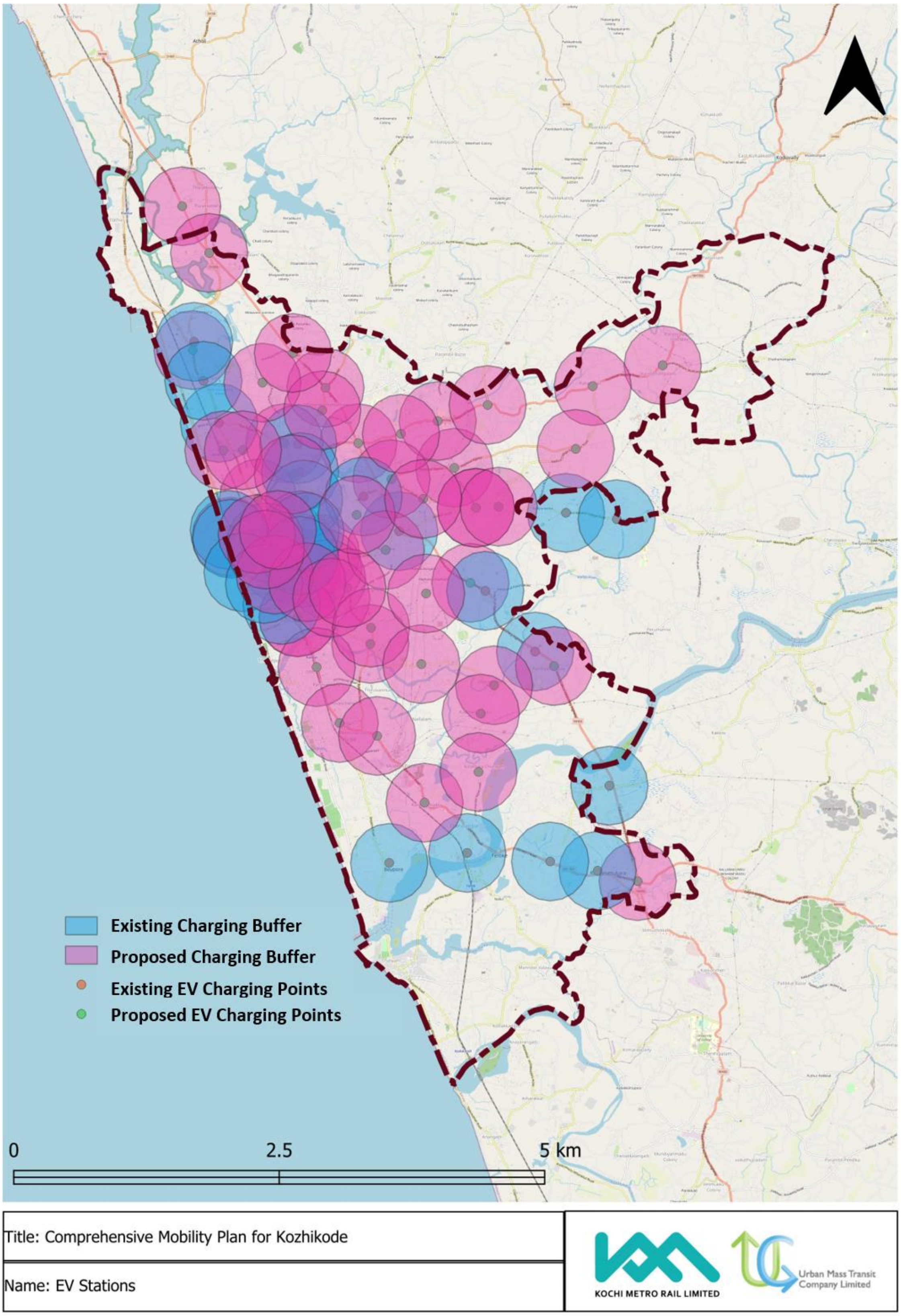


Figure 8-68 *Proposed IPT Charging Stations and the area covered.*

8.8.3 SMART CITY BUS SHELTER

Smart city bus shelters are modernized and technologically advanced bus shelters that aim to enhance the overall experience for commuters and improve the efficiency of public transportation systems. These bus shelters incorporate various features and technologies to provide a more convenient, comfortable, and connected environment for passengers. Here are some key aspects of smart city bus shelters:

1. **Real-Time Information:** Smart bus shelters are equipped with digital display boards or screens that provide real-time information about bus arrival and departure times, route details, and any service disruptions or delays. This information helps passengers plan their journeys more effectively and reduces the uncertainty associated with waiting for buses.
2. **Interactive Touchscreens:** Many smart bus shelters feature interactive touchscreens or kiosks that allow passengers to access additional information, such as maps, fare details, and nearby points of interest. These touchscreens may also provide access to other services like weather updates, emergency contacts, and local news.
3. **Passenger Amenities:** Smart bus shelters prioritize passenger comfort by providing seating arrangements, lighting for enhanced visibility and safety, and shelter from inclement weather conditions. Some shelters may have charging stations for mobile devices, free Wi-Fi connectivity, and even air conditioning or heating systems for extreme weather conditions.
4. **Safety and Security:** Smart bus shelters are designed to ensure the safety and security of passengers. They may include surveillance cameras for monitoring activities, emergency call buttons to contact authorities in case of emergencies, and well-lit areas to discourage criminal activities.
5. **Sustainability Features:** Many smart bus shelters incorporate environmentally friendly features. These may include solar panels to generate electricity for lighting and charging stations, rainwater harvesting systems, and energy-efficient lighting systems. These sustainability measures help reduce the carbon footprint and promote eco-friendly practices.
6. **Integration with Mobile Applications:** Smart bus shelters can be integrated with mobile applications that provide real-time bus tracking, ticketing services, and other travel-related information. Passengers can use these apps to plan their journeys, purchase tickets, and receive notifications about their bus arrivals.

Smart city bus shelters are part of the larger vision of creating intelligent and connected urban spaces. By leveraging technology and innovation, these shelters aim to enhance the overall public transportation experience, encourage the use of public transit, and contribute to the development of smarter, more sustainable cities. The identified locations for implementing the smart bus shelters in Kozhikode is provided below.

Table 8-37 *Smart Bus Shelters*

S. No.	Smart Bus Shelters
PHASE I	
1	Mananchira Bus Stop
2	Nadakkavu Bus Stop
3	Medical College Bus Stop
4	Meenchanda Bus Stop
5	Railway Station Bus Stop
6	Civil Station Bus Stop
PHASE II	
1	West Hill Chungam Bus Stop
2	Feroke Bus Stop
3	Cheriya Mankavu Bus Stop
4	Mavoor Junction Bus Stop
5	Christian College Bus Stop
6	Pantheerankavu Bus Stop
7	Vengeri Bus Stop
8	HiLITE Mall Bus Stop
9	Cheruvannur Bus Stop
10	Chelavoor Bus Stop
11	Law College Bus Stop
12	Eranjipalam Bus Stop
13	Jail Road Bus Stop
14	Stadium Junction Bus Stop
15	Azhinjillam Bus Stop
16	Pottammal Bus Stop
17	Chevayoor Bus Stop
18	Mayanad Bus Stop

8.8.4 ADAPTIVE TRAFFIC CONTROL SYSYTEM (ATCS)

The Adaptive Traffic Control System (ATCS) is an advanced traffic management technology that uses real-time data and intelligent algorithms to optimize traffic flow and improve the efficiency of signalized intersections. It is designed to adapt to changing traffic conditions dynamically and provide optimal signal timings for different traffic volumes and patterns. Here are some key aspects of the Adaptive Traffic Control System:

1. **Real-Time Traffic Monitoring:** ATCS utilizes various sensors, such as video cameras, radar, and inductive loop detectors, to collect real-time data on traffic flow, vehicle counts, and occupancy at intersections. This data is continuously analysed to assess current traffic conditions.
2. **Intelligent Signal Optimization:** The ATCS employs advanced algorithms and predictive models to optimize signal timings based on the collected data. It takes into account factors such as traffic volume, congestion levels, queue lengths, and pedestrian activity to dynamically adjust signal phases and timings.
3. **Traffic Responsive Operation:** Unlike traditional traffic control systems that operate on fixed signal timings, ATCS responds to the prevailing traffic conditions. It can automatically adjust signal timings based on the demand and prioritize the movement of vehicles along the most congested routes.
4. **Coordination of Multiple Intersections:** ATCS can coordinate signal timings across multiple intersections within a road network to create a coordinated and synchronized traffic flow. This helps to minimize stops, reduce delays, and enhance the overall efficiency of traffic movement.
5. **Emergency Vehicle Pre-emption:** ATCS can provide special priority and pre-emption for emergency vehicles such as ambulances and fire trucks. It can detect the approach of emergency vehicles and modify the signal timings to give them a clear and unobstructed path.
6. **Data Analysis and Performance Monitoring:** ATCS generates valuable data on traffic patterns, congestion levels, and signal performance. This data can be analysed to identify traffic trends, optimize signal timings further, and make informed decisions for transportation planning and infrastructure improvements.

Benefits of ATCS include reduced travel times, improved traffic flow, decreased congestion and delays, enhanced safety for motorists and pedestrians, and reduced environmental impact by minimizing vehicle emissions. By dynamically adapting to changing traffic conditions, ATCS helps optimize the use of existing road infrastructure and contributes to more efficient and sustainable transportation systems.

Figure 8-69 *AI Cameras for Traffic Monitoring*

It's worth noting that the specific implementation and capabilities of ATCS may vary depending on the location and system provider. However, the overall goal remains consistent: to intelligently manage and optimize traffic flow for enhanced mobility and efficiency. The proposed intersections at which the ATCS is planning to be implemented are listed in the following Table.

Table 8-38 *Proposed Intersection for ATCS*

S. No	Location of Junctions for ATC Placements
1	Karaparamba Junction
2	Eranjippalam Jn
3	Medical College Junction
4	Vattakinar Jn
5	Meenchanda Jn
6	Palayam Junction
7	West Hill Chungam Jn
8	Puthiyangadi Jn
9	Thondayad Junction
10	Vengeri Junction
11	Malaparamba junction
12	CH Fly Over Jn
13	Parolamala Junction
14	Pooladikkunnu Jn
15	Panniyankara Over bridge
16	Stadium Jn

S. No	Location of Junctions for ATC Placements
17	Rajaji Jn
18	Puthiyara Junction
19	Kalluthankadavu Junction
20	Kovoor Jn
21	MCC West
22	MCC East
23	Gandhi Road Jn
24	Pushpa Junction
25	Mankavu Junction
26	Iringadan Palli Jn
27	Chevarambalam Jn
28	Ramanattukara Jn
29	Nisari Jn
30	Mukkom Jn KMG
31	Vellamadikkunnu Jn

8.8.5 SMART PARKING

Smart Parking analyses the real time data of the city's parking and sends the information to the usres so that they can save the time spent in looking for the parking facilities in the city.

1. Real-time data and guidance to drivers so they can locate the best available parking space quickly.
2. Parking asset control for cities, operators and facility management so they can understand occupancy, payment compliance and much more.
3. A direct way to affect climate change with cars searching for parking less so we have a sustainable future.

There are three methods of smart parking implementation:

1. **Ground sensor technology:** ground sensors are installed into the concrete at each parking space or bay. When a car enters the space, the sensor below will identify an object above it and register that single parking space as occupied.
2. **Counter technology:** This involves a raiseable gate that allows cars to enter and exit while it counts the number of vehicles and dispenses a ticket for payment.
3. **Overhead sensor or camera-based technology:** With the use of overhead parking sensors or cameras, large parking areas or on-street parking can be viewed more efficiently from above

Smart Parking solutions are proposed in all the six off street parking locations identified in the mobility plan.

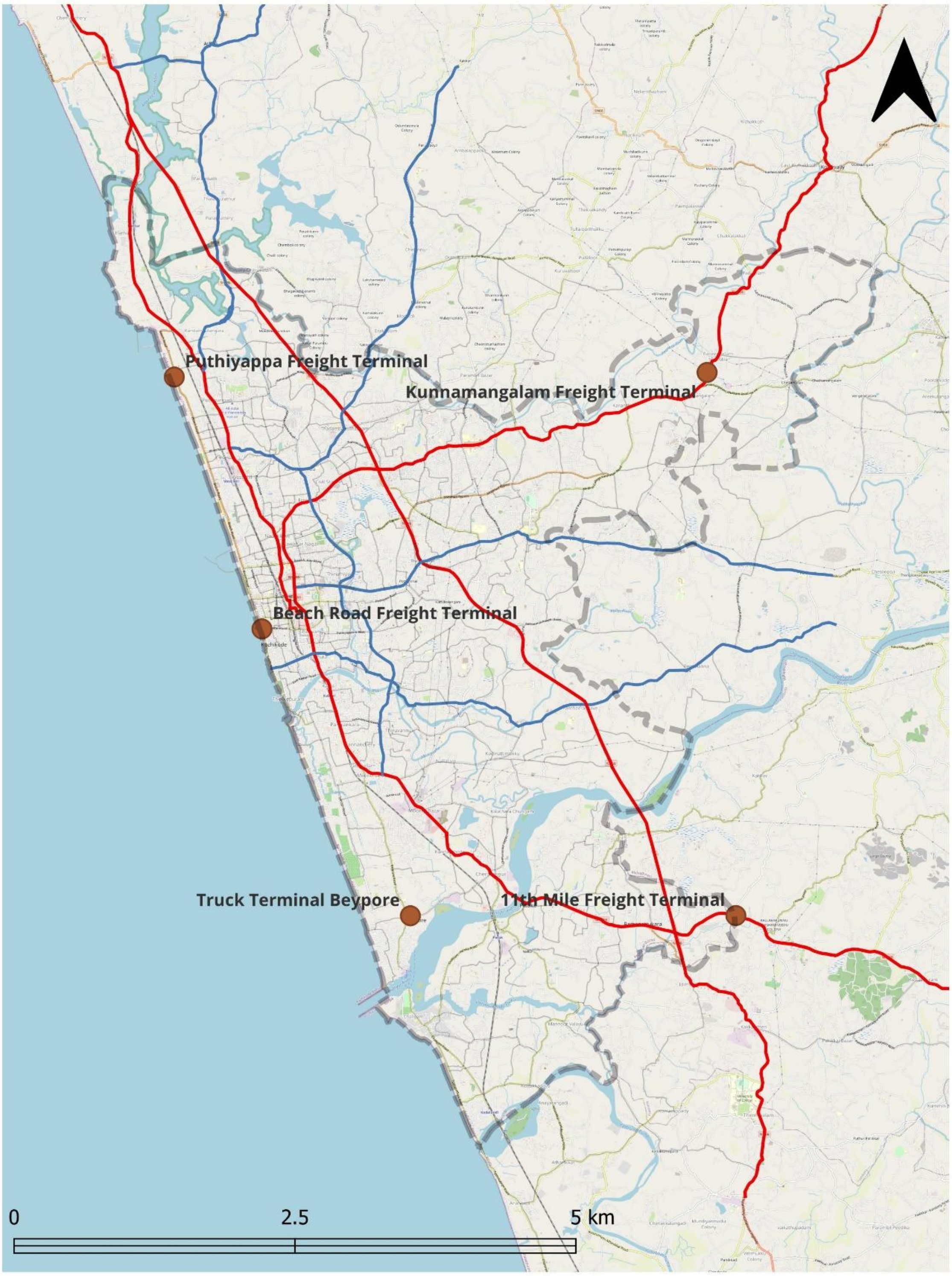
8.9 FREIGHT STRATEGY

Freight movement in indicates the level of economic activities in the city. The location of economic nodes decides the movement of goods traffic and managing the goods traffic movement is vital to maintain the acceptable level of congestion during peak hours within the city.

Restricting the heavy goods vehicle movement in major mobility corridors during peak hours is the long-term strategy that need to be considered to avoid excess congestion caused by goods traffic during peak hours. A freight traffic deviation is proposed at the main arterial roads and a bypass connectivity for freight vehicles is proposed between NH 66 and Beypore. Beach road shall carry freight between 10 pm and 5 am, but the traffic shall be restricted during all other times due to the recreational activities on the link.

Table 8-39 *Proposed Freight Terminals with Capacity*

S. NO.	LOCATION	TRUCKS	AREA REQUIRED (SQ. M.)	PHASE
1	Beypore	350	98000	II
2	Beach Road	200	56000	I
3	11th Mile	150	42000	II
4	Puthiyappa Harbour	100	28000	I
5	Kunnamangalam	100	28000	III



Title: Comprehensive Mobility Plan for Kozhikode	KOCHI METRO RAIL LIMITED / Urban Mass Transit Company Limited
Name: Freight Terminals	

Figure 8-70 *Proposed Freight Terminals*

9. IMPACT ASSESSMENT

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited

9 PROJECT IMPACT ASSESSMENT

Projects evolved in CMP will help to achieve sustainable development goals by means of reducing private mode share and travel time. This chapter presents the impact of the proposed strategies under Sustainable Urban Transport scenario in comparison to the Business as Usual scenario. The impact assessment is based on the following parameters as suggested in the CMP – Toolkit 2014.

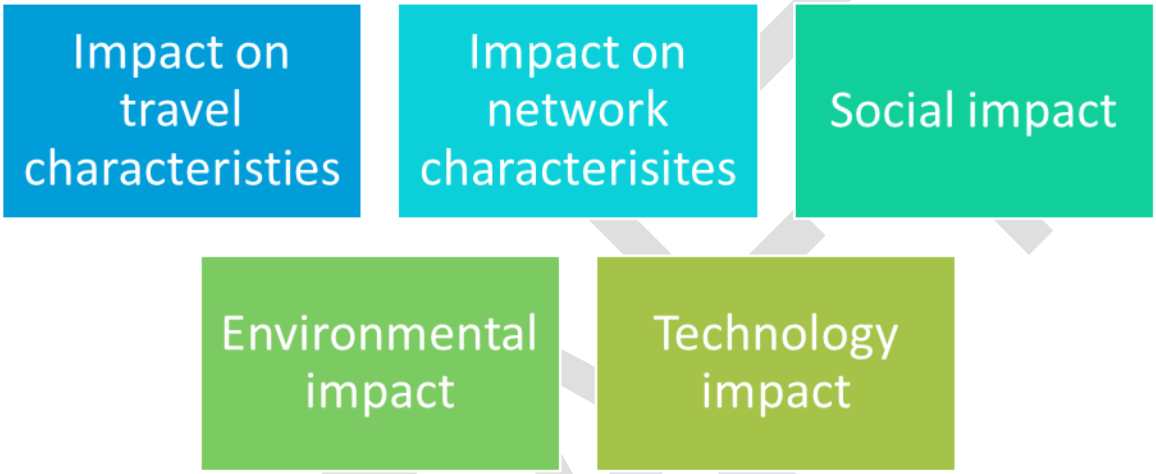


Figure 9-1 Parameters for Impact Assessment

9.1 IMPACT ON TRAVEL CHARACTERISTICES

The anticipated impacts of proposed projects on travel characteristics are assessed based on the following parameters,

- **Mode Share** - Variations in the composition of trips made by various modes (users).
- **Average Trip Lengths** - Average travel Time of users of various mode in the study area
- **Average Travel Time** – Average travel Time of users of various mode in the study area
- **Accessibility to Public Transport** – Share of Population Having Access to PT in Kozhikode.

The impact on the above are as presented in the table below.

Table 9-1 Impact Assessment for Travel Characteristics.

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Impact on Network Characteristics					
1	**Passenger Modal Share (%)-Motorized Modes**				
	Private Modes	% of trips made by private motorized modes (two-wheelers, car)	60%	70%	56%
	Public Modes	% of trips made by public transport modes	25%	14%	32%
	IPT Modes	% of trips made by intermediate public transport modes (auto-rickshaws, shared auto-rickshaws)	15%	16%	15%
2	**Trip Length (Km)**				
	Trip Length (PvT Modes)	Average Trip Length of the Two-wheeler, Car and Auto users in the study area	5.9	6.4	6.3
	Trip Length (PT Modes)	Average Trip Length of the Public Transport users in the study area	6.13	4.8	7.32
3	**Average Speed**				
	Average Speed (Kmph) (Pvt.)	Average speed of private modes	22.2	18	**23.5**
	Average Speed (Kmph) (PT)	Average speed of public transport modes	17.2	10	20.2
4	**Accessibility to Public Transport (Population in lakh)**				
	Access to PT	Population having access to PT	7.0	7.1	8

9.2 IMPACT ON NETWORK CHARACTERISTICES

The anticipated impacts of proposed projects on network characteristics are assessed based on the following parameters,

- **Demand on corridors** – PUC and Passenger demand on major mobility corridors.
- **Congestion Levels** - Variations in the composition of trips made by various modes (users).
- **Average Speed** – Average speed of modes on the network in each scenario.
- **Footpath Coverage** – Percentage of major network covered with footpath.

The impact on the above are discussed in the following sections.

Reduction in intensity of vehicles on major roads is observed along with the distribution onto other roads in SUT scenario. However, the impact on SUT scenario on travel demand is presented is observed to improve in intensity as well as the coverage due to introduction of new routes and improved frequency of PT transit systems.

Table 9-2 Impact Assessment for Network Characteristics- Demand (PHPDT)

SN	NAME OF THE CORRIDOR	From	To	DEMAND 2023	DEMAND 2051
1	**Mavoor Road**	Thondayad	Kunnamangalam	10863	24488
2	**Mavoor Road**	Mavoor Road Jn	Thondayad	9889	20717
3	**SH 28, NH 966, Calicut Road**	Ramanattukara	Meenchanda	9316	18820
4	**NH-66**	Vengeri Jn	Thondayad Jn	8294	21257
5	**Mini- Bypass Road**	Arayadathu Paalam Junction	Bypass Junction	8254	13307
6	**SH 28, NH 966, Calicut Road**	Meenchanda	Mananchira	7423	17830
7	**Kannur Road**	Mananchira	West Hill	7222	16649
8	**NH-66**	Thondayad Jn	Ramanattukara	6664	22047
9	**NH 766, Wayanad Road**	Kunnamangalam	Malaparamba Jn	6636	13544
10	**Mini- Bypass Road**	Eranjippalam	Arayadathu Paalam Junction	6159	8546
11	**Kannur Road**	West Hill	Elathur	5576	8508
12	**Feroke City Road**	Cheruvannur	Kottakadavu Bridge	4800	7639
13	**Beach Road**	Bhatt Road	Gandhi Road	4797	7565
14	**Mini- Bypass Road**	West Hill Chungam	Eranjippalam	4331	5948
15	**Beach Road**	Gandhi Road	East Kallayi Road	4129	6480

SN	NAME OF THE CORRIDOR	From	To	DEMAND 2023	DEMAND 2051
16	**Puthiyara Road**	Canoli Canal	Pottammal Jn	3828	20717
17	**Karaparamba Road, Kozhikode Balusserri Road**	Kakkodi	Karaparamba	3671	7561
18	**Pavamani, Puthiyara Road**	Mananchira	Canoli Canal	3548	4491
19	**Beypore Road**	Meenchanda	Beypore Port	3490	9638
20	**NH 766, Wayanad Road**	Malaparamba Jn	Mananchira	3420	16081
21	**Oyitty Road**	Palayam Junction	Mananchira	3131	11648
22	**MM Ali Road, Jail Road**	Palayam Junction	Mini Bypass	2742	5222

The average speed of vehicles on the network was measured for the horizon years in the model and is observed that vehicle speed in the SUT scenario have increased owing to the improvements in road network and public transport proposals.

Table 9-3 Impact Assessment for Network Characteristics

S.NO.	INDICATOR TYPE	DESCRIPTION	BASE YEAR (2023)	BAU (2051)	SUT (2051)
1 Infrastructure and Landuse					
1	**Infrastructure Quality**				
	Average Speed (Kmph) (PvT)	Average speed of private modes	22.5	18	24.6
	Average Speed (Kmph) (PT)	Average speed of public transport modes	17	10	21
2	**Safety**				
	Quality of footpath infrastructure	% of city covered with Footpaths (Arterial and Sub-Arterial)	10%	10%	100.0%

9.3 SOCIAL IMPACT

The impact of the proposed projects from the social angle is analysed at a broader perspective. It is found that most of the projects have significantly less impact with respect to Rehabilitation and Resettlement. Land acquisition for some of the projects is inevitable. The proposed projects significantly improve mobility with reduced travel time.

Table 9-4 Broad Impact of Proposed Projects

PROJECT	ROW/LAND ACQUISITION	IMPROVE MOBILITY	REDUCTION IN TRAVEL TIME
Improved Bus Systems	No	Yes	Yes
Mass Transit System	Yes	Yes	Yes
Bus Terminals	Yes	Yes	NA
Freight Terminals	Yes	Yes	NA
Bus Shelters	Yes	Yes	Yes
ROBs/ New Roads/Flyovers	Yes	Yes	Yes
Bypass/Ring Roads	Yes	Yes	Yes
Foot Path	No	Yes	NA
Cycle Tracks	Yes	Yes	Yes
Major Junction Improvements	No	Yes	Yes

Some of the broad indicators for social changes are quantified and are presented in below.

Table 9-5 Social Impacts of Proposed Projects

NAME OF THE IMPACT	BASE YEAR (2023)	BAU SCENARIO (2051)	SUT SCENARIO (2051)
Private Transport (PVT) Trips	77%	86%	67.7%
Intermediate Public Transport (IPT) Trips	14.6	16%	12.1%
Public Transport Trips	21.7%	14%	32%
Walkability (Arterial & Sub-Arterial)	14%	50%	100.0%
Cyclability (Arterial & Sub-Arterial)	0%	20%	80%
Public Transport Accessibility	70%	72%	83%
Average distance to nearest stop from house of a PT user	0.9	0.9	0.5
Percent of public transport vehicles that provide disability access (by public transport mode)	0	0	50%
Percent public transport stations / bus stops that provide disability access	0	0	50%
Percent length of public footpaths (km) that provide disability access	0	0	75%

9.4 ENVIRONMENTAL IMPACTS

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the CMP. Screening is conducted by identifying the interaction of environmental components on the project activities for various projects. Screening conducted for the identified projects and respective impacts identified are presented in the Table 6.2-3.

