Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation

LOW CARBON MOBILITY PLAN

KAKINADA

FINAL REPORT

QUALITY MANAGEMENT

Revision	Revision 0
Report Prepared By	Harshita Sarma M, Kabilan M, Sri Navya Annem, Siva Niranjan, Mahesh Chenna
Report Reviewed By	S. Rama Krishna
Report Approved By	N Seshadri
Description	Final Report Low Carbon Mobility Plan - Kakinada

DISCLAIMER

This document has been prepared for the "Low Carbon Mobility Plan for Kakinada" and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority of UMTC being obtained. UMTC accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm his agreement to indemnify UMTC for all loss or damage resulting there from. UMTC accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

CBD	Central Business District
CDP	City Development Plan
CMP	Comprehensive Mobility Plan
CPKM	Cost Per Km
DPR	Detailed Project Report
EPKM	Earning Per Km
GAD	General Arrangement Drawings
GCC	Gross Cost Contract
GIS	Geographical Information System
GoI	Government of India
IL & FS	Infrastructure Leasing and Financial Services
IOE	Institutions of Engineers
IPT	Integrated Public Transport
IRDP	Integrated Road Development Project
IT/ITES	Information Technology and Information Technology Enabled Services
ITS	Intelligent Transport System
JnNURM	Jawaharlal Nehru Urban Renewal Mission
kmph	Kilometers per hour
MoUD	Ministry of Urban Development
MRTS	Mass Rapid Transit System
APSRTC	Andhra Pradesh State Road Transport Corporation
NCC	Net Cost Contract
NH	National Highway
NMT	Non-Motorized Transport
PBS	Public Bike Sharing Schemes
PHPDT	Peak Hour Peak Direction Trips
PT	Public Transport

SEZ	Special Economic Zone
SH	State Highway
SPV	Special Purpose Vehicle
UMTC	Urban Mass Transit Company
URDPFI	Urban and Regional Development Plans Formulation and Implementation

1. INTRODUCTION

1.1. STUDY BACKGROUND

Amaravati Metro Rail Corporation (AMRCL) intends to develop Low Carbon Mobility Plan for nine towns in the state of Andhra Pradesh, with all modes including pedestrians, cyclists, Intermediate Public Transport (IPT), public transport, canal navigation etc. UMTC has been appointed as the consultant for providing the consultancy services for Low Carbon Mobility Plan, which would look into the assessment of traffic and transportation needs for the cities based on the present and projected demand in the nine cities. Kakinada is one of the nine cities identified.

1.2. LOW CARBON MOBILITY PLAN

Low Carbon Mobility Plan (LCMP) provides a roadmap for infrastructure development options and investment requirements to provide a desirable level of mobility and accessibility to all sections of the citizens, while focusing on minimising carbon emissions. LCMP relies on "avoid, shift and improve" framework, i.e., avoid motorized trips, where possible or give options for using shared/public transport, encourage shift to low-carbon modes and improve the efficiency of motorized vehicles ***(Figure 1-1).***

The LCM plan thus, provides technological as well as planning strategies to meet the mobility and accessibility demands of all the people by the least carbon emitting modes of transport.

Accordingly, the overall objective of the LCMP is to provide a long-term strategy, which ensures desirable mobility, safety and accessibility to people across gender and socio-economic profiles, while reducing carbon emissions.

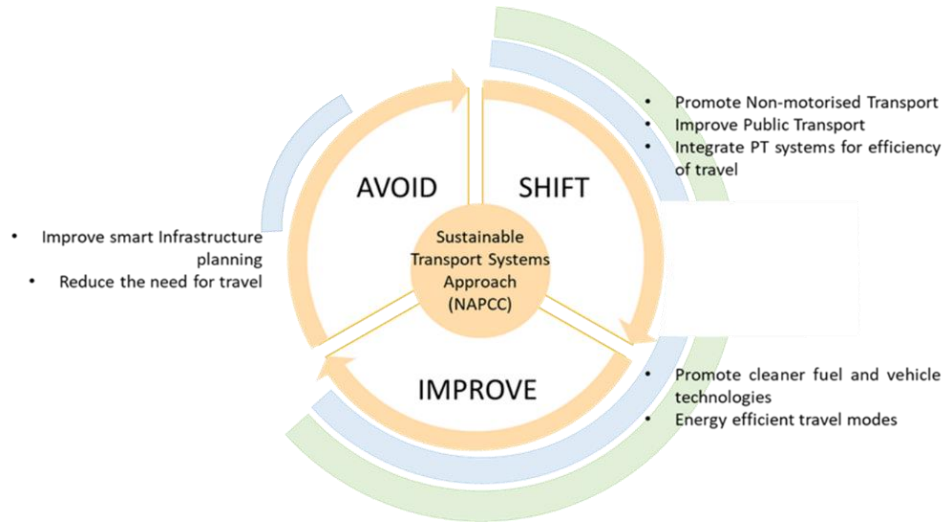


FIGURE 1-1: GENERALISED LCMP APPROACH

1.3. SCOPE OF LOW CARBON MOBILITY PLAN - KAKINADA

The low carbon mobility plan focusses on,

a. Providing sustainable access option for all kind of residents in Kakinada.
b. Emphasizing the importance of pedestrian facilities, NMT measures and Public Transport systems
c. Increasing the efficiency and cost-effectiveness of the transportation of persons and goods
d. Integrating Land use development and transport systems
e. Strategizing effective and sustainable urban development
f. Reducing pollution, greenhouse gas emissions and energy consumption.

The low carbon mobility plan does not deal with,

a. Detail cost estimates
b. Project detailing (DPR & DBR)
c. Detail traffic engineering plans

1.4. STUDY OBJECTIVES

The objectives of the low carbon mobility plan are as stated below:

a. To improve mobility for all socio-economic groups and genders.
b. To improve air quality of Sustainable Urban Transport Scenario.
c. To improve in safety and security for pedestrians, NMT and live-ability in the city.
d. To increase sustainable transport mode share and decrease in private motor vehicle use.
e. To plan strategies for achieving desirable indicators and transportation benchmarks.

1.5. SCOPE OF THE STUDY

The Scope of work for the study is as discussed below:

1. Conducting a reconnaissance survey to identify the data needs, gaps in the existing data and to identify the primary survey locations.
2. Delineating the planning area and the traffic analysis zones.
3. Developing a Mobility Vision for Kakinada.
4. Secondary data collection and analysing the existing transport and environmental needs with respect to the land use patterns and population densities for Kakinada.

5. Conducting primary traffic surveys to assess the current travel patterns and behaviour in the Kakinada.
6. Analysing and estimating the travel needs for the city.
7. Review of Energy consumptions and Environmental quality in the city.
8. Comparing the services to the Service Level Benchmarking indicators to understand and evaluate the level of services delivered to the citizens.
9. Developing Business as Usual scenario to assess the base year travel characteristics and the horizon year travel demand and characteristics under business as usual scenario.
10. Developing a Sustainable Urban Transport scenario by identifying strategies for sustainable transport options and analysing transport demand of alternative strategies for sustainable transport.
11. Identifying the technology transitions under the low carbon scenario and analysing carbon dioxide emissions and air quality under the sustainable scenario with the specified benchmarks.
12. Developing the low carbon mobility plan involving
    a. Integration of land use and mobility plan
    b. Formulation of public transport improvement plan
    c. Network improvements
    d. NMT facility improvement strategies
    e. Mobility management measures
    f. Freight Movement Plan
13. Identifying and prioritizing projects.
14. Identifying of funding sources.
15. Preparing the of implementation program.

1.6. APPROACH AND METHDOLOGY

Keeping in view the project objectives and the scope of the work and experience in similar projects, the approach and methodology is detailed out in the following sections. ***Figure 1-2*** shows the study methodology highlighting the major tasks and their sequence.

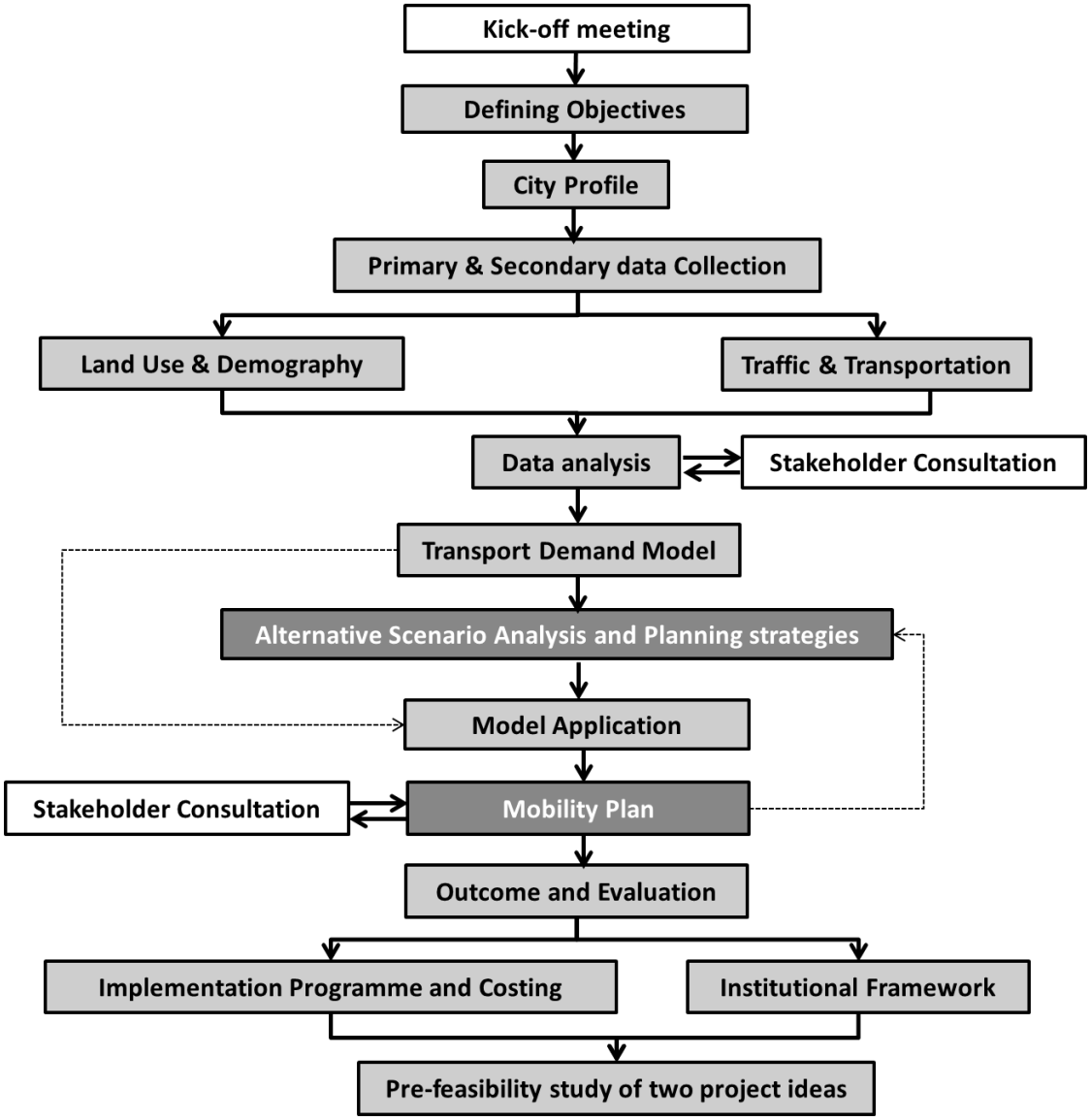


FIGURE 1-2: LCMP METHODOLOGY

The major tasks that cover the scope of work of the LCMP, are listed below. They have been discussed elaborately in subsequent sections.

- Task 1: Delineate the planning area and the planning horizon
- Task 2: Analyse the existing situation
- Task 3: Develop Business as Usual (BAU) Scenarios
- Task 4: Develop and Analyse for Alternate Scenarios
- Task 5: Develop Indicators for BAU and Alternate Scenarios and evaluate all Scenarios
- Task 6: Prepare the Implementation Program – propose policy measures, projects and financial requirements to achieve the low carbon scenario.

1.6.1. TASK 1: DELINEATE PLANNING AREA AND PLANNING HORIZONS

1.6.1.1. DELINEATE THE PLANNING AREA

The study area for the Low Carbon Mobility Plan is the Kakinada Municipal Corporation area consisting of 50 administrative wards. These wards shall be used as delineated traffic analysis zones as represented in Chapter 2 and Chapter 3.

1.6.1.2. DETERMINE PLANNING HORIZONS

It has been ascertained that the overall goal of LCMP can be realised over a long term horizon period of 20 years. A long term planning horizon of 20 years has been envisioned to attain the goals of LCMP. This timeframe has been divided into four time horizons. The four horizon periods are defined as follows:

1. **Immediate Term:** The Immediate-term time horizon will last up to two years. It will focus on Immediate-term planning measures that include enforcement measures, lane markings, street furniture and lighting facilities, improvement in pedestrian facilities, traffic management and calming measures, parking plans etc. The overall emphasis will remain on improving the safety and accessibility standards.
2. **Short-term:** The short-term time horizon will last two to five years. It will focus on short-term planning measures that include intersection improvements, signalisation of intersections, Improvement of non-motorized transport, improvement in pedestrian facilities, traffic circulation plans, parking plans etc. The overall emphasis will remain on improving the safety and accessibility standards.
3. **Medium-term:** The time-period for this horizon will last for five to ten years. The focus will be on medium-term planning projects such as NMT corridors, city bus networks and public transport and NMT networks. The objective of medium term planning is to arrest the current trend of heavy dependence on private vehicles and set ground for higher PT and NMT usage in the future.
4. **Long-term:** This is a 20-year long period, with a long-term vision of achieving overall low-carbon mobility goals.

1.6.2. TASK 2: ANALYSE EXISTING SITUATION

1.6.2.1. REVIEW OF STUDY AREA PROFILE

The aspects which define the profile of the study area were studied in this task.

- Location of the study area
- Population and other demographic details like employment, income groups.
- Land area of the urban agglomerated area of the study area.
- Regional linkages with other major towns of Andhra Pradesh
- Socio-economic data, since this plays a major role in the travel patterns of people.
- Tourism activities in and around Kakinada, which attract tourists from across the world.

1.6.2.2. REVIEW OF LAND-USE PATTERNS

- The proportion of Land-use for various purposes i.e. Residential, Commercial, Institutional, Recreational, Transportation etc.
- Accessibility of people between different types of Land-use areas.
- Densities of each type of land-use i.e. population density, employment density (number of employment opportunities per commercial land area used) etc.

1.6.2.3. REVIEW OF EXISTING TRANSPORT SYSTEM

This task focuses on current transport network with respect to private, public and para-transit systems. Demand patterns and travel characteristics. Previous studies and relevant reports were collected and reviewed for this purpose. It is assessed through the in the following steps are as discussed in Chapter 2:

- Reviewing of previous studies for Kakinada
- Review of Existing Transport Infrastructure for Kakinada
- Review of Public Transport System in the study area
- Review of Traffic Safety and its enforcement in the study area

1.6.2.4. TRAVEL DEMAND SURVEY

Base year travel patterns and demand is very important input to the overall planning for the future horizon period. In this regard, various primary surveys were conducted to gather the base year data.

The details about the primary surveys and the detailed methodology for estimating the base year travel demand is as discussed in Chapter 3.

1.6.2.5. BENCHMARKING THE TRANSPORT SYSTEMS

The existing transportation system will be benchmarked with respect to the 11 Service Level Benchmarks issued by Ministry of Urban Development-Urban Transport as represented in the Chapter 4, wherein the gaps for improving the existing transportation system in Kakinada were identified.

1.6.3. TASK-3 DEVELOP BUSINESS AS USUAL (BAU) SCENARIO

1.6.3.1. DEVELOP A SOCIO-ECONOMIC PROFILE FOR FUTURE

The future demand for the system are derived based on an estimation of the following socio-economic aspects.

- **Population growth:** It will be projected, based on trends available from studies conducted in the past and the Census data.
- **Economic growth:** The overall economic growth of the city will be projected, based on growth trends of Per Capita Income and the Gross Domestic Product (GDP). The income growth with the increase in vehicle ownership may be a useful measure for projecting per capita carbon emission trends for different income strata of the population.
- **Vehicular growth:** The growth in number of private and public vehicles will be projected using the vehicle registration records from the local Road Transport Authority (RTA) in Kakinada.

1.6.4. TASK-4: DEVELOP AND ANALYSE ALTERNATE SCENARIOS

The study develops two alternate scenarios for the horizon years, based on the strategies that have been identified in the Terms of Reference to the BAU scenario. The alternative scenario will be analysed to project the likely deviations from the BAU scenarios considering public transport and non-motorised transport improvements.

1.6.4.1. ALTERNATE SCENARIO WITH IMPROVEMENTS IN PUBLIC TRANSPORT

Improving public transport involves infrastructural improvements like reserving bus-lanes and tracks, improving location and design of stops and operational improvements. The improvement in level of service is likely to not only result in retaining the existing modal share of public transport but also

cause a shift from other modes to the use of public transport. The following scenarios will be developed:

- **City-Wide Bus Transport System:** A comprehensive citywide bus network will be developed to meet the travel demand. This network shall be evaluated against emissions and low carbon objectives.
- **Adaptive Transit:** Change in Land-use is usually very tough to implement in developed and old areas of the city. Keeping in mind the nature of all areas with such Land-use, suitable transit such as minibuses, para-transit and motor and cycle rickshaws will provide connectivity in the short and medium term.
- **Transit-Oriented Development:** Major travel corridors will be identified in the city and mass **transit** modes will be provided along these corridors. The rest of the road network built around these major corridors by providing feeder services to them. The development along the mass transit corridors will triggered by designing various strategies like, increasing the FSI and etc.
- **Combination of Transport Modes:** A combination of the afore-mentioned three strategies will be adopted.

1.6.4.2. ALTERNATE SCENARIO WITH IMPROVEMENTS IN NON-MOTORISED TRANSPORT

Improving non-motorized transport (NMT) will involve development of a conducive environment to provide barrier free, direct, continuous, comfortable, safe and secure movement. The likely shift in modal share from motorised to non-motorised modes by providing a combination of these infrastructure items will be analysed:

- Footpaths along all arterial and sub arterial roads
- Exclusive cycle lanes along all arterial and sub arterial roads
- Traffic calming measures in residential zones
- Adequate street furniture to promote NMT modes and spaces for street hawkers and vendors
- Public bicycling and bicycling schemes

1.6.4.3. ALTERNATE SCENARIO WITH ADVANCEMENTS IN VEHICLE TECHNOLOGY

The urban transport scenario can be improved by the following improvements in technology:

- Use of Intelligent Transport Systems (ITS) to manage all modes of traffic in an efficient and better way.

- Improvement in vehicle and fuel technology to reduce emissions of particular vehicles, such as conversion of all public transport to low emission fuels, for example, CNG or bio-fuels.

An analysis and comparison of the alternate scenarios will be conducted and the best scenario will be identified. The selection will be based on the following considerations:

i. It should be the best scenario for promoting the goals of the plan
ii. It should be declared acceptable following a consultation and consent from the various stakeholders.

1.6.5. TASK-5: DEVELOP INDICATORS FOR BAU AND ALTERNATE SCENARIOS AND EVALUATE ALL SCENARIOS

The various indicators will be calculated for each scenario, including BAU and alternate scenarios, based on the list that has been already developed. As is already mentioned in the previous section, the best scenario based on a comparison of these indicators will be selected for adoption. A detailed travel demand analysis will be developed for this scenario following the four-step approach, which is detailed under Task 3. An important aspect of this analysis exercise will be the quantification of CO_2 emissions that will be produced for each horizon period. Long-term national CO_2 goals will be compared against the forecasted emissions through the back-casting approach for short and medium horizon periods. Based on this comparison, mitigation measures will be proposed in order to meet the national CO_2 goals.

1.6.6. TASK 6: PRIORITIZATION OF PROJECT IDEAS

The following critera will be used for prioritizing and phasing of projects:

- Urgency of Implementation
- Capital Investment
- Ease of Implementation
- Resource Availability
- Environmental Impact Assessment

The phasing of projects will be done according to the long-term, medium-term , short-term and Immediate requirements.

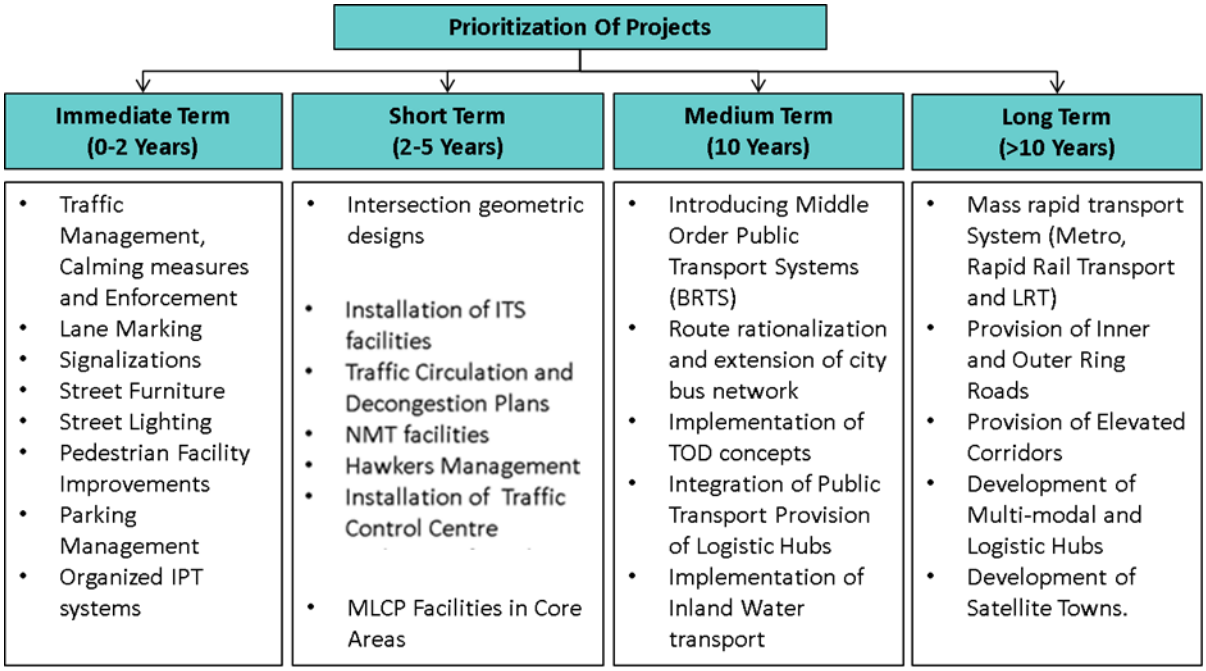


FIGURE 1-3: PRIORITIZATION OF IMPLEMENTATION PROGRAM

2. KAKINADA CITY PROFILE

2.1. INTRODUCTION

Kakinada formerly called Cocanada and Kakinandiwada is a city and the district headquarters of East Godavari district in the Indian state of Andhra Pradesh. Earlier the city used to store and export Coconut products and, hence, the name Co–Canada. Today, it is the headquarters and largest city of East Godavari district. It is the 12th largest city by area and 8th largest by population in Andhra Pradesh.

FIGURE 2-1: AERIAL VIEW OF KAKINADA

2.2. LOCATION AND REGIONAL LINKAGES

Kakinada is located at 16.93°N 82.22°E. The city is located near harbour line. It is long 151 km from Visakhapatnam via road, 672 km from Chennai, 860 Km from Bengaluru, 499 Km from Kakinada also one of the port station, 219 Km from Vijayawada, 492 Km from Hyderabad, and nearest city is Rajahmundry which is 62 Km from Kakinada. The city consists of two regions, connected by bridges. The southern part, Jagannathapuram, is separated from the rest of the city by the Buckingham Canal. The canal and its branches form Medaline Island, which abuts the city in the southwest.

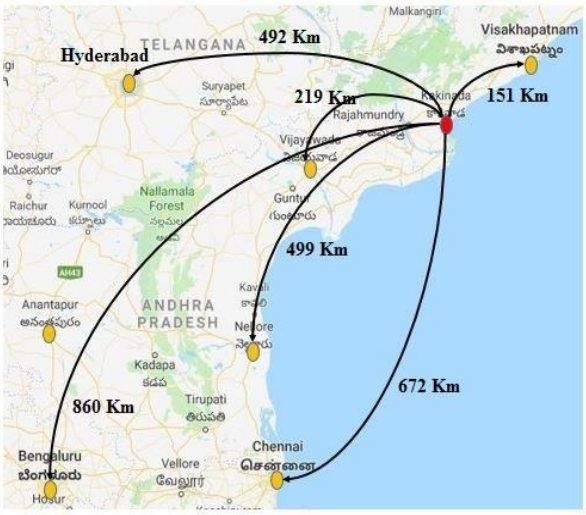


FIGURE 2-2: LOCATION AND REGIONAL LINKAGES

2.3. ADMINISTRATION

Kakinada Municipal Corporation is the civic body governing Kakinada. The corporation is spread over an area of 30.5 square kilometre. It has 50 municipal wards which are as shown in Figure 2-3.

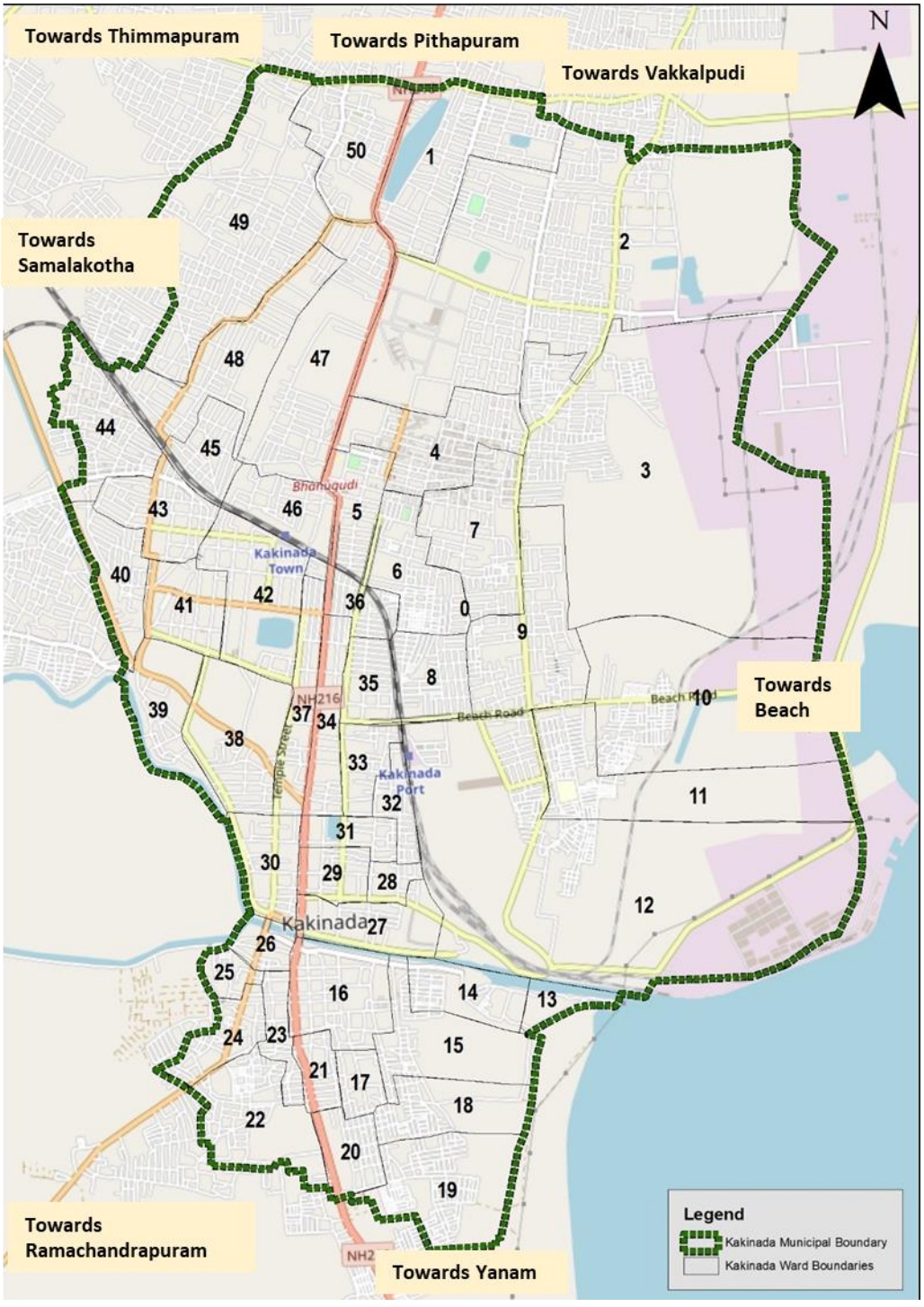


FIGURE 2-3: KAKINADA MUNICIPAL CORPORATION WARD MAP

2.4. GROWTH PATTERN

The rail network and sea connectivity have led to initial horizontal growth. In the recent years the city is observed to be spreading in semi radial form due its physical restriction on the eastern side

due to the Bay of Bengal. Kakinada Uppada Corridor is identified as a potential trade corridor and industrial growth is anticipated in this (north east direction). While the new layouts are observed establishing towards Smarlakota.

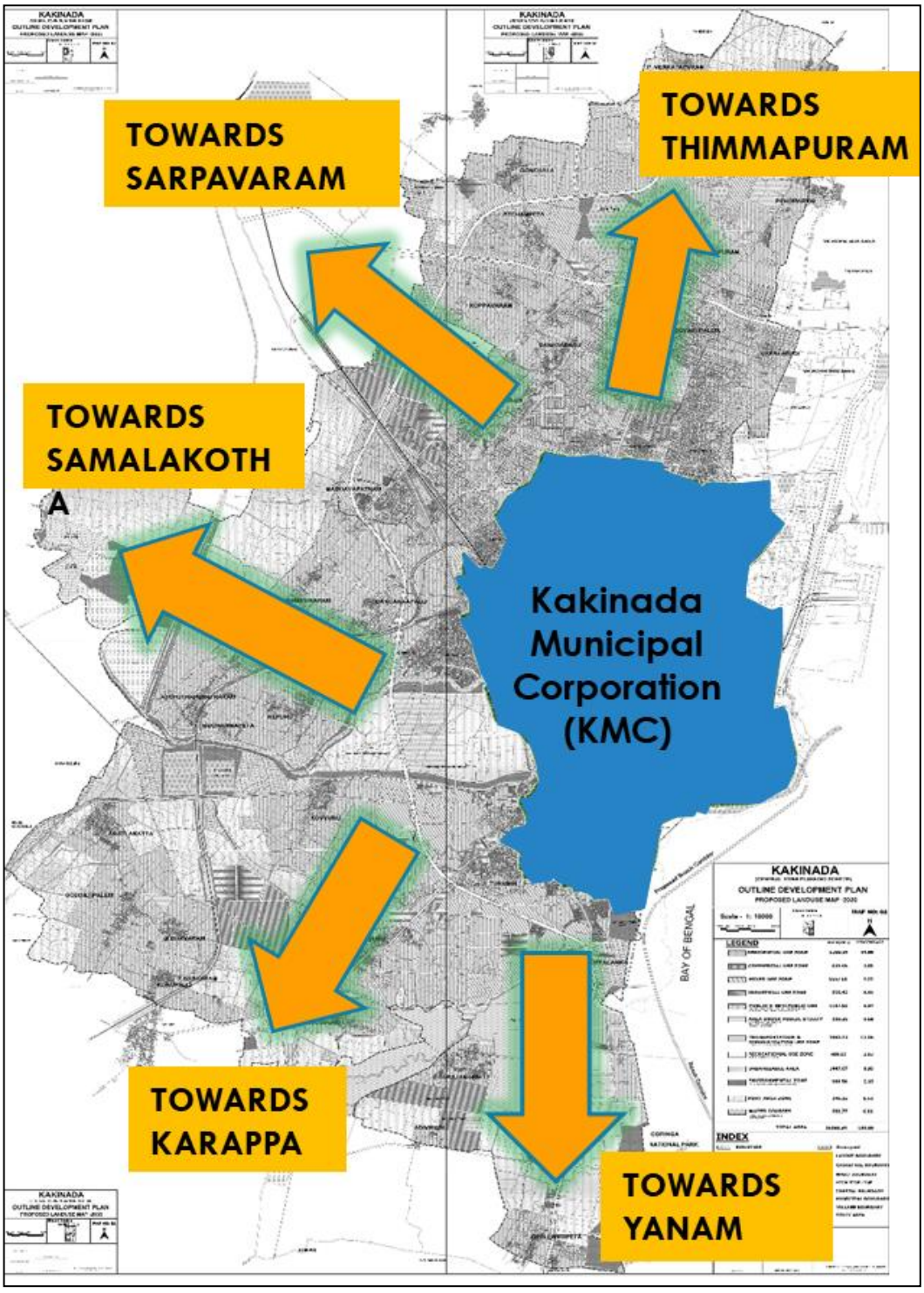


FIGURE 2-4: GROWTH PATTERN OF KAKINADA CITY

2.5. LANDUSE

The existing land use (2013) as per Kakinada master plan 2031 is as shown in Figure 2-5, whereas the proposed master plan is represented in the Figure 2-7. As per the Proposed Master Plan 2031, the major land use is residential accounting to 22%, followed by 6% water courses and 27% agriculture area and public use is about 9%. The proposed master plan identifies 12% of the land that is used for future urbanization.

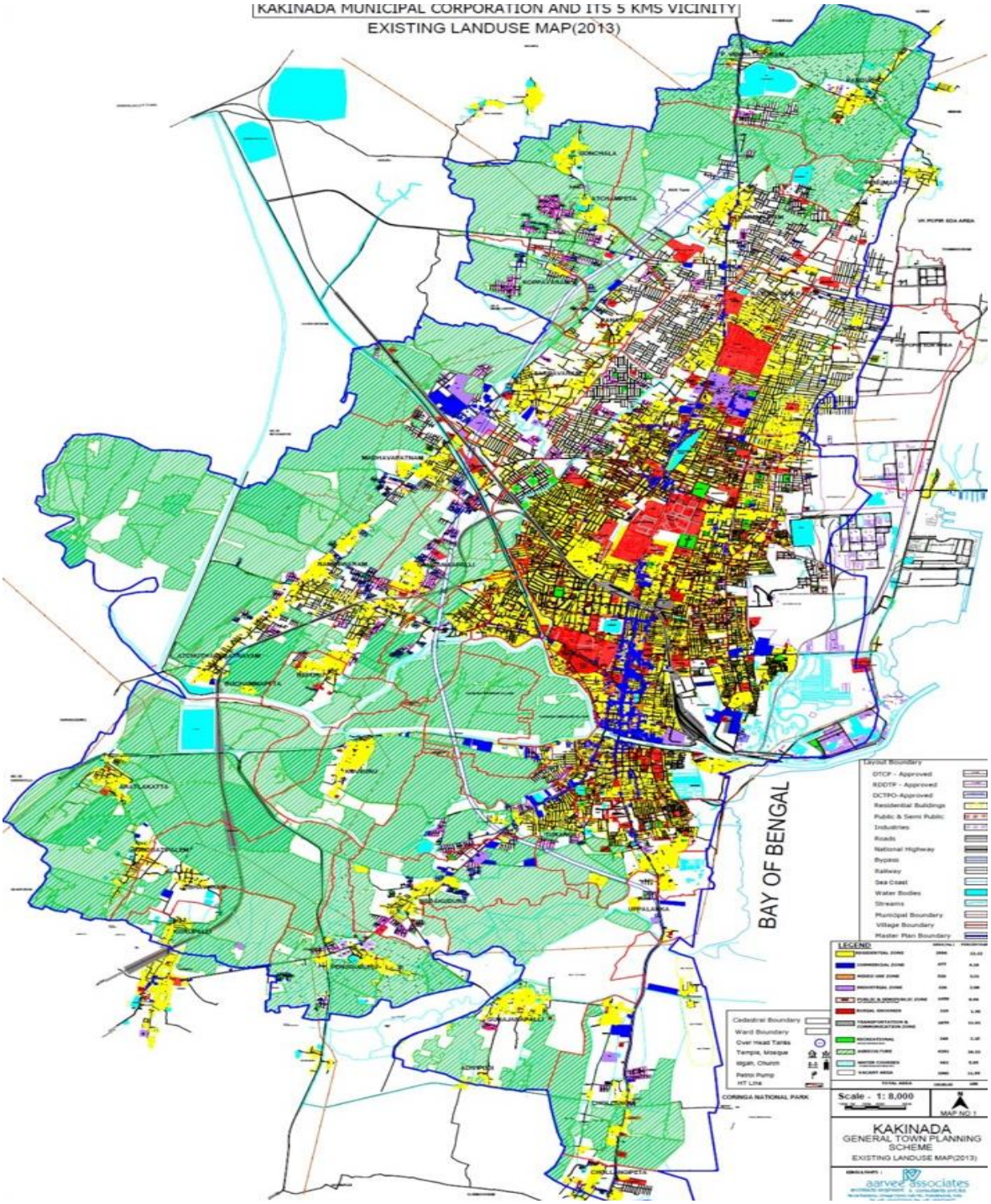


FIGURE 2-5: KAKINADA EXISTING LAND USE MAP

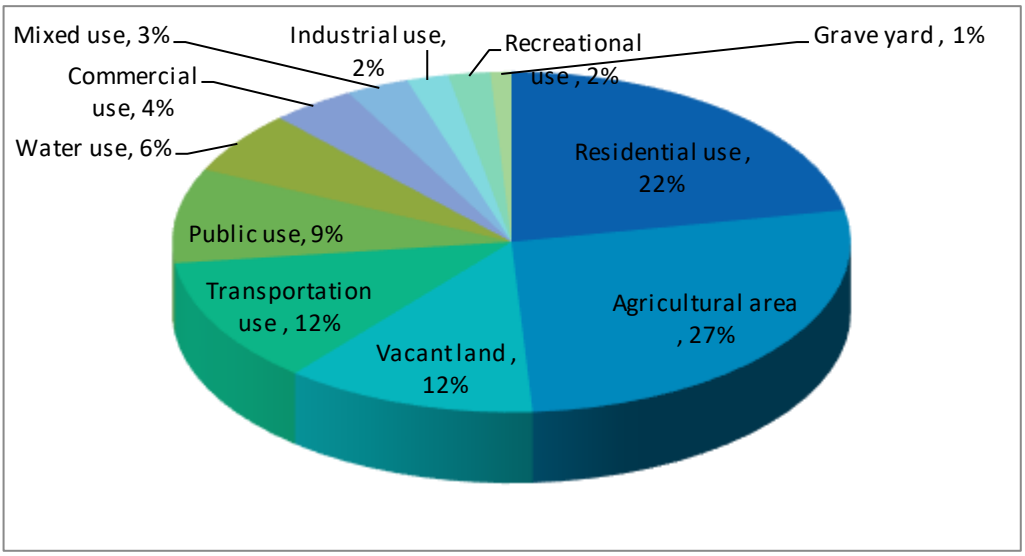


FIGURE 2-6: KAKINADA EXISTING LAND USE STRUCTURE FOR 2031

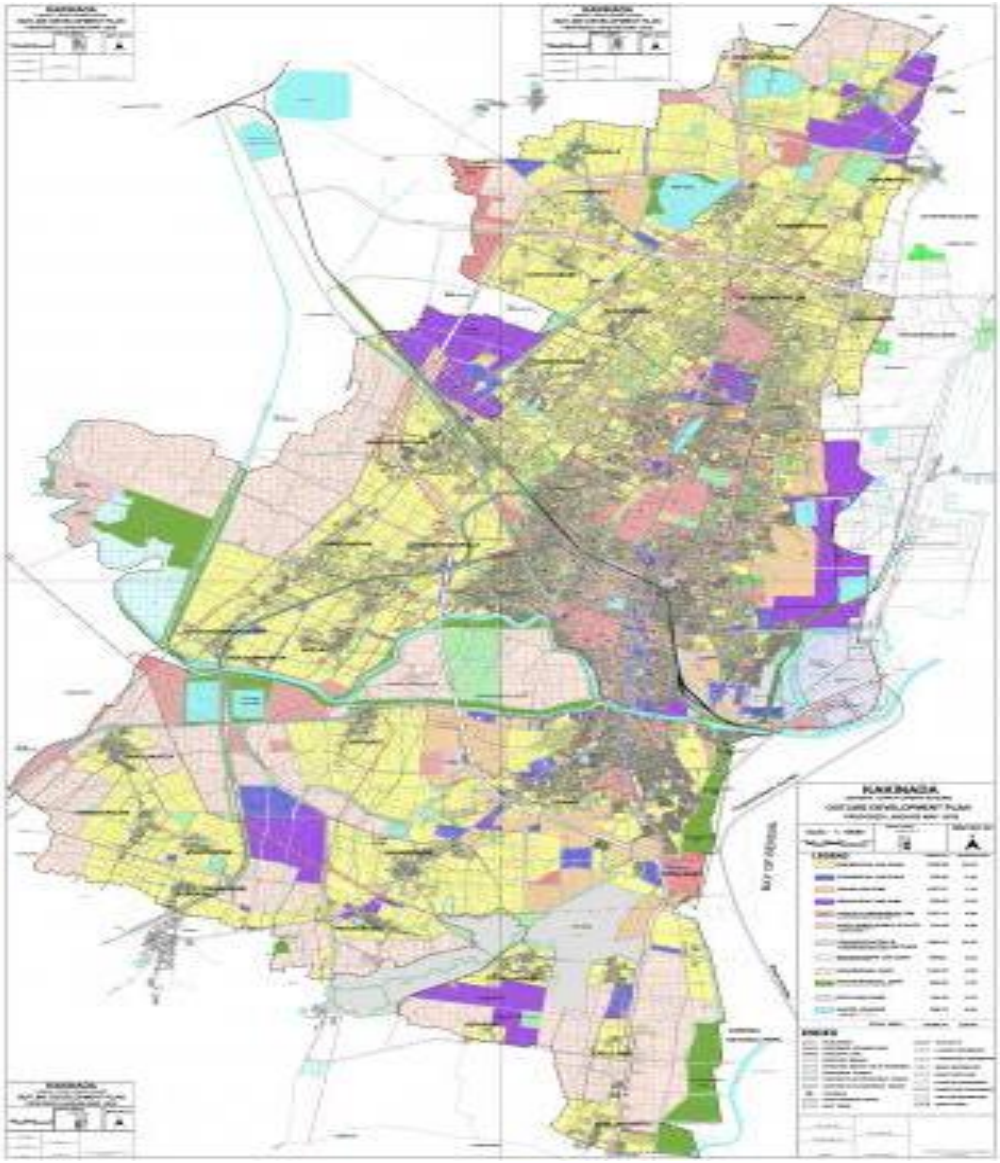


FIGURE 2-7: KAKINADA PROPOSED LAND USE MAP

2.6. DEMOGRAPHIC PROFILE

2.6.1. POPULATION

As of 2011 Census of India, Kakinada had a population of 3,25,985. The total population constitute 52,596 males and 159,659 females with a sex ratio of 1046 female per 1000 males, higher than the national average of 940 per 1000. The growth rate over the last decade is observed to be 5.38%. The population density in the city is observed to be 5,449 people per Sqkm. Indicate sparsely densified urban fabric. There are 93,373 households living in the municipal, 23.79 % share of ULB population in urban, literacy of city is 81.23 % out of 88 % for males and 77.76 % for females. As per the Kakinada Municipal Corporation the Population of the city is 3,53,159.

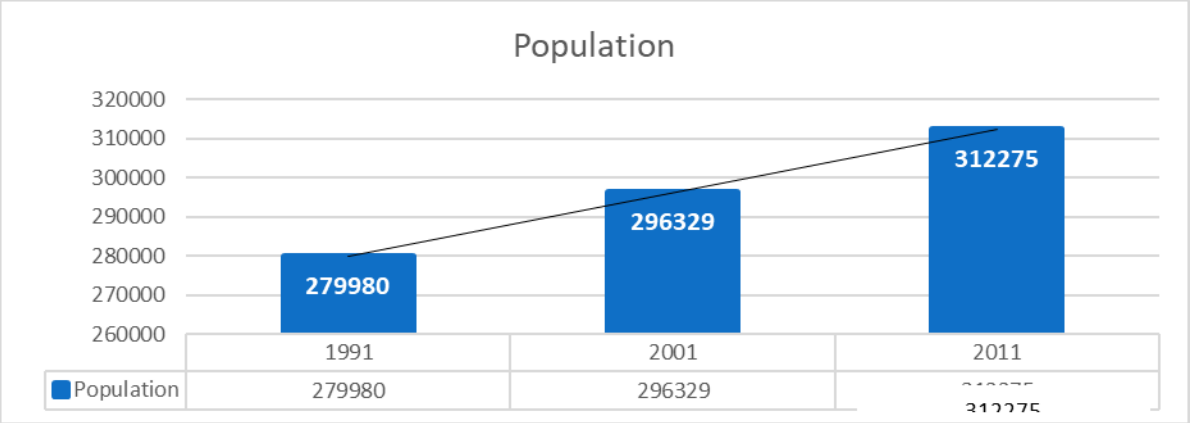


FIGURE 2-8: POPULATION OF KAKINADA

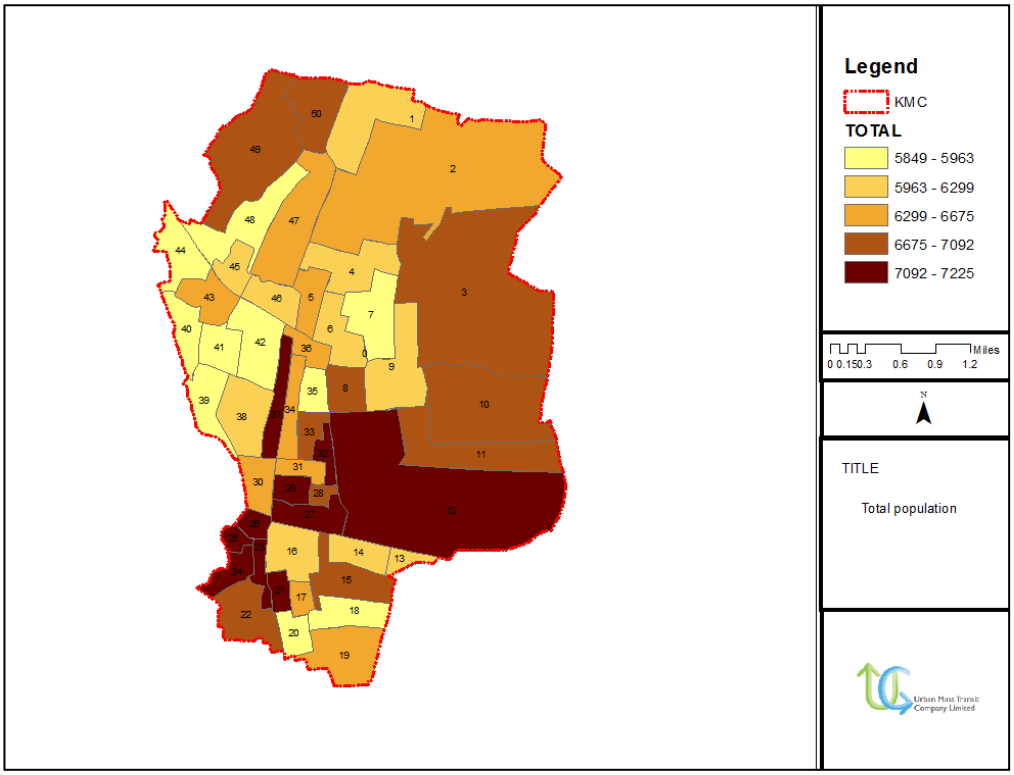


FIGURE 2-9: POPULATION DISTRIBUTION OF KAKINADA

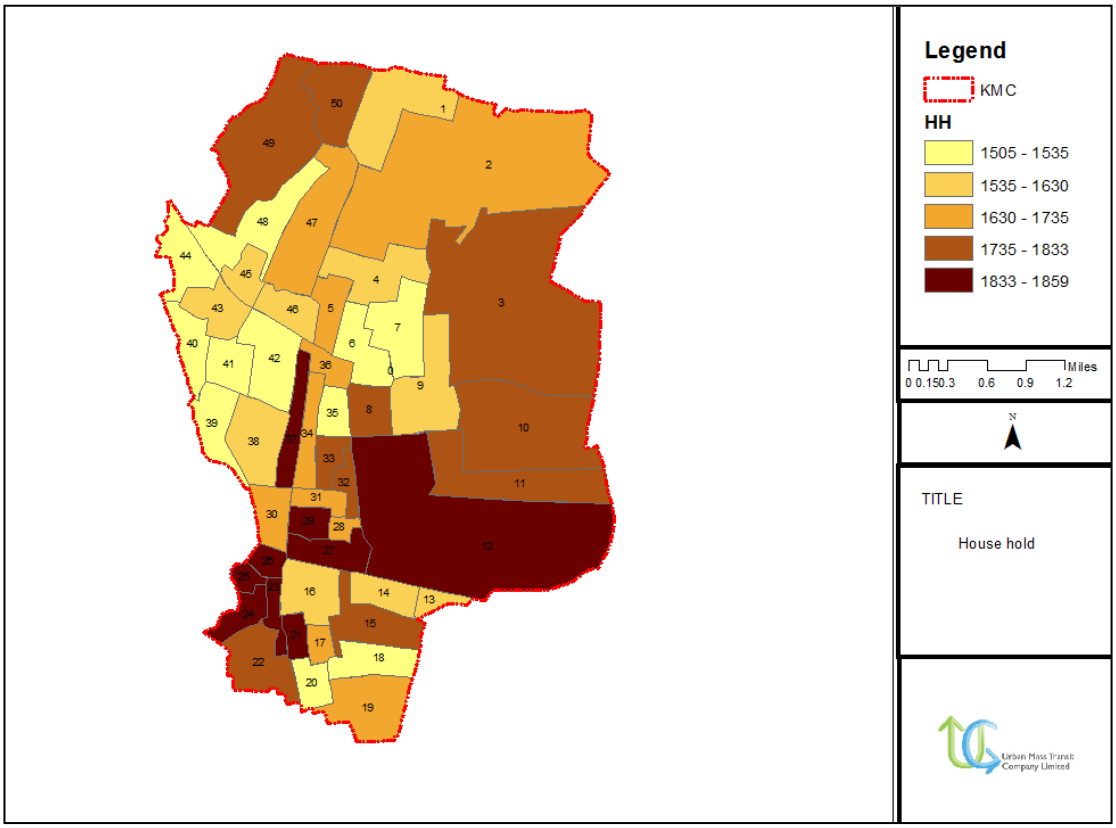


FIGURE 2-10: HOUSEHOLD DISTRIBUTION IN KAKINADA

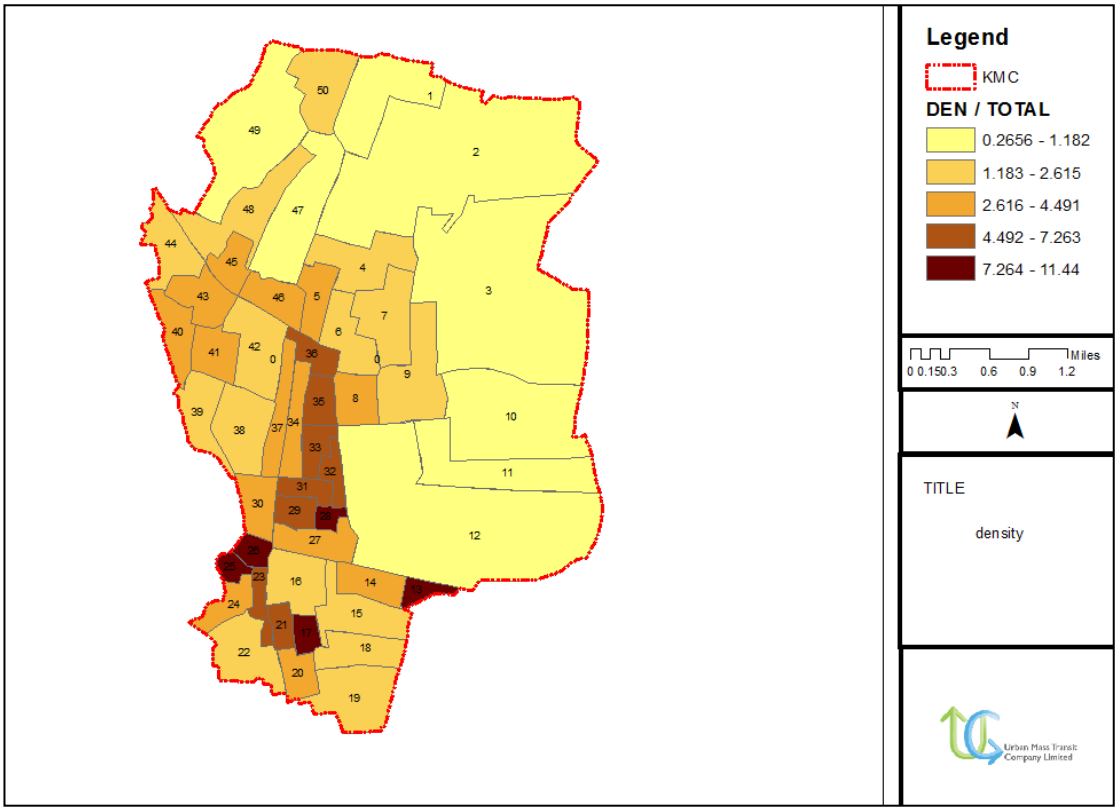


FIGURE 2-11: POPULATION DENSITY DISTRIBUTION IN KAKINADA

2.7. ECONOMIC PROFILE

Kakinada is part of a Special Economic Zone and a proposed Petroleum, Chemical and Petrochemical Investment Region (PCPIR). From the former history of Kakinada it could be seen that the industries are mainly comprised of agriculture and fishing but the present situation is utterly different and it completely rejuvenated the past story of industrialized segment in Kakinada. The development of industries is being very rapid and it can be clearly known by the various well-known industries planning to expand their business in and around Kakinada.

It is known as the "Fertilizer City" of Andhra Pradesh. The city is home to two fertiliser producers: Nagarjuna Fertilizers (the largest urea manufacturer in coastal Andhra) and Godavari Fertilizers (owned by Murugappa Group, and producing diammonium hydrogen phosphate).

Kakinada is an educational hub, meeting the growing educational demands of the state. Several professional colleges in and around the city offer courses in engineering, medicine, information technology and management at the graduate and postgraduate levels. The Jawaharlal Nehru Technological University, Kakinada offers engineering courses and has a business school, and Rangaraya Medical College is a respected medical college in the state. The other factors that help the Kakinada is the education sector with about 71 schools within the municipal.

FIGURE 2-12: EDUCATIONAL INSTITUTIONS AND INDUSTRIES IN KAKINADA

2.8. TRANSPORTATION PROFILE

2.8.1. ROAD NETWORK:

Kakinada is connected by road to the rest of the state and India. NH-214 from Kathipudi to Ongole (both on NH-5) passes through the city, and state highways connect it to Rajahmundry and other towns in the district. Municipal constructed C.C. Roads-243 KMs, B.T. Roads-330 KMs, W.B. M. Roads- 80 KMs, and Kutcha Roads-70 KMs.

The National highway No. 214 starting connects Kakinada to other major cities providing for healthier transport. This highway starts from junction of National highway No.5 near Kathipudi connecting Kakinada, Razole sinchinada, Narasapur and terminating at junction of National Highway No.9 near Pamurru. The total length of the highway is 270 km, while city has a total road network of

521 kms. The road network structure of Kakinada is Grid Iron, which is represented in the Figure 2-13.

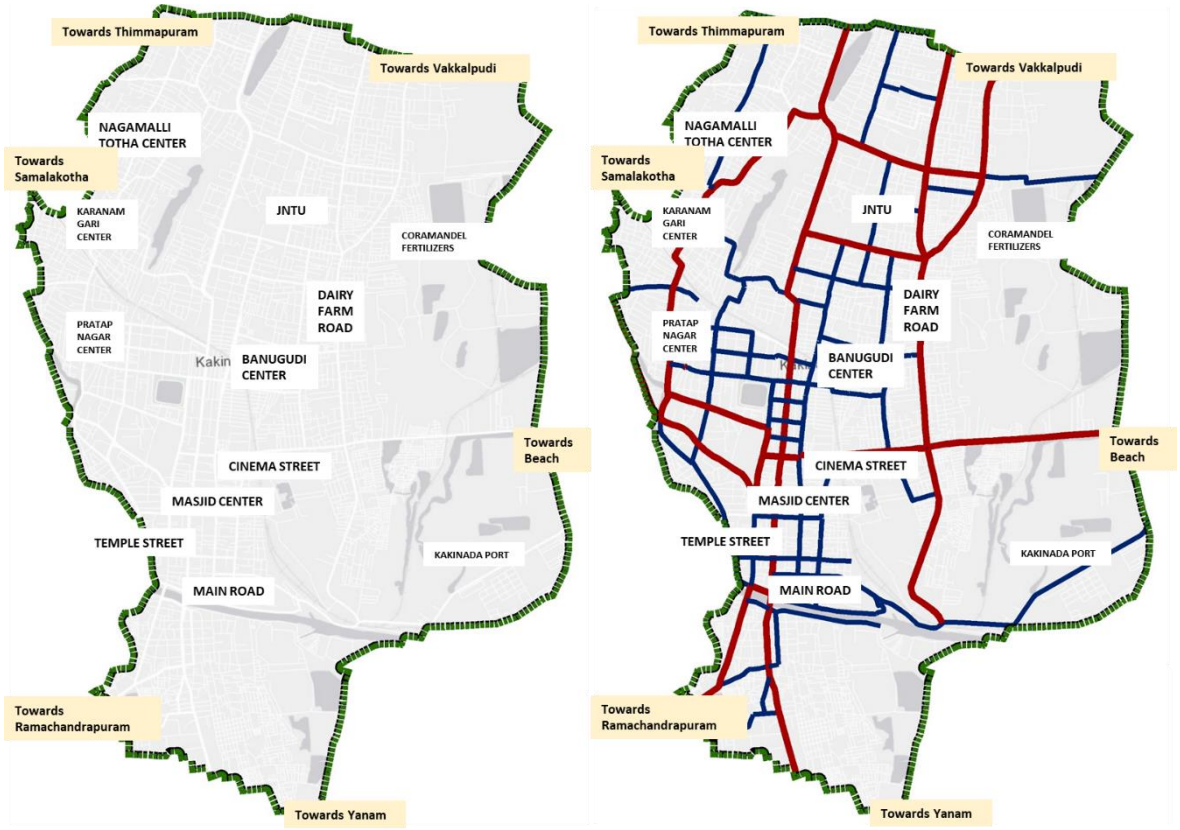


FIGURE 2-13: ROAD NETWORK STRUCTURE OF KAKINADA

FIGURE 2-14: TRAFFIC SCENARIO IN THE CITY

Though the city is well-planned with wide roads and less number of bottlenecks when compared to any other city, yet the road users experience traffic snarls due to increase vehicular growth. Vehicles coming from Yanam enter the city via Indrapalem junction, which is, of late, emerged as one of the ever busy junctions in the city. Similarly, the traffic police have identified 16 junctions in the city and on the outskirts as ever-busy junctions. The Main Road and Beach Road are observed to witness heavy traffic in the recent times. The other roads with high vehicular movement and high traffic concerns are Jagannaickpur, Cinema road and Main road.

Adding to its absence of parking places along the major corridor and commercial area is observed to be one of the root-cause of all traffic problems.

2.8.2. RAIL CONNECTIVITY:

Railways connect Kakinada to all major locations in the country. Kakinada Town and Kakinada Port are the two railway stations serving the rail needs of the city. It is as an A–category station in Vijayawada railway division and is one stations recognised for the Adarsh station of the division in South Central Railway zone.

Kotipalli Railway Line besides easing the problem of logistics such as crossing rivers and canals, offers a cheaper and quicker means of transport of vegetables and a variety of farm produce from one place to another within the district and from one district to the other. It can also result in the setting up of agro-based processing industries in the region where the supply of raw material is durable for a long time to come. Industries based on processing paddy, fisheries, coconut, fruits such as mango, pulses and coir will have enormous growth potential with facilities for export and import at the Kakinada and Machilipatnam ports.

FIGURE 2-15: KAKINADA SEA PORT RAILWAY LINE

2.8.3. AIR CONNECTIVITY:

The nearest airport is located at Rajahmundry. Strategically it is a good connecting point for both business and tourists who visit Rajahmundry and surrounding places. The connectivity to major other cities like Bangalore, Chennai, Hyderabad, etc and increase in number of flights by current

operator and introduction flights by other operators will be crucial in the development of this airport.

2.8.4. WATER CONNECTIVITY:

The city has two main Port terminal stations namely, Kakinada Town and Kakinada Port. Kakinada Port is located on the shore of Bay of Bengal. It is one of the intermediate ports in the state. Hope Island, about 5 kilometres (3.1 mi) from the coast, makes Kakinada Port a natural harbour. It is home to two ports namely, an Anchorage port and a Deep-water port (and also third port is going to be constructed in KSEZ which will be Greenfield Seaport). The city is connected to the Howrah-Chennai main line at Samalkot. Kakinada Town is classified as an A–category station.

