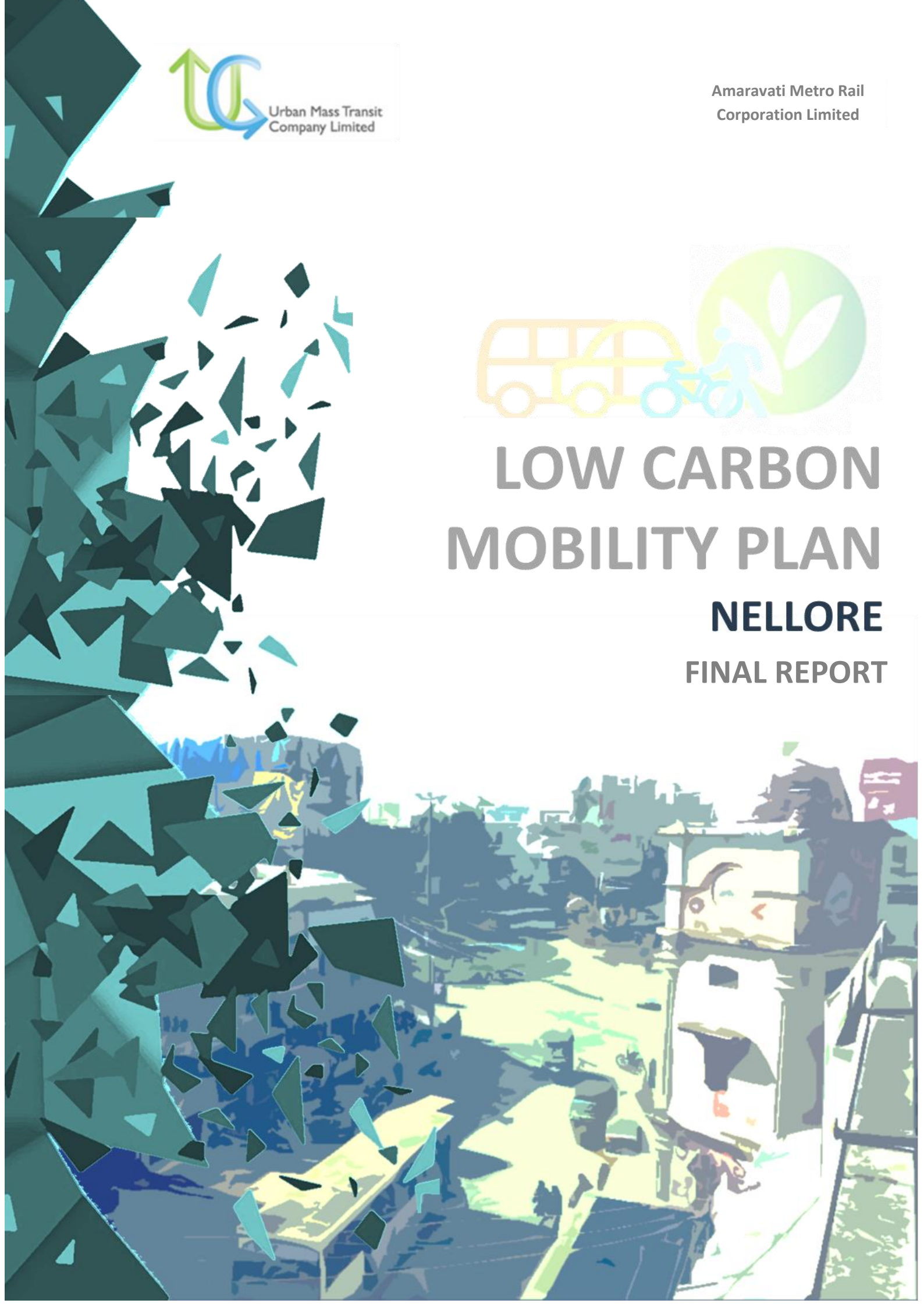




LOW CARBON MOBILITY PLAN

NELLORE
FINAL REPORT





QUALITY MANAGEMENT

Revision	Revision 0
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Description	Final Report of Low Carbon Mobility Plan-Nellore



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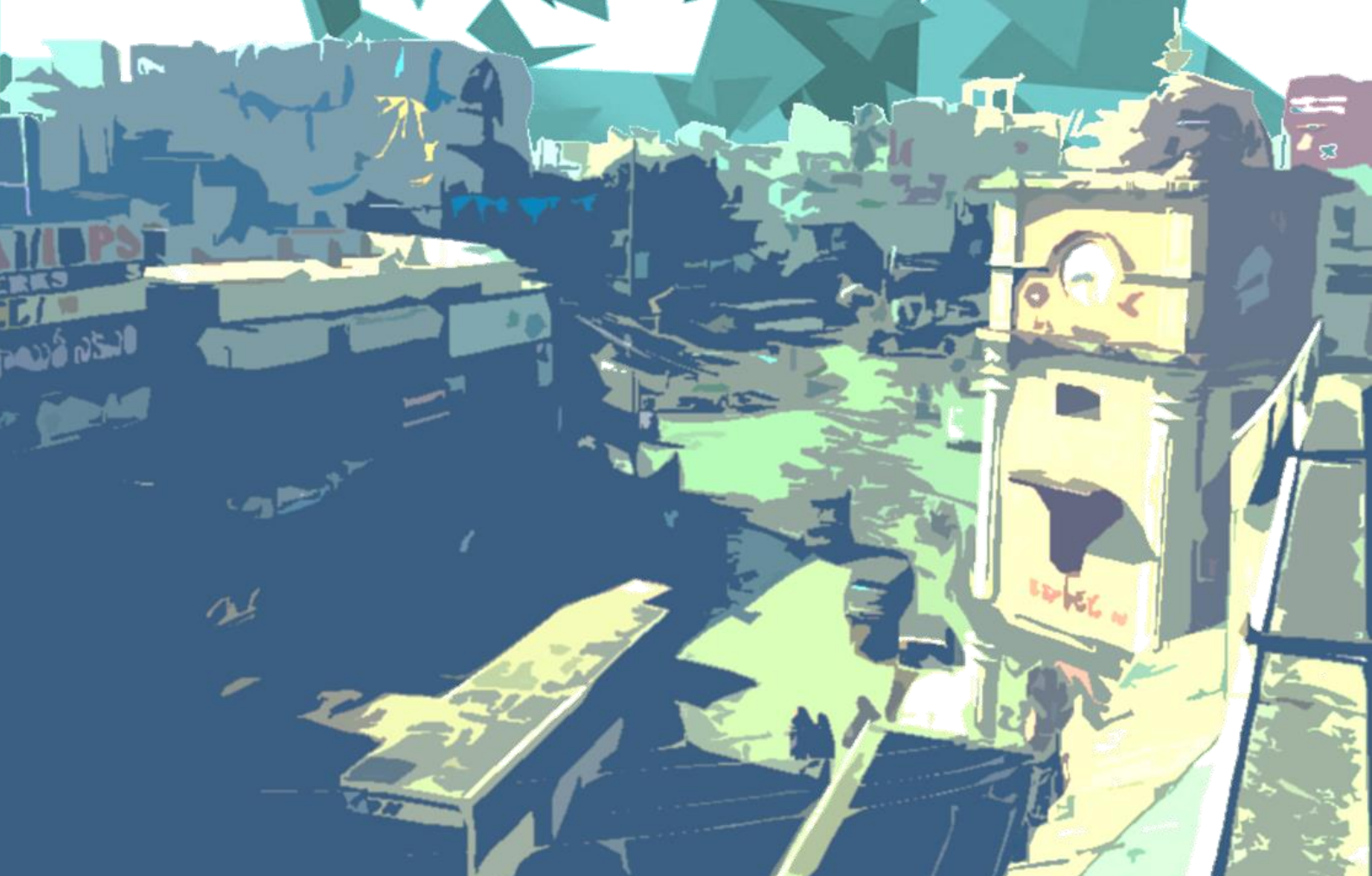


ABBREVIATIONS

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
MoHUA	Ministry of Housing and Urban Affairs
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

Chapter 1

PROJECT OVERVIEW



1 PROJECT OVERVIEW

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 in to the assessment of traffic and transportation needs for the cities based on the present and projected demand in the nine cities. Nellore also known as Vikrama Simhapuri 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 1.2.1)

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.