Table 9-6 Impacts of Proposed Project Implementation

	PROJECT	SUB COMPONENTS	IMPACTS
1	Transit Hubs (based on TOD principles)	Development of serviced land for high density development Public transport interchange hubs	• Construction activity around the highway.
2	Pedestrian / NMT Infrastructure Improvement	Land acquisition for road widening wherever necessary	• Relocation of existing vending activity. • Removal of squatters and encroachers from the footpaths, if any. • Causing livelihood loss even though they are un-authorized.
		Construction of new footpath	• Improvement in safety of pedestrians due to measures proposed.
3	Public Transport Planning	Terminals/Depots/ Transport Hubs/Bus Stops/ MRT Systems	• Acquisition of land for the facilities causes loss of livelihood, loss of shelter, severance of community & social ties. • Increase of noise and air pollution in the areas of terminals and depots. • Improvement in approaches to the terminals and depots causing impacts on adjacent land-uses and land acquisition. • Temporary interruption to traffic and increases of emissions from vehicles due to higher idling times • Temporary increase of noise levels due to idling and traffic snarls • Alternate traffic diversion routes increasing route length and consequently emissions • Alternate traffic diversion routes exposing previously low traffic routes

	PROJECT	SUB COMPONENTS	IMPACTS
			to higher urban traffic and increasing air / noise pollution.
4	Road Network Improvements	Road Widening/New Link/Flyovers	• Land acquisition causes loss of livelihood, property dismantling etc. • Temporary interruption to traffic and increases of emissions from vehicles due to higher idling times • Temporary increase of noise levels due to idling and traffic snarls • Alternate traffic diversion routes increasing route length and consequently emissions • Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air / noise pollution
		Junction Improvements	• May cause removal / displacement of squatters & Encroachers. • Air and noise pollution from construction impacts • Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth
5	Freight Management	Creation of new freight terminal	• Acquisition of land in the peripheries • Contamination of runoff from road with construction material as sand / cement/ silt from stacked excavated earth

An understanding of vehicles, fuels and CO emissions from electricity use in transportation system is essential to learning the implications of travel demand on CO_2 emissions and air quality.

The transport sector relies primarily on fossil fuels. The dependence on fossil fuels is linked to the domination of internal combustion engine technology on a global scale. In future, however, multiple transitions can affect vehicles and associated infrastructures. In the case of Kozhikode, there would be:

1. A change in fuels due to greater use of cleaner petrol and diesel; more efficient engines.
2. More electricity for transportation such as buses, e-rickshaws well as promoting electric vehicles.

The impact of the proposed projects from the environmental effects is analysed at a broader perspective. Very few projects have significantly less impact with respect to air and noise pollution.

Thus, the timely implementation of the proposed project shall result in improved travel times, cleaner air and improved travel experience in the city.

9.4.1 ENVIRONMENTAL IMPACT ASSESSMENT & MITIGATION MEASURES

This section provides a summary of the screening conducted to determine the potential environmental impacts associated with the proposed expansion of roads under Comprehensive Mobility Plan. It covers all the major roads that come under Kozhikode.

Road projects can produce negative impacts. The impacts of road improvement, as the one being proposed, although usually more limited, can still be significant, not only on natural resources and systems but also on the social environment.

A wide variety of direct and indirect negative impacts have been attributed to road construction or improvement project. Though sharing a common concern over most environmental attributes, depending on their past experience in various projects, different agencies tend to lay varying emphasis on different biophysical and socio-environmental components and issues.

(i) Land Acquisition and Involuntary Relocation/Resettlement: These essentially include:

- Adverse social impacts on affected persons/households/business due to acquisition of land and property.
- Impacts due to removal of squatters and encroachers in the existing R.O.W., majority of whom might belong to economically and socially vulnerable sections of the society and thus needing rehabilitation/ compensation
- Stresses on the host community where project affected persons are relocated

(ii) Community Impacts – these include:

- Community severance
- Loss of roadside community businesses and social activities
- Bypassing of communities

- Reduced convenience of traditional modes of transport
- Gentrification effect, viz. displacement of low-income and socially vulnerable sections due to increase in market value of land/property as a consequence of improved infrastructure.

9.4.2 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Environmental Management Plan recommended for the proposed NH-66 Improvement Project is discussed in this section. The EMP discussed below includes:

- Specific actions to be taken related to specific issues
- Responsible agencies for implementation and supervision
- Time frame for implementing mitigation measures
- Cross-reference to documents and specifications
- Project level environmental monitoring
- Cost of Mitigation Measures
- Environmental Monitoring Plan

9.4.2.1 ENVIRONMENTAL MITIGATION MEASURES

In order to mitigate the adverse impacts likely to crop up during construction stage and operation stage, the environmental management plan is worked out indicating the impacts, measures to be adopted and authorities' responsibility to implement during construction and operation phase of the project. Generic mitigation measures applicable to the proposed project are outlined in Tables for Pre-construction, Construction and Operational phase respectively.

9.4.2.2 ENVIRONMENTAL MONITORING PLAN

The environmental monitoring plan is prepared to check the effectiveness of the mitigation measures during the construction and operational phases. To ensure the effective implementation of the EMP, an appropriate environmental monitoring plan is prepared with objectives outlined below:

- To evaluate the performance of mitigation measures proposed in EMP
- To evaluate the adequacy of Environmental Impact Assessment
- To suggest improvements in management plan, if required
- To satisfy the legal and community obligations

At the project level, the vital parameters or performance indicators that will be monitored during construction and/or operational phases of the project include:

- Ambient air quality measures such as PM10, PM2.5 SO2, CO, NOx, HC, etc.
- Noise levels

- Traffic volume and characteristics
- Tree plantation survival rate

The recommended environmental monitoring plan is presented below. The methods for sampling and analysis will be as per prevalent requirements of CPCB and Indian Standard (IS) codes.

Table 9-7 Project Specific Environmental Mitigation Measures

ADVERSE IMPACT	MITIGATION MEASURES
PRE-CONSTRUCTION STAGE	
The impact of road generated noise, which could affect residents along the road.	The road design shall provide for constructing noise barriers near residential areas. Fixing of traffic signs such as 'No Honking' etc.
The impact of road generated dust, which could affect residents along the road.	Regular air monitoring shall be done & accordingly dust suppression methods shall be applied.
Increased traffic speed as result of 4 laning &/or 2 laning of road could increase the number of accidents.	Safe pedestrian pathway shall be included.
CONSTRUCTION STAGE	
Construction of the road to 4 laning/2 laning will affect traffic movement and generates dust due to drilling/excavation, unloading of construction materials and exposure of stored material to wind.	Construction will be taken phase-wise so that road surface is open for traffic movement and major construction work during off-peak/night hours.
	Area under construction will be covered and equipped with dust collector. Construction material shall be covered or stored in such a manner so as to avoid affected by wind direction.

ADVERSE IMPACT	MITIGATION MEASURES
	Vehicles carrying construction materials will have covered top and beds. The fall height will be kept low so that least amount of dust is airborne, during unloading of materials.
Operation of construction equipment and delivery trucks generates air & noise pollution.	Stationary construction equipment will be kept at least 500m away from residential areas.
	Idling of delivery vehicles will not be allowed at construction site
	Construction equipment with noise level more than 70 dB (A) not to be allowed at site. Mufflers to be used to reduce the noise level.
	The operation of equipment and activities such as drilling, excavation to be restricted during night time as the site has dense residential pockets in most of the stretches of the project road.
Unplanned dumping of excavated material	The excavated material to be deposited in relatively low-lying areas away from residential areas and water bodies. Care should be taken that dumped material does not block natural drainage system.
OPERATION PHASE	
1. Increase in traffic volume over time and pollution level and poor road surface	Strict compliance with emission standards to reduce vehicular emission load for SO_x, NOx, CO, $PM_{10.5}$ etc.

ADVERSE IMPACT	MITIGATION MEASURES
2. Increased vehicular speed due to un-interruption from pedestrian may increase road accidents	Enforcement of strict road safety measure is needed

Generic Environmental Mitigation Measures

Table 9-8 Pre-Construction Stage Mitigation Measures

S. NO.	ADVERSE IMPACT	MITIGATION MEASURES	CROSS REFERENCE TO DOCUMENTS	TIME FRAME	RESPONSIBILITY	
					IMPLEME-NTATION	SUPER VISION
1	Improvement schemes suggest cutting the number of trees	Try to save the tree to the possible extent. An approval from appropriate Authority of Maharastra is required so that new trees can be planted to maintain the ecological balance. Compensatory afforestation and additional trees for landscaping		Before Start of Construction of relevant section	KMC	PIA
2	Local Traffic Arrangements	Temporary traffic arrangements during construction within ROW have to be planned. This plan shall be periodically reviewed with respect to site conditions	MoRTH:112	During site clearance and Construction	Contractor	KMC
3	Pedestrian Safety	Special considerations shall be given in the local traffic management to the pedestrian safety especially at congested locations. Adequate provisions to segregate through the local traffic.	MoRTH:112.2	At Congested locations	Contractor	KMC

S. NO.	ADVERSE IMPACT	MITIGATION MEASURES	CROSS REFERENCE TO DOCUMENTS	TIME FRAME	RESPONSIBILITY	
					IMPLEMENTATION	SUPERVISION
		Guard railing all along the urban section.				
4	Land Acquisition	Acquisition of land is minimized to the maximum extent. Land shall be acquired as per the Government Land Acquisition Policy, applicable. To avoid impact of land outside ROW, construction activities shall be restricted within Row, wherever possible.	Land Acquisition Policy by GOI. MoRTH 201.2	Before Start of Construction of the project road	Contractor	KMC
5	Air Quality	NOC from concerned State Pollution Control Board shall be obtained. Adequacy of measures shall be checked to control air pollution.	MoRTH 111	Before start of the project road	Contractor	KMC
6	Water Quality	NOC from concerned State Pollution Control Board shall be obtained. Adequacy of measures shall be checked to control water pollution.	MoRTH 111	Before start of the project road	Contractor	KMC
7	Noise Level	NOC from concerned State Pollution Control Board shall be obtained. Noise screening by trees plantation scheme proposed as noise barriers. Adequacy of measures shall be checked to control noise pollution.	MoRTH 111	Before start of the project road	Contractor	KMC
8	Relocation of utility lines/community utilities	Affected utilities shall be relocated with prior approval of the concerned agencies. All the R & R activities shall be reasonably completed as per RAP.	MoRTH 110	Before start of the project road	Contractor	KMC

S. NO.	ADVERSE IMPACT	MITIGATION MEASURES	CROSS REFERENCE TO DOCUMENTS	TIME FRAME	RESPONSIBILITY	
					IMPLEME-NTATION	SUPER VISION
		All the cultural properties that have been identified as affected shall be relocated as per resettlement plan.				
9	Road Drainage	Provision of adequate size and number of cross-drainage structures (Culverts) as well as drains along the road	MoRTH 306	Throughout the project road	Design Consultant	PIA

9.4.2.3 INSTITUTIONAL STRENGTHENING

The implementation of an environmentally sound transport strategy involves a number of institutions/organizations at various levels, with each organization having a distinct role to play. Introducing environmental dimensions in formulating and implementing a transport strategy would require that these institutions should have additional responsibilities for ensuring that the strategy does not result in any significant adverse environmental impacts.

In order to examine the existing capacities & identify the additional responsibilities that the concerned Organizations/Institutions may take up to address environmental issues, these Organizations are categorized in four groups – Apex Organizations, Project Implementation Agencies, Transport Service Organizations and Regulatory Organizations.

Kozhikode Corporation is the apex organization and being the regional funding authority has to be regular interactions with various Project Implementing Agencies. The existing capabilities of these organizations for environmental management will have to be carefully assessed. The envisaged roles & responsibilities of these organizations and additional strengthening requirements to meet the environmental obligations are given below.

Table 9-9 Institutional Strengthening & Training Requirements

ORGANIZATION	ROLES & RESPONSIBILITIES	STRENGTHENING REQUIRED
Municipal Corporation	Review the Implementation of EMPs Facilitate implementation of policy directives/emission laws etc. for pollution prevention/mitigation by interacting with various Gov. Depts. Like Environment Dept., Urban Development Dept. etc. Review the environmental management capabilities of implementing agencies to assist them in developing their capabilities. Obtain and analyze environmental information generated by organizations like KSPCB (Kerala State Pollution Control Board), etc.	Enhance the capabilities of the KMC by out sourcing whenever required. Training coordinated by KMC with support of EMCB Consultants on: • Environmental assessment • Appreciation of Environmental impacts and EMPs procedure and responsibilities for EMP implementation, monitoring & reporting etc.

9.4.2.4 ROLE OF IMPLEMENTING AUTHORITIES IN CONSTRUCTION PHASE MITIGATION

Implementing Organizations for Construction Stage Mitigation:

The project implementing authorities like KMC has major role in enforcement mitigation of measures during construction phase. These measures can be taken care by the contractors assigned the project under supervision of implementing authorities.

Mechanisms for Implementing Mitigation:

The project implementing agency shall include a section in their tender document for the project, which is aimed at getting the mitigation measure implemented during construction stage. Various points recommended for incorporation as:

- Construction should be scheduled in such a manner that excavated site does not remain exposed during monsoons.
- Construction should be taken up stage wise to reduce inconvenience to users.
- Covering trucks carrying construction materials which are susceptible to getting air borne.
- Enclosing the construction sites for the reasons of public safety, containment of dust and aesthetics.
- Specification of noise level for construction equipment. Values recommended are
    - Drilling 75 dB A)
    - Vibrator 75 dB (A)
    - Dumpier 75 dB (A)
- Assurance from the Contractor that noise level shall not be exceeding the ambient noise standards of 50 dB (A) during day time and 40 dB (A) as project sites have residential buildings and sensitive receptors.
- Specifications for operating construction equipment away from sensitive receptor, unless it is not feasible, in which case temporary noise shield to be used.
- Specification for the sites to be used for the disposal of the excavated material at the KMC /PWD specified sites.

9.4.2.5 COST ESTIMATES FOR IMPLEMENTING EMP

The cost estimates for EMP implementation during construction and operational phase are summarized below. The estimate has been prepared for the task as mentioned below:

- Air Pollution monitoring during construction and operation stages
- Noise monitoring during construction and operation stages
- Water quality monitoring during construction and operation stages
- Soil Quality monitoring during construction
- Monitoring of tree survival rate (Compensatory Avenue Plantation)
- Dust Suppression at Site

Table 9-10 Cost Estimates for EMP Implementation

S. NO.	ITEM NO.	ASSUMPTION	RATE ADOPTED (IN RS.)	TOTAL COST (IN RS.)
CONSTRUCTION PHASE				
1	Air Quality Monitoring	20 representative samples for 24 hours (Once every – pre-monsoon & post monsoon for 24 months)	6000/-per sample	400000
2	Noise Monitoring	20 representative samples for 24 hours Once every – pre-monsoon & post monsoon for 24 months)	2,000/-per day	160000
3	Water quality monitoring	10 representative samples Once every – pre-monsoon & post monsoon for 24 months)	3500/- per sample	160000
4	Soil Quality testing	10 representative samples (Once every – pre-monsoon & post monsoon for 24 months)	2800/- per sample	120000
5	Compensatory avenue plantation of twice the number of trees to be cut and their fencing and maintenance for two years	1000 Nos	600/tree	1200000
6	Dust Suppression at Site(3 trips/day for 365 days for 2 years)	3000 nos.	500/Tanker	3000000
Total				**50,40,000**

Notes: Operational Phase Air quality, water quality and Noise level and Soil quality monitoring will be for one year.

9.4.2.6 CONCLUSION

Summary of Key Issues and Mitigation Commitments:

This section provides a summary of conclusions and recommendations drawn following completion of the Initial environmental assessment. These conclusions and recommendations are intended to provide:

- Guidance to KMC as to policy decisions which will affect the roadway design, implementation and future planning for the CMP.
- Direction for further environmental impact assessment work to be conducted in the stage of project development and implementation.

It is intended that the conclusions and recommendations included in this report will generate discussion, and interpretation of the environmental assessment scope of work.

The following general conclusions are drawn:

- The initial Screening and scoping helped to address the probable issues that have already been, and/or are expected to be addressed in subsequent stages of road design.
- The Initial environmental assessment should be considered as a preliminary assessment. Most conclusions and recommendations require confirmation following more detailed assessment in subsequent stages of project development.
- Overall it is concluded that The CMP can be developed without causing significant adverse environmental impacts to the natural, economic or cultural environment of the study area, assuming the mitigation measures identified in this report are incorporated into design; the most important of these are;
- The widening of the road may be limited to available RoW especially at congested locations,
- Appropriate mitigation measures as suggested in environmental assessment shall be incorporated especially in case of educational institutes, religious structures, Health care facilities, etc.
- In general, it is suggested that the choice of developing additional lanes to the right or left side of the existing carriageway, and /or the routing of re-alignments may be made so as to minimize:
- The relocation of residences, business / commercial establishments; and/or institutional facilities such as government buildings and schools,
- The relocation of cultural properties (Church, temples, masjid, etc.),

9.5 TECHNOLOGY TRANSITIONS (VEHICLES AND FUELS)

The impact of the proposals in each of the scenario is accessed under technological transitions is measures under this section.

9.5.1 VEHICLE FUEL TRANSITION

An understanding of vehicles, fuels and CO emissions from electricity use in transportation system is essential to learning the implications of travel demand on CO2 emissions and air quality.

The transport sector relies primarily on fossil fuels. The dependence on fossil fuels is linked to the domination of internal combustion engine technology on a global scale. In future, however, multiple transitions can affect vehicles and associated infrastructures. In the case of Kozhikode, there would be:

1. A change in fuels due to greater use of cleaner petrol and diesel; more efficient engines.
2. More electricity for transportation such as buses, e-rickshaws well as promoting electric vehicles.

Table 9-11 Vehicle Fuel Transition Impacts of Proposed Projects

NAME OF THE IMPACT	BASE YEAR (2023)	BAU (2051)	SUT (2051)
Percent of public transport fleet in compliance with Indian emissions standards	40%	60%	80%

9.5.2 ITS TRANSITION

The efforts to add information technology to transport infrastructure and vehicles in an effort to manage factors that are typically at odds with each other are measured under this section based on the following parameters.

- Availability of Traffic Surveillance
- Passenger Information System (PIS)
- GPS/GPRS Systems
- Signal Synchronization

9.5.2.1 AVAILABILITY OF TRAFFIC SURVEILLANCE

Transitions due to level of usage of ITS under availability of traffic surveillance for BAU and SUT scenario is shown below.

Table 9-12 Availability of Traffic Surveillance

PARAMETER	DESCRIPTION	BASE (2023)	BAU (2051)	SUT (2051)
Availability of Traffic Surveillance – CCTV	Share of Stations with CCTV on Terminals, Stations and Signalized Intersections	10%	50%	80%

9.5.2.2 PASSENGER INFORMATION SYSTEM (PIS)

Transitions due to level of usage of ITS under availability of passenger information system for BAU and SUT scenario is shown below.

Table 9-13 Passenger Information System

PARAMETER	DESCRIPTION	BASE (2023)	BAU (2051)	SUT (2051)
Passenger Information System (PIS) for Public Transport	Share of Terminals, Stations having PIS	0%	50%	100%

9.5.2.3 GLOBAL POSITIONING SYSTEM (GPS/GPRS)

Transitions due to level of usage of ITS under availability of Global Positioning System for BAU and SUT scenario is shown below.

Table 9-14: Global Positioning System

PARAMETER	DESCRIPTION	BASE (2023)	BAU (2051)	SUT (2051)
Global Positioning System / GPRS	Share of Public Transport Vehicles and IPT with on-board GPS/GPRS which are connected to common control center	50%	50%	**100%**

10. IMPLEMENTATION PLAN

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited


coxswain

10 IMPLEMENTATION PLAN

10.1 PHASING AND PRIORTIZATION OF PROJECTS

"Prioritization" as an activity, identifies all individual projects that need to be executed in order to achieve the transportation goals of the city. This phase weaves the projects in one logical sequence, thus forming an "implementation program" which shall be discussed in the Chapter7. The implementation program outlines the following elements:

1) A sequence in which the projects should be undertaken. It should be noted that the "duration" of a project does not necessarily indicate its "priority". Some very long duration project may have to be started 5 years after the implementation of the CMP commences whereas some short duration projects may have to be started immediately. Priorities of projects would be reflected in the suggested sequence.
2) Identification of all projects in two categories, as "Critical" and "Desirable." It should be noted that "Critical" does not necessarily mean "High priority", and vice versa. Also, as with priority, the duration of a project does not necessarily indicate its criticality. Some Critical projects may have to be logically started 10 or 15 years down the line, but are still critical for achieving the stated objectives of the CMP. In other words, not implementing "Desirable" projects may have only a mild impact on achieving the transportation objectives, but not implementing "Critical" projects would severely compromise the essence of the vision and objectives of CMP.

Each project is prioritized based on scoring it across seven criteria:

1. Mobility
2. Accessibility
3. Safety
4. Energy
5. Environment
6. Carbon-di-Oxide Mitigation
7. Project Cost

The Phase I indicate Short-term measure (2023-2027), while Phase II indicates Medium Term measure (207-2031-2041) and Phase III indicates long term measures (2051)

10.1.1 PROPOSAL 1: PUBLIC TRANSPORT SYSTEM

Table 10-1: Phasing and Prioritization Of Public Transport System Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
Improved City Bus System	Critical	High	Phase I, II,III
Development of Mass Trasnsit System	Critical	High	Phase I, II
Development of Inland Water Transportation	Critical	High	Phase I, II
Public Terminals	Critical	Medium	Phase II
Intermediate Public Transport	Critical	High	Phase I,II

10.1.2 PROPOSAL 2: NON-MOTORISED TRANSPORT FACILITY IMPROVEMENT

Table 10-2: Phasing and Prioritization of Pedestrian Facility Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
Footpath	Critical	High	Phase I

Table 10-3: Phasing and Prioritization of Bicycling Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
Segregated Cycle Tracks	Critical	High	Phase I,II
Public Bick Sharing Schemes	Critical	High	Phase I,II

10.1.3 PROPOSAL 3: FREIGHT MANAGEMENT PLAN

Table 10-4: Phasing and Freight Management Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
Freight Terminals	Critical	Medium	Phase II, III

10.1.4 PROPOSAL 4: PARKING MANAGEMENT PLAN

Table 10-5: Phasing and Prioritization of Parking Management Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
On-street Parking	Desirable	Medium	Phase I
Off-street Parking	Desirable	Medium	Phase I, II
MLCP	Desirable	Medium	Phase I, II

10.1.5 PROPOSAL 5: INTELLIGENT TRANSPORTATION SYSTEMS

Table 10-6: Phasing and Prioritization of Its Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
ITS control Centre, PIS, GPS, Mobile phone Applications and Surveillance Cameras	Desirable	Medium	Phase II, III

10.1.6 PROPOSAL 6: ROAD NETWORK PLAN

Table 10-7: Phasing and Prioritization of Road Network Proposals

PROPOSED SCHEMES	CATEGORY	PRIORITY BASED ON SCORING	PHASING
Upgradation of New Links	Critical	High	Phase I, II, III
Development Ring Roads	Desirable	Medium	Phase II, III
New / Missing Links	Desirable	Medium	Phase II, III
ROBs/RUB/Canal Crossings	Desirable	Medium	Phase II, III

All the proposals discussed so far can be broadly grouped under three categories:

- Short Term Improvements (Phase I): these are short term proposals that need to be reviewed and implemented within 2-5 years as per the requirement.
- Medium Term Improvements (Phase II): the projects than need to reviewed implemented between 5-20 years as per the requirement.

- Long Term Improvements (Phase III): the projects than need implemented between above 20 years.

Accordingly, long term, medium term and short-term proposals for Kozhikode are presented below.

10.1.7 SHORT TERM PROPOSALS

Table 10-8: List of Short-Term Proposals

S. NO	PROJECTS
1	Junction, Corridor Improvements
2	Pedestrian Network Improvements
3	Bicycles Corridors Improvements
4	Area Improvement Plans
5	Parking Management Plan
6	Improved Public Transportation System (Bus, Waterways & MRTS)

10.1.8 MEDIUM TERM PROPOSALS

Table 10-9: List of Medium-Term Proposals

S. NO	PROJECTS
1	Upgradation of Existing Roads / Development of New Links
2	Flyover / ROBS / RUBS/ Canal Crossings
3	Dedicated Cycle Tracks
4	Pedestrian Network Improvements
5	New Bus Terminal
6	Improved Bus System
8	Off-Street Multi-Level Parking
9	ITS Systems

10.1.9 LONG TERM PROPOSALS

Table 10-10: List of Medium-Term Proposals

S. NO	PROJECTS
1	Development of New Links
2	Upgradation of Existing Roads
3	Flyover / ROBS / RUBS/ Canal Crossings
4	Improved Bus System
2	Truck Terminals

The projects identified in the earlier section are divided into three categories based on the urgency and duration of the implementation. Some of the long-term projects have potential to enter into Public Private Partnership (PPP); however, case to case project reports are required for validating the feasibility of each project.

10.2 PROJECT COSTING

The projects identified in the earlier section are divided into three categories based on the phasing of projects for implementation. The long-term, medium-term and short-term projects have come as the output of transportation assessment carried out specifically to understand the future demand and system requirement. Some of these evolved projects have potential to enter into Public Private Partnership (PPP). It is important to highlight that the CMP serves only to identify schemes and once these schemes are detailed for feasibility and engineering purpose, some of these costs may vary. The tentative block cost estimation is done in reference with the district scheduled rates for year 2020.

The projects proposed are to be implemented in three phases.