The Port of Kakinada is the principal sea port amongst the minor ports in INDIA and is under the control of the government of the State of Andhra Pradesh. Under privatization policy the same is now manned by Kakinada Sea Port Private Limited from 1st April 1999 onwards The old anchorage and deep water port operate side by side making massive business and providing employment to several citizens. This is the only port encompassing the facility of transporting goods from one ship to another within the water specifying the importance of safety, time and labour energy.

The National Waterway 4 connects Kakinada with Puducherry and was declared in 2008 as National Waterway by the Inland Waterways Authority of India for cargo transport and tourism.

2.8.5. PUBLIC TRANSPORT:

APSRTC Buses operate from Kakinada for short as well as long distance travel. Currently, APSRTC has one bus terminal cum depot. These services are largely sub urban services, through 63 Telugu Velugu buses. Earlier, there were defined routes that connected the major locations in the city. However, the city bus service was withdrawn in 1999 due to losses as it could not compete with the fares charged by the auto rickshaws in the city.

TABLE 2-1: SERVICE CHARACTERISTICS

Sl.No	Type Of Vehicles	Old Basic Fare	Basic Fare	Special Hire Rs.	Minimum Fare	Or Factor	Seating Capacity
1	TELUGU VELUGU	59	PRESENT FARE INCREASE 5% (62.5)	41	6	3.32	54

The 63 Telugu Velugu services operating connect the surrounding villages and town. A total of 386 trips are made up and down carrying 9,15,600 passengers.

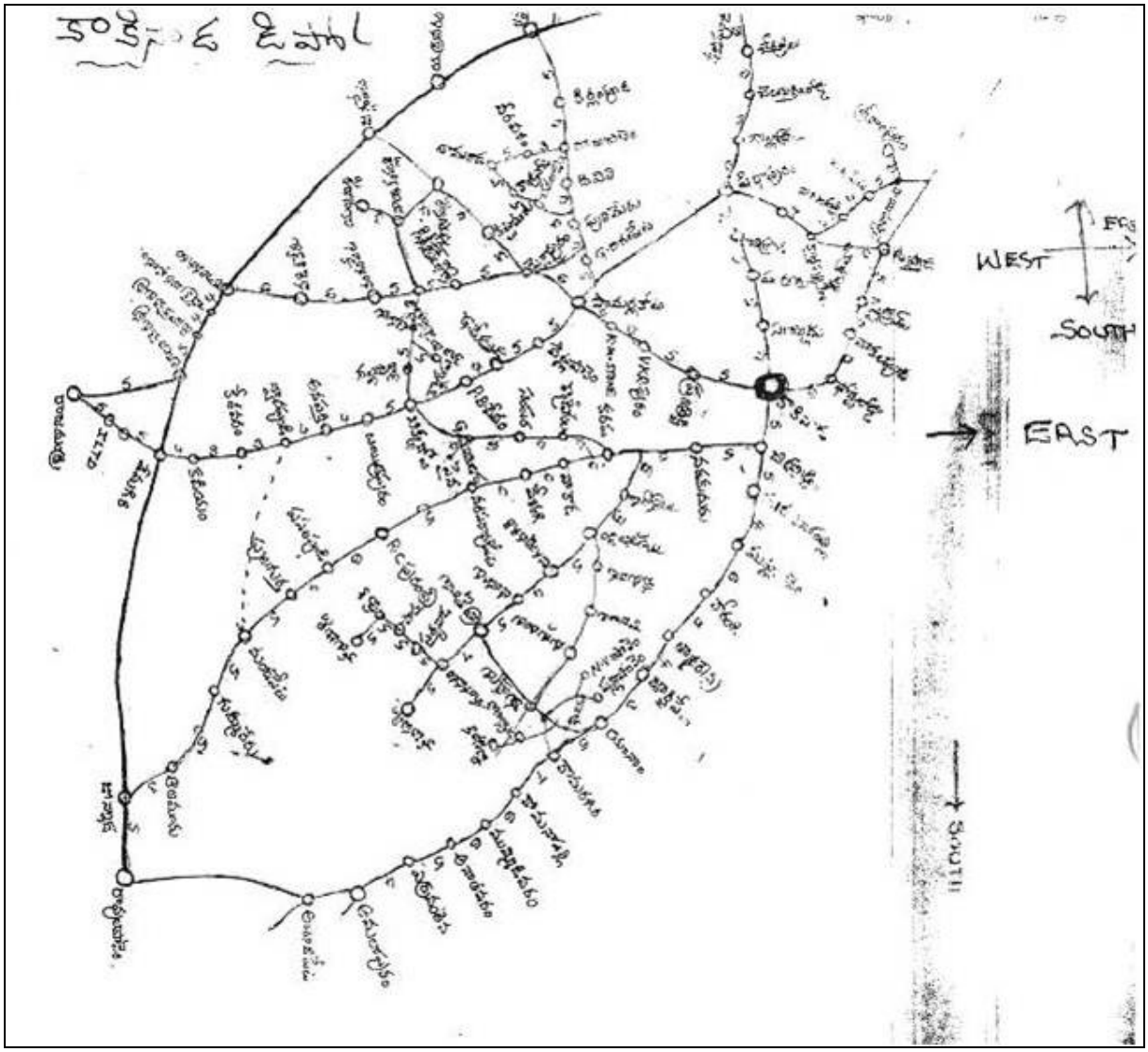


FIGURE 2-16: ROUTE MAP OF APSRTC

2.8.6. INTERMEDIATE PUBLIC TRANSPORT:

Auto rickshaw is the major mode of transport since the city bus services has not been in operation since 1999. This mode is used for both short and long trips in the city. Auto rickshaws constitute of 7-seater and 3-seater versions. The 3-seater auto rickshaws run for shorter trips whereas the 7-seater auto rickshaws run for longer trips within and out of city to the nearby towns. The minimum fare per km is Rs.20 but for shared auto rickshaw it is as low as Rs. 5, depending on the trip length. The number of auto rickshaws have increased 5 fold.

2.8.7. VEHICLE REGISTRATION

The annual growth rate of vehicular REGISTRATION in Kakinada is 10%. Two wheelers constitute higher share in the vehicle composition followed by cars and auto-rickshaws (Figure 2-17 and Figure 2-18).

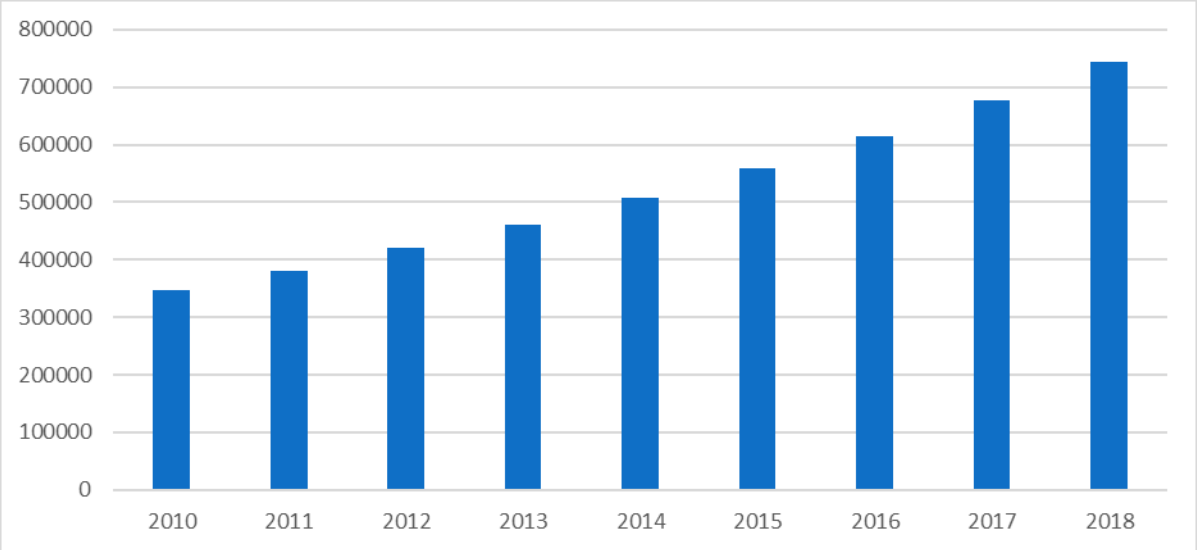


FIGURE 2-17: KAKINADA VEHICLE STRENGTH

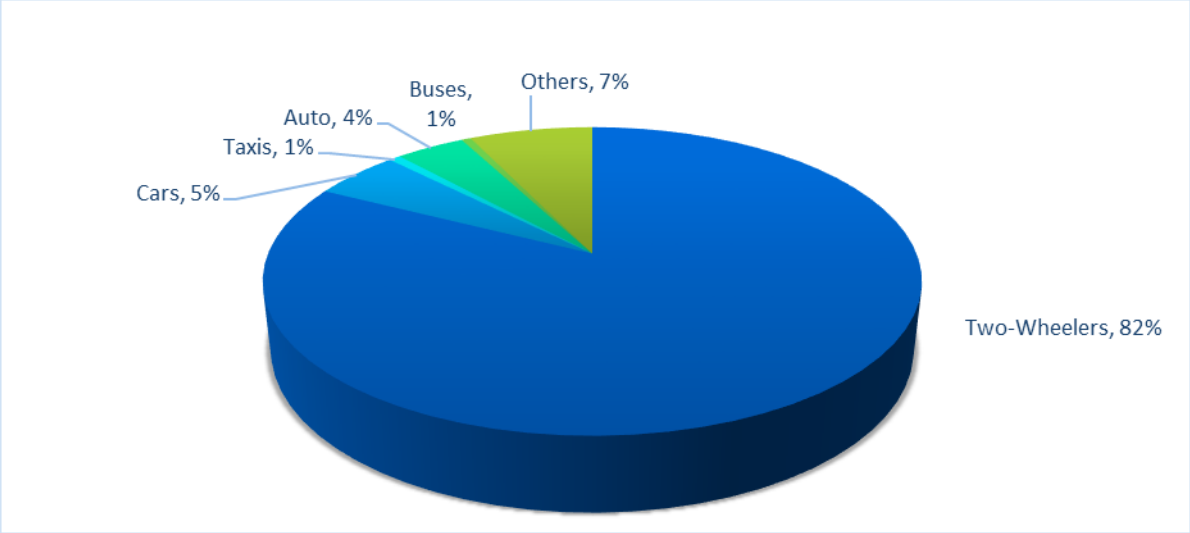


FIGURE 2-18: KAKINADA VEHICLE COMPOSITION

2.8.8. ROAD SAFETY:

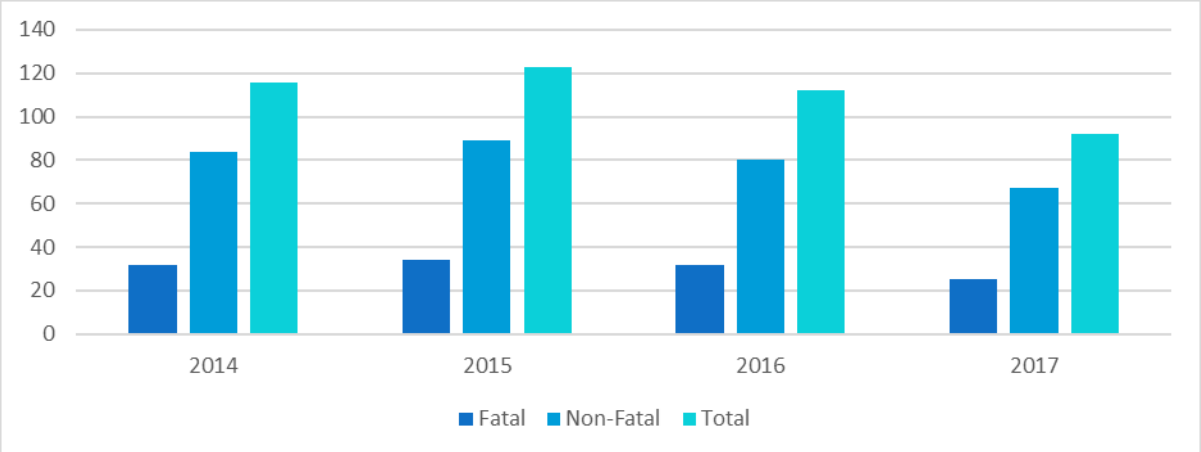


FIGURE 2-19: ACCIDENT DATA

The number of accidents in the city were observed to be decreasing over the last few years owing to the traffic safety measures in the city. Banugudi Junction is observed to be an import black spot within the city.

2.8.9. ENVIRONMENTAL QUALITY

The air quality measure at air pollution monitoring station are as shown in the Table 2-2. It indicates that the PM^{10} value is higher than the permissible levels.

TABLE 2-2: AIR POLLUTION VALUES

Monitoring Station Name	Parameter Name	Current value	Standard
Public	CO	0.6 mg/m3	2 mg/m3
Public	NH3	84 ug/m3	400 ug/m3
Public	NOx	27 ug/m3	80 ug/m3
Public	O3	43.2 ug/m3	100 ug/m3
Public	PM10	113 ug/m3	100 ug/m3
Public	SO2	15 ug/m3	80 ug/m3

TABLE 2-3: INDUSTRY CAAQM STATION (AMBIENT)

Monitoring Station Name	Parameter Name	Current value	Standard
Near_West_Gate	NO	1.88 ug/m3	100 ug/m3
Near_West_Gate	NO2	1.42 ug/m3	100 ug/m3
Near_West_Gate	NOx	4.07 ug/m3	80 ug/m3
Near_West_Gate	PM10	112 ug/m3	100 ug/m3
Near_West_Gate	PM2.5	47 ug/m3	60 ug/m3
Near_West_Gate	SO2	23.05 ug/m3	80 ug/m3

2.8.9.1. OBSERVATIONS

The major observations made through the reconnaissance survey are as follows,

- Lack of pedestrian infrastructure
- Lack of NMT safety measures
- Insufficient or no parking at prime locations in the city.
- Delays in traffic flows especially at Banugudi Junction, Jagannaickpur, Cinema road and Main road.
- Allowance of heavy vehicles in core city disregard to the street sizes.
- Haphazard pick up and drop off of auto rickshaws at junctions disrupting the traffic flow
- Significant share of two-wheeler and auto rickshaws.

3. EXISTING TRAVEL AND TRAFFIC SCENARIO IN KAKINADA

3.1. TRAVEL AND TRAFFIC SURVEYS

As part of the current study for Kakinada town, primary traffic surveys were conducted to analyse in detail the traffic volumes and travel characteristics in the city. In case of Kakinada, the following surveys have been conducted as represented in the Table 3-1.

TABLE 3-1: PRIMARY SURVEYS LIST FOR KAKINADA LCMP

Sl. No.	List of Surveys
1	Road Network Inventory (km)
2	Classified Turning Movement Count Survey - 16hrs
3	Classified Volume Count Surveys (SL) - 16 hrs
4	Classified Volume Count Surveys (OC) - 24 hrs
5	Vehicle Occupancy Survey – 16 hrs
6	On-Street Parking Surveys (Km) - 16hrs
7	Off-Street Parking Surveys - 16 hrs
8	Road Side Passenger - Goods OD Survey (OC) - 24 hrs
9	Speed Delay Survey-Cars (km) GPS Based
10	Terminal Count Survey - 16hrs
11	Terminal OD Survey - 16hrs
12	Bus Stop Boarding Alighting Survey - 16hrs
13	Pedestrian Volume Count Survey - 16hrs
14	Stated Preference Survey
15	IPT Commuter Survey
16	Goods Operator Survey
17	Household Survey
18	Passenger Opinion Survey

In order to analyse the data and ease the data collection the city is delineated in small Traffic Analysis Zones (TAZ). Considering the population and the density of Kakinada the existing 50 wards are considered as the TAZ boundaries. The TAZ boundaries and TAZ list is as show in Table in Annexure II and Figure 3-1.

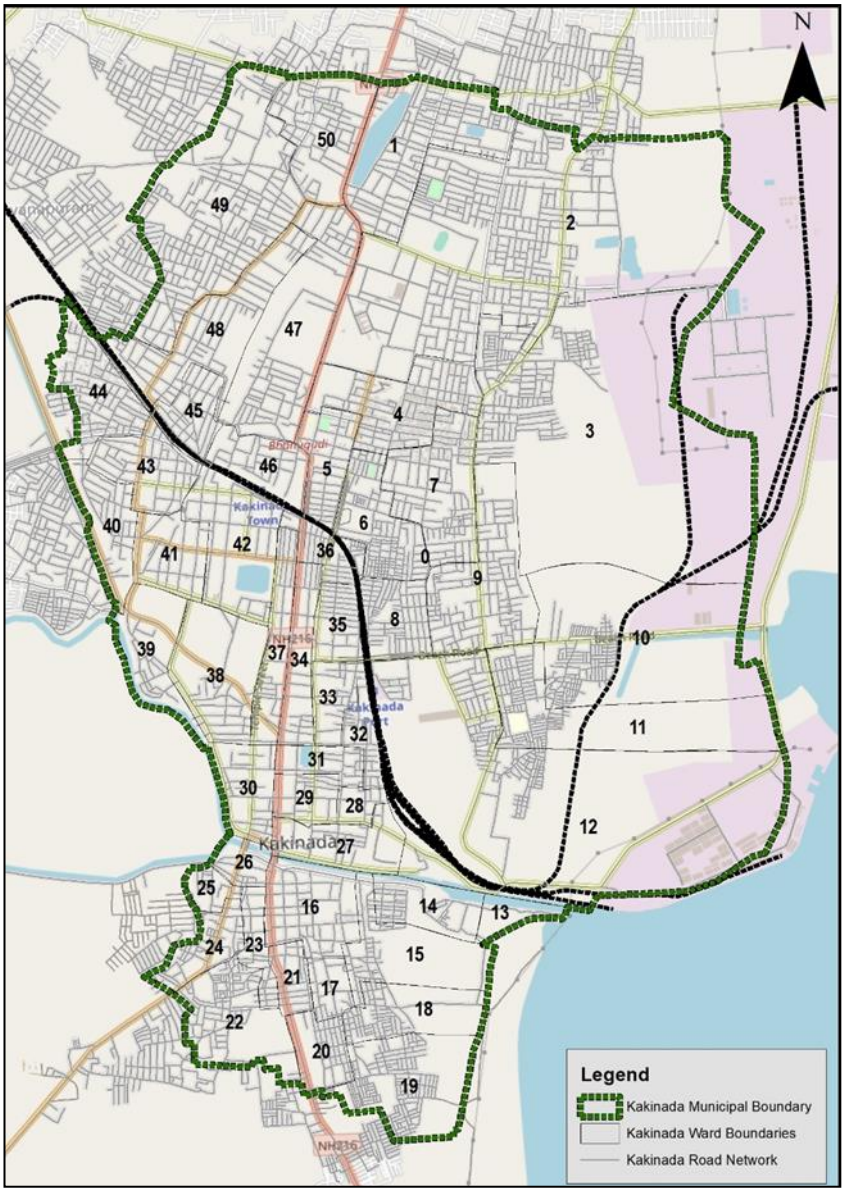


FIGURE 3-1: KAKINADA TRAFFIC ANALYSIS ZONES

3.2. TRAVEL AND TRAFFIC CHARACTERISTICS

The above mentioned surveys were carried out and analysed to assess existing scenario of travel and identify the issues for mobility of people and goods within the study area. The detailed analysis is as discussed in Annexure B. The key inferences from the primary and secondary survey analysis are as follows;

1. Road Network:

a. The road network is gridded in nature in Kakinada with lots of cross roads providing connectivity to the city.

b. 41% of this network has Right of Way (ROW) below 12m and about 38% of the network with ROW varying between 18m to 24m. The Arterial roads are observed to have ROW

ranging from 20m to 24m while the few Sub Arterials such as the Uppada Beach Road have ROW varying between 18m to 24m.

c. A larger share which is about 98% of the surveyed network has well paved road surface, of which 68% is flexible in nature and 30% of the survey network has rigid surface. The surveyed network is largely two-way in nature allowing movement on either directions. The important links with one-way movements are observed along Pantham Padbanam junction to Jammi Chettu Center, Profit Shoe Mart to Ram Prasad Complex.

d. 24% of the survey network is divided while the remaining 76% is undivided. It is observed that the divided lanes are observed on the arterial roads and sub arterial road namely Uppada Beach Road indicating the infrastructure supporting higher speeds for the external movement in the city. Most of the local streets are two laned . It is observed that 81% of the surveyed network is 2 laned in nature.

e. Majority of the roads are having only 2 lanes having 81% share of total length. Remaining are Single Lane, Intermediate Lane (IL) and 4 lane with divided/undivided roads.

f. It is observed that 67% of the surveyed network has shoulder space available to cater the needs of the future traffic and transport demand. 88% of the potential roads which are the sub arterial and collector roads varying between 12m to 24m.

g. Pedestrian Facilities: It has been observed that only 11% of the network has facilities (footpath) to support safe pedestrian movement. While the remaining 89% of the network has no provisions for pedestrian facilities.

h. Non-Motorised Vehicle Facilities: Currently there are no dedicated Non Motor Vehicle facilities (corridors) existing within the study area. Designated bicycle parking is available at the bus and rail terminals.

i. Parking Facilities: The nature of parking in the city is both on street and off street. On street parking is majorly observed at public spaces like bus depots, railway station and certain recreational spaces. It is observed that only 2% of the survey network has on street parking activates.

j. Intersections: There are 68 Junctions in the city, of which only 7 junctions are signalized. Some of the major intersections within the Kakinada are;

    i. Achchampet junction,

    ii. Sarpavaram junction,

iii. Nagamalli Thota junction,
iv. Bhanugudi Junction,
v. YSR junction,
vi. Pantham Padbanam Junction,
vii. Tilak street junction,
viii. Gold Market junction,
ix. Karnam Gari junction,
x. Kanakadurga Temple junction,
xi. Varalapudi junction,
xii. Uppada Beach road junction

2. Speed and Delay

a. The average journey speed along the network is observed to 30.5kmph.
b. The average speed along the arterial roads is observed to be over 25kmph, while along the sub-arterial roads ranges between 20kmph to 80kmph.
c. The speed along the collector and local roads varies between 15kmph to 50kmph.
d. The delays in travel speeds are caused largely due to traffic and delay at intersections due to turning movements.

3. Outer Cordon Volume Counts and Opinion Surveys

a. The outer cordon location OC-5 at Sri Tirumala theatre has highest traffic volume.
b. Two-wheelers contribute to the highest modal share (70.5%) at the surveyed outer cordon locations.

4. **Screen Line Volume Counts**

a. The screen line location SL 6 at Jagannathapuram Bridge has highest traffic volume, since it provides a connectivity to access the busy CBD area, and nearby ferry terminals, fish markets, schools temples etc.
b. Two-wheelers constitute the highest share in modal composition at all the screen line locations.
c. Highest two wheeler occupancy was observed at SL_3 along RD cross street and Subbarao Street, while the highest occupancy of cars, auto rickshaws and buses were observed at SL_6.

5. Average Occupancy

a. The average occupancy of two wheelers is observed to be 1.6.

b. The average occupancy of 3 seater auto rickshaw was observed to be 3.45, while the average occupancy of shared auto rickshaw (7seater) is observed to be 4.66.

6. Traffic Volume Counts

a. Highest traffic volume is observed at Bhanugudi Junction (TMC_4) due is interaction with NH 216, which connects Kakinada with the external cities and towns.

b. Two wheelers contribute to the higher share of traffic composition in the city, followed by auto-rickshaws.

c. Highest share of two wheelers and cars are observed at Bhanugudi junction, the highest share of auto rickshaws are observed at Kakinada register office.

7. Terminal Counts and Passenger Surveys

a. The terminal passenger surveys indicate that RTC Bus Station has the highest share of passenger volume accounting up to 35%, followed by Kakinada town railway station.

b. It is observed that the peak hour for the Bus based transit is between 7pm to 8pm in RTC bus stand, while for old bus stand it is between 2:15pm to 3:15pm and for the rail based transit the peak passenger flow is between 10:00am to 12:45pm.

c. It is observed that majority of the trips are work based trips accounting to 24.5% of the total trips, which is observed to be justified by trip frequency distribution wherein 33% of the trips are made on daily basis and about 39% of them occasionally take bus and rail travel.

d. The access and egress modes of the terminal passengers were analysed and it was observed that auto rickshaws (39.78%) are used as the major mode of last mile connectivity by the terminal passengers.

e. It is observed that the average access and dispersal time of terminal passengers is observed to be around 20 minutes and the average distance accounts to about 5.6km. It is observed that auto rickshaw is used as a prominent mode to access the terminals by passengers travelling from the surrounding villages.

f. The boarding and alighting survey indicates that NTR Bus Stop has the highest number of passengers boarding and alighting amongst all the surveyed locations with 7511 passengers. The only mode of public transport in the city is through Intercity bus services.

g. The only mode of public transport in the city is through Intercity bus services.

h. Over 63.33% of them are willing to pay for the 25% reduction in travel time and cost for a new and improved public transit system.

i. About 46.32% of them are willing to pay even if the waiting time is 0 minutes and if he travel cost and travel time is reduced by 50% with more comfort.

8. IPT Passenger Surveys

a. About 90% of the surveyed IPT passenger trips were observed to be daily trips followed by occasional trip and weekly trips accounting to each 5% of total trips. The average trip distance of daily trips is about 13.5km while the occasional users is about 17.5km. Thus, the work based daily trips are made within a distance of 13kms.

b. 42% of the IPT commuter trips are work based trips, followed by shopping trips.

c. The work based daily trips are made for a distance of 12km indicating a longer travel distance to work.

9. Pedestrian Counts

a. Registrar office Ramaraopeta is observed to have highest footfall amongst all the surveyed locations.

b. The morning peak hour for the pedestrian is observed between 11am to 12am and evening peak between 6:30pm to 7:30pm.

c. It is analysed that Registrar office Ramaraopeta and Bhanugudi Junction requires immediate attention in terms of pedestrian crossing infrastructure facilities such as Zebra crossings.

10. Stated Preference Survey

a. The majority of the trip observed are weekly trips to the nearby towns.

b. 71% of the operation are engaged in Off-street parking of vehicles adjoin their plots.

11. Goods Operator Survey

a. The average unloading time within the city is observed to 2 hours.

b. Petrol/Diesel/Gas contribute to the highest share (33%) in commodity type, followed by Iron Coil and Vegetables/Fruits/Milk.

c. The average number of trips made by the goods vehicle is observed to be 4 trips per month.

12. Household Surveys

a. It observed that, Kakinada has a good share (56%) of younger population aged below 35. The working age group (15 to 64) contribute to about 80% of the total population. The

share of females is higher in age groups between 35 years to 45 years. The sex ratio derived from the house hold survey is 1165. It is observed that number of males are higher than number of females in Kakinada.

b. It is observed that 34% of the population are students, 38% are employed in various sectors and remaining share of population constitute retired, home-makers and unemployed members. The classification based on employment sector indicates that the highest share comprises the agriculture sector with 20% followed by service sector with a share of 18%. The manufacturing sector contributes to 18% while construction/mining constitutes to 15% and retail/whole sale trade constitutes to 11%. This, agriculture and service sectors are the major sectors of employment in the city. The average number of students per household is observed to be 3.

c. The average monthly income as per the Household survey in Kakinada is about INR 14,164. About 74% of households have monthly income below INR 10,000 and 26% of the households earn more than INR 15,000 per month. The average number of earning members per house hold was observed to be 1 (Approx. 1.28). It was also observed that 94% of the households owning a vehicle own two wheelers while only 5% of the households own cars.

d. The classification based on the category of vehicles owned indicates that 60% of the households own only two wheelers, while only 3% of the households own only cars. 31% of the households do not any vehicle while only 0.2% of the population own only cycles.

e. It is observed that only 53.11% of the households have parking spaces available within their building or property premises. The remaining share of households utilize the space around the properties in the form of On-Street Parking.

f. It is observed that only 15% of the households travel below 500m to access their daily household errands while majority of 43% of them want to travel more than 1500m to satisfy their daily needs. 76% of the household travel more than 1km for their educational needs and the medical needs are majorly accessed over a distance of 1.5km. Thus, it is observed the longer trips are made for all shopping, educational and medical needs.

g. Based on the travel dairy information collected as a part of the household survey, the Per Capita Trip Rate (PCTR) for Kakinada was observed to be 1.29, i.e. each person makes 1.29 trips per day.

h. The average waiting time to access the public transport services in 19 minutes. The longest waiting time is observed for Cycle Rickshaw. The average trip length in the Kakinada is observed to be 4.18Km.

i. The accessibility of households to Public Transit (PT) or Intermediate Public Transport (IPT) stops is as assessed in terms of distance and time. The average distance travelled by the house hold to access the near PT or IPT stop is 1.72km which is not a comfortable distance to access the PT or IPT by walk. Similarly, the average time taken to reach the PT or IPT stops in 19.62 minutes.

j. The user opinion survey reflected a considerable performance in terms of reliability of Public Transit services along with the IPT services. Safety is perceived to a major concern in regard to all the public transit modes. The safety aspects of auto rickshaws especially in terms of driving is prioritized to be improved amongst the other modes. Similarly, the fares of cycle rickshaws are perceived to be affordable compared to the bus services and share auto as the nature of bus services is largely sub-urban services.

k. It is observed that majority of the users perceive it somewhat convenient to travel using motorised modes in the city while a considerably larger share perceive the need to improve the travel conditions for the pedestrians in the city.

13. On Street Parking Number Plate Surveys

a. When the parking accumulation and demand was compared with the on street parking, it is observed that the demand at on street parking locations was higher than the supply. The reasons identified for the same were,

    i. Lack of distribution of off street parking spaces in the city.

    ii. Availability of free supply of on street parking spaces.

14. Passenger Opinion Survey

a. The survey analysis indicates the need for improved traffic and travel management along with strategies to refrain increasing the usage of private modes over the public transit modes.

b. The majority of the responders are inclined towards indirect funding such as vehicle costs and registration charges, high compounding fee or high penalty for the traffic violators to promote travel and traffic fund.

c. 10% of the users perceive the overall experience of road traffic conditions reasonably good, while 30% of the users perceive it somewhat congested.

d. 65% of the users desired improved footpaths and cycle tracks to enhance the quality of Non-Motorised Transport travel experience.

3.3. SERVICE LEVEL BENCHMARKING

Benchmarking is a tool used by public agencies to make more informed decisions regarding the performance, make comparisons internally and with other organizations and continuously improve performance using the lessons learned through this comparison process. Benchmarking allows public agencies to direct limited resources to the program. 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.

3.3.1. Need for Benchmarking

The National Urban Transport policy (NUTP) 2006 highlights the crucial link between transport demand and land use planning and the need to develop an integrated mobility plan for each city. Accordingly, each city should develop comprehensive mobility plan during the 12th five year plan with focus on accessibility, mobility and traffic flow (in that order). Rather than the present approach of "predict and provide" it has to be "Planning for the desirables". Urban agencies in India currently do not have any system for measuring performance of urban transport activities, assessing impacts of projects and taking further action on them. The service level benchmarks (SLB) issued by MOUD specify parameters to measure the effectiveness of existing land use-transport planning in Kakinada and set benchmarks for achieving the same.

3.3.2. Need for Benchmarking

The SLBs describe the levels of transport performance like safety and access, pollution, accidents, congestion etc. in the study area. The parameters identified by the Ministry of Urban Development (MoUD) are as follows:

i. Public transport facilities
ii. Pedestrian infrastructure facilities
iii. Non Motorized Transport (NMT)facilities
iv. Level of usage of Intelligent Transport System (ITS) facilities
v. Travel speed (Motorized and Mass Transit) along major corridors
vi. Availability of parking spaces
vii. Road safety
viii. Pollution levels

ix. Integrated land use transport system

3.3.3. Computation of Indices

The consolidated benchmarking of the existing scenario of the study area is as represented in the Table 3-2. The level of service (LOS) is given on the scale of 4 wherein 1 indicates "Good to be Maintain" and 4 indicates "Needs immediate improvement".

TABLE 3-2: OVERALL LOS CALCULATED FOR STUDY AREA

S. No	Bench Mark	Overall LOS	Inference As Per MOUD Guidelines
1	Public Transport Facilities	4	The city has no dedicated city based public transport system which needs to planned and improvements in terms of supply of buses/coaches and coverage as most part of the city is not served by the existing telugu velugu buses.
2	Pedestrian infrastructure facilities	4	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 lacks adequate NMT facilities.
4	Level of usage of Intelligent Transport System(ITS) Facilities	4	The city lacks adequate ITS facilities.
5	Travel speed (Motorized and Mass transit)	2	The city 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	4	The city 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	3	Level of pollution in a city is very low, the quality can be adopted by encouraging and introduction the usage of public modes rather than the private modes.
9	Integrated land use Transport system	3	Faint coherence between study area structure and public transport system.

4. ENVISIONING KAKINADA

Low Carbon Mobility Plan is a long term vision for the development of transport in Kakinada and ideally should follow or guide the land-use planning for the region. The Transport Plan seeks to develop a most optimal transport road map keeping in view the National Urban Transport Policy which strongly suggests that if transport has to be sustainable, a radical shift must be made towards public transport supply and non-motorized transport modes.

The goals and objectives set for the transportation needs of Kakinada can be achieved by formulating a series of strategies as per NUTP guidelines. Each of the strategies will be evaluated to see their suitability and applicability for Kakinada.

4.1. VISION

As stated earlier, the LCMP is a long term vision for desirable accessibility and mobility pattern for people and goods in Kakinada. The four major elements identified to outline the city's vision are:

- **Sustainability**: The transportation system of the City shall be conducive to lower consumption of fossil fuels. It shall be based on managing the travel demand itself, rather than trying to provide for whatever demand exists and allowing demand to grow in an unplanned way.
- **Equity**: Transportation in the City shall be accessible to all demographic sections of society. The City shall provide "Mobility for all", meaning any person above a certain age should be able to travel independently. Special attention shall be paid to school students, senior citizens, people from financially weaker sections, women - especially pregnant women, physically challenged persons.
- **Convenience**: Not only residents of the City, but also visitors should also be able to figure their way around the city very easily.
- **Safety**: Rates of fatal and serious traffic accidents should be at par with the best in the world. The City shall have low rates of respiratory issues, spine injuries and other such ailments related to traffic.

Based on above outlined elements the vision of Low Carbon Mobility Plan for Kakinada is defined as:

"To attain a People Centric Urban Transport System with an integrated, efficient, liveable and sustainable transport system by providing safe and convenient mobility to people of all abilities and goods"

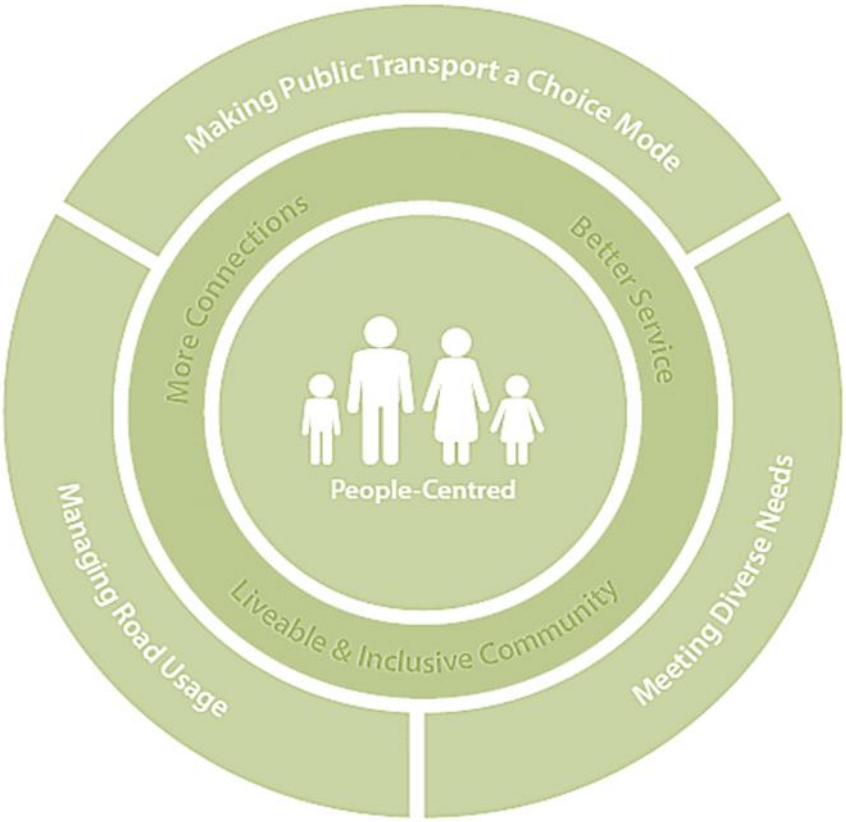


FIGURE 4-1: **PEOPLE CENTRIC VISION AS ENVISAGED FOR KAKINADA**

Based on the vision, various goals have been targeted for the horizon year under certain scenarios. A Master Plan was prepared for Kakinada was prepared for the year 2031 considering the future developments. Hence, for the purpose of study, Master Plan was considered along with consultations to assess future development directions and required transport network. Based on which 2 scenarios for horizon years were established on land use and sustainable transportation strategies, which are as follows:

1. Business As Usual (BAU) Scenario
2. Sustainable Urban Transport (SUT) Scenario

Table 4-1 shows the goals set to be achieved in the horizon year by implementing all the proposals recommended in this study.

TABLE 4-1 ENVISAGED GOALS

Name of the Impact	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038) – Target
Non-Motorised Trips	12.4%	3.72%	>20%
Private Transport (PVT) Trips	37.7%	39.76%	<35%
IPT Transport Trips	30.8%	32.31%	<25%
Public Transport Trips	19.1%	24.02%	>25%
Avg. Network Speed (kmph)	22	18	>22
% of city covered with Footpaths (Arterial and Sub-Arterial)	11%	11%	100%
% of city covered with Cycle Tracks (Arterial and Sub-Arterial)	0%	0%	>50%
Local Emissions (Tonnes/day)	7.6	10.5	Reduce by 50%
GHG Emissions (Tonnes/day)	214	491	Reduce by 50%
Vehicle-km travelled in Thousands	613	933	Reduce by 30%

Each goal can be achieved by meeting the following objectives:

- Improve the public transport system by provision of dedicated lanes/ROW and good quality of service.
- Improve the Public Transport (PT) accessibility by densification along major public transport corridors and integration with feeder services. This reduces the need for travel to daily needs and increase the usage of sustainable modes.
- Ensure safety and mobility of Pedestrians and cyclists by designing streets and areas that make a more desirable, livable city for residents and visitors and support the public transport system.
- Encourage low carbon emission modes by providing Public Bicycle Sharing schemes and disincentive and taxation for highly polluted private vehicles.
- Develop a Parking Policy that reduces the demand for parking and need for private mode of transport and also facilitate organized parking for various types of vehicles.

4.2. FUTURE PROJECTIONS

The population and employments projections for horizon year for various scenarios are derived on the basis of proposed land use from the Master Plan, assessing the current growth pattern of the city and location of the further growth centres. The same is discussed in succeeding sections.

4.2.1. LANDUSE

The proposed land use plan for Kakinada and its 5 Kms Vicinity as per the Draft Master Plan for 2035 is represented in the Table 4-2. The land use under transportation is marginally below URDPFI

guidelines is more than adequate. The growth pattern of the city is largely envisaged towards the North, West and South of the city as represented in the Figure 4-2. Based on this the land use structure for the BAU and SUT scenarios have been developed.

TABLE 4-2 LAND USE BY CATEGORIES

Category	URDPFI Guidelines	Proposed (2031)[1]
Residential	36-38%	39.49%
Commercial	5-6%	7.50%
Industrial	7-8%	3.73%
Public & Semi Public	10-12%	16.08%
Recreational	14-16%	3.85%
Transportation	12-14%	20.84%

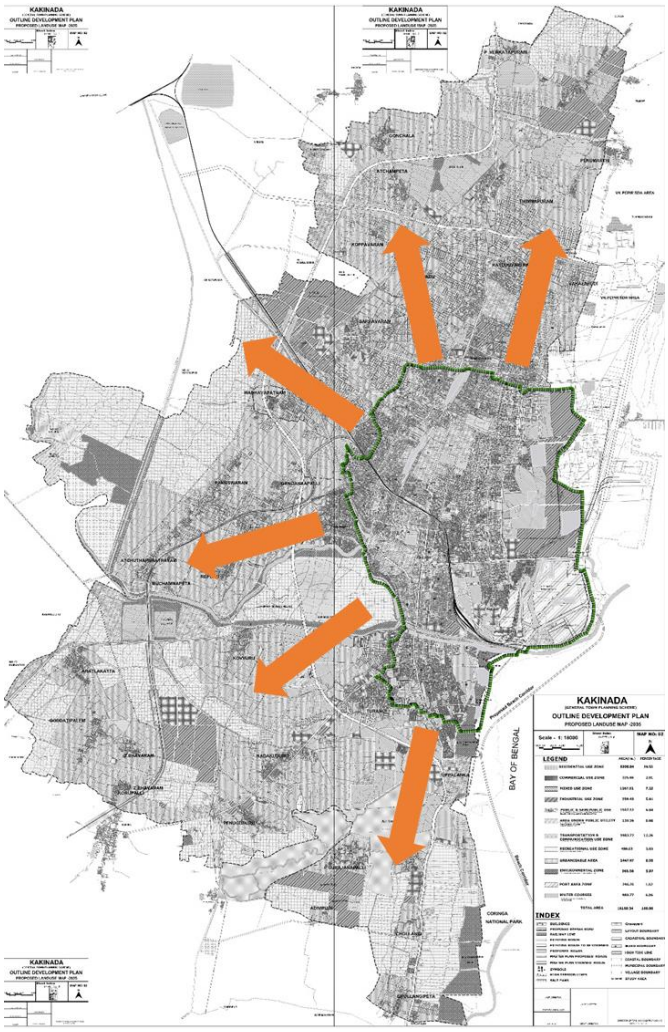


FIGURE 4-2: LAND USE WITHIN KMC AND GROWTH PATTERN

[1] Extracted for the Developed Area from the Master Plan for the Kakinada Municipal Corporation and its 5 Kms Vicinity for 2035

4.3.1.1. BUSINESS AS USUAL (BAU) SCENARIO

The Business as Usual 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 mitigations. According to the proposed draft development plan, higher growth is expected towards north and North west i.e. towards Pithapuram and Samarlakota along NH 216 and bypass road i.e ADB Road, whereas Medium Growth is expected towards South and South West direction i.e towards Karappa and Chollangi. Thus, similar land use and growth structure is adopted in BAU scenario.

4.3.1.2. SUSTAINABLE URBAN TRANSPORT (SUT) SCENARIO

As per Ministry of Urban Development guidelines and RFP, a sustainable scenario has to be considered to reduce congestion and pollution, while conserving resources like urban space and capital expenditure. Hence, a scenario has been developed that achieves the goals stated in the earlier chapter in line with LCMP vision. The Sustainable Urban Transport scenario considerers the outputs of BAU scenario and secondary reports while prioritizes interventions based on Transit Oriented Development along mobility corridors, Development of Public transit corridors, Augmentation of buses, Network Development (i.e. missing links, Hierarchy road system, part of public transit corridor).

Thus, in SUT scenario, mixed land use development is considered along identified mobility corridors. Additional population and employment will be achieved by densification (i.e. allowing higher FSI) along the mobility corridors which is termed as Transit Oriented Development (TOD). Corridors considered for transit-oriented development are as discussed under Section 5.1.2.

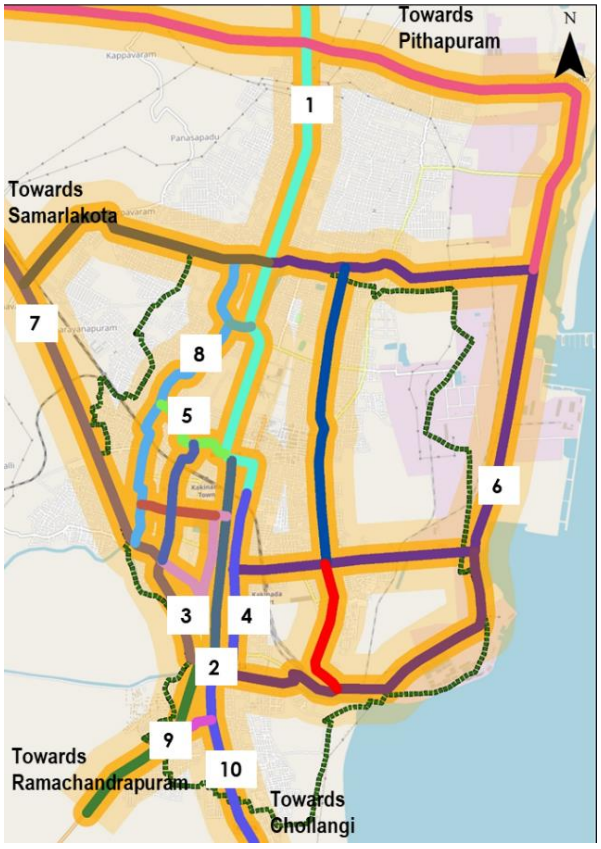


FIGURE 4-3: MOBILITY CORRIDORS FOR DENSIFICATION

4.2.2. POPULATION AND EMPLOYMENT PROJECTIONS

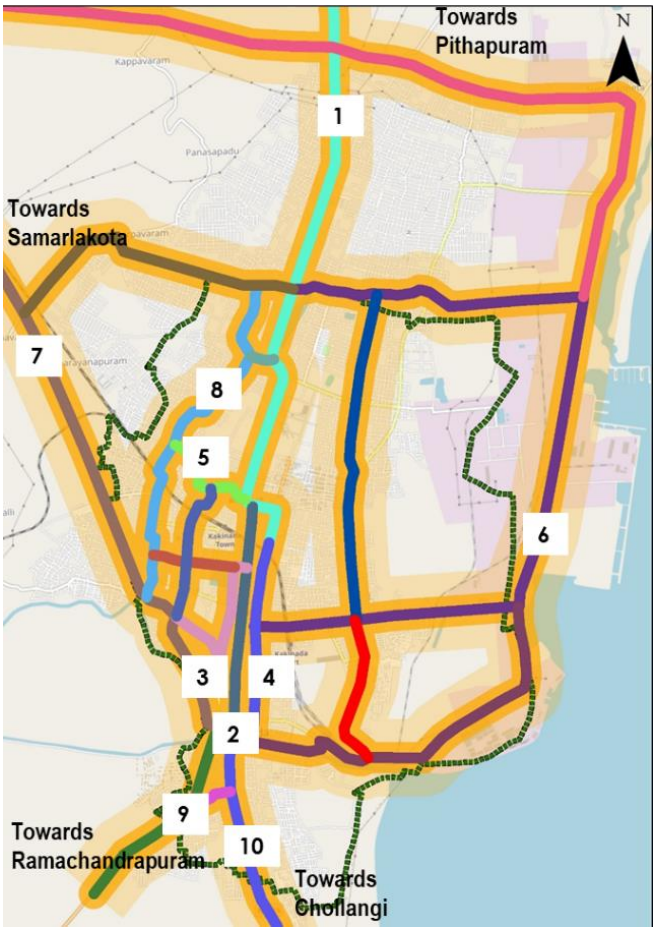
4.3.2.1. POPULATION PROJECTIONS

According to the census the population since 2001 to 2011 is increased at growth of around 9.09 %. 1991 to 2001 the actual population was increased from 2,33,717 to 3,42,973. The population projection methods namely, arithmetic progression, geometric progression and incremental increase method have been consider to forecast the future population. After examining the available methods for projecting the population in Kakinada and considering the present stature of KMC, future developments, the Incremental Increase Method has been taken into consideration. The details of Population projection which is represented in Table 4-3.

TABLE 4-3 POPULATION PROJECTIONS[2]

Year	Incremental Increase Method
2011	3,25,985
2018	3,53,159
2028	3,93,124
2038	4,34,438

The land along the identified mobility corridor has potential to be developed as Transit Oriented Development and is also considered for population projections in SUT scenario, while the population and employment for the entire study area is considered same as in BAU scenario.



[2] Source: Census of India and UMTC Projections

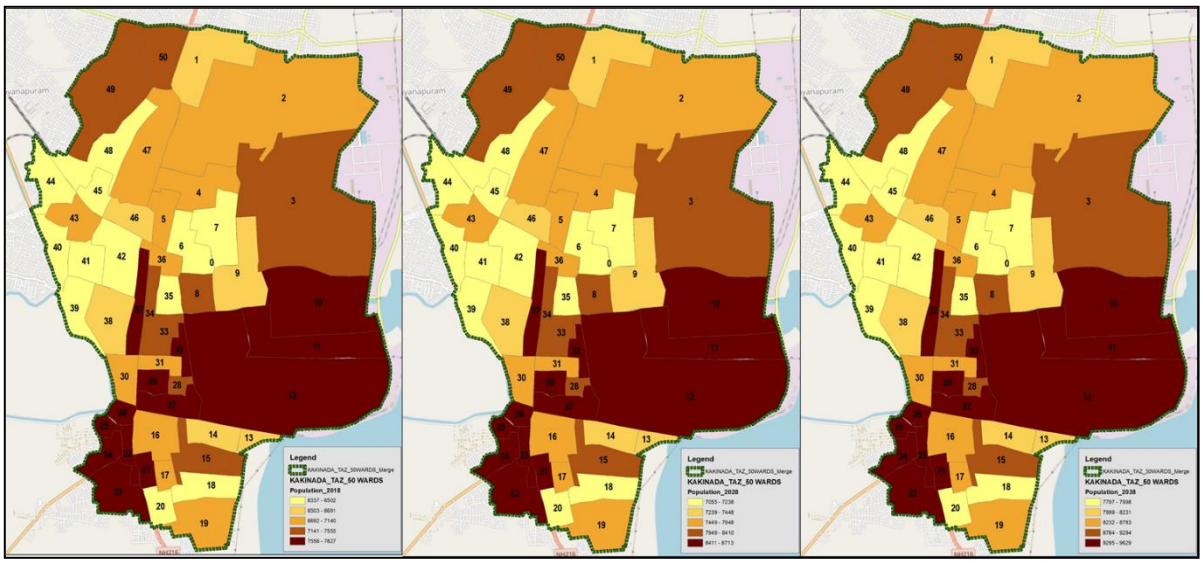


FIGURE 4-4: POPULATION PROJECTIONS FOR 2018, 2028, 2038

4.3.2.2. EMPLOYMENT PROJECTIONS

The economy of the city depends mainly on agriculture, fishing and industrial sectors. Paddy and Coconut are agro products from the city. The majority of the industrial sector is covered edible oil refineries, fertilizers and natural gas. Kakinada is a home to two ports namely, an Anchorage port and a Deep Water port (which is the second largest in the state after Vishakhapatnam port). Kakinada's principal exports include seafood (Prawns, Shrimp, and Fish) and related products, agricultural products (including rice and corn, oil meals, processed food products, chemicals, iron ore, bauxite powder and biofuel). About 35 IT companies are operating in Kakinada. There are several power plants in and around Kakinada. Kakinada is the base for Oil and Natural Gas Corporation's Eastern Offshore Asset. Several Oil companies use Kakinada for oil and gasoline shipments. The Krishna Godavari Basin is considered the largest natural gas basin in India. The Master Plan supports the growth of these sectors. Taking into consideration the proposals to strength the economic growth and accessing the current growth patterns the employment was forecasted which is as shown in Table 4-4.

TABLE 4-4 POPULATION AND EMPLOYMENT FOR HORIZON YEARS (2016-2036)[3]

Year	Population	Employment
2011	3,25,985	1,20,182
2018	3,53,159	1,26,923
2028	3,93,124	1,33,783
2038	4,34,438	1,47,843

[3] Source: Census of India and UMTC Projections

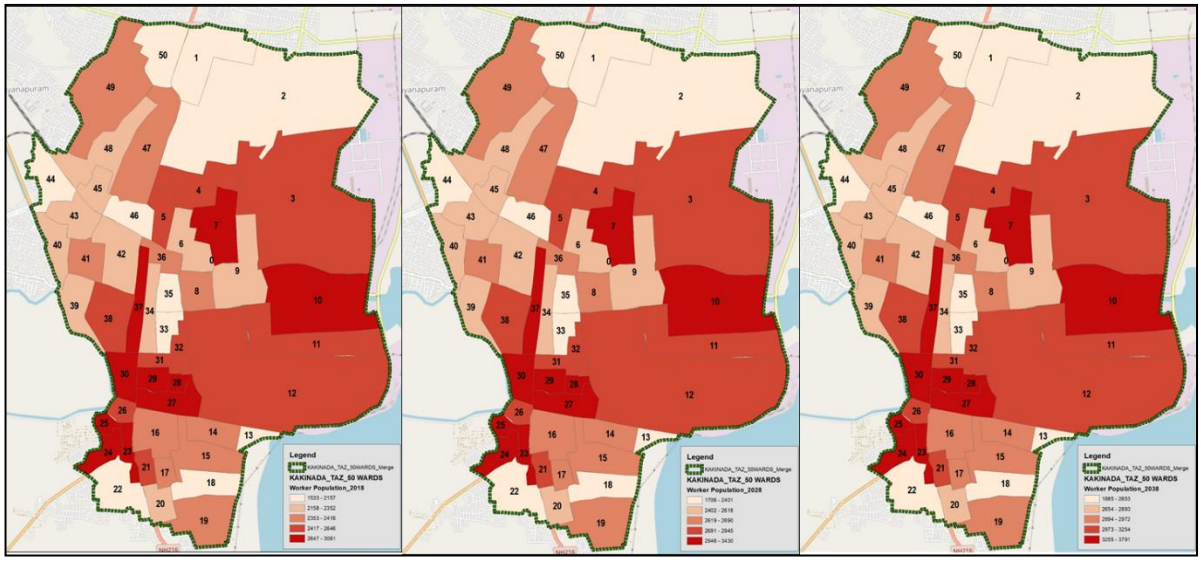


FIGURE 4-5: WORKER POPULATION PROJECTIONS FOR 2018, 2028, 2038

4.3. TRAVEL DEMAND CHARACTERISTICS

Based on the various traffic surveys conducted the intercity travel demand and its characteristics were assessed. Using the zonal expansion factors, O-D trip matrices have been generated for the intra-city and inter-city trips by mode using the data source as presented in

TABLE 4-5 DATA SOURCES FOR GENERATION OF O-D PERSON TRIP MATRICES

Intra/Intercity Trips	Category	Data Source
Intra-city Trips	Home based trips	HIS
	Non-home based trips	HIS (Supplemented by O-D surveys at terminals)
Inter-city Trips	Internal – External	Outer Cordon O-D surveys (Supplemented by HIS and O-D surveys at Terminals)
	External – Internal	Outer Cordon O-D surveys (Supplemented by HIS and O-D surveys at Terminals)
	External – External	Outer Cordon O-D surveys

The trips obtained were validated with the outer cordon and screen line counts. Table 4-6 summarizes the trips obtained from the matrices.

TABLE 4-6 SUMMARY OF BASE YEAR PASSENGER TRIPS

MODE	I-I	I-E & E-I	E-E	Total
2W	74%	13%	13%	100%
Car	49%	26%	24%	100%
IPT	83%	5%	11%	100%
PT	75%	24%	2%	100%
NMV	100%	0%	0%	100%
Walk	100%	0%	0%	100%

TABLE 4-7 SUMMARY OF BASE YEAR PASSENGER TRIPS

MODE	I-I	I-E & E-I	E-E
2W	34%	38%	49%
Car	4%	13%	15%
IPT	31%	12%	34%
PT	19%	38%	3%
NMV	6%	0%	0%
Walk	7%	0%	0%
Total	100%	100%	100%

The trip interactions of various modes were assessed based on the intercity and intra-city movements.

4.4. COMPARISION OF SCENARIOS

The master plan was considered to assess future development directions and required transport network. Considering the various transportation improvements at two scenarios for horizon year were modelled. They are:

1. Business As Usual (Current Scenario+ Committed Projects) Scenario
2. Sustainable (BAU + Proposed Projects + Transit Oriented Development) Scenario

The BAU scenario extrapolates existing trends and assumes no radical policy interventions for sustainable development and emission mitigations. Future transport demand is based on the preferences of different socio- economic groups in the base year. In terms of passenger transport, the BAU Scenario predicts increased car ownership and higher demand for motorization.

While in the Sustainable Urban Transport scenario, following interventions have been prioritized and considered based on the outputs of BAU and secondary reports. These proposals have been evaluated in the calibrated travel demand model.

- Transit Oriented Development along mobility corridors
- Augmentation of buses
- Development of Public transit corridors
- Completion of inner ring road and outer ring road (Network Completion)
- Development of other roads that have been identified based on specific purpose (i.e. missing links, Hierarchy road system, part of public transit corridor)

The assessed outputs for each of the scenarios are discussed under the following heads,

1. Network Characteristics
2. V/C Ratio and PT PHPDT
3. Public Transit Ridership for Improved System

4.4.1. NETWORK CHARACTERISTICS

A comparison of traffic and travel characteristics in Business As Usual Scenario and Sustainable Urban Transport Scenario is presented in Table 4-8.

TABLE 4-8: SUMMARY OF BASE YEAR PASSENGER TRIPS

Network Characteristics	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Walk	6.7%	2.02%	13.2%
Car	3.8%	2.17%	8.1%
Two wheeler	34.0%	37.59%	13.5%
Auto Rickshaw	30.8%	32.31%	22.2%
Public Transport	19.1%	24.20%	35.5%
NMV (Cycle +Cycle Rickshaw)	5.6%	1.70%	7.5%
Avg. Network Speed (kmph)	22	18	26
Avg. Volume-Capacity (V/C) Ratio	0.69	1.13	0.97

It is observed that the share of Public Transport in Sustainable Urban Transport scenario has increased 1.5 times when compared to Business as Usual Scenario. Also, average V/C ratio has reduced by 15% and average network speed has increased by 15% in Sustainable scenario. Sustainable scenario is selected for proposing various transport improvement proposals.

4.4.2. V/C RATIO AND PT PHPDT

V/C ratios along with PT PHPDT on major roads for horizon year 2038 is compiled and presented in Table 4-9.

TABLE 4-9: V/C AND PT PHPDT ON MAJOR ROADS FOR HORIZON YEAR 2038

S.No	ROAD NAME	V/C			PHPDT		
		BAU	SUT	% Change	BAU	SUT	% Change
1	Pithapuram-Kakinada Rd	0.72	0.62	16.1%	594	2511	76.3%
2	IBP Auto Service	0.92	0.8	15.0%	2907	4191	30.6%
3	Kakinada	0.9	0.78	15.4%	875	1262	30.6%
4	Uppalanka NH_24	1.04	0.9	15.6%	3376	4867	30.6%
5	Sri Tirumala Theatre	3.89	3.36	15.8%	281	4786	94.1%
6	Kothapeta Fish Market	1.16	1	16.0%	1125	4956	77.3%
7	Commercial Tax	1.43	1.24	15.3%	2063	2974	30.6%
8	Jagannathapuram Bridge	1.75	1.51	15.9%	1719	7385	76.7%
9	ESI Hospital	2.54	2.19	16.0%	969	4382	77.9%
10	Near Kotiah Sweets	2.79	2.41	15.8%	1125	1622	30.6%
11	NH 214 towards two town police station	1.07	0.92	16.3%	652	3635	82.1%
12	Towards Railway Station	0.26	0.22	18.2%	5	7	30.6%
13	NH 214 towards JNTU Engineering College	2.63	2.27	15.9%	277	2581	89.3%
14	NH214 towards Kondayya Palem Road	0.33	0.28	17.9%	110	980	88.7%
15	Government Hospital Road towards	0.56	0.48	16.7%	1043	1504	30.6%

S.No	ROAD NAME	V/C			PHPDT		
		BAU	SUT	% Change	BAU	SUT	% Change
	Balaji Cheruvu Center						
16	Wharf Road	0.21	0.18	16.7%	351	506	30.6%
17	Wharf Road towards Rama Rao Peta	1.04	0.9	15.6%	1157	1668	30.6%
18	Zilla Praja Parishad Office Towards Surya Rao Peta	0.41	0.35	17.1%	1553	2239	30.6%
19	Nukkalamma temple street towards Gandhi Nagar	0.8	0.69	15.9%	54	77	30.6%
20	Nageshwar Rao Street towards Pattabhi Street	1.33	1.15	15.7%	1783	3766	52.7%
21	Nukkalamma temple street towards 2 Town Police Station	0.27	0.23	17.4%	26	262	90.2%
22	Nageshwar Rao Street via Ramarao Peta Junction	0.66	0.57	15.8%	153	656	76.6%
23	Dairy farm Road Towrds Kalpana Center	0.62	0.54	14.8%	92	621	85.1%
24	Dairy Farm Road towards ESI Hospital	0.61	0.53	15.1%	44	538	91.9%
25	Dairy Farm Road towrds Punnai Tower	0.58	0.5	16.0%	49	70	30.6%
26	Towards Revenue Colony	0.94	0.82	14.6%	53	77	30.6%

The V/C ratio on major roads has reduced by 15% in SUT scenario compared to BAU. PT PHPDT on major roads has increased by 1.7 times in SUT scenario compared to BAU.