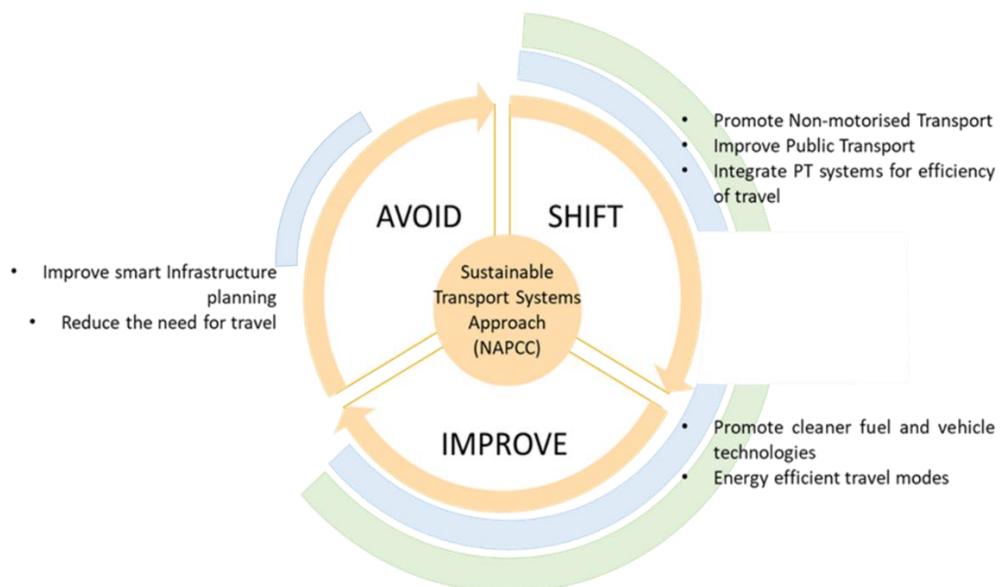


Figure 1 GENERALISED LCMP APPROACH

1.3 SCOPE OF LOW CARBON MOBILITY PLAN - NELLORE

The low carbon mobility plan focusses on,

- a. Providing sustainable access option for all kind of residents in Nellore.
- 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 REPORT

The Scope of work for the report 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 Nellore.
4. Secondary data collection and analysing the existing transport and environmental needs with respect to the land use patterns and population densities for Nellore.

5. Conducting primary traffic surveys to assess the current travel patterns and behaviour in the Nellore.
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 of low carbon mobility plan involving
 - a. Integration of land use and mobility plan
 - b. Formulation of public transport improvement plan
 - c. Network improvements
 - d. MNT facility improvement strategies
 - e. Mobility management measures
 - f. Freight Movement Plan
13. Identifying and prioritizing projects.

1.6 APPROACH AND METHODOLOGY

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 1.6-1 shows the study methodology highlighting the major tasks and their sequence.

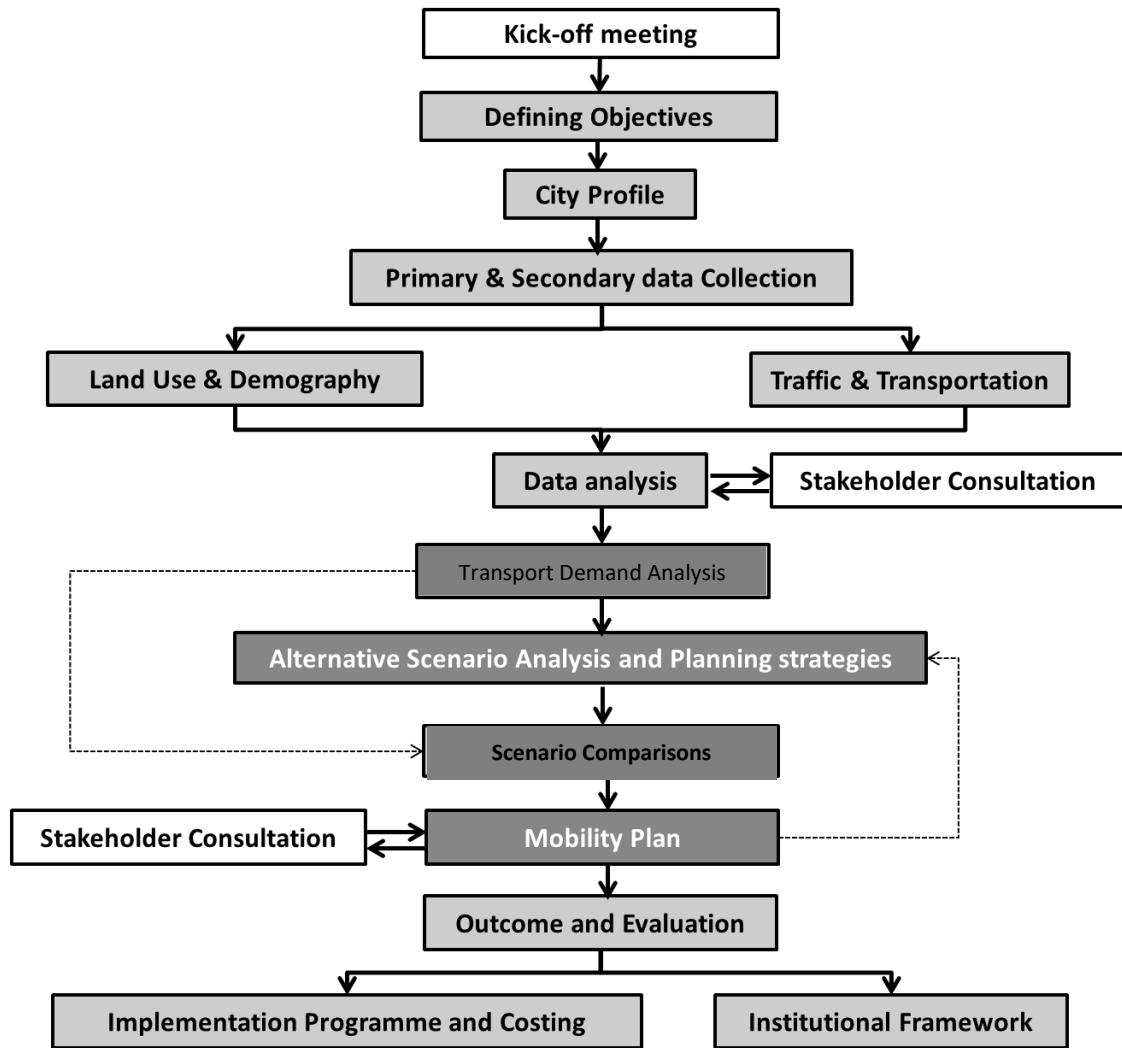


Figure 2 METHODOLOGY

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 Nellore Municipal Corporation area consisting of 54 administrative wards. These wards have been 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 three-time horizons. The horizon periods are defined as follows:

- 1.1 **Immediate Term:** The immediate term time horizon will last upto 2 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.
- 1.2 **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. The projects such as enforcement measures, lane markings, street furniture and lighting facilities, improvement in pedestrian facilities, traffic management and calming measures, parking plans etc shall be prioritized as **immediate action plan** within the short-term improvements. The overall emphasis will remain on improving the safety and accessibility standards.
- 1.3 **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.
- 1.4 **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 Nellore, 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 which are as discussed in Chapter 2:

- Reviewing of previous studies for Nellore.
- Review of Existing Transport Infrastructure for Nellore.
- 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 is benchmarked with respect to the 11 Service Level Benchmarks issued by Ministry of Urban Development-Urban Transport as shown in Chapter 3, wherein the gaps for gaps for improving the existing transportation system are 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 is 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 Nellore.

1.6.4 TASK-4: DEVELOP AND ANALYSE ALTERNATE SCENARIOS- SUSTAINABLE URBAN TRANSPORT (SUT) SCENARIO

The alternative scenario will be analysed to project the likely deviations from the BAU scenarios considering public transport and non-motorised transport improvements. The Sustainable Urban Transport Scenario will take into consideration the following improvements,

1.6.4.1.1 ALTERNATE SCENARIO 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 considerations will be considered in the sustainable scenario:

- **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.

1.6.4.1.2 ALTERNATE SCENARIO 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

1.6.4.1.3 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.

The above three improvements are considered and developed as a comprehensive Sustainable Urban Transport Scenario An analysis and comparison of the Business as Usual Scenario and Sustainable Urban Transport Scenario 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 CO₂ emissions that will be produced for each horizon period. Long-term national CO₂ 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 CO₂ goals.

1.6.6 PRIORITIZATION OF PROJECT IDEAS

The following criteria 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.

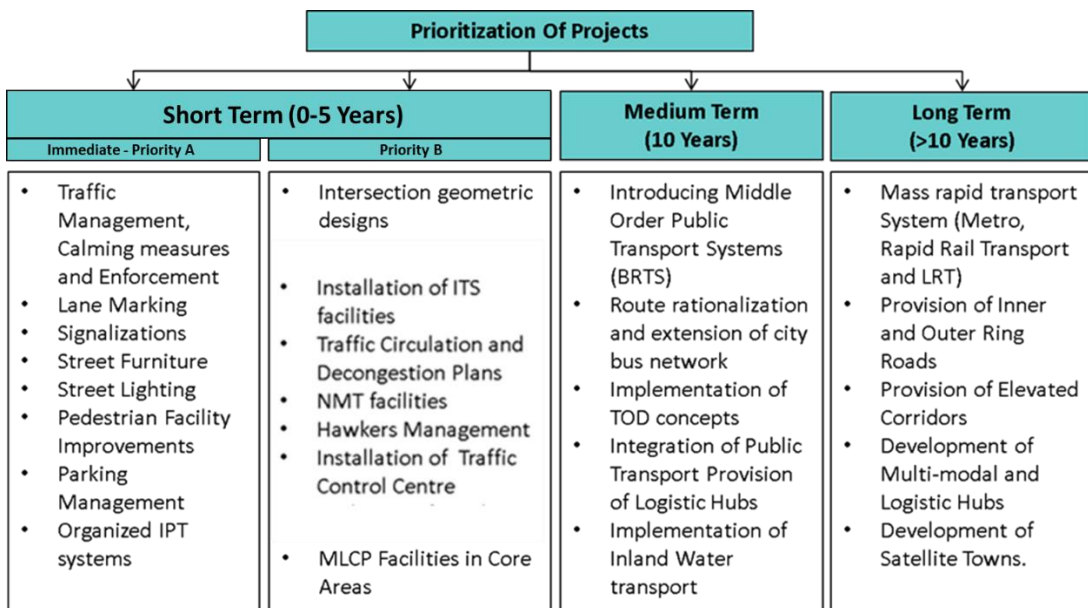


Figure 3: PRIORITIZATION OF IMPLEMENTATION PROGRAM

Chapter 2

CITY PROFILE



2 NELLORE CITY PROFILE

2.1 INTRODUCTION

Nellore is a city and municipal corporation in the state of Andhra Pradesh. Nellore is the 4th most populous city in Andhra Pradesh and the district headquarters as well. The ancient name of Nellore was "Vikrama Simhapuri" until the 13th century. Nellore Municipal Corporation was constituted as a municipality on 1 November 1866 by the Madras District Municipality Act. It was upgraded to corporation on 18 October 2004.



Figure 4 NELLORE CITY VIEW

2.2 LOCATION AND REGIONAL LINKAGES

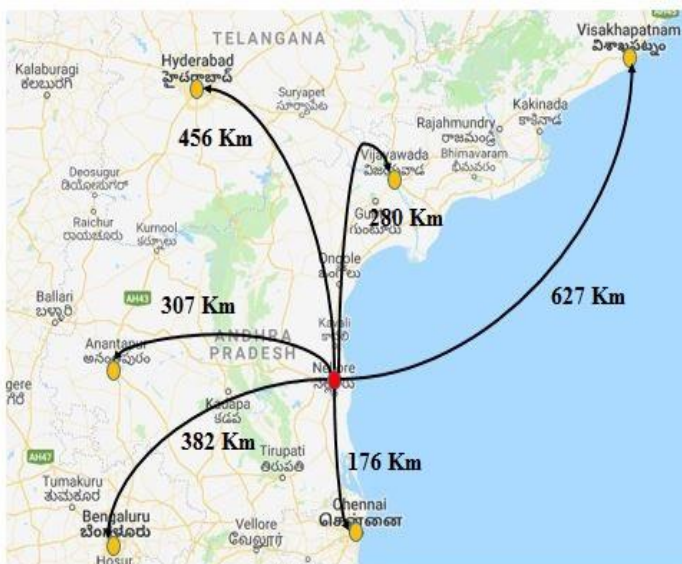


Figure 5 LOCATION AND REGIONAL CONNECTIVITY OF NELLORE

The study area Nellore is located at 14.43°N 79.97°E and encompasses a total area of 149.96 Sq.km. Nellore city is connected to major Cities through National Highway 5 (Vijayawada, Tirupati and Chennai. National Highway 45 connects to Hyderabad and National Highway 4 connects to Bangalore. Nellore is situated about 279 kms south of the state capital Amaravati and 168 Kms north of Chennai on the Chennai-Kolkata highway.