- Phase I - To be implemented between 2023 and 2031
- Phase II – To be implemented between 2031 and 2041
- Phase III - To be implemented between 2041 and 2051

The overall short-term project cost is estimated to be **1995** crores. All junction improvement schemes, footpath implementation, cycle track network development, removal of encroachment will fall into this category. While the approximate cost of medium-term projects is **2269** crores and **1501** crores for Long term measures.

Table 10-11: Estimated Project Costs

Sl.No	Projects	Total Cost (in Crores)	Phasing Rs (in Crores)		
			2023-2027	2027-2041	2041-2051
1	Improvement of Road Network	1184.82	149.82	114.16	920.8
2	Improvement of Non-Motorised Transport Facilities	241.52	163.17	78.35	0.00
3	Improvement of Public Transport System	3980.01	1598.0	1970.4	411.4

4	Improvement of Freight Transportation System	343.71	115.82	70.82	157.0
5	Intelligent Transportation System Facilities	49.37	13.45	23.90	12.02
6	Improvement of Parking Facilities	6.53	2.01	4.52	0.00
Overall CMP Proposals		**5805.9**	**2042.3**	**2262.2**	**1501**

Table 10-12: Estimated Project Costs

Sl.No	Projects	Unit	Total Quantity	Project Phasing Quantities			Unit Rate (in Crore)	Total Cost (in Crores)	Phasing Rs (in Crores)		
				2023-2027	2027-2041	2041-2051	2027		2023-2027	2027-2041	2041-2051
Improvement of Road Network											
1	Upgradation of Existing Roads	Km.	88.9	16.60	24.40	47.90	2.770	298.24	45.98	72.32	179.94
2	New Links	Km.	68.9	1.20	3.30	64.40	3.693	340.04	4.43	13.04	322.57
3	Flyover upgradation (2-Lane)	No.	0.0	0.00	0.00	0.00	42.84	0.00	0.00	0.00	0.00
	ROB/ Canal Crossing Upgradation (2-Lane)	No.	7.0	1.00	0.00	6.00	51.40	469.74	51.41	0.00	418.33
4	Flyover (4-Lanes)	No.	0.0	0.00	0.00	0.00	59.97	0.00	0.00	0.00	0.00
5	Junction Improvements	No.	48.0	32.00	16.00	0.00	1.500	76.80	48.00	28.80	0.00
	Total Project Cost							**1184.82**	**149.82**	**114.16**	**920.84**

Improvement of Non-Motorised Transport Facilities											
1	Footpath	Km.	145.0	100.00	45.00	0.00	1.625	240.75	162.50	78.25	0.00
2	NMT Only Lanes	Km.	0.0	0.00	0.00	0.00	2.556	0.00	0.00	0.00	0.00
3	Shared Cycle Tracks	Km.	26.0	26.00	0.00	0.00	0.026	0.67	0.67	0.00	0.00
4	Dedicated Cycle Tracks	Km.	0.0	0.00	0.00	0.00	0.052	0.00	0.00	0.00	0.00
5	Public Bike Sharing Stations	No.	0.0	0.00	0.00	0.00	0.018	0.00	0.00	0.00	0.00
6	Public Bike Sharing Cycles	No.	14.0	0.00	14.00	0.00	0.007	0.10	0.00	0.10	0.00
	Total Project Cost							**241.52**	**163.17**	**78.35**	**0.00**

Improvement of Public Transport System											
1	Bus Fleet Augmentation	No.	436.0	141.00	133.00	162.00	1.80	909.56	254.95	257.34	397.27
2	Improvement of Bus Terminals / Multi Modal Mobility Hubs	No.	10.0	5.00	5.00	0.00	1.950	20.18	9.75	10.43	0.00
3	New Public Transportation Station	No.	0.0	0.00	0.00	0.00	1.773	0.00	0.00	0.00	0.00
4	In Land Water Ways System	Km	43.3	17.30	25.00	1.00	10.46	475.30	181.08	280.02	14.20
5	MRT System (BRT/LRT)	Km	56.0	26.00	30.00	0.00	44.31	2574.96	1152.27	1422.69	0.00
Total Project Cost								**3980.01**	**1598.06**	**1970.48**	**411.47**
Improvement of Freight Transportation System											
1	Proposed New Truck Terminals	Sq. m	343.7	98000.00	56000.00	98000.00	0.001	343.71	115.82	70.82	157.08
Total Project Cost								**343.71**	**115.82**	**70.82**	**157.08**
Technological and Intelligent Transportation System Facilities											
1	New Signal Installations	No.	1.0	1.0	0.0	0.0	0.295	0.30	0.30	0.00	0.00
2	Adaptive Traffic Control System	No.	26.0	13.0	13.0	0.0	0.886	23.85	11.52	12.33	0.00
3	Smart City Bus Shelters	No.	24.0	6.0	18.0	0.0	0.266	6.72	1.60	5.12	0.00
4	ITS control Centre, PIS, GPS, Mobile phone Applications and Surveillance Cameras)	Km.	30.0	5.0	10.0	15.0	0.000	18.34	0.00	6.32	12.02
5	Electric Charging Stations - 2w and 3w	No.	55.0	15.0	40.0	0.0	0.003	0.16	0.04	0.12	0.00
Total Project Cost								**49.37**	**13.45**	**23.90**	**12.02**
Improvement of Parking Facilities											

1	On street Parking	Km.	2.0	3.00	0.00	0.00	0.671	2.01	2.01	0.00	0.00
2	Off street Parking (MLCP)	No.	4.5	0.00	3.30	0.00	1.343	4.52	0.00	4.52	0.00
2	Off street Parking (Surface))	No.	0.0	0.00	0.00	0.00	0.537	0.00	0.00	0.00	0.00
Total Project Cost								**6.53**	**2.01**	**4.52**	**0.00**
Overall Comprehensive Traffic and Transportation Plan Proposals											
Total Project Cost								**5805.9**	**2042.3**	**2262.2**	**1501.4**

10.3 FINANCING OPTIONS

As per the Recommendations of Working Group on Urban Transport for 12th Five Year Plan, the financing of urban transport projects in the country has largely been confined to gross budgetary support from the government and the user charges. Due to heavy investment needs of urban transport and conflicting demands on the general exchequer, the investment in urban transport in past has not kept pace with the rapidly increasing requirement of the sector. The current level of user charges of limited urban transport facilities, do not make the system self-sustainable. At the same time, providing safe, comfortable, speedy and affordable public urban transport to all has to be a necessary goal of the governance. The key funding sources besides GBS and fare box can be dedicated levies, land monetization, recovery from non-user beneficiaries, debt and private investments. The paradigm of financing has to clearly move towards non-users pay principle and the polluters pay principle. There is a need for long-term sustainable dedicating financing mechanism to address fast worsening scenario in the field of urban transport. All the various components in which the investment would be required in the 12th Five Year Plan would need to be funded through a combination of funding from Govt. of India, State Govt./urban local body, development agencies, property development, loan from domestic and financial institutions as well as PPP. Thus, it is imperative to identify projects that are amenable to Government funding or PPP.

10.3.1 PUBLIC PRIVATE PARTNERSHIP (PPP)

Public-Private Partnerships is cooperation between a public authority and private companies, created to carry out a specific project. They can take on a number of forms, and can be a useful method of capturing property value gains generated by transport infrastructure in a PPP for a new transport infrastructure development project, the public authority creates a secure environment for the private sector to carry out the project, and the private partner offers its industry know-how, provides funding and shares in the project's risk. The objectives of the public and private sector partners appear to be quite different. The public sector aims to best serve the interests of taxpayers. The aim is not to use public money to obtain a return on capital investments. The private sector, on the other hand, aims to ensure a return on investment for its shareholders and to be as profitable as possible and yet these two contrasting goals can function perfectly well together in the framework of a PPP. The decision to undertake a public-private partnership and the choice of the most suitable form of partnership greatly depends on the context and the types of project to be developed are given below:

- The project context may influence the type of PPP to be implemented. The public partner must evaluate the total cost of the project, its importance in terms of public need, the time frame, the number of actors involved and the geographic area in question. Does providing this public service require a major infrastructure? Will it require high levels of human and financial resources to provide this service? Before a decision can be made, it is necessary to fully understand the context of the proposed project.
- The cost of the project is of course a critical factor, which will weigh on the choice. Many PPP concern projects for underground systems, LRT and BRT requiring significant levels of financing which the local authorities would have difficulty assuming alone.
- A well-structured institutional framework and the local authority's experience in developing transport projects are also decisive factors. Urban transport is an industrial and commercial activity, which involves financial risk. Bringing in experienced partners is one way of compensating for a lack of certain skills in this field, though a good PPP should call upon other forms of expertise on the part of the public authority. This can sometimes facilitate obtaining a loan, in particular from international funding agencies.
- The tasks entrusted to the private sector (design, construction, development, operation, maintenance) will influence the type of contract.
- The sharing of responsibilities and risks will determine the degree of involvement of each partner and the type and clauses of the contract. There are many types of contracts but it is primarily the sharing of financial risk, which will determine the key characteristics. There are two categories of risk: commercial risk, related to trends in revenue, and industrial risk, related to the cost of construction and trends in operating and maintenance expenses. If both types of risk are covered by the public partner, then it would be a management contract in which the private partner is merely performing the work. The private partner must meet the specifications but will not be motivated to improve the service nor propose innovative techniques or management;
- If the project is not self-financing, i.e. if, at the end of the contract, the total revenues and gains do not balance out the total costs, the transit authority may be required to provide compensation, depending on the clauses of the contract.

10.3.2 GOVERNMENT SOURCES OF FUNDING

One of the particularities of the urban transport sector is that it depends on funding from several sources and involves various partners, public and private, individual and collective.

10.3.2.1 VIABILITY GAP FUNDING

In a recent initiative, the Government of India has established a special financing facility called "Viability Gap Funding" under the Department of Economic Affairs, Ministry of Finance, to provide support to PPP infrastructure projects that have at least 40% private equity committed to each such project. The Government of India has set certain criteria to avail this facility under formal legal guidelines, issued in August 2004, to support infrastructure under PPP framework. Viability Gap Funding can take various forms such as capital grants, subordinated loans, O&M support grants and interest subsidies. It will be provided in instalments, preferably in the form of annuities. However, the Ministry of Finance guidelines require that the total government support to such a project, including Viability Gap Funding and the financial support of other Ministries and agencies of the Government of India, must not exceed 20% of the total project cost as estimated in the preliminary project appraisal, or the actual project cost, whichever is lower. Projects in the following sectors implemented by the Private Sector are eligible for funding:

- Roads and bridges, railways, seaports, airports, inland waterways
- Power
- Urban transport, water supply, sewerage, solid waste management and other physical infrastructure in urban areas
- Infrastructure projects in Special Economic Zones
- International convention centers and other tourism infrastructure projects

10.3.2.2 DEDICATED URBAN TRANSPORT FUND AT CITY LEVEL

For the projects, which are not admissible under viability gap funding, the alternative sources of funding that a city could avail by setting up a dedicated urban transport fund at city level are given below:

A dedicated urban transport fund would need to be created at the city level through other sources, especially land monetization, betterment levy, land value tax, enhanced property tax or grant of development rights, advertisement, employment tax, congestion, a cess on the sales tax, parking charges reflecting a true value of the land, traffic challans etc.

Pimpri-Chinchwad Municipal Corporation has already set up a dedicated urban transport fund through land monetization and advertisement rights. Similarly, Karnataka has set up a dedicated urban transport fund through MRTS cess on petrol and diesel sold in Bangalore, which is being used to fund the metro rail projects. The various sources of funding that can be used to set up the urban transport fund is given below:

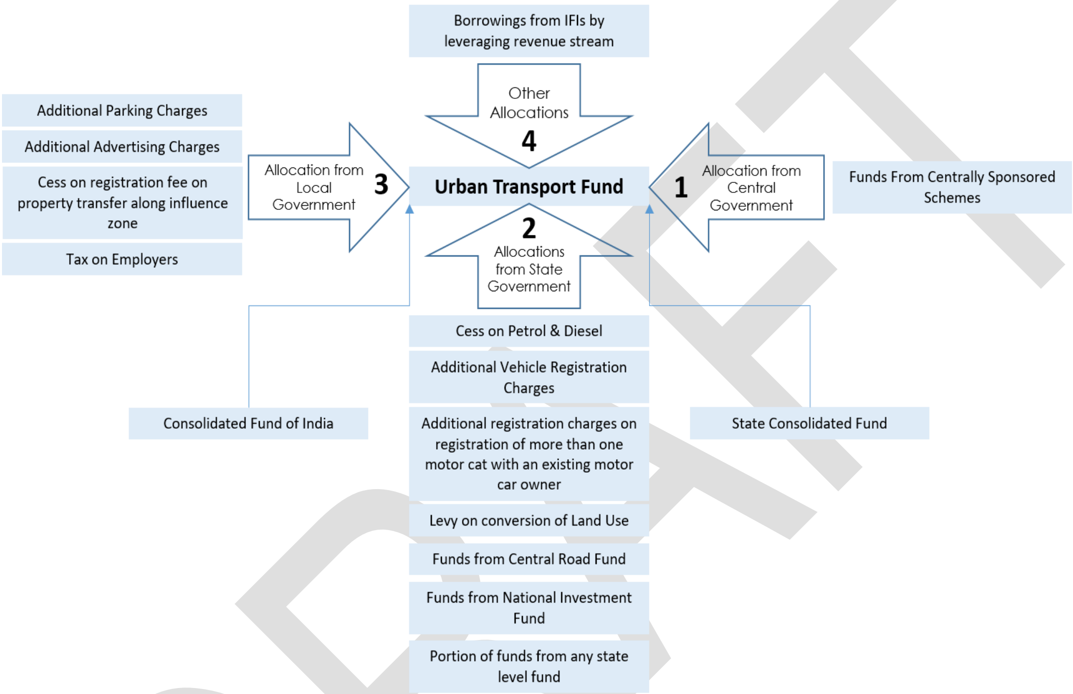


Figure 10-1 Sources of Funds For Urban Transport Fund

10.3.2.2.1 ANTICIPATED PURCHASE OF LAND

This method involves public authorities buying land before announcing that an infrastructure will be built or where the route will run. In this way, the purchase can be made at market price without the infrastructure. The strategy then consists in:

- Directly selling the land to private developers including the estimated added value in the sale price, such as was done in Aguas Claras on the periphery of Brasilia, or in Copenhagen;
- Developing the area as part of an urban renewal project and then selling it at market price, as was done in Copenhagen or in Japan, where rail companies were the first to use this method to finance their operations

A city can also levy additional stamp duty (5%) on registration of property.

10.3.2.2.2 BETTERMENT TAX

A betterment tax is not the same as a property tax, because the increase in value of property is not due to the action of the owner (such as would be the case with renovations and improvements) but from a community action, thus justifying the public authorities to impose such a tax. However, it is not easy to implement, which no doubt explains why this financing mechanism is still underused.

This tax must be levied on all areas that benefit from the new transport infrastructure. The land is valued each year based on an optimal use of each site, without considering the existing facilities. A tax based on the value of the land is then levied in order to generate funds for the public sector. Thus, if the value of the land increases, the tax collected also increases. This means that a vacant plot of land in the city centre which has been earmarked for building a residential and commercial complex will pay the same tax as an identical site which has already been developed in a similar manner. Unlike construction taxes, no tax reduction is available to landowners who leave the site empty. Likewise, taxes are not increased if the site is built upon. Landowners will therefore to seek to capitalize on the use of their land.

10.3.2.2.3 LAND VALUE TAX

Once an area is well connected by public transport and is accessible to the commercial area and also the liveability of the area increases it is possible that the price of the land will increase. Such increase in price can be source revenue for the municipality. Similar to parking, the obtained revenue needs to be utilized for improvement of the area and other areas in the vicinity. A substantial amount of revenue could be generated through cess on turnover, particularly in cities, based on industry, trade and commerce activities. Such cess has already been levied for Bangalore MRTS project. Bangalore has also levied luxury tax and professional tax towards the metro fund.

10.3.2.2.4 ADVERTISING

This is another important source of revenue for the city. When properly utilised, this source can be of immense value in supporting sustainable urban transport measures in a city. The revenues from advertising in the city can be used to improve the existing transport system and/or create new schemes in sustainable transport.

Paris, France has used the advertising money in developing a public bike scheme, which is now a well renowned model. Similarly, Transport for London (TfL) has made a deal with the advertising specialist, Clear Channel, for the regular maintenance and design of the street furniture in return for the advertising space on bus shelters.

One important aspect that needs to be considered is that the advertising money needs to be utilized for improving the transport system rather than spending it on building more roads. In the similar way, the advertising should not be overdone to avoid visual pollution. Further, ideally advertising revenue should not be a reason for building of pedestrian overpasses as the greater good for the society from these overpasses is minimal.

10.1 IMPLEMENTING AGENCIES

Based on roles and responsibilities of various institutions, the agencies responsible for implementing the proposed projects in the CMP are as follows-

Table 10-13: Details of Implementation Agency

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
Improvement of Road Network				
1	Upgradation of Existing Roads	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private
2	New Links	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private
3	Flyover upgradation (2-Lane)	PWD/NHAI	PWD/ NHAI / Private	PWD / NHAI / Private
4	ROB/ Canal Crossing Upgradation (2-Lane)	PWD/NHAI/KMC	PWD/ NHAI / Private	PWD / NHAI / Private
5	Flyover (4-Lanes)	PWD / KMC / State Govt. / NHAI	State Govt. / KMC	PWD / NHAI / Private
6	Junction Improvements	PWD / KMC / State Govt. / NHAI	State Govt. / KMC	PWD / NHAIs
Improvement of Non-Motorised Transport Facilities				
1	Footpath	KMC / Smart City / PWD	KMC / Smart City / PWD	KMC / Smart City / PWD/ Traffic Police
2	NMT Only Lanes	KMC / Smart City / PWD	KMC / Smart City / PWD	KMC / Smart City / PWD/ Traffic Police
3	Shared Cycle Tracks	KMC / Smart City / PWD	KMC / Smart City / PWD	KMC / Smart City / PWD/ Traffic Police

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
4	Dedicated Cycle Tracks	KMC / Smart City / PWD	KMC / Smart City / PWD	KMC / Smart City / PWD/ Traffic Police
5	Public Bike Sharing Stations	KMC / Smart City / Private	KMC / Smart City / Private	KMC / Smart City / Private
6	Public Bike Sharing Cycles	KMC / Smart City / Private	KMC / Smart City / Private	KMC / Smart City / Private
7	Public Education and Awareness program	KMC / Smart City / Private / NGOs /State Govt.	KMC / Smart City / NGOs	KMC / Smart City / Private /NGOs
Improvement of Public Transport System				
1	Bus Fleet Augmentation	KSRTC	State Govt.	KSRTC
2	Improvement of Bus Terminals / Multi Modal Mobility Hubs	KSRTC/ KMC / Smart City	KSRTC/KMC / Smart City / Private	KSRTC/KMC / Smart City / Private
3	New Public Transportation Station	KSRTC/ SPV /KMC / Smart City	KSRTC/SPV/ KMC / Smart City / Private	KSRTC/KMC / Smart City / Private /SPV
4	In Land Water Ways System	KSRTC/ SPV /KMC / Smart City	KSRTC/SPV/ KMC / Smart City / Private	KSRTC/KMC / Smart City / Private /SPV
5	MRT System (BRT/LRT)	KSRTC/ SPV /KMC / Smart City	KSRTC/SPV/ KMC / Smart City / Private	KSRTC/KMC / Smart City / Private /SPV
Improvement of Freight Transportation System				
1	Proposed New Truck Terminals	State Govt. / KMC / Traffic Police	State Govt. / Private	Private
Technological and Intelligent Transportation System Facilities				
1	New Signal Installations	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police
2	Adaptive Traffic Control System	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police
3	Smart City Bus Shelters	KSRTC/ KMC/ Smart City / Traffic Police	KSRTC/ KMC/ Smart City / Traffic Police / Private	KSRTC/ KMC/ Smart City / Traffic Police / Private
4	ITS control Centre, PIS, GPS, Mobile phone Applications and Surveillance Cameras)	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police
5	Electric Charging Stations - 2w and 3w	KMC / Smart City / KSEB / Private	KMC / Smart City / KSEB / Private	KMC / Smart City / KSEB / Private
Improvement of Parking Facilities				

SN	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
1	On street Parking	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police / Private	KMC/ Smart City / Traffic Police / Private
2	Off street Parking (MLCP)	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police / Private	KMC/ Smart City / Traffic Police / Private
3	Off street Parking (Surface))	KMC/ Smart City / Traffic Police	KMC/ Smart City / Traffic Police / Private	KMC/ Smart City / Traffic Police / Private

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11. INSTITUTIONAL FRAMEWORK

KOCHI METRO RAIL LIMITED

Urban Mass Transit Company Limited

11 INSTITUTIONAL FRAMEWORK

11.1 BACKGROUND

City transport system generally involves several organizations that look after various forms and aspects of the transport system and network and have overlapping functions and areas of work. Therefore, to delineate areas and to remove ambiguity of functions the institutional framework has been proposed.

Following is the list of departments and Organizations involved in urban affairs and urban transport in Kozhikode

- Kozhikode Municipal Corporation (KMC)
- Regional Town Planning Office, Kozhikode
- Local Self Government Department (LSGD)
- State Urban Development Department
- Public Works Department (PWD)
- Roads and Buildings Department (R&B)
- National Highway Authority of India (NHAI)
- Traffic Police Department
- Kerala State Road Transport Corporation (KSRTC)
- Railways
- Regional Transport Authority (RTA)
- Airport Authority of India, Kozhikode

In view of bringing the institutional setup in a proper structure, it is important to understand the issues with the present Institutional set up, listed below.

- No clear segregation between the planning and implementing bodies
- Lack of coordination amongst all the departments in the urban transport sector
- All departments related to urban transport do not function in coherence.

Road projects are implemented in isolation with other projects which should otherwise be an integral part of road development like footpath, cycle tracks, pedestrian facilities etc. No control over mushrooming IPT modes in the city, which lead to issues of congestion along with contesting with the buses for passengers. Operation issues in public transport due to poor route and service planning. No dedicated organization that is in charge of long-term urban transport planning for the city.

With a view to coordinate all urban transport activities in the city, it is recommended that a UMTA be set up at the city level that acts as a planning and decision-making body for all matters related to urban transport in the city.

11.2 INSTITUTIONAL SETUP

It is recommended that the city level UMTA be set up on an executive order for the ease of formation however, it must be given a legal backing so that it's functioning falls under an act and commands greater authority.

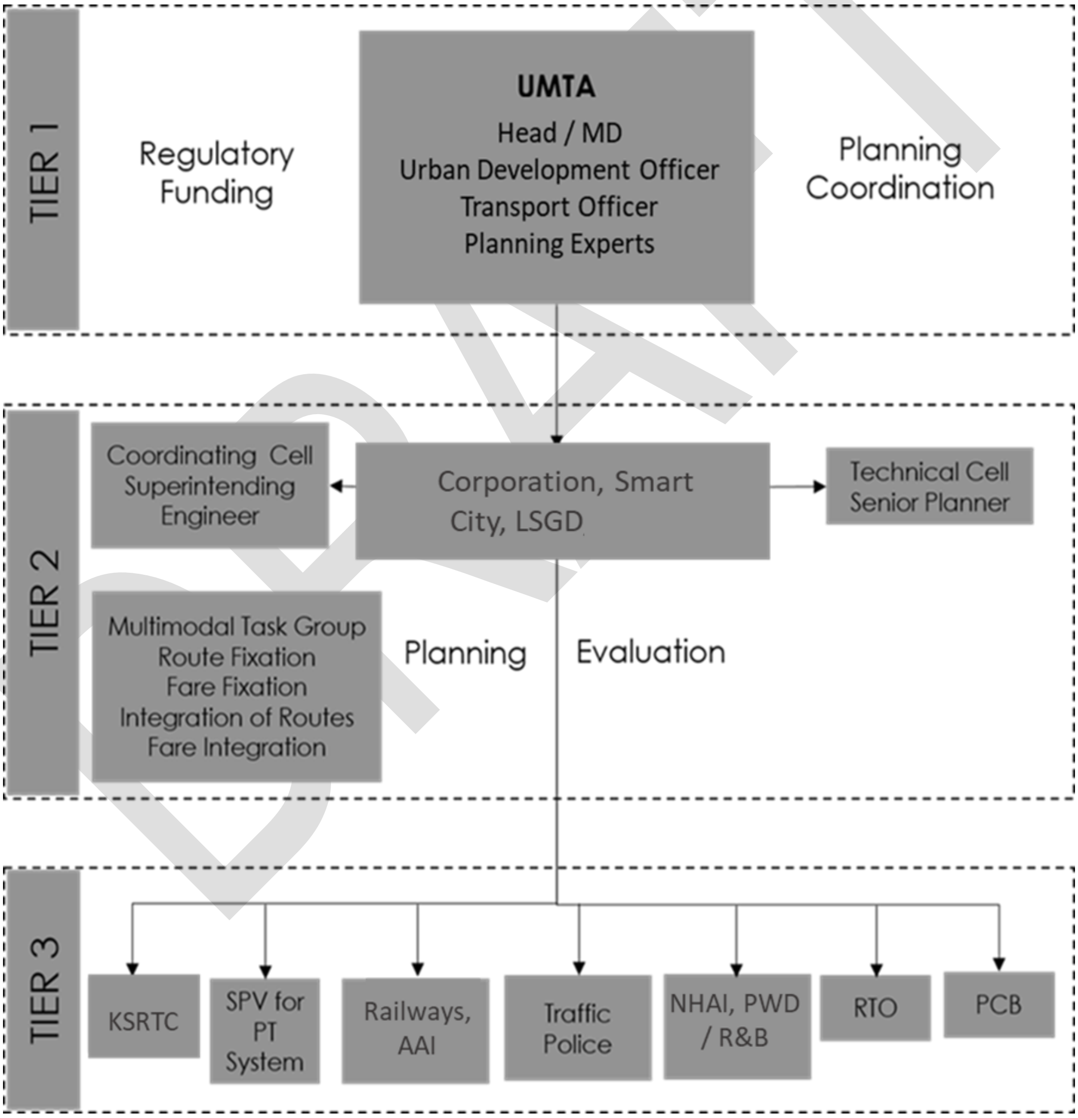

Figure 11-1 Recommended Structure for UMTA Setup

11.3 BROAD FUNCTIONS OF UMTA

The following functions are proposed to fall under the purview of the city level UMTA

Undertake overall planning for public transport in the city, covering all modes - road, rail, and water and air transport systems

- Allocate routes amongst different operators
- Procure public bus services for different routes through contracting, concessions, etc. Ensure compliance of terms and conditions of license
- Recommend revocation of license for non-compliance of terms and conditions of the license
- Carry out surveys and manage a database for scientific planning of public transport requirements
- Co-ordinate fare integration among different operators of public transport and determine the basis for sharing of revenues earned from common tickets or passes.
- Operate a scheme of passes for the users of public transport and channelize subsidies to operators for any concessions that are offered in accordance with government policy.
- Regulate the Arrangement amongst Operators for the Sharing of Their Revenue Derived from The Use of Passes promote efficiency in public transport operation

Protect the interest of the consumers

- Settle disputes between different operators and between operators and infrastructure providers
- Levy fees and other charges at such rates and in respect of such services as may be determined by regulations;
-

11.4 LEGAL BACKING OF UMTA

In order to give UMTA objectives, functions and operations a legal status, a draft Act has to be prepared by UMTA to be taken up for approval by the State Cabinet after finalization. The draft Act shall cover the following:

- Objectives and functions of UMTA
- Operational area of UMTA

- Powers and delegation of powers of UMTA
- Authority to have power to acquire land by agreement
- Power of Government to transfer to the Authority lands belonging to it or to other ULBs, etc.
- Power of Authority to borrow
- Laying of annual estimate of income and expenditure
- Authority to approve or amend such estimate
- Estimates to be submitted to Government for sanction
- Supplementary estimates may be prepared and submitted when necessary
- Provisions regarding expenditure
- Accounts and audit
- Schedule of officers and employees to be submitted for sanction of Government
- Appointments, etc., by whom to be made
- Powers of entry
- Directions by the Authority
- Members and officers to be public servants
- Power to make rules
- Power to make regulations

11.5 MANPOWER REQUIREMENT AND STAFFING PLAN

UMTA shall have to avail the services of an expert team of traffic and transportation planners, engineers, urban planners and other technical advisers. In order to strengthen its human resource, UMTA shall have to form a schedule of officers and employees whom it shall deem it necessary and proper to maintain for the purposes of UMTA Act. In addition to this, various powers related to appointment, promotion, suspension, etc. shall also have to be worked out as per the Government's schedule.