4.4.3. RIDERSHIP FOR IMPROVED PUBLIC TRANSIT SYSTEM

The PHPDT of the public transport corridors were arrived at using the travel demand and has been summarized in Table 4-10. Based on traffic pattern of the city and ridership evaluation, the below listed corridors are eligible for exclusive PT lanes. However, a feasibility study is required to evaluate these corridors for various options.

TABLE 4-10: PHPDT FOR PUBLIC TRANSPORT FOR THE BASE YEAR (2018) AND HORIZON YEAR (2038)

S.No.	ROAD NAME	PHPDT			Improved System PHPDT
		Base (2018)	BAU (2038)	SUT (2038)	
1	RTC to Pithapuram	385	690	2521	1199
2	RTC to Chollangi Peta	536	959	4478	1991
3	RTC Bus Stop to Coromandel Fertilizers via Dairy Farm Road, Ramanayapeta and Vakalapudi Road	287	514	2002	934
4	RTC Bus Stop to Samarlakota	473	846	2725	1348
5	RTC Bus Stop to Sarpavaram,via Income Tax Colony, Kacheripeta	414	740	1970	1041

The major public transport mobility corridors identified are as represented in the Table 4-11.

TABLE 4-11: MAJOR PT MOBILITY CORRIDORS IN KAKINADA

S.No.	ROAD NAME	BASE (2018)	BAU (2038)	SUT (2038)
1	Pithapuram_Kakinada Rd	332	594	2511
2	Nukkalamma temple street towards Gandhi Nagar	30	54	77
3	NH214 towards two town police station	364	652	3635
4	Kakinada	489	875	1262
5	Towards Revenu Colony	30	53	77
6	Wharf Road towards Rama Rao Peta	647	1157	1668
7	IBP Auto Service	1625	2907	4191
8	Sri Tirumala Theatre	157	281	4786
9	Kothapeta Fish Market	629	1125	4956
10	ESI Hospital	542	969	4382
11	R K Plaza Complex	280	500	721
12	Near Kotiah Sweets	629	1125	1622
13	NH214 towards JNTU Engineering College	155	277	2581
14	Nageshwar Rao Street towards Pattabhi Street	996	1783	3766
15	Jagannathapuram Bridge	961	1719	7385
16	Commercial Tax	1153	2063	2974

5. URBAN MOBILITY PLAN

The mobility goals for Kakinada 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 Kakinada

1. Land Use and Transport Strategy
2. Public Transit Improvement Strategy
3. Road Network Development Strategy
4. Non-Motorized Transport Strategy
5. Freight Management Strategy
6. Traffic Engineering and Traffic Management Strategy
7. Travel Demand Management Strategy
8. Technological Strategy

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 LCMP. The sections below discuss these strategies.

5.1. 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/ cyclable neighbourhoods

The land use transport strategies adopted for Kakinada are as follows;

1. Multi- Nodal Transit Network
2. Transit Oriented Development

5.1.1. NETWORK STRUCTURE-MULTI NODAL TRANSIT CONCEPT

The urban form and its spatial structure are articulated by two structural elements, Nodes and Linkages.

5.1.1.1. NODES

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. Terminals, such as bus stations, rail yards, and airports, are important nodes around which activities agglomerate at the local or regional level. 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.

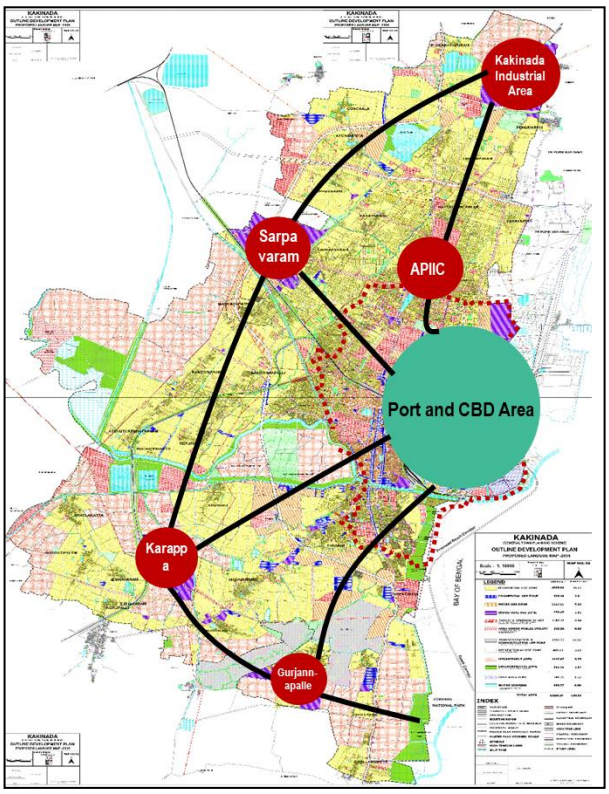


FIGURE 5-1: ACTIVITY/ECONOMIC NODES IN KAKINADA

The spread of activities in Kakinada shows a multi-nodal model of development. Major Economic Nodes in Kakinada are,

The commercial area of the city mainly lies within the core area of the city. It includes the Main road, Cinema Road and Temple Street, wherein the major institution JNTU is also located. The recent developments are observed along the Nukkalamma Temple Road, Dairy Farm Road, Mohammad Ali Street and Military Road.

-The industrial zone is mainly located towards the East of the City, wherein two ports are located (Anchorage Port and Deep Water Port). Kakinada Industrial Area is located on the North of the City,

whereas the IT and ITES facilities are located on the North Western part of the city near Sarpavaram. Gurjanapalle and Karappa are recommended to be developed as Industrial Areas as per the Draft Master Plan 2035 for Kakinada.

The incomplete ring radial road network of the city ensures linkage of these nodes with minor ones. The National highway 214 is the major spine strengthen the movement along the nodes. The Figure 5-3 represents the distribution of activity nodes in and around the city.

5.1.1.2. LINKAGES

Various transit network concepts are developed world wide 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 and a hybrid concept is a combination of dispersed (Multi nodal) and compact development. The Figure 5-2represents the conceptual mobility corridor patterns.

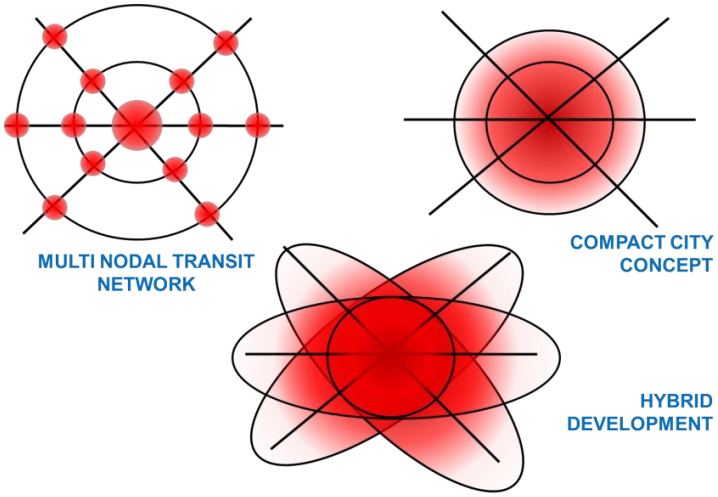
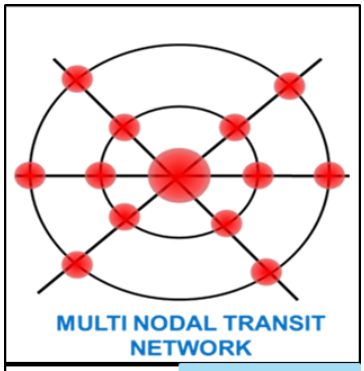
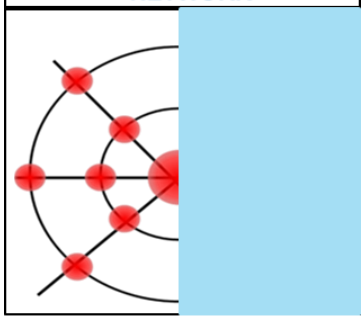


FIGURE 5-2: MOBILITY CORRIDOR PATTERNS CONCEPT

Kakinada already has a multi nuclei city with different nodes around the city. The transport infrastructure in the smaller nodes should substantiate the land use development and should complement the development. Kakinada Core area is the major node in the city. Kakinada Anchorage and Deep Sea Port, Bhanugudi Junction, Kakinada Industrial Area, APIIC, Sarpavaram, Karappa, and Gurujannapalle are the minor nodes developing around Kakinada. In order to decongest the core city 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. The LCMP has proposed the development of sub-city centres at the areas where different transport modes intersect with each other (Figure 5-3).





Semi Radial Multi Nodal Transit Network for Kakinada

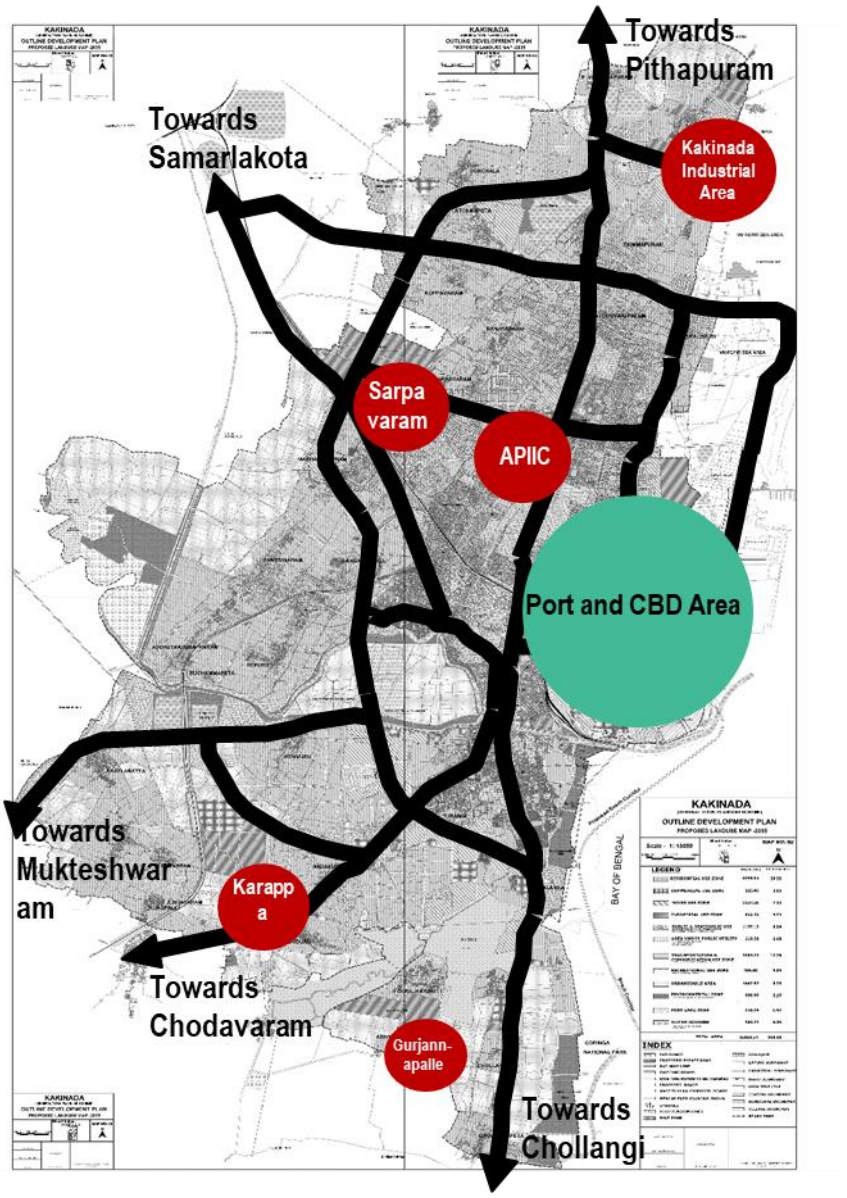


FIGURE 5-3: KAKINADA MULTI NODAL TRANSIT NETWORK CONCEPT

Thus, the ideal network pattern for Kakinada is Semi Radial Multi Nodal Transit Network. The city network structure is radial with incomplete rings. The development of a ring-radial road network will enhance the current semi radial growth of the city as envisioned in the Master Plan. The core area can be the main city center. The sub centers can be divided based on the proximity to the main city center, i.e within immediate proximity (along inner ring road), medium proximity (between IRR and ORR) and Low proximity (along outer ring road).

TABLE 5-1: PROXIMITY OF CORE AND SUB-CENTRES

Core Area (Within Inner ring road)	Immediate Proximity (Along Inner ring road)	Medium Proximity (b/w IRR and ORR)	Low Proximity (Along Outer Ring Road)
Kakinada Port, Revenue Colony, Pallamraju Nagar, Venkat Nagar, Sasikanth Nagar, Ramanayapeta	Sarpavaram, Vidhyut Nagar, Pratap Nagar, Jagannaickpur, Yetimoga	Vakalapudi, Penumarthi, Panasapadu, Koppavaram, Atchutapuratrayam, Kovvuru Nadakuduru,	Chollangi, Gurujanapalle, Karappa, Samarlakota, Kapavaram, Nemam,

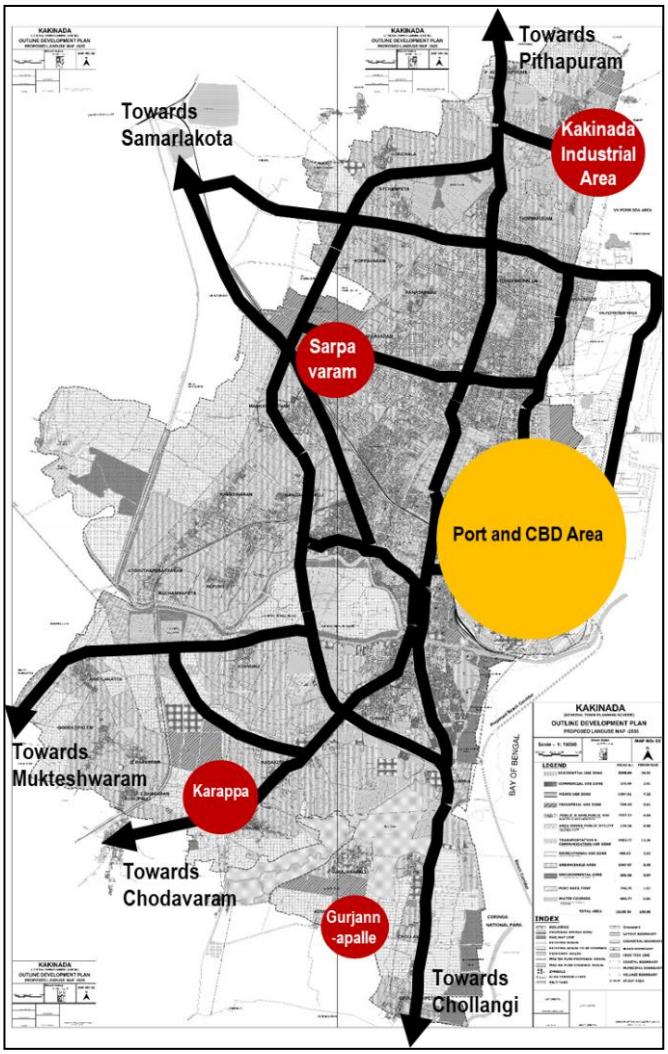


FIGURE 5-4: ROAD NETWORK DEVELOPMENT VS ECONOMIC NODES IN THE CITY

All major nodes should consider a transport development strategy in accordance with the overall vision of the city. For example, the major nodes like Main road, Temple Road and Cinema Road can develop a Non-motorized transport plan to enhance the NMT user movement along the commercial area under restricted motorised vehicular movements and supported Public transport plan so that the node is well connected for inter node travel as well as intra node travel.

5.1.2. TRANSIT ORIENTED DEVELOPMENT

The semi ring-radial network is designated as the structure for mobility corridors. To maximize the passenger throughput, these corridors should be developed on the concepts of transit oriented development. 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 Figure 5-5.

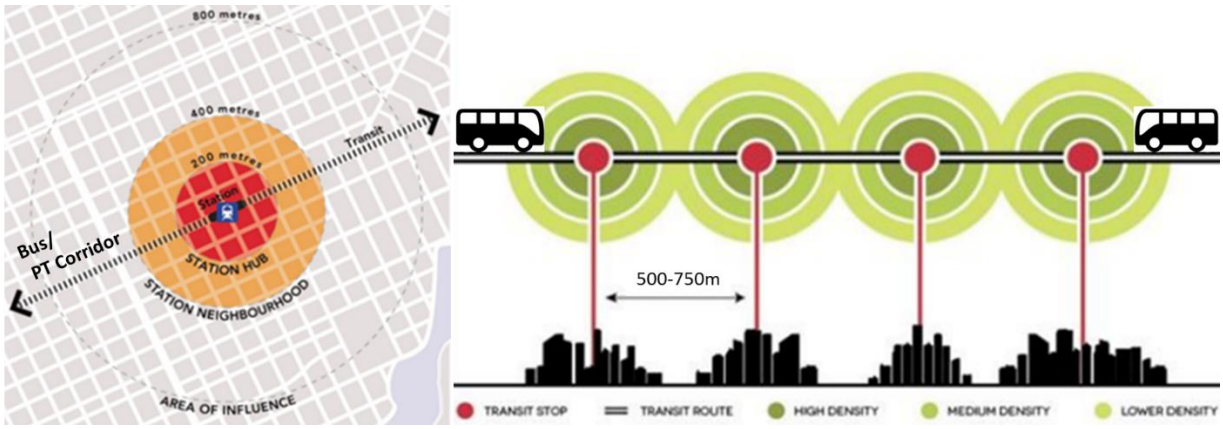


FIGURE 5-5: CONCEPT OF TRANSIT ORIENTED DEVELOPMENT[4]

The TOD 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) **Public Spaces**: 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
4) **Parking**: Parking structures/shared parking lots are two ways to reduce the amount of space occupied by parking facilities.

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

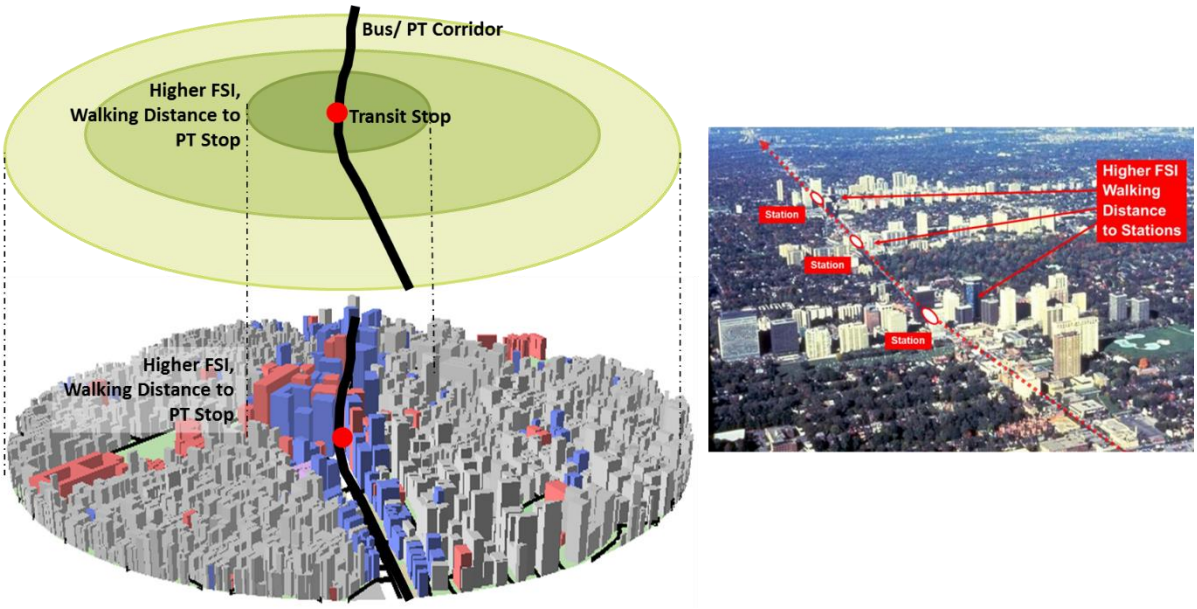


FIGURE 5-6: BUILDING HEIGHT AND SCALE IN TOD

As Kakinada is largest city in the state has the potential to adopt TOD principles to retain as well as enhance the Non-Motorised Transport (NMT) share and would strength the usage of proposed Public Transport (PT) systems. Following corridors are considered for transit-oriented development (i.e. increase in population density by increasing FSI) and are shown in Figure 5-7.

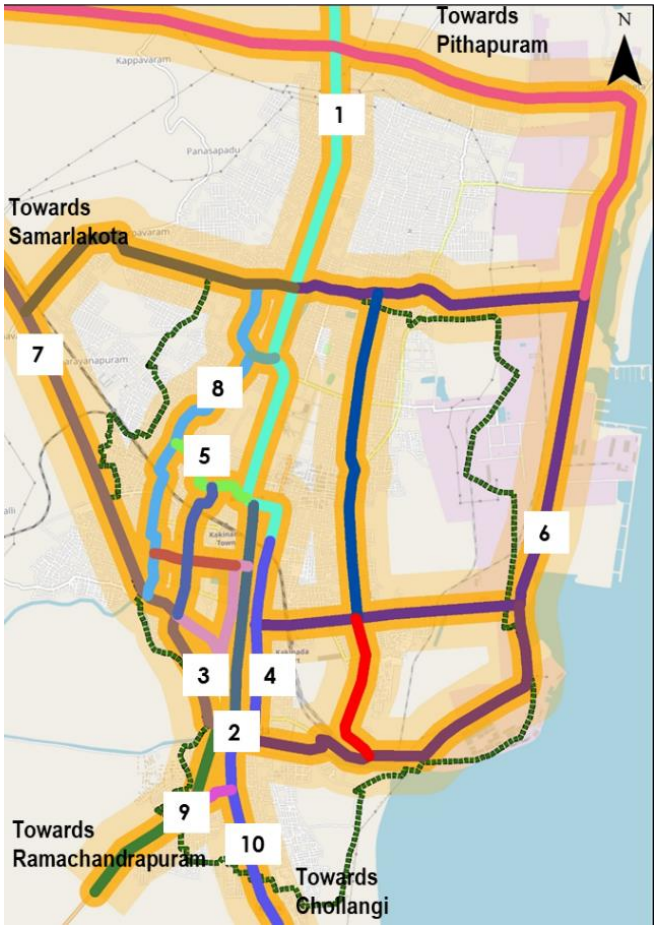


FIGURE 5-7: MAJOR MOBILITY CORRIDORS FOR TRANSIT ORIENTED DEVELOPMENT

Further, a detailed Transit Oriented Development (TOD) study need to be carried out for understanding the consumed Floor Space Index (FSI) and potential for Densification along the high mobility public transit corridors.

5.2. PUBLIC TRANSPORT IMPROVEMENT PLAN

Public transport is a shared passenger transport service which is available for use by the general public, as distinct from modes such as taxicab, carpooling or hired buses which are not shared by strangers without private arrangement. Improving public transport includes NMT also as any public transport trip includes a component of access and egress which will be covered under NMT Strategy. Improving public transport includes improvements in bus service and mass rapid transit with compatible pedestrian and bicycle infrastructure.

Public transport strategy includes following action plans:

1. Proposal for transit corridors with NMT access facilities.
2. Rationalization of existing city bus routes.
3. Phased expansion of bus fleet.
4. Creation of adequate infrastructure in the form of depot, terminals, bus queue shelters and signage.
5. The intermediate public transport (IPT) system comprising shared and private auto-rickshaws, which currently cater to a major part of overall trips in the city have to be integrated with proposed public transport system for the city. The following strategies are proposed in this regard:
    i) Restructuring of corridors to allow plying of IPT modes so as to reduce overlap of routes between them and the city bus system. This shall ensure that the IPT modes work as a feeder system to the PT system and both the systems are financially viable.
    ii) Creation of signage to demarcate the IPT stops to reduce the chaos occurring on the streets due to erratic stoppages of IPT modes.
    iii) Creation of adequate spaces for parking of IPT vehicles in the city away from the traffic junctions.
    iv) Integrate the multiple modes of transport to provide single journey experience.

At present, sub-urban bus transport is the sole public transport system in operation in Kakinada APSRTC (Andhra Pradesh State Road Transport Corporation) provides the public transport services. At present, the Kakinada Depot operates with a fleet of 63 Telugu Velugu Buses, providing services from Kakinada to nearby towns and cities. Kakinada has no designated city bus services. The sub-

urban services provide certain level on intra city connectivity. The major stops with in the city are as follows,

1. Rangarao Bus Stop
2. Jagannathapuram Bus Stop
3. Yanam Bus Stop
4. Balaji Cheruvu Bus Stop
5. NTR Bus Stop
6. Vivekananda Park Bus Stop
7. Kakinada RTC Bus Terminal
8. Bhanugudi Bus Stop
9. Yati Bus Stop
10. Ramanayapeta Bus Stop

These bus stops are mainly located along the NH 216, Main Road, Cinema Road and Temple Road indicating the intercity/town connectivity. The Figure 5-8 indicates the locations of the bus stops.

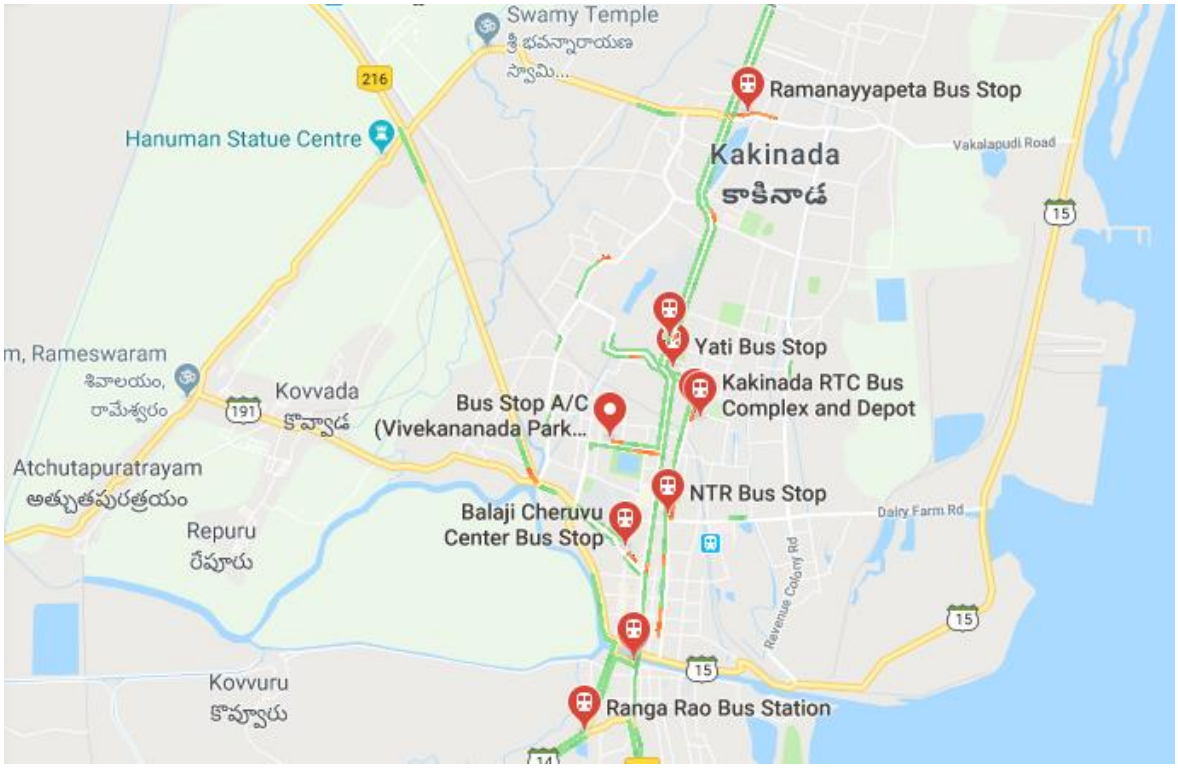


FIGURE 5-8: BUS STANDS AND BUS STOPS IN KAKINADA

The public transport system for Kakinada should be convenient, efficient, affordable, reliable and integrated. Public transport system planning for Kakinada will not only consider where terminal, routes and stops are placed but also whether they are accessible to all potential users. The proposals under public transport improvement plan for Kakinada are:

1) Development of efficient bus based Public Transport systems.
2) Intermediate Public Transit/ Feeder System
3) Multi-modal integration in public transport

4) Providing adequate infrastructure facilities for public transport in terms of intermodal mobility hubs and bus stops
5) Implementation of ITS to improve the reliability of public transport systems
6) Promoting public participation and campaigning mass awareness programs

5.2.1. CITY BUS SYSTEMS

Based on the results of trip interactions obtained from various Origin and Destination (OD) surveys, the prominent trip patterns and trip generators were identified and the Bus routes shown in below figure 5-9 were identified by as public transport corridors for augmentation of buses.

TABLE 5-2: PT PHPDT ON MOBILITY CORRIDORS IN KAKINADA

S.No.	ROAD NAME	BASE (2018)	BAU (2038)	SUT (2038)
1	Pithapuram_Kakinada Rd	332	594	2511
2	Nukkalamma temple street towards Gandhi Nagar	30	54	77
3	NH214 towards two town police station	364	652	3635
4	Kakinada	489	875	1262
5	Towards Revenu Colony	30	53	77
6	Wharf Road towards Rama Rao Peta	647	1157	1668
7	IBP Auto Service	1625	2907	4191
8	Sri Tirumala Theatre	157	281	4786
9	Kothapeta Fish Market	629	1125	4956
10	ESI Hospital	542	969	4382
11	R K Plaza Complex	280	500	721
12	Near Kotiah Sweets	629	1125	1622
13	NH214 towards JNTU Engineering College	155	277	2581
14	Nageshwar Rao Street towards Pattabhi Street	996	1783	3766
15	Jagannathapuram Bridge	961	1719	7385

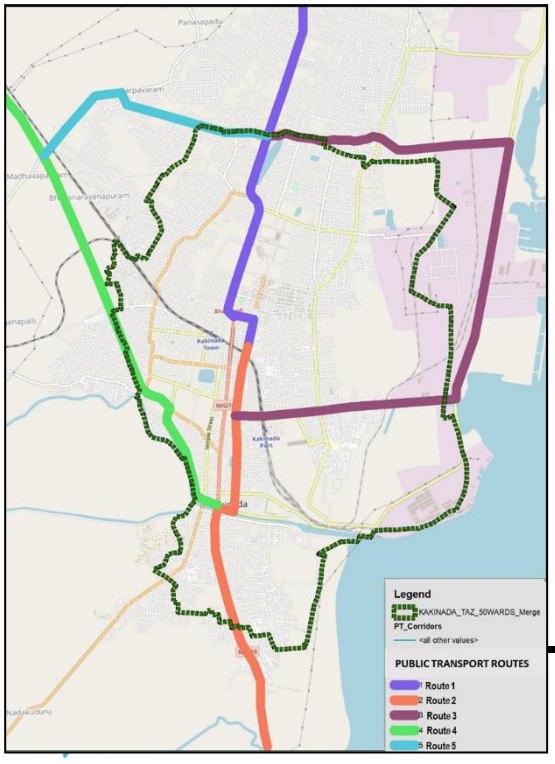


FIGURE 5-9: PT ROUTES IDENTIFIED FOR KAKINADA

A fleet of about 45 buses have been estimated for implementation on above routes and their details are listed below.

TABLE 5-3: PROPOSED BUS ROUTES AND FLEET DETAILS FOR HORIZON YEAR 2038

S. No.	Name	Route Length (km)	Proposed Peak Hour Headway (min)	Proposed Fleet
1	RTC to Pithapuram	17.8	15	10
2	RTC to Chollangi Peta	9.4	15	6
3	RTC Bus Stop to Coromandel Fertilizers via Dairy Farm Road, Ramanayapeta and Vakalapudi Road	19.1	15	11
4	RTC Bus Stop to Samarlakota	16.9	15	9
5	RTC Bus Stop to Sarpavaram,via Income Tax Colony, Kacheripeta	16.9	15	9
1	RTC to Pithapuram	17.8	15	10
				45

5.2.2. PUBLIC TRANSPORT TERMINALS

5.2.2.1. BUS TERMINAL

There are two main bus terminals in Kakinada are as follows;

1. RTC Complex, Burma Colony
2. RTC Old Bus Stand

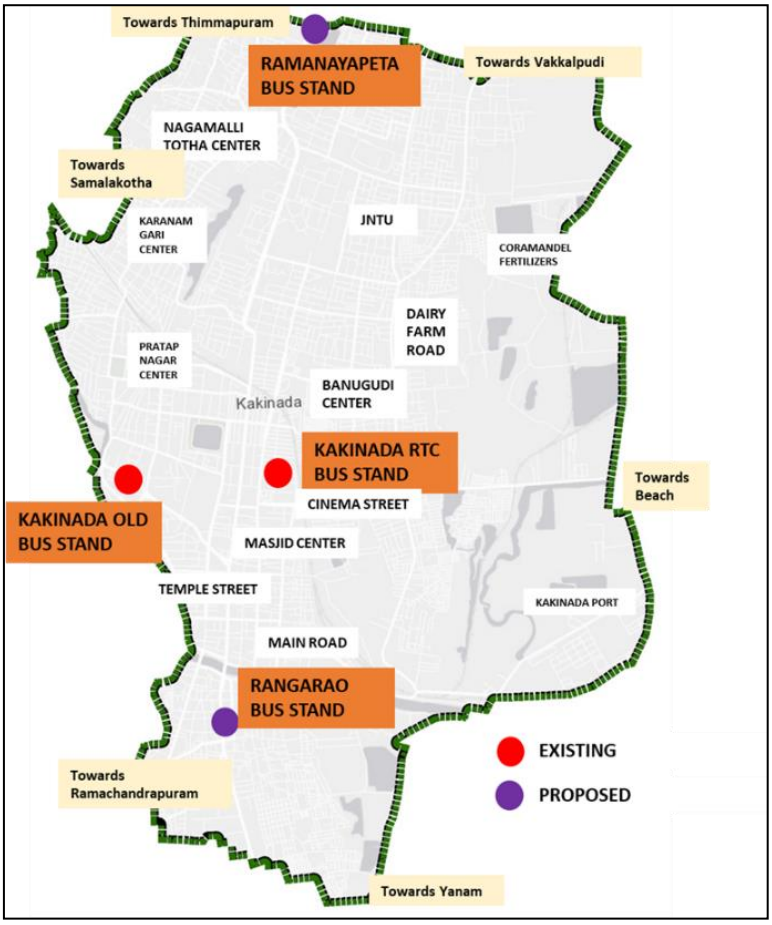


FIGURE 5-10: EXISTING AND PROPOSED BUS TERMINALS IN KAKINADA

It is proposed to develop one bus terminal at Ramanayapeta and Rangarao bus terminals and terminate the inter-city buses plying to Kakinada via Pithapuram, Amalapuram etc at Ramanayapeta terminal and Yanam at Rangarao bus terminal.

5.2.2.2. Rail Terminal

Kakinada has two railway stations namely, Kakinada Port Railway Station and Kakinada Town Railway Station Average daily outflow passengers are presented below (Primary Survey conducted for 16 hours).

TABLE 5-4: DAILY PASSENGERS AT RAIL TERMINALS

S. No.	Code	Name of the Terminal	Daily Passengers
1	PT_3	Kakinada port Railway Station	5392
2	PT_4	Kakinada town railway station	8552
			13944

Kakinada Town Railway Station is the predominantly used station in the city. From primary surveys, it is observed that about 8552 passengers are using Kakinada Town railway station in the base year (2018) during 16 hours. Summary of peak hour passenger at Kakinada Town railway station is shown below.

TABLE 5-5: PROJECTED PEAK HOUR PASSENGERS AT RAIL TERMINALS

S. No.	Name of the Terminal	2018	2028	2038
1	Kakinada town railway station	770	947	1166

As per Indian Railway Manual-2009, allocated space per passenger for various components in the terminal area at Level of Service 'C' is used for station planning. Based on the forecasted demand, below table provides total required area for passengers using the terminal area. The current area is adequate to cater to the demand of the future years. To further supplement the demand, Railway Station at Sarpavaram can be upgraded.

5.2.3. INTERMEDIATE PUBLIC TRANSPORT/ FEEDER SYSTEMS

Auto Rickshaw is the major mode of public transportation system in Kakinada. In the absence of city bus services auto rickshaws provide end to end connectivity. Auto-rickshaws and cycle rickshaws can act as efficient feeder services for the proposed public transport systems. Thus, an integrated system will aid ease of access for users. They play a key role in improving sustainability for urban 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.

Due to the restrictive policies, IPT providers largely operate informally

1. Drivers lack job security and benefits
2. They also do not have documentation of income, which limits access to credit to purchase their rickshaws
3. Drivers are often subjected to harassment and confiscation of vehicles
4. Negative environmental implications due to lack of regulation on emissions

Passenger service is also often poor

1. No regulation of fares
2. Little integration between modes due to lack of co-operation inconveniences passengers
3. Lack of safety regulations puts passengers at risk
4. Concern for safety due to mixed traffic flow driven by growth in private vehicles

Attempts need to be made to organize IPT

1. Provide better service to passengers
2. Transparency of fares and complaints hotline
3. Driver behaviour and road safety training
4. Dispatch services or “dial-a-rickshaw”
5. Include added features such as seatbelts, newspapers, etc.
6. Organize drivers and provide basic insurance, credit and allowances
7. Tea vendors can co-ordinate bookings and dispatch in return for rent-free space and a captive market of drivers
8. Medical and accident insurance and discounted medical facilities
9. Children’s education allowance
10. Integrate with public transport
11. Feeder services for first and last mile connectivity - Cycle Rickshaws from railway station and bus stations to homes (Pre-paid services)
12. Promote sustainability: Cycle rickshaws, solar-powered rickshaw or rickshaws on CNG

Key Challenges

Competition of Auto-Rickshaw Services with Public Transport

Current trends in urban transport highlight the usage of IPT modes (i.e. auto-rickshaws and taxis) in cities for daily commute trips, because of the poor quality of public transport. Thus, improving public

transport in cities would be a key strategy in ensuring that auto-rickshaw services fulfill their intended role as feeder services instead of competing with public transport for long-distance trips.

Challenges in Technology Implementation for Dispatch (Dial-A-Rickshaw) Services

Dispatch (dial-a-rickshaw) services in the auto-rickshaw sector would be important in making auto-rickshaw services an attractive door-to-door transport alternative to private motor vehicles for occasional and emergency trips. Fleet operations have been noted to be most effective at implementing the necessary technology for dial-a-rickshaw services (Schaller 2007). However, auto-rickshaw services in the majority of Indian cities are provided by individual owner-operators rather than by fleet companies. The lack of organization poses a barrier for the provision of dial-a-rickshaw services. Regulatory reforms that allow fleet-based operations with dispatch services to enter the auto-rickshaw sector could help address this issue.

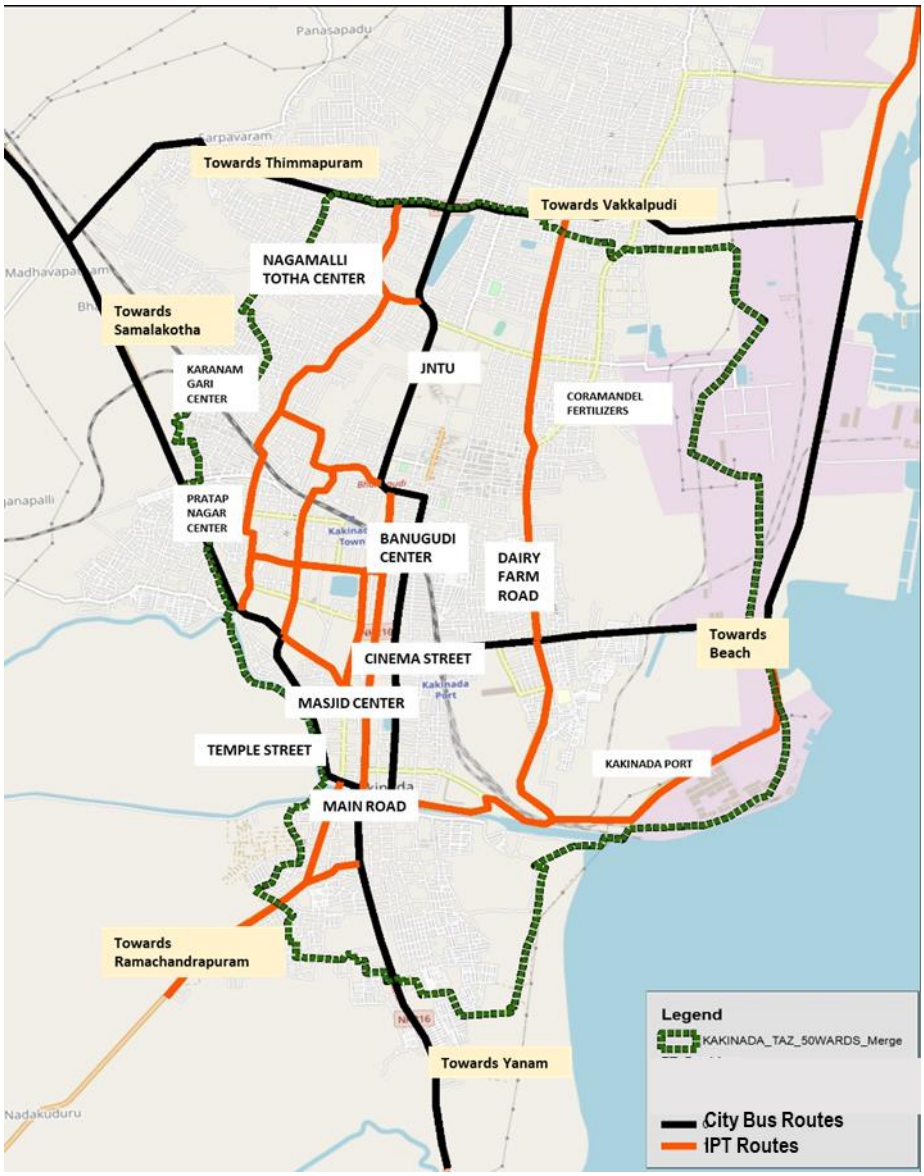


FIGURE 5-11: IPT ROUTES IN KAKINADA

In Kakinada, the major IPT routes are operated along the commercial areas and along the transit stations. Majority of the auto-rickshaws provided end to end connectivity. The availability of auto rickshaws along the residential areas (eastern side) is observed to scarce when compared to core city area.

Although improving public transport in Kakinada would be a key strategy, it is also important to ensure that auto-rickshaw services fulfil their intended role as feeder services and providing connectivity to areas which are not accessible by bus based public transport. The same is achieved by rationalizing their major routes to feed into the PT corridors, designating the routes, stops.

Auto-Rickshaws or updated E-Rickshaws can be rationalized to provide sustainable mobility solutions in the core city, especially along the Main Road.

The following IPT routes are proposed as major IPT corridors as shown in Figure 5-11. These IPT routes which will feed to the major trunk PT corridors. The major PT routes operate on the radials which are the arterial and sub-arterial corridors while IPT major routes form the rings connecting the PT corridors and providing access to area where PT services aren't available. A total network length of 41 km has been identified.

5.2.4. MULTI-MODAL INTEGRATION PROPOSALS

At the intersection of each mobility corridor/ transit corridor with the major road of the city, a transfer terminal should be facilitated. The transfer terminal is technically called as Transport and Traffic Management Centres (TTMC) or Multi-Modal Transit Hubs. The main objective of these are to provide Urban Transport Infrastructure with several amenities under one roof. 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

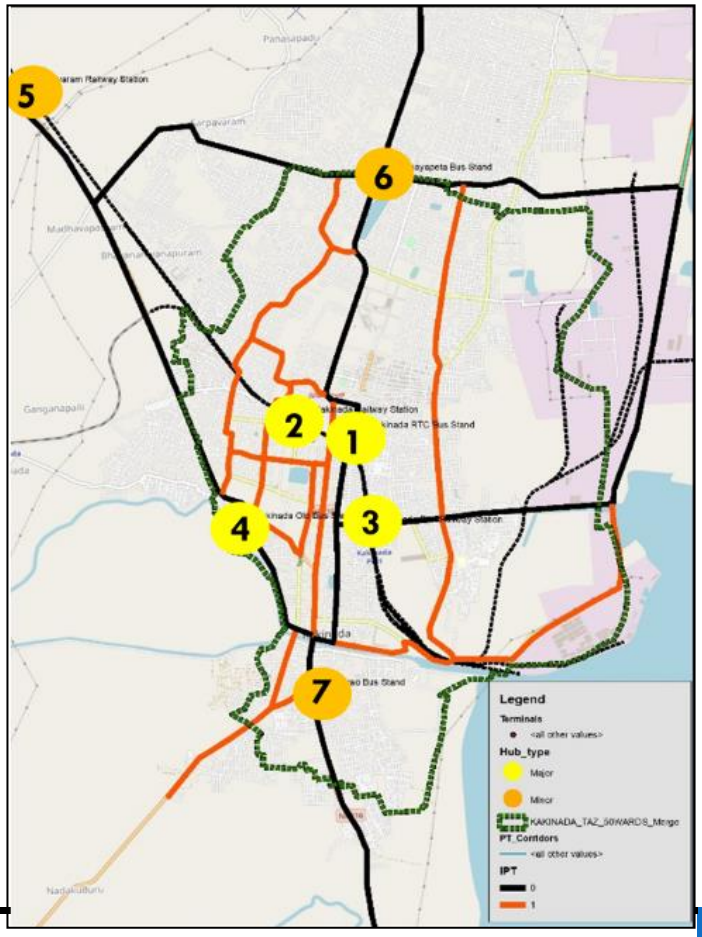


FIGURE 5-12: PROPOSED MULTI MODAL HUBS IN KAKINADA

help the city to minimize congestion and also reduce the pollution hazards. This system can be integrated with other modes of transportation systems like metro, mono and express rail corridors. The proposed Multi-Modal Integration locations are given below and are shown in Table 5-6.

TABLE 5-6: MULTI MODAL HUBS

S.NO.	LOCATION	TYPE	INTEGRATION
1	RTC Complex – Burma Colony	Major	Bus, IPT, NMT
2	Kakinada Town Railway Station	Major	Train, Bus, IPT, NMT
3	Kakinada Port Railway Station	Major	Train, Bus, IPT, NMT
4	RTC Bus Stand Old	Minor	Bus, IPT, NMT
5	Sarpavaram Railway Station	Minor	Train, Bus, IPT, NMT
6	Ramanayapeta Bus Stop	Minor	Bus, IPT, NMT
7	Rangarao Bus Stop	Minor	Bus, IPT, NMT

5.2.5. PROMOTING PUBLIC TRANSPORT-OUTREACH PROGRAMMES

For successful implementation of the transit system, it is necessary to promote public awareness and create a sense of public ownership of the project. For this to happen effectively, it is necessary to evolve an outreach and education strategy for promoting the system.

The outreach and education goals need to be defined at the planning stage of the system itself to focus the efforts of the project implementation. The outreach and education goals as listed under UNDP Reference Guide for Public Transport are as follows:

a) Introduce the concept of the transit system, its purpose and the benefits to the various stakeholders
b) Create profile of the system as a big impact, with incremental steps for achieving the long term vision for mobility in the city
c) Enhance the understanding that mass transit projects positively impact economic health and environmental stability of the city
d) Introduce the concept of specific systems as an important strategy in making the best use of transportation resources
e) Establish communication channels for the public to receive information and interact with the implementing agencies

Following strategies can be adopted for an effective public outreach

1) Create a network of allies and provide platforms for them to actively participate as disseminators of project benefits
2) Use proactive and creative communication media to promote key messages. Communication media can be print, broadcasts, short films, event marketing etc.

3) Programmes can be conducted in schools and colleges advocating the need for public transport. Events like Car Free Day, Happy Streets, Cycle Day can also be promoted.

Further, an Integrated Public Transport study need to be carried out for detailed estimation of infrastructure and service requirement. This study will include both physical and service integration.

5.3. ROAD NETWORK DEVELOPMENT STRATEGY

A well connected and planned road network is essential for the city. Road network development also includes improving the intersections to give equal emphasis to all road users. The road network development should add to the overall development strategy for the city. The network should have sufficient capacity to carry the vehicles. Road Network proposals are considered only if it is absolutely necessary. Provision of more flyovers and more widening will support more and more use private vehicles; hence those proposals are considered such that it will help in decongesting the junctions and can be helpful in improving the PT speeds and safer NMT movements. The proposals of improving road network include:

- Road Widening/Up gradation
- Development of Missing links/New Links/Ring Roads
- Road Infrastructure Development (River/Canal Bridges and ROBs)

5.3.1. ROAD WIDENING/UPGRADATION

Widening of roads is a must when the volume carried increases considerably compared to its capacity. All the roads identified for road widening shall be provided with median in between to reduce accidents and safety. The road widening has been discussed under the following section.

- Development of Mobility Corridors

5.2.5.1. Development of Mobility Corridors (Ring and Radial Roads)

Kakinada city clearly has a characteristic semi ring-radial network development. In Kakinada, these major radials are either Bypass Roads/National Highways and are important mobility corridors. In addition, there is a possibility to develop rings which bind these radial roads together providing a semi ring radial pattern for the network considering the geographic constraints of the Bay of Bengal.

The streets need to be classified into primary, secondary and tertiary so as to provide uniform standards of road geometry and public transit services. We can consider radial lines as primary transit network served by bus-based PT systems and rings as secondary transit network served by

IPT based PT systems. These primary and secondary transit network together constitute the major mobility corridors for the city.

In essence, mobility corridors maximize throughput of people, focusing on public transport and non-motorized traffic, rather than vehicle traffic. These mobility corridors offer a strong network providing connectivity to major attraction centres in the city along with regional connectivity. These corridors should be considered for an augmented public transport system.

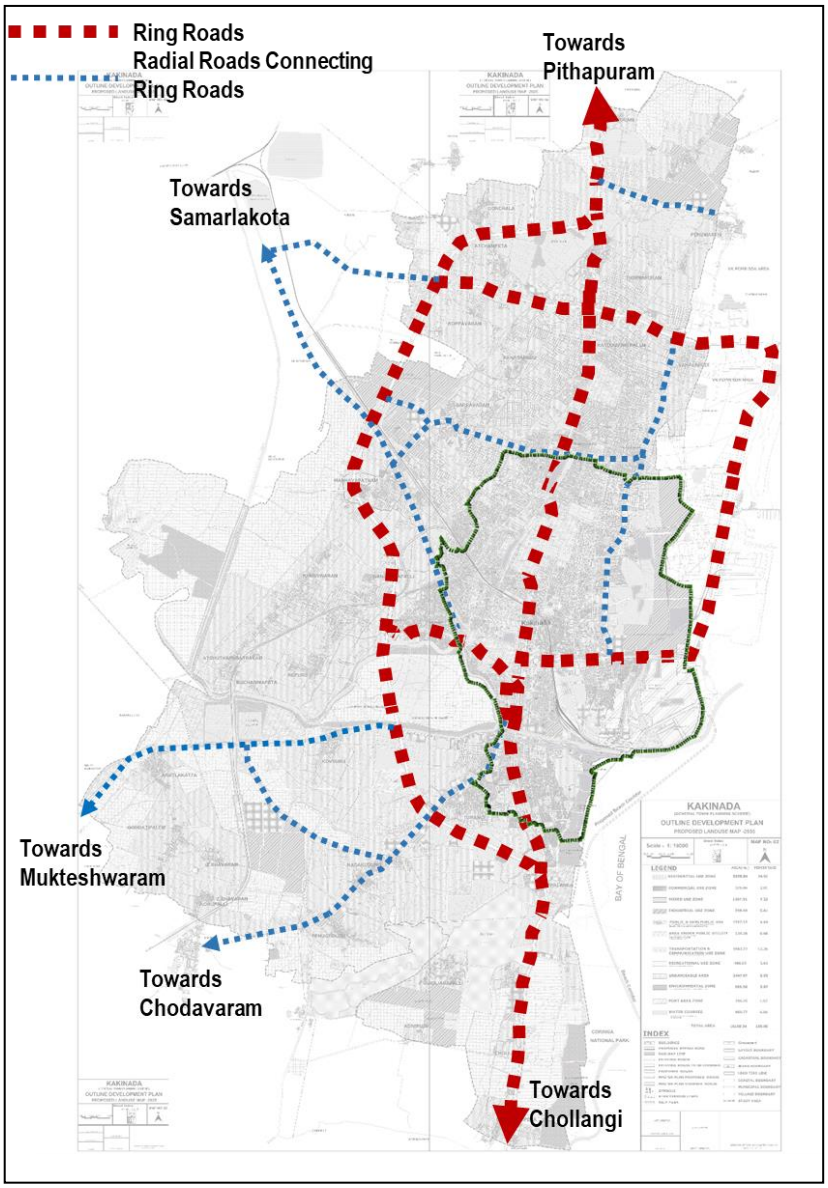


FIGURE 5-13: MOBILITY CORRIDORS IN KAKINADA

The radial corridors are:

1. National Highway 216 towards Pithapuram
2. Dairy Farm Road
3. Uppada Beach Road
4. Samalakota – Kakinada Bypass Road

5. National Highway 216 towards Samalakota

The Rings binding these radials are:

1. Towards Choodavaram
2. Towards Mukteshwaram
3. Towards Samalakota
4. Dairy Farm Road,
5. Military Road

Since these corridors include all the major spines within Kakinada, they should be designed based on the standards. Kakinada 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:

1. Continuous kerb, footpath and bi-cycle lanes
2. Service roads where feasible
3. Restriction or preferably prohibition of parking on the carriageway/shoulders
4. At-grade/grade-separated public transport systems as per the public transport/mass transport master plan

The following figures from Figure 5-14 to Figure 5-18 shows the indicative cross sections of various ROWs of roads to be followed for mobility corridors and other corridors.

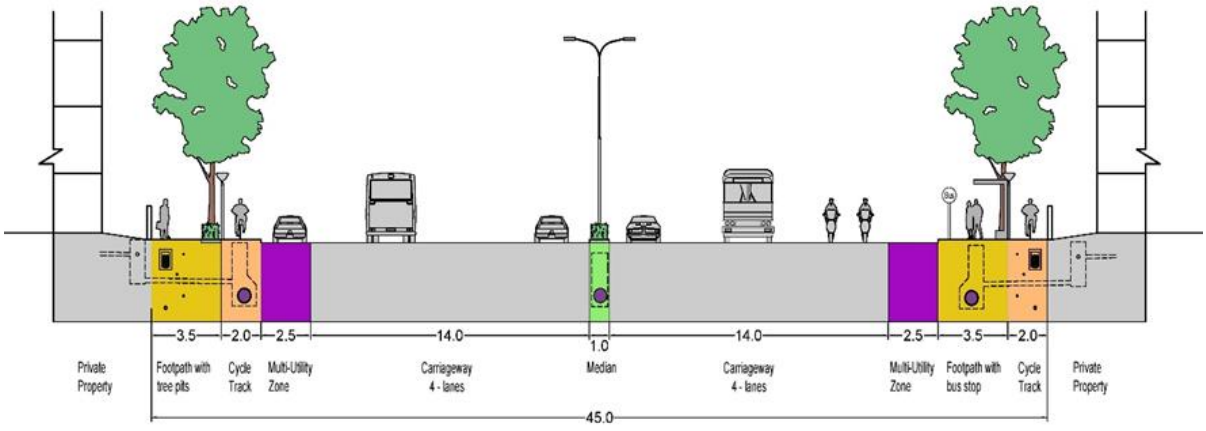


FIGURE 5-14: TYPICAL SECTION OF 45M WIDE ROAD

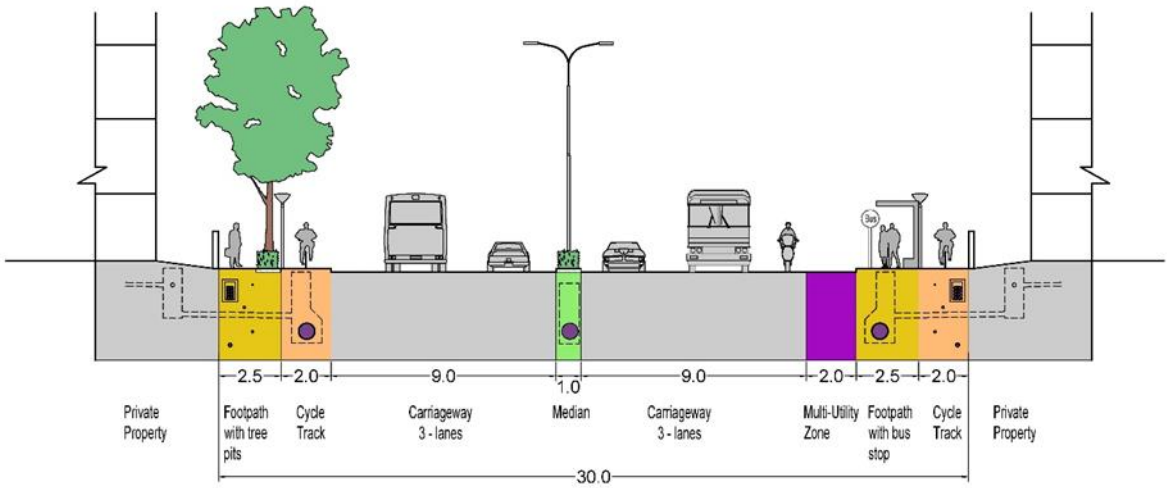


FIGURE 5-15: TYPICAL SECTION OF 30M WIDE ROAD

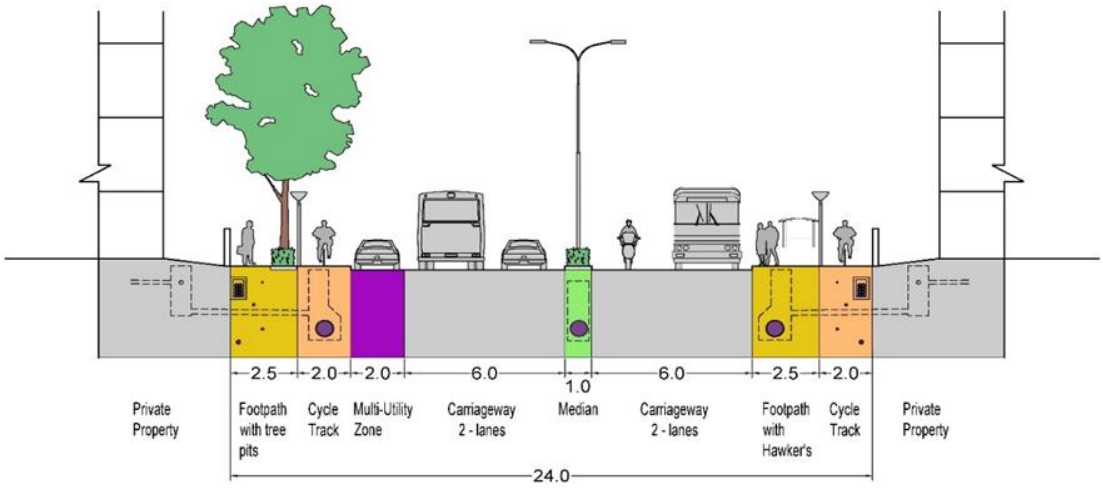


FIGURE 5-16: TYPICAL SECTION OF 24M WIDE ROAD

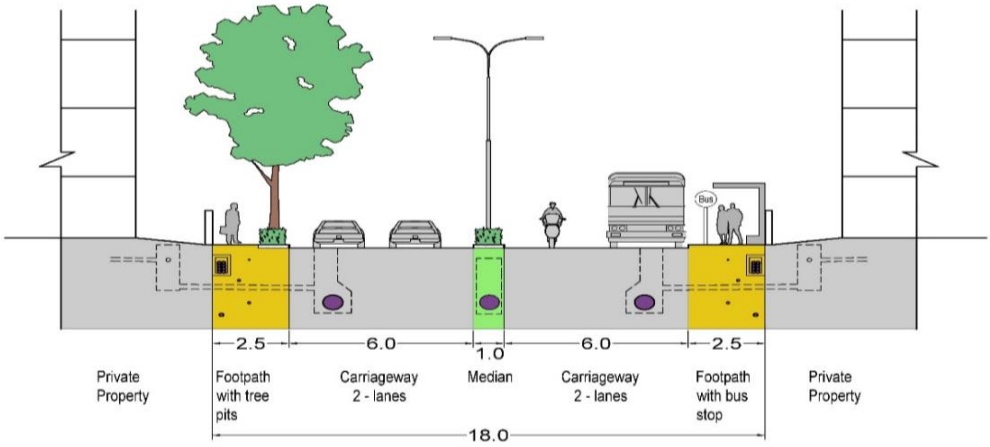


FIGURE 5-17: TYPICAL SECTION OF 18M WIDE ROAD

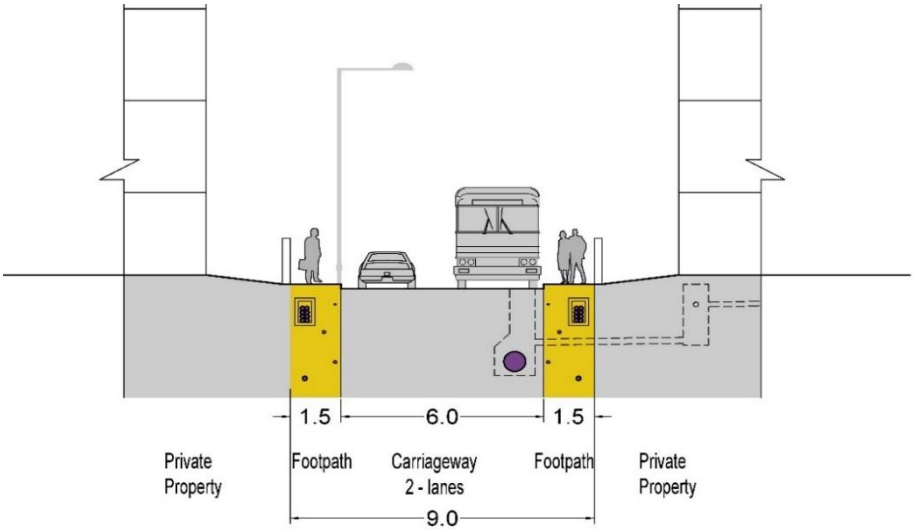


FIGURE 5-18: TYPICAL SECTION OF 9M WIDE ROAD

The road widening of mobility corridors is presented in Table 5-7.