2.3 ADMINISTRATION

The study area for the study is limited to the Nellore Municipal Corporation, which is the civic body governing Nellore. The corporation is spread over an area of 149.2 square kilometre. It has 54 electronic wards which are as shown in Figure 2.3.1

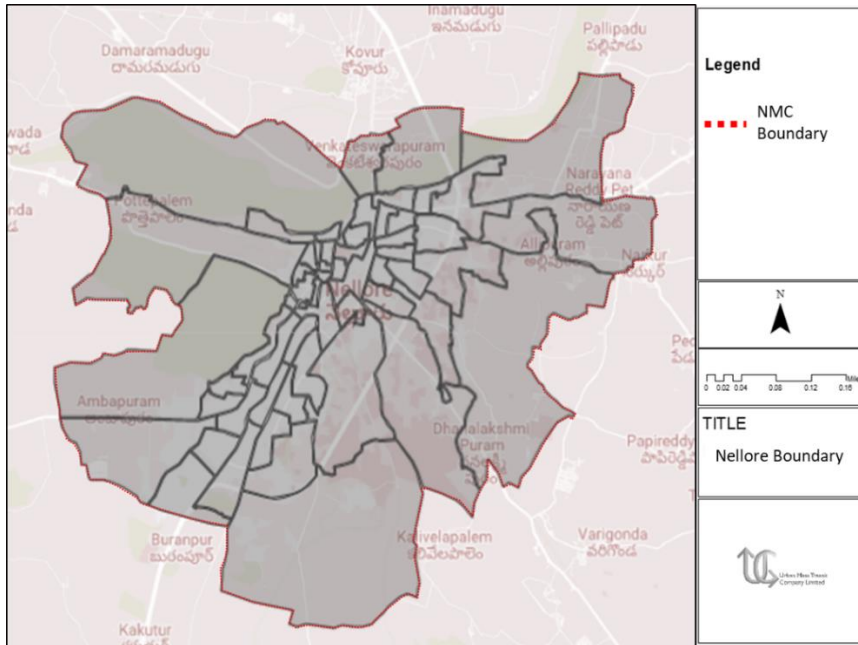


Figure 6 NELLORE MUNICIPAL CORPORATION BOUNDARY MAP

2.4 GROWTH PATTERN

The growth pattern of the town is observed to be along the major and minor roads but initial stage of growth of city near to Penna River and Nellore Tank (Cheruvu) due source of water, other way the city growth is in-between natural physical barrier i.e. Penna River and Nellore Tank and NH 5. The urban growth is observed spreading along the NH 5 and Railway line of the city. Growth of commercial and residential area situated at core of the city and growth along the Chennai-Vijayawada Highway in 2018. Figure 2.4.1 depicts the growth pattern of Nellore over last 27 years.

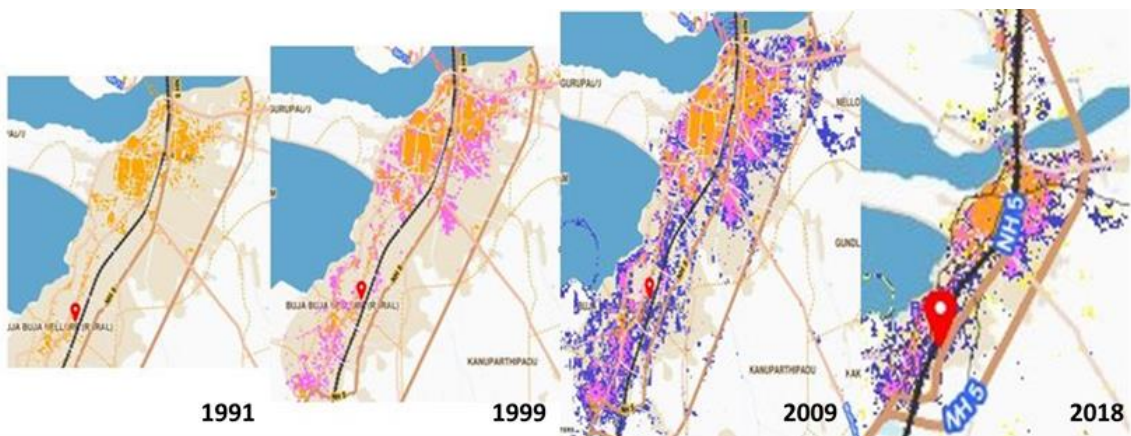


Figure 7 NELLORE GROWTH PATTERN

2.5 LANDUSE

The proposed land use as per the Nellore Master Plan 2031 is as shown in the Figure. The major land use is residential accounting to 33%, followed by 17% water courses and 11% transport infrastructure. The proposed master plan identifies 12% of the land that is about 1760Ha for future urbanization. The proposed land use structure is as shown in Figure 2.5.1.