ANNEXURE

ANNEXURE

WARD DETAILS OF STUDY AREA

The study area comprises of Kozhikode Municipal Corporation, Ramanattukara & Feroke Municipality and three adjoining panchayats spread over an area of 210 sqkm. The details of the above mentioned study area is presented in the Table Below,

Table 0-1 TAZ Details of Study Area

Taz Number	Name	Location Coded
95	Pathirikad	Feroke Municipality
96	Iriyampadam	Feroke Municipality
97	Madathilpadam West	Feroke Municipality
98	Chenaparamb South	Feroke Municipality
99	Munnilampadam	Feroke Municipality
100	Puttekaadu	Feroke Municipality
101	Nallurangadi	Feroke Municipality
102	Puthukuzhipadam	Feroke Municipality
103	Pullikadavu	Feroke Municipality
104	Kallikoodam	Feroke Municipality
105	Kallithodi	Feroke Municipality
106	Petta North	Feroke Municipality
107	Chandakadavu	Feroke Municipality
85	Chaliyam Kadukka Bazar	Kadalundi Panchayat
86	Kadukka Bazar	Kadalundi Panchayat
87	Kappalangadi	Kadalundi Panchayat
88	Kadalundi West	Kadalundi Panchayat
89	Mannoor Central	Kadalundi Panchayat
90	Edachira	Kadalundi Panchayat
91	Keezhkode	Kadalundi Panchayat
92	Mannoor Valavu	Kadalundi Panchayat
93	Prabodhini	Kadalundi Panchayat
94	Vadakkumbadu	Kadalundi Panchayat
1	Kommery	Kozhikode Corporation
2	Chevarambalam	Kozhikode Corporation
3	Civil Station	Kozhikode Corporation
4	Paropady (Malaparamba)	Kozhikode Corporation
5	Poolakkadavu (Maloorkunnu)	Kozhikode Corporation

Taz Number	Name	Location Coded
6	Vengery	Kozhikode Corporation
7	Thadambattuthazham	Kozhikode Corporation
8	Malaparamba (Karanparamba)	Kozhikode Corporation
9	Karuvissery	Kozhikode Corporation
10	Kunduparamba	Kozhikode Corporation
11	Mokavur	Kozhikode Corporation
12	Puthur	Kozhikode Corporation
13	Eranjikkal	Kozhikode Corporation
14	Chettikulam	Kozhikode Corporation
15	Pottammel	Kozhikode Corporation
16	Kuthiravattom (Govindpuram)	Kozhikode Corporation
17	Puthiyara	Kozhikode Corporation
18	Parayanchery (Kottuli)	Kozhikode Corporation
19	Kottooli	Kozhikode Corporation
20	Kudilthodu	Kozhikode Corporation
21	Nellikode (Thondayad)	Kozhikode Corporation
22	Kovoor (Palazhi)	Kozhikode Corporation
23	Chevayur	Kozhikode Corporation
24	Medical College	Kozhikode Corporation
25	Medical College South	Kozhikode Corporation
26	Mayanadu	Kozhikode Corporation
27	Chelavur	Kozhikode Corporation
28	Moozhikkal	Kozhikode Corporation
29	Vellimadukunnu	Kozhikode Corporation
30	Pokkunnu	Kozhikode Corporation
31	Kuttiyilthazham	Kozhikode Corporation
32	Elathur	Kozhikode Corporation
33	Puthiyappa	Kozhikode Corporation
34	Puthiyangadi	Kozhikode Corporation
35	Edakkadu	Kozhikode Corporation
36	Westhill	Kozhikode Corporation
37	Athanikkal	Kozhikode Corporation
38	Easthill	Kozhikode Corporation
39	Karapparamba (East Nadakkavu)	Kozhikode Corporation
40	Chakkorathkulam	Kozhikode Corporation
41	Thoppayil (Kamburam Bridge)	Kozhikode Corporation
42	Thoppayil (Kamburam Bridge)	Kozhikode Corporation
43	Vellayil	Kozhikode Corporation
44	Vellayil	Kozhikode Corporation
45	Nadakkavu (Bilathikulam)	Kozhikode Corporation

Taz Number	Name	Location Coded
46	Eranjippalam	Kozhikode Corporation
47	Thiruthiyadu (Javahar Nagar)	Kozhikode Corporation
48	Moonnalinkal (Nadakkavu)	Kozhikode Corporation
49	Moonnalinkal (Nadakkavu)	Kozhikode Corporation
50	Valiyangadi	Kozhikode Corporation
51	Palayam	Kozhikode Corporation
52	Chalappuram	Kozhikode Corporation
53	Kuttichira	Kozhikode Corporation
54	Kuttichira	Kozhikode Corporation
55	Mukhador (Pallikandy)	Kozhikode Corporation
56	Mukhador (Pallikandy)	Kozhikode Corporation
57	Chakkumkadavu	Kozhikode Corporation
58	Payyanakkal	Kozhikode Corporation
59	Kappakkal (Meenchanda)	Kozhikode Corporation
60	Mathottam	Kozhikode Corporation
61	Arakkinar	Kozhikode Corporation
62	Arakkinar	Kozhikode Corporation
63	Punjappadom	Kozhikode Corporation
64	Naduvattam	Kozhikode Corporation
65	Marad	Kozhikode Corporation
66	Beypore	Kozhikode Corporation
67	Beypore Port	Kozhikode Corporation
68	Cheruvannur West	Kozhikode Corporation
69	Cheruvannur East	Kozhikode Corporation
70	Kundayithodu	Kozhikode Corporation
71	Kolathara	Kozhikode Corporation
72	Nallalam	Kozhikode Corporation
73	Areekad	Kozhikode Corporation
74	Areekad	Kozhikode Corporation
75	Areekad North	Kozhikode Corporation
76	Areekad North	Kozhikode Corporation
77	Thiruvannur	Kozhikode Corporation
78	Meenchantha (Kannachery)	Kozhikode Corporation
79	Panniyankara (Thiruvannoor)	Kozhikode Corporation
80	Kallayi (Panniyamkara)	Kozhikode Corporation
81	Azhchavattom (Manakavu)	Kozhikode Corporation
82	Mankavu	Kozhikode Corporation
83	Kinassery (Nacherikunnu,Thottummaram)	Kozhikode Corporation
84	Kinassery (Nacherikunnu,Thottummaram)	Kozhikode Corporation
141	Edakkadu	Kozhikode Corporation

Taz Number	Name	Location Coded
142	Puthur	Kozhikode Corporation
143	Edakkadu	Kozhikode Corporation
144	Puthur	Kozhikode Corporation
145	Athanikkal	Kozhikode Corporation
146	Westhill	Kozhikode Corporation
147	Easthill	Kozhikode Corporation
148	Elathur	Kozhikode Corporation
149	Puthiyappa	Kozhikode Corporation
150	Karapparamba (East Nadakkavu)	Kozhikode Corporation
151	Chakkorathkulam	Kozhikode Corporation
152	Malaparamba (Karaparamba)	Kozhikode Corporation
153	Civil Station	Kozhikode Corporation
154	Parayanchery (Karimbanapalam)	Kozhikode Corporation
155	Kottooli (Karimbanapalam)	Kozhikode Corporation
156	Kottooli	Kozhikode Corporation
157	Kudilthodu	Kozhikode Corporation
158	Kudilthodu	Kozhikode Corporation
159	Paropady (Malaparamba)	Kozhikode Corporation
160	Paropady (Malaparamba)	Kozhikode Corporation
161	Thadambattuthazham	Kozhikode Corporation
162	Thadambattuthazham	Kozhikode Corporation
163	Eranjikkal	Kozhikode Corporation
164	Vellimadukunnu	Kozhikode Corporation
165	Moozhikkal	Kozhikode Corporation
166	Palayam	Kozhikode Corporation
167	Palayam	Kozhikode Corporation
168	Puthiyara	Kozhikode Corporation
169	Kuthiravattom (Govindpuram)	Kozhikode Corporation
170	Chalappuram	Kozhikode Corporation
171	Chalappuram	Kozhikode Corporation
172	Chalappuram (Kuttichira)	Kozhikode Corporation
173	Kuthiravattom (Govindpuram)	Kozhikode Corporation
174	Kallayi (Panniyamkara)	Kozhikode Corporation
175	Panniyankara (Thiruvannoor)	Kozhikode Corporation
176	Thiruvannur	Kozhikode Corporation
177	Mankavu (Nacherikunnu,Thottummaram)	Kozhikode Corporation
178	Azhchavattom (Manakavu)	Kozhikode Corporation
179	Chakkumkadavu	Kozhikode Corporation
180	Kommery	Kozhikode Corporation

Taz Number	Name	Location Coded
181	Kuttiyilthazham	Kozhikode Corporation
182	Kuttiyilthazham	Kozhikode Corporation
183	Nellikode (Thondayad)	Kozhikode Corporation
184	Kovoor (Palazhi)	Kozhikode Corporation
185	Kovoor (Palazhi)	Kozhikode Corporation
186	Poolakkadavu (Maloorkunnu)	Kozhikode Corporation
187	Moozhikkal	Kozhikode Corporation
188	Chelavur	Kozhikode Corporation
189	Eranjikkal	Kozhikode Corporation
190	Vengery	Kozhikode Corporation
191	Cheruvannur West	Kozhikode Corporation
192	Cheruvannur East	Kozhikode Corporation
193	Naduvattam	Kozhikode Corporation
194	Beypore Port	Kozhikode Corporation
195	Mokavur	Kozhikode Corporation
196	Chevarambalam	Kozhikode Corporation
197	Nellikode (Thondayad)	Kozhikode Corporation
198	Pottammel	Kozhikode Corporation
199	Kappakkal (Payyanakkal)	Kozhikode Corporation
200	Payyanakkal (Meenchanda)	Kozhikode Corporation
201	Beypore	Kozhikode Corporation
203	Chelavur	Kozhikode Corporation
204	Chelavur	Kozhikode Corporation
205	Vellimadukunnu	Kozhikode Corporation
206	Chevayur	Kozhikode Corporation
207	Nallalam	Kozhikode Corporation
208	Chalappuram (Kuttichira)	Kozhikode Corporation
209	Nellikode (Thondayad)	Kozhikode Corporation
210	Moozhikkal	Kozhikode Corporation
211	Kommery	Kozhikode Corporation
212	Eranjippalam	Kozhikode Corporation
213	Paropady (Malaparamba)	Kozhikode Corporation
214	Elathur	Kozhikode Corporation
215	Paropady (Malaparamba)	Kozhikode Corporation
216	Thadambattuthazham	Kozhikode Corporation

Taz Number	Name	Location Coded
217	Meenchantha (Kannachery)	Kozhikode Corporation
218	Mokavur	Kozhikode Corporation
219	Nadakkavu (Bilathikulam)	Kozhikode Corporation
220	Marad	Kozhikode Corporation
221	Puthiyangadi	Kozhikode Corporation
222	Kovoor (Palazhi)	Kozhikode Corporation
223	Cheruvannur West	Kozhikode Corporation
224	Vengery	Kozhikode Corporation
225	Eranjikkal	Kozhikode Corporation
226	Punjappadom	Kozhikode Corporation
227	Mathottam	Kozhikode Corporation
228	Puthiyappa	Kozhikode Corporation
229	Civil Station	Kozhikode Corporation
230	Kundayithodu	Kozhikode Corporation
231	Eranjikkal	Kozhikode Corporation
232	Cheruvannur West	Kozhikode Corporation
233	Karuvissery	Kozhikode Corporation
234	Thiruthiyadu (Javahar Nagar)	Kozhikode Corporation
235	Moozhikkal	Kozhikode Corporation
236	Civil Station	Kozhikode Corporation
237	Kolathara	Kozhikode Corporation
238	Poolakkadavu (Maloorkunnu)	Kozhikode Corporation
240	Valiyangadi	Kozhikode Corporation
241	Medical College	Kozhikode Corporation
242	Mayanadu	Kozhikode Corporation
243	Kunduparamba	Kozhikode Corporation
244	Kunduparamba	Kozhikode Corporation
245	Medical College South (Palazhi)	Kozhikode Corporation
246	Chettikulam	Kozhikode Corporation
247	Moozhikkal	Kozhikode Corporation
248	Valiyangadi	Kozhikode Corporation
249	Medical College	Kozhikode Corporation

Taz Number	Name	Location Coded
250	Mayanadu	Kozhikode Corporation
251	Medical College South	Kozhikode Corporation
118	Pantheerpadam	Kunnamangalam Panchayat
119	Veloor	Kunnamangalam Panchayat
120	Karanthoor East	Kunnamangalam Panchayat
121	Karanthoor	Kunnamangalam Panchayat
122	Paingottupuram East	Kunnamangalam Panchayat
123	Chathankavu North	Kunnamangalam Panchayat
124	Chathankavu	Kunnamangalam Panchayat
125	Chethukadavu North	Kunnamangalam Panchayat
126	Choolamvayal	Kunnamangalam Panchayat
127	Pilasseri	Kunnamangalam Panchayat
202	Padanilam	Kunnamangalam Panchayat
239	Paingottupuram West	Kunnamangalam Panchayat
128	Kothanari	Olavanna Panchayat
129	Kunnathpalam	Olavanna Panchayat
130	Kambiliparamba	Olavanna Panchayat
131	Kayatti	Olavanna Panchayat
132	Thondilakadavu	Olavanna Panchayat
133	Palakurumba	Olavanna Panchayat
134	Moorkanad	Olavanna Panchayat
135	Kodalnadakav	Olavanna Panchayat
136	Muthuvanathara	Olavanna Panchayat
137	Poolangara	Olavanna Panchayat
138	Pantherankav North	Olavanna Panchayat
139	Palazhi East	Olavanna Panchayat
140	Palazhi Pala	Olavanna Panchayat
108	Pallimethal	Ramanattukara Municipality
109	Madathilthazham	Ramanattukara Municipality
110	Kodampuzha	Ramanattukara Municipality
111	Unnialungal	Ramanattukara Municipality
112	Muttumkunnu	Ramanattukara Municipality
113	Ramanattukara West	Ramanattukara Municipality

Taz Number	Name	Location Coded
114	Palakaparambu	Ramanattukara Municipality
115	Kolorkunnu	Ramanattukara Municipality
116	Chirakkam Kunnu	Ramanattukara Municipality
117	Melevaram	Ramanattukara Municipality

PRIMARY SURVEYS MTHODOLOGY

LIST OF PRIMARY TRAFFIC & TRANSPORTATION SURVEYS

The study mandate requires 21 types of primary surveys to capture the travel and transportation characteristics in the city. The list of surveys primary traffic and transportation surveys to be conducted is as presented below in Table 1.

Table 0-2 List of Surveys to be Conducted

SN	PARTICULARS OF SURVEY	HOURS	UNIT	QUANTITY
1	Classified Volume count at cordon locations	24	Location	6
2	Classified Volume counts surveys at Screen Line locations and vehicle occupancy	24	Location	8
3	Classified Turning Volume Counts at Junctions	16	Location	15
4	RSI at Screen Line location (10% sample size of daily vehicle volumes)	24	Location	8
5	RSI at Cordon locations (10% sample size of daily vehicle volumes)	24	Location	6
6	Passenger Terminal Counts	16	Location	10
7	Passenger Terminal Origin and Destination Surveys (10 % sample of the daily passenger count)	16	Location	10
8	Public Transport (PT) Stop Waiting, Boarding and Alighting (B/A) survey – Bus/ Metro/ Ferry	16	Location	12
9	Public Transport (PT) Stop Passenger Origin and Destination Surveys (10 % sample size of the daily B/A) at PT stops -– Bus/ Metro/ Ferry	16	Location	12
10	Stated Preference Surveys for PT, IPT, Private Users (2W and Car) and NMT (cycle and walk) users along major activity centres	-	Sample	500
11	Pedestrian Volume Counts at critical junctions	16	Location	16
12	Speed and Delay Study at peak and off-peak hours	-	Km	150
13	IPT Operator Survey (Taxi/auto)	-	Sample	150
14	Parking Survey-On Street with inventory	-	km	10

SN	PARTICULARS OF SURVEY	HOURS	UNIT	QUANTITY
15	Parking Survey-off Street with inventory	-	location	5
16	Household Interview with opinion survey	-	Sample	3500
17	Road Network Inventory with lux levels	-	Km	150
18	Vehicles Survey at Petrol Pump	-	Sample	200
19	Establishment and Workplace survey	-	Sample	200
20	Goods Operator Survey	-	Sample	150

CLASSIFIED TRAFFIC VOLUME COUNTS (CVC) AT OUTER CORDON LOCATION

Objective: The survey aims to assess the floating population, interaction of the surrounding regions with the study area and to establish the peak to daily flow ratios.

Conduct of the Survey:

- Video traffic counts will be carried out on typical working day at all locations listed.
- At each identified location both **directional classified volume counts will be carried out by vehicle type for a period of 24 hours**.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Location: The survey will be conducted at **six (6) outer cordon points**.

Table 0-3 Outer Cordon Survey Locations

Code	Name of Location
OC_1	Kakkodi River Cross Bridge
OC_2	Kunnamangalam
OC_3	Perumanna Road
OC_4	Purakkattiri Bridge on Atholi Road
OC_5	Airport Road near District Boundary
OC_6	Idimuzhikkal

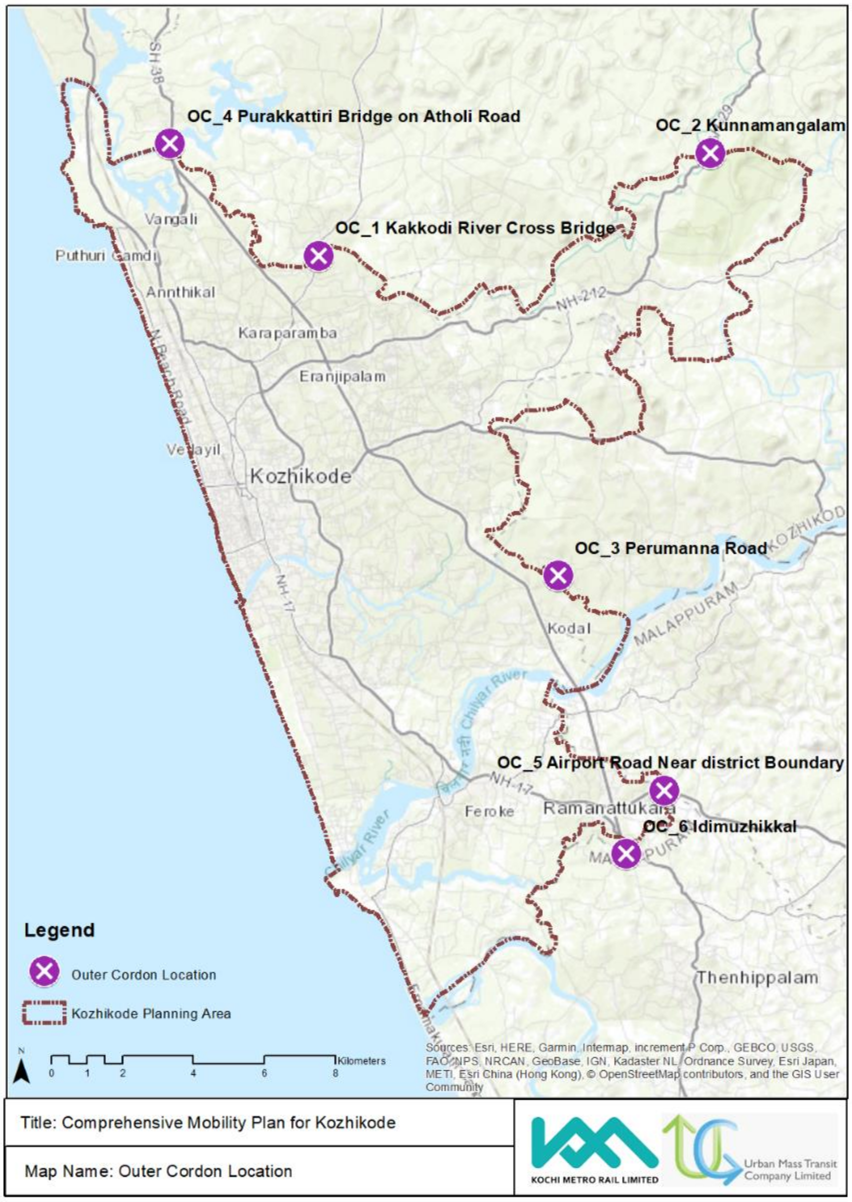

Figure 0-1 Outer Cordon Survey Location

CLASSIFIED TRAFFIC VOLUME COUNTS (CVC) AND VEHICLE OCUPANCY AT SCREEN LINE LOCATIONS

Objective: The survey aims to assess and the validate the traffic and passenger flows at identified locations mode wise and to establish the peak to daily flow ratios.

Conduct of the Survey:

- Video traffic counts will be carried out on typical working day at all locations listed.
- At each identified location both **directional classified volume counts will be carried out by vehicle type for a period of 24 hours**.

- Passenger occupancy by vehicle type. i.e., cars, jeeps, vans, buses, trucks, MAVs, LCV's tractors, motorized two wheelers and so on need to be captured.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Location: The survey will be conducted at **eight (8) screen lines points** along the north-south and east-west screen lines.

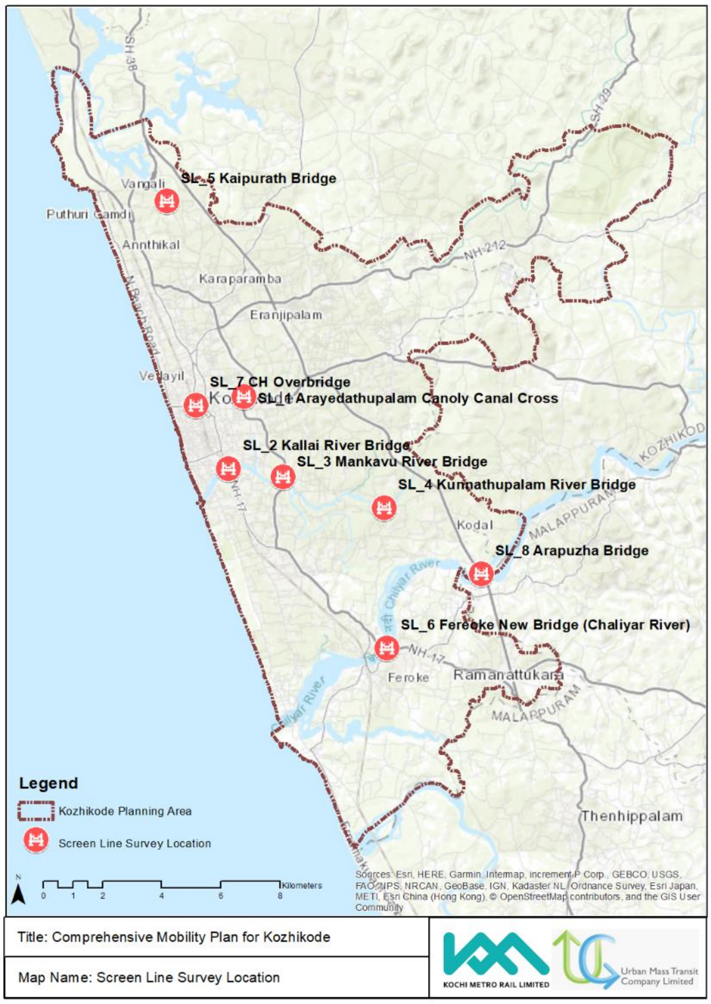

Figure 0-2 Locations for Screen Line Survey

Table 0-4 Outer Cordon Survey Locations

Code	Name of Location
SL_1	Arayedathupalam Canoly Canal Cross
SL_2	Kallayi River Bridge
SL_3	Mankavu River Bridge
SL_4	Kunnathupalam River Bridge
SL_5	Kaipurath Bridge
SL_6	Feroke New Bridge (Chaliyar River
SL_7	CH Over bridge
SL_8	Arapuzzha Bridge

CLASSIFIED TURNING MOVEMENT COUNTS AT INTERSECTIONS

Objectives: The survey aims to in identifying and analysing the critical movements, validate mode-wise traffic flows in all directions at the intersection and for deriving inputs for designing the intersection to perform more efficiently.