TABLE 5-7: ROAD WIDENING REQUIRED FOR MOBILITY CORRIDORS

S.NO	NAME OF THE ROAD	LENGTH (KM)	BASE (2018)	SUT (2038)
1	Pithapuram_Kakinada Rd	8.75	6	6
2	Nukkalamma temple street towards Gandhi Nagar	0.17	3	3
3	NH214 towards two town police station	0.52	6	6
4	Kakinada	8.79	6	6
5	Towards Revenue Colony	0.20	3	3
6	Wharf Road towards Rama Rao Peta	0.18	6	6
7	IBP Auto Service	1.42	6	6
8	Sri Tirumala Theatre	5.37	6	6
9	Kothapeta Fish Market	1.24	6	6
10	ESI Hospital	0.43	4	6
11	R K Plaza Complex	1.03	6	4
12	Near Kotiah Sweets	1.03	4	6
13	NH214 towards JNTU Engineering College	0.19	4	6
14	Nageshwar Rao Street towards Pattabhi Street	0.24	3	3
15	Jagannathapuram Bridge	0.49	6	6
16	Commercial Tax	2.35	6	6

5.3.2. ROAD INFRASTRUCTURE DEVELOPMENT (FLYOVER, RIVER/CANAL BRIDGES AND ROBS)

Adequate and properly maintained road infrastructure 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.

The study recognizes that there is a need for Rail Over Bridges near Atchuthapuram, Kondayyapalem, Rechallapeta, Dummalapeta and Kakinada Anchorage Port. The study also recognizes the need for Bridges across Salt Creek near Indrapalem and Dugirala Vari Street. Figure 5-19 represents the Location of Rail over Bridges and Bridges.

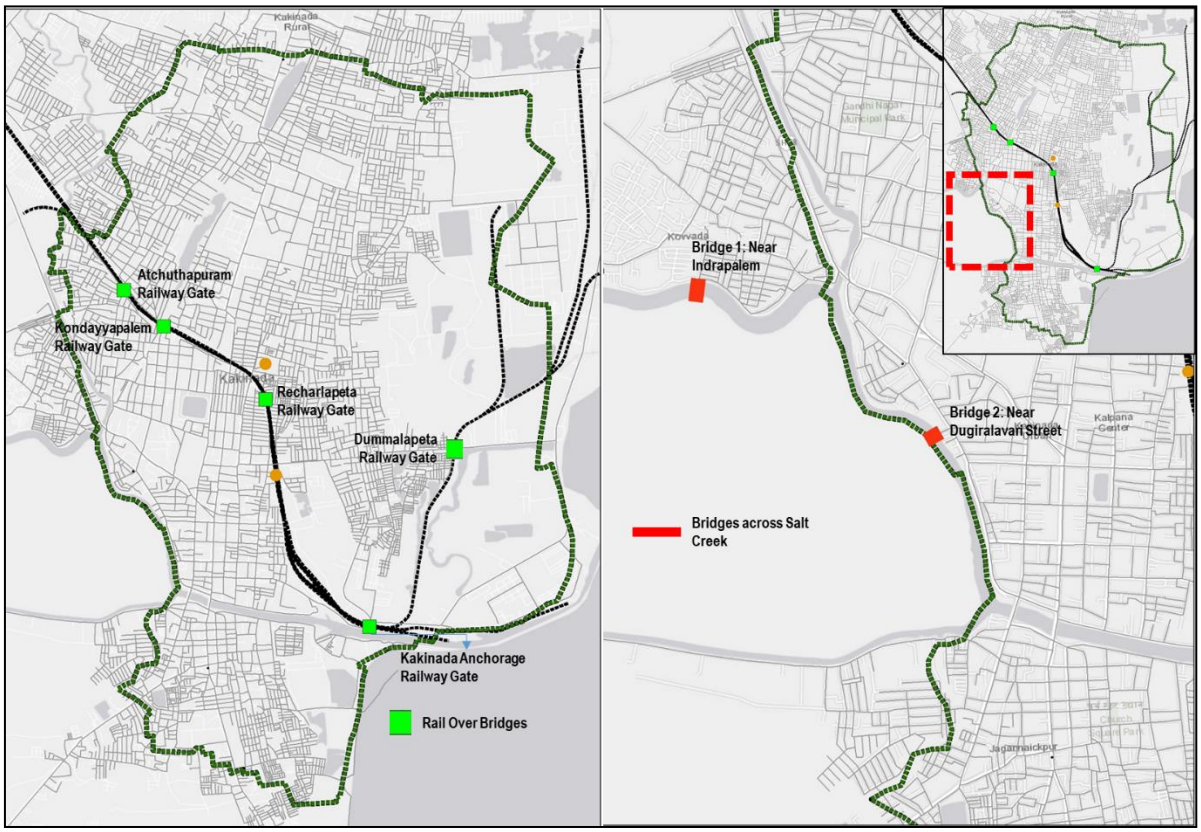


FIGURE 5-19: PROPOSED RAIL OVER BRIDGE (ROB) LOCATIONS

5.4. NON-MOTORIZED TRANSPORT (NMT) PLAN

The LCMP envisions an environment where people are encouraged to walk and cycle in Kakinada through equitable allocation of public space and infrastructure; and access to opportunities and mobility for all residents. Kakinada Municipal Corporation (KMC) should aim to increase the use of cycling and walking by creating a safe and pleasant NMT network of footpaths, cycle tracks, greenways, and other facilities to serve all citizens. The design of the streets in the city must be consistent with best practices in pedestrian-oriented, multi-modal street design. They will also incorporate appropriate environmental planning and water management techniques. Together, these measures will achieve the following:

1. Improved access and mobility for all residents.
2. Social and economic empowerment through the provision of improved low-cost mobility.
3. Gender equity through the provision of NMT facilities that are safe for women to use.

4. Social inclusion in creating NMT facilities that follow principles of universal design and are usable to the greatest extent possible by everyone, regardless of his or her age, ability, or status in life.
5. Reduced local and global environmental impacts of Kakinada transport system through expanded use of zero pollution modes.
6. A changed culture that accepts the use of cycling and walking as acceptable and aspirational means to move around in the city.
7. Participation of local residents, businesses, and other stakeholders in the preparation of designs and standards in order to foster the community's active use and sense of ownership of these spaces.

The proposals under Non-Motorized Transport (NMT) Plan are:

- Development of Footpath facilities.
- Development of Cyclist-Friendly streets

5.4.1. DEVELOPMENT OF FOOTPATHS

Pedestrian trips are generally short trips and can be observed everywhere in a city. And hence, ideally pedestrian walkways should be provided on all major roads and streets in the city. However, special consideration for pedestrians should be given near junctions (dangerous intersections), major activity nodes (like schools, colleges, etc.).

A good share of students use non-motorised mode to commute to school in case Kakinada, hence it is crucial to develop strategies to enhance the safeguard these trips. On such strategy is Safe Routes to School.

5.4.1.1 IMPROVEMENT OF LOCAL STREETS

The smaller local streets/residential streets may not have sufficient width to provide a segregated pedestrian walkway. But these residential streets should also provide safe route to pedestrians. This can be achieved by

a) Installation of speed limits
b) Installing speed breakers at frequent intervals
c) Providing table top crossings etc.

FIGURE 5-20: IMAGES SHOWING CONCEPTS OF LOCAL STREET DESIGNS

5.4.1.2 FOOTPATH DEVELOPMENT-NETWORK

Low Carbon Mobility Plan for Kakinada has identified all the major spines of the city for immediate need of footpaths. All the major junctions should be immediately designed with due consideration for pedestrians. The crucial junctions which require immediate pedestrian infrastructure improvements are:

1. Z P center Junction
2. Bhanugudi Junction
3. Kondayyapalem Junction
4. Municipal Office Junction
5. 2 Town Police Station Junction
6. Kottapeta Market Junction
7. Suryarao Peta Junction
8. Three Light Junctions
9. Ramarao Peta Junction
10. NTR Bus Stop Junction
11. Balaji Tank Junction
12. Masjid Center Junction

The footpath design should be uniform across the city. Depending on the volume of pedestrians, the area requires footpaths with minimum 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 sample design of footpath is shown in Figure 5-21.

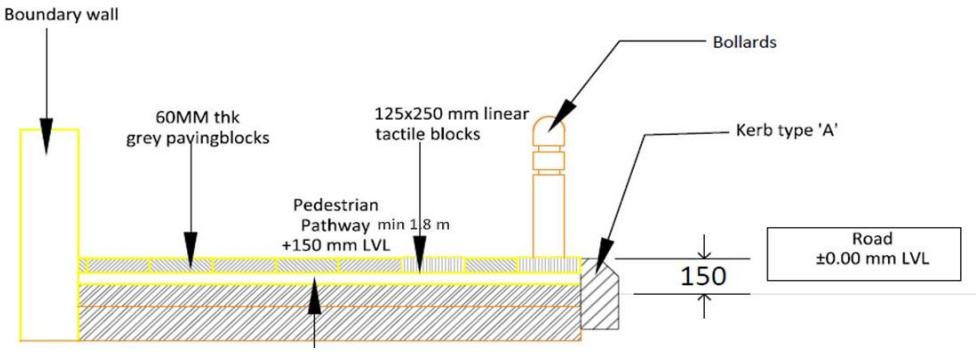


FIGURE 5-21: DETAILED CROSS SECTION OF FOOTPATH DESIGN

Accordingly, LCMP has identified about 85 kms of roads within KMC where the footpaths have to be built immediately or the existing footpath should be reconstructed according to the design standards (refer Figure 5-21). In addition, local authorities should develop the footpaths in all other streets following the development of footpaths in the priority streets. Similarly, the core area has been identified for rejuvenation where in major spines shall act as NMT and PT only corridors for certain hours of the day (for instance, market hours 11am to 7pm).

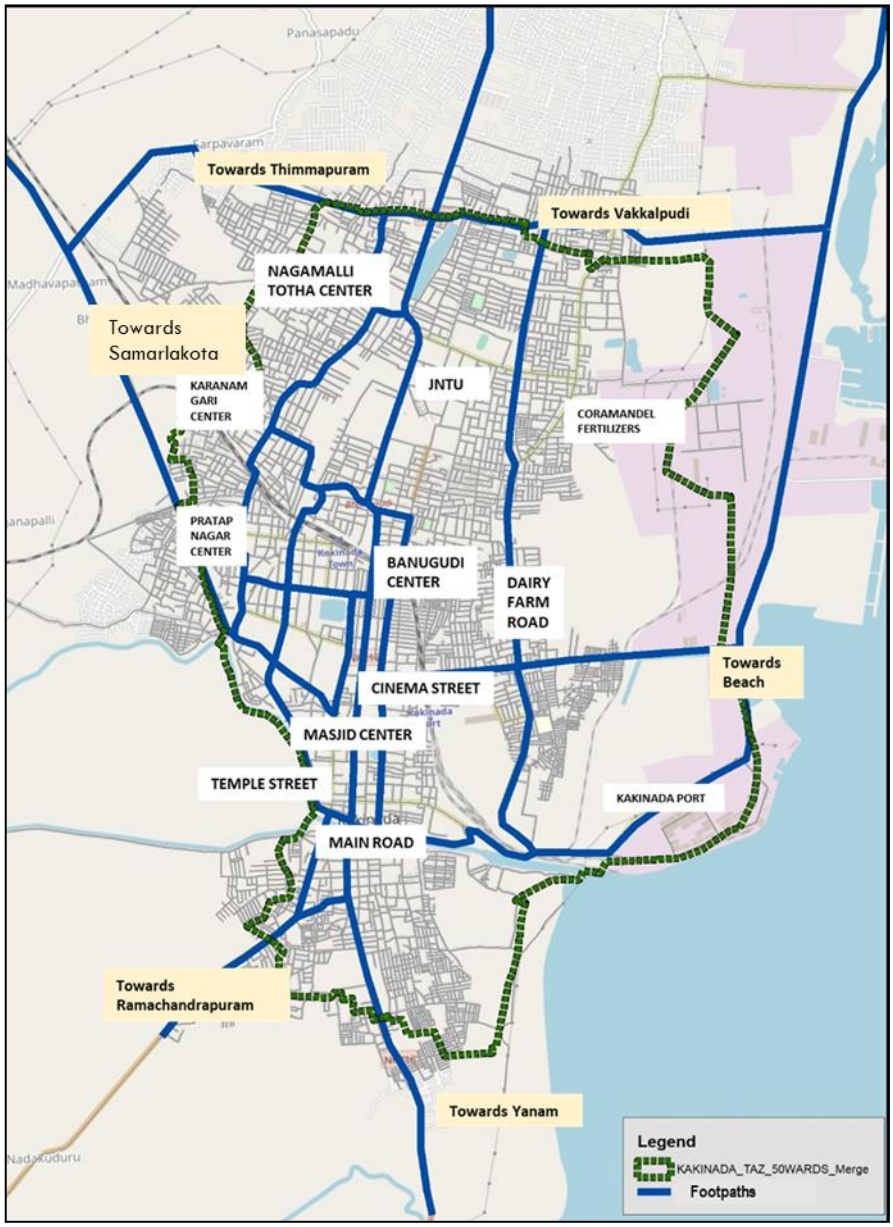


FIGURE 5-22: PROPOSED FOOTPATH NETWORK FOR KAKINADA

The identified streets are connecting streets with an average length of 0.5m connecting the Main Road and proposed mobility corridors. In addition, the adjoining land use is commercial creating possibility to act as pedestrian friendly streets.

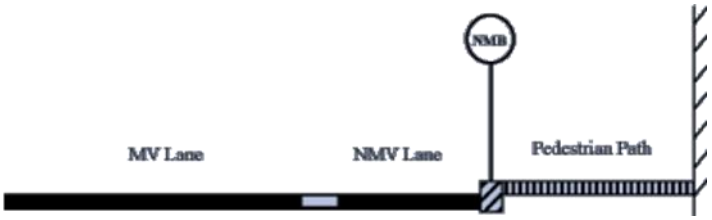
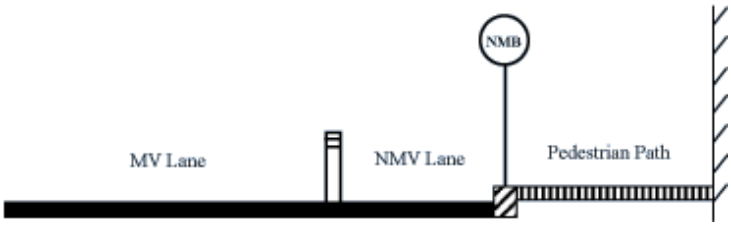
5.4.2. DEVELOPMENT OF CYCLIST-FRIENDLY STREETS

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. Kakinada has a good share of existing bicycle uses compared to other cities, hence it becomes important it safeguard the interests of these users.

5.4.2.1 DESIGN APPROPRIATE MEASURES

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. Non-Motorized Vehicles (NMV) lanes can generally be classified into four main categories and are listed in Table 5-8.

TABLE 5-8: 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	

4	NMV-exclusive lanes within an independent right-of-way (often referred to as NMV paths)	

5.4.2.2 Non-Motorized Vehicles (NMV) lanes for Kakinada

LCMP suggests to have Type 3 NMV lanes (**Dedicated Bicycle Tracks)** along major mobility corridors with higher ROW, whereas Type 2 NMV lanes **(Shared Bicycle Tracks**) on other identified roads in Kakinada.

A total of 41 **km dedicated bicycle tracks** along with 44 **km of shared NMT routes** are proposed in the plan connecting important activity centres and trip attractors and are shown in Figure 5-23. Kakinada needs to improve the infrastructure to create a safe environment for its cyclists.

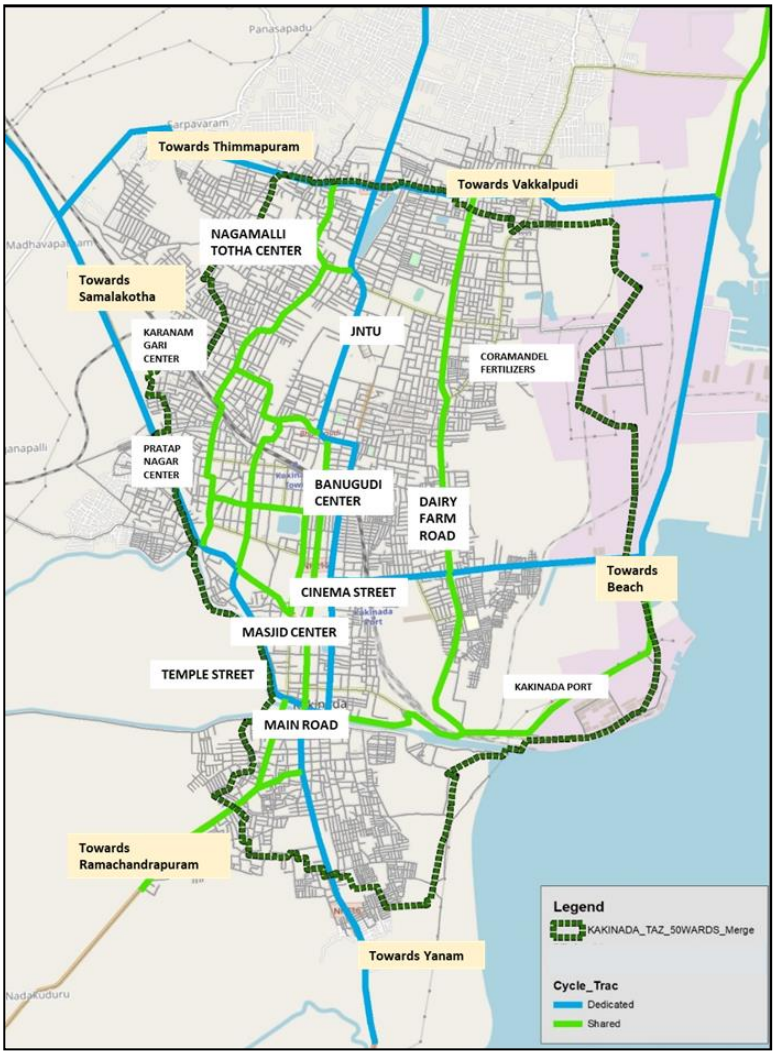


FIGURE 5-23: PROPOSED BICYCLE NETWORK FOR KAKINADA

5.5. FREIGHT MANAGEMENT PLAN

A safe, reliable and efficient movement of freight and servicing trips to, from, within and through Kakinada in balance with the needs of other transport users to support the overall economy is necessary.

The overall aim of freight management plan is to

- Ensure that the Kakinada road network allows efficient and reliable handling and distribution of goods vehicles
- Minimize the impact of congestion
- Minimize the impact of pollution
- Shift gradually to more sustainable freight movement.

Kakinada with its growing economy also has many retail market bases scattered across the area and considerable share of freight movement is observed along certain roads within the city. Thus, under the freight management strategy, freight policy and truck terminals are proposed.

5.5.1. FREIGHT POLICY

Freight has always remained as an unnoticed transportation policy. The word “FREIGHT” should be considered in all the planning and policy documents to give considerable recognition to its management. For an efficient management of freight within the city, periodic stakeholder consultations should be held. The freight policy will be aimed at the overarching aim of efficient and reliable handling and distribution of goods and services. Freight policy principles adopted for Kakinada are:

a) Manage the heavy demands placed on the regional infrastructure, by balancing the needs of freight and passenger traffic
b) Improve the array of transportation options available to regional freight users
c) Restrict the heavy vehicles entering the city during day time.
d) Develop truck terminals near cordon points and distribute the goods in the city through LCV/sustainable transport choices
e) By pass the external freight traffic passing through the city.
f) It is advisable to develop a Freight Operator Recognition Scheme. A tiered set of membership levels can be given to frequent operators coming to the city.
g) Develop a freight information portal i.e. a single interface is available for information on the freight movement.

5.5.2. FREIGHT TERMINALS

A freight terminal is a processing node for freight. Freight terminals are required for the efficient movement of freight vehicles within the city so that congestion is very limited. Freight Terminals need to be provided near various sensitive areas in the city which attract heavy vehicles and also in the outskirts.

Kakinada is known for its contribution in agro products and edible oil refineries and bio fuel plants About 22% of total freight transport in Kakinada consists of Forest Products and 20% of the food and agro-based products and 14.87% consists of Construction material.

TABLE 5-9: SHARE OF GOODS COMMODITIES TYPES

COMMODITY	SHARE IN FREIGHT TRANSPORT
ForestProducts(Wood/Rubberetc)	21.72%
Sand/Brick/Cement/Steel/Aggregate	14.87%
FoodGrains(Rice/Wheat/Jowaretc)	10.12%
Vegetable/Fruit/Milk/Fish	9.50%

Presence of two ports and Industrial areas near Ramanayapeta and along Uppada Road contribute freight movement along the NH 216. As a result in certain inflow of freight traffic through the city. To reduce the conflict with city traffic and decrease the congestion during peak hours, freight traffic should be restricted in the city. The freight traffic should not be allowed in the city between 8am to 9pm, stopping most of carries outside city boundaries.

In addition to these, two new truck terminals are proposed near Kakinada Industrial Area and near Chollangi based on goods traffic demand and are shown in Figure 5-24.

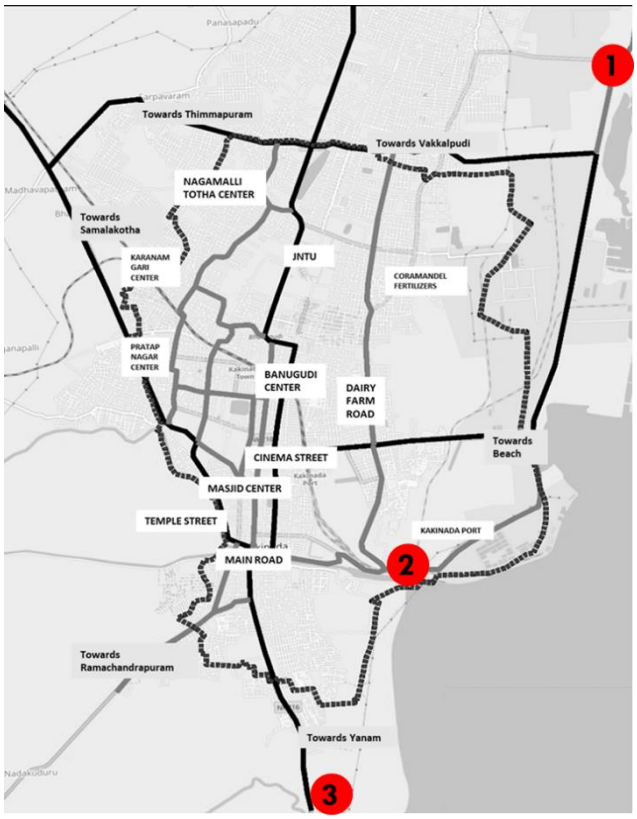


FIGURE 5-24: PROPOSED TRUCK TERMINALS FOR KAKINADA

The freight terminal is proposed near Chollangi and Kakinada Industrial area such that the heavy vehicles coming to the city for loading and unloading could be parked during day time and if necessary smaller commercial vehicles could help for transition of the goods.

5.6. TRAFFIC ENGINEERING AND MANAGEMENT MEASURES

Traffic engineering 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 etc. Traffic management includes various strategies adopted to efficiently manage the movement of vehicles like one-way systems, no parking zones, etc.

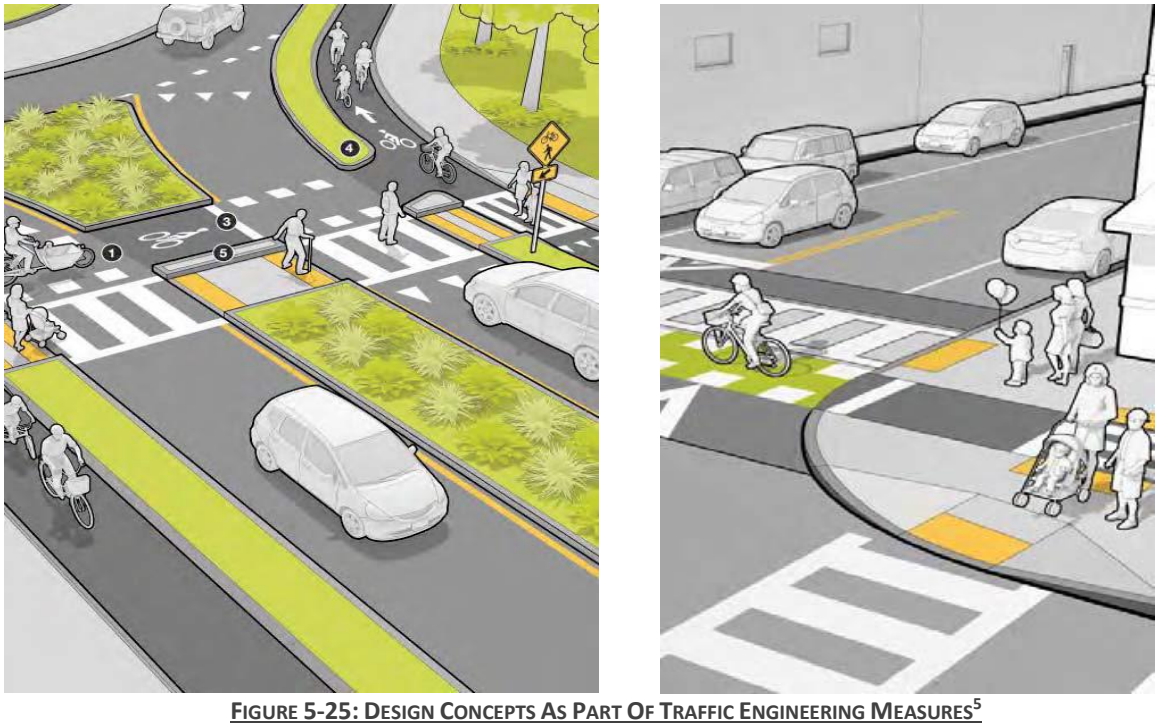


FIGURE 5-25: DESIGN CONCEPTS AS PART OF TRAFFIC ENGINEERING MEASURES[5]

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.

5.6.1. 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

[5] Image Source: https://www.mass.gov.pdf

- 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 coming 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 in Table 5-10 and are shown in Figure 5-26

TABLE 5-10: JUNCTIONS IDENTIFIED FOR GEOMETRIC CORRECTIONS

S. No	Name of the Junction
1	Z P Center Junction
2	Bhanugudi Junction
3	Kondayyapalem Junction
4	Municipal Office Junction
5	2 Town Police Station Junction
6	Kottapeta Market Junction
7	Surya rao peta junction
8	Three Lights junction
9	Ramarao Peta Junction
10	NTR Bus Stop Junction
11	Balaji Cheruvu Junction
12	Masjid Center Junction
13	Sarpavaram Junction
14	Nagamalli Thota Junction
15	Gold Market Junction
16	Munsif Junction
17	Indrapalem Bridge Junction
18	Nukkalamma Temple Junction.
19	Dairy Farm Junction

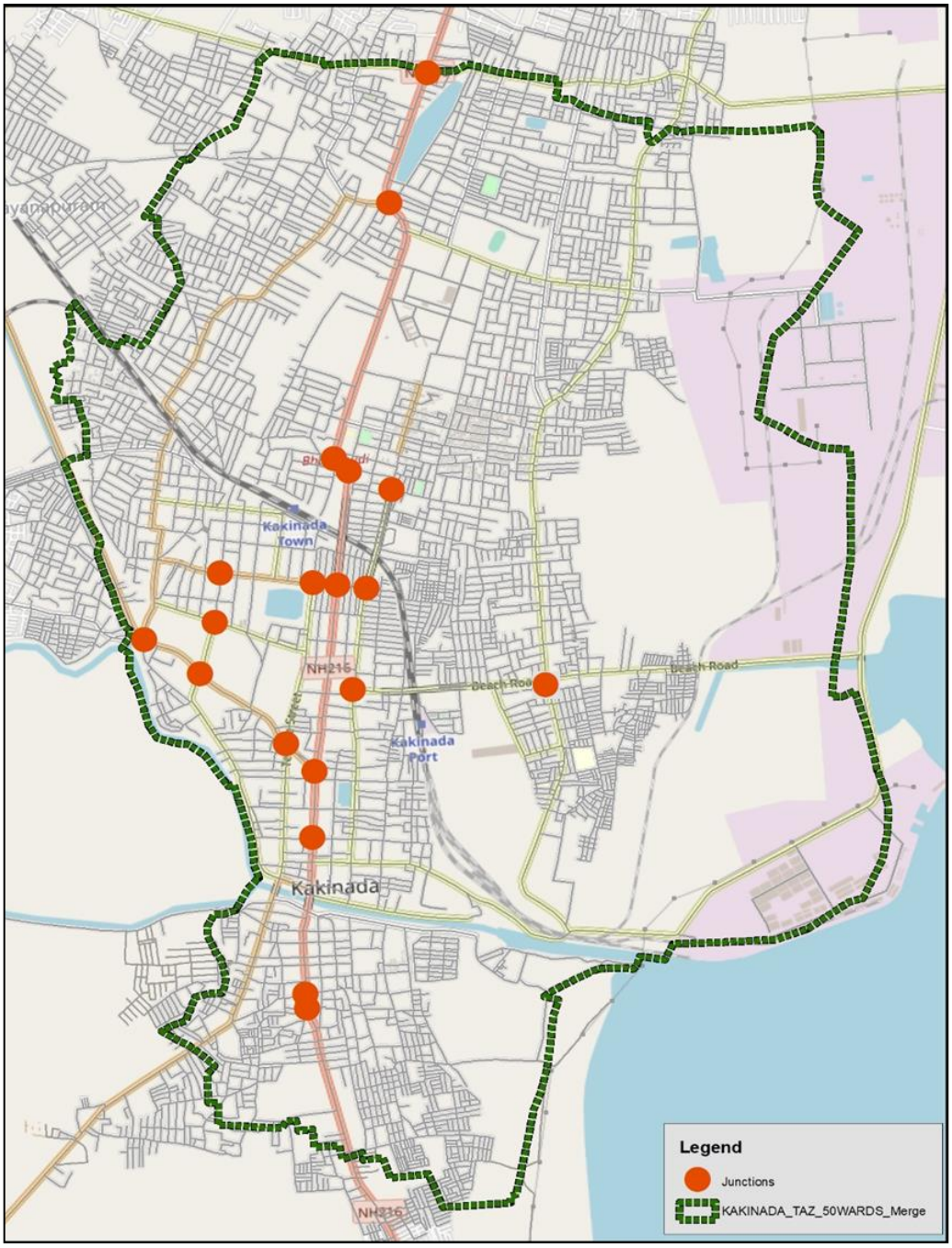


FIGURE 5-26: JUNCTION FOR IMPROVEMENT

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 suggests 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 need for signals at surveyed junctions in the city was checked through Warrants given in IRC 93:1985. All the survey junctions qualified for signal installation. The following are the locations for

which installation of signals is proposed. These junctions, either do not have a signal or have signals which do not function. List of junctions proposed for signalization are presented below,

1) Bhanugudi Junction
2) ZP Center Junction
3) Three Lights Junction
4) Dairy Farm Junction

Geometric improvements and signalization serve only for short term duration. The traffic level at few junctions reach the 10000 PCU mark during peak hours as shown below. The crucial junction being Bhanugudi Junction and ZP Center Junctions. The situation will deteriorate considerably with growing population of private modes in the city.

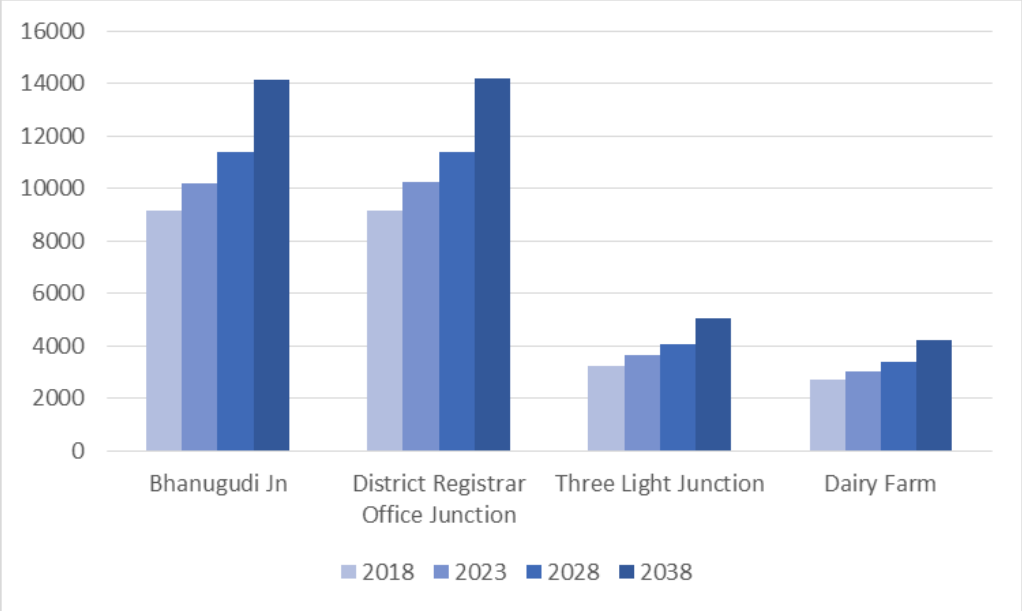


FIGURE 5-27: ESTIMATED TRAFFIC AT JUNCTIONS

Hence improvements to these junctions need to be considered for signalization/ roundabouts or grade separtors. 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.

However, 2 junctions has been identified for grade separation which is the Bhanugudi Junction and ZP Center Junction

TABLE 5-11: LIST OF JUNCTIONS WITH TYPE OF IMPROVEMENT

Junction Type	2018	2023	2028	2038
Bhanugudi Junction	Signal	GS	GS	GS
ZP Center Junction	Signal	GS	GS	GS
Three Lights Junction	Signal	Signal	Signal	Signal
Dairy Farm Junction	Rotary	Signal	Signal	Signal

It was observed that most of the locations have $PV^2/(2*10^8)$ values higher than 2, this indicates a considerable need to improve the pedestrian crossing facilities. Based on the PV^2 value and ROW constraints, pedestrian proposals were made at important junctions in Table 5-12.

TABLE 5-12: PV^2 ANALYSIS FOR VARIOUS JUNCTIONS IN KAKINADA

S. No.	LOCATION	PV Square/10^8 Value	Intervention
1	**Bhanugudi Junction**	2.23	Zebra Crossing
2	**ZP Center Junction**	2.82	Zebra Crossing
3	**Three Lights Junction**	0.24	Zebra Crossing
4	**Dairy Farm Junction**	0.53	Zebra Crossing

Detailed Junction improvement plans/ designs need to be carried for important junctions which shall be supplemented by topographic surveys.

5.6.2. TRAFFIC MANAGEMENT PLANS

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 programmes shall be organized.

5.6.2.1 Ramaraopeta and Gold Market

Ramaraopeta is one of the major commercial activity center and traffic attracting area. The area development encourages the integration of land-use and transport to reduce the needs of vehicle trip making and trip lengthening in a manner that contributes to the city's economic well-being, environmental stewardship, health and safety, social equity and mobility.

5.6.2.1.1 ISSUES IDENTIFICATION

- The number of Autos parked in IPT stands exceeds the number of autos authorized to be parked in the IPT stand. The chaotic drop-off and pick-up of at the junction hinders the traffic flow. This adds to the congestion in the area and requires immediate attention.
- The area sees the heavy pedestrian traffic yet no pedestrian facilities are provided.
- Considerable parking is observed.

5.6.2.1.2 PROPOSED INTERVENTIONS AND IMPROVEMENTS

- An elevated walkway with escalator or lifts on either ends is proposed between Bus Terminal and Railway station with a total length of 0.6km and width of 3m.
- Road markings such as zebra crossings, lane markings, etc. are necessary on all roads for safety and convenience of vehicles and pedestrians. These facilities not only reduce accidents but also increase walkability.
- The number of autos in the IPT Stand needs to be regulated. It is proposed that the IPT stand should be provided. The IPT drop-off and pick points shall provide at a distance of 30m from the junction.
- For safer crossing of pedestrians Hooters and Pedestrian signals needs to be installed and signal timing should not be less than 15 sec. and should be designed as per IRC-93.
- Footpath shall be provided along the major roads to improve pedestrian safety.
- Lane markings, pedestrian crossing where ever are faded need to be marked.
- Junction improvement shall be carried with geometric corrections and channelizers.
- On Street Parking within 30m from the junction needs to be prohibited.

5.6.3. PARKING PROPOSALS

5.6.3.1 OFF-STREET PARKING RECOMMENDATIONS

Limited on-street parking shall be encouraged on major corridors by various methods such as limited parking restriction, parking meter control and paid parking. Strict enforcement is required for all commercial shops for providing parking facilities.

Based on the survey analysis and on ground conditions the following are the identified off-street parking locations. A multi-level parking is proposed at Santha Cheruvu (315 slots) and smart off-street parking facility at MC Lauren School (280 slots) along with Off Street Surface parking at RTC Complex and Kakinada Town Railway Station and Kakinada Port Railway Station.

The parking infrastructure at the following location have to improved to cater the parking needs of commercial activities.

List of off-street parking locations with number of proposed slots is given in Table 5-13.

TABLE 5-13: OFF-STREET PARKING- LOCATION WISE RECOMMENDATIONS

No	Location	Area (m^2)	ECS (Proposed)	TYPE
1	Santha Cheruvu	7875	315	MLP
2	MC Lauren School	7000	280	MLP
3	RTC Complex	1500	60	Surface
4	Kakinada Town railway Station	1500	60	Surface
5	Kakinada Port Railway Station	1125	45	Surface

Source: UMTC Estimates

The off-street parking spaces are proposed at public spaces and along the periphery of the old city in order to facilitate parking facilities to support the traffic management proposals.

5.6.3.2 ON-STREET PARKING RECOMMENDATIONS

For on-street parking, it is recommended to increase the capacity of existing facilities by using currently wasted areas (corners, edges, undeveloped land, etc.). Also, in the case of off-street parking being present in the vicinity, steps should be taken to ensure the effective usage of the off-street facility by imposing No-Parking zones around the facility. The off-street parking shall be considered while designing and reallocating the road spaces at following locations and the required is as shown in the Table 5-14.

TABLE 5-14: ON-STREET PARKING- LOCATION WISE RECOMMENDATIONS

No	Location	Length (m)	Type	Civil Works
1	Cinema Road	1000	30 Degree Angular and parallel parking for Cars	Sign Boards, Thermoplastic Paints, QR Post
2	Main Road	1500	30 Degree Angular and parallel parking for Cars	Sign Boards, Thermoplastic Paints, QR Post
3	Karanam Gari Junction	1600	30 Degree Angular	Sign Boards, Thermoplastic Paints, QR Post
4	Temple Street	1500	30 Degree Angular and parallel parking for Cars	Sign Boards, Thermoplastic Paints, QR Post

Source: UMTC Estimates

5.6.3.2.1 PROPOSED PAYMENT COLLECTION METHOD FOR PARKING:

Electronic Pay-Per-Space or Time-coded ticket systems is suggested for Kakinada city. Following objectives were formulated to introduce paid parking system in Kakinada.

1) Manage and price the most convenient parking spaces to favour priority users. Charge higher rates for longer durations and use shorter pricing periods at more convenient parking spaces such as on-street and near building entrances to increase turnover and favor higher-priority users. The increase in turnover does not only link with higher revenue but also with managing more demand with less number of parking bays. This is an important initiative for cities like Kakinada where land prices are increasing rapidly, especially along the JN Road. The effective way of management is to charge performance-based prices, set to maintain 85-90% occupancy rates (i.e. parking index). At more convenient locations, prices should be higher, time increments smaller, and rates may increase over time (e.g., Rs. 10 for the first hour, Rs. 20 for the second hour and Rs. 50 for each subsequent hour) to encourage turnover. Case in which short term parking is predominant, the parking fees should be higher during peak periods and lower during off-peak periods. Less convenient locations can have lower rates and long-term discounts to shift demand from on-street / easy locations to less convenient off-street locations.
2) Implement parking pricing as part of an integrated parking management program that also includes improved user information on parking and transportation options, commuter trip reduction programs, improvements to alternative modes, and adequate, predictable and courteous enforcement.
3) Avoid excessive parking supply. Apply reduced and more flexible parking standards that reduce requirements if parking is efficiently managed.

4) Establish pricing policies that respond to changing conditions and demands. Optimal rates may vary from one location or time to another, and often need adjustment as supply and demand changes, for example, if nearby parking lots is closed or new businesses open. Establish performance indicators and identify additional management strategies that can be deployed as needed if problems develop.
5) Prices should be well publicized and predicable. Use signs, maps, brochures, websites and other resources to provide information to users.
6) Avoid discounts for long-term parking leases (i.e., cheap monthly rates). For example, set daily rates at least 6 times the hourly rates, and monthly rates at least 20 times daily rates. Even better, eliminate unlimited-use passes altogether. Instead, sell books of daily tickets, so commuters save money every day they avoid driving. Eliminate early-bird discounts.
7) Management programs should anticipate potential spill over problems, and respond with appropriate regulations and enforcement.
8) Parking fees should be coordinated throughout a district or region, so that comparable areas have comparable fees.
9) Dedicate some or all of the revenue from on-street parking to benefit local businesses and residents.
10) Unbundle parking from building rents, so occupants only pay for the number of parking spaces they want.
11) Tax parking spaces - Reform existing tax policies that favour free parking. For example, tax land devoted to parking at the same rate as land used for other development. Parking pricing implementation requires changing well-entrenched habits and institutional practices, so it is important to build community support. Opponents focus on parking pricing problems and costs, while overlooking benefits. It is important to identify all benefits and to illustrate savings and benefits to typical households. Clearly communicate the options a community face.

Further, a parking master plan is required for developing a parking policy and implement efficient parking system in Kakinada. This master plan relates the value of land with parking pricing.

5.6.4 PAVEMENT MARKINGS AND SIGNAGES

Even though road signs and markings are provided on major road stretches of Kakinada, 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 5-28).

FIGURE 5-28: 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. (Figure 5-29).

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 5-30).

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.

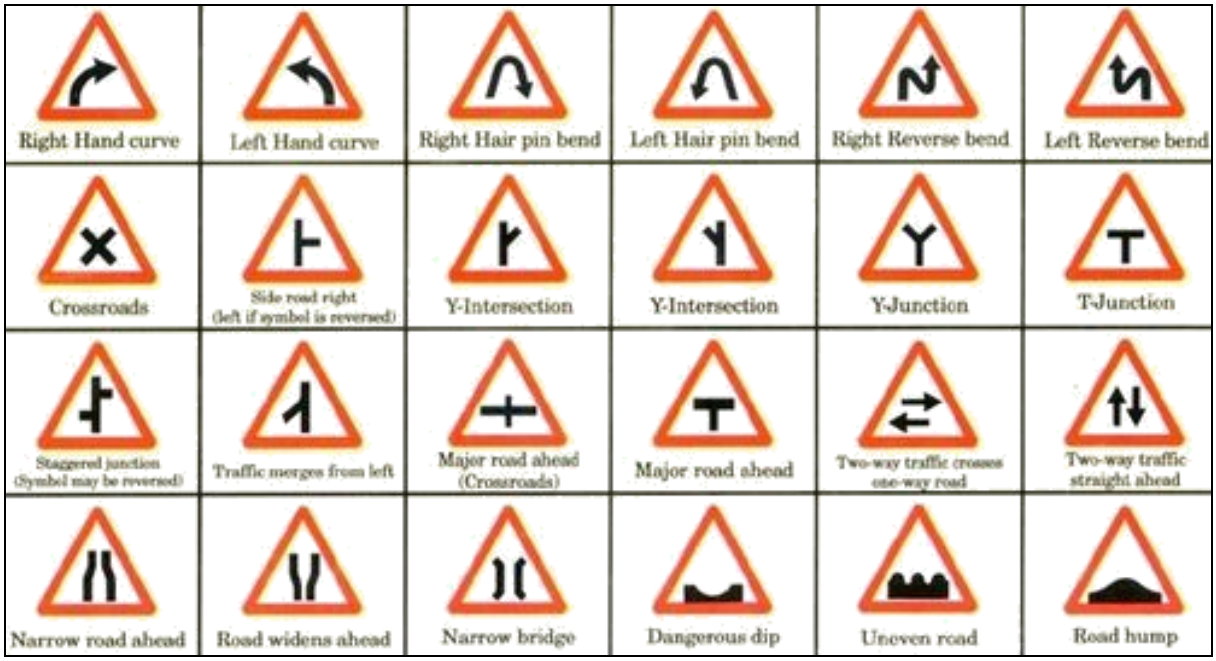


FIGURE 5-29: CAUTIONARY OF WARNING SIGNS

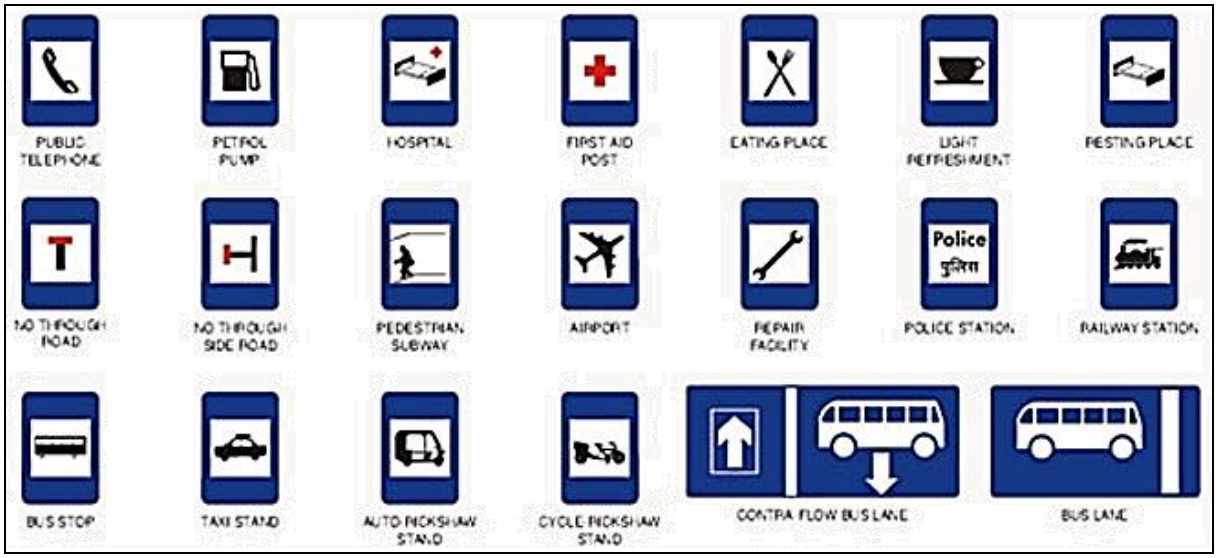


FIGURE 5-30: INFORMATORY SIGNS

5.7. TRAVEL DEMAND MANAGEMENT MEASURES

Travel demand management is an intervention (excluding provision of major infrastructure), to modify travel decisions so that more desirable transport, social, economic and/or environmental objectives can be achieved, and the adverse impact of travel can be reduced. A combination of TDM strategies and policies help reduce travel demand or redistribute this demand in space or in time. A demand management approach to transport has the potential to deliver better environmental outcomes, improved public health and stronger communities, and more prosperous and livable cities. A broad range of demand management strategies are available and can be brought to use depending on the situation and suitability. Some of the “tools” used for TDM are listed below:

- Subsidizing transit costs for employees or residents.
- Car parking controls and pricing
- Flex-time work schedules with employers to reduce congestion at peak times
- Road space rationing by restricting travel at certain times and places.
- Workplace travel plans
- Road space reallocation, aiming to re-balance provision between private cars and other sustainable modes
- Introducing active trip reduction programs
- Public education and awareness programs

The city can choose and implement any of these strategies, as they do not have any significant financial implications and most of them are policy decisions.

5.7.1. PARKING POLICY AND MANAGEMENT

Effective parking strategies are essential to manage the unauthorized parking activities in the city. The parking strategies should address the issues which will in turn reduce the automobile dependency. The various measures adopted for parking are:

SHORT TERM MEASURES

- Develop and approve multi-year parking tariff policy
  - Differential parking tariffs to encourage the use of Multi-level car parks and off-street surface parking, and escalate tariff as per pre-defined increments
  - Have effective penalties for parking violation and enforce them
  - No free residential parking on main roads (width > 6m) between 08:00 hrs and 21:00 hrs; no on –street parking within 75 m of entry/exit points near important/major traffic junctions, major industries, commercial spaces, education buildings, hospitals etc.
  - Improve public transport to realize mode shift
  - Ban on street parking in Core city/Commercial Areas

MEDIUM- AND LONG-TERM MEASURES

- Promote use of technology for effective enforcement of parking violations-
- Develop and approve a differential parking tariff to encourage use of peripheral parking
- Parking Restriction and Enforcement
- Congestion Charge
  - Impose congestion charge during peak hours on entry of private vehicles in core city area
- Cash-out measures, transit incentives, unbundling, curb side parking meters, price sensitivity, shared parking, parking regulation, remote parking and public transport facilities, improved enforcement and control

5.7.1.1 ON-STREET PARKING- DEMAND MANAGEMENT

1. Many of the on-street parking locations show a parking index of less than 50%. KMC should curtail parking supply by 50% on the stretches where parking index is less than 50%.
2. Signs and pavement markings: On–street parking areas (eg. for cars, two wheelers) should be provided with marked parking bays. Parking bays should be delineated by painted lines, studs, markers or textured surfaces different to the rest of the area. KMC should provide proper signboards with the words 'Park in Bays Only' and should be used at all entry points to the precinct and the 'END RESTRICTED PARKING AREA' sign should be used at all exit points from a precinct. In addition, a smaller version of RESTRICTED PARKING AREA signs should be used as repeater signs where necessary within the area.

FIGURE 5-31: PARKING SIGNS AND ROAD MARKINGS

3. Permissive parking: In order to provide equitable parking to all the road users, permissive parking spaces should be provided at designated parking areas within a restricted parking area

scheme using permissive parking signs. If so, the parking spaces/areas should be signposted using parking control signs in accordance.

Types of parking control include:

- Parking symbol – eg. ¼p, ½p, 1p or 2p
- Times of operation – eg. 9 am– 9 pm mon – fri
- User limitations – eg. Motor cycles, bicycles, cars.

4. Enforcement: Enforcement of other parking schemes such as pay parking and permissive parking implemented by parking authorities within restricted parking areas should be carried out by authorized officers. They should regulate parking demand by issuing high penalty charge for breaching the traffic rules, restricting parking duration, encouraging employees to use less convenient parking spaces (such as parking lots at the urban fringe) during peak periods in order to leave the most convenient spaces for **customers, limiting the use of on-street parking** for longer duration by local residents and prohibiting on-street parking on certain routes during peak periods to increase traffic lanes.
5. Parking Pricing: Parking pricing should be allowed on following road stretches with proper markings clearly. It is suggested that a parking fee of Rs.5/- for two-wheelers and Rs. 10/- of cars for one hour should be charged. Time restriction is important to encourage short-term parking. It is also recommended to implement a differential parking fee policy with increasing fee structure in the central area and outer areas or a differential parking fee policy with increasing fee structure in peak hours or duration of parking. Paid parking can also provide a means of revenue generation to the municipality.

5.8 TECHNOLOGICAL MEASURES

Technological improvements include advanced applications which, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

5.8.1 INTELLIGENT TRANSPORT SYSTEMS

ITS encompasses all modes of transportation- air, road and rail and intersects various components of each mode- vehicles, infrastructure, communication and operational systems. Intelligent Transport Systems will include:

a) **Advanced Traffic Management Systems (ATMS)** integrates various sub-systems (such as CCTV, vehicle detection, communications, variable message signs etc) into a coherent single interface that provides real information on traffic status.

b) **Advanced Traveller Information Systems (ATIS)** provides users of transportation systems both public and private mode users travel related information regarding routes, estimated travel times etc.

c) **Advanced Vehicle Control Systems (AVCS)** are tools and concepts that enhance the driver's control of the vehicle to make safe and more efficient.

d) **Commercial Vehicle Operations** for constant monitoring of heavy vehicles. It can be in the form of smart cards, weigh bridges etc.

e) **Advanced Public Transportation Systems** to enhance efficiency of public transit systems through information systems, signal priorities, GPRS etc

Vehicle-actuated control uses information on current demands and operations, obtained from detectors within the intersection, to alter one or more aspects of the signal timing on a cycle-by-cycle basis. Timing of the signals is controlled by traffic demand. Actuated controllers may be programmed to accommodate:

- Variable phase sequences (e.g., optional protected LT phases)
- Variable green times for each phase
- Variable cycle length, caused by variable green times

Such variability allows the signal to allocate green time based on current demands and operations. A proper clearance interval between the green & the red phases is also ensured. The various advantages of actuated signals are:

- They can reduce delay (if properly timed).
- They are adaptable to short-term fluctuations in traffic flow.
- Usually increase capacity (by continually reapportioning green time).
- Provide continuous operation under low volume conditions.
- Especially effective at multiple phase intersections.

TYPICAL OPERATION OF ATCS

- An area sub-divided into zones or corridors
- Corridors operate on common background cycle
- Signal timings and Cycle lengths updated dynamically based on real-time demand
- Signals synchronized for green-wave
- Offset deviation corrected at plan transition

5.8.1.1 CASE STUDY: VEHICLE-ACTUATED WITRAC TECHNOLOGY IN PUNE

The WiTrac is a vehicle-actuated system that uses wireless technology to control traffic signals. The Master control of this system operates several sub-controls by sending wireless signals. The system is also equipped with cameras that constantly monitor traffic status and keep an eye on each and every vehicle within its jurisdiction. A special centralized control room monitors these cameras. The system is power efficient since it runs on solar power with power backup of up to 72 hours. Also, its installation does not require digging up of roads to lay cables (it being wireless). The system is highly power efficient, and the mounted solar panels offer the system 72 hours of backup time. A typical Junction Installation is shown below:

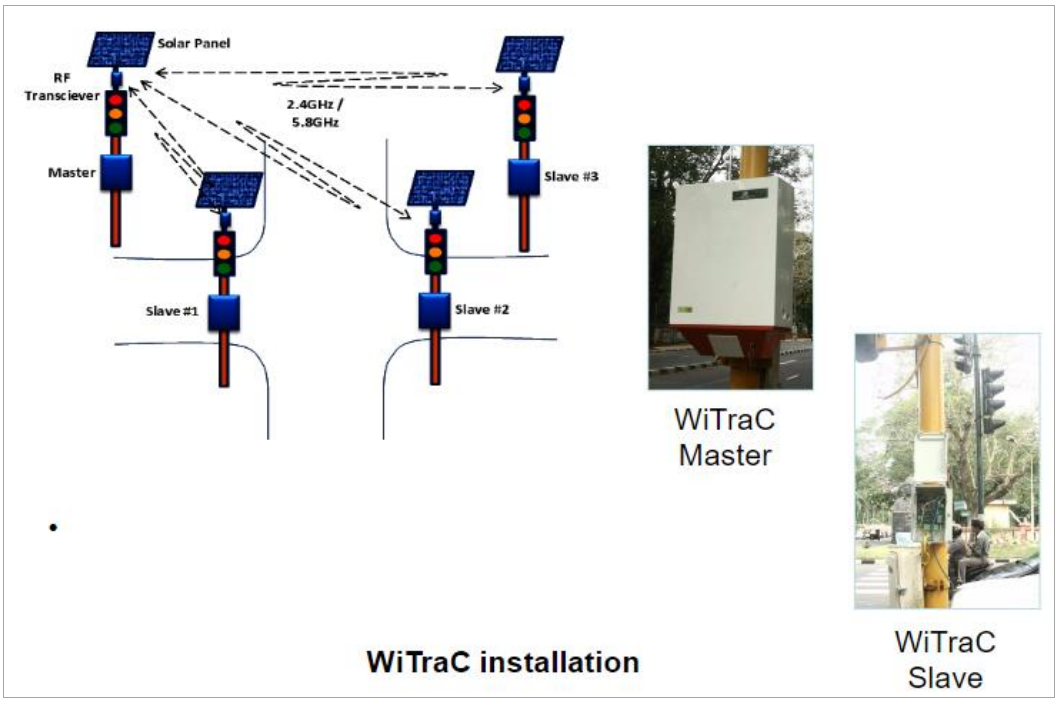


FIGURE 5-32: WITRACC INSTALLATION

Trafitronics, the company responsible for marketing of WiTrac, has already installed the system in the following cities:

TABLE 5-15: CITIES WITH WITRAC SYSTEMS IMPLEMENTED

LOCATION	NO. OF JUNCTIONS
Pune Phase I	38
Pune Phase II	30
Kolkata	95
Jaipur Phase (I,II,II)	25
Ahmedabad	93

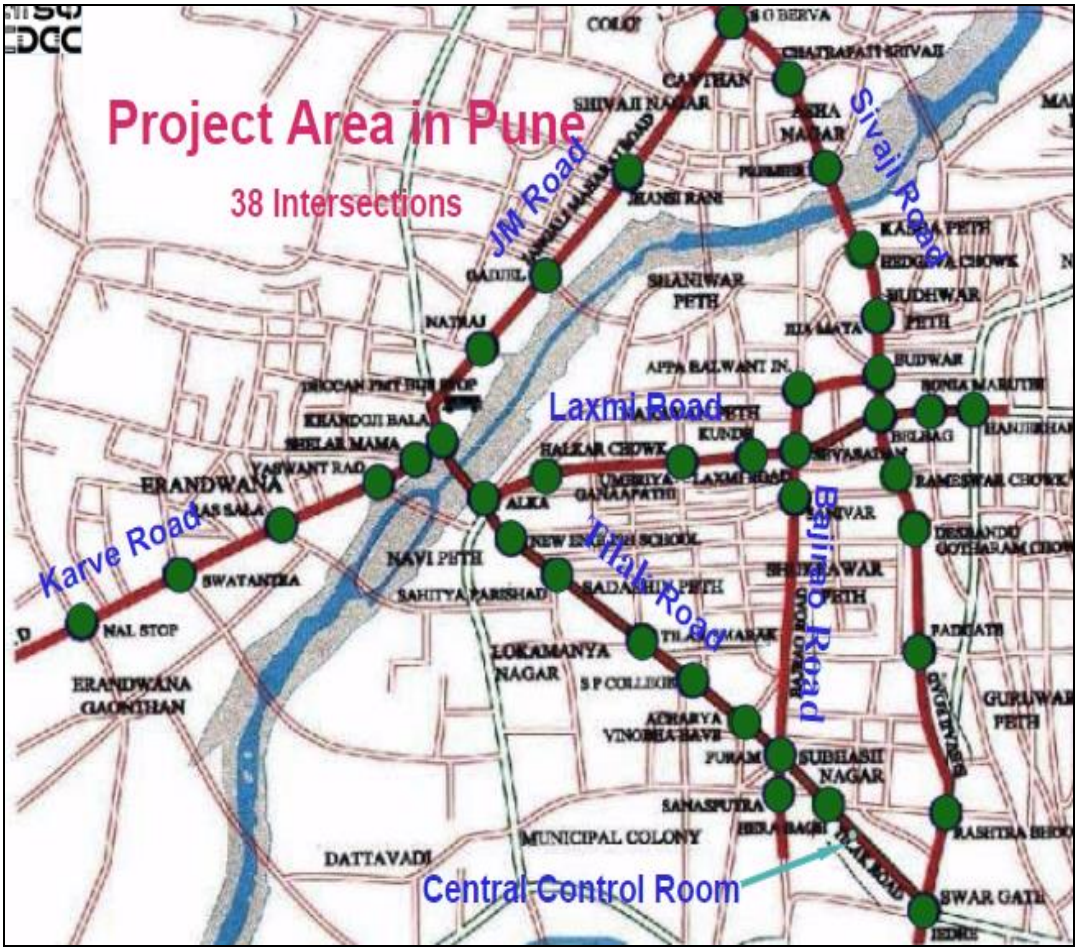


FIGURE 5-33: ATCS PROJECT JUNCTIONS IN PUNE

Impact Analysis of ATCS System in Pune

- Average travel speed increase in the range of 2% to 12%
- Reduction in average delay in the range of 11% to 30%
- Estimated annual fuel savings in the year 2006 due to implementation of ATCS is about Rs. 4.77 Crores
- Estimated annual time saving benefits in the year 2006 due to implementation of ATCS is about Rs. 0.83 Crores
- Total annual saving in the year 2006 due to implementation of ATCS on the 6 project corridors is about Rs. 5.60 Crores
- Overall Increase in the Traffic Volume is 9.06%

5.8.1.2 ATCS for KAKAINADA

In case of Kakinada based on the traffic volume analysis and proposed junction improvements in Section 5.6, the following list of junctions have been identified for the installation of ATCS systems.