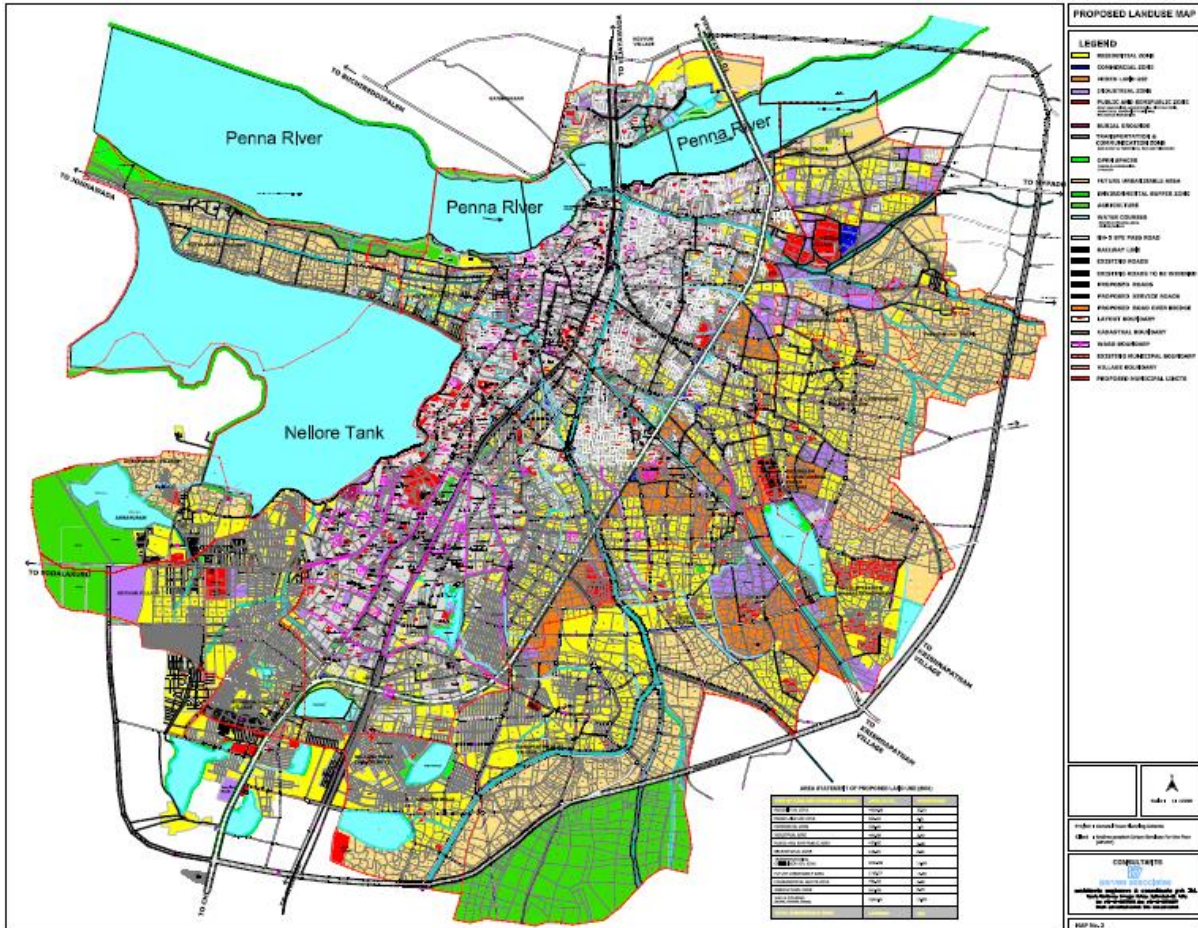


Figure 8 NELLORE PROPOSED LANDUSE MAP -2031¹

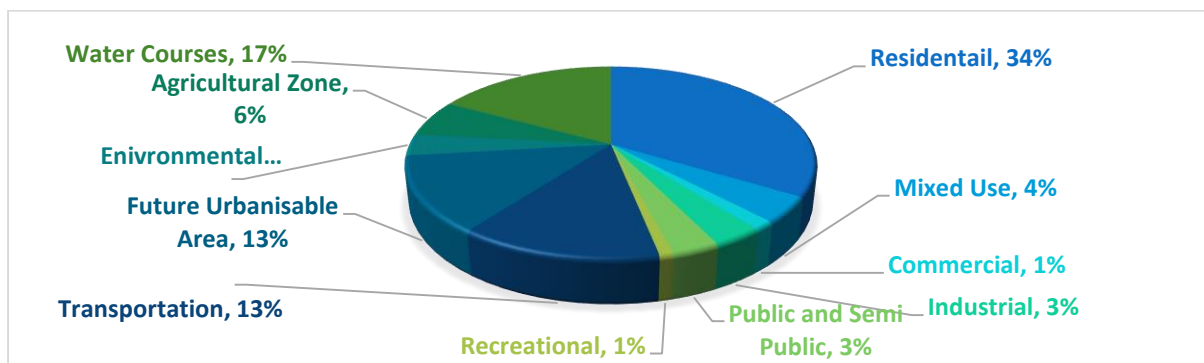


Figure 9 NELLORE PROPOSED LANDUSE STRUCTURE FOR 2031

¹ Source Nellore Municipal Corporation

2.6 DEMOGRAPHIC PROFILE

As per census 2011, Nellore city had a population of 505,258, constituting 257,043 males and 248,215 females. The literacy of city is 75 %. The expanded city population post-merger of 15 gram panchayats into Nellore Municipal Corporation stands at 600,869. The city has 121756 Households, 54 revenue wards and 54 electronic wards. The decadal growth is 37.98 % during the 2011 census (Figure 2.6.1).

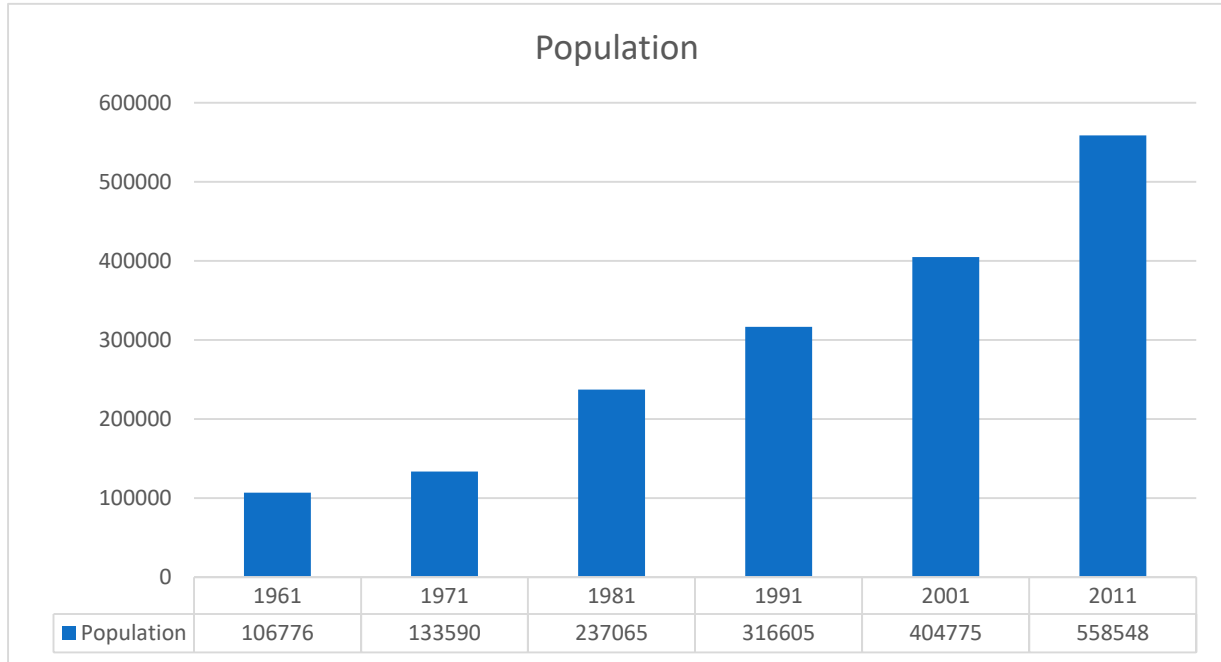


Figure 10 POPULATION OF NELLORE

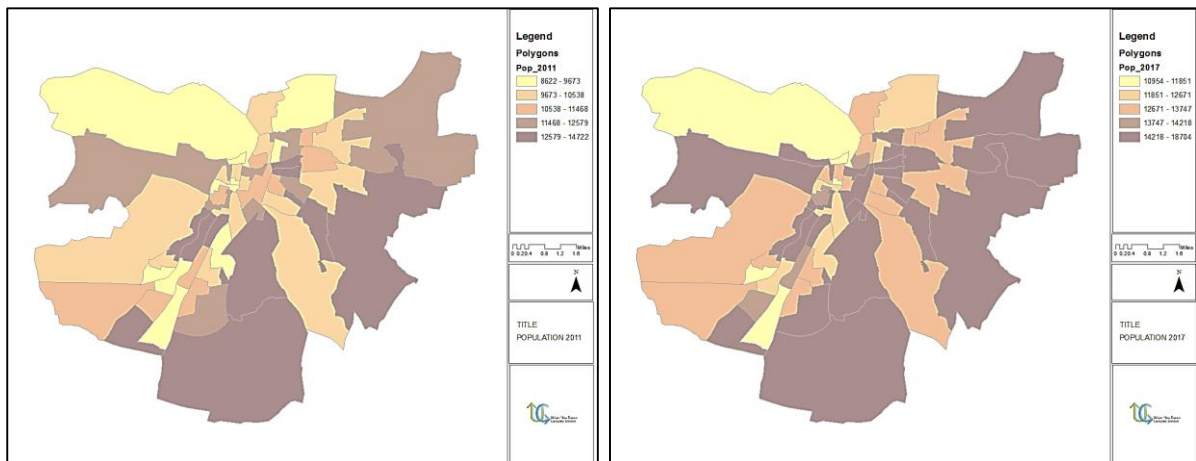


Figure 11 SPATIAL REPRESENTATION OF POPULATION IN NELLORE

The Figure 2.6.2 represent the spatial distribution of population. The total number of households in Nellore are 139692. The average household size in the city is 4.3. The Figure 2.6.7 represents the house hold distribution in the city. The density in the city accounts to 4000 per square km. The average population density in the city accounts to 40 persons per hectare.