Conduct of the Survey:

- Video traffic counts will be carried out on typical working day at all locations listed.
- At each identified location both intersections, for **all arms both directional counts will be carried out by vehicle type**. I.e., cars, jeeps, vans, buses, trucks, MAVs, LCV's tractors, motorized two wheelers and slow-moving vehicles **for a period of 16 hours**.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted at **Fifteen (15) critical intersections**.

Table 0-5 TVC Survey Locations

Code	Location Name	Code	Location Name	Code	Location Name
TVC_1	Stadium Junction	TVC_6	Thondayad Junction	TVC_11	Feroke Town
TVC_2	Palayam Junction	TVC_7	Medical College Junction	TVC_12	Pantheerankavu Junction
TVC_3	Francis Road Junction	TVC_8	Malaparamba Bypass Junction	TVC_13	Poonthanam Junction
TVC_4	Eranjippaalam Junction.	TVC_9	Bank Road Junction	TVC_14	Vattakinar Junction
TVC_5	Karaparamba Junction	TVC_10	Cheruvannur Junction Sunni Juma Masjid	TVC_15	West Hill - Chungam Junction

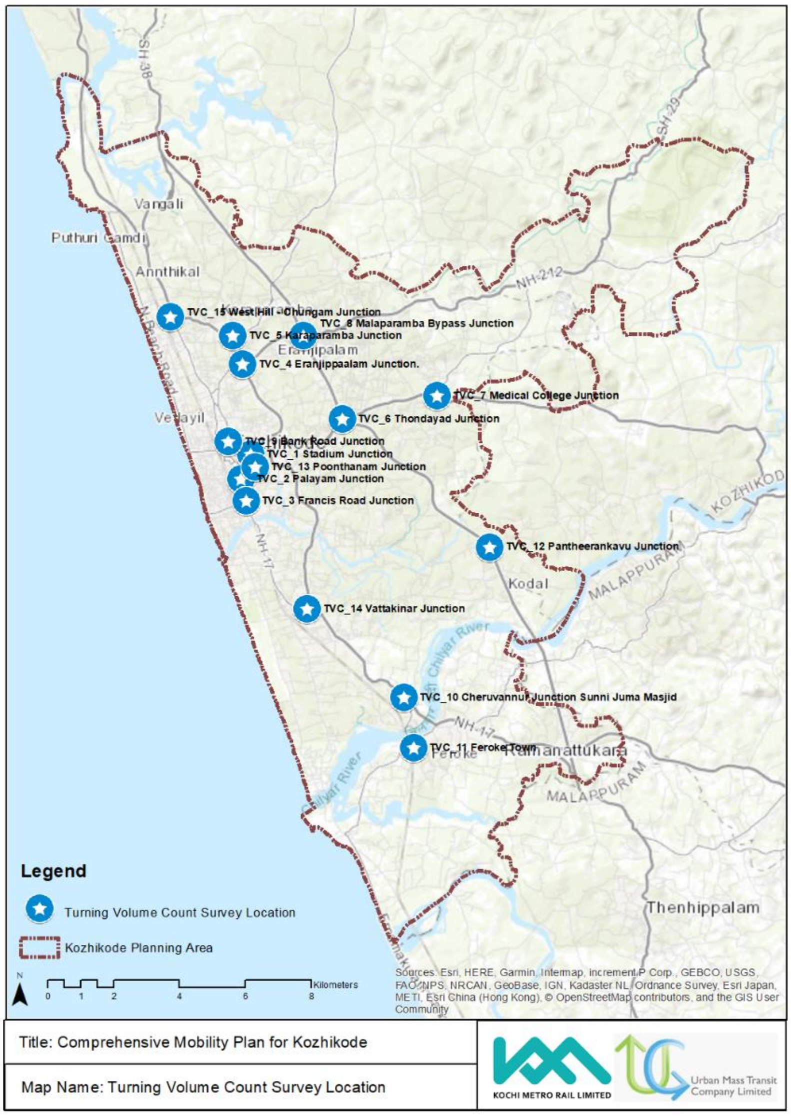

Figure 0-3 Turning Volume Counts Junctions Location

ROADSIDE (ORIGIN – DESTINATION) SURVEY - SCREEN LINE

Objective: The survey aims to assess and the validate the traffic and passenger flows at identified locations mode wise and in evaluating the travel characteristics and mode wise travel pattern.

Conduct of the Survey:

- The survey will be conducted for **24 hours at screen line locations** with a **sample of 10% of the traffic** on a typical working day.
- Manual interviewing **passenger vehicles and goods for OD, occupancy, travel cost, time etc. needs to be carried out.**

- The data will be collected and complied and submitted as per the templates provided by UMTC.

Location: The survey will be conducted at **eight (8) screen lines points** along the north-south and east-west screen

Table 0-6 KMC Survey Locations

Code	Name of Location
SL_1	Arayedathupalam Canoly Canal Cross
SL_2	Kallayi River Bridge
SL_3	Mankavu River Bridge
SL_4	Kunnathupalam River Bridge
SL_5	Kaipurath Bridge
SL_6	Feroke New Bridge (Chaliyar River
SL_7	CH Over bridge
SL_8	Arapuzzha Bridge

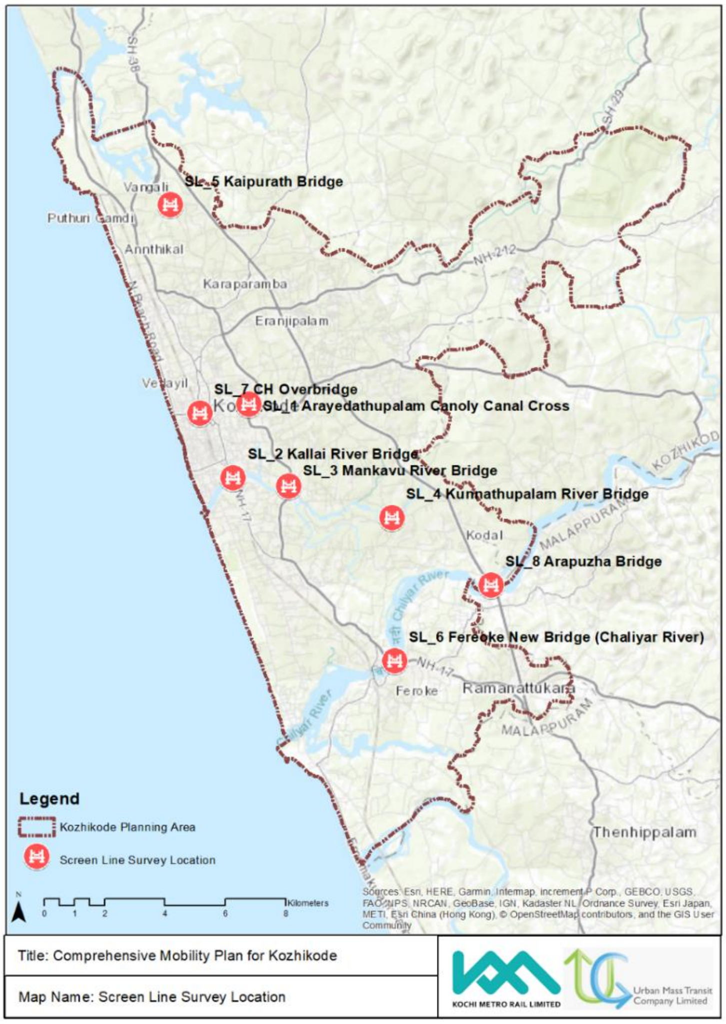

Figure 0-4 Location for RSI at Screen Line Survey

ROADSIDE (ORIGIN – DESTINATION) SURVEY - OUTER CORDON

Objective: The survey aims to assess the floating population, interaction of the surrounding regions with the study area and in assessing the travel characteristics and mode wise travel pattern.

Conduct of the Survey:

- The survey will be conducted for **24 hours at outer cordon locations** with a **sample of 10% of the traffic** on a typical working day.
- Manual interviewing **passenger vehicles and goods for OD, occupancy, travel cost, time etc. needs to be carried out.**
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Location: The survey will be conducted at **six (6) outer cordon points** along the north-south and east-west screen lines, similar to the CVC locations at Outer cordon locations.

Table 0-7 Outer Cordon RSI Survey Locations

Code	Name of Location
OC_1	Kakkodi River Cross Bridge
OC_2	Kunnamangalam
OC_3	Perumanna Road
OC_4	Purakkattiri Bridge on Atholi Road
OC_5	Airport Road near District Boundary
OC_6	Idimuzhikkal

PASSENGER TERMINAL COUNTS SURVEY

Objective: The survey aims to evaluate the percentage of people using Bus/Rail/Air/Water transport and under the volumes and demands at these transit nodes.

Conduct of the Survey:

- The survey will be conducted for a period of **16 hours at Bus/ Rail/ Air/ Water Terminals**.
- **Manual counts of passengers** entering and exiting the terminal will be captured at all entry and exit location of the identified locations.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The surveys will be conducted at all the **ten (10) public transit terminals**.

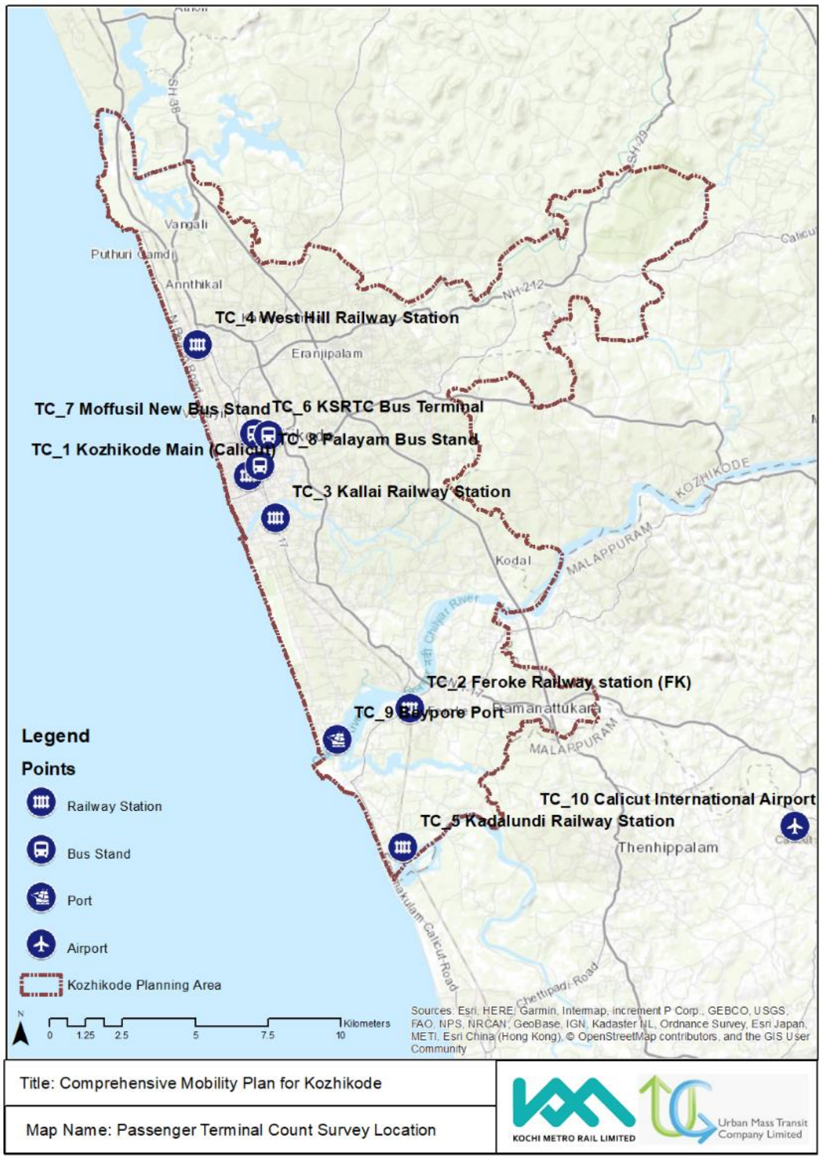

Figure 0-5 Location for Passenger Counts at Different Terminals

Table 0-8 Terminal Count Survey Locations

S. No	Code	Name of Location
Railway Station	**TC_1**	Kozhikode Main (Calicut)
	TC_2	Feroke Railway station (FK)
	TC_3	Kallayi Railway Station
	TC_4	West Hill Railway Station
	TC_5	Kadalundi Railway Station
Bus Terminal	**TC_6**	KSRTC Bus Terminal - Kozhikode
	TC_7	Moffusil Bus Stand (New Bus stand Calicut)
	TC_8	Palayam Bus Stand
Port	**TC_9**	Beypore Port
Airport	**TC_10**	Calicut International Airport

PASSENGER TERMINAL ORIGIN AND DESTINATION SURVEYS

Objective: The survey aims to evaluate the travel and trip characteristics of the passengers using Bus/Rail/Air/Water transport and to capture the floating population and their impact on the travel demand in the study area.

Conduct of the Survey:

- The survey will be conducted for a period of **16 hours at Bus/ Rail/ Air/ Water Terminals**.
- **Manual interviews of passengers** entering and exiting the terminal will be captured at all entry and exit location of the identified locations.
- Data pertaining to travel and traffic characteristics of the intercity & intra city travellers are captured along with trip characteristics, and details to estimate the PT passengers the existing demand and need for additional supply to be captured.
- The data will be collected and complied and submitted as per the templates provided by UMTC.
- Samples collected need to be at least 10 % of the daily passenger count at passenger terminals.

Table 0-9 Outer Cordon RSI Survey Locations

S. No	Code	Name of Location
Railway Station	**TC_1**	Kozhikode Main (Calicut)
	TC_2	Feroke Railway station (FK)
	TC_3	Kallayi Railway Station
	TC_4	West Hill Railway Station
	TC_5	Kadalundi Railway Station
Bus Terminal	**TC_6**	KSRTC Bus Terminal - Kozhikode
	TC_7	Moffusil Bus Stand (New Bus stand Calicut)
	TC_8	Palayam Bus Stand
Port	**TC_9**	Beypore Port
Airport	**TC_10**	Calicut International Airport

Locations: The surveys will be conducted at all the **ten (10) public transit terminals** similar to the passenger terminal count survey locations.

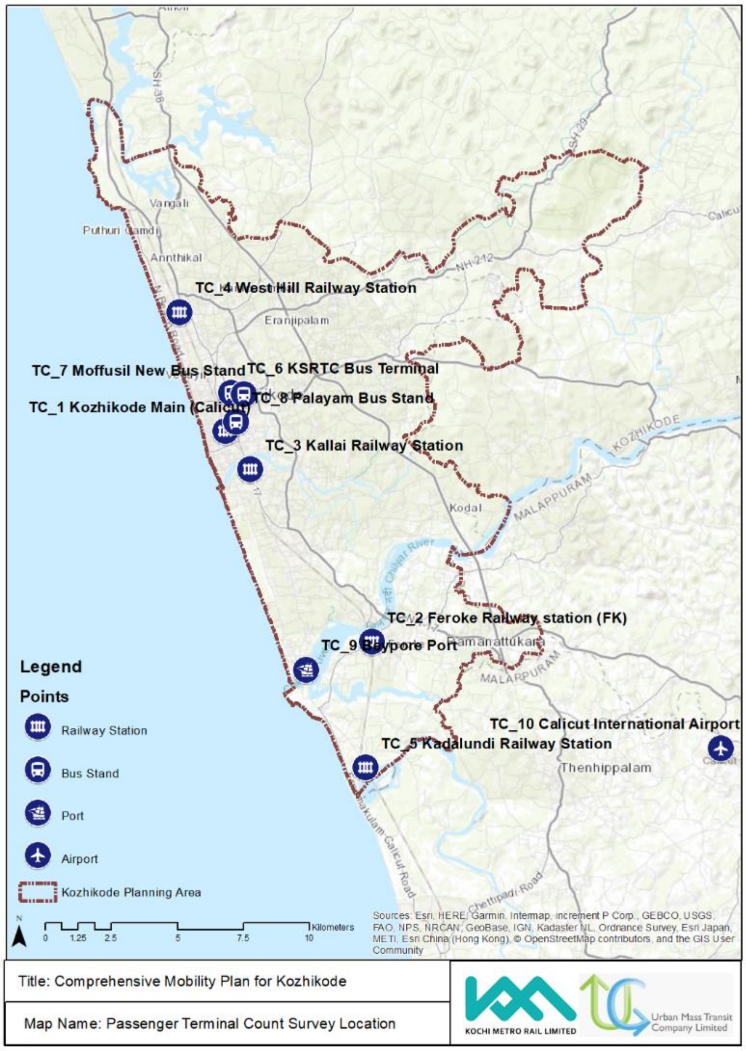

Figure 0-6 Locations for Passenger Terminal OD Surveys

PUBLIC TRANSPORT STOP WAITING, BOARDING AND ALIGHTING SURVEY

Objective: The survey aims to capture the quantum of people using Public Transport for their daily travel in the city and to identify and validate the existing PT demand at identified locations.

Conduct of the Survey:

- The survey will be conducted for a period of **16 hours at Public Transport Stops (Bus/ Metro/ Ferry, etc.)**.
- **Manual counts of passengers** of boarding and alighting the public transport services at the identified locations.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted in **twelve (12) public transportation stop locations**.

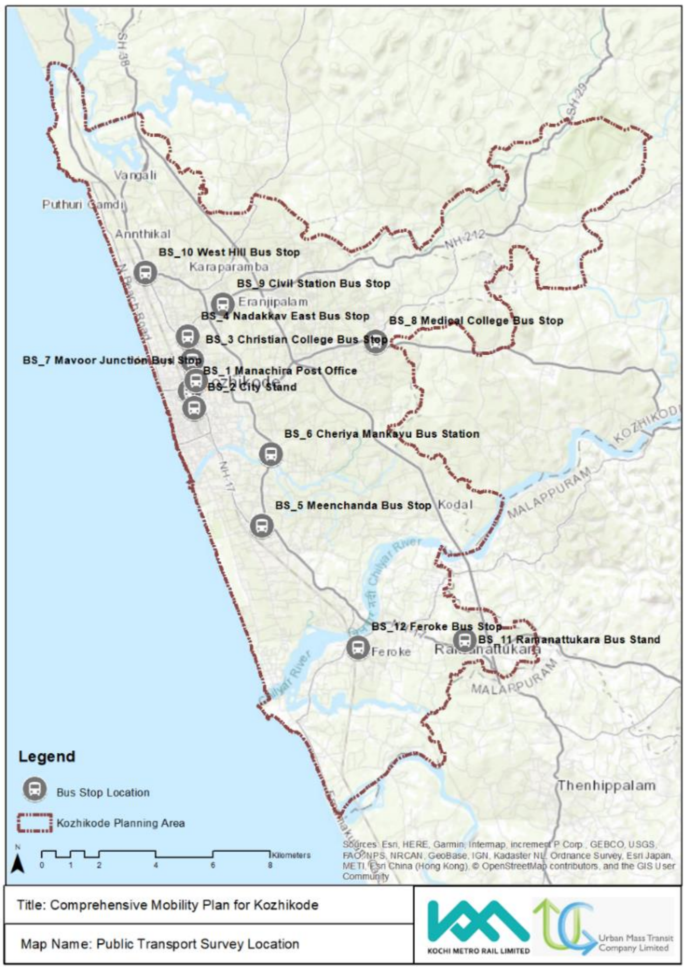

Figure 0-7 Location for Public Transport (PT) Stop, Boarding and Alighting Survey

Table 0-10 Location for Public Transport (PT) Stop, Boarding and Alighting Survey

Code	Bus Stop Location
BS_1	Mananchira Head Post Office Bus Stop
BS_2	City Stand
BS_3	Christian College Bus Stop
BS_4	Nadakkav East Bus Stop
BS_5	Meenchanda Bus Stop
BS_6	Cheriya Mankavu Bus Station
BS_7	Mavoor Road Junction Bus Stop
BS_8	Medical College Bus Stop
BS_9	Civil Station Bus Stop
BS_10	West Hill Bus Stop
BS_11	Ramanattukara Bus Stand
BS_12	Feroke Bus Stop

PUBLIC TRANSPORT STOP ORIGIN AND DESTINATION SURVEYS

Objective: To evaluate the number of people using Public Transport for their daily travel in the city and to identify the characteristics of travellers.

Conduct of the Survey:

- The survey will be conducted for a period of **16 hours at Public Transport Stops (Bus/ Metro/ Ferry, etc.)**.
- **Manual interviews of passengers** boarding and alighting the public transport services at the identified locations.
- Data pertaining to travel and **traffic characteristics of the PT travellers are captured along with trip characteristics** and details to estimate the PT passengers the existing demand and need for additional supply to be captured.
- The data will be collected and complied and submitted as per the templates provided by UMTC.
- Samples collected need to be at least 10% of the daily passenger count at PT stops.

Locations: The survey will be conducted in **twelve (12) public transportation stop locations** similar to the PT Stop counts survey.

Table 0-11 Location for Public Transport (PT) Stop, Origin Destination Survey

Code	Bus Stop Location
BS_1	Mananchira Head Post Office Bus Stop
BS_2	City Stand
BS_3	Christian College Bus Stop
BS_4	Nadakkav East Bus Stop
BS_5	Meenchanda Bus Stop
BS_6	Cheriya Mankavu Bus Station
BS_7	Mavoor Road Junction Bus Stop
BS_8	Medical College Bus Stop
BS_9	Civil Station Bus Stop
BS_10	West Hill Bus Stop
BS_11	Ramanattukara Bus Stand
BS_12	Feroke Bus Stop

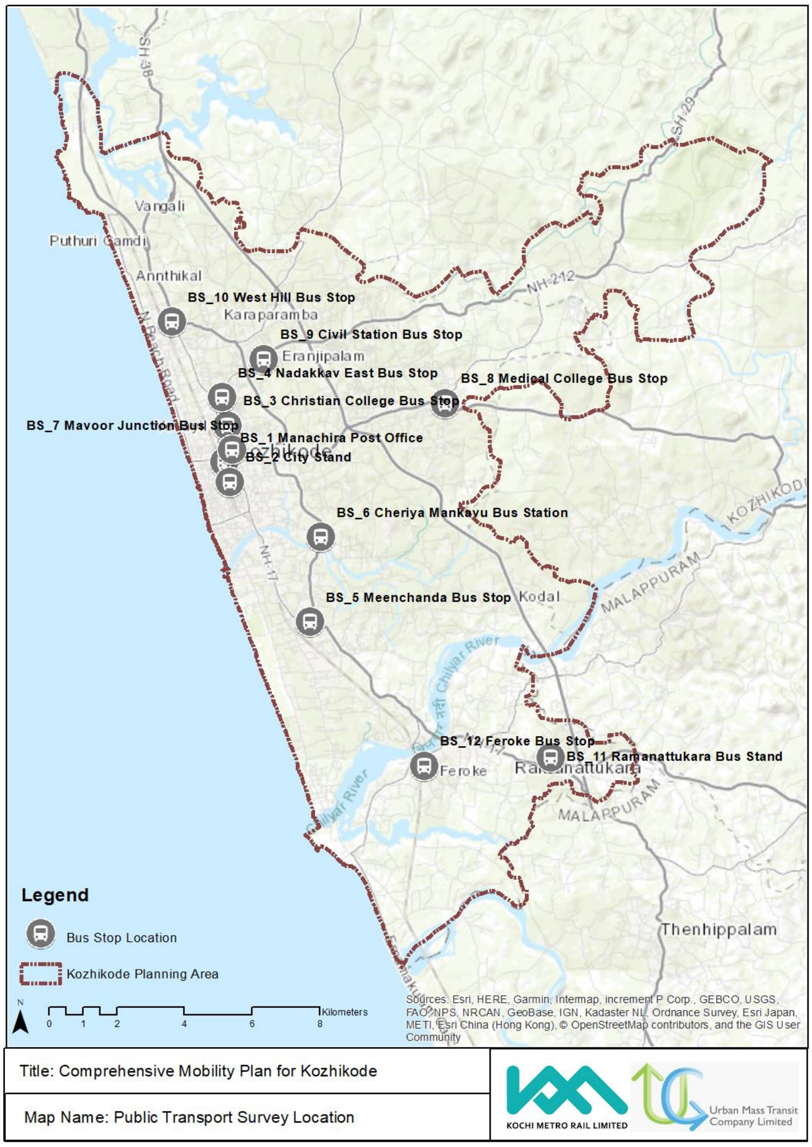

Figure 0-8 Public Transport (PT) Stop, Passenger and OD Survey

STATED PREFERENCE SURVEYS FOR PT, IPT, PRIVATE USERS (2W AND CAR) AND NMT (CYCLE AND WALK) USERS

Objective: The survey aims to evaluate the preferences of commuters towards improved transportation systems and travel conditions and to identify their travel characteristics

Conduct of the Survey:

- The survey will be conducted for a period of **16 hours at major activity centres identified**
- **Manual interviews of PT, IPT, Private users (2w and car) and NMT (cycle and walk) users** are to be captured which an equal representation all modes while sampling.