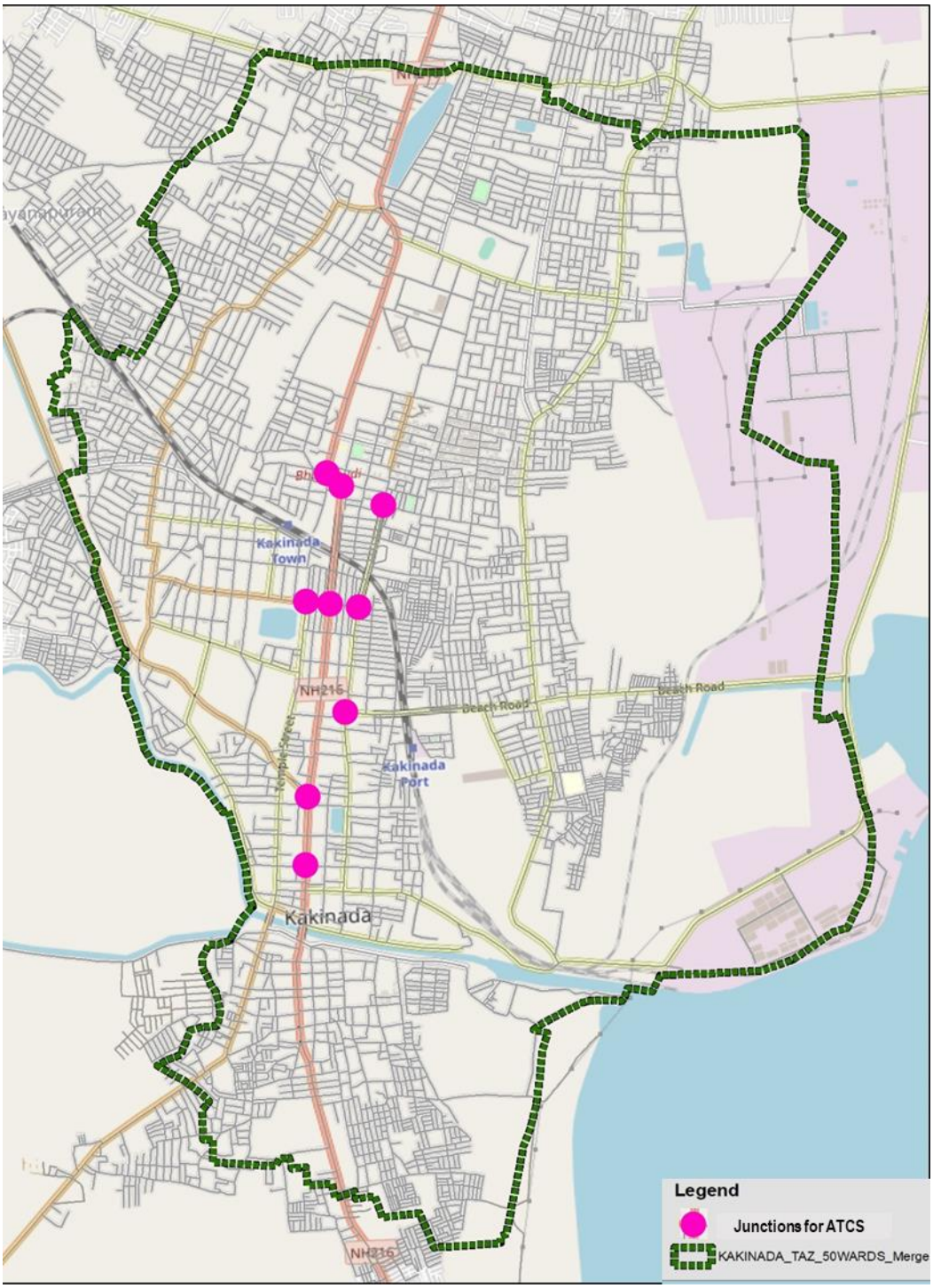


FIGURE 5-34: PROPOSED LOCATIONS FOR ATCS

This system is expected to considerable improvement the traffic movement in the city.

6. PROJECT IMPACT ASSESSMENT

6.1. 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 Chapter 7.

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 LCMP 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 LCMP. 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 LCMP.

Each project is prioritized based on scoring it across seven criteria:

- Mobility
- Accessibility
- Safety
- Energy
- Environment
- Carbon-di-Oxide Mitigation
- Project Cost

6.1.1 PROPOSAL 1: PUBLIC TRANSPORT SYSTEM

TABLE 6-1: PHASING AND PRIORITIZATION OF PUBLIC TRAMSPORT SYSTEM PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Improved Bus System	Critical	High	Phase I, II
Intermodal Facilities	Desirable	High	Phase I, II,III
Terminals	Critical	Medium	Phase II
Bus Stops	Critical	High	Phase I
Intermediate Public Transport	Critical	High	Phase I

6.1.2 PROPOSAL 2: NON-MOTORISED TRANSPORT FACILITY IMPROVEMENT

TABLE 6-2: PHASING AND PRIORITIZATION OF PEDESTRIAN FACILITY PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Footpath	Critical	High	Phase I

TABLE 6-3: PHASING AND PRIORITIZATION OF BICYCLING PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Semi Segregated Cycle Track	Critical	High	Phase II
Segregated Cycle Tracks	Critical	Medium	Phase II
Cycle parking Stands	Critical	High	Phase I

6.1.3 PROPOSAL 3: FREIGHT MANAGEMENT PLAN

TABLE 6-4: PHASING AND FREIGHT MANAGMENT PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Freight Policy	Critical	Medium	Phase II
Freight Terminals	Critical	Medium	Phase II

6.1.4 PROPOSAL 4: PARKING MANAGEMENT PLAN

TABLE 6-5: PHASING AND PRIORITIZATION OF PARKING MANAGEMENT PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
On-street Parking	Desirable	Medium	Phase I
Offstreet Parking	Desirable	Medium	Phase I, II
MLCP	Desirable	Medium	Phase I, II

6.1.5 PROPOSAL 5: INTELLIGENT TRANSPORTATION SYSTEMS

TABLE 6-6: PHASING AND PRIORITIZATION OF ITS PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Automated Vehicle Location System	Desirable	Medium	Phase I, II
Variable Message Signs	Desirable	Medium	Phase I, II
ITS control Centre, PIS, Common Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras	Desirable	Low	Phase III

6.1.6 PROPOSAL 6: ROAD NETWORK PLAN

TABLE 6-7: PHASING AND PRIORITIZATION OF ROAD NETWORK PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
ROB			
Atchuthapuram	Critical	Low	Phase II
Kondayyapalem	Critical	High	Phase I
Rechallapeta	Critical	High	Phase I
Kakinada Anchorage Port	Critical	Low	Phase II
Dummalapeta	Critical	Low	Phase II
Bridges			
Near Indrapalem	Critical	Low	Phase III
Near Dugiralavari Street		Low	Phase III
Road Widening			
Pithapuram_Kakinada Rd	Desirable	Medium	Phase II
Nukkalamma temple street towards Gandhi Nagar		Medium	Phase II
NH214 towards two town police station		Medium	Phase II
Kakinada		Medium	Phase II
Towards Revenu Colony		Medium	Phase II
Wharf Road towards Rama Rao Peta		Low	Phase II
IBP Auto Service		Medium	Phase II
Sri Tirumala Theatre		Medium	Phase II
Kothapeta Fish Market		Medium	Phase II
ESI Hospital		Medium	Phase II
R K Plaza Complex		Medium	Phase II
Near Kotiah Sweets		Medium	Phase II
NH214 towards JNTU Engineering College		Medium	Phase II
Nageshwar Rao Street towards Pattabhi Street		High	Phase II
Jagannathapuram Bridge		Medium	Phase II
Commercial Tax			
Junctions for Geometry Improvement			
Z P Center Junction	Critical	High	Phase I
Bhanugudi Junction		High	Phase I
Kondayyapalem Junction		High	Phase I
Municipal Office Junction		High	Phase I
2 Town Police Station Junction		High	Phase I
Kottapeta Market Junction		High	Phase I
Surya rao peta junction		High	Phase I
Three Lights junction		High	Phase I
Ramarao Peta Junction		High	Phase I
NTR Bus Stop Junction		High	Phase I
Balaji Cheruvu Junction		High	Phase I
Masjid Center Junction		High	Phase I
Sarpavaram Junction		High	Phase I
Nagamalli Thota Junction		High	Phase I

Proposed Schemes	Category	Priority based on scoring	Phasing
Gold Market Junction		High	Phase I
Munsif Junction		High	Phase I
Indrapalem Bridge Junction		High	Phase I
Nukkalamma Temple Junction.		High	Phase I
Dairy Farm Junction		High	Phase I

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 5 years as per the requirement.
- Medium Term Improvements (Phase II): the projects than need to reviewed implemented between 5-10 years as per the requirement.
- Long Term Improvements (Phase III): the projects than need implemented between 10-20 years.

Accordingly, long term, medium term and short-term proposals for Kakinada are shown in Table 6-8, Table 6-9 and Table 6-10.

6.1.7 SHORT TERM PROPOSALS

TABLE 6-8: LIST OF SHORT-TERM PROPOSALS

S. NO	PROJECTS
1	Junction Improvements
2	Footpath
3	Bicycles Stands
4	Bus Shelters
5	Improvement of Existing Bus Terminals
6	Parking Management Plan – On Street Parking
7	Improved Bus System
8	Skywalks

6.1.8 MEDIUM TERM PROPOSALS

TABLE 6-9: LIST OF MEDIUM-TERM PROPOSALS

S. NO	PROJECTS
1	Up-gradation of Existing Roads
2	Shared Cycle Tracks
3	Dedicated Cycle Tracks
4	New Bus Terminal
5	Proposed Truck Terminals
6	Off-Street Multi-Level Parking
7	ITS Systems

6.1.9 LONG TERM PROPOSALS

TABLE 6-10: LIST OF MEDIUM-TERM PROPOSALS

S. No	Projects
1	Development of New Links
2	Rail Over Bridges

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.

6.2 IMPACT ASSESSMENT OF SHORT, MEDIUM- & LONG-TERM IMPROVEMENTS

Projects evolved in LCMP will help to achieve sustainable development goals by means of reducing private mode share and travel time. The anticipated impacts of proposed projects are presented IN Table 6-11.

TABLE 6-11: IMPACT OF PROPOSED PROJECTS

Scenario	Private vehicle share (%)	IPT Share (%)	PT Share (%)	NMT Share (%)	Average Trip length (km)	Speed (in Kmph)	Average V/C
Base Year – 2018	37.7%	30.8%	19.1%	12.4%	7.0	22.3	0.70
Business as Usual – 2038	39.76%	32.31%	24.20%	3.72%	9.0	21.8	1.14
Sustainable Urban Transport – 2038	21.6%	22.2%	35.5%	20.7%	8.1	25	0.99

6.2.1 SOCIAL IMPACT

The impact of the proposed projects from the social angle is analyzed 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. The broad impacts have been compiled in Table 6-12.

TABLE 6-12: BROAD IMPACT OF PROPOSED PROJECTS

Project	ROW/Land Acquisition	Improve Mobility	Reduction in Travel Time
Improved Bus Systems	No	Yes	Yes
Intermodal Stations	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

6.2.2 ENVIRONMENTAL IMPACTS

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the LCMP. 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 6-13.

TABLE 6-13: 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.
		Pedestrian Infrastructure development like subways/foot over bridges/ signals etc.	Improvement in pedestrian safety. Slowing of traffic at the time of constructing and erecting structures across major intersections.
3	Public Transport Planning	Terminals/Depots/ Transport Hubs/Bus Stops	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. Construction stage impacts include the increase in air and noise pollution. Contamination of road runoff with stacked construction materials.

	Project	Sub Components	Impacts
			Improvement of traffic conditions during operation stage causing reduction in air and noise pollution. 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.
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	Others-Road Infrastructure	Banning and restrictions	Reduction in urban congestion due to banned movement of freight in the day hours Improved speeds in core area due to reduction in congestion
6	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

6.2.2.1 TECHNOLOGY TRANSITIONS

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.

6.2.2.1.1 VEHICLES AND FUELS

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 Kakinada, there would be:

- A change in fuels due to greater use of CNG (predominantly in buses), and cleaner petrol and diesel; more efficient engines.
- 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. Some of the broad indicators for environmental impact changes are quantified and are presented in Table6-14 and Table 6-15.

TABLE 6-14: ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS

Name of the Impact	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Local Emissions (Tonnes/day)	7.6	10.6	3.5
GHG Emissions (Tonnes/day)	214.0	491.3	192.4
Exposure to Transport Noise	>75	>75	<75
Percent of public transport fleet in compliance with Indian emissions standards	0	0	80%

TABLE 6-15: MODE-WISE ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS

Emission Type	Local Emissions				CO2/GHG Emissions			
Vehicle Type	Base-2018	BAU-2038	SUT-2038	% Reduction	Base-2018	BAU-2038	SUT-2038	% Reduction
	Tonnes/Day				Tonnes/Day			
Cars	0.4	3.6	0.4	-90%	16.8	199.4	23.8	-88%
2Ws	1.1	0.0	0.5	940%	17.1	0.9	11.7	1147%
3Ws	1.3	0.5	0.1	-75%	34.2	38.7	11.1	-71%
Buses	4.9	6.4	2.5	-61%	145.9	252.3	145.7	-42%
All Modes	7.6	10.6	3.5	-67%	214.0	491.3	192.4	-61%

Thus, the timely implementation of the proposed project shall result in improved travel times, cleaner air and improved travel experience in the city.

7. IMPLEMENTATION PLAN

7.1 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 LCMP 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 2018.

The projects proposed are to be implemented in three phases.

- Phase I - To be implemented between 2018 and 2022
- Phase II – To be implemented between 2022 and 2032
- Phase III - To be implemented between 2032 and 2038

The overall short-term project cost is estimated to be 277.44 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 152.74 crores. The long-term projects will cost around 228.41 crores. The detail costing is represented in Table 7-1 & Table 7-2.

TABLE 7-1: PHASE WISE COSTING OF THE PROPOSED PROJECTS

Sl.No	Projects	Total Cost (in Crores)	Phasing Rs (in Crores)		
			2018-2022	2022-2032	2032-2038
1	Improvement of Road Network	293.64	11.40	85.96	196.28
2	Improvement of Non-Motorised Transport Facilities	193.71	189.06	4.36	0.29
3	Improvement of Public Transport System	93.50	65.69	27.81	0.00
4	Improvement of Freight Transportation System	38.21	0.00	16.98	21.23
5	Intelligent Transportation System Facilities	35.19	10.82	13.75	10.61
6	Improvement of Parking Facilities	4.34	0.46	3.88	0.00
Overall LCMP Proposals		**658.59**	**277.44**	**152.74**	**228.41**

TABLE 7-2: PHASE WISE COSTING OF THE PROPOSED PROPOSALS

Sl.No	Projects	Unit	Total Quantity	Unit Rate (in Crore)	Total Cost (in Crores)	Project Phasing Quantities				Phasing Rs (in Crores)			
						2018-2023	2023-2028	2028 - 2038	2031-2036	2016-2021	2021-2026	2026-2031	2031-2036
Improvement of Road Network													
1	Upgradation of Existing Roads	Km.	32.4	2.653	85.96	0.00	32.40	0.00	0.00	0.00	85.96	0.00	0.00
2	New 4-Lane Roads (Proposed Outer Ring Road)	Km.	25.0	5.041	126.03	0.00	0.00	25.00	0.00	0.00	0.00	126.03	0.00
3	Bridges (2-Lanes)	No.	2.0	4.616	9.23	0.00	0.00	2.00	0.00	0.00	0.00	9.23	0.00
4	Flyover (4-Lanes)	No.	0.0	7.694	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Rail Over Bridges (4-Lanes)	No.	5.0	12.205	61.02	0.00	0.00	5.00	0.00	0.00	0.00	61.02	0.00
6	Junction Improvements	No.	19.0	0.600	11.40	19.00	0.00	0.00	0.00	11.40	0.00	0.00	0.00
Total Project Cost					293.64					11.40	85.96	196.28	0.00
Improvement of Non-Motorised Transport Facilities													
1	Footpath	Km.	85.0	1.167	99.23	147.80	0.00	0.00	0.00	172.54	0.00	0.00	0.00
2	Foot Over Bridges	No.	0.0	0.849	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Skywalk	Km.	1.0	16.000	16.00	1.00	0.00	0.00	0.00	16.00	0.00	0.00	0.00
4	Pedestrian Subway	No.	0.0	2.547	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Shared Cycle Tracks	Km.	44.0	0.019	0.82	0.00	75.00	0.00	0.00	0.00	1.39	0.00	0.00
6	Dedicated Cycle Tracks	Km.	41.0	0.037	1.52	0.00	71.00	0.00	0.00	0.00	2.64	0.00	0.00
7	Bicycles	No.	725.0	0.001	0.69	75.00	350.00	300.00	0.00	0.07	0.33	0.29	0.00
8	Bicycle Sub Docking Stations	No.	20.0	0.013	0.27	20.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00
9	Bicycle Major Docking Stations	No.	5.0	0.037	0.19	5.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00
Total Project Cost					118.71					189.06	4.36	0.29	0.00
Improvement of Public Transport System													
1	Bus Fleet Augmentation-(Diesel & CNG Buses)	No.	45.0	0.722	32.47	30.00	15.00	0.00	0.00	21.65	10.82	0.00	0.00
2	Bus Fleet Augmentation-Electric Buses	No.	30.0	1.443	43.30	20.00	10.00	0.00	0.00	28.87	14.43	0.00	0.00
3	Bus Shelters	No.	150.0	0.096	14.33	150.00	0.00	0.00	0.00	14.33	0.00	0.00	0.00
4	Improvement of Existing Bus Terminals	No.	2.0	0.425	0.85	2.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00
5	New Bus Terminal	No.	2.0	1.274	2.55	0.00	2.00	0.00	0.00	0.00	2.55	0.00	0.00
6	Bus Rapid Transit System	Km.	0.0	15.919	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Rail based Transit System	Km.	0.0	95.514	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Project Cost					93.50					65.69	27.81	0.00	0.00
Improvement of Freight Transportation System													
1	Upgradation of Existing Truck Terminal	Sq.m	0.0	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Proposed New Truck Terminals	Sq.m	45000.0	0.001	38.21	0.00	20000.00	25000.00	0.00	0.00	16.98	21.23	0.00
Total Project Cost					38.21					0.00	16.98	21.23	0.00
Intelligent Transportation System Facilities													
1	New Signal Installations	No.	15.0	0.425	6.37	15.00	0.00	0.00	0.00	6.37	0.00	0.00	0.00
2	Area Traffic Control System	Km.	7.0	0.637	4.46	7.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00
3	ITS control Centre, PIS, Common Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras)	Km.	57.4	0.425	24.37	0.00	32.40	25.00	0.00	0.00	13.75	10.61	0.00
Total Project Cost					35.19					10.82	13.75	10.61	0.00
Improvement of Parking Facilities													
1	On street Parking	Km.	5.6	0.083	0.46	5.60	0.00	0.00	0.00	0.46	0.00	0.00	0.00

LOW CARBON MOBILITY PLAN FOR KAKINADA

Sl.No	Projects	Unit	Total Quantity	Unit Rate (in Crore)	Total Cost (in Crores)	Project Phasing Quantities				Phasing Rs (in Crores)			
						2018-2023	2023-2028	2028 - 2038	2031-2036	2016-2021	2021-2026	2026-2031	2031-2036
2	Off street Parking (Surface)	No.	2.0	0.129	0.26	0.00	2.00	0.00	0.00	0.00	0.26	0.00	0.00
3	Off street Parking (Multi-Level-Car-Parking)	No.	2.0	1.809	3.62	0.00	2.00	0.00	0.00	0.00	3.62	0.00	0.00
Total Project Cost					4.34					0.46	3.88	0.00	0.00
Overall Comprehensive Traffic and Transportation Plan Proposals													
Total Project Cost					**583.59**					**277.44**	**152.74**	**228.41**	**0.00**

7.2 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.

7.2.1 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.

7.2.2 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.

7.2.2.1 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

7.2.2.2 AMRUT FUNDING

Since cities and towns in India constitute the second largest urban system in the world and contribute over 50% of the country's GDP, they are central to economic growth. For the cities to realise their full potential and become effective engines of growth, it is necessary that focused attention be given to the improvement of infrastructure in an organised manner. According to AMRUT guidelines:

One-third of the project cost as grant from GoI for cities with a population of above 10 lakh.

Balance funding by State Governments / ULBs or through private investment.

The tender will include O & M for five years based on user charges. For the purpose of calculation of the project cost, the O&M cost will be excluded; however, the States/ULBs will fund the O&M through an appropriate cost recovery mechanism in order to make them self-reliant and cost-effective.

7.2.2.3 DEDICATED URBAN TRANSPORT FUND AT CITY LEVEL

For the projects, which are not admissible under AMRUT, or 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:

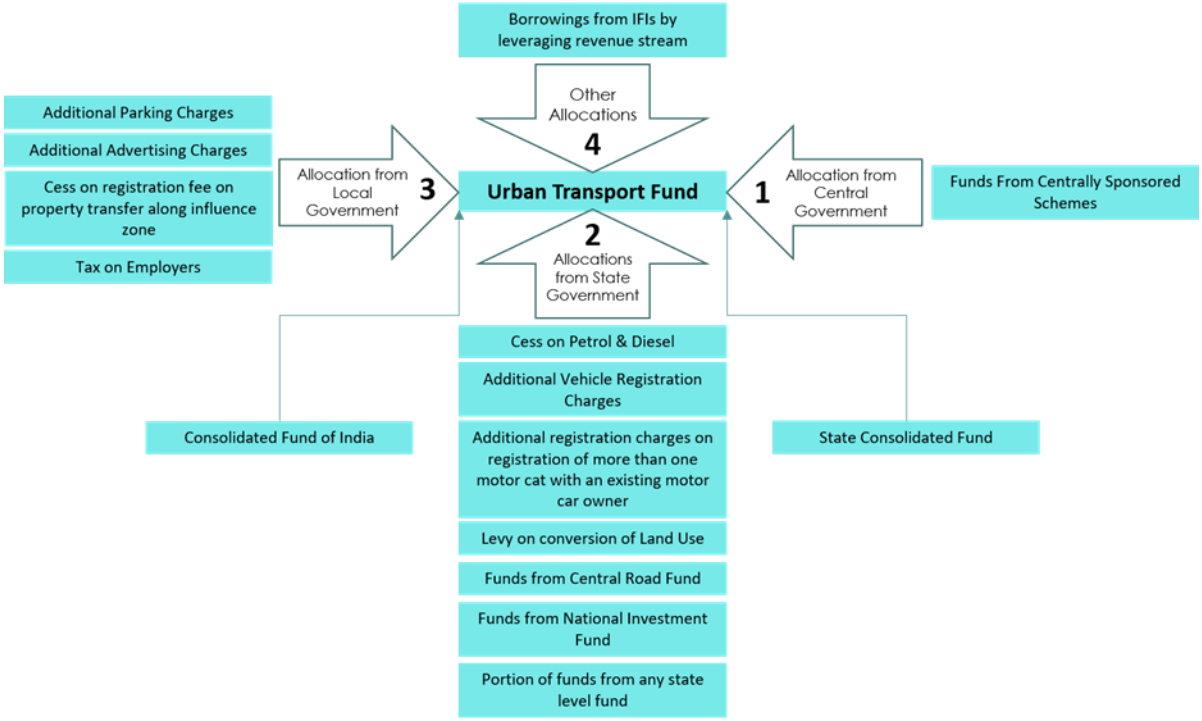


FIGURE 7-1: SOURCES OF FUNDS FOR URBAN TRANSPORT FUND

7.2.2.3.1 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.

7.2.2.3.2 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.

7.2.2.3.3 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.

7.2.2.3.4 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.

8. INSTITUTIONAL FRAMEWORK

8.1 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.

With the formation of a State level UMTA, part of the problem has been sorted. However, this would have a macroscopic view of resolving policy issues for all urban centres within the state. There still remains a need to set up a localized organization that results in coordinated strategic level planning at the city level and deal with more day to day issues of urban transport.

Following is the list of departments and Organizations involved in urban affairs and urban transport in Kakinada

- Housing and Urban Planning Department
- State Urban Development Department
- Public Works Department
- National Highway Authority of India (NHAI)
- Superintendent of Police, (Traffic) Kakinada
- Andhra Pradesh State Road Transport Corporation (APSRTC)
- Railways
- Regional Transport Office (RTO)
- Kakinada Municipal Corporation (KMC)

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.

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.

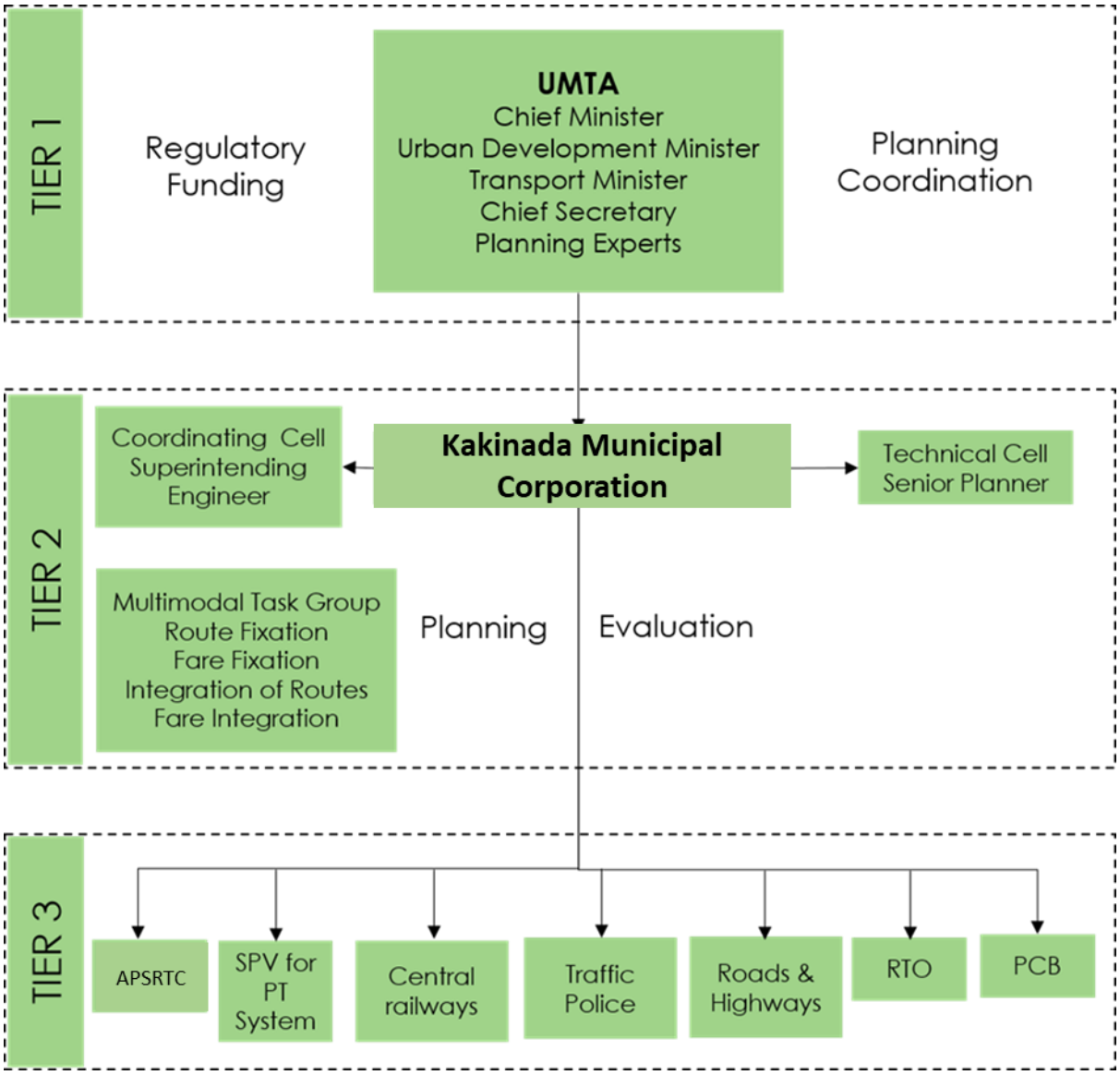


FIGURE 8-1: RECOMMENDED STRUCTURE FOR UMTA SETUP

8.2 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;

8.3 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

8.4 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.

8.5 IMPLEMENTING AGENCIES

Based on roles and responsibilities of various institutions, the agencies responsible for implementing the proposed projects in the LCMP are given in Table 8-1.

TABLE 8-1: DETAILS OF IMPLEMENTATION AGENCY

Sl.No	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
4	Flyover (4-Lanes)	PWD/NHAI	PWD/ NHAI / Private	PWD / NHAI / Private
5	Rail Over Bridges (4-Lanes)	PWD/NHAI/KMC	PWD/ NHAI / Private	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	PWD / KMC/ Traffic Police	KMC / PWD/ Traffic Police
2	NMT Only Lanes	KMC / PWD	PWD / KMC	KMC / PWD
5	Shared Cycle Tracks	KMC / PWD	PWD / KMC	KMC / PWD
6	Dedicated Cycle Tracks	KMC / PWD	PWD / KMC	KMC / PWD
Improvement of Public Transport System				
1	Bus Fleet Augmentation-(Diesel & CNG Buses)	APSRTC	State Govt.	APSRTC
3	Bus Shelters	APSRTC/KMC	APSRTC/KMC/PPP	APSRTC/KMC/PPP
4	Improvement of Existing Bus Terminals	APSRTC / State Govt.	State Govt. / APSRTC	APSRTC
5	New Bus Terminal	APSRTC / State Govt.	State Govt. / APSRTC	APSRTC
6	Public Education and Awareness program	Directorate of Urban development /KMC/traffic police	GoI / State Govt. / KMC	Public Education and awareness program
Improvement of Freight Transportation System				
2	Proposed New Truck Terminals	State Govt. / KMC / Traffic Police	State Govt. / Private	Private
Intelligent Transportation System Facilities				
1	New Signal Installations	KMC/Traffic Police	Traffic Police/KMC/PPP	Traffic Police/KMC/PPP
2	Area Traffic Control System	KMC/Traffic Police	Traffic Police/KMC/PPP	Traffic Police/KMC/PPP
3	ITS control Centre, PIS, Common	KMC/Traffic Police	Traffic Police/KMC/PPP	Traffic Police/KMC/PPP

Sl.No	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
	Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras)			
Improvement of Parking Facilities				
1	On street Parking	KMC/Traffic Police /respective and owner/PWD	KMC/Traffic Police	KMC/Traffic Police
2	Off street Parking (Surface)	KMC/Traffic Police /respective and owner/PWD	KMC/Traffic Police /Private	KMC/Traffic Police /Private
3	Off street Parking (Multi-Level-Car-Parking)	KMC/Traffic Police /respective and owner/PWD	KMC/Traffic Police /Private	KMC/Traffic Police /Private
4	Parking Policy	Traffic Police/KMC		Traffic Police/KMC

9. STAKEHOLDER CONSULTATION

The Stakeholder workshop on Low Carbon Mobility Plan for Kakinada was held on 10th of December, 2018 at the AP Secretariat in Vijayawada. It was held to get suggestions on the recommendation of the comprehensive mobility plan adopted for Kakinada city. The workshop included a presentation by Urban Mass Transit Company on the Business as Usual (BAU) and Sustainable Urban Transport (SUT) and the projects identified as part of the LCMP project. The presentations were followed by a rich discussion with the city stakeholders, which gave new perspective and suggestions on the implementation of this project in the city after making a Detailed Project Report (DPR) for the same.

Introduction of the Project: Mr. N P Rama Krishna Reddy (Managing Director) from the Amaravati Metro Rail Corporation Limited introduced the LCMP project to the city stakeholders by explaining its importance of planning for the future developments of Kakinada City. He further added that the LCMP team had been working diligently on the project, and had devised the project proposals, which could be further detailed out for implementation. The presentation was attended by the following members (refer Annexure 3);

Mr. N. P. Ramakrishna Reddy	Managing Director, AMRC
Mr. V. Ramudu	Director, Town and Country Planning
Mrs. S. Pavani	Mayor, Kakinada
Mr. K. Ramesh	Municipal Commissioner
Mr. Vijaya Saradhi	Regional Transport Officer
Mr. C. Ravi Kumar	Regional Manager, APSRTC
Mr. SK. Kalesh	Asst. City Planner, KMC
Ms. Siri Anand	Dy. Transport Commissioner, RTA (I/C)
Mr. S. Rama Krishna	Sr. Vice President, UMTC
Mr. Ankush Malhotra	Vice President, UMTC
Mr. J. Siva Niranjan	Manager, UMTC
Mrs. M Harshita Sarma	Asst. Manager, UMTC
Mr. Rakesh Jinka	Project Officer, UMTC
Ms. Sri Navya Annem	Sr. Office, UMTC

FIGURE 9-1: IMAGES OF THE STAKEHOLDER CONSULTATION MEETING

A detailed presentation on the Comprehensive Mobility Plan for Kakinada was carried out by the UMTC team (Refer Annexure 4).

The following points are discussed in detail in the presentation:

- An overview of the CMP project was presented with a detail description of:
  - The scope of work.
  - Detailed approach and methodology of the CMP Project.
  - Details of Secondary data collection and Primary Surveys.

- Profile of the City
- Inferences from the travel characteristics and city growth patterns are presented along with the projected population and employment for the base and horizon years.
- The existing and forecasted travel demand in the study area are explained.
- The following Sustainable Urban Transport Strategies are discussed in detail:
    - Integrated Land Use Transport Strategy - The major and minor activity nodes in the City identified and network suggested and further network linkages established are detailed along with the identified mobility corridors for Transit Oriented Development.
    - Road Network Improvement Strategy - Strategies such as Network Pattern (Ring Radial Structure), Lane Configurations (Up gradations of Existing Roads, envisaged Road Cross Sections), Proposed New Links (Missing Links and New Roads) and Proposed Road Infrastructure (ROBs/RUBs) are narrated in detail.
    - Public Transport Strategy - Strategies such as City Bus Systems (with details on Required Fleet, Routes and Vehicle Type), Proposed new Bus Terminal Locations, Intermediate Public Transport System (with details on Infrastructure Improvements, Routes to be integrated with the Public Transport System and Phase wise up gradation of e-Rickshaws), Locations of Multimodal Integration Nodes and programs to promote Public Transport Outreach are explained.
    - Non-Motorised Transport Strategy - Corridors identified for the footpath development and bicycle infrastructure along with their details are indicated.
    - Traffic Engineering and Management Strategy - Proposals pertaining to junction improvements in terms geometry, design and pedestrian safety infrastructure is explained. Parking Management with idea on parking policy and Parking Solutions with identified On-Street and Off-Street Parking Locations are also explained. Intelligent Transport Solutions with proposed location for improvements and Proposed Vehicle Technologies are discussed.
    - Freight Strategy - Locations of the truck terminals along with the area required and proposed trucks capacity with the stakeholders is narrated.
- The scenario comparison assessing the impacts on travel characteristics for horizon year for Business as Usual Scenario and Sustainable Urban Transport Scenario are incidentally explained the benefits of Sustainable Urban Transport Scenario and Sustainable Urban Transport Strategies.

- Prioritization of identified Projects in three phases under Immediate - Short term plans, Medium term plans and Long-term plans for development of a comprehensive system to capture the maximum benefits are explained.
- The presentation concluded by explaining the total and phase wise Block Cost Estimates.

ANNEXURE 1- TRAFFIC ANALYSIS ZONES

WARD NO.	LOCALITIES
1	Pithapuram Road, Boat Club Back Side, Ramanayya Peta, R.T.C. College Street, Ashrama Public School Opp. Street, Padma Nagar Street
2	Ramanayya Peta, Vaidya Nagar, J.N.T.U. College, Suresh Nagar, Venkat Nagar, Yadav Nagar, Bonthagunta Area
3	N.F.C.L. Street, Siddardha Nagar, Santhanapuri Colony, Jayaparakash Nagar Colony, Rajaram Ratna Nagar, Godarigunta, Military Road, Lakshmi Nagar
4	Perraju Peta, Sri Nagar, Endoments Colony, 100 Buildings, Aditya College Street, Janmabhoomi Park
5	Srinagar, Vallabai Street, Padma Priya Theater Street, Meka vari Street, Peketi vari Street
6	Nookalamma Manyam, 100 Buildings, Nallam vari Street, Gurrala vari Street, Barma Colony, Old Church Street, Ambedkar Community Hall
7	Sri Vidya Colony, Venkat Nagar, Kotha Kakinada, Kannayya Kapu Nagar, Santhi Nagar, Postal Colony, Ayodhya Nagar
8	Anjaneya Swamy Temple Street, Kalara Pakalu, Sambamurthy Nagar, Dophin Colony, Jyothula Colony, Sambamurthy Nagar 1,2,3,4 Streets
9	RajaRam Mohan Nagar, Municipal Employees Street, Satya Nagar,Indira Colony, Pallamraju Nagar 1,2,3,4,5,6 Streets
10	Satya Nagar, Dummula Peta, Taraka Rama Nagar
11	Satya Nagar, Dummula Peta, Sanjay Nagar, Kotha Pakalu, Parlo Peta
12	Rangayya Naidu Street, Sanjay Nagar, Revenue Colony, Beach Road, Dairy Form, Venkateswara Nagar, New Port Station
13	Yetimoga, Nookalamma Temple Street, Anjaneya Swamy Temple Street, Nandi Temple Street, Palepu vari Street,
14	Yetimoga, Near Elementary School, Ramalayam Street, Nandi Temple Street, Palepuvari Street,
15	Goleela Street, Gampala vari Street, Pidugulamma Temple Street, Ramalayam Street, Konda vari Street, Yetimoga Near Municipal School
16	Old Hospital Street, Kotistambham Peta, Gandhi Centanary School Street, B.C. Hostel Street, Church Square Center, Yesu vari Street, Market Street, Valanda Peta, Bhupathi vari Street, Chodipalli vari Street
17	Goleela Peta, Market Street, Maridamma Peta, Myla vari Street, Aadam vari Street, Badesammana vari Street, Gampala vari Street, Naicker Street, Bade vari Street
18	Garikina Sattiraju gari Street, Jaalavari Street, Goleela Peta Line Club vari Street, Indira Nagar, Gopala Krishna Nagar, Yalla vari Garuvu, Sammidi vari Street
19	Saladi vari Street, Mutha Nagar, Health Center area, Sameer Nagar, Mahalakshmi Nagar, Lakshmi Nagar
20	Yanam Road, Komalivari Road, Sharif Street, Akasapu vari Street, Nunnaguppala vari Street, Palladi vari Street
21	Yesuvari Street (Side Street), Bade vari Street, Natla vari Street, Lankadi vari Street, Kurakula vari Street, Behara Hospital (Side Street), Neralamma Street, Bade vari Street

WARD NO.	LOCALITIES
22	Kesanavari Street, Meka vari Street, Paster Peta, Sishta vari Street, Agraharam, Chandika vari Street, Peddibottla vari Street, Relli Street, Kesanavari Street
23	Puram vari Street, Nagababu Street, Vishnalayam Street, Sivalayam Street, Chikkala vari Street, Nerelamma Temple Street, Velisetti vari Street, Nakka vari Street, Kosayya vari Street
24	Narasimha Road, Kunthi Devi Peta, Bhanu vari Street, Mahalakshmi Peta, Chikkala vari Street, Kapula Sandhu
25	Nunna vari Street, Kovvuru Road, Jagannadhapuram Main Road, Pappu Millu Area, Kanumuri vari Sandhu, Puram vari Street, Palepu vari Sandhu, Narasimha Road
26	Matha vari Street, Ponnamanda vari Sandhu, Nagaraju Peta, Paradesamma Peta, Canal Road Kovvuru Road, Jagannadhapuram Main Road
27	Tilak Street, Vivekananda Street, Nunna vari Street, Pydi vari Street, Warf Road, Cinema Road, Vijaya Rice Mill Sandhu, Vallabai Street, Old Post Office Street, Commercial Road
28	Jyothula vari Street, Rangayya Naidu Street, Suryanarayana Murthy Puram, Vaddialvari Street, Rajaji Street, Mallipamula vari Street
29	Chittu vari Street, Jonnada vari Street, Subhash Street, Ashramam vari Street, Patnala vari Street, Ganji vari Sandhu, Yallavari Street, Rangayya Naidu Street, Rajaji Street, Inti vari Street
30	Ganjam vari Street, Devalayam Street, Rajaji Street, Warf Road, Penke vari Street, Nalam vari Street, Duvvuri vari Street, Buddavarapu vari Street, Duvvuri vari Street
31	Mantripragada vari Street, Durgani Sandhu, Chitturi vari Street, Polisetti vari Street, Koyya vari Sandhu, Manda vari Sandhu, Jyothula vari Street,
32	Venkateswara Swamy Temple Street, Kasikayala vari Street, Kaboli vari Street, Ramula vari Street, Gollala Street, Aatham vari Street,
33	Satyaprasanna Nagar, Chinna Street, Ragam Peta, Police Line Street, Bank Peta, Telu vari Sandhu, Anusuri vari Street
34	Vallabai Street, Ibrahim Street, S.B.I. Street, Seshabgalli, Majestic Street, Ramasomayajulu Street, Nookalamma Temple Street, Ungarala vari Street
35	Gabuvari Street, Ramakrishnarao Peta Main Road, Venkataratna Puram, Gorusu vari Street, Ramakrishnarao Peta, Neelapu vari Street, Gorusu vari Street
36	Cinema Road, Ramakrishnarao Peta, Madireddy vari Street, Lakshmi Raju vari Street, Mummidi vari Street, Ibrahim Street, Krishnamurthy Street
37	Main Road, Jawahar Street, Bavirisetti vari Street, Ramayya Street, Immandi vari Street, Gajula vari Street , R.R. Road, Ganjam vari Street
38	Atchutaramayya Street, Jawahar Street, Town Hall Street, Sali Peta, P.R. College Road, R.R. Rao, Mummidi vari Street, T.T.D. Kalayanamandapam Street, Devarakonda vari Street
39	Warf Road, Kacheri Peta, Venkateswara Colony Old Bus Stand Road, Warf Road Left Side
40	Mallayya Agraharam, Tirumalrao Street, Mahamod Ali Street, Old Post Office Street, Nookalamma Temple Street, Venkatanarayana Street, Tirumalarao Street
41	Sambamurthy Street, Mahamod Ali Street, Seshagirirao Street, Nageswara Rao Street, Atchutaramayya Street, Prakasam Street,
42	Main Road, Seshagirirao Street, Sambamurthy Street, Bala Tripurasundari Temple Street, Nookalamma Temple Street, Atchutaramayya Street, Veterinary Hospital Street, Gopalakrishna Street
43	Cheedial Pora, Trimularao Street, Penumudi vari Street, Police Club Street, Red Cross Street, Oleti vari Street, Datla vari Street, Jammalamadaka vari Street, Subbarao

WARD NO.	LOCALITIES
	Street
44	Mallayya Agraharam, Jwahar Ali Street, Pratap Nagar, Tresary Colony, Water Tank Front & Back,Ramalayama Street, Durgayya Thota Main Road, Ahutapuram Gate Main Road
45	Krishan Main Road Street, Mehar Nagar, Tyagaraju vari Street, Kala Venkatrao Street, Venugopala Swamy Street, Sai Baba Temple Street Dwaraka Nagar, Inti vari Street, Gowri Sankar Street, Kanakamahalakshmi Temple Street
46	Ramaswamy Street, Sriram Nagar 4th Street, Avasaralu vari Street, Sriram Nagar 2, 3rd & 4th Street, Cement Road, Kondayyapalem, Sriram Nagar Post Office,Railway Station Back Street, Pithapuram Road
47	Ramaswamy Street, Mahatma Street, Church Street, Military Road Kondayya Palem, 5 Buildings Center, L.B. Nagar, L.B. Nagar 1,2 3, 5 & 6, Industrial Area, Little Hood School Street
48	Karnamgari Junction, Vivekananda vari Street, Dhanunjaya Street, S.Atchutapuram, Ramakrishna Paramahamsa Street, Lal Bhadhur Sastry Street, Jagannadha Shaitan Residency, Andhra Bank Side Street, Santhi Ashramam Opp.
49	Ashok Nagar, Netaji Street, Veer Kamal Theater, Nallam vari Street, Abdul Kalam Street, S.B.I. Bank Colony, Rajeswari Nagar, Vidyut Nagar, Gaigolupadu Main Road, Ram Nagar,
50	Gaigolupadu Main Road, Rajendra Nagar, Vegullu Papayya Street, Srinivasa Nagar Bank Colony, Lalitha Nagar, Gaigolupadu, S.B.I. Bank Colony

ANNEXURE 2- PRIMARY SURVEY ANALYSIS

ROAD NETWORK INVENTORY

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: The Survey is conducted on the major road sections identified within the study area, a full-scale inventory survey was undertaken to create a road network database as shown in the survey format in Annexure A. Manual carriage way section wise details were carried out on a typical working day.

Road Stretches: Road length of approx. 84 km in Kakinada (Figure 1).

Inventory Analysis: The scenario of the existing road network for Kakinada has been analysed under the following sections**,**

RIGHT OF WAY

The network inventory analysis of the surveyed 84km network indicates that 41% of this network has Right of Way (ROW) below 12m and about 38% of the network with ROW varying between 18m to 24m. The Arterial roads are observed to have ROW ranging from 20m to 24m while the few Sub Arterials such as the Uppada Beach Road have ROW varying between 18m to 24m (Figure 1 and Figure 2).

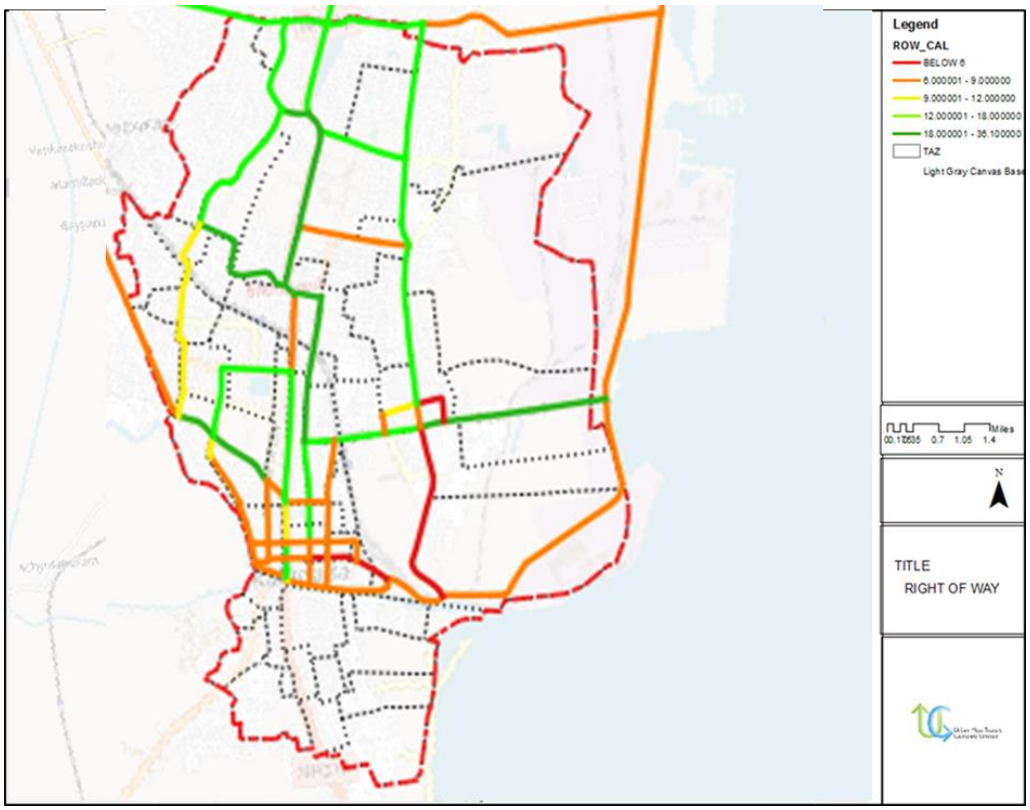


Figure 1 Existing Road Network Classification Based On Right Of Way

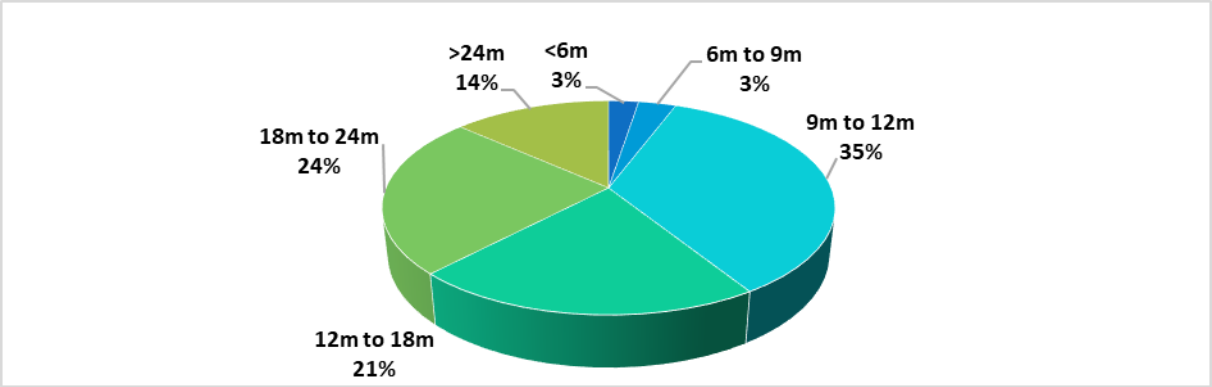


Figure 2 Distribution of Existing Road Network Classification Based On Right Of Way

From the network inventory analysis it is observed that, a larger share which is about 98% of the surveyed network has well paved road surface, of which 68% is flexible in nature and 30% of the survey network has rigid surface. The surveyed network is largely two-way in nature allowing movement on either directions. The important links with one-way movements are observed along Pantham Padbanam junction to Jammi Chettu Center, Profit Shoe Mart to Ram Prasad Complex.

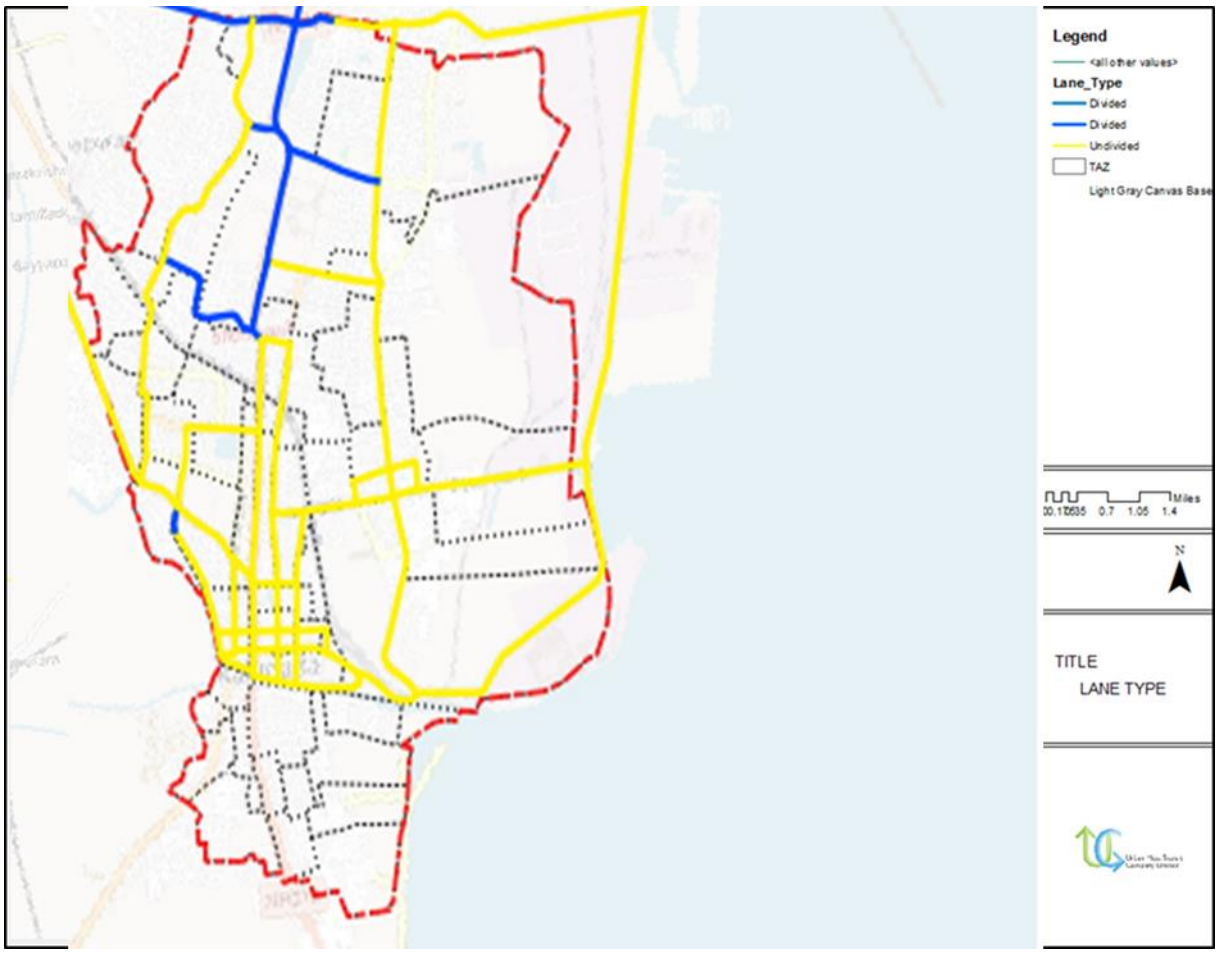


Figure 4: Existing Network Classification Based On Lane Typology

24% of the survey network is divided while the remaining 76% is undivided. It is observed that the divided lanes are observed on the arterial roads and sub arterial road namely Uppada Beach Road

indicating the infrastructure supporting higher speeds for the external movement in the city. Most of the local streets are two lanes. It is observed that 81% of the surveyed network is 2 lanes in nature (Figure 4 and 5).

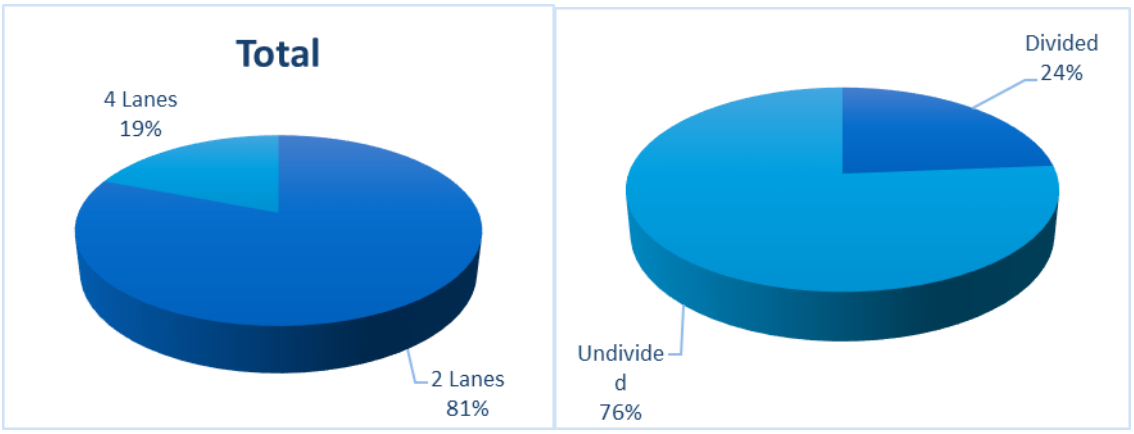


Figure 5: CLASSIFICATION BASED ON NUMBER OF LANES AND LANE TYPOLOGY

CARRIAGE WAY

Distribution of network according to their carriage way width is given in Figure 6. Majority of the roads are having only 2 lanes having 81% share of total length. Remaining are Single Lane, Intermediate Lane (IL) and 4 lane with divided/undivided roads.

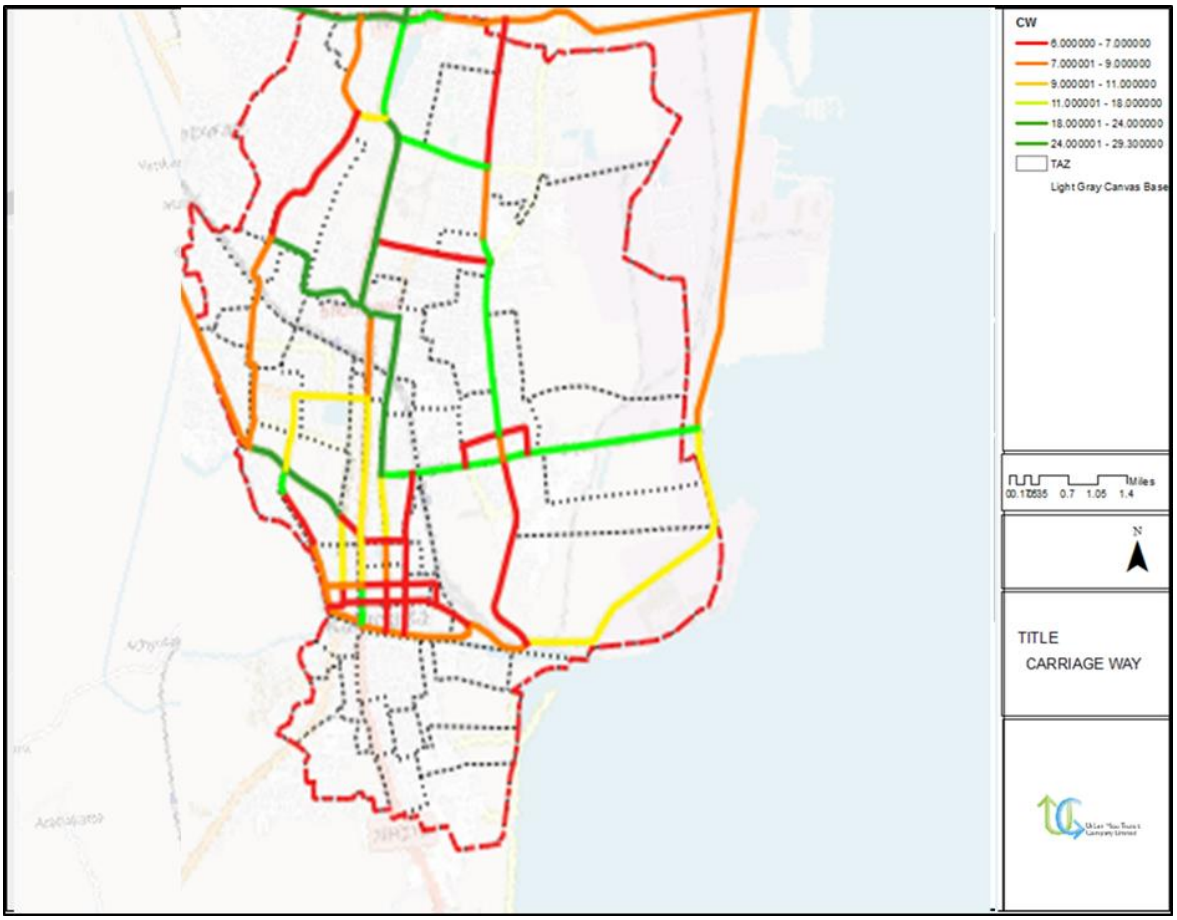


Figure 6 Existing Road Network Classification Based On Carriage Way

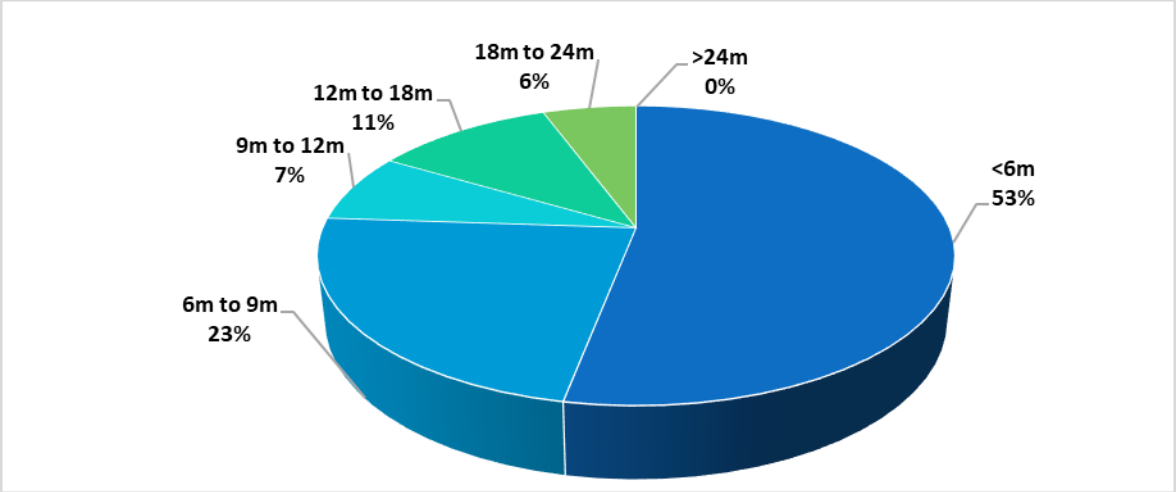


Figure 7: Distribution of Existing Road Network Classification Based On Carriage Way

It is observed that 67% of the surveyed network has shoulder space available to cater the needs of the future traffic and transport demand. 88% of the potential roads which are the sub arterial and collector roads varying between 12m to 24m.