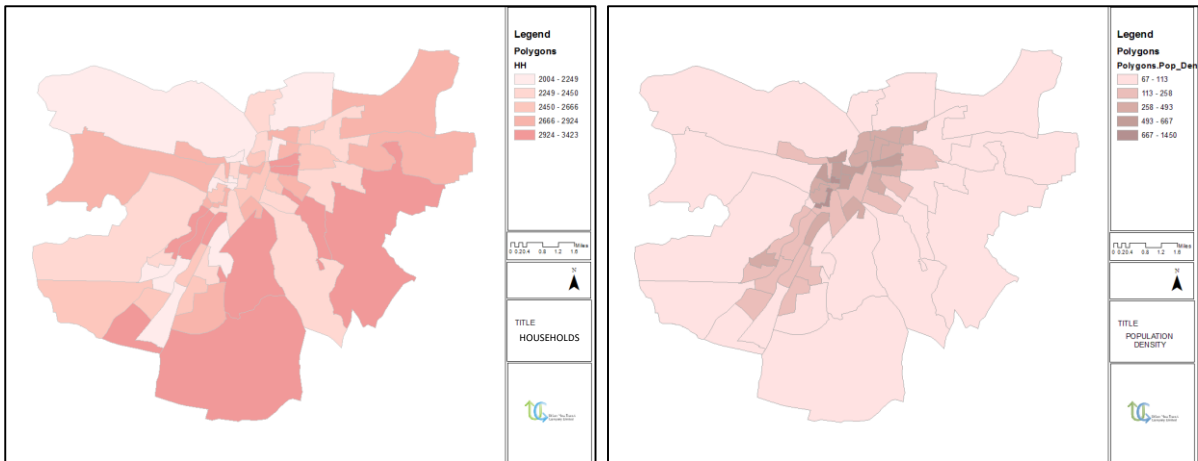


Figure 12 HH DISTRIBUTION (LEFT) & POPULATION DENSITY (RIGHT) NELLORE

2.7 ECONOMIC PROFILE

Proximity to the sea and fertile land towards the east has led to agriculture and aquaculture being the backbone of the economy. The district has a cultivable area equal to 41.3% and the crops which are most commonly grown in the district are paddy, jowar, bajra along with tobacco, chillies, groundnut and sugarcane. Handloom, mica mines, thermal power generation and handmade jewellery are other industries that contribute to the economic development. Also salt production is the most popular in Nellore District mostly in Gogulapalli, Iskapalli and Ramathirdam villages. For the salt production Krishnapatnam port takes the top position in Andhra Pradesh which is located around 20 km from the city serving major economic activities to the city and district as whole. The other factors that help the Nellore is the education sector with about 185 schools in the municipal area. As per Census of India, 2011 the total worker population in Nellore accounts to 32% of the total population. The workforce details are as shown in Table

Table 2.7-1 WORKER POPULATION

	Population	%
Worker Population	194215	32%
Non-Worker Population	406654	68%
Total Population	600869	100%

2.8 TRANSPORTATION PROFILE

2.8.1 ROAD NETWORK:

The city has a total road length of 1,189.95 km.² The city is connected with major National highways such as, National Highway 16, a part of Asian Highway 45 and Golden Quadrilateral, bypasses the city. Nellore is well connected by road with National Highway 5 from Chennai to Kolkata, part of the Golden Quadrilateral expressway project, passing through it. The major roads in the city bearing the brunt of traffic are GNT road, Krishnapatnam Road, S. Bose Road, Narakur road, Podalakur road, Mypadu road and Mini Bypass road. There are two bus stations providing bus service to major towns and cities of the State and other parts of the country. The detailed inventory of the network is as discussed in chapter 3.



Figure 13 GNT ROAD & TRAFFIC CONDITIONS IN NELLORE

Nellore is connected by APSRTC (Andhra Pradesh State Road Transport Corporation) to major parts of Andhra Pradesh, Tamil Nadu and Karnataka, TNSTC from Chennai and KSRTC from Bangalore. National Highway 45 connects to Hyderabad and National Highway 4 connects to Bangalore.

2.8.2 PUBLIC TRANSPORT:

Transport operations in Nellore city being a losing proposition for APSRTC, then bus operations are limited and are left to the private agencies to cater to the demand. There are about 150 buses that run in the town and a majority of these buses are under private operators.

The city has no dedicated fleet or routes for city based services. The sub urban services with Telugu Velugu (TV) bus services provide certain degree of intra city connectivity.

² "Details of Roads in each ULB of Andhra Pradesh". Municipal Administration and Urban Development Department. 2016

- A total of 153 TV buses are operated from 2 APSRTC depots within the city limits.³
- 135 bus are owned by the APSRTC while the remaining 18 are hired buses. 1390 bus trips are made daily form Nellore to the sub urban areas. .⁴
- The minimum route length is 15km while the maximum route length is 91km for the TV buses.

2.8.3 INTERMEDIATE PUBLIC TRANSPORT:

The auto rickshaws and the share- autos meet the gap between supply and demand of public transport facility in the town. Intermediate public transport is by Auto Rickshaws & Cycle rickshaws and these are substantial in number. The heterogeneity of traffic adds to the problems of mobility with a sizeable number of cycle rickshaws operating in busy stretches impeding mobility of fast moving vehicles. These privately operated auto rickshaws accounts to around 6,000, dominating most part of the city for local commuting.⁵

2.8.4 VEHICULAR REGISTRATION:

It was observed that these is a drastic increase in the registration of vehicles over the last three years. Higher growth rate was observed in 2016. The CAGR as of 2018 is 6%. Highest share in the vehicular strength is constituted by the two wheelers. The Figurer 2.8.2 depict the vehicular strength and vehicular growth in the city.