- Data pertaining to travel and **traffic characteristics are captured along with trip characteristics** and the preferences of commuters towards improved transportation systems and travel conditions.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted at 27 workplaces and major activity centres in the city, through roadside interviews.

Samples: The survey aims to collect **Five hundred (500) clean samples** to be collected across all modes of travel.

Table 0-12 Location for Public Transport (PT) Stop, Origin Destination Survey

Code	Location Name	Code	Location Name	Code	Location Name
SPS_1	IIM Kozhikode	SPS_10	Fathima Hospital	SPS_19	Palayam
SPS_2	Calicut International Airport	SPS_11	Aster MIMS Hospital	SPS_20	West Hill
SPS_3	Calicut University	SPS_12	Government General Hospital	SPS_21	SM Street
SPS_4	Cyberpark Calicut	SPS_13	Kozhikode District Co-Operative Hospital Ltd	SPS_22	Kozhikode Beach
SPS_5	Kinfra Techno Industrial Park	SPS_14	Regional Town Planning Office	SPS_23	Botanical Garden Botany Dpt.
SPS_6	Island Tourism Kadalundi	SPS_15	Administrative Building	SPS_24	District Information Office
SPS_7	Feroke College	SPS_16	Govt. Arts & Science College Calicut	SPS_25	Sarvodhaya Sangh Head Office
SPS_8	NIT	SPS_17	Government Medical College	SPS_26	Government Veterinary Hospital
SPS_9	IPIX Technologies	SPS_18	St Xavier's Arts and Science College	SPS_27	Umbichy Hajee School

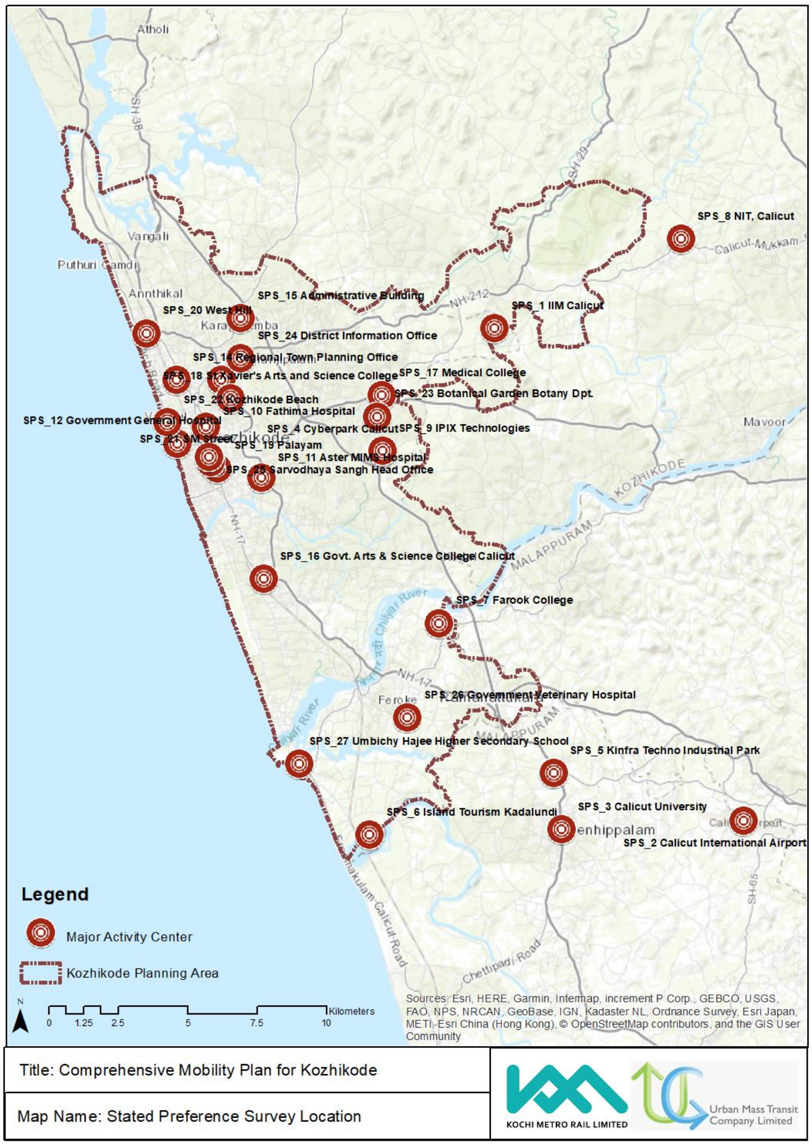

Figure 0-9 Location for Stated Preference Survey for PT, IPT, Private User (Car, 2W) and NMT

PEDESTRIAN VOLUME COUNTS AT CRITICAL JUNCTIONS

Objective: The objective of the survey is to quantify the extent of pedestrian movement in order to design facilities for such movement.

Conduct of the Survey:

- **The** survey will be conducted using video/manual counts for a **period of 16 hours** on important locations where heavy pedestrian movement and critical junction in the city.
- **The survey will capture both along and across movements of pedestrians at all the arms of the intersection.**

Locations: The survey will be conducted at **sixteen (16) critical intersections** similar to the locations for turning movement counts survey.

Table 0-13 Location for Pedestrian Volume Count Survey

Code	Location Name	Code	Location Name
PVC_1	Stadium Junction	**PVC_9**	Bank Road Junction
PVC_2	Palayam Junction	**PVC_10**	Cheruvannur Junction Sunni Juma Masjid
PVC_3	Francis Road Junction	**PVC_11**	Feroke Town
PVC_4	Eranjippaalam Junction.	**PVC_12**	Pantheerankavu Junction
PVC_5	Karaparamba Junction	**PVC_13**	Kunnamangalam Junction
PVC_6	Thondayad Junction	**PVC_14**	Vattakinar Junction
PVC_7	Medical College Junction	**PVC_15**	West Hill - Chungam Junction
PVC_8	Malaparamba Bypass Junction	**PVC_16**	HiLite Mall

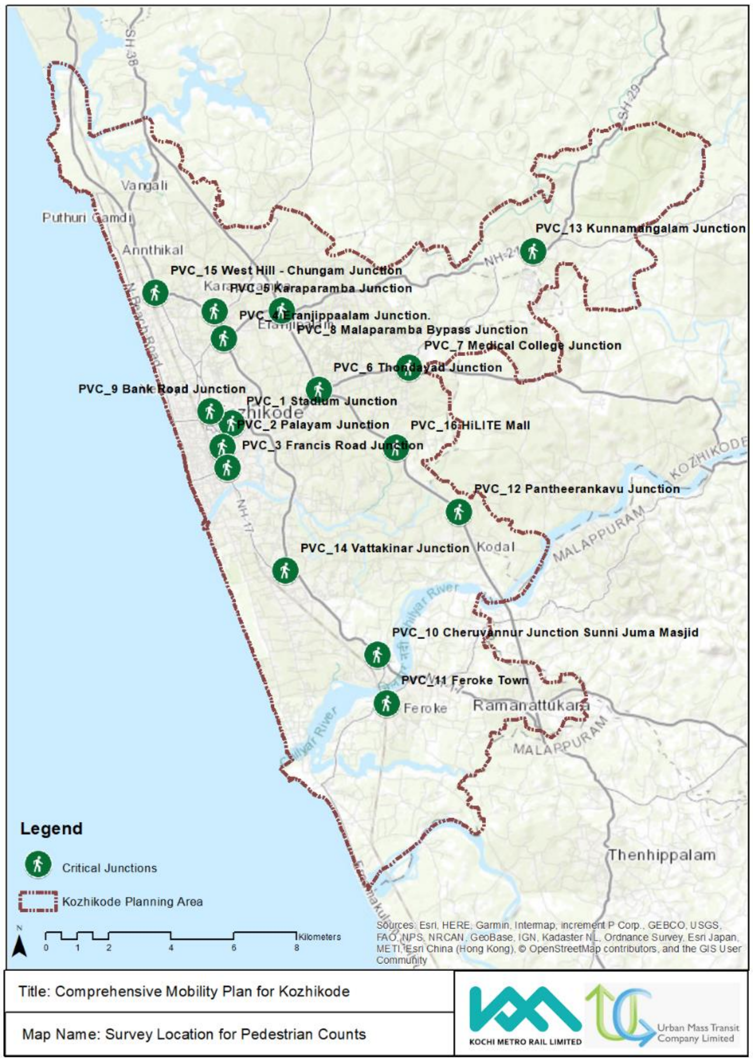

Figure 0-10 Critical Junctions for Pedestrian Volume Counts

SPEED AND DELAY SURVEY AT PEAK AND OFF-PEAK HOURS

Objective: The principle objective of the study is to find out the journey speed, running speed and types of delay, such as stopped delay and operational delay to evaluate the level of service or quality of traffic flow of a road or entire road network system.

Conduct of the Survey:

- The survey should be conducted using GPS based method/ moving car method **during peak and off period in both directions on a typical working day**.
- Data such as speed and delay information on different road stretches and at intersections/level crossings in the study area are to be collected along with capturing the reason for delays along the identified stretches.
- The survey needs to conducted using a car and on bus for identified routes.
- The data will be submitted as per the templates provided by UMTC.

Road Stretches: Road length of **approx. 150 km** similar to the road network inventory will be surveyed including 4 bus routes.

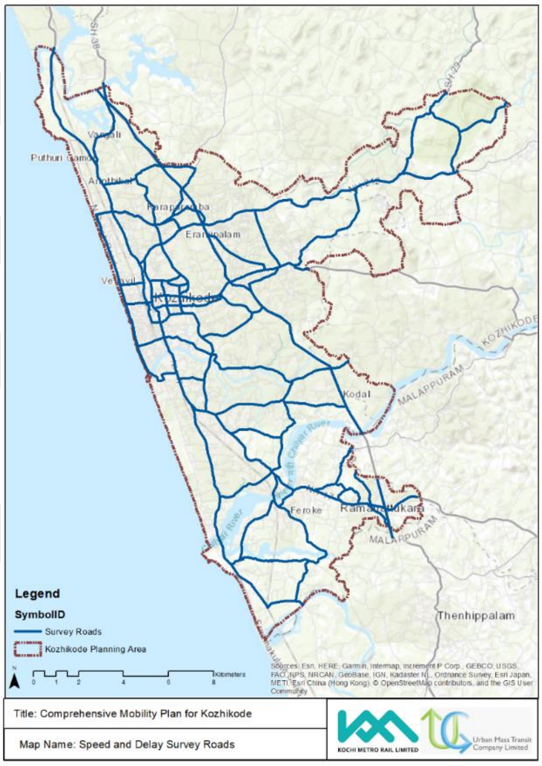

Figure 0-11 Network for Speed and Delay Survey

INTERMEDIATE PUBLIC TRANSPORT (IPT) OPERATOR SURVEY

Objective: The survey aims to evaluate the travel characteristics of Intermediate Public Transport in the study area.

Conduct of the Survey:

- The survey will be conducted through manual interviews capturing the operator trip details.
- The details pertaining to operations such as major routes, travel conditions, trip details, etc. will be captured.
- The samples should include equal representation of auto-rickshaws, shared auto-rickshaw operators, cabs, taxies, (all yellow plate IPT vehicles) etc.

Location: The survey will be conducted at across the 16 locations which were observed to be the major IPT catchments nodes in the study area.

Samples: A clean sample size **of One hundred and Fifty (150)** to be collected.

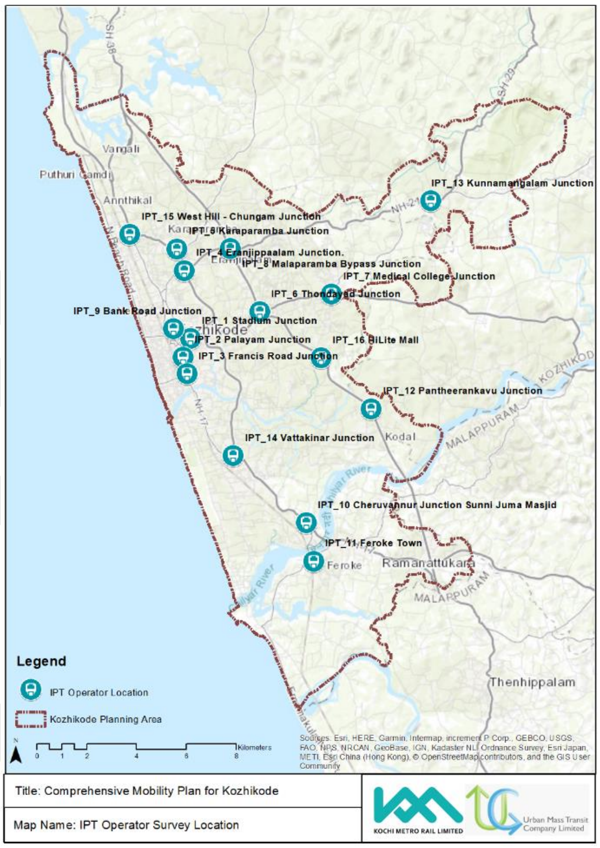

Figure 0-12 Location of IPT Operator Survey

Table 0-14 Location for IPT Surveys

Code	Location Name
IPT_1	Stadium Junction
IPT_2	Palayam Junction
IPT_3	Francis Road Junction
IPT_4	Eranjippaalam Junction.
IPT_5	Karaparamba Junction
IPT_6	Thondayad Junction
IPT_7	Medical College Junction
IPT_8	Malaparamba Bypass Junction
IPT_9	Bank Road Junction
IPT_10	Cheruvannur Junction Sunni Juma Masjid
IPT_11	Feroke Town
IPT_12	Pantheerankavu Junction
IPT_13	Kunnamangalam Junction
IPT_14	Vattakinar Junction
IPT_15	West Hill - Chungam Junction
IPT_16	HiLite Mall

ON STREET PARKING NUMBER PLATE SURVEYS

Objective: The principal objective of the study is to assess the demand for parking and characteristics of the parked vehicles.

Conduct of the Survey:

- The survey will be conducted **for a period of 12 hours** on identified important commercial areas where parking is predominant.
- Number Method will be used capturing the vehicle type and registration number of parked vehicles **every 15mins** and associated parking fees.\
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted at along a total length of **ten (10) kilometres** with on-street parking activity.

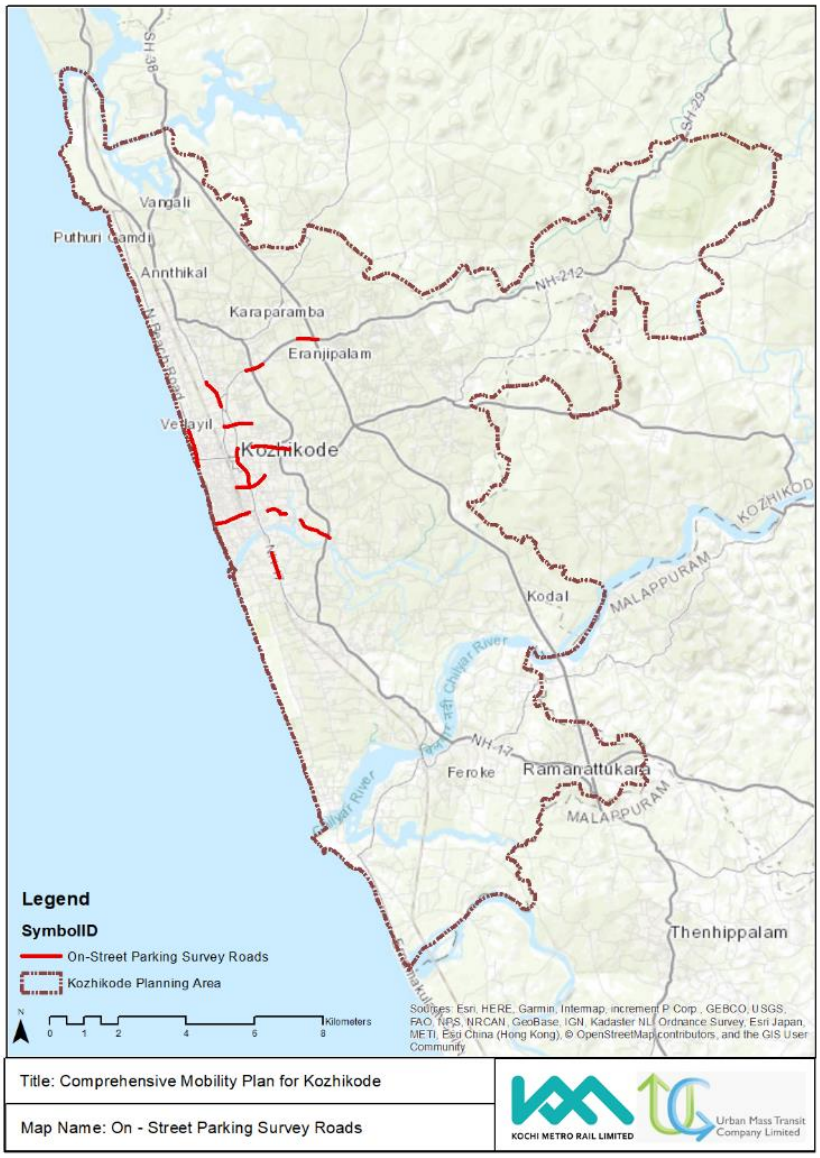

Figure 0-13 On Street Parking Survey

Table 0-15 Location for On Street Parking Surveys

Code	Location	Length (in km)
ONSP 1	Calicut Road	0.75
ONSP 2	Francis Road	1.00
ONSP 3	Kesari Junction	0.60
ONSP 4	Kaloor Junction to Mankavu Junction	1.00
ONSP 5	Eranjippalam Junction	0.50
ONSP 6	Wayanad Road	0.60
ONSP 7	Indira Gandhi Road	1.00
ONSP 8	Mananchira Square	1.80
ONSP 9	MM Ali Road	0.30

Code	Location	Length (in km)
ONSP 10	Ashok pura Junction to MCC Cross Road	0.80
ONSP 11	Kannur Road	0.65
ONSP 12	Beach Road	1.00
ONSP 13	Near Ramanattukara Bus Stand	0.53
ONSP 14	Near Feroke Railway Station	0.98

OFF STREET PARKING NUMBER PLATE SURVEYS

Objective: The principal objective of the study is to assess the demand for parking and characteristics of the parked vehicles.

Conduct of the Survey:

- The survey will be conducted **for a period of 12 hours** on identified important commercial areas where parking is predominant.
- Number Method will be used capturing the vehicle type and registration number of parked vehicles **every 15mins** and associated parking fees.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted at the **five (5) off street Parking l**ocations.

Table 0-16 Location for Off Street Parking Surveys

Code	Location Name
OFS_1	Railway Station Parking
OFS_2	Paid Parking
OFS_3	Pay And Park KSRTC
OFS_4	Mittayi Theruvu Parking
OFS_5	K C Group Pay and Park Parking

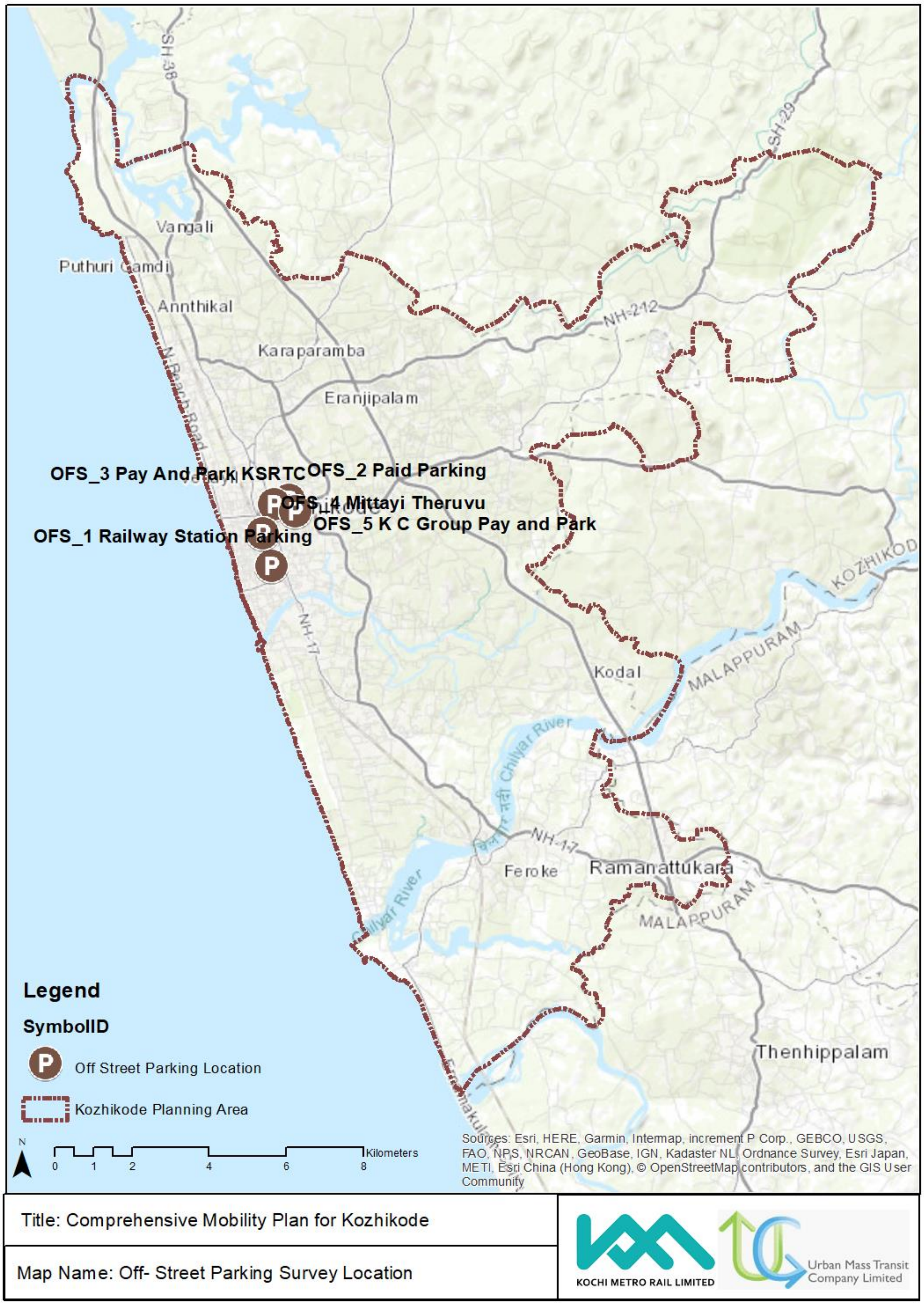

Figure 0-14 Off Street Parking Survey

HOUSEHOLD INTERVIEW SURVEYS

Objective: The household survey aims to capture the data which is used for describing the travel patterns in the city and travel preferences of its residents.

Conduct of the Survey:

- Collection of data on **socio-economic characteristics, household members and their travel diary with their opinion of study area residents** is to be carried out by manual interview within the delineated traffic analysis zones.
- Details relating to Socio-economics, Household member characteristics, and travel diary of each individual member of the household will be captured.
- Sample size needs to be well distributed capturing all types of households (HIG, MIG and MIGs) and collected in all types of residential dwellings.
- The samples with completely filled data set would only be considered.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Samples: A total cleaned sample set shall comprise of **3500 cleaned** and completely filled samples.

ROAD NETWORK INVENTORY WITH LUX READING

Objective: Road network inventory aims at updating the network database with the existing features of roadway sections covering all arterial, sub arterial and other important local/connecting links in the study area.

Conduct of the Survey:

- The survey will be conducted on the major road sections identified within the study area.
- A full-scale inventory survey to be undertaken to create a road network database.
- **Manual carriage way section wise details were carried out on a typical working day.**
- Data pertaining to ROW, CW, Median, footpath, bicycle tracks, drainage, parking, shoulder, MUZs widths along with the quality and the condition of the surfacing will be captured.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Road Stretches: Road length of approx. **one hundred and fifty (150) km** to be surveyed.

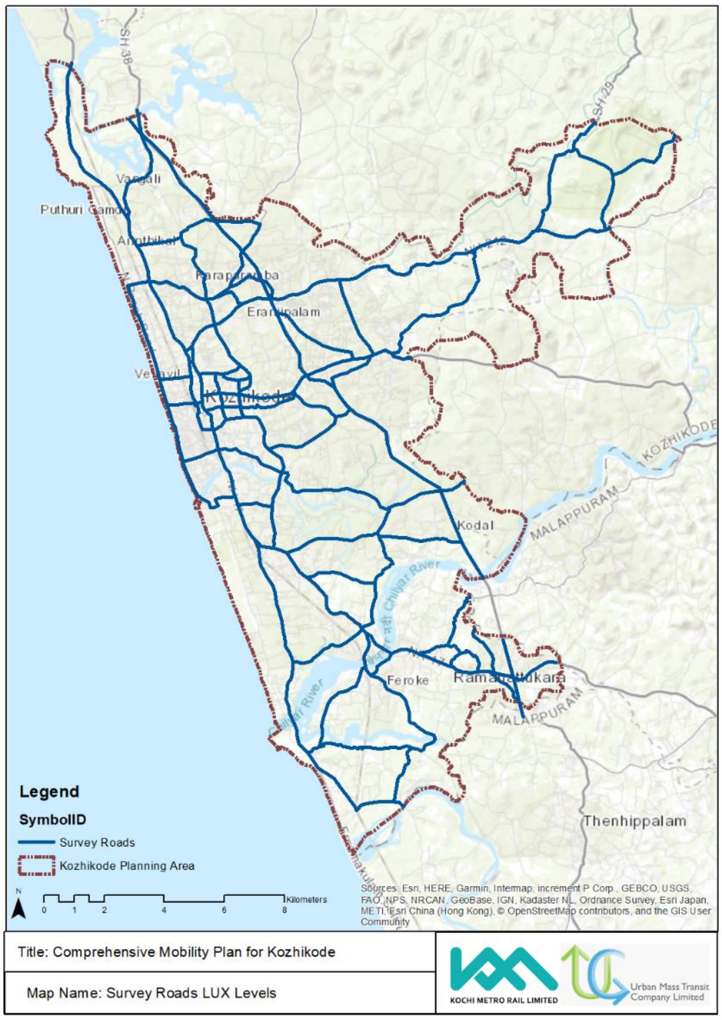

Figure 0-15 Road Network for Lux levels

VEHICLE SURVEY AT PETROL PUMPS

Objective: Road network inventory aims at updating the network database with the existing features of roadway sections covering all arterial, sub arterial and other important local/connecting links in the study area.