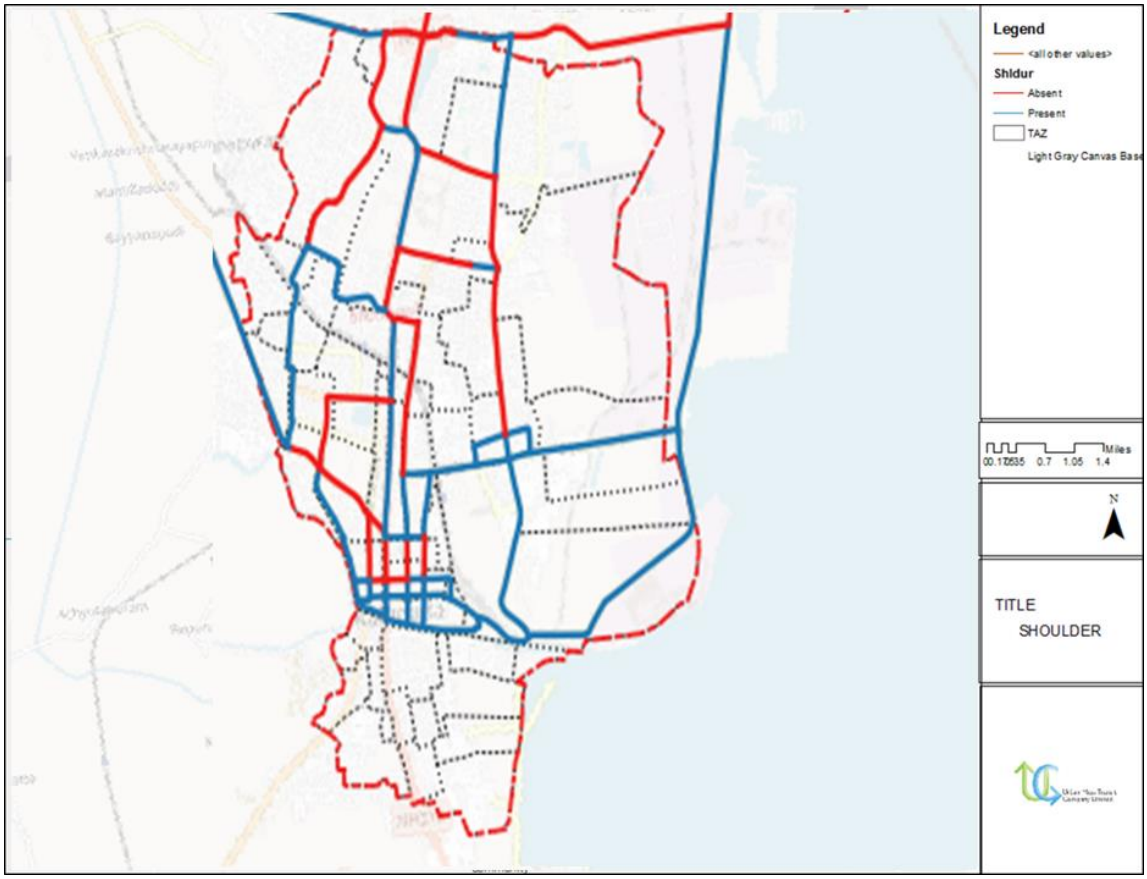


Figure 8: Existing Road Network Classification Based On Availability of Shoulder

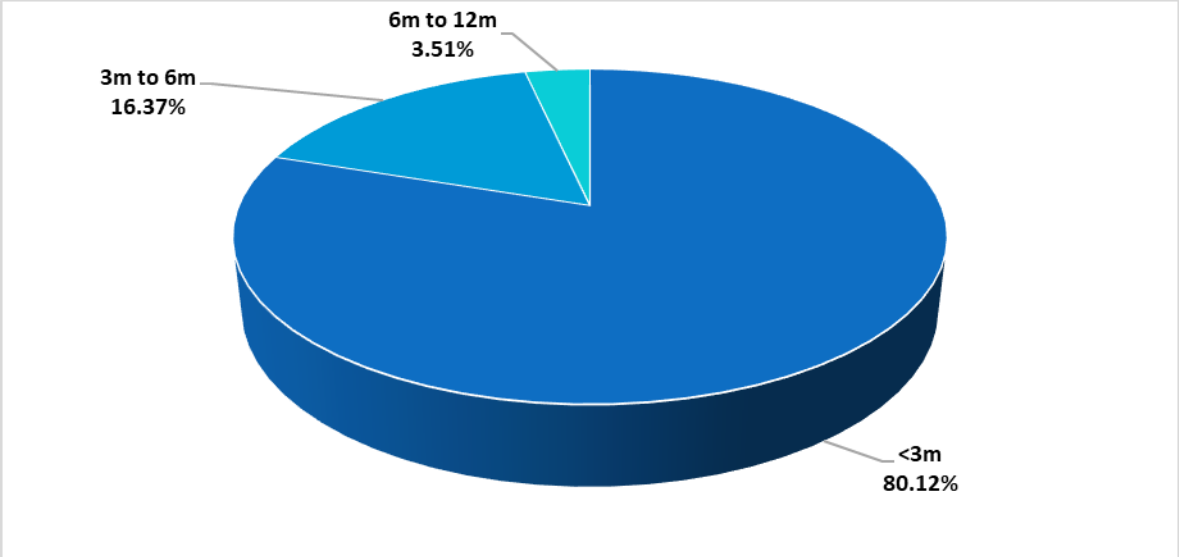


Figure 9: Distribution of Existing Road Network Classification Based On Shoulder Width

PEDESTRIAN FACILITIES

From the surveyed Road Network Inventory Analysis it is observed that only 11% of the network has facilities (footpath) to support safe pedestrian movement. While the remaining 89% of the network has no provisions for pedestrian facilities (Figure 10).

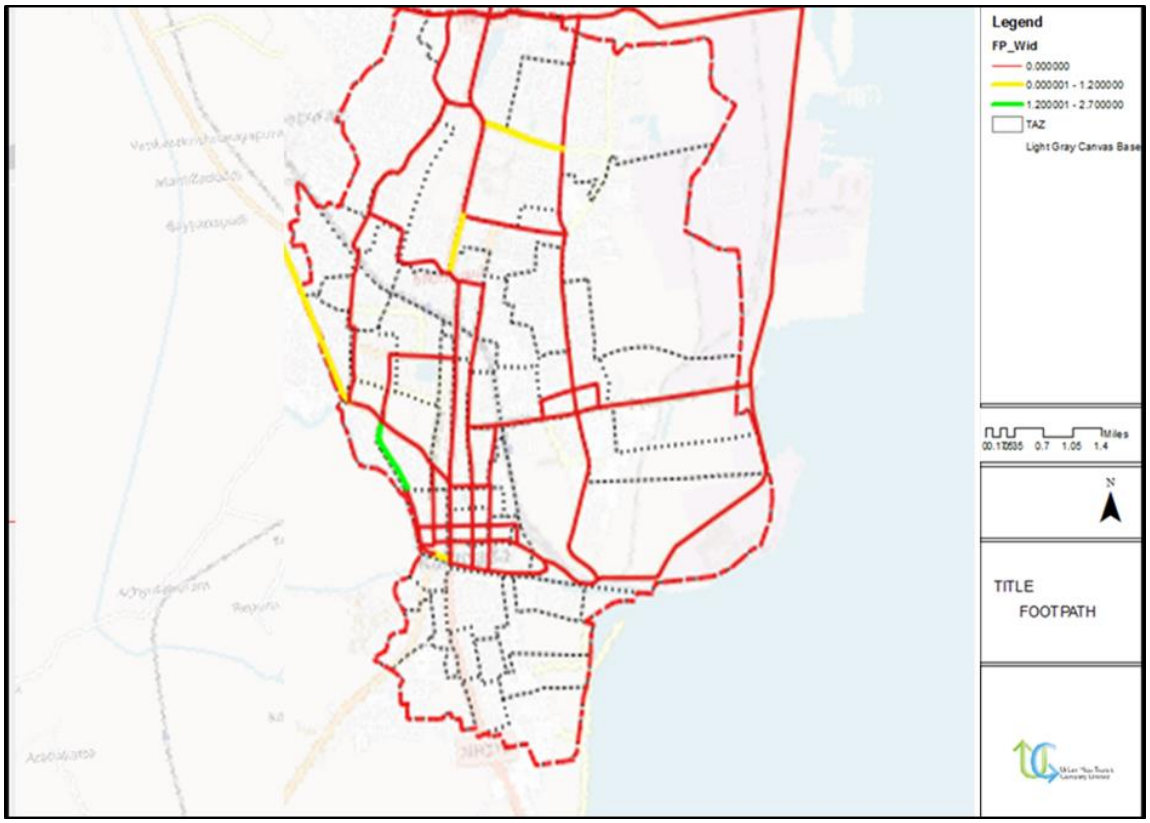


Figure 10: Distribution of Existing Road Network Classification Based On Footpath Width

NON-MOTORISED VEHICLE FACILITIES

Currently there are no dedicated Non Motor Vehicle facilities (corridors) existing within the study area. Designated bicycle parking is available at the bus and rail terminals.

PARKING FACILITIES

The nature of parking in the city is both on street and off street. On street parking is majorly observed at public spaces like bus depots, railway station and certain recreational spaces. It is observed that only 2% of the survey network has on street parking activates.

INTERSECTIONS

The major intersections within Kakinada study area are Achchampet junction, Sarpavaram junction, Nagamalli Thota junction, Bhanugudi Junction, YSR junction, Pantham Padbanam Junction, Tilak street junction, Gold Market junction, Karnam Gari junction, Kanakadurga Temple junction, Varalapudi junction, Uppada Beach road junction and so on. There are about 68 junctions of which only 7 junctions are signalised junction

Key Inferences:

1. The road network is gridded in nature in Kakinada with lots of cross roads providing connectivity to the city.
2. The network is observed to be dense on the southern side of the city.
3. 41% of the surveyed network has Right of Way (ROW) below 12m.
4. About 83% of the survey network has carriage way below 12m.
5. Only 11% of the surveyed network is facilitated with pedestrian infrastructure.
6. The city has no designated infrastructure facilities for non-motorised vehicles.
7. Only 2% of surveyed road network found to have on street parking activities in the city.

SPEED AND DELAY SURVEY

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: The survey was conducted using GPS during only peak period in both directions. Data such as delay information on different road stretches and at intersections/level crossings in the study area as shown in the survey format in Annexure A.
Road Stretches: Road length of approx. 70 km in Kakinada similar to the road network inventory was surveyed.

Data Analysis: The speed and delay of the existing road network for Kakinada has been analysed under the following sections,

TRAVEL SPEED

The average speed within the city is observed to 30.51 Kmph. The average speed observed along the National Highway, NH 216 is 51.43 Kmph, which passes through the west border of the city. The speed of other important roads within the city range between 20kmph to 40kmph.

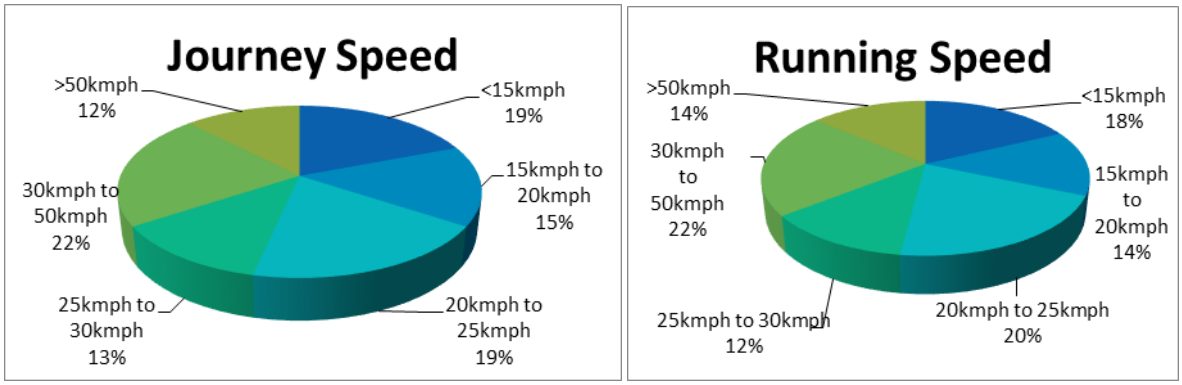


Figure 11: Distribution of Journey and Running Speeds along the Network

Table 1: Journey and Running Speeds across Various Roads In The Study Area

S.No.	Name of the road	Length	Journey Speed	Running Speed
1	Pithapuram-Kakinada Road	8.1	27.65	27.65
Arterial Roads		**8.1**	**27.65**	**27.65**
1	Cinema Road	0.7	21.91	21.91
2	Uppada Beach Road	5.3	60.41	64.21
3	Kakinada Road	2.2	45.78	45.78
4	ADB Road	1.3	48.71	50.32
5	Achchampet Junction	4.6	52.41	52.41
Sub-Arterial Collector Roads		**16**	**50.67**	**50.67**
Local Roads		**59.2**	**25.62**	**26.95**

DELAYS IN TRAVEL

The delays observed in the travel speed along the survey network is largely due to traffic movement and hindrances. The other major reasons of delay experienced is due to delay at junctions, chaotic movement through narrow roads and the condition of roads along certain stretches (Under maintenance). The Figure 12 shows the share of cause of delays along the surveyed network.

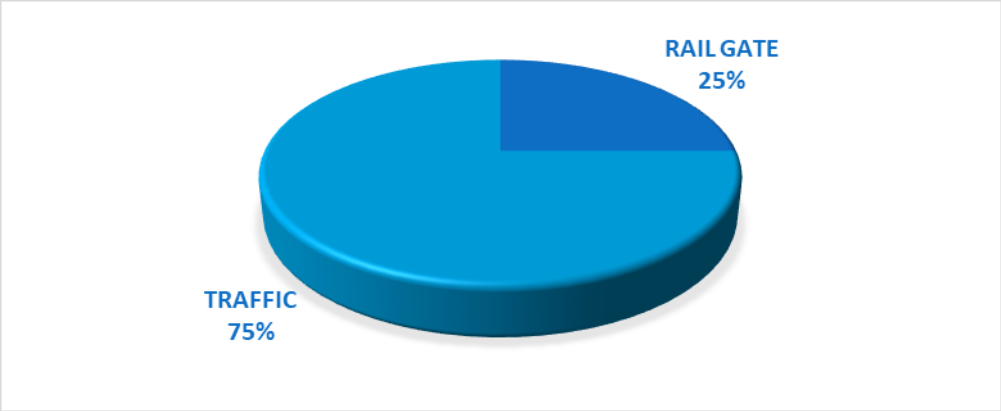


Figure 12: Distribution of Causes of Delay along The Network

Key Inferences:

1. The average journey speed along the network is observed to 30.5kmph.
2. The average speed along the arterial roads is observed to be over 25kmph, while along the sub-arterial roads ranges between 20kmph to 80kmph.
3. The speed along the collector and local roads varies between 15kmph to 50kmph.
4. The delays in travel speeds are caused largely due to traffic and delay at intersections due to turning movements.

ORIGIN - DESTINATION SURVEY (OD) - OUTER CORDON

Objective: Surveys will be conducted at outer cordons identified at the periphery of the city. The data will help in realising the travel characteristics and mode wise travel pattern.

Conduct: The survey is conducted for 24 hours with a sample of 10% of the traffic on a typical working day, interviewing vehicle passenger and goods for OD, occupancy, travel cost, time etc. as shown in the survey format in Annexure A

Location: Five outer cordon points were identified to capture the external and internal interactions with Kakinada (Figure 13 and Table 2).

Table 2: Outer Cordon Locations

CODE	LOCATION
OC_1	Near GAIL, Pithapuram-Kakinada Road
OC_2	Near IBP Auto Service Indian Oil Petrol Pump, Kakinada Road
OC_3	Near Kusuma Satya Convention, Karapa-Kakinada Road
OC_4	Near Petrol Bunk, Uppalanka, NH-214 (Old NH-216)
OC_5	Near Sri Tirumala Theater, Kakinada-Uppada Beach Road

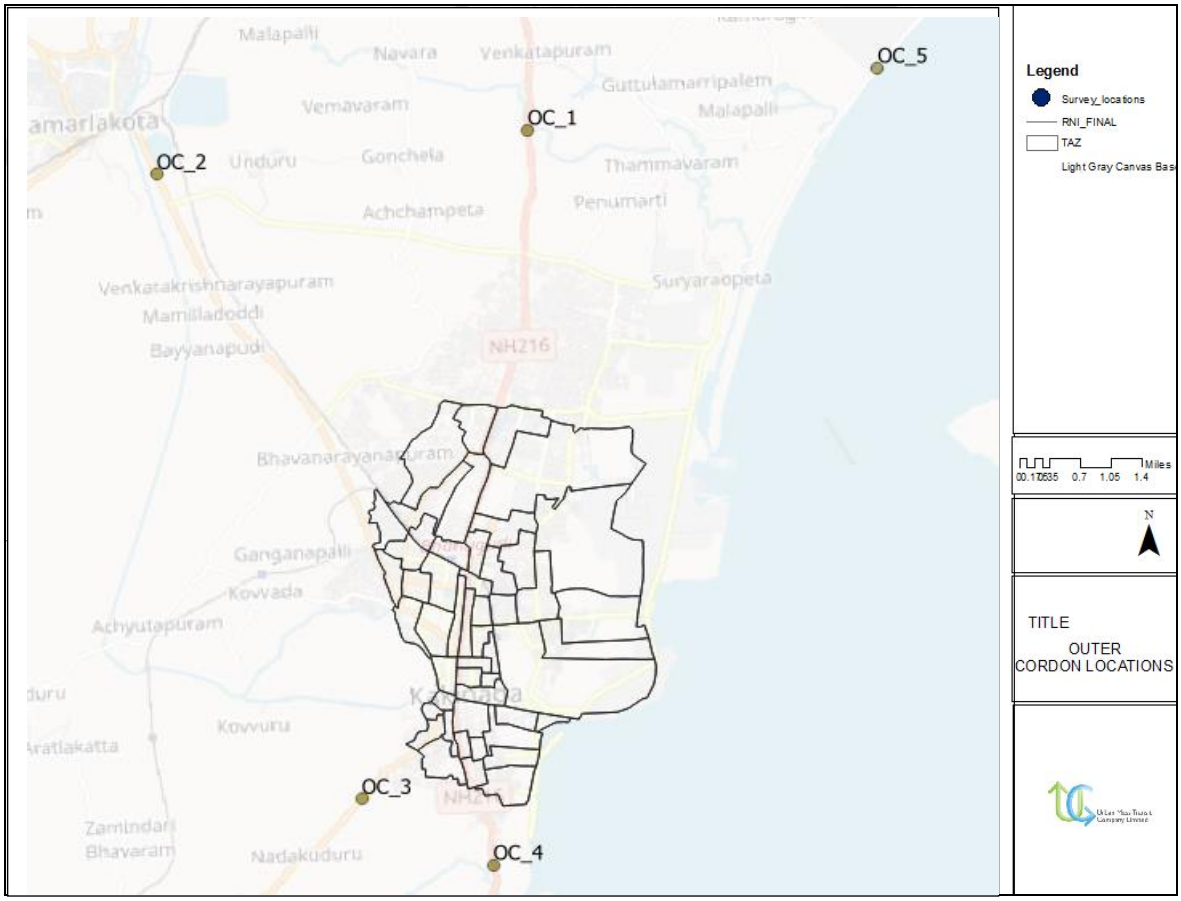


Figure 13: Outer Cordon Locations

Analysis:

The general analysis for Origin and Destination Survey was carried out for the Interim stage of the study. A detailed analysis with the share of zonal interactions will be discussed in the draft report.

PASSENGER VEHICLES:

It was observed that majority of the trips were home and education trips, accounting to 39% and 9.3% of the trips (Figure 14) respectively. The same pattern is observed in the trip frequency analysis, wherein more than 50% of the trips were made daily twice (up and down).

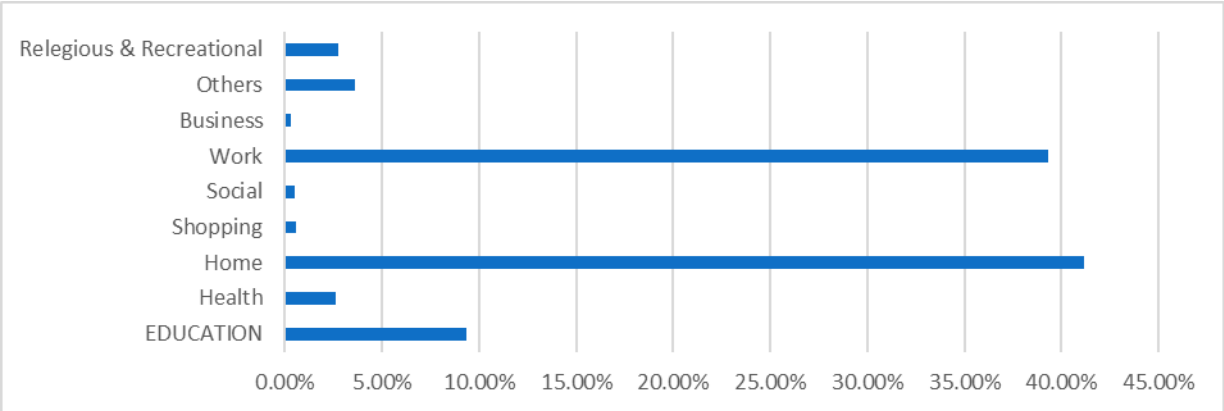


Figure 14: Trip Purpose for Passenger Vehicles at Outer Cordon Locations

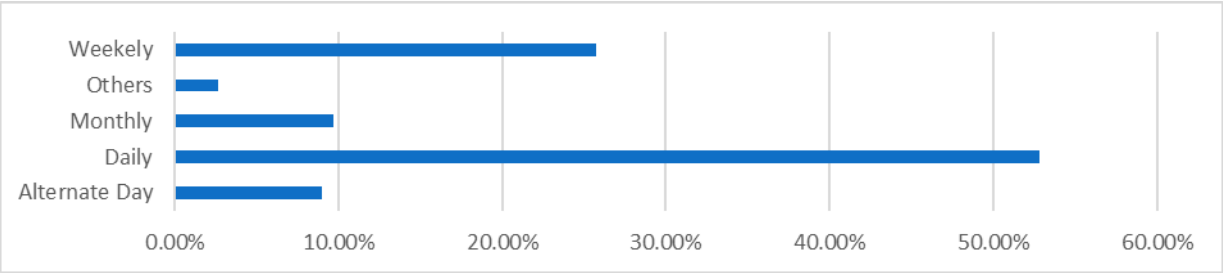


Figure 15 Trip Frequencies for Passenger Vehicles at Outer Cordon Locations

It has been observed that the city has greater share of interactions with surrounding town and city such as Eluru, Gokavaram, Gollaprollu, Rajahmundry, Tanuka. Where more trips were observed to occur from Rajahmundry to Kakinada. These trips are mostly work based trips indicating that Kakinada is an important employment node for these towns. The average travel distances captured for the passenger vehicles at the outer cordon locations are as shown in Figure 16.

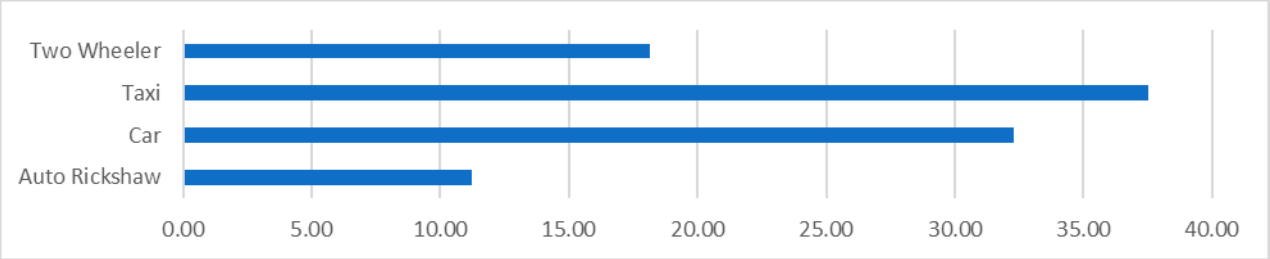


Figure 16 Average Travel Distances at Outer Cordon Locations

CLASSIFIED TRAFFIC VOLUME COUNTS - OUTER CORDON

Objective: The survey aims to assess the floating population and to establish the peak to daily flow ratios.

Conduct of the Survey: Manual traffic counts were carried out on typical working day at all locations listed. At each identified station, both directional counts will be carried out by vehicle type for 24 hours as shown in the survey format in Annexure A.

Location: The survey was conducted at five outer cordon points as shown in Figure 17 and Table 3.

Analysis: The quantum and temporal variation of total daily traffic, intensity and composition of vehicles and passenger trips moving in the study area are presented in the following sections. Table 3 represents the daily traffic volume at outer cordon.

Table 3: Daily Volume at Outer Cordon Locations

Location ID	Inbound		Outbound		Total		% Incoming PCU	% Out going PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
OC 01	14,023	19,422	13,924	19,070	27,947	38,492	50%	50%
OC 02	16,979	24,647	12,272	18,875	29,251	43,522	57%	43%
OC 03	17,107	22,966	15,167	20,378	32,274	43,344	53%	47%
OC 04	10,183	14,420	10,766	15,907	20,949	30,327	48%	52%
OC 05	4,104	5,330	81,015	103,679	85,119	109,009	5%	95%

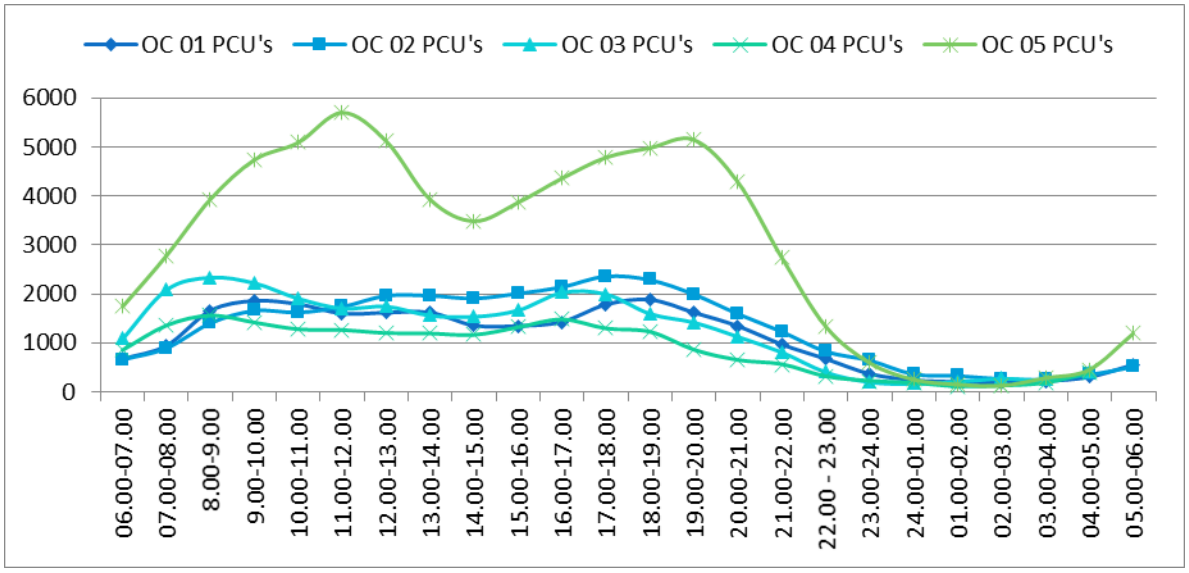


Figure 17: Hourly Variations of PCU's At Outer Cordon Locations

Table 4: Peak Hour Volumes at Outer Cordon Locations

Location ID	Peak Hour	Towards Kakinada		Away From Kakinada		Total	
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
OC 01	**08.45-09.45**	1,340	1,186	783	694	2,123	1,880
OC 02	**17.30-18.30**	1235	1288.35	1,101	1,129	2,336	2,417
OC 03	**08.30-09.30**	1,622	1,471	971	884	2,593	2,355
OC 04	**08.00-09.00**	866	856	783	708	1,649	1,565
OC 05	**18.00-19.00**	97	68	5,010	4,296	5,107	4,364

Table 5: Peak Hour Volume Shares at Outer Cordon Locations

ID	Location	Peak Hour PCUs	Daily PCUs	Share
OC 01	Galipithapuram – Kakinada Road	1,880	38,492	5%
OC 02	IBP Auto Service	2,417	43,522	6%
OC 03	Near Kusuma Satya convention, karapa – Kakinada road	2,355	43,344	5%
OC 04	Uppalanka NH – 24	1,565	30,327	5%
OC 05	Sri Tirumala Theatre	4,364	109,009	4%

It is observed that two-wheelers constitute the highest accounting to about 70.5% of the modal share at outer cordon locations preceding Cycle (9.3%) and Car/Jeep/Van (8.7%) shares. The modal share for the same are as shown in Figure 18 and Table 6.

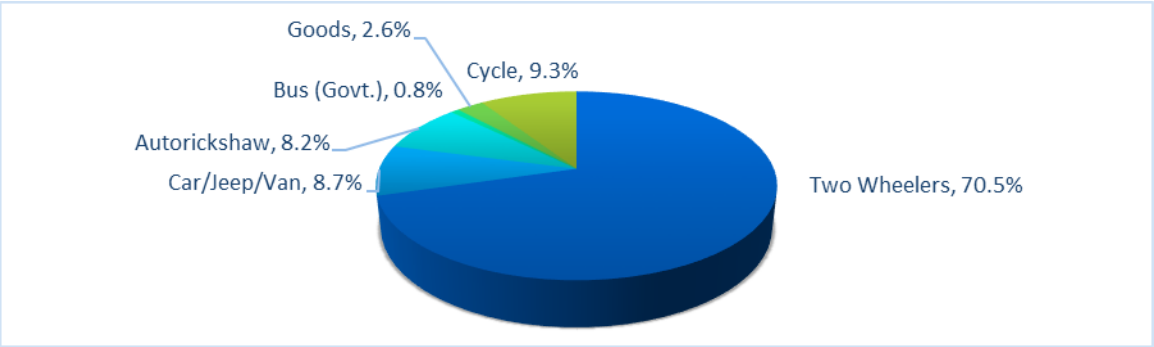


Figure 18 Overall Daily Traffic Composition at Outer Cordon Locations

Table 6: Location Wise Classification of Daily Traffic

MODE	OC_1	OC_2	OC_3	OC_4	OC_5
Two Wheelers	68.2%	63.9%	70.2%	64.5%	74.2%
Car/Jeep/Van	7.6%	20.8%	7.9%	11.8%	5.1%
Auto Rickshaw	9.7%	5.9%	6.3%	10.6%	8.5%
Bus	0.9%	2.2%	0.8%	1.6%	0.2%
Goods	2.8%	5.8%	2.8%	4.6%	1.0%
Cycle	10.6%	1.4%	11.9%	6.7%	10.8%

Key Inferences:

1. The outer cordon location OC-5 at Sri Tirumala theatre has highest traffic volume.
2. Two-wheelers contribute to the highest modal share (70.5%) at the surveyed outer cordon locations.

CLASSIFIED TRAFFIC VOLUME COUNTS – SCREEN LINE

Objective: The survey aims to assess the traffic scenario and to establish the peak to daily flow ratios.

Conduct of the Survey: Video traffic counts were carried out on typical working day at all locations listed. At each identified station, both directional counts will be carried out by vehicle type for 16 hours as shown in the survey format in Annexure A.

Location: The survey was conducted at five screen lines points along the two north-south and east-west screen lines as shown in Figure 19 and Table 8.

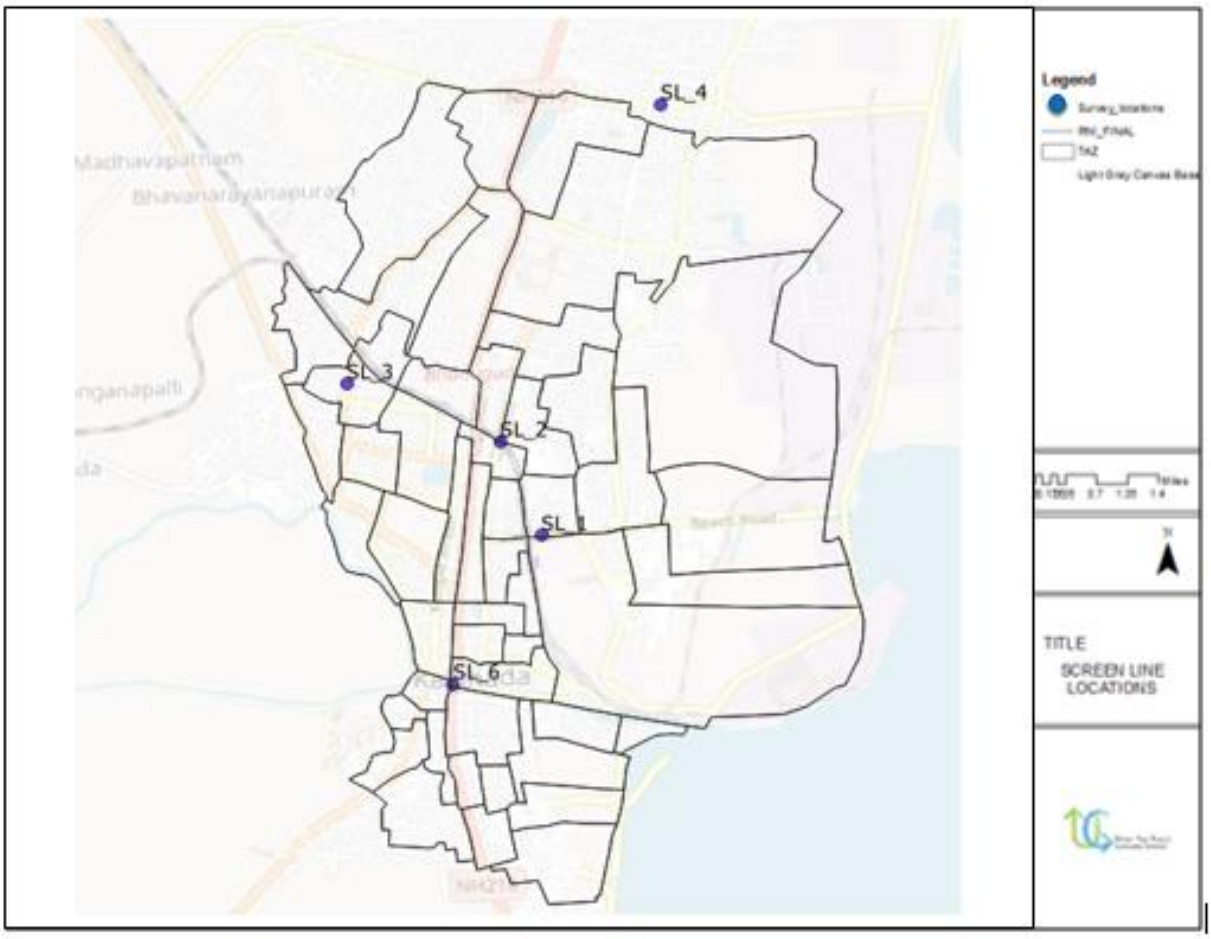


Figure 19 Screen Line Locations

Table 8: Screen Line Locations

CODE	LOCATIONS
SL_1	Near ESI Hospital
SL_2	Bridge Near Kothapeta Fish Market
SL_3	Near Kotaiah sweets
SL_4	Near RK Plaza complex
SL_5	Commercial tax office
SL_6	Jagannathapuram Bridge

Analysis: The quantum and temporal variation of total daily traffic, intensity and composition of vehicles and passenger trips moving in the study area are presented in the following sections. Table 3.6-2 represents the daily traffic volume at outer cordon.

Table 9 Daily Volume at Screen Line Locations

Location ID	East bound		west bound		Total	
	vehicles	PCUs	vehicles	PCUs	vehicles	PCUs
SL 4	14,128	11,990	14,365	12,204	28,493	24,194
SL 6	62,629	53,335	24,564	17,833	87,193	71,169
Location ID	**North bound**		**south bound**		**Total**	

	vehicles	PCUs	vehicles	PCUs	vehicles	PCUs
SL 1	24,531	20,508	22,042	18,502	46,573	39,010
SL 2	32,294	28,070	18,432	14,979	50,726	43,049
SL 3	12,164	10,166	14,659	12,261	26,823	22,426
SL 5	31,776	27,326	30,276	26,003	62,052	53,330

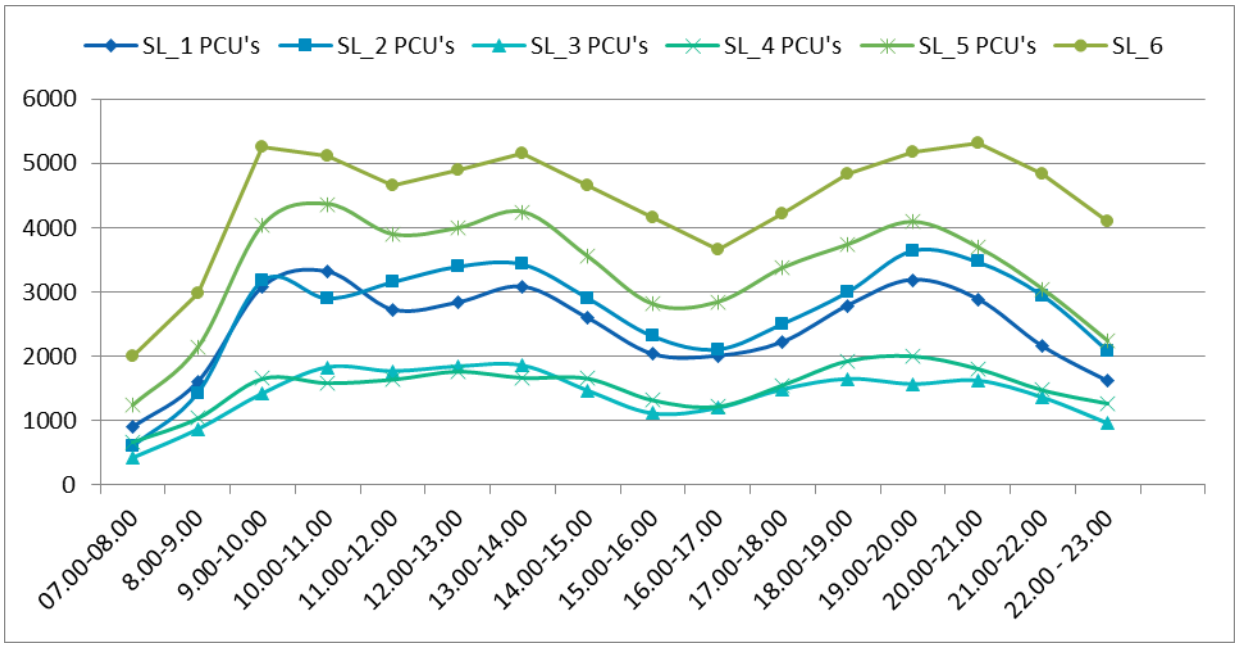


Figure 20: Hourly Variations of PCUs At Screen Line Locations

Table 10 Peak Hour Variations at Screen Line Locations

Location ID	Morning Peak Hour	Total PCUs	Evening Peak Hour	Total PCUs
SL_1	08.30-09.30	4,159	18.15-19.15	3,842
SL_2	11.30-12.30	3,498	18.15-19.15	3,655
SL_3	11.30-12.30	2,219	17.00-18.00	1,995
SL_4	11.00-12.00	2,015	18.00-19.00	2,375
SL_5	08.30-09.30	5,332	17.45-18.45	4,889
SL_6	08.15-09.15	6,976	18.45-19.45	6,675

Table 11: Peak Hour Share at Screen Line Locations

ID	Location	Peak Hour PCU	Daily PCU	Share
SL_1	Near ESI Hospital	4,159	39,010	10.7%
SL_2	Bridge Near Kothapeta Fish Market	3,655	43,049	8.5%
SL_3	Near Kotaiah sweets	2,219	22,426	9.9%
SL_4	Near RK Plaza complex	2,375	24,194	9.8%
SL_5	Commercial tax office	5,332	53,330	10.0%
SL_6	Jagannathapuram Bridge	6,976	71,169	9.8%

It is observed that two wheelers constitute the highest accounting to about 70% of the modal share at outer cordon locations, followed by auto rickshaw with 13%. The modal share for the same are as shown in Figure 21 and Table 12.

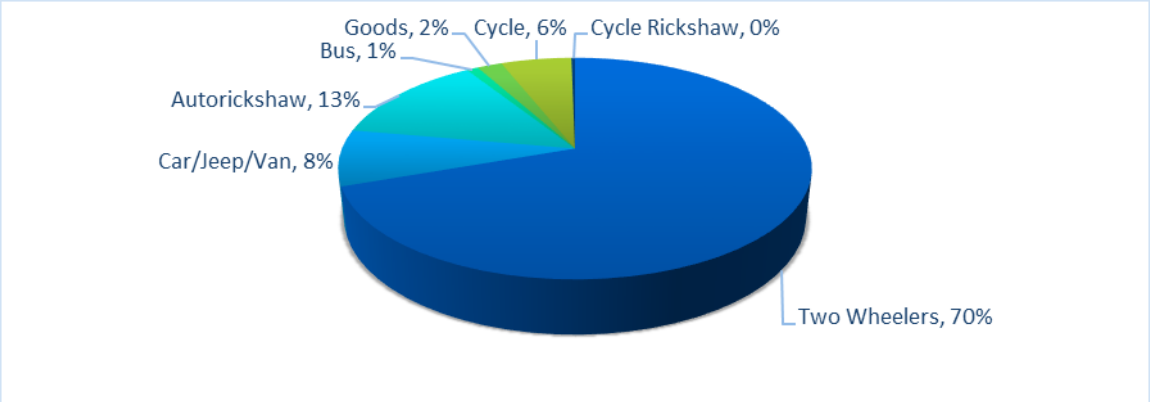


Figure 21 Overall Daily Traffic Composition At Screen Line Locations

Table 12 Location Wise Classification of Daily Traffic

MODE	SL 01	SL 02	SL 03	SL 04	SL 05	SL 06
Two Wheelers	72.1%	74.5%	64.5%	65.7%	67.6%	66.6%
Car/Jeep/Van	4.7%	8.1%	5.9%	8.6%	11.7%	3.7%
Autorickshaw	14.4%	11.9%	15.4%	14.7%	11.8%	10.8%
Bus (Govt.)	0.5%	1.5%	0.2%	0.6%	1.2%	0.7%
Goods	2.0%	1.3%	1.6%	2.1%	2.7%	2.4%
Cycle	6.1%	2.5%	11.4%	7.7%	4.8%	14.7%
Cycle Rickshaw	0.2%	0.1%	0.9%	0.5%	0.1%	1.0%

Key Inferences:

1 The screen line location SL 6 at Jagannathapuram Bridge has highest traffic volume, since it provides a connectivity to access the busy CBD area, and nearby ferry terminals, fish markets, schools temples etc.

2 Two-wheelers constitute the highest share in modal composition at all the screen line locations.

VEHICLE OCCUPANCY SURVEY

Objective: The survey aims to identify and establish the average occupancy of vehicles.

Conduct: Manual survey was carried out on a typical working day for a duration of 16hrs at all identified locations. The captured occupancy by vehicle type. i.e. cars, jeeps, vans, buses, trucks, MAVs, LCV's tractors, motorized two wheelers and so on as show in the survey format in Annexure A.

Location: The survey was conducted at six screen line points as shown in Figure 19 and Table 8.

Analysis: From the table it is observed that bus occupancy varies from 29 to 30 and averages out at 29.6. Average occupancy for cars and two wheelers is found to be 2.9 and 1.6 respectively. The Auto Rickshaw has an average occupancy of 4.1.

Table 13: Occupancy at Screen Line Locations

CODE	Direction	Two Wheeler	Car	Auto Rickshaw	Bus	Cycle	Cycle Rickshaw
SL_1	Dairy Form- Kalaprasad Centre	1.6	3.0	4.2	29.28	1.3	2.2
	Kalaprasad centre-Dairy form	1.6	3.0	4.1	28.98	1.3	2.2
SL_2	Poonam bakers-Kalpana centre	1.6	3.0	4.0	-	1.3	2.4
	Kalpana centre-Poonam bakers	1.5	3.0	4.1	29.73	1.3	2.2
SL_3	RD cross street-Subbarao street	1.6	3.0	4.0	-	1.3	2.3
	Subbarao street-RD cross street	1.6	2.9	4.2	-	1.3	2.3
SL_4	Sarpararam junction-Valkapudi road	1.6	3.0	4.1	30.02	1.3	2.3
	Valkapudi road-Sarpararam junction	1.5	2.5	4.1	29.49	1.3	2.2
SL_5	Kakinada-Achannapalli	1.6	3.0	4.0	29.95	1.3	2.3
	Achannapalli-Kakinada	1.5	3.0	4.0	29.64	1.1	2.3
SL_6	ASD Degree college-Airtel banking point	1.6	3.0	4.3	29.95	1.3	2.4
	Airtel banking point-ASD Degree college	1.5	3.0	4.1	29.62	1.3	2.4
Overall		**1.6**	**2.9**	**4.1**	**29.6**	**1.3**	**2.3**

Key Inferences:

1. The average occupancy of two wheelers is observed to be 1.6.
2. The average occupancy of 3 seater auto rickshaw was observed to be 3.45, while the average occupancy of shared auto rickshaw (7seater) is observed to be 4.66.
3. Highest two wheeler occupancy was observed at SL_3 along RD cross street and Subbarao street, while the highest occupancy of cars, auto rickshaws and buses were observed at SL_6.

TURNING MOVEMENT COUNTS AT INTERSECTIONS

Objectives: The survey aims to in identifying and analysing the seriousness of problem at the intersection, critical movements, etc. and for designing the junction to perform more efficiently.

Conduct: Video traffic counts were carried out on a typical working day for a duration of 16 hours at all locations listed below. At each identified intersection, 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 as shown in the survey format in Annexure A.

Locations: Four critical intersections were identified as shown in Figure 22 and Table 14.

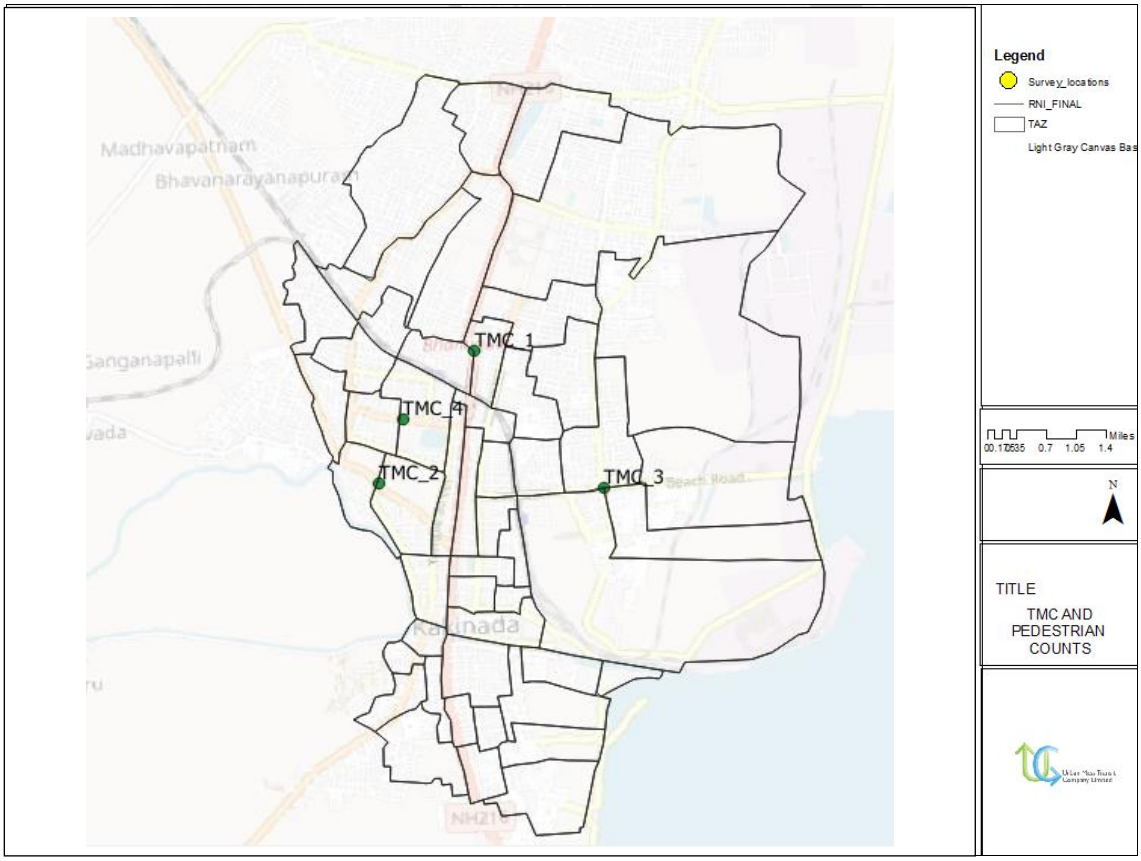


Figure 22 TMC Locations

Table 14 TMC Locations

Code	Location
TMC_1	Dairy Farm
TMC_2	Kakinada register office
TMC_3	Three light junction
TMC_4	Bhanugudi junction

Analysis: The quantum and temporal variation of total daily traffic, intensity and composition of vehicles and passenger trips moving in the study area are presented in the following sections. Table 3.8-2 represents the daily traffic volume at the surveyed intersections.

Table 15 Daily Traffic Volume at Intersections

Code	Location	Total Vehicles	Total PCUs
TMC_1	Dairy Farm	46566	43972
TMC_2	Kakinada register office	100074	101557
TMC_3	Three light junction	42303	38575
TMC_4	Bhanugudi junction	116726	111238

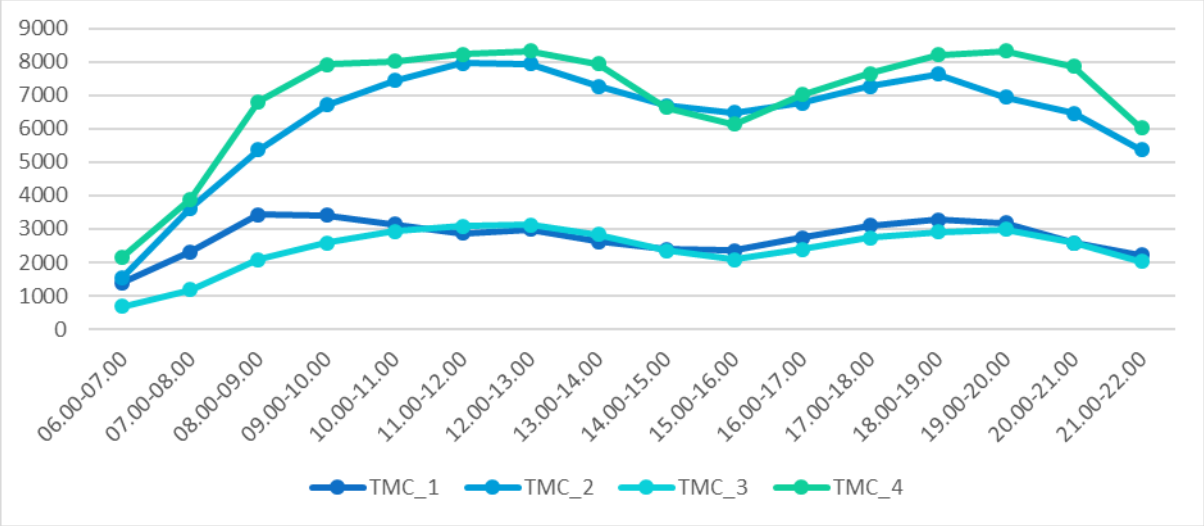


Figure 23 Hourly Variations of Daily Traffic Volumes

Table 15 Peak Hour Traffic Volumes

Location ID	Location	Peak Hour	Morning Peak		Peak Hour	Evening Peak		Daily Total
			PCUs	PH%		PCUs	PH%	PCUs
TMC_1	Dairy Farm	**08.30-09.30**	**3524**	**8%**	**18.15-19.15**	**3318**	**8%**	43972
TMC_2	Kakinada register office	**11.30-12.30**	**8261**	**8%**	**17.45-18.45**	**7759**	**8%**	101557
TMC_3	Three light junction	**12.00-13.00**	**3119**	**8%**	**19.00-20.00**	**2979**	**8%**	38575
TMC_4	Bhanugudi junction	**11.15-12.15**	**8462**	**8%**	**18.30-19.30**	**8384**	**8%**	111238

It is observed that two wheelers constitute the highest share accounting to about 71% of the modal share at survey intersections, followed by car/jeep/vans with 9%. The modal share for the same are as shown in Figure 24 and Table 16.

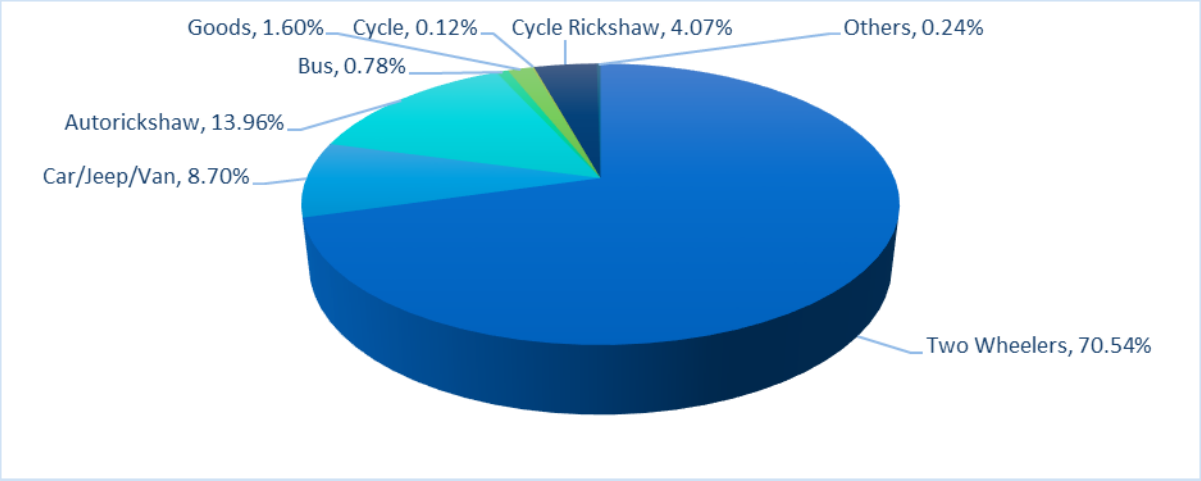


Figure 24 Traffic Composition At TMC Locations

Table 16 Location Wise Traffic Composition For Intersections

MODE	TMC_1	TMC_2	TMC_3	TMC_4
Two Wheelers	69%	70%	71%	72%
Car	4%	8%	10%	10%
Auto rickshaw	14%	16%	9%	14%
Bus	0%	1%	2%	0%

Goods	2%	2%	1%	1%
Cycle	0%	0%	0%	0%
Cycle rickshaw	10%	2%	7%	3%
others	1%	0%	0%	0%

Key Inferences:

1. Highest traffic volume is observed at Bhanugudi Junction (TMC_4) due is interaction with NH 216, which connects Kakinada with the external cities and towns.
2. Two wheelers contribute to the higher share of traffic composition in the city, followed by autorickshaws.
3. Highest share of two wheelers and cars are observed at Bhanugudi junction, the highest share of auto rickshaws are observed at Kakinada register office.

TERMINAL PASSENGER COUNTS AND SURVEY

Objective: The survey aims to evaluate the percentage of people using Bus/Rail transport and to identify the characteristics of travellers.

Conduct: The survey for a period of 16 hours at Bus/Rail Terminals and the travel and traffic characteristics of the intercity & intra city bus travellers are captured along with trip characteristics and details to estimate the rail/bus passengers the existing demand and supply scenarios for the same as shown in the survey formats in Annexure A.

Locations: The surveys were conducted at all the four public transit terminals in Kakinada.

Table 18: Terminal Survey and Counts Locations

CODE	LOCATION
TC_1	RTC Bus stand, Burma Colony
TC_2	Old Bus Stand, Old bus stand Road
TC_3	Kakinada Port Railway Station
TC_4	Kakinada Town Junction Railway Station

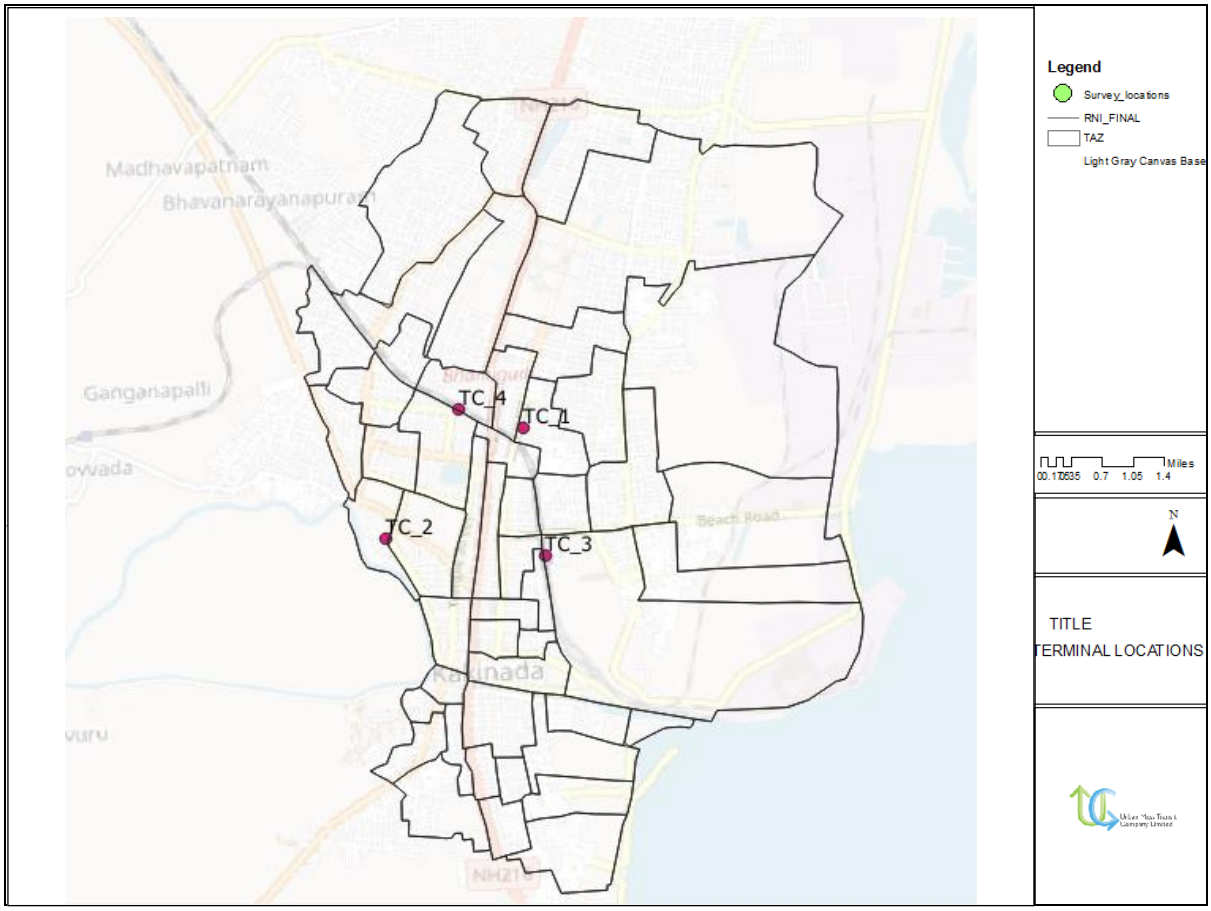


Figure 25: Terminal Survey Locations

Analysis: The terminal passenger surveys indicate that RTC Bus Station has the highest share of passenger volume accounting up to 35%, followed by Kakinada town railway station. The in and out flow volumes are shown in Table 19. The hourly variations at these terminals are as shown in Figure 25.