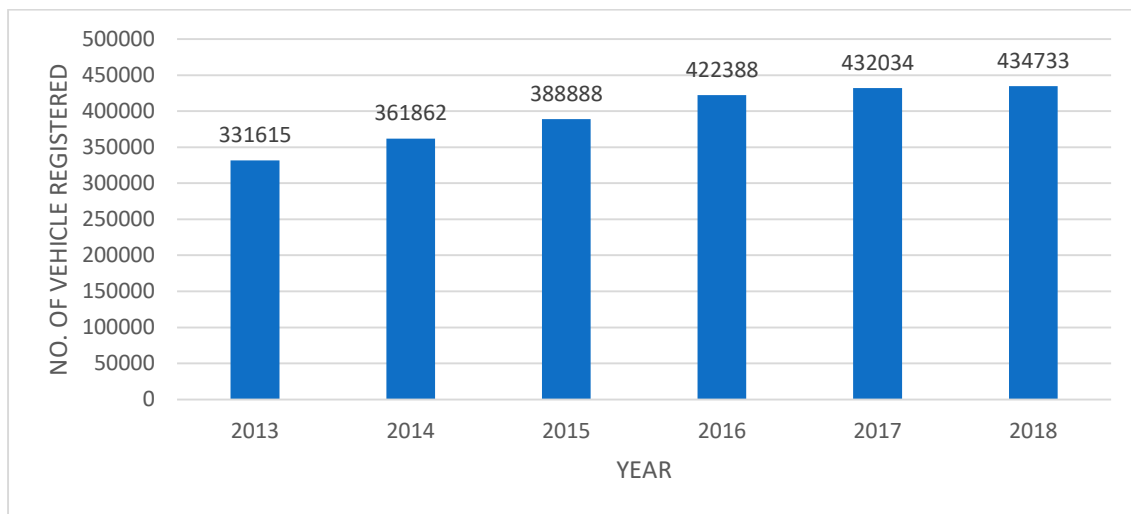


Figure 14 YEAR-WISE VEHICLE REGISTRATION IN NELLORE CITY⁶

³ Source: APSRTC- Nellore, Data as on April 2018

⁴ Source: APSRTC- Nellore, Data as on April 2018

⁵ ORR proposed for Nellore to decongest city traffic, HansIndia-2017

⁶ RTA-Nellore, Data as on April 2018

2.8.5 ROAD SAFETY:

Based on the data collected from the Traffic Police Department, Nellore it is observed that the number of accidents have slightly decreased over the last years. The Figure 2.8.3 depicts the quantum of accidents over the last four years with in the study area.

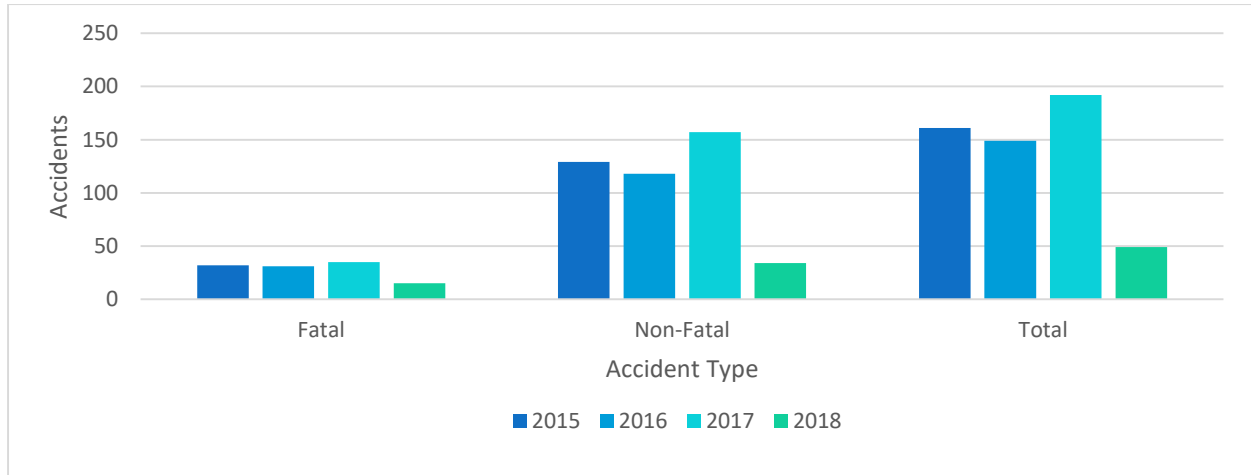


Figure 15 ACCIDENTS DATA OVER THE LAST 4 YEARS

The major black spots identified for the year 2018 are as follows,

- Chintha Reddy Palem 'X' Road
- Gollamudi Cross Road
- Tr Nagar Center
- Ayyappagudi Highway Circle
- Atmakur Bus Stand Flyover Bridge

It was observed that 30 to 50% of the total fatalities occur at these black spot locations⁷.

2.9 ENVIRONMENTAL QUALITY

The air quality measure at air pollution monitoring station near the paper mill units is as shown in the Table 2.9-1. It indicates that the PM10 value is higher than the permissible levels.

Table 2.9-1 AIR POLLUTION VALUES (PCB Manual Air Station)

Monitoring Station Name	Parameter Name	Current value	Permissible
Public	CO	0.78 mg/m ³	2 mg/m ³
Public	NH ₃	29.4 ug/m ³	400 ug/m ³
Public	NO _x	25 ug/m ³	80 ug/m ³
Public	O ₃	31.8 ug/m ³	100 ug/m ³
Public	PM ₁₀	63 ug/m ³	100 ug/m ³
Public	SO ₂	5 ug/m ³	80 ug/m ³

(Industry CAAQM Station)

⁷ Nellore City Police-Transport Wing, 2018

Monitoring Station Name	Parameter Name	Current value	Permissible
Fire station	CO	1.67 ppm	100 ppm
	NOx	6.96 ug/m ³	100 ug/m ³
	PM10	52.63 ug/Nm ³	100 ug/Nm ³
	PM2.5	42.5 ug/Nm ³	100 ug/Nm ³
	SO ₂	14.45 ug/m ³	100 ug/m ³
Switchyard	CO	0.3 mg/m ³	100 mg/m ³
	CO ₂	320.67 ug/m ³	100 ug/m ³
	NO	2.98 ug/m ³	80 ug/m ³
	NO ₂	5.55 ug/m ³	80 ug/m ³
	NOx	8.53 ug/m ³	80 ug/m ³
	PM10	58.49 ug/m ³	100 ug/m ³
	PM2.5	47.71 ug/m ³	60 ug/m ³
Coal Gate	CO	2.13 mg/m ³	100 mg/m ³
	CO ₂	593.34 ug/m ³	100 ug/m ³
	NO	538.2 ug/m ³	80 ug/m ³
	NO ₂	10.39 ug/m ³	80 ug/m ³
	NOx	249.25 ug/m ³	80 ug/m ³
	PM10	71.73 ug/m ³	100 ug/m ³
	PM2.5	36.42 ug/m ³	60 ug/m ³
	SO ₂	20.04 ug/m ³	80 ug/m ³
Field Hostel	CO	2.66 mg/m ³	50 mg/m ³
	CO ₂	503.68 ug/m ³	100 ug/m ³
	NO	10.65 ug/m ³	80 ug/m ³
	NO ₂	0.02 ug/m ³	80 ug/m ³
	NOx	10.02 ug/m ³	80 ug/m ³
	PM10	114.51 ug/m ³	100 ug/m ³
	PM2.5	72.56 ug/m ³	60 ug/m ³
	SO ₂	11.82 ug/m ³	80 ug/m ³
Ash Pond	CO	1.06 mg/m ³	100 mg/m ³
	CO ₂	315.25 ug/m ³	100 ug/m ³
	NO	3.74 ug/m ³	80 ug/m ³
	NO ₂	3.93 ug/m ³	80 ug/m ³
	NOx	7.51 ug/m ³	80 ug/m ³
	SO ₂	6.63 ug/m ³	80 ug/m ³
Near Diesel Pump	NO	3.83 ug/m ³	80 ug/m ³
	NO ₂	2.64 ug/m ³	80 ug/m ³
	NOx	8.15 ug/m ³	80 ug/m ³
	PM10	3.63 ug/m ³	100 ug/m ³
	PM2.5	80 ug/m ³	60 ug/m ³
Near ETP	NO	1.72 ug/m ³	80 ug/m ³
	NO ₂	2.64 ug/m ³	80 ug/m ³
	NOx	5.04 ug/m ³	80 ug/m ³