Conduct of the Survey:

- The survey will be conducted at petrol pumps identified within the study area, capturing the details such as **type of fuel, make, model, year of manufacture, mileage, etc.**
- **The survey will be carried out through manual interviews.**
- The samples should represent an equal representation of all vehicle types includes passenger and good vehicles.
- The samples with completely filled data set would only be considered.

- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey shall be conducted at 10 petrol pumps identified in the study area.

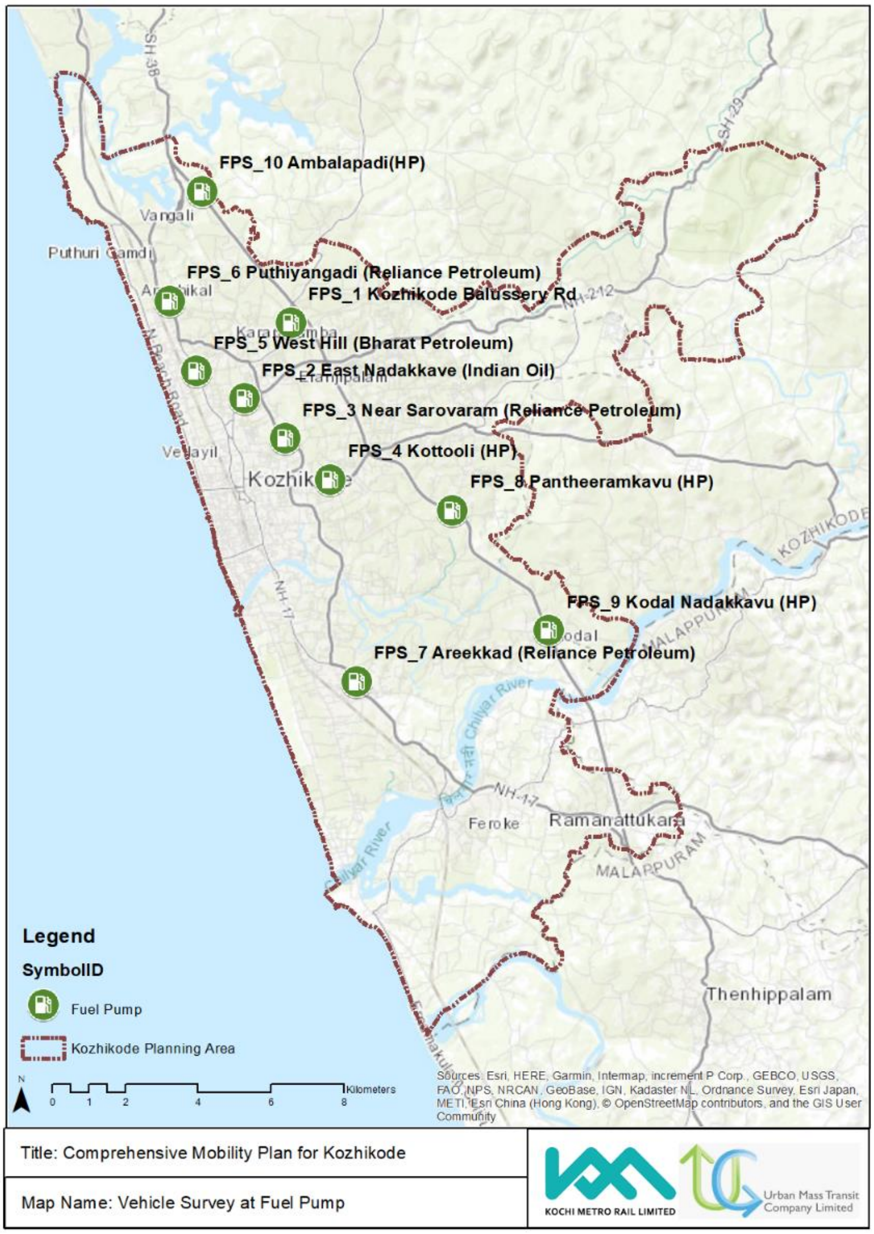

Figure 0-16 Location of Petrol Pump for Vehicle Survey

Table 0-17 Locations for Fuel Pump Survey

Code	Location Name
FPS_1	Kozhikode Balusserri Rd
FPS_2	East Nadakkavu (Indian Oil)

Code	Location Name
FPS_3	Near Sarovaram (Reliance Petroleum)
FPS_4	Kottooli (HP)
FPS_5	West Hill (Bharat Petroleum)
FPS_6	Puthiyangadi (Reliance Petroleum)
FPS_7	Areekkad (Reliance Petroleum)
FPS_8	Pantheeramkavu (HP)
FPS_9	Kodal Nadakkavu (HP)
FPS_10	Ambalapadi (HP)

Samples: The survey should be done collecting at least **200 clean samples.**

ESTABLISHMENT AND WORKPLACE SURVEYS

Objective: The survey aims to capture and evaluate the travel patterns to workplaces and also to capture the floating populations trips in the city.

Conduct of the Survey:

- The workplace survey will be conducted to collect data regarding the travel costs (whole and distributed costs), trips characteristics and related socio-economic data.
- This survey should capture the journey to work, travel arrangements in the study area, modes used for work trips and the associated costs, the average distance travelled for work in the study area.
- The samples with completely filled data set would only be considered.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted at workplaces and major activity centres in the city, through interviews at the identified 20 locations

Table 0-18 Locations for Work Place Survey

Code	Location Name
WPS_1	IIM Kozhikode
WPS_2	Calicut International Airport
WPS_3	Calicut University
WPS_4	Cyberpark Calicut
WPS_5	Kinfra Techno Industrial Park
WPS_6	Island Tourism Kadalundi
WPS_7	Feroke College
WPS_8	NIT Calicut
WPS_9	IPIX Technologies
WPS_10	Fathima Hospital

Code	Location Name
WPS_11	Aster MIMS Hospital
WPS_12	Government General Hospital
WPS_13	Kozhikode District Co-Operative Hospital Ltd
WPS_14	Regional Town Planning Office
WPS_15	Administrative Building
WPS_16	Govt. Arts & Science College Calicut
WPS_17	Malabar Christian College
WPS_18	St Xavier's Arts and Science College
WPS_19	Palayam
WPS_20	West Hill

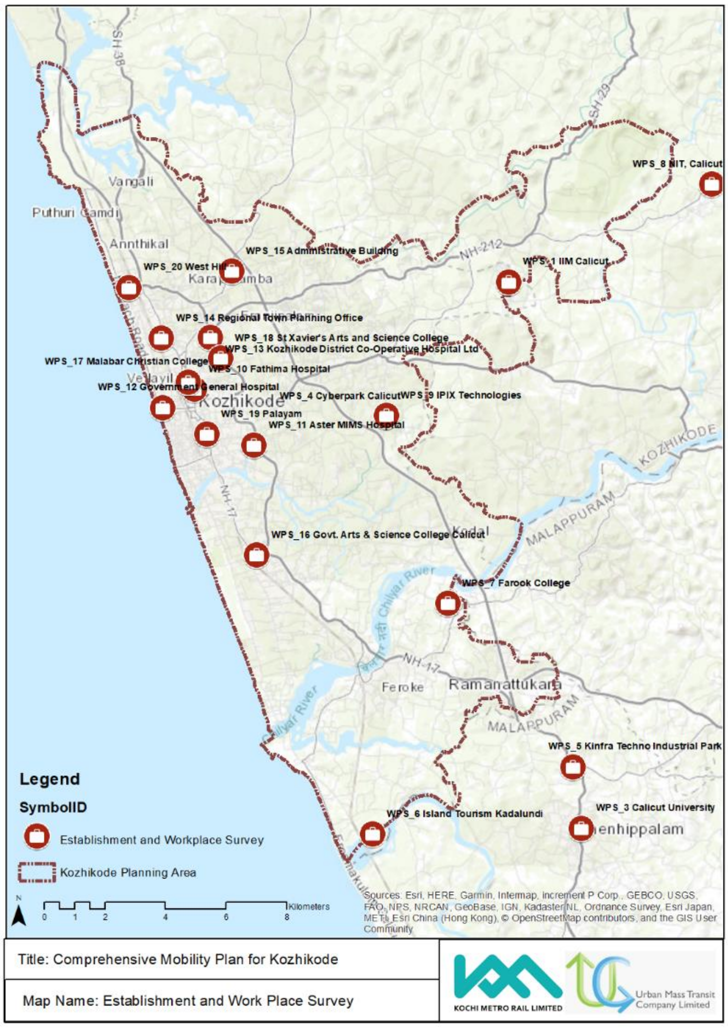

Figure 0-17 Establishment and Workplace Survey Location

Samples: About **200 cleaned samples** shall be collected.

GOODS OPERATOR SURVEYS

Objective: The survey aims to evaluate the travel patterns of goods vehicles in the study area.

Conduct of the Survey:

- The surveys will be conducted at major good focal points through **manual interviews capturing the goods vehicle trip characteristics.**
- The samples with completely filled data set would only be considered.
- The data will be collected and complied and submitted as per the templates provided by UMTC.

Locations: The survey will be conducted in the following 10 locations.

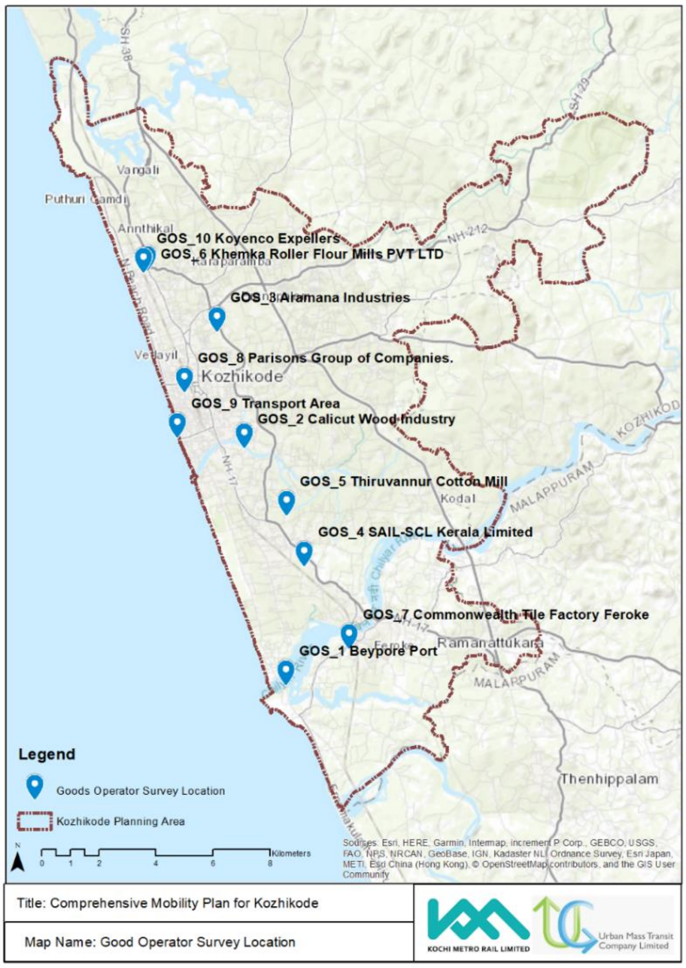

Figure 0-18 Goods Operator Survey Location

Table 0-19 Locations for Goods Survey

Code	Location Name
GOS_1	Beypore Port

GOS_2	Calicut Wood Industry
GOS_3	Aramana Industries
GOS_4	SAIL-SCL Kerala Limited
GOS_5	Khemka Roller Flour Mills PVT LTD
GOS_6	Commonwealth Factory Feroke
GOS_7	Parisons Group of Companies.
GOS_8	Transport Area
GOS_9	Koyenco Expellers
GOS_10	Fisheries Station Beypore
GOS_11	Puthiyappa Fishing Harbour
GOS_12	Food Corporation of India
GOS_13	Kallayi Railway Goods

Samples: About **150 cleaned samples** shall be collected.

BLACK SPOTS KOZHIKODE CITY

Table 0-20 Black Spots Identified in Kozhikode City

Black Spots identified in Kozhikode City for the period from 01.01.2022 to 31.10.2022							
Police Stations	**Number of Cases**				**Number of Persons**		
	Fatal	**Grievous**	**Minor**	**Non-Injury**	**Died**	**Grievous Injury**	**Minor Injury**
Chevayur	**11**	**57**	**14**	**2**	**11**	**61**	**39**
Elathur	**14**	**56**	**9**	**6**	**14**	**64**	**32**
Feroke	**4**	**26**	**7**	**5**	**5**	**30**	**11**
Kasaba Kozhikode	**2**	**14**	**7**	**3**	**2**	**15**	**8**
Kunnamangalam	**8**	**39**	**12**	**2**	**8**	**41**	**17**
Mavoor	**1**	**4**	**3**	**3**	**1**	**5**	**3**
Med. College	**13**	**98**	**15**	**8**	**13**	**101**	**45**
Nadakkavu	**1**	**22**	**6**	**2**	**1**	**22**	**9**
Nallalam	**1**	**20**	**8**	**1**	**1**	**21**	**10**
Panniyankara	**3**	**25**	**9**	**4**	**3**	**25**	**20**
Pantheerankavu PS	**1**	**30**	**5**	**5**	**1**	**30**	**10**
Town Kozhikode	**1**	**4**	**1**	**1**	**1**	**4**	**1**
Vellayil	**0**	**2**	**1**	**0**	**0**	**4**	**1**

Grand Total	**60**	**397**	**97**	**42**	**61**	**423**	**206**

SERVICE LEVEL BENCHMARKING

COMPUTATION OF INDICES

In Service Level Benchmark, four levels of Service (LoS) have typically been specified. They are LOS1, LOS2, LOS3 and LOS4. The LOS1 represents the highest performance level whereas LOS4 represents the Lowest. This section describes the computation process for all the indicators.

PUBLIC TRANSPORT FACILITIES

This benchmark indicates the city-wide level of services provided by public transport systems during peak hours in Thiruvananthapuram. The overall level of service for this benchmark is based on the following indicators:

i. Presence of Organized Public Transport System in Urban Area
ii. Availability of Public Transport
iii. Service Coverage of Public Transport in the City
iv. Average Waiting Time for Public Transport Users
v. Level of Comfort in Public Transport
vi. Percentage of Fleet as per Urban Bus Specifications

PRESENCE OF ORGANIZED PUBLIC TRANSPORT SYSTEM IN URBAN AREA

Computation of presence of organized public transport system in urban area is shown below.

Presence of Organized Public Transport

S. No.	Computation	Unit	Description	Data Source	Value
a.	Total buses	No.	Buses operating on road.	KSRTC +Private (2022)	365
b.	The total number of buses under the ownership of STU/SPV or under concession agreement	No.	Organized public transport – run by a company or SPV formulated specifically for the operation or public transport within the city or under concession agreement.	KSRTC +Private (2022)	365
c.	Presence of Public Transport System in Urban Area	%	Calculate= [b / a]*100		100
LOS					1
LOS1: >= 60, LOS2: 40 to 60, LOS3: 20 to 40, LOS4: Below 20					

Based on the above, the corresponding LoS for the indicator 'Presence of Organized Public Transport System in Urban Area' is 1, indicating the presence of public transportation in the Kozhikode Region.

EXTENT OF SUPPLY / AVAILABILITY OF PUBLIC TRANSPORT SYSTEM

The computation of the extent of supply/availability of public transport system is shown below.

Availability of Public Transport

S. No.	Computation	Unit	Description	Data Source	Value
a.	No of Buses/ train coaches available in a city on any day.	No.	Number of public transport vehicles operating in the city, which may be lower than the number of vehicles owned by the utility or that authorized to ply. Daily average values over a time period of a month may be considered. (1 train coach is equivalent to 3 buses).	KSRTC +Private (2022)	365
b.	Total Population of the city (lakhs)	No.	Current population should be considered. Past census figures should be used as base, and annual growth rate should then be used to arrive at current population.	Estimated Population UMTC 2022	10.5
c.	PT Availability /1000 population	Ratio	Calculate= [a / b]		0.35
LOS					3
LOS1: >= 0.6, LOS2: 0.4 to 0.6, LOS3: 0.2 to 0.4, LOS4: Below 0.2					

Based on the above, the corresponding LoS for the indicator 'Extent of Supply/Availability of Public Transport System' is 3. Thus, indicating deficiency in supply of organized city based public transport.

SERVICE COVERAGE OF PUBLIC TRANSPORT IN THE CITY

The computation of the Service Coverage of Public Transport in the study area, shows the public transport network in the city.

Service Coverage of Public Transport

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total length in road of the corridors on which public transport systems ply in the city.	Road Kms.	Total length of the public transport corridor within the urban limits should be considered. Corridors along which the service frequency is one hour or less should only be considered. Public transport systems may be road or rail or water based, and include public or private transport service provider	KSRTC +Private (2022)	120
b.	Area of the urban limits of the city	Area in sq. Kms.	Area of the urban limits should be considered. This may correspond to the urban limits demarcated by the development authority / metropolitan area, or any other such urban planning agency which need to be covered by public	KSRTC +Private (2022)	210

			transport. This need not be restricted to municipal boundaries		
c.	Service Cover	Ratio	Calculate= [a / b]		0.57
LOS					3.0
LOS1: >= 1, LOS2: 0.7 to 1, LOS3: 0.3 to 0.7, LOS4: Below 0.3					

Based on the above table, the corresponding LoS is 3 for Kozhikode area. Thus, indicating the need to improve service coverage of public transport in the study area.

AVERAGE WAITING TIME FOR PUBLIC TRANSPORT USERS:

The computation of the Average Waiting Time of Public Transport users in the study area is given below..

Average Waiting Time of Public Transport Users

S. No	Calculation	Unit	Data Source	Value
a.	Average Waiting time for Public Bus	Min	Primary Surveys at Bus Stops and Households- 2022	8.1
LOS				**3**
LOS1: <= 4, LOS2: 4 to 6, LOS3: 6 to 10, LOS4: Above 10				

Based on the above table, the corresponding LoS is 3 for Kozhikode area. Thus, indicating the need to improve the headway of public transport in the study area.

LEVEL OF COMFORT IN PUBLIC TRANSPORT

The computation of the level of comfort in Public Transport users in the study area is given below..

Level of Comfort In Public Transport Users

S. No	Calculation	Unit	Description	Data Source	Value

A.	Passenger Count on Bus at Key Identified Routes	No.	Passenger count survey should be carried out on bus of each identified route in both directions.	Primary Surveys-2022	28
B.	Seats Available in The Bus		Count the number of seats available in a bus of each type on each identified route.	Primary Surveys-2022	42
C.	Passenger Comfort- Load Factor (Passengers Per Seat)		Calculate= [A / B]		0.6
LOS					**1.0**
Los1: <= 1.5, Los2: 1.5 To 2, Los3: 2 To 2.5, Los4: Above 2.5					

Based on above table, the corresponding LoS is 1. Thus, indicating contented level of comfort in public transport in the study area.

PERCENTAGE OF FLEET AS PER URBAN BUS SPECIFICATIONS

The computation of the Percentage of Fleet as per Urban Bus Specifications is shown below.

Percentage of Fleet as Per Urban Bus Specifications

S. No.	Calculation	Unit	Description	Data Source	Value
a.	Total number of buses in the city	No.	Total fleet	KSRTC +Private (2022)	365
b.	Total number of buses as per urban bus specifications in the city	No.	Fleet as per UBS	KSRTC +Private (2022)	207
c.	% of Fleet as per Urban Bus Specifications	%	Calculate= [b / a] * 100		56
LOS					2.0
LOS1: >= 75, LOS2: 50 to 75, LOS3: 25 to 50, LOS4: Below 25					

Based on above table, the corresponding LoS for this indicator is 2 for Kozhikode area. Thus, indicating deficiency in supply of fleet as per Urban Bus Specifications.

LEVEL OF SERVICE FOR PUBLIC TRANSPORT FACILITIES

Level of Service for Public Transport Facilities for Thiruvananthapuram Area

LOS	Presence of Organized Public Transport System in Urban Area (%)	Extent of Supply/ Availability of Public Transport	Service Coverage of Public Transport in The City	Avg. Waiting Time for Public Transport Users	Level Of Comfort in Public Transport	% of Fleet as per Urban Bus Specification
1	>= 60	>= 0.6	>= 1	<= 4	<= 1.5	75 – 100
2	40-60	0.4-0.6	0.7- 1	4—6	1.5 - 2	50 – 75
3	20-40	0.2-0.4	0.3 - 0.7	6—10	2 - 2.5	25 – 50
4	<20	<0.2	< 0.3	> 10	> 2.5	< 25
Indicator LoS	**1**	**3**	**3**	**3**	**1**	**2**
LOS VALUE:12 (LOS -2)						
OVERALL: LOS1 <12, LOS2: 12-16, LOS3:17-20, LOS4 21-24						

Based on above table, the overall score of the benchmark for Thiruvananthapuram region computes to 12 with LOS for the parameter “Public Transport Facilities” being 2. Thus, indicating a reasonably good city bus services which can be further improved.

PEDESTRIAN INFRASTRUCTURE FACILITIES

This benchmark indicates the percentage of road length along arterial and major road network, Public Transport corridors, and intersections, having adequate pedestrian facilities. The overall level of service for this benchmark is based on the following indicators:

1. Signalized Intersection Delay
2. Street Lighting (LUX)
3. Percentage of City Covered

SIGNALIZED INTERSECTION DELAY

The computation of the Signalized Intersection Delay is shown below.

Signalized Intersection Delay

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total number of signalized intersections having average waiting time more than 45 seconds for pedestrians	No.	Calculate the average total waiting time of passengers of all arms of signalized intersection and divide by 2 to get average waiting time. If there is any foot over/under bridge at any arm, then waiting time for that particular arm is zero	Primary Survey 2022 (RNI)	0

b.	Total number of signalized intersections	No.	Identify the total number of signalized intersections surveyed in a city	Primary Survey 2022 (RNI)	25
c.	Signalized intersections Delay (%)	%	Calculate= [a / b] * 100		0
LOS					1
LOS1: >= 75, LOS2: 50 to 75, LOS3: 25 to 50, LOS4: Below 25					

The existing traffic signals queue length is considerably low; this retains the LoS value for the indicator ‘Signalized Intersection Delay’ at 1.

STREET LIGHTING

The computation of the service level for street lighting is shown below.

Street Lighting

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total length of roads	km	Length of major Network in the study area i.e., arterial / sub-arterial roads or public transit corridors	Primary Survey 2022 (RNI)	120
b.	Lux Level	%.	Cumulative frequency of LUX levels	Primary Survey 2022	36
c.	Street Lighting		Value		9
LOS					1
LOS1: >= 8, LOS2: 6-8, LOS3: 4-6, LOS4: Below 4					

The calculation of the Street lighting is based on lux data collected by undertaking primary surveys. The LoS value for the indicator ‘Street lighting’ is 1 for Kozhikode. This indicates that Thiruvananthapuram area requires adequate visibility along the footpaths. Though some locations had streetlights, but with low intensities.

PERCENTAGE OF CITY COVERED

The computation of the percentage of city covered by footpaths is shown below.

Percentage of City Covered by Footpaths

S. No.	Computation	Unit	Description	Source	Value
a.	Total length of road network	Km	Calculate the total length of road network	Primary Survey 2022 (RNI)	300

b.	Total length of footpath of a city	Km	Total length of footpath of a city (footpath width >= 1.8m)	Primary Survey 2022 (RNI)	70
c.	Percentage of City Covered by Footpaths	%	Calculate= [b / a] * 100		0.23
LOS					**4**
LOS1: >= 75, LOS2: 50 to 75, LOS3: 25 to 50, LOS4: Below 25					

The LoS value for the indicator 'Percentage of City Covered' is 4 for Kozhikode area. Though the city has footpaths along the arterial roads, it lacks a clear walking space of 1.8m. Thus, indicating the need for immediate attention for improving construct continuous and usable footpaths across the city.

LEVEL OF SERVICE FOR PEDESTRIAN INFRASTRUCTURE FACILITIES

Based on table below, the overall score of the benchmark for Kozhikode region for pedestrian infrastructure facilities computes to 6 with a level of service of 2. Thus, indicating that the city lacks adequate Pedestrian facilities and requires major improvements/investments in this category.

Pedestrian Infrastructure Facilities

Level of Service (Los)	Signalized Intersection Delay (%)	Street Lighting (Lux)	% of City Covered
1	<25	> = 8	> = 75
2	25 – 50	6-8	50 - 75
3	50 – 75	4-6	25 - 50
4	> = 75	< 4	<25
Indicator LoS	1	1	4
OVERALL - LOS1: 3-5, LOS2: 6-8, LOS3: 9-10, LOS4 11-12			

NON-MOTORISED TRANSPORT (NMT) FACILITIES

This benchmark indicates the percentage of dedicated cycle track/lane along the arterial and major road network, and public transport corridors in Thiruvananthapuram region, with a minimum of 2.5 m width. It is characterized by continuous length, encroachment on NMT lanes, and parking facilities.

The overall level of service for this benchmark is based on the level of service for the following indicators:

1. Percentage of Network Covered

2. Encroachment on NMT roads by Vehicle Parking
3. NMT Parking facilities at interchanges

PERCENTAGE OF NETWORK COVERED

The calculation of the percentage of network covered by NMT Facilities is shown below.