Table 19: Terminal Passenger Volumes

S. No.	Code	Name of the Terminal	Buses			Passengers			Occupancy	% Share of Overall Passengers
			In	Out	Both	In	Out	Both	Both	
Bus Station										
1	TC_1	RTC Bus Station	321	316	637	5077	4508	9585	15.0	35%
2	TC_2	Old Bus Station	505	591	1096	1684	2463	4147	3.8	15%
Total			826	907	1733	6761	6971	13732	7.9	**50%**
Railway Station										
3	TC_3	Kakinada port Railway Station				2982	2410	5392		19%
4	TC_4	Kakinada town railway station				4603	3949	8552		31%
Total						7585	5488	13073		47%
Grand Total						14346	13330	27676		**100%**

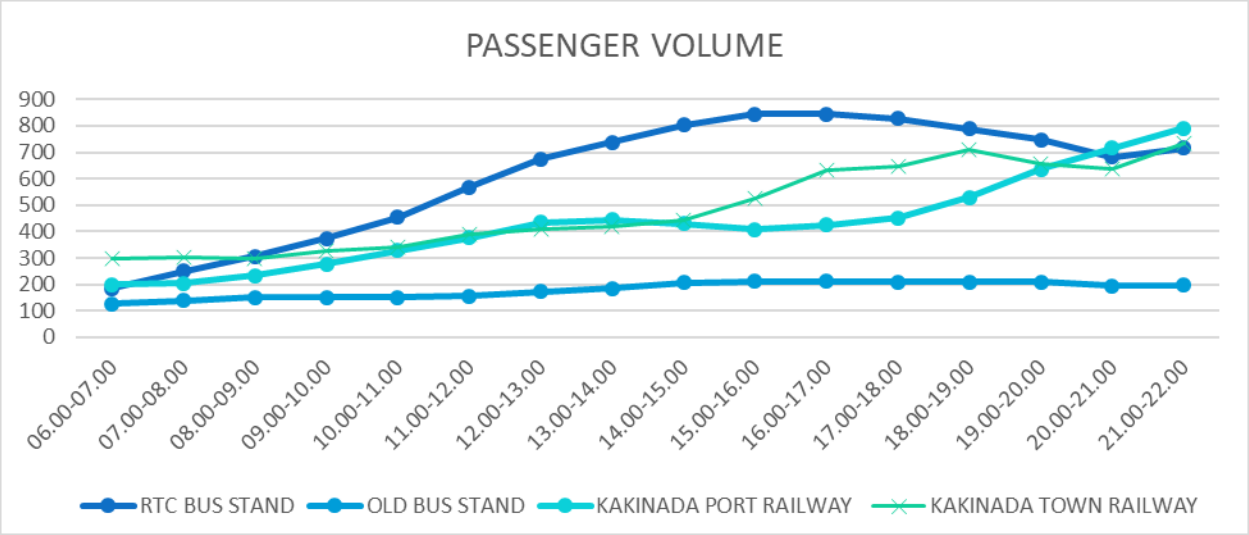


Figure 25 Hourly Variations Of Passengers At Terminal Locations

It is observed that the peak hour for the Bus based transit is between 7pm to 8pm in RTC bus stand, while for old bus stand it is between 2:15pm to 3:15pm and for the rail based transit the peak passenger flow is between 10:00am to 12:45pm. The peak hour volumes are shown in Table 3.9-3.

Table 20 Peak Hour Passenger Volumes at Terminal Locations

S. No.	Code	Name of the Terminal	Peak Hour	Passengers			% Share in Total Volumes		
				In	Out	Both	In	Out	Both
Bus Station									
1	TC_1	RTC Bus Station	19.00-20.00	335	444	912	7%	10%	10%
2	TC_2	Old Bus Station	14.15-15.15	98	185	348	6%	8%	8%
Railway Station									
3	TC_3	Kakinada port Railway Station	10.00-11.00	180	112	800	6%	5%	15%
4	TC_4	Kakinada Town Railway Station	11.45-12.45	655	478	1211	14%	12%	14%

The terminal passenger survey analysis was conducted along with the counts to capture the travel characteristics and trip matrices. The interim report discusses the travel characteristic of the same while the trip interactions will be addressed in draft reports.

It is observed that majority of the trips are work based trips accounting to 24.5% of the total trips, which is observed to be justified by trip frequency distribution wherein 33% of the trips are made on daily basis and about 39% of them occasionally take bus and rail travel. (Table 3.9-4 and Table 3.9-5).

Table 21: Distribution of Terminal Passenger Trips Based On Purpose

PURPOSE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Work	24.49%	18.23%	39.07%
Education	11.36%	10.62%	13.08%
Shopping	13.29%	13.31%	13.26%
Social	14.32%	15.15%	12.37%
Religious/Recreation	7.32%	10.38%	0.18%
Health	12.59%	11.77%	14.52%
Home(Return)	11.57%	13.38%	7.35%
Others	4.90%	6.92%	0.18%

Table 22: Distribution of Terminal Passenger Trips Based On Frequency

FREQUENCY	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Daily once(one-way)	5.86%	8.47%	0.54%
Daily twice(up & down)	25.17%	16.61%	46.59%
Daily thrice or more	2.53%	3.19%	1.25%
Weekly	24.10%	26.36%	21.15%
Occasionally	39.70%	45.37%	30.47%

The access and egress modes of the terminal passengers were analysed and it was observed that auto rickshaws (39.78%) are used as the major mode of last mile connectivity by the terminal passengers. The mode wise distribution of dispersal mode is as show in the Table 23 and Figure 26.

Table 23 Mode Wise Dispersal of Terminal Passengers

DISPERSAL MODE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
2-wheeler	11.50%	15.06%	5.02%
Car/Jeep/Van	17.82%	19.09%	17.03%
Auto Rickshaw	39.78%	38.44%	47.13%
Bus	23.87%	24.53%	25.09%
Cycle	2.83%	1.65%	5.73%
Cycle Rickshaw	0.00%	0.00%	0.00%
Walk	4.20%	1.23%	0.00%

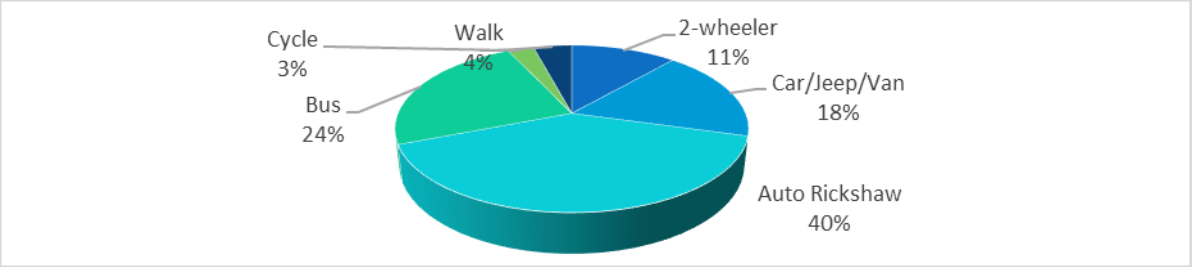


Figure 26 Distribution of Dispersal Modes Of Terminal Passengers

It is observed that the average access and dispersal time of terminal passengers is observed to be around 20 minutes and the average distance accounts to about 5.6km. It is observed that auto rickshaw is used as a prominent mode to access the terminals by passengers travelling from the surrounding villages. The Figure 27 and Table 24 represent the access and egress trip characteristics in terms of distance, time and costs.

Table 24: Mode Wise Terminal Passenger Access And Egress Trip Characteristics Within City

ACCESS/EGRESS MODE	AVERAGE TIME	AVERAGE DISTANCE	AVERAGE COST
2-wheeler	20.99	7.39	16.43
Car/Jeep/Van	19.27	9.74	18.09
Auto Rickshaw	20.61	8.04	14.96
Bus	20.95	8.69	14.65
Cycle	22.29	7.89	16.74

Cycle Rickshaw	20.00	6.11	15.56
Walk	20.00	1.00	0.00

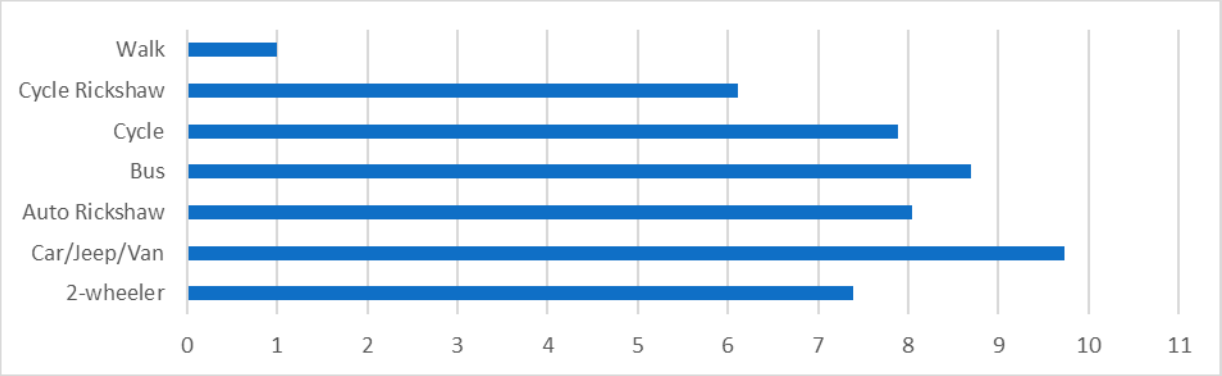


Figure 27: Mode Wise Average Distance of Terminal Passenger Access And Egress

BOARDING AND ALIGHTING COUNTS SURVEY

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: The survey aims to capture the quantum of boarding and alighting at the identified bus stops for a period of 16 hours.

Locations: The survey was conducted in the following 5 bus stop locations as shown in Table 3.10.1 and Figure 28

Table 25: Boarding and Alighting Locations

CODE	LOCATIONS
BS_1	Jagannadhapurum Bus Stop
BS_2	Balaji Cheruvu
BS_3	Bhanugudi Bus Stop
BS_4	Zilla Parishad Bus Stop
BS_5	Ntr Bus Stop

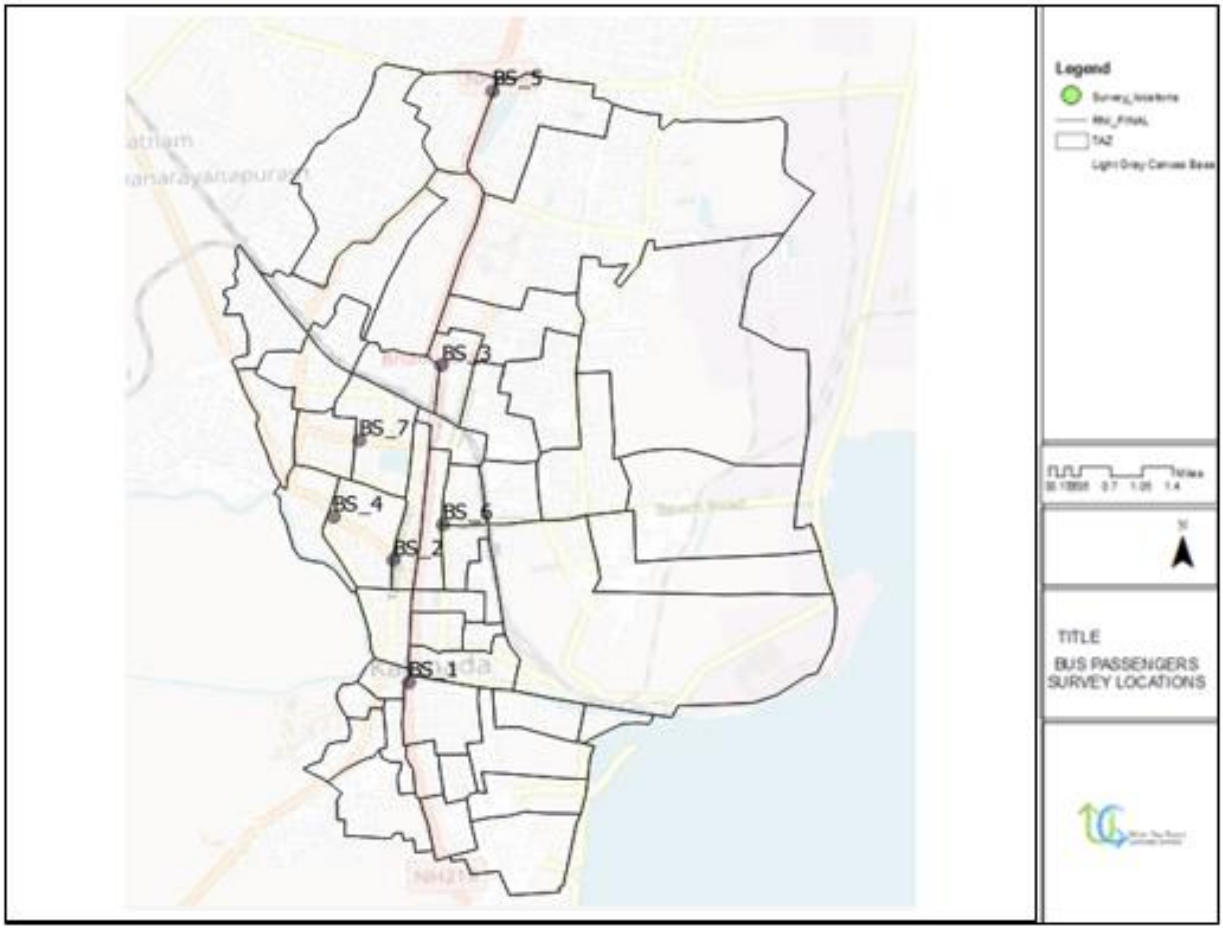


Figure 28: Boarding and Alighting Survey Locations

Analysis: The results boarding and alighting survey indicates that NTR Bus Stop has the highest number of passengers boarding and alighting amongst all the surveyed locations. The following Table 3.10.2 represents the location wise boarding and alighting at surveyed locations.

Table 26: Daily Boardings And Alightings At Surveyed Locations

CODE	LOCATIONS	PB	PA	Total PB+PA	Average Dwell Time (min)
BS_1	Jagannadhapurum Bus Stop	2161	2183	4344	1.108
BS_2	Balaji Cheruvu	2068	2307	4375	1.095
BS_3	Bhanugudi Bus Stop	3447	1985	5432	1.042
BS_4	Zilla Parishad Bus Stop	2287	1703	3990	1.004
BS_5	NTR Bus Stop	4917	2594	7511	1.011
Total		14880	10772	25652	1.051

Table 27: Mode Wise Boardings and Alightings

Mode	PB	PA	Total PB+PA	PB	PA	Dwell Time (min)	Sitting	Stan -ding	Total
Intercity bus/ Inter-state (Govt./Pvt.)	14880	10772	25652	58%	42%	1.05	28.87	3.60	32

The only mode of public transport in the city is through Inter-city bus services.

Key Inferences:

1. NTR Bus Stop is observed to have higher footfalls with respect to the boarding and alighting.
2. The only mode of public transport in the city is through Inter-city bus services.

STATED PREFERENCE SURVEY:

Objective: The survey aims to evaluate the preferences of commuters and to identify their travel characteristics.

Conduct: The survey was conducted for a period of 16 hours through manual interviews wherein the user trip characteristics, deals and their preferences in regard to the public transit were collected as shown in the survey format in the Annexure A.

Locations: The survey was conducted at workplaces, through roadside interviews at above identified 4 TMC locations as discussed in Section 3.8. (Figure 22 and Table 14.).

Analysis: The stated preference data represented a reasonable share of sample form all the public transport modes

It is observed that 63.33% of the users are willing to use a new and improved public transport facilities with a waiting time of 10 minutes and below and reduction in travel time and cost over 25% of the their existing modes. The Table 28 details out the results of users preferences.

Table 28: Willingness To Use New And Improved Public Transit Services

Code	Choice	SP: OP1	SP: OP2	SP: OP3	SP: OP4	SP: OP5	SP: OP6	SP: OP7	SP: OP8	All SP %
1	Definitely Existing	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	Probably Existing	25.4%	16.6%	27.9%	31.6%	28.9%	22.7%	21.8%	24.2%	24.9%
3	Can't Say	11.03%	15.9%	18.1%	8.5%	14.4%	2.4%	11.0%	12.2%	11.7%
4	Probably Improved PT System	25.7%	9.5%	12.2%	13.4%	12.2%	15.5%	19.6%	17.1%	15.7%
5	Definitely Improved PT System	37.7%	57.8%	41.6%	46.3%	44.3%	59.0%	47.5%	46.3%	47.6%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Key Inferences:

1. Over 63.33% of them are willing to pay for the 25% reduction in travel time and cost for a new and improved public transit system.
2. About 46.32% of them are willing to pay even if the waiting time is 0 minutes and if he travel cost and travel time is reduced by 50% with more comfort.

IPT COMMUTER SURVEY:

Objective: The survey aims to evaluate the travel characteristics of people using Intermediate Public Transport for their daily travel in the study area.

Conduct: The survey is conducted for a duration of 16 hours through interviews at major IPT Stops capturing the commuter trip details as shown in the survey format in Annexure A.

Location: The survey is conducted at across the 4 TMC locations (Figure 3.8.1 and Table 3.8.1.) which were observed to be the major IPT catchments nodes in Kakinada.

Analysis: It is observed that majority of the IPT trips were work based trips followed by shopping trips (Figure 29). The average distances commuted by the surveyed passenger's trip purposes are as shown in 30. It is observed that, for the surveyed passengers the average distance of work trips and shopping trips is about 12km, for educational about 11 km and religious/recreational trips its about 8km.

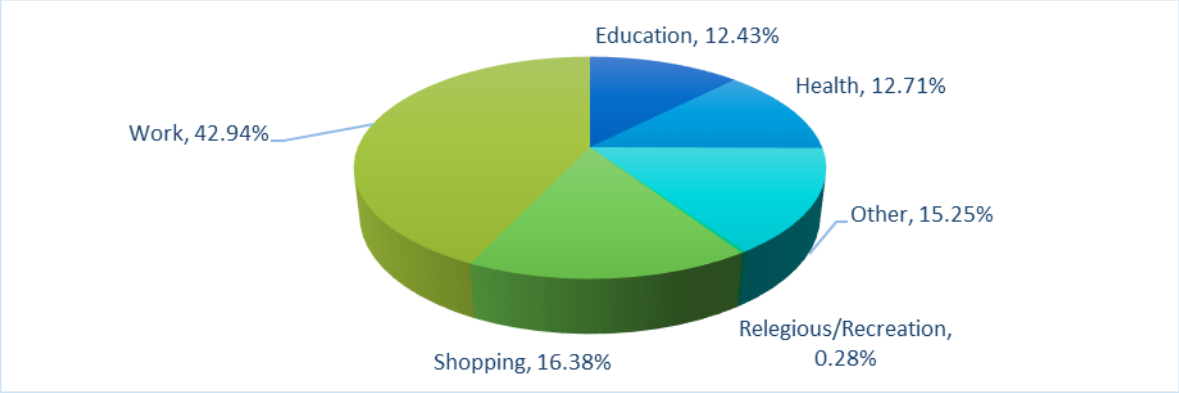


Figure 29: Distribution IPT Commuter Trips Based On Trip Purpose Within City[6]

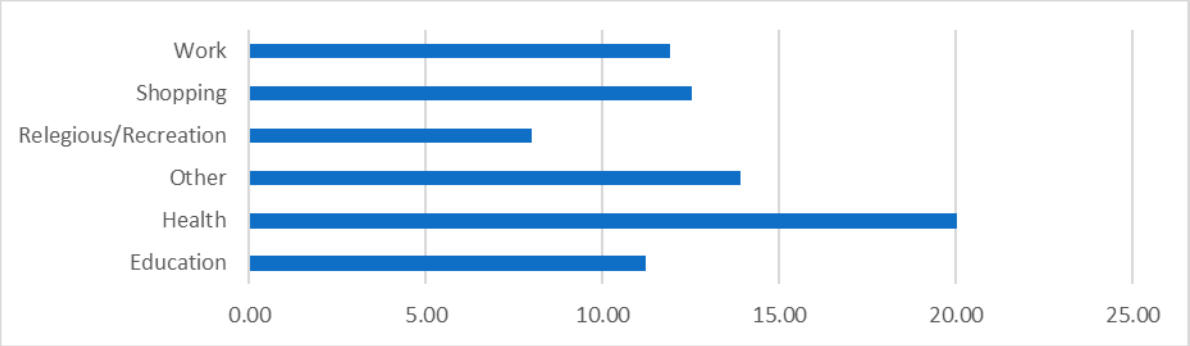


Figure 30: Trip Purpose Based Average Trip Distances [2]

[6] Distribution based on survey passengers, this share will later be computed with the household survey data to extract the overall travel characteristics.

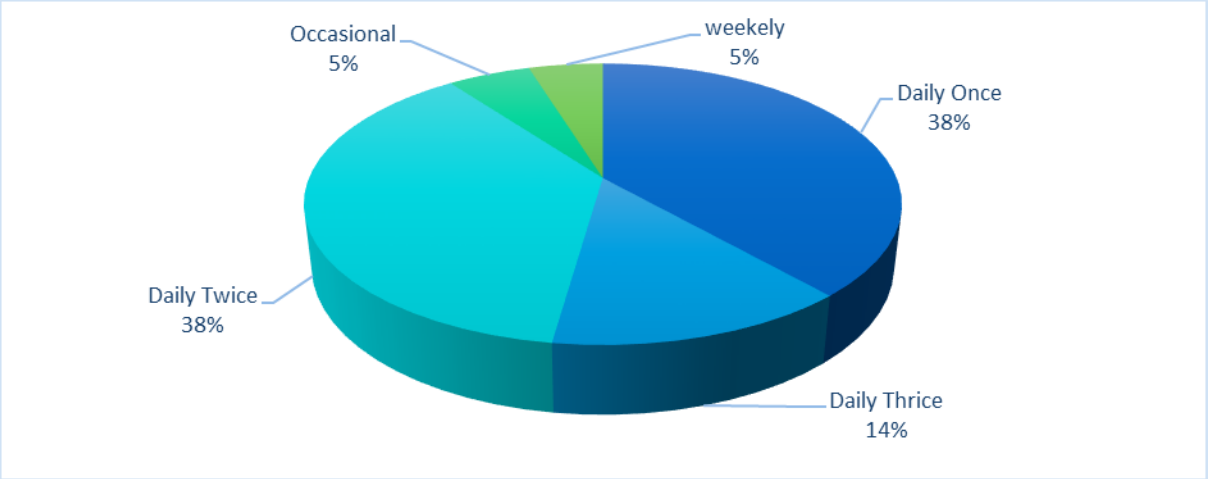


Figure 31 Distribution IPT Commuter Trips Based On Trip Frequency[7]

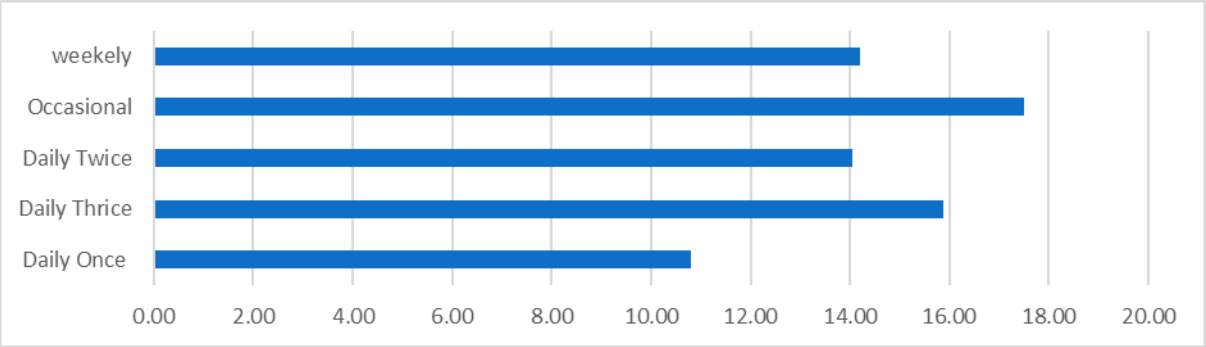


Figure 32 Trip Frequency Based Average Trip Distances [3]

About 90% of the surveyed IPT passenger trips were observed to be daily trips followed by occasional trip and weekly trips accounting to each 5% of total trips (Figure 31). The average trip distance of daily trips is about 13.5km while the occasional users is about 17.5km. Thus, the work based daily trips are made within a distance of 13kms. The Figure 32 shows average trip lengths of survey passengers' base on the trip frequency.

Key Inferences:

1 42% of the IPT commuter trips are work based trips, followed by shopping trips.
2 The work based daily trips are made for a distance of 12km indicating a longer travel distance o work.

PEDESTRIAN COUNT SURVEYS

Objective: The objective of the survey is to quantify the extent of pedestrian movement in order to design facilities for such movement

Conduct: The survey is conducted for a period of 16 hours on important locations where heavy pedestrian movement was observed during the reconnaissance survey.

Locations : The following 4 locations were identified for the same (Table 19 and Figure 22).

[7] Distribution based on survey passengers, this share will later be computed with the household survey data to extract the overall travel characteristics.

Table 29: Pedestrian Count Locations

CODE	LOCATION
TMC_1	Dairy Farm Center
TMC_2	Registrar office Ramaraopeta
TMC_3	Three lights Junction
TMC_4	Bhanugudi junction

Analysis: It is observed that registrar office at Ramaraopeta junction has the highest volume of footfall due to its strategic location government offices like registrar office, divisional consumer court, R.D.O office, Zilla parishad office and educational institutes etc. The pedestrian daily volumes and peak hour volumes are as shown in Table 30 and the hourly variations in daily volumes is shown in figure 33.

Table 30: Pedestrian Volumes

CODE	LOCATION	Daily Volume (Along+Across)	Peak Hour	Peak Hour Volume (Along+Across)
TMC_1	Dairy Farm Center	8109	08.30-09.30	1071
TMC_2	Registrar office Ramaraopeta	7722	11.00-12.00	838
TMC_3	Three lights Junction	4287	11.00-12.00	582
TMC_4	Bhanugudi junction	7425	18.30-19.30	863

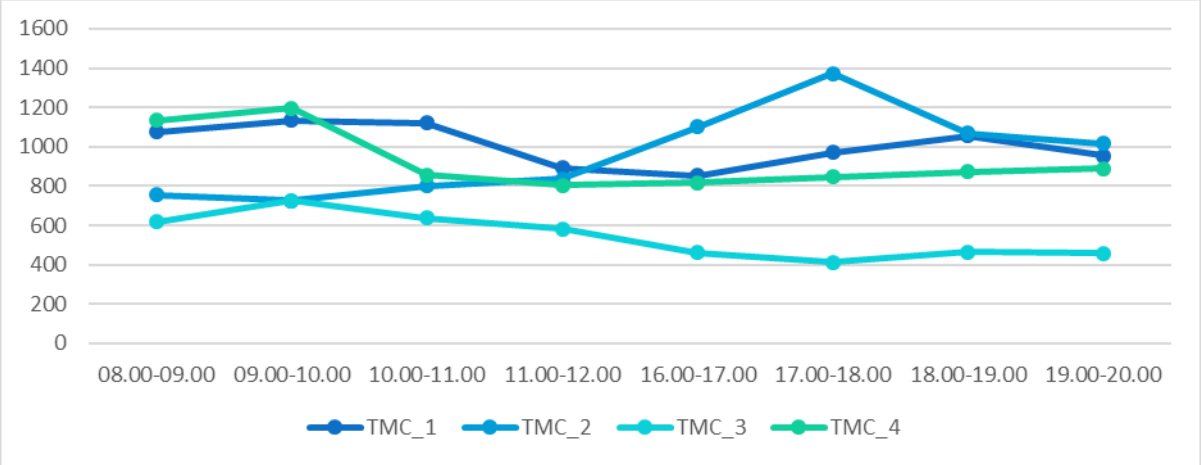


Figure 33 Hourly Variations In Pedestrian Volumes

The degree of conflict between the pedestrians and vehicles is analysis and it observed that Registrar office Ramaraopeta and Bhanugudi junction requires immediate attention in terms of pedestrian crossing infrastructure facilities such as Zebra crossings. The Table 3.13-3 exhibits the values for the PV square analysis.

Table 31 PV Square Analysis Values

CODE	LOCATION	PV Square/10^8 Value

TMC_1	Dairy Farm Center	0.53
TMC_2	Registrar office Ramaraopeta	2.82
TMC_3	Three lights Junction	0.24
TMC_4	Bhanugudi Junction	2.23

Key Inferences:

1. Registrar office Ramaraopeta is observed to have highest footfall amongst all the surveyed locations.
2. The morning peak hour for the pedestrian is observed between 11am to 12am and evening peak between 6:30pm to 7:30pm.
3. It is analysed that Registrar office Ramaraopeta and Bhanugudi Junction requires immediate attention in terms of pedestrian crossing infrastructure facilities such as Zebra crossings.

GOODS OPERATOR SURVEYS

Objective: The survey aims to evaluate the travel patterns of goods vehicles in the study area.

Conduct: The study is conducted at major good focal points through manual interviews capturing the goods vehicle trip characteristics as show in the survey format in Annexure A.

Locations : The survey was conducted in the following three location as shown in Figure 34 and Table 32.

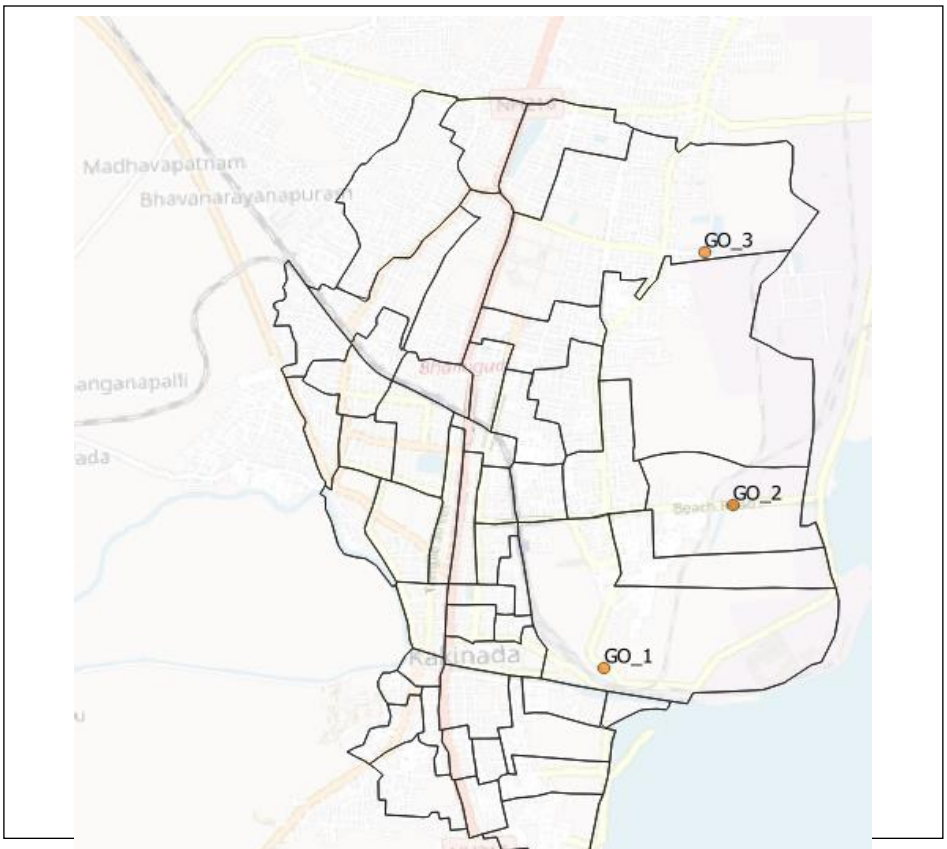


Figure 34 Goods Operator Survey Locations

Table 32 Goods Operator Survey Locations

CODE	LOCATION

GO_1	Revenue Colony Road, Near Kakinada Port
GO_2	Dairy Farm Road
GO_3	NFCL Road

Analysis: It is observed that majority of the trips are weekly trips, commuting to nearby towns owing to the imports and export activities from the port. The trip frequencies of goods vehicles captured through Goods Operator Survey is as shown in Figure 35.

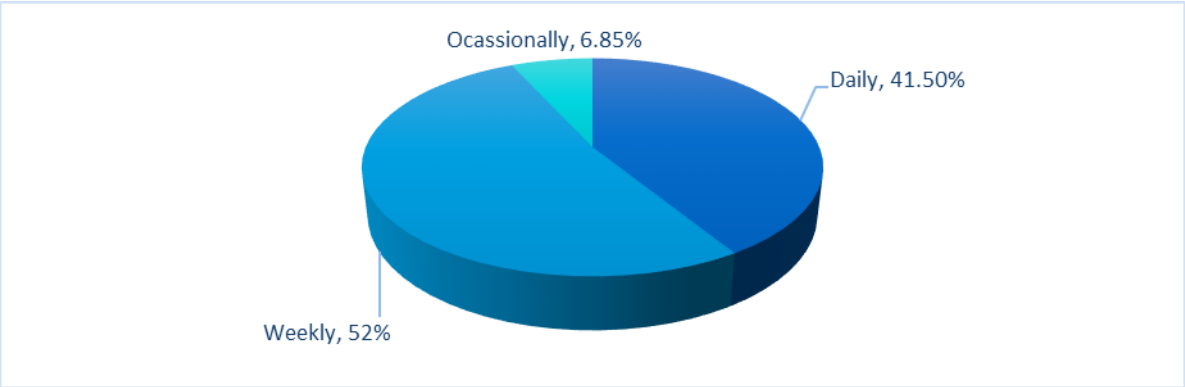


Figure 35 Trip Frequencies Of Goods Vehicles

The list of major routes used by goods operators are shown in Table 33

Table 33 Frequent Routes Operated For Goods Vehicles In The City

S.NO.	GOODS VEHICLE ROUTES
1	RAJAMANDRY TO KAKINADA
2	KAKINADA TO RAJAMANDRY
3	VIJAYWADA TO KAKINADA
4	KAKINADA TO KAKINADA
5	VIZAG TO KAKINADA
6	KAKINADA TO TUNI
7	KAKINADA TO SAMARLAKOTA
8	ELURU TO KAKINADA
9	KAKINADA TO VISAKAPATNAM
10	KAKINADA TO CHAGALLU

The survey indicates that 42% of the goods operators in Kakinada own designated parking areas of which 71% has an off street parking facility and 28% of them use on street parking facility. It was stated that the average unloading time with the city is about 2 hours. The average of 4 number of goods trips per month is carried out. The nature and share of commodity type are as shown in Table 34.

Table 34 Nature of Commodities

COMMODITY TYPE	SHARE
Vegetable/Fruit/Milk/Fish	22.5%
Food Grains/Rice/Wheat/Jowar etc	2.8%
Petrol/Diesel/Gas/LPG	33.1%
Forest Products(Wood/Rubber etc)	2.2%

Container	11.8%
Iron coils/Sheets	23.0%
Consumer Goods	3.4%
Industrial Goods(Alloy/Machine etc)	1.1%

Key Inferences:

1. The majority of the trip observed are weekly trips to the nearby towns.
2. 71% of the operation are engaged in Off-street parking of vehicles adjoin their plots.
3. The average unloading time within the city is observed to 2 hours.
4. Petrol/Diesel/Gas contribute to the highest share (33%) in commodity type, followed by Iron Coil and Vegetables/Fruits/Milk.
5. The average number of trips made by the goods vehicle is observed to be 4 trips per month.

HOUSEHOLD INTERVIEW SURVEYS

Objective: The house hold survey aims to capture the data which is used for describing the travel patterns in the city and travel preferences of its residents.

Conduct: Collection of data on socio-economic characteristics, household members and their travel diary of study area residents was 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 was captured as shown in survey format in Annexure A.

Samples: A total cleaned sample set comprises of 2% of the total households in Kakinada.

Analysis: The household survey data has been analysed under the following sections**,**

SOCIO-ECONOMIC CHARACTERISTICS

DEMOGRAPHIC DISTRIBUTION

The age wise distribution of population based on the house hold data is as shown in Table 35. It observed that, Kakinada has a good share (56%) of younger population aged below 35. The working age group (15 to 64) contribute to about 80% of the total population. The age-sex pyramid is as shown in Figure 3.15.1. The share of females is higher in age groups between 35 years to 45 years. The sex ratio derived from the house hold survey is 1165. It is observed that number of males are higher than number of females in Kakinada.

Table 35 Age Wise Distribution of Population

Code	Age	All	Male	Female
1	0-5	2.63%	2.92%	2.28%
2	5-17	15.84%	16.63%	14.91%
3	18-24	19.04%	19.35%	18.69%
4	25-34	18.49%	16.47%	20.83%
5	35-44	20.70%	17.79%	24.09%
6	45-58	19.43%	21.67%	16.82%
7	59-64	2.37%	3.08%	1.54%
8	65-74	1.33%	1.80%	0.79%
9	>75	0.17%	0.28%	0.05%

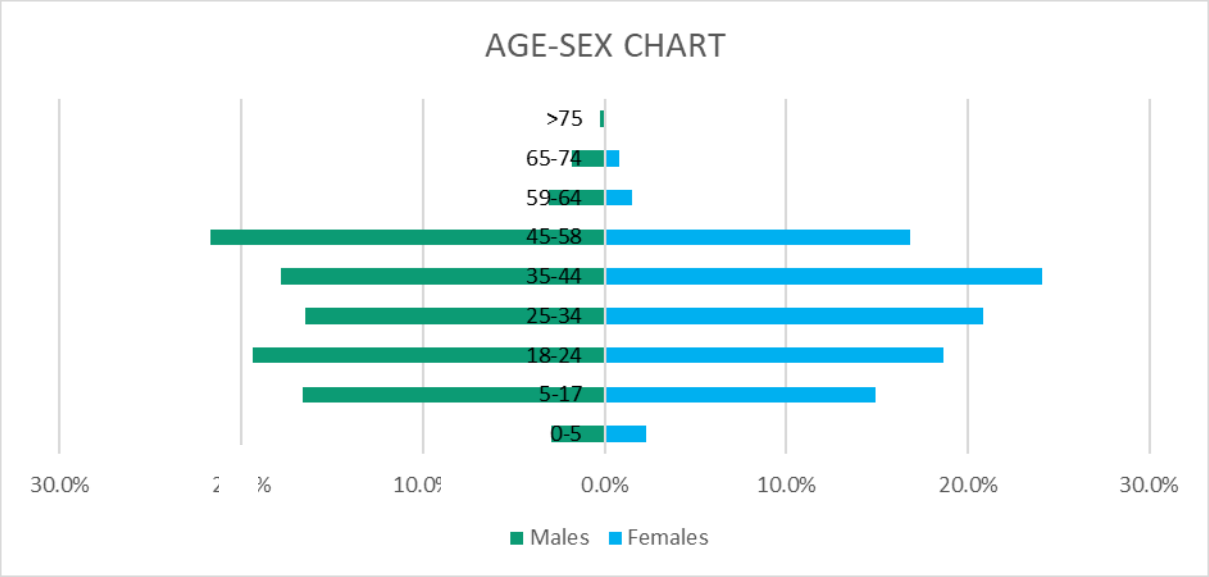


Figure 36: Age-Sex Pyramid

SOCIO ECONOMIC DISTRIBUTION

This section deals with the general socio-economic characteristics of the surveyed population. The distribution based on educational qualification is as shown in Figure 37. Similarly, the distribution based on occupational status and employment sector are shown below in Figures 38 and Figure 39. It is observed that 34% of the population are students, 38% are employed in various sectors as shown in Figure 38 and remaining share of population constitute retired, home-makers and unemployed members. The classification based on employment sector indicates that the highest share comprises the agriculture sector with 20% followed by service sector with a share of 18%. The manufacturing sector contributes to 18% while construction/mining constitutes to 15% and retail/whole sale trade constitutes to 11%. This, agriculture and service sectors are the major sectors of employment in the city. The average number of students per household is observed to be 3.

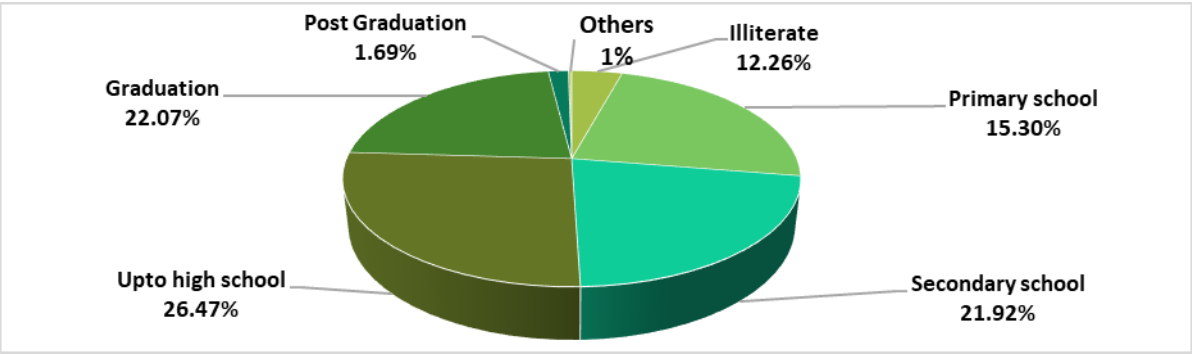


Figure 37 Distribution Based On Educational Qualification

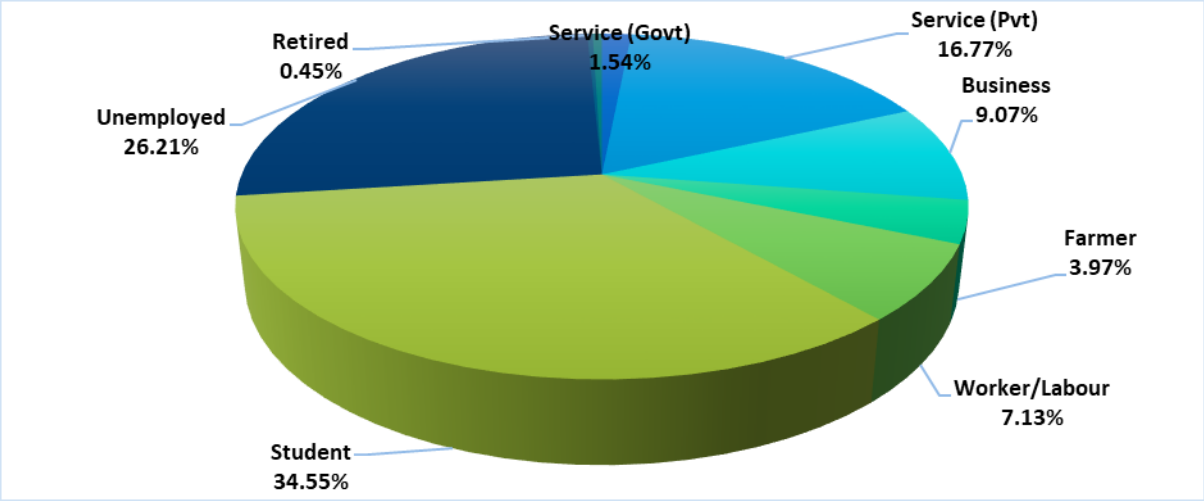


Figure 38 Distribution Based On Occupational Status

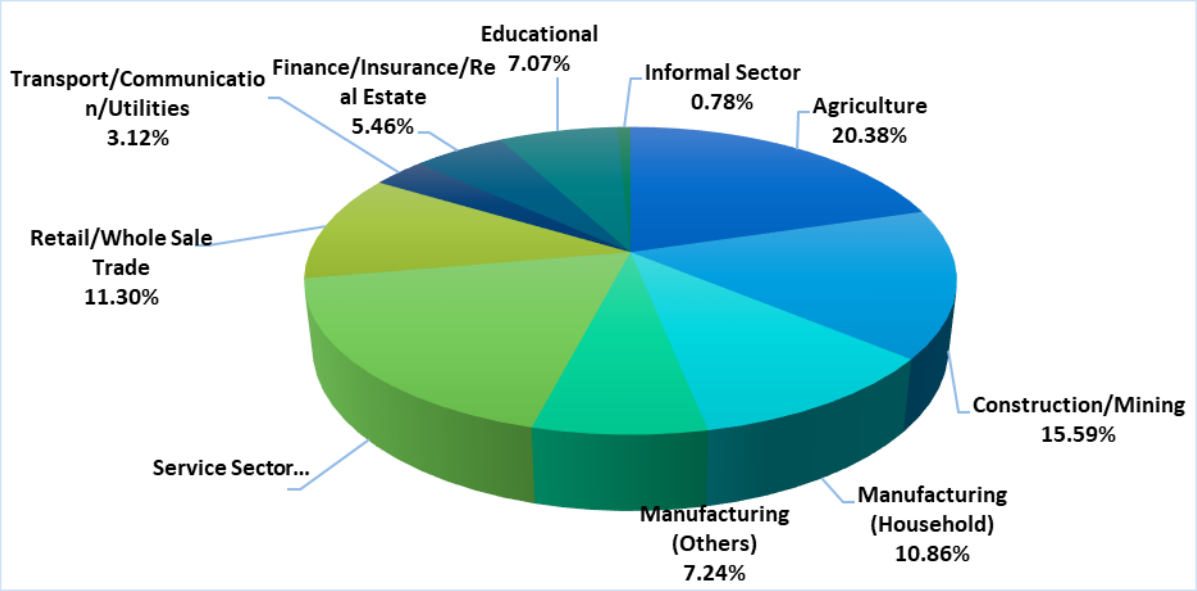


Figure 39 Distribution Based On Employment Sector

The average monthly income as per the Household survey in Kakinada is about INR 14,164. The distribution of households based on monthly income is as show in Table 36. About 74% of households have monthly income below INR 10,000 and 26% of the households earn more than INR 15,000 per month. The average number of earning members per house hold was observed to be 1 (Approx. 1.28). It was also observed that 94% of the households owning a vehicle own two wheelers while only 5% of the households own cars. The distribution is as shown in figure 37.

Table 36: Distribution Based On Average Monthly Income

Code	Category	Monthly HH Income	% Distribution	Avg. Monthly HH Income (INR)
1	EWS	<5000	2%	2,609
2	LIG	5001-10000	21%	7,639
3	MIG	10001-15000	51%	11,769

4	HIG	>15000	26%	25,254
Total			100%	**14,164**

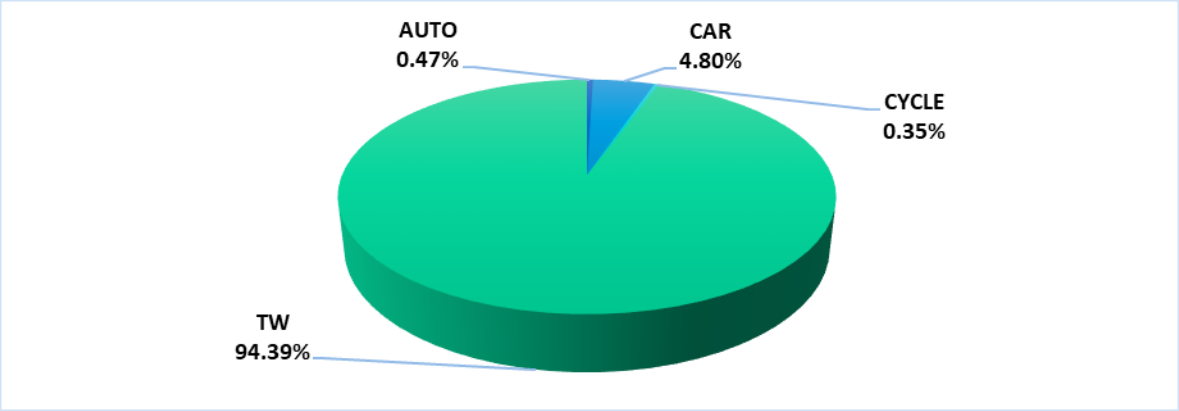


Figure 37: Vehicle Ownership Composition

The classification based on the category of vehicles owned indicates that 60% of the households own only two wheelers, while only 3% of the households own only cars. 31% of the households do not any vehicle while only 0.2% of the population own only cycles. The detailed classification is as shown in Figure 38.

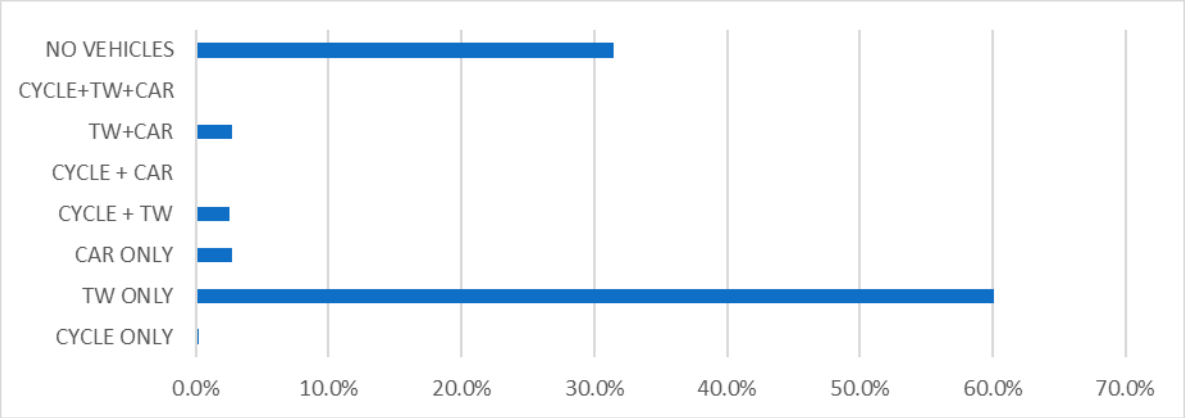


Figure 38 Distribution Households Based On Vehicle Ownership

It is observed that only 53.11% of the households have parking spaces available within their building or property premises. The remaining share of households utilize the space around the properties in the form of On-Street Parking.

Table 37: Parking Availability Within The Property Premises

Code	Parking Availability	% Dist.
1	**Yes**	**53.11%**
2	**No**	**46.89%**
Total		**100%**

Table 38 Distance Based Distribution Of Households To Daily Needs

Code	Distance to Daily needs	To Shop	Educational Needs	Medical Needs
		% Dist	% Dist	% Dist
1	<250	4%	4%	3%
2	251 to 500	11%	5%	6%
3	501 to 750	20%	12%	12%
4	751 to 1000	2%	3%	3%
5	1001 to 1500	20%	32%	32%
6	>1500	43%	44%	45%
	Total	**100%**	**100%**	**100%**

It is observed that only 15% of the households travel below 500m to access their daily household errands while majority of 43% of them want to travel more than 1500m to satisfy their daily needs. 76% of the household travel more than 1km for their educational needs and the medical needs are majorly accessed over a distance of 1.5km. Thus, it is observed the longer trips are made for all shopping, educational and medical needs.

TRAVEL CHARACTERISTICS

Based on the travel dairy information collected as a part of the household survey, the Per Capita Trip Rate (PCTR) for Kakinada was observed to be 1.29, i.e. each person makes 1.29 trips per day.

Table 39: Average Time

Code	Mode	Avg. WT (Mins)
1	Public Bus	17.9
2	Auto Rickshaw	15.2
3	Cycle Rickshaw	22.4
Total		**19.1**

The average waiting time to access the public transport services in 19 minutes. The longest waiting time is observed for Cycle Rickshaw. The average wait times of all the public transport modes are shown in Table 3.15-5. The average trip length in the Kakinada is observed to be 4.18Km.

HOUSEHOLD ACCESSIBILITY AND OPINION

The accessibility of households to Public Transit (PT) or Intermediate Public Transport (IPT) stops is as assessed in terms of distance and time. The average distance travelled by the house hold to access the near PT or IPT stop is 1.72km which is not a comfortable distance to access the PT or IPT by walk. Similarly, the average time taken to reach the PT or IPT stops in 19.62 minutes. The mode wise distances and access time to PT and IPT stops are as shown in Table 3.15-6.

Table 39: Accessibility To PT Or IPT Stops

Code	Mode	Nearest Stop (km)	Time taken to reach (min)
1	Public Bus	1.67	20.82
2	Shared Auto	1.77	18.42
	Total	**1.72**	**19.62**

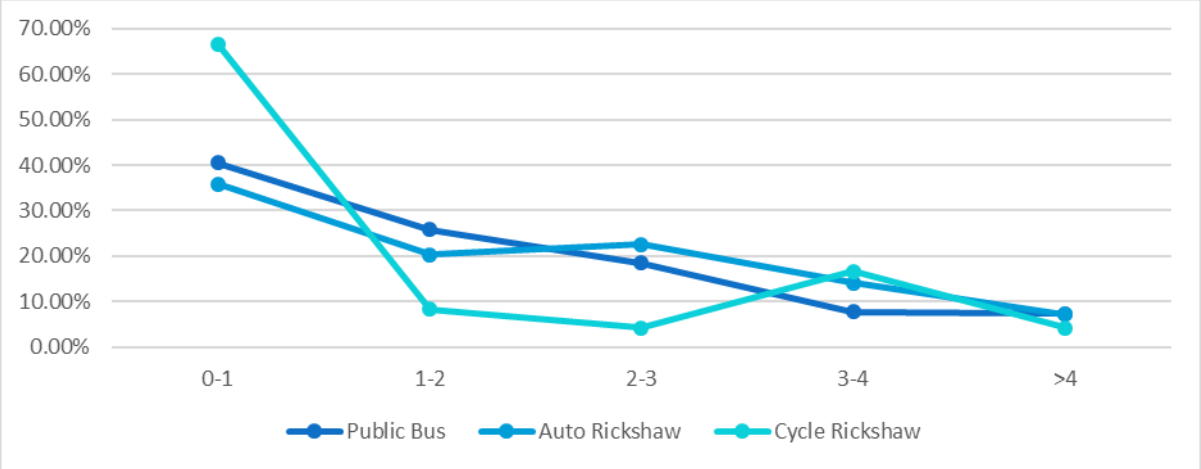


Figure 40: Distribution Based On Access To IPT And PT Stops

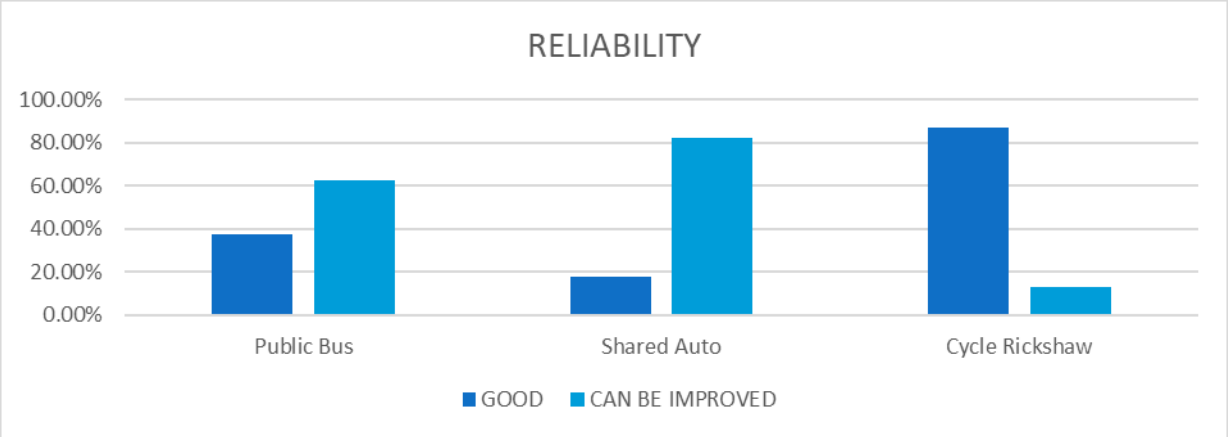


Figure 41: Users Opinion On Reliability Of PT And IPT Modes

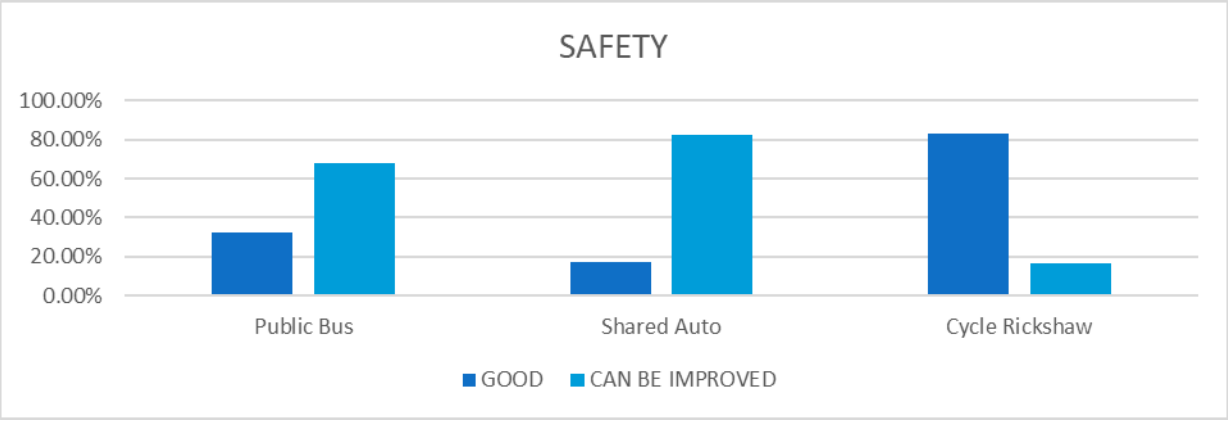


Figure 42 Users Opinion On Safety Of IPT Modes

The user opinion survey reflected a considerable performance in terms of reliability of Public Transit services along with the IPT services. Safety is perceived to a major concern in regard to all the public transit modes. The safety aspects of auto rickshaws especially in terms of driving is prioritized to be improved amongst the other modes. Similarly, the fares of cycle rickshaws are perceived to be

affordable compared to the bus services and share auto as the nature of bus services is largely sub-urban services.

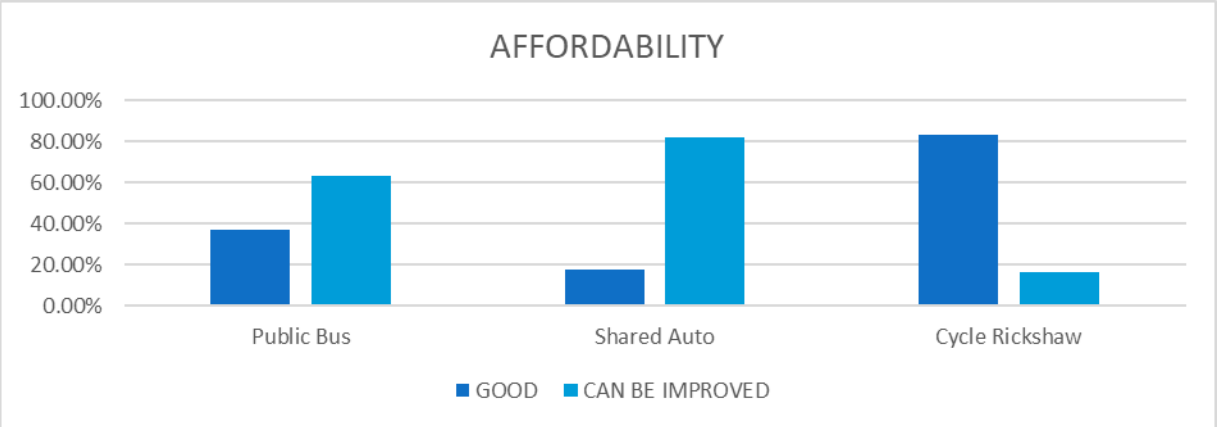


Figure 43 Users Opinion On Affordability Of IPT Modes

It is observed that majority of the users perceive it somewhat convenient to travel using motorised modes in the city while a considerably larger share perceive the need to improve the travel conditions for the pedestrians in the city.

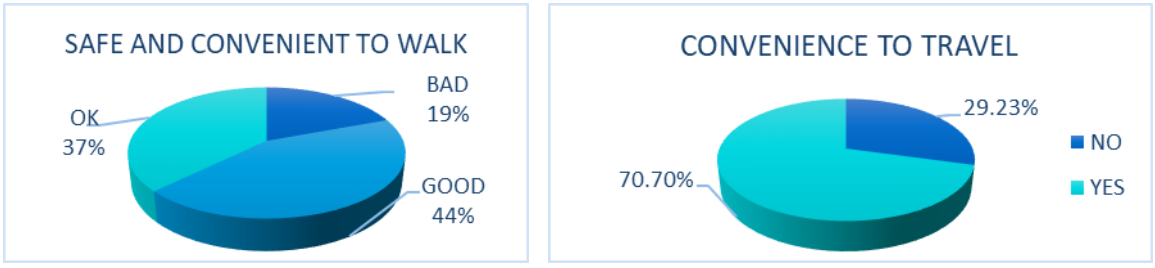


Figure 44 Perception of Travel Conditions In The City

Key Inferences:

1. The sex ratio derived from the house hold survey is 1165 females for 1000 men.
2. The average monthly income as per the Household survey in Kakinada is about INR 14,164 with the average number of earning members per house hold being 1 (Approx. 1.28).
3. The average distance travelled by the house hold to access the near PT or IPT stop is 1.72km which is not considered as a comfortable walking distance.

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: The survey is conducted for a period of 16 hours on important commercial areas where parking is predominant wherein the note the vehicle type and registration number of parked vehicles every 1/2 hour and associated parking fees data are collected as shown in survey formats in Annexure A.

Locations: The survey is conducted at the 4 on street Parking locations as shown in Figure 45 and Table 44.

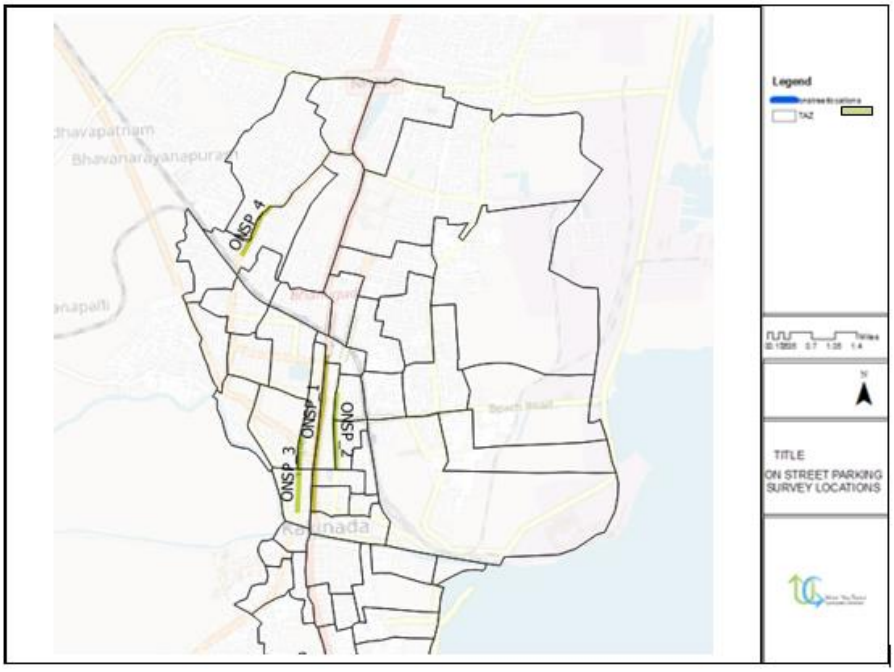


Figure 45 On Street Parking Locations

Table 44: On Street Parking Locations

CODE	LOCATIONS
ONSP_1	Cinema Road
ONSP_2	Main Road
ONSP_3	Temple Street
ONSP_4	Karanam Gari Junction Road

Analysis: It is observed peak across all the surveyed locations is observed to be between 11am to 12am. The location with highest accumulation of parking is observed to be Location 3 Temple Street followed by Main road and Karanam Gari Junction Road. The peak hour accumulation is observed to be 10% to 11% of the daily accumulation. The parking durations is observed to vary between 25mins to 35min. The longest parking duration at peak hour is observed at Temple Street due to the people coming to the temple, while the highest turnover rates are observed at Karanam Gari Junction Road and Temple street. The details of the parking survey analysis is as shown in Table 3.16-2.

Table 45 On Street Parking Analysis

PARKING ANALYSIS	Location 1	Location 2	Location 3	Location 4
	ECS	ECS	ECS	ECS
Parking Accumulation (Daily)	495	547	648	537
Parking Accumulation (Peak)	50.5	52.25	72.5	51.75
Peak Period	10.15-11.15	20.30-21.30	06.30-07.30	18.00-19.00
PH%	10%	10%	11%	10%
Parking Load (Veh-Hr)	62	81	107	98
Parking Duration (Minutes)	26.0	34.4	35.1	25.3
Parking Turnover (Veh/Hr/Bay)	2.55	2.50	3.25	4.14

Parking Index	111%	143%	190%	175%

The composition of parked vehicles at each of the surveyed location is as shown in Figure 46, Figure 47. Two-wheeler constitute the highest share followed by cars.

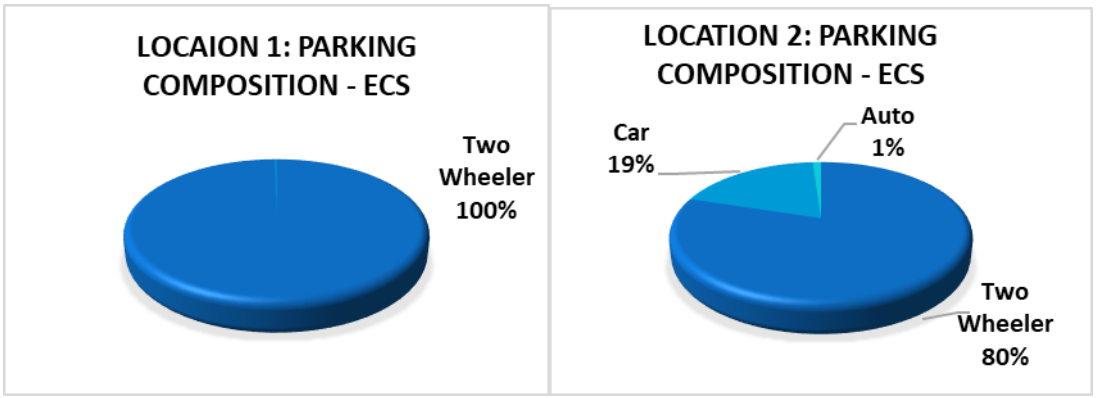


Figure 46: Parking Composition at Locations ONSP1 and ONSP2

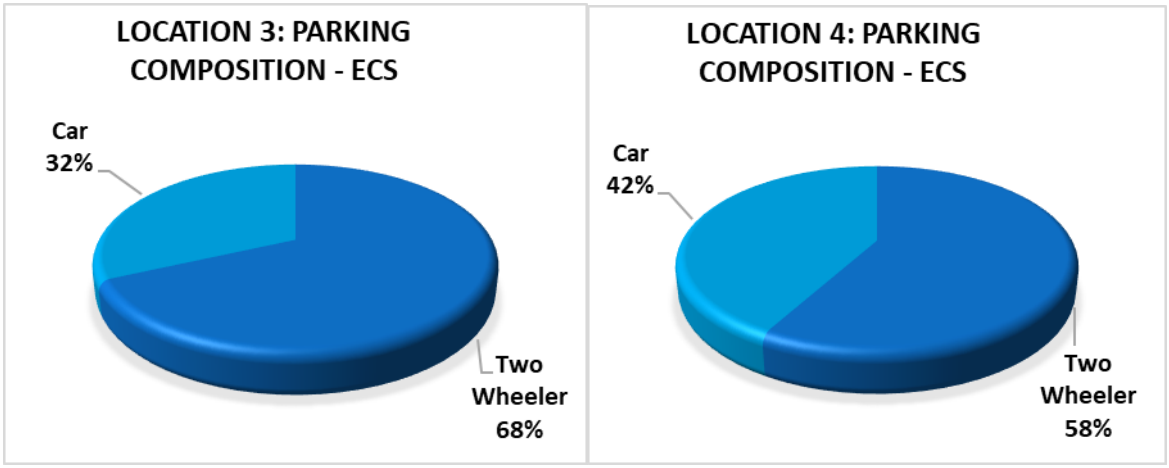


Figure 47: Parking Composition At Locations ONSP3 And ONSP4

Key Inferences of On Street Parking:

When the parking accumulation and demand was compared with the on street parking, it is observed that the demand at on street parking locations was higher than the supply. The reasons identified for the same were,

1. Lack of distribution of off street parking spaces in the city.
2. Availability of free supply of on street parking spaces.

PASSENGER OPINION SURVEY

Objective: The objective of the survey is to assess the opinion of all the transport mode users.

Conduct: The survey was conducted at important locations like public transit nodes and parking areas. Information such as socio-economic characteristics, travel characteristics, issues, opinion of existing situation, existing travel modes etc. as shown in the survey format in Annexure A.

Locations: The following five bus stop locations were identified as shown in Table 46 and Figure 3.10.1.

Table 46: Passenger Opinion Survey Locations

CODE	LOCATION
BS_1	Jagannadhapuram Bus Stop
BS_2	Balaji Cheruvu Bus Stop
BS_3	Bhanugudi Bus Stop
BS_6	NTR Bus Stop
BS_7	Three Lights Junction Bus Stop

Analysis: The results of the passenger opininon survey reflected that the major concerns with regard to travel in the city were

- Lack of walking space and pedestrian facilities
- Public transport connectivity
- Longer waiting time
- Lack of easy access to public transport service

Due to the lack of city based public bus services, passengers especially aged below 20years (who are the dependent users) percive difficulty in accessing various places with in the city. The detailed analysis of the passenger perception with regard to travel experience concerns are shown in Figure 48.

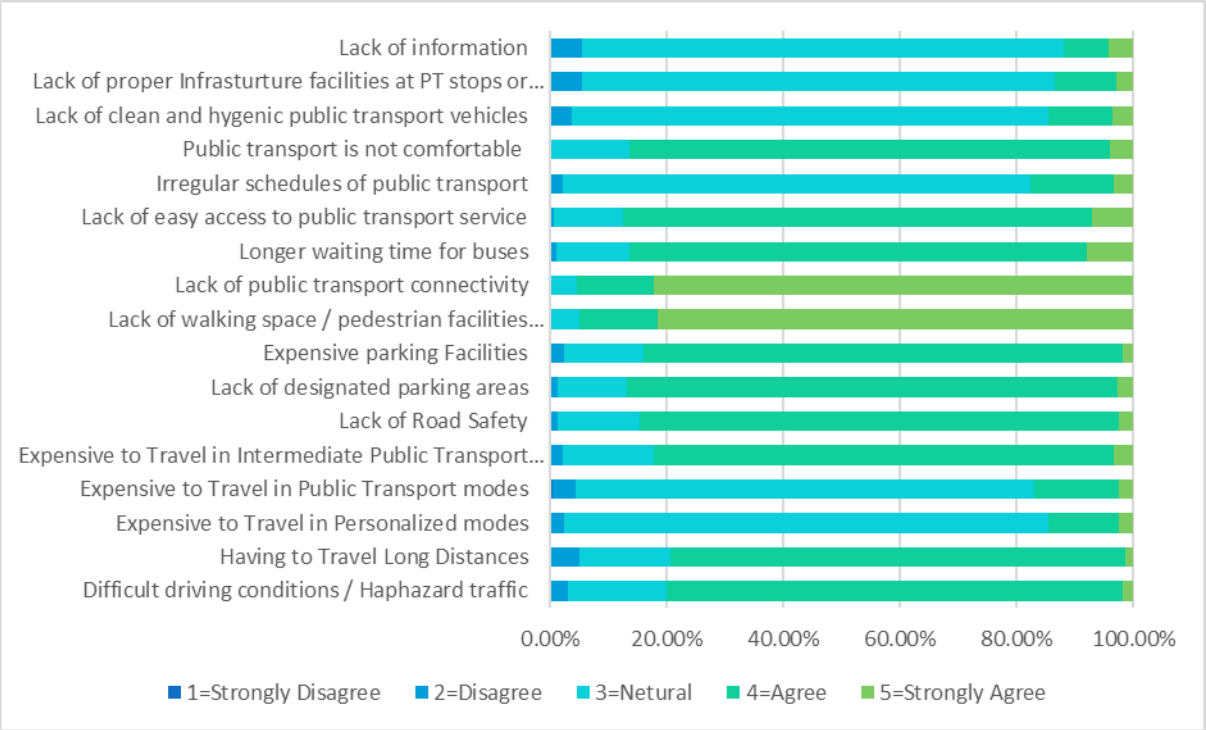


Figure 48: Perception Of Passenger Travel Concerns

Similarly, the passenger's opinion in regard to the reasons for above experienced issues was assessed as shown in the Figure 49. The major reasons for the concerns in regard to the travel are,

- Lack of travel information
- Lack of traffic sense in public

- High growth of personalised modes

Thus, indicating the need for improved traffic and travel management along with strategies to refrain increasing the usage of private modes over the public transit modes.

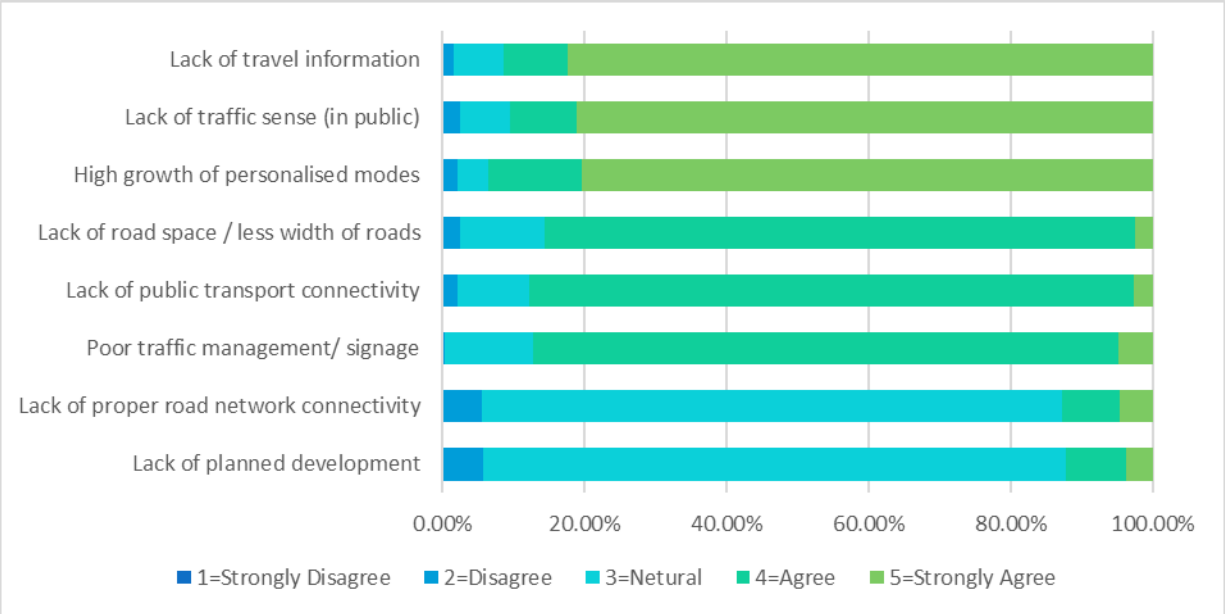


Figure 49: Reasons For Travel Concerns As Perceived By The Passengers

The passengers' perception in regard to improvement measures for enhancing the travel experience is as shown in Figure 50. The measures which are perceived of high importance by the users are as follows,

- Improving public transport service
- Traffic Education In Public
- Better information on roads/Traffic conditions
- Improving Public Transport Service

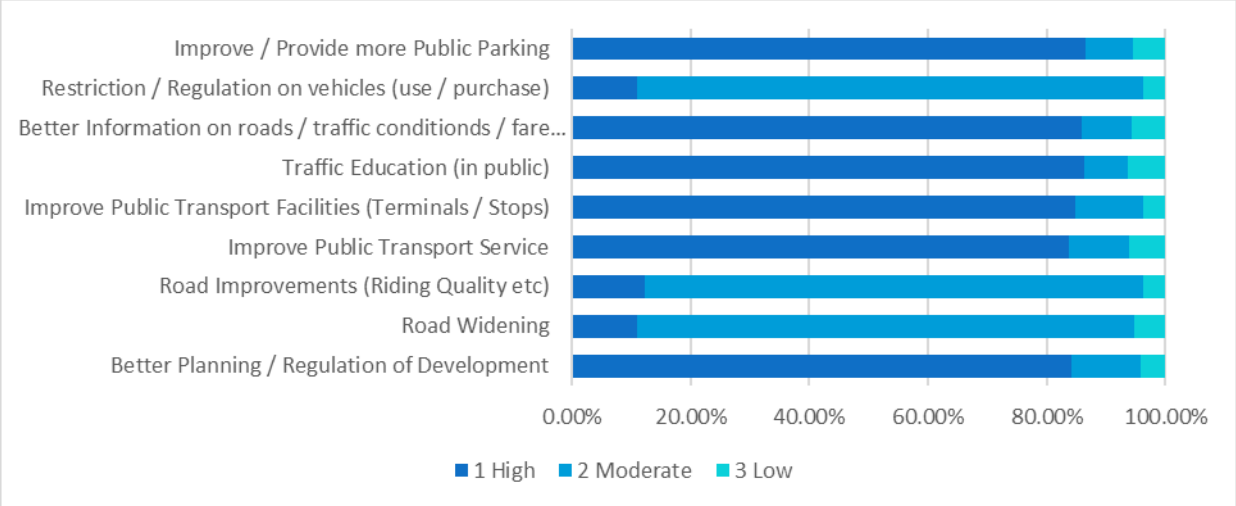


Figure 50: Passenger Perception In Regard To Improvements

The passenger opinion on ways to promoted transport and traffic fund is as shown in Figure 51.

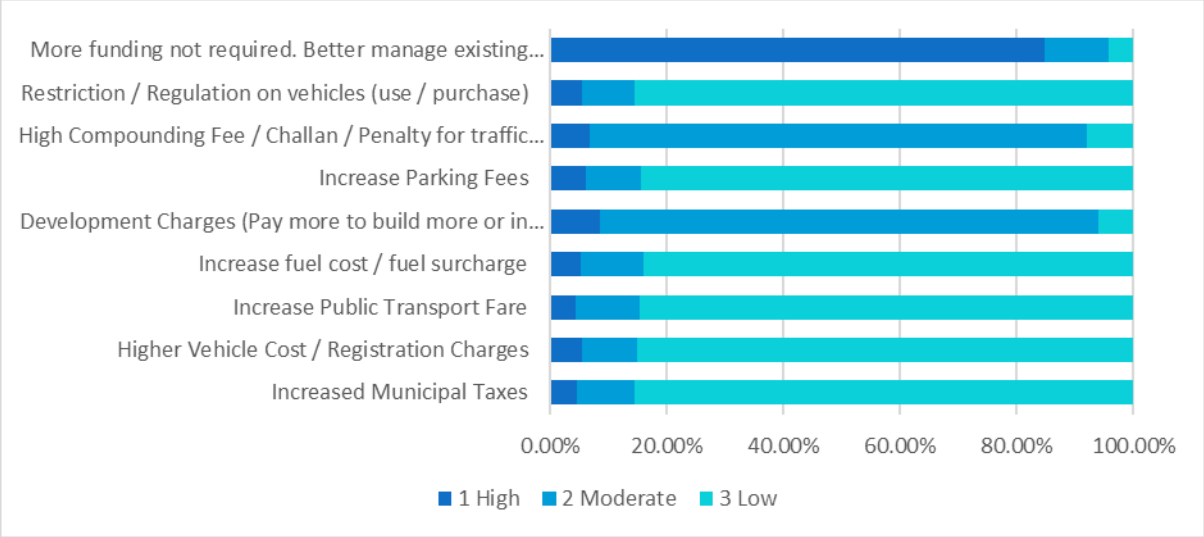


Figure 51 Passengers Opinion on Ways To Promote Traffic And Transport Fund

The following measures are the highest perceived ways to promote travel and traffic fund,

- Better manage of existing funds
- Development charges and Increasing fuel cost/fuel surcharge
- High Compounding Fee

It is observed that majority of the users are inclined towards indirect funding. The overall experience of road traffic conditions as perceived by the passengers is as shown in Figure 52. It was observed that 43% of the users perceive it Somewhat congested and Poorly managed, while 31% of the users perceive it somewhat congested but well managed.

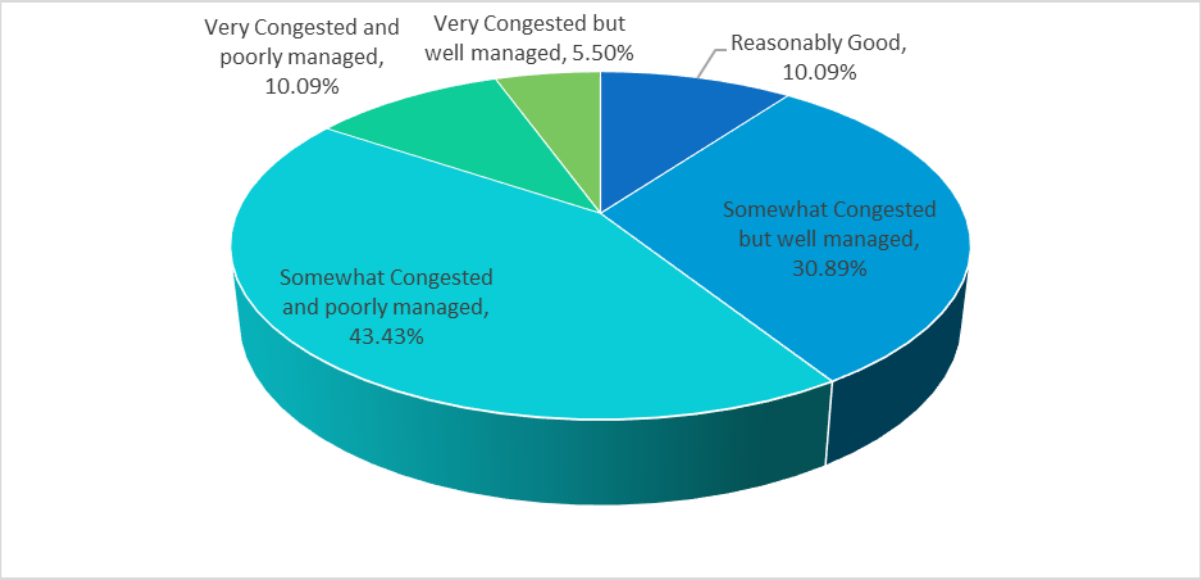


Figure 52 Overall Experience Of Road Traffic Conditions

It is observed that the passengers are willing to pay for the improved services if the time savings are over 25 minutes. The willingness to pay with respect to the time saving are as shown in Figure 53.

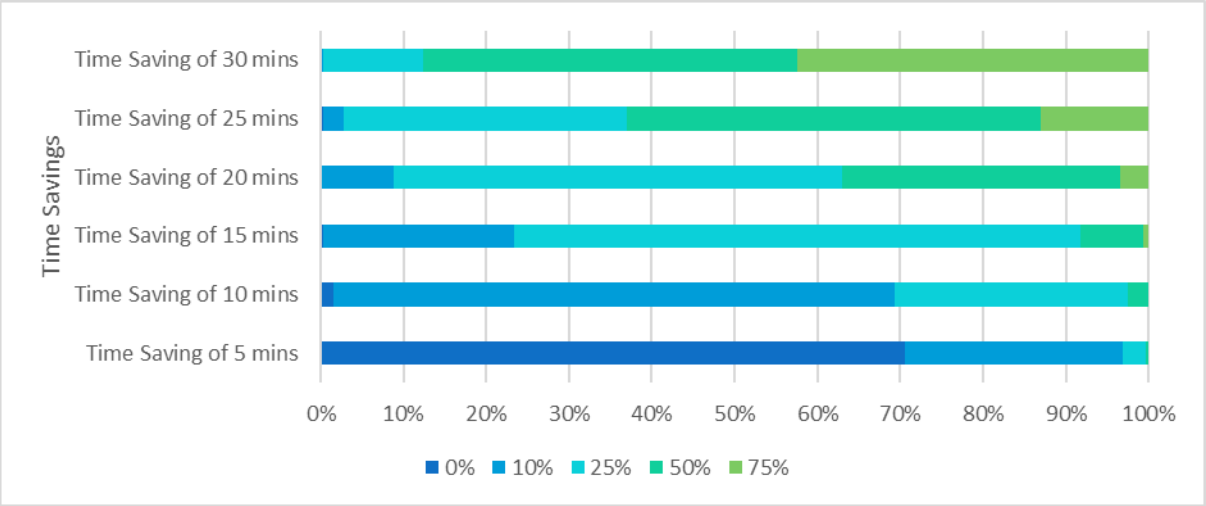


Figure 53 Willingness To Pay With Respect To Time Savings

The major concern of the Non-Motorised Transport users is observed to the Comfort followed by Lack of Infrastructure (Refer 3.17.7). 65% of the users desired improved footpaths and cycle tracks to enhance the quality of Non-Motorised Transport travel experience (Refer 3.17.8).

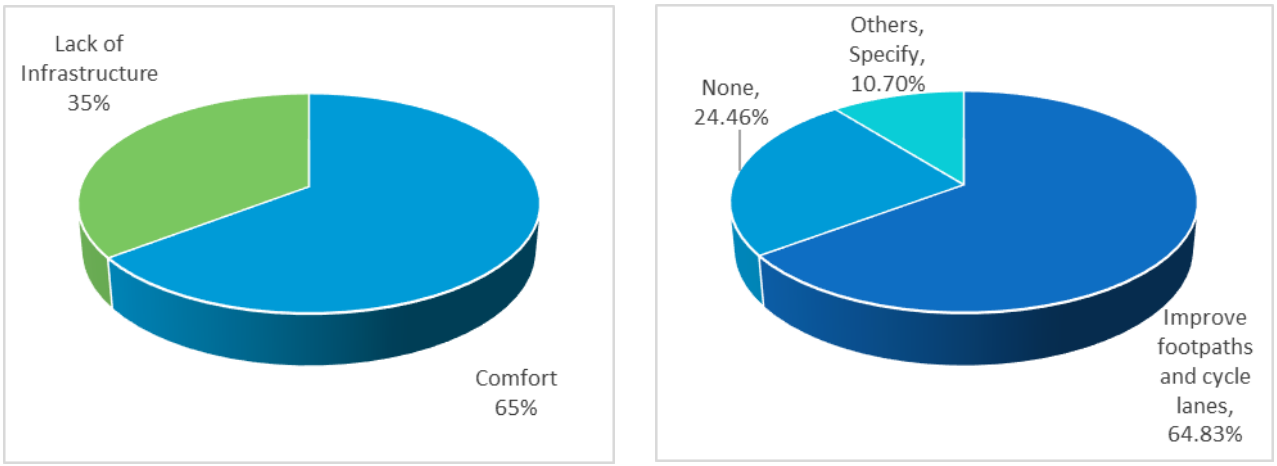


Figure 54 NMT User Concerns (Left)

The perceptions regarding the need for dedicated lanes for buses and cyclists was collected and analysed as shown in Figure 56 that only 4.59% of the passengers perceive the need for dedicated bus lanes and only about 7.95% of the users perceive the need for dedicated bicycle lanes.

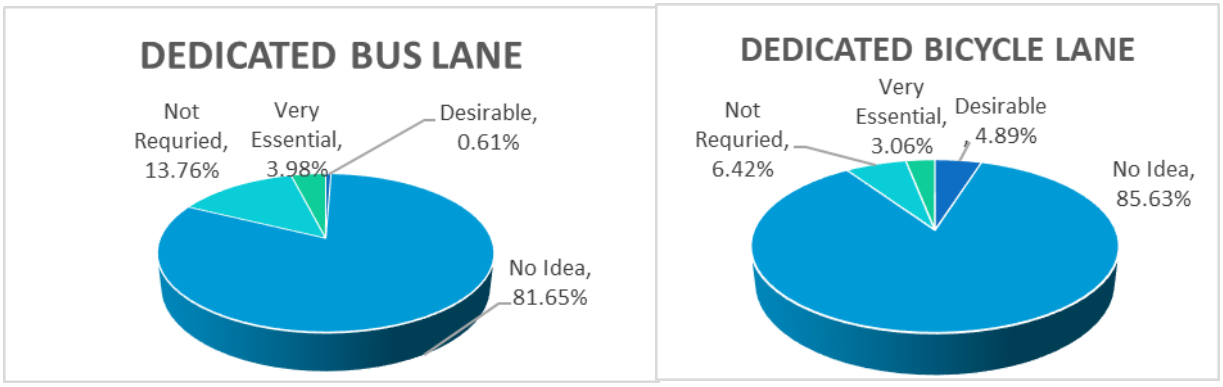


Figure 56 Perceptions Regarding The Need For Dedicated Bus And Bicycle Lanes

Key Inferences:

1. The survey analysis indicates the need for improved traffic and travel management along with strategies to refrain increasing the usage of private modes over the public transit modes.
2. The majority of the responders are inclined towards indirect funding such as vehicle costs and registration charges, high compounding fee or high penalty for the traffic violators to promote travel and traffic fund.
3. 10% of the users perceive the overall experience of road traffic conditions reasonably good, while 30% of the users perceive it somewhat congested.
4. 65% of the users desired improved footpaths and cycle tracks to enhance the quality of Non-Motorised Transport travel experience.

ANNEXURE 3: LIST OF ATTENDEES

Attendance Sheet

Preparation of Low Carbon Comprehensive Mobility Plan – Kakinada

Dt: 10-12-2018

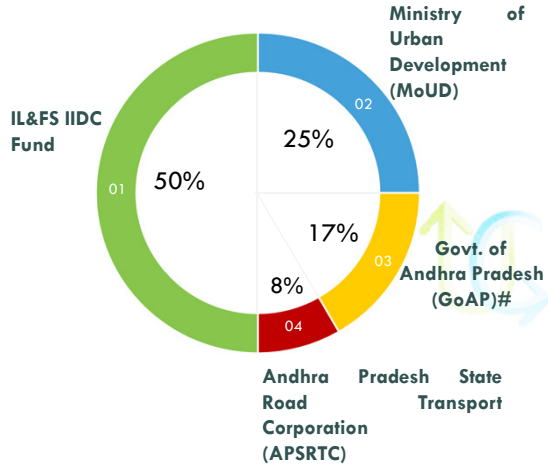
Sl.No.	Name	Designation	Signature
1	K. Rama Mohan	Municipal Commissioner	
2	V. Siri Anand	Dy. Transport Commissioner i/c	10/12/18 (9603345627)
3	C. Ravi Kumar	Regional Manager	9959225524
4	SK. KALESHA	Assistant city planner Kakinada Mpl Corp.	7702255275
5	A. Vijaya Saradhi	Regional Transport Officer Rtc.	9848528346.
6		DTCo	
7	S. PAVANI	Mayor – Attended.	
8	S. Rama Krishna	Sr. Vice-President, UMTC	9000265056.
9	Ankush Malhotra	Vice-President, UMTC	9811330228
10	Siva Niranjan. T	Manager, UMTC	9989437651
11	Harshita Sarma	Asst. Manager, UMTC	9573810022
12	Rakesh Jinka	Project officer, UMTC	9632794756
13	Sai Navya Annem	Sr. officer, UMTC	9246776642
14			
15			

ANNEXURE 4- STAKEHOLDER CONSULTATION PRESENTATION

Preparation of COMPREHENSIVE (LOW CARBON) MOBILITY PLAN for KAKINADA

DECEMBER 2018

About UMTC



 # Prior to bifurcation of the state of Andhra Pradesh pursuant to Andhra Pradesh Reorganization Act, 2014

Urban Mass Transit Company Limited

Secretary, Urban Development, GoI is the Chairman of UMTC

2

Experience with Metro Rail Organizations

- Feasibility and DPR for Delhi-Gurgaon-Rewari-Alwar Regional Rapid Transit System Corridor – 180 kms; Rs 30,000 cr.
- Ridership Assessment and PPP Structuring, Business Plan for Rapid Metro
- Multi Modal Public Transport Plan
  Concept Note on One City One Ticket
- Transit Oriented Development Plan for Nagpur Metro Corridors
- DPR with Operation and Implementation Plan for Feeder Service System for Nagpur Metro Corridors
- Business Plan for Feeder Services for Delhi Metro
- DPR for Integrated Public Transport Solutions for greater Kochi Region
- Non Motorised Transport Master Plan and Public Bike Sharing Schemes for Kochi Metro
- Transit Oriented Development Action Plan for Kochi
- Comprehensive Mobility Plan for Greater Kochi Region
- DPR for Integrated Water Transport System for Kochi
- DPR for Optimal Feeder Service System for Hyderabad Metro Corridor
- DPR for Metro Corridor Accessibility and Rejuvenation Plan for Hyderabad Metro Rail Phase 1
- Quick Assessment Study for Ridership updation for Lucknow Metro

Urban Mass Transit Company Limited

Assisted MouD in Appraisal of about 486 kms of Metro Corridors

3

UMTC Experience in Bus Rapid Transit System (BRTS)

Components	Pune (99 Km)	Guwahati (28.4 Km)	Delhi (16.6 Km)	Ludhiana (40 Km)	Amritsar (31.5 Km)	Rajkot (11 Km)	Surat (63.5 Km)
Feasibility/DPR	✓	✓	✓	✓	✓		
Infrastructure Design	✓	✓	✓	✓	✓	✓	
Operational Plan Design	✓	✓	✓		✓	✓	✓
Project Management & Supervision	✓				✓	✓	✓
Operations Hand Holding	✓				✓		✓
Capacity Building	✓				✓		✓

NEED FOR THE STUDY

- Growth of Private Vehicles
- Growth of unorganised Intermediate Public transport
- Lack of Public Transport Systems
- Increasing rate of road accidents concerning the pedestrians
- Decreasing mode shares of sustainable transport

To meet the objectives of Smart City (Smart Mobility)

WHAT IS COMPREHENSIVE (LOW CARBON) MOBILITY PLAN? VISION - 2040

What It Covers

1. Vision for Future Sustainable Transport (Vision - 2040)
2. Focusses on moving people and goods
3. Establishes Service Level Bench Marking
4. Defines Mobility Corridor and Accessibility Solutions
5. Identifies Sustainable Mobility Projects
6. Identifies Phasing and Block Cost Estimates
7. Smart Mobility
8. Focusing on Minimizing Carbon Emissions

What It Doesn't Cover

1. Final System Configuration
2. Identify Station Location and Size
3. Alternative Analysis
4. Conduct Feasibility Analysis
5. Detailed Traffic Engineering
6. Detailed Cost Estimates
7. Detailed Impact Assessment

All the above issues would be covered in DPR

SECONDARY DATA COLLECTED
(EXISTING DATA COLLECTED FROM VARIOUS ORGANISATIONS)

S.NO.	SECONDARY DATA	SOURCE
1	Population Employment data	Census of India 2011/ District Industrial Centers
2	Bus route information, Shared Auto Route Information, Fare Details etc.	APSRTC, RTO Offices,
3	Bus Stops, Shared Auto Stops, Bus Depots & Terminal Infrastructure	MC & APSRTC
4	Master plan development plan etc.	MC, Town & Country Planning Department
5	Past study reports	MC
6	Committed transport proposals, future proposals	MC, Town & Country Planning Department, other Stakeholders
7	Vehicle Registration data - past 5 years	RTO office

Urban Mass Transit Company Limited Amaravati Metro Rail Corporation Limited

7

SECONDARY DATA COLLECTED
(EXISTING DATA COLLECTED FROM VARIOUS ORGANISATIONS)

S.NO.	SECONDARY DATA	SOURCE
8	Accident Data - past 5 years	Traffic Police
9	Pollution data	AP State Pollution Control Board
10	Zone map, Ward map Study area road network map	MC
11	Major development activities-SEZ, Smart City Etc..	MC, Other Stakeholders
12	One way corridors	Traffic Police
13	Road Infrastructure such as Footpaths, Street Lighting, etc	MC
14	Signalized intersections	Traffic Police

Urban Mass Transit Company Limited Amaravati Metro Rail Corporation Limited

8

CITY PROFILE

Strategic location between

State Capital Amaravati and Vijayawada (219km) and Port City Visakhapatnam (151km)

Emerged as an crucial **important Port City in Godavari District**

POPULATION 3.11 LAKH (2011) 3.53 LAKH (2018)

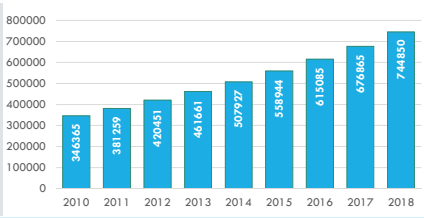
36% WORKING POPULATION (1.2lakhs)

Urban Mass Transit Company Limited | Amaravati Metro Rail Corporation Limited

9

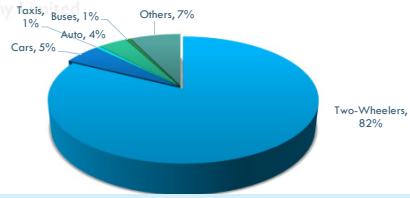
CITY PROFILE

Vehicular Growth in Kakinada



Annual Vehicular Growth Rate – 10%

Vehicular Share in Kakinada (2018)



4.2 Fatality Rate - 2017 (per 1 Lakh Population) - (per annum)

Urban Mass Transit Company Limited | Amaravati Metro Rail Corporation Limited

10

CITY PROFILE

Lack of City based Public Transport

⇩

Increasing **Dependency** on **Private Modes**

Drastic **increase** in **Auto Rickshaws**

Congestion along **Major Roads**

Safety Concerns amongst Pedestrians and cyclists

Increasing levels of **Air Pollution**

Increasing Vehicles
Increasing Safety Concern

Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

11

SUSTAINABLE TRANSPORT STRATEGIES

Sustainable Transport Strategies

- *Land Use and Transport Strategy*
- *Mobility Corridor Strategy*
- *Public Transit Strategy*
- *Non-Motorized Transport Strategy*
- *Parking strategy*
- *Traffic Engineering & Management Measures*

Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

12

Strategy 1

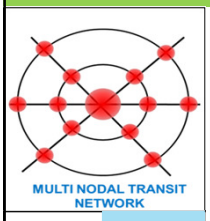
INTEGRATED LANDUSE TRANSPORT STRATEGY

- Multi-Nodal Transit Network
- Transit Oriented Development

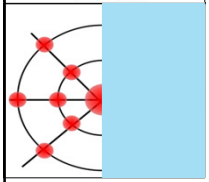
Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

LANDUSE AND TRANSPORT STRATEGY

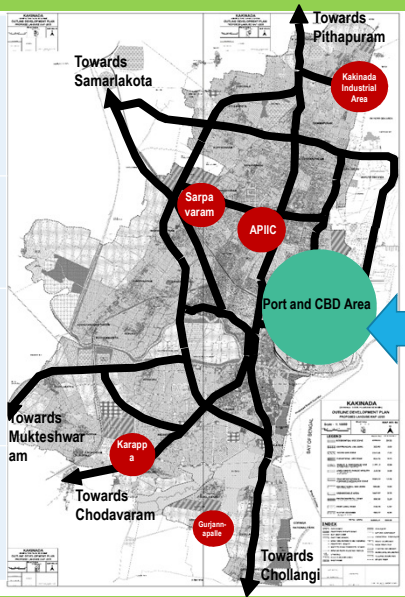


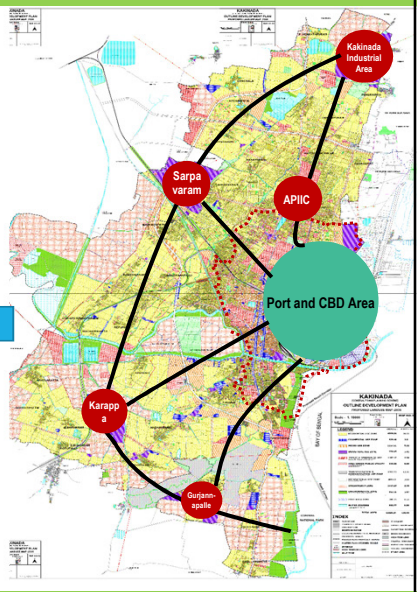
MULTI NODAL TRANSIT NETWORK



Semi Radial Multi Nodal Transit Network for Kakinada

Core Area (Within Inner Ring Road)	Kakinada Port, Revenue Colony, Pallamraju Nagar, Venkat Nagar, Sri Nagar, Ramanayapeta
Immediate Proximity (Along Inner Ring Road)	Sarpavaram, Vidhyut Nagar, Pratap Nagar, Jagannaickpur, Yetimoga
Medium Proximity (b/w IRR and ORR)	Vakalapudi, Penumarthi, Panasapadu, Koppavaram, Atchutapuratrayam Kovvuru, Nadakuduru,
Low Proximity (Along ORR)	Chollangi, Gurujanapalle, Karappa, Samarlakota, Kapavaram, Nemam,

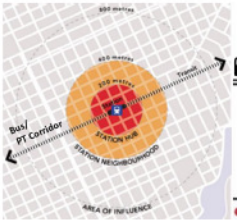


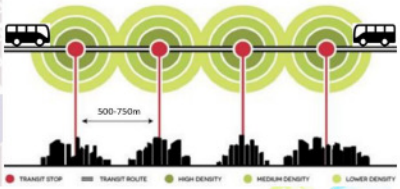


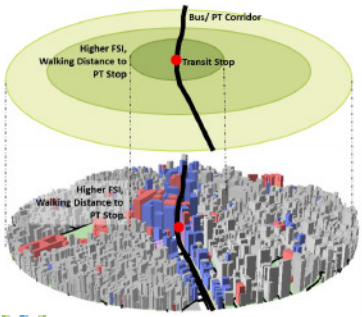
Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

TRANSIT ORIENTED DEVELOPMENT





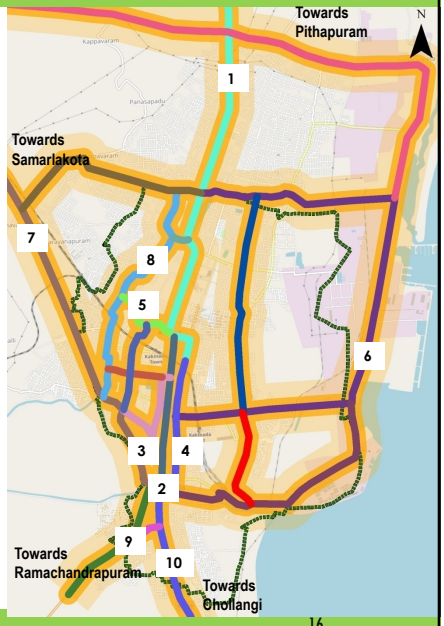


- To maximize the passenger throughput.
- Mixed-use development along the Transit Corridors
- To create environments where walking and transit are viable transportation options
- Components to Improve in TOD Zones
  - Travel Connections
  - Building Scale and Orientation
  - Public Spaces
  - Parking

TRANSIT ORIENTED DEVELOPMENT

Corridors identified for densification are;

1. NH 216 towards Pithapuram in North
2. Main Road
3. Temple Road
4. Cinema Road
5. Military Road
6. Uppada Beach Road
7. Kakinada Samarlakota Bypass
8. GPT Road
9. NH 216 towards Ramachandrapuram
10. NH 21 towards Chollangi



Strategy 2

ROAD NETWORK IMPROVEMENT STRATEGY

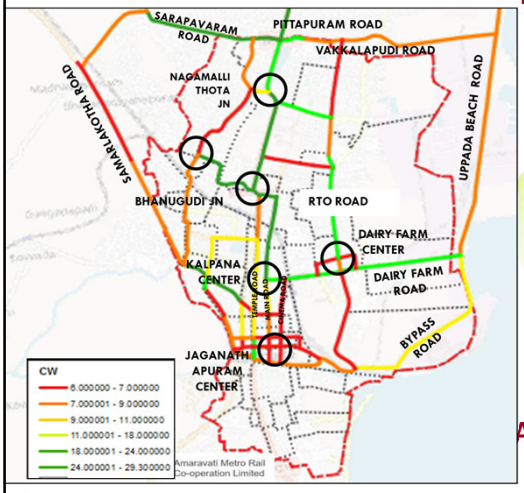
- Road Widening/Upgradation
- Development of Missing Links/ New Links
- Road Infrastructure improvements

Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

17

EXISTING ROAD NETWORK SCENARIO



Network Hierarchy Jumps

Bottle Necks

RTO Center
Kalpana Center
Bhanugudi Junction
Cinema Road
Temple Road
Nagamalli Thota junction

Average V/C Ratio

0.70 (2018) → 1.15 (2038)

Average Network Speed

25.72 km/hr (2018) → 21.84 Km/hr (2038)

V/C Ratio

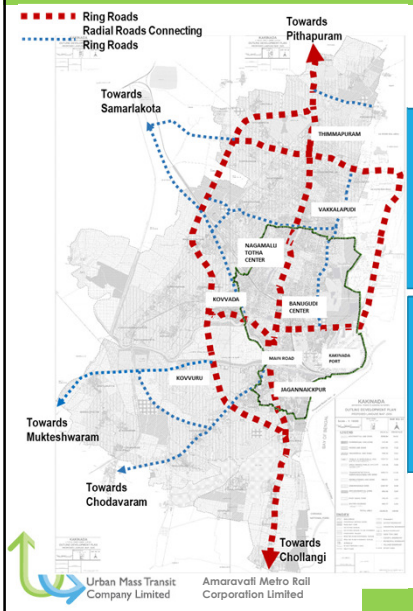
Road Name	2018	2038 (BAU)
Pithapuram_Kakinada Rd	0.44	0.72
Nukalamma temple street towards Gandhi Nagar	0.49	0.80
NH214 towards two town police station	0.65	1.07
Kakinada	0.55	0.90
Towards Revenu Colony	0.58	0.94
Wharf Road towards Rama Rao Peta	0.64	1.04
IBP Auto Service	0.56	0.92
Sri Tirumala Theatre	2.38	3.89
Kothapeta Fish Market	0.71	1.16
ESI Hospital	1.55	2.54
R K Plaza Complex	0.94	1.53
Near Kotiah Sweets	1.71	2.79
NH214 towards JNTU Engineering College	1.61	2.63
Nageshwar Rao Street towards Pattabhi Street	0.81	1.33
Jagannathapuram Bridge	1.07	1.75
Commercial Tax	0.88	1.43

Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

18

PROPOSED ROAD NETWORK STRATEGY



SEMI RING RADIAL

Radial Roads

1. National Highway 216 towards Pithapuram
2. Dairy Farm Road
3. Uppada Beach Road
4. Samarlakota – Kakinada Bypass Road
5. National Highway 216 towards Samalakota

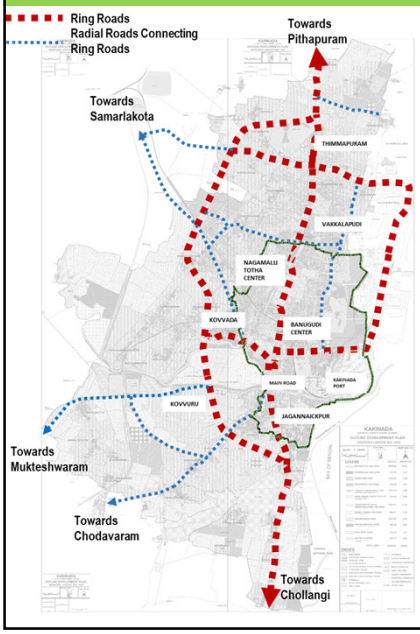
Ring Roads

1. Towards Choodavaram
2. Towards Ramachandrapuram
3. Towards Samarlakota
4. Dairy Farm Road,
5. Military Road

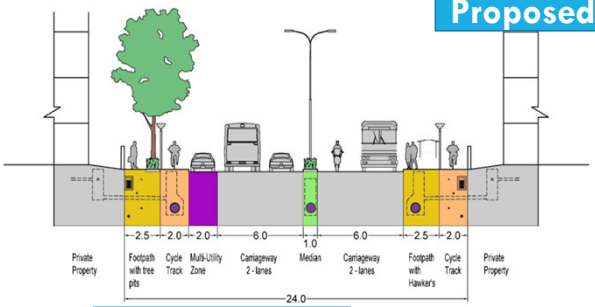
NAME OF THE ROAD	LENGTH (KM)	BASE (2018)	SUT (2038)
NH214 towards two town police station	0.52	4	4
Kakinada	8.79	4	4
Towards Revenu Colony	0.20	3	3
Wharf Road towards Rama Rao Peta	0.18	4	4
IBP Auto Service	1.42	4	4
Sri Tirumala Theatre	5.37	4	6
Kothapeta Fish Market	1.24	4	4
ESI Hospital	0.43	4	4
R K Plaza Complex	1.03	2	4
Near Kotiah Sweets	1.03	4	4
Nageshwar Rao Street towards Pattabhi Street	0.24	2	4
Jagannathapuram Bridge	0.49	4	6
Commercial Tax	2.35	4	6

19

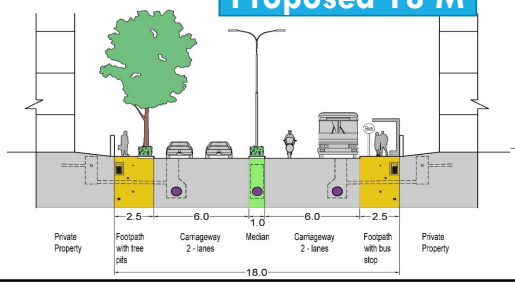
PROPOSED ROAD NETWORK STRATEGY



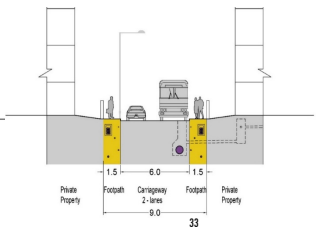
Proposed 24 M



Proposed 18 M



Proposed 09 M



Strategy 3

PUBLIC TRANSPORT IMPROVEMENT STRATEGY

- City Bus Systems
- Public Transport Terminals
- Intermediate Public Transport/Feeder Systems
- Multi-Modal Integration Nodes
- Promoting Public Transport-Outreach Programs

Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

PROPOSED CITY BUS NETWORK

S. No.	Name	Route Length (km)	Proposed Peak Hour Headway (min)	Proposed Fleet
1	RTC to Pithapuram	17.8	15	10
2	RTC to Chollangi Peta	9.4	15	6
3	RTC Bus Stop to Coromandel Fertilizers via Dairy Farm Road, Ramanayapeta and Vakalapudi Road	19.1	15	11
4	RTC Bus Stop to Samarlakota	16.9	15	9
5	RTC Bus Stop to Sarpavaram via Income Tax Colony, Kacheripeta	16.9	15	9
				45

5 Routes

45 Buses

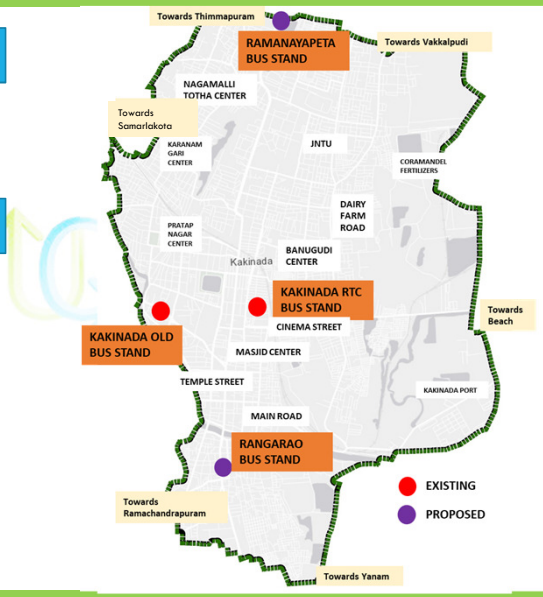
PUBLIC TRANSPORT TERMINALS

Existing Bus Terminal

1. Kakinada Old Bus Stand
2. Kakinada RTC Bus Stand

Proposed Bus Terminal

1. Ramanayapeta Bus Stand
2. Rangarao Bus Stand



Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

23

INTERMEDIATE PUBLIC TRANSPORT

ANY VEHICLE LESS THAN 10 SEATER IS CONSIDERED TO BE INTERMEDIATE PUBLIC TRANSPORT

Intermediate Public Transport - KAKINADA

↓

Auto-Rickshaw

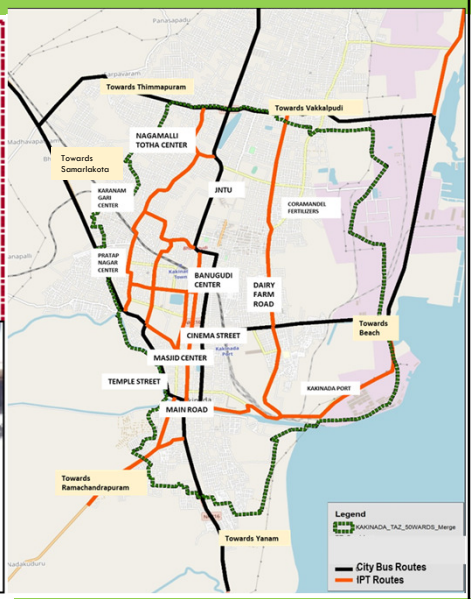
MAJOR ISSUES

- Lack of safety regulations
- Competition of Auto-Rickshaw Services with Public Transport
- No regulation of fares

IMPROVEMENTS

- Transparency of fares
- Driver behaviour and road safety training
- Integrating the System

- Promoting use of E-Rickshaws on Proposed Routes
- Auctioning of IPT Routes/ Zones
- Provision of infrastructure for physical integration with the bus/rail systems



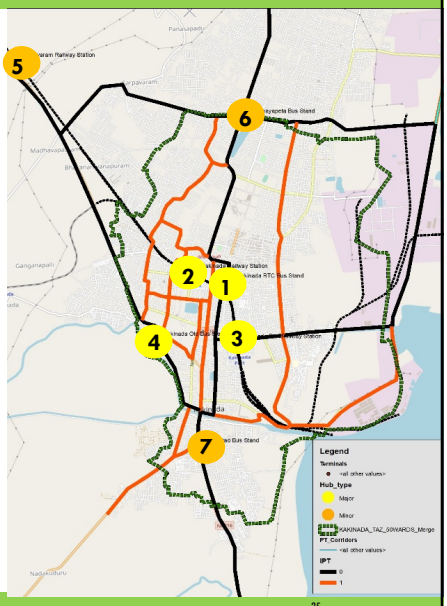
Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

24

MULTI MODAL INTEGRATION NODES

S.NO.	LOCATION	TYPE	INTEGRATION
1	RTC Complex – Burma Colony	Major	Bus, IPT, NMT
2	Kakinada Town Railway Station	Major	Train, Bus, IPT, NMT
3	Kakinada Port Railway Station	Major	Train, Bus, IPT, NMT
4	RTC Bus Stand Old	Minor	Bus, IPT, NMT
5	Sarpavaram Railway Station	Minor	Train, Bus, IPT, NMT
6	Ramanayapeta Bus Stop	Minor	Bus, IPT, NMT
7	Rangarao Bus Stop	Minor	Bus, IPT, NMT



Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

25

Strategy 4

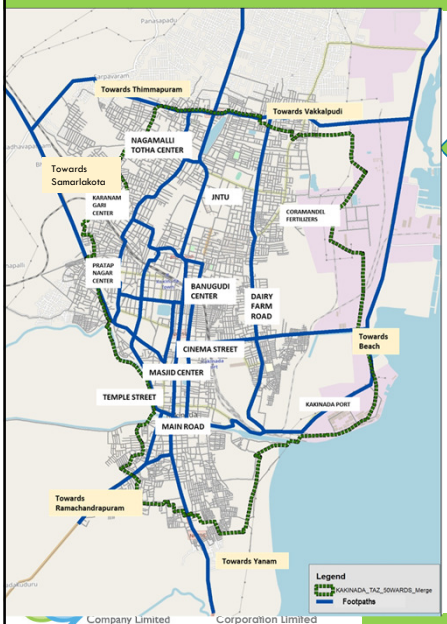
NON-MOTORISED TRANSPORT STRATEGY

- Development of Footpath
- Development of Bicycle Friendly Streets

Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

26

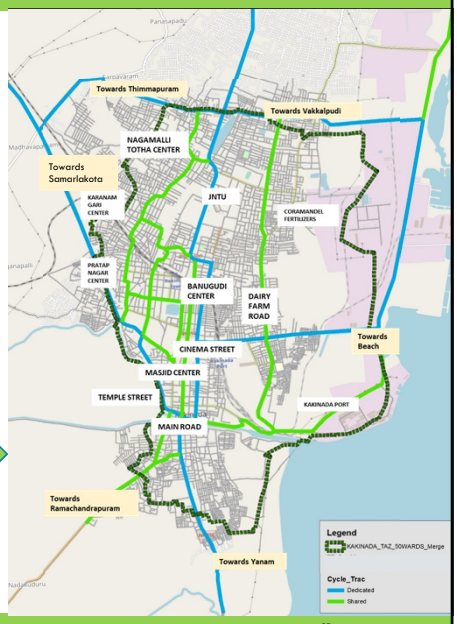
NON MOTORIZED TRANSPORT SCENARIO



85 Kms
For Footpath Development
2 m
Minimum Clear Walking Space

41 Kms
Dedicated Cycle Tracks

44 Kms
Shared Cycle Tracks



Company Limited Corporation Limited

27

VEHICLE TECHNOLOGIES

80% Buses are proposed to be **Diesel (BS-IV) Buses** and **20% Buses** are proposed to be **Electrical Bus.**

E-rickshaws are highly recommended in the city along with CNG Vehicles. As a part of the old city rejuvenation, **only E-Rickshaws shall be allowed to ply in the core** area to provide connectivity during the restricted vehicle hours.

Urban Mass Transit Company Limited Amaravati Metro Rail Corporation Limited

28

Strategy 5

TRAFFIC ENGINEERING AND MANAGMENT

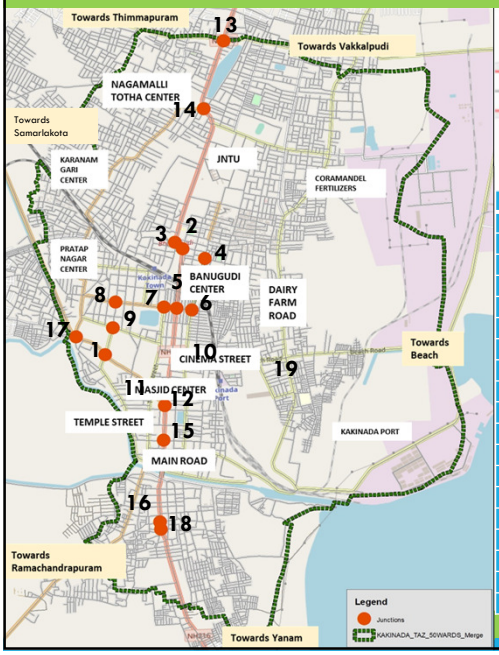
- Junction Improvements
- Traffic Management Plans
- Parking Proposals

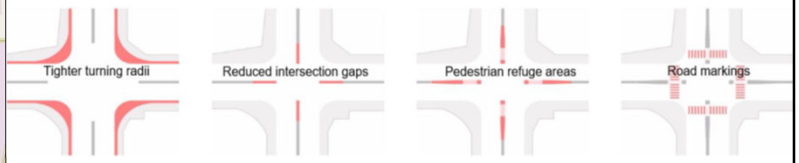
Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

29

JUNCTION IMPROVEMENT PLANS





S. No	Name of the Junction
1	Z P Center Junction
2	Bhanugudi Junction
3	Kondayyapalem Junction
4	Municipal Office Junction
5	2 Town Police Station Junction
6	Kottapeta Market Junction
7	Surya rao peta junction
8	Three Lights junction
9	Ramarao Peta Junction
10	NTR Bus Stop Junction
11	Balaji Cheruvu Junction
12	Masjid Center Junction
13	Sarpavaram Junction
14	Nagamalli Thota Junction
15	Gold Market Junction
16	Munsif Junction
17	Indrapalem Bridge Junction
18	Nukalamma Temple Junction.
19	Dairy Farm Junction

30

Strategy 6

FREIGHT MANAGMENT

- Freight Terminals

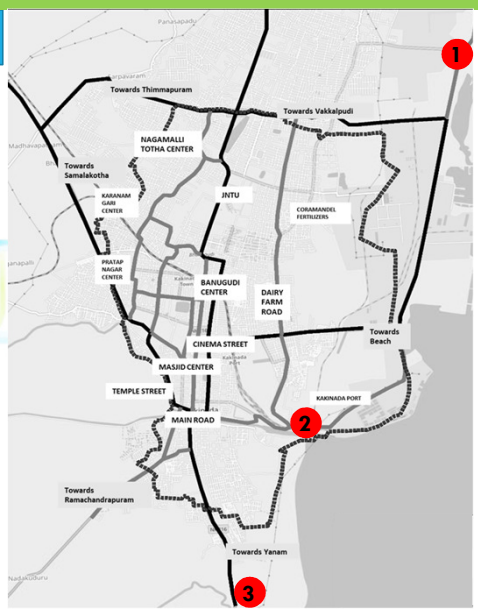
Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

31

FREIGHT STRATEGY

Proposed Freight Terminals

1. Kakinada Industrial Area
2. Kakinada Anchorage port
3. Near Chollangi



Urban Mass Transit Company Limited
Amaravati Metro Rail Corporation Limited

32

COMMENTS AND SUGGESTIONS

COMMENTS AND SUGGESTIONS FROM MEMBERS/ STAKEHOLDERS…

Urban Mass Transit Company Limited

Thank You

Urban Mass Transit Company Limited

Urban Mass Transit Company Limited

2nd Floor, Corporate Tower, Ambience Mall, Gurgaon 122002 .

Ground Floor, Mani Mansion, Behinde Tarnaka Welfare Assossiation, Tarnaka, Secunderabad 500017

Tel: +91 1244716300 Fax: +91 124 4716248

Email: umtc@ilfsindia.com Website: www.umtc.co.in