Percentage of Network Covered by NMT Facilities

S. No.	Calculation	Unit	Description	Value
a.	Total length of road network	Km	Primary Survey 2022 (RNI)	300
b.	Total length of NMT network (minimum of 2.5 m width)	Km	Primary Survey 2022 (RNI)	0
c.	Percentage of network covered	%	Calculate= [b / a] * 100	0
LOS1: >= 50, LOS2: 25 to 50, LOS3: 15 to 25, LOS4: Below 15				

Based on above table, percentage of city covered by NMT network is 0% with a LOS of 4. Thus, indicating the absence of Non-Motorized Vehicles (NMV) network in the city.

ENCROACHMENT ON NMT ROADS BY VEHICLE PARKING

As Kozhikode has no NMT network, this indicator is not applicable. Thus, accounting to a LoS value of 4.

NON-MOTORISED TRANSPORT (NMT) PARKING FACILITIES AT INTERCHANGE

The computation of the NMT parking facilities at interchange is shown below. The corresponding LoS value is 2 for Kozhikode region, indicating significant number of interchanges have NMT parking within 250 m around them.

NMT Parking Facilities at Interchange

S. No.	Calculation	Unit	Description	Data Source	Value
a.	Total number of interchanges (major Bus, Terminals and Railway stations)	No	-	Primary Survey 2022 (RNI)	10
b.	Total number of interchanges having Bicycle parking (within 250m radius)	No	-	Primary Survey 2022 (RNI)	7
c.	NMT parking facility at interchanges	%	Calculate= [b / a] * 100		70
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

LEVEL OF SERVICE FOR NON-MOTORIZED TRANSPORT (NMT) FACILITIES

Based on the below table, the overall score of the Benchmark for computes to 10, with a LOS of 3. Thus, indicating poor performance in the provision of Non-Motorized Transport facilities.

Non-Motorized Transport Facilities

LOS	% of Network Covered	Encroachment on NMT Roads by Vehicle Parking (%)	NMT Parking Facilities at Interchanges (%)
1	> = 50	< = 10	> = 75
2	50 – 25	10 – 20	50 - 75
3	25 – 15	20 – 30	25 - 50
4	< 15	> 30	<25
Indicator LoS	**4**	**4**	**2**
OVERALL - LOS1: 3-5, LOS2: 6-8, LOS3: 9-10, LOS4 11-12			

LEVEL OF USAGE OF ITS FACILITIES

This benchmark indicates the efforts to add information technology to transport infrastructure and vehicles in an effort to manage factors that are typically at odds with each other. The overall level of service for this benchmark is based on the following indicators:

1. Availability of Traffic Surveillance
2. Passenger Information System (PIS)
3. GPS/GPRS Systems
4. Signal Synchronization
5. Integrated Ticketing System

AVAILABILITY OF TRAFFIC SURVEILLANCE

The calculation of the availability of traffic surveillance is shown below.

Availability of Traffic Surveillance

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total number of Bus stations on BRTS, Terminals, Metro Stations and Signalized Intersections having CCTVs	No	-	Traffic Police Department	6
b.	Total number of Bus stations on BRTS, Terminals, Metro Stations and Signalized Intersections	No	-	Primary Survey 2022	56
c.	Availability of Traffic Surveillance – CCTV	%	Calculate= [b /a] * 100		**9**
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

The LoS value for indicator ‘Availability of Traffic Surveillance’ is 4.

PASSENGER INFORMATION SYSTEM (PIS)

The calculation of the Availability of Passenger Information System (PIS) is show in table below. The LoS accounts to 4 indicating the need to improve PIS at terminals. But still has a scope to improve the services especially at the bus terminals Thus, a significant investment is required in this sector.

Passenger Information System

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total number of Terminals, Metro Stations having PIS	No	-	Primary Survey 2022	0
b.	Total number of Terminals, Metro Stations	No	-	Primary Survey 2022	56
c.	Passenger Information System (PIS) for Public Transport	%	Calculate= [b /a] * 100		0
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

GLOBAL POSITIONING SYSTEM (GPS/GPRS)

The calculation of Global Positioning System (GPS/GPRS) is shown below.

Global Positioning System

S. No	Calculation	Unit	Description	Data Source	Value
a.	Public transport vehicles and IPT with functional onboard GPS/ GPRS, connected to common control center	No.	Calculate total No. of Public Transport Vehicles and IPT with onboard GPS/GPRS which are connected to common control center	KSRTC, RTO Primary Survey 2022	0
b.	Total public transport vehicles and IPT	No.	Calculate total no. of Public Transport Vehicles and IPT	KSRTC, RTO Primary Survey 2022	365
c.	Global Positioning System / GPRS	%	Calculate= [a / b] * 100		0
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

The, corresponding LoS value for the indicator ‘Global Positioning System (GPS/GPRS)’ is 4.

SIGNAL SYNCHRONIZATION

To improve the traffic flow along the road networks, the signals along the corridor are inter connected. The phasing of the signal at any specific intersection are in tune with the phasing of the intersection before and after it to provide a continuous green phase for the traffic stream. It helps in reducing congestion and stopping time at each intersection. The computation of benchmarking for signal synchronization as shown below.

Signal Synchronization

S. No	Calculation	Unit	Description	Data Source	Value
a.	No. of signals which are synchronized	No.	Calculate total No. of signalized signals which are synchronized in	Traffic Police Department and Primary Surveys	0
b.	Total no. of signalized intersections	No.	Calculate Total no. of signalized intersections in the city	Traffic Police Department and Primary Surveys	25
c.	Signal Synchronization	%	Calculate= [a / b] * 100		0
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

The LOS for signal synchronization parameter computes to 4.

INTEGRATED TICKETING SYSTEM

The calculation of Integrated Ticketing System is shown below.

Integrated Ticketing System

S. No.	Calculation	Unit	Description	Data Source	Value
a.	Total number of modes and operators in the city (buses, IPT, metro etc) which have integrated ticketing system	No.	Calculate number of public transport modes and operators for each route in the city which are integrated	KSRTC, RTO Primary Survey 2022	0
b.	Total Number of modes and operators in the city (Buses, IPT, Metro etc)	No.	Calculate the total number of public transport modes and operators for each route in the city	KSRTC, RTO Primary Survey 2022	2
c.	Integrated Ticketing System	%	Calculate= [a / b] * 100		0
LOS1: >= 75, LOS2: 75 to 50, LOS3: 25 to 50, LOS4: Below 25					

In absence of city based public transport system none of the modes have an integrated ticketing system. Hence there is no change in LoS value for indicator ‘Integrated Ticketing System’ which is 4.

LEVEL OF SERVICE FOR ITS FACILITIES

Based on the table below, the overall score of this Benchmark computes to 15, with a LOS of 3. This throws light on the need for drastic improvements in terms of synchronized signals, PIS facilities at all bus stops in the city.

ITS Facilities

LOS	Availability of Traffic Surveillance (%)	Passenger Information System (PIS) (%)	Global Positioning System / GPRS (%)	Signal Synchronization (%)	Integrated Ticketing System (%)
1	>=75	>=75	>=75	>=75	>=75
2	50 - 75	50 – 75	50 – 75	50 - 75	50 - 75
3	25 - 50	25 – 50	25 – 50	25 - 50	25 - 50
4	< 25	< 25	< 25	< 25	< 25
Indicator LoS	**4**	**4**	**4**	**4**	**4**
OVERALL - LOS1: 5-7, LOS2: 8-10, LOS3: 11-15, LOS4 16-20					

TRAVEL SPEEDS

This benchmark provides an indication of effective travel time or speed of public or private vehicles by considering indications of congestion or traffic density. The overall level of service for this benchmark is based on the following indicators:

1. Travel speed of personal vehicles along key corridors
2. Travel speed of public Transport along key corridors

TRAVEL SPEED OF PERSONAL VEHICLES ALONG KEY CORRIDORS

The computation of Travel Speed of Personal Vehicles along Key Corridors is based on Speed and Delay Survey data. The surveys involved identification of the key corridors using motorized transport in the city. On these average speeds during peak hours on working days were calculated. The LoS's ranges are shown below.

LOS Range for Average Travel Speeds of Personal Vehicles

LOS	Average Travel Speed of Personal Vehicles (Kmph)
1	> =30
2	25 – 30
3	15 – 25
4	< 15

The observed average travel speed for personal vehicles indicates an LOS value of 3.

TRAVEL SPEED OF PUBLIC TRANSPORT ALONG KEY CORRIDORS

The calculation of travel speed of public transport along key corridors is based on Speed and Delay Survey data. Based on the LoS's below, the LoS was determined to be 2 for public transport system in the Kozhikode area.

LOS Range for Average Travel Speeds of Public Transport

LOS	Average Travel Speed of Public Transport (Kmph)
1	> =20
2	15 – 20
3	10 – 15
4	< 10

This indicates that public transport modes in Kozhikode area face high congestion along the network and will require traffic management plans to improve travel times.

LEVEL OF SERVICE FOR TRAVEL SPEEDS

The LOS for Travel speeds in the city computes to 3 with a score of 5.

Travel Speed

LOS	Average Travel Speed of Personal Vehicles (Kmph)	Average Travel Speed of Public Transport (Kmph)
1	> =30	> =20
2	25 – 30	15 – 20
3	15 – 25	10 – 15
4	< 15	< 10
Indicator LOS	**3**	**2**
OVERALL - LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4 7-8		

AVAILABILITY OF PARKING SPACES

This benchmark indicates the restrictions on free parking spaces for all vehicles in Kozhikode region. The overall level of service for this benchmark is based on the level of service for the following indicators:

1. Availability of On-Street Paid Public Parking Spaces
2. Ratio of Maximum and Minimum parking fee in the city

AVAILABILITY OF ON-STREET PAID PUBLIC PARKING SPACES

The computation of the availability of on-street paid parking spaces is shown below.

Availability of On-Street Paid Parking

S. No	Computation	Unit	Description	Data Source	Value
a.	Total available on-street paid parking spaces in ECS allotted for all vehicles	ECS	-	Primary Survey, 2022	374
b.	Total available on-street parking spaces in ECS allotted for all vehicles	ECS	-	Primary Survey, 2022	2601

c.	Availability of paid parking spaces	%	Calculate= [a /b] * 100		14
LOS1: >= 75, LOS2: 75 to 51, LOS3: 26 to 50, LOS4: Below 25					

The LoS for the indicator 'Availability of On-Street Paid Public Parking Spaces' is 4.

RATIO OF MAXIMUM AND MINIMUM PARKING FEE IN THE CITY

It is the ratio of maximum parking fee being charged per 2 hours for public parking, to the minimum parking fee being charged per 2 hours for public parking at a location in the city. This indicator is based on on-street parking survey data and off-street parking operations data from the operators or the local authority.

The calculation of the ratio of maximum and minimum paid parking is shown below.

Ratio of Maximum and Minimum Parking Fee

S.NO	CALCULATION	UNIT	DESCRIPTION	VALUE
a.	Maximum parking fee being charged per 2 hours in the city for public parking	INR	Primary Surveys, 2022	20
b.	Minimum parking fee being charged per 2 hours in the city for public parking	INR	Primary Surveys, 2022	5
c.	Availability of paid parking spaces		Calculate= [a /b]	4
LOS1: >4, LOS2: 3-4, LOS3: 1-2, LOS4: 1				

As there is much variation in the minimum and maximum parking charges in the city, the ratio of the same is 4 with a LOS level of 2.

LEVEL OF SERVICE FOR AVAILABILITY OF PARKING SPACES

Based on the above indicators, the overall score of the Benchmark for computes to 6, with a LOS level of 3. The excessive availability of free on-street parking needs to be controlled by the authorities to regulate heavy vehicular traffic. The on-street parking facilities shall need to be charged, and the same may be used to provide for improved NMT infrastructure in the city.

Availability of Parking Spaces

LOS	Availability of on Street Paid Public Parking Spaces (%)	Ratio of Maximum and Minimum Parking Fee in the City
1	> =75	> 4
2	50 – 75	2 – 4
3	25 – 50	1 – 2

4	< 25	1
Indicator LoS	**4**	**2**
OVERALL LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4: 7-8		

ROAD SAFETY

This benchmark monitors the extent to which road users, and especially vulnerable road users, are impacted within the overall set of road users. The overall level of service for this benchmark is based on the following indicators:

1. Fatality rate for lakh population
2. Fatality rate for pedestrian and NMT

FATALITY RATE PER LAKH POPULATION

The calculation of fatality rate per lakh population is shown below.

Fatality Rate Per Lakh Population

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total number of fatalities recorded in road accidents within city limits in the given calendar year	No.	Record of fatalities from police records. Data should be considered pertaining to the urban limits or jurisdiction of police department for the urban areas within that district.	DCRB	198
b.	Population of the urban agglomeration in that year	No.	Population of the urban agglomeration as per the latest census should be projected to arrive at current population, considering the projected growth rate.	Estimated Population-2022, UMTC	1044110
c.	Fatality rate per 1,00,000 population	Ratio	Calculate= [(a*100000) / b].		18
LOS1: <=2, LOS2: 2-4, LOS3: 4-6, LOS4: Greater than 6					

There has been a drastic increase in the number of fatalities per lakh population. Based on the above, the corresponding LoS value for the indicator ‘Fatality Rate per Lakh Population’ is 4 for

Kozhikode area. This indicates poor safety in the Kozhikode area and actions are required to improve the same.

FATALITY RATE OF PEDESTRIAN AND NON-MOTORISED TRANSPORT

The calculation of fatality rate of pedestrian and NMT is shown below.

Fatality Rate of Pedestrian and NMT Users

S. No	Calculation	Unit	Description	Data Source	Value
a.	Total number of fatalities recorded of persons who were pedestrians or on non-motorized transport vehicles, in road accidents within city limits in given year	No.	From the records from police, the number of persons of above, who were pedestrians or on non-motorized vehicles (such as bicycles, cycle-carts / cycle rickshaws, etc.)	DCRB	12
b.	Total number of fatalities recorded in road accidents within city limits in the given calendar year	No.	Record of fatalities from police records. Data was pertaining to the urban limits or jurisdiction of police department for the urban areas within that district	DCRB	198
c.	Fatality rate for pedestrian and NMT	%	Calculate = [(a / b)*100].		6
LOS1: >=20, LOS2: 20-40, LOS3: 40-60, LOS4: Greater than 60					

LEVEL OF SERVICE FOR ROAD SAFETY

Based on the above indicators, the overall score of the benchmark for Kozhikode Region computes to 5. The overall LoS for the parameter "Road Safety" is 3. NMT and pedestrians are hence observed to be unsafe on the streets of Kozhikode area.

LOS	Fatality Rate per Lakh Population	Fatality Rate for Pedestrian and NMT (%)
1	< =2 persons	< =20
2	2 -4 persons	20 -40
3	4 - 6 persons	40 - 60
4	> 6 persons	> 60
Indicator LoS	**4**	**1**
OVERALL LOS1: 2, LOS2: 3-4, LOS3: 5-6, LOS4: 7-8		

POLLUTION LEVELS

This benchmark indicates the level of air pollutants in the city i.e., average level of pollution. The overall level of service for this benchmark is based on the level of service for the following indicators:

1. Annual Mean Concentration Range of Sulphur Dioxide (SO2)
2. Annual Mean Concentration Range of Oxides of Nitrogen (NOX)
3. Annual Mean Concentration Range of Suspended Particulate Matter (SPM)
4. Annual Mean Concentration Range of RSPM

The data collected for pollution levels is as shown below.

Pollution Levels

LOS	Description	Data Source	Value
1	Annual Mean Concentration of SO2	Pollution Control Board (PCB) zonal office	7
2	Annual Mean Concentration Range of Oxides of Nitrogen		18
3	Annual Mean Concentration of SPM		59
4	Annual Mean Concentration of RSPM		45

LEVEL OF SERVICE FOR POLLUTION LEVELS

Based on the above indicators, the overall score of the Benchmark computes to 5 with a LOS of 1. This indicates the city dneed considerable improvements in emission standards, and should adopt and encourage public transport use to keep pollution in check.

LOS Range for Pollution Levels

LOS	Annual Mean Concentration of Sulphur Dioxide (SO_2)	Annual Mean Concentration Range of Oxides of Nitrogen (NO_2)	Annual Mean Concentration of Suspended Particulate Matter (SPM)	Annual Mean Concentration of RSPM (Size less than 10 microns)
1	0 – 30	0 – 30	0 – 70	0 - 40
2	30 – 60	30 – 60	70 – 140	40 – 80
3	60 – 90	60 – 90	140 – 210	80 – 120
4	> 90	> 90	> 210	> 210
Indicator LoS	**1**	**1**	**1**	**2**
OVERALL LOS1: <=5, LOS2: 6-9, LOS3: 10-13, LOS4: 14-16				

INTEGRATED LAND USE TRANSPORT SYSTEM

This benchmark indicates the effectiveness of land use and transport arrangements and identifies the level of integrated land use transport system expected to result in overall trip reduction and mode shift in favour of public transit. The overall level of service for this benchmark is based on the level of service for the following indicators:

1. Population Density (Gross)
2. Mixed Land Use on Major Transit Corridors / Network
3. Intensity of Development – City Wide
4. Intensity of Development along Transit Corridor
5. Clear Pattern and completeness of the Network
6. Percentage of Area under Roads

POPULATION DENSITY

The calculation of Population Density is shown below.

Population Density

S. No	Calculation	Unit	Description	Data Source	Value
a.	Master Plan, or from remote sensing/satellite image or from Google compute developed area.	Ha.	Total developed area	LSGD, 2022	14700
b.	Population of current year or the year for which data is available.	No.		UMTC Estimates, 2022	1044110
c.	Population density	Ratio	Population density= [b / a]		71
LOS1: >=175, LOS2: 150-175, LOS3: 125-150, LOS4: <125					

The LoS value for the indicator 'Population Density' is 4 in Kozhikode.

MIXED LAND USE ZONING

The percentage of mixed land use along the major corridors was calculated as less than 5% for Kozhikode region. The corresponding LoS value for the indicator 'Mixed Land Use Zoning' is 4 for Kozhikode region. This indicates the need to strategies the planning regulations to improve mixed non- residential usage along the mobility corridor to improve the usage of public modes as envisaged.

LOS Range for Share of Mixed Land Use Zoning

LOS	Mixed Land –Use on Major Transit Corridor / Network (% Area Under Non-Residential Use)
1	>= 30
2	15 – 30
3	5 – 15
4	< 5

INTENSITY OF DEVELOPMENT-CITY WIDE

The calculation of Intensity of Development-City Wide is shown below. The corresponding LoS value for the indicator 'Intensity of Development-City Wide' is 3.

Development Intensity – City Wide

S. No	Calculation	Unit	Description	Data Source	Value
a.	Floor space Index (applicable to most part of the city as per Master Plan/DP.	No.	As per Master plan/Development plan as applicable to developed/developable area, i.e., Intensity of Development -City (FSI (Floor Space Index - Master Plan/DP)	LSGD	1.5
LOS1: >=2, LOS2: 1.5-2, LOS3: 1.0-1.5, LOS4: <1					

INTENSITY OF DEVELOPMENT ALONG TRANSIT CORRIDORS

The calculation of intensity of development along transit corridors is shown below. The corresponding LOS value is 4. There is currently no development control guideline promoting higher density development along mass transit corridors in the city.

Intensity of Development Along Transit Corridors

S. No.	Calculation	Unit	Description	Data Source	Value
a.	Floor space Index (applicable to most part of the city as per Master Plan/DP.	No.	As per Master plan/ Development plan as applicable to developed/ developable area	LSGD	1.5
b.	FSI along transit corridors.	No.	As per Master plan/ Development plan as applicable to areas along transit corridors	LSGD	1.5
c.	Intensity of Development along Transit Corridors	Ratio	Calculate Ratio = [b/ a].	LSGD	1
LOS1: >=3, LOS2: 2-3, LOS3: 1.5-2, LOS4: <1.5					

ROAD NETWORK PATTERN AND COMPLETENESS

This is a qualitative indicator and is based on the extent of clarity and completion of existing and proposed road network of the city. Kozhikode region has a somewhat clear pattern radial pattern with somewhat incomplete rings in the road network. The indicator's LoS ranges are given below.. The corresponding LoS value for the 'Road Network Pattern and Completeness' is 2.

LOS Range for Road Network Pattern and Completeness

LOS	Clear Pattern and Completeness of the Network
1	Clear pattern (ring-radial or grid-iron) and Complete network
2	Somewhat clear pattern (ring-radial or grid-iron) but somewhat incomplete network
3	Somewhat unclear pattern and incomplete network
4	No clear pattern incomplete / sparse network

PERCENTAGE OF AREA UNDER ROADS

The calculation of percentage of area under roads is shown below. Based on the above, the corresponding LoS value is 4. This indicates that certain areas could require network augmentation.

Percentage of Area Under Roads

S. No.	Calculation	Unit	Description	Data Source	Study Area
a.	Measure overall developed area	km. sq.	Measure developed area of a city	LSGD	147
b.	Measure overall area under road network.	km. sq.	Total area under roads	LSGD	5.4
c.	Percentage of area under road network	%	Calculate Ratio = [b / a] * 100.		3.6
LOS1: >=15, LOS2: 12-15, LOS3: 10-12, LOS4: <10					

PERCENTAGE NETWORK WITH EXCLUSIVE ROW FOR TRANSIT (FOR > 1 MILLION POPULATION)

There has been no exclusive RoW assigned for public transit in the city. Thus, the LoS value for the indicator ‘Percentage Network with Exclusive RoW for Transit’ is 4.

LEVEL OF SERVICE FOR INTEGRATED LAND USE TRANSPORT SYSTEM

Based on the table below, the overall score of the Benchmark for computes to 25. The Benchmark’s LoS is at 4 indicating need to develop a coherence between city structure and public transport system in Kozhikode

Integrated Land Use Transport System

LOS	Population Density	Mixed Land Use Zoning	Intensity Of Development-Citywide (FSI)	Intensity Of Development Along Transit Corridor	Road Network Pattern & Completeness	% Of Area Under Roads	% Network With Exclusive Row for Transit
1	> =175	> = 30	> = 2	> = 3	Clear pattern (ring-radial or grid-iron) and complete network	> = 15	>=30
2	150-175	15-30	1.5 - 2.0	2 – 3	Somewhat clear pattern (ring-radial or grid-iron) but somewhat incomplete network	12 – 15	20 – 30
3	125-150	5 – 15	1.0 - 1.5	1.5 – 2	somewhat unclear pattern and incomplete network	10 – 12	10 – 20
4	< 125	<5	<1	<1.5	no clear pattern incomplete / sparse network	< 10	< 10
Indicator LoS	**4**	**4**	**3**	**4**	**2**	**4**	**4**
LOS1: <=8, LOS2: 9-15, LOS3: 16-22, LOS4: 23-28							

LAND USE DETAILS

LAND USE- 2012

Land Use 2012 (Master Plan for Kozhikode Corporation 2035)

Land Use	Area in Sq Km	% Area
Commercial	3.36	1.88%
Residential	120.53	67.63%
Industrial	3.26	1.83%
Public & Semi Public	7.17	4.03%
Religious	1.85	1.04%
Roads & Transportation	9.53	5.35%
Environmentally Sensitive	7.47	4.19%
Water Body	11.57	6.50%
Parks & Open Spaces	0.32	0.18%
Agriculture	11.41	6.40%
Vacant	1.73	0.97%
Total	178.21	100.00%

EXISTING LAND USE-2019

Existing Land Use 2019 (Master Plan for Kozhikode Corporation 2040)

Land Use	Area in Sq Km	% Area
Agricultural Land	4.53	3.87%
Central Govt Property	0.578	0.49%
Commercial	3.469	2.97%
Communication	0.147	0.13%
Mangrove	0.287	0.25%
Industrial	2.821	2.41%
Mixed	0.103	0.09%
Educational	2.222	1.90%
Health Services	1.637	1.40%
Public Utilities	0.007	0.01%
Public & Semi public	0.499	0.43%
Railway Property	0.076	0.06%
Recreational Builtup	0.084	0.07%
Recreational Openspace	0.265	0.23%
Religious	1.479	1.27%
Residential	82.434	70.49%
Road	4.064	3.48%
Solid Waste Management	0.075	0.06%

State Govt Property	1.117	0.96%
Transportation	1.091	0.93%
Vacant Land	1.388	1.19%
Water Bodies	5.752	4.92%
Wetlands	1.815	1.55%
Converted Paddy Land	0.347	0.30%
Uncultivated Paddy	0.651	0.56%

PROPOSED LAND USE-2040

Proposed Land Use 2040 (Master Plan for Kozhikode Corporation 2040)

Land Use	Area in Sq Km	% Area
High_Density_Residential Zone	5288.25	44.54%
Mixed_Use_Zone	1965.26	16.55%
Public_Semipublic_Others	577.54	4.86%
Water_Body	554.44	4.67%
Commercial_Zone	502.41	4.23%
Low_Intensity_Industrial_Zone	501.6	4.22%
Low_Density-Residential_Zone	498.5	4.20%
Road	407.24	3.43%
Environmentally_Sensitive_Area	342.59	2.89%
Tourism_Promotion_Zone	320.72	2.70%
Industrial_Zone	190.02	1.60%
Wet_Agriculture_Zone	185.4	1.56%
Recreational_Zone	117.75	0.99%
Transportation	117.6	0.99%
Religious_Zone	116.03	0.98%
Special_Zone_E_	43.32	0.36%
Port_And_Allied_Developments	39.33	0.33%
Itpark	26.5	0.22%
Irrigation_Canal	18.31	0.15%
Defence_Land	17.97	0.15%
Eco_Tourism_Zone	15.36	0.13%
Special_Zone_A	7.87	0.07%
Special_Zone_B	6.8	0.06%
Buffer_To_Treatment_Plant	6.34	0.05%
Harbour	5.02	0.04%
Special_Zone_C	0.45	0.00%