Monitoring Station Name	Parameter Name	Current value	Permissible
	PM10	96 ug/m ³	100 ug/m ³
	PM2.5	25.5 ug/m ³	60 ug/m ³
	SO ₂	27.92 ug/m ³	80 ug/m ³
Main Gate	NH ₃	1.42 ug/m ³	80 ug/m ³
	NO _x	0 ug/m ³	80 ug/m ³
	PM10	700 ug/m ³	100 ug/m ³
	PM2.5	37 ug/m ³	60 ug/m ³
	SO ₂	0 ug/m ³	80 ug/m ³
NC Station	PM10	56 ug/m ³	100 ug/m ³
	PM2.5	27 ug/m ³	60 ug/m ³

The air pollution values within the city centre indicate higher levels of PM10, PM 2.5, CO₂, NO, NO_x, particles. The main pollutants in the Nellore are CO, PM10 and PM2.5. The levels of CO have been continuously increasing during peak hours in the city indicating the impact of vehicular growth on the air quality. The Figure 2.9.1 shows peak values of air quality index for Nellore during the peak hours for the January, 2018 by CPCB. The overall air quality index for Nellore is about 70 specifying cause minor breathing discomfort to sensitive people.

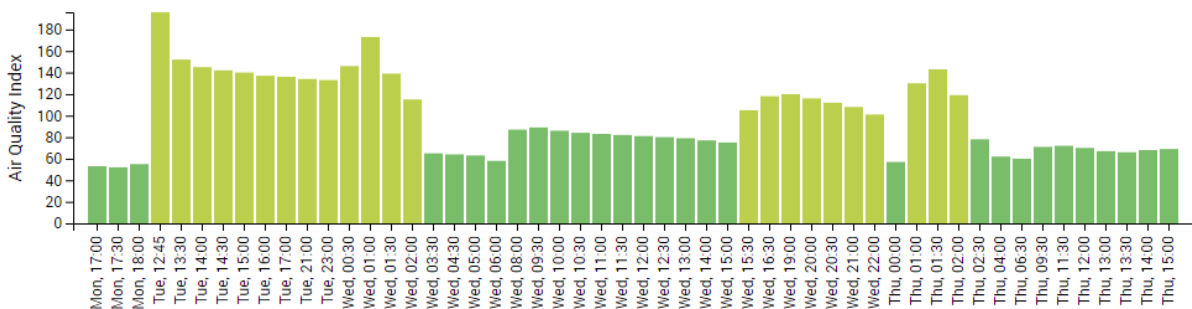


Figure 16 AIR QUALITY INDEX DURING THE PEAK HOURS IN NELLORE

2.10 OBSERVATIONS

The major observations made through the review of Nellore city profile are as follows,

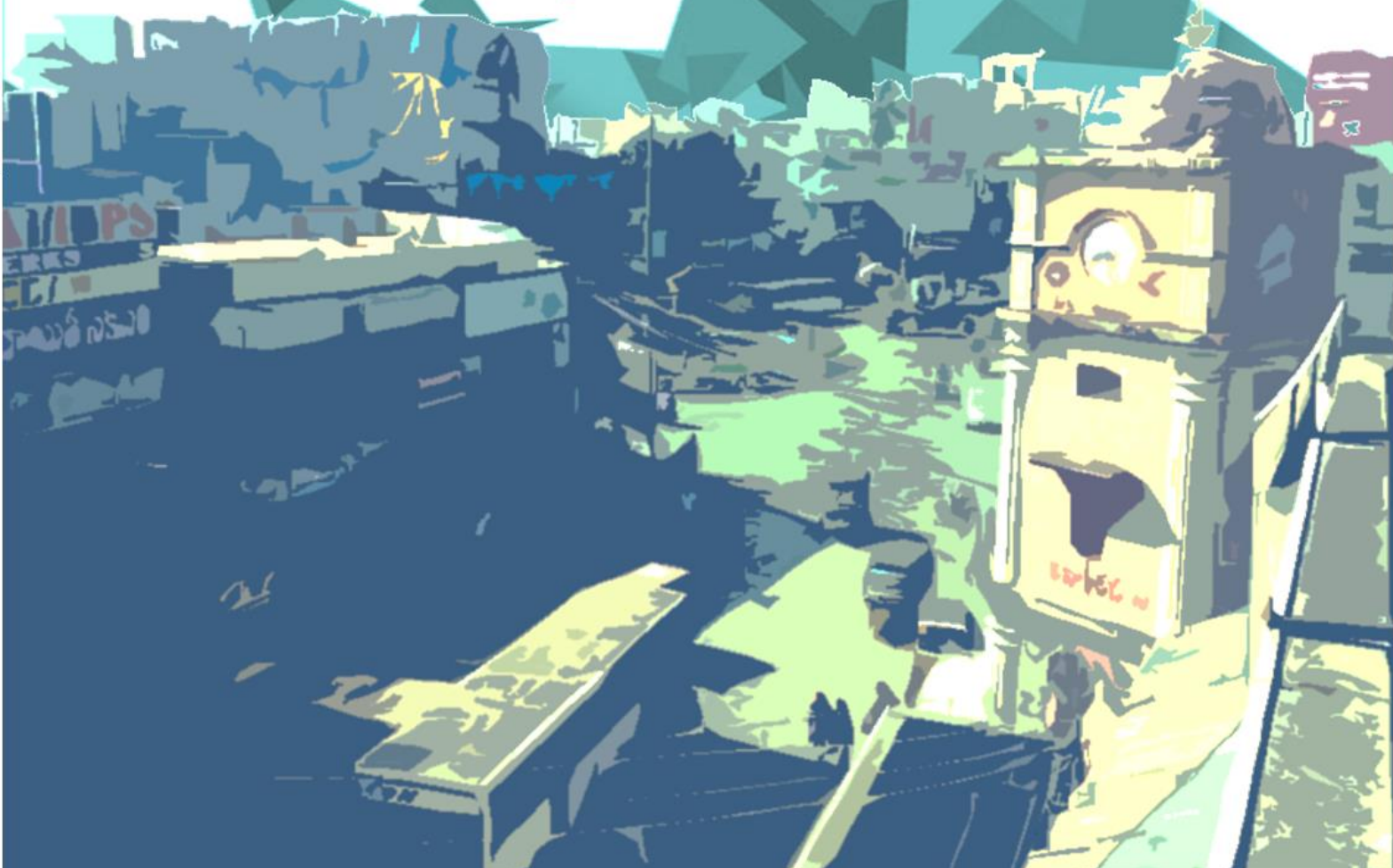
1. The city has well established linkages to various in important city in the country.
2. The growth pattern is linear along the National Highways, establishing the signification relation between the network connectivity and Nellore urban sprawl.
3. The future land available for urbanization as per the Master Plan 2031 is proposed all the Eastern and South-Eastern part of the city, thus a network improvement along the proposed development are considered crucial.

4. With the population growth (2011-2017) observed along these proposed urban areas indicate the need for clear network pattern and structured network hierarchy.
5. Lack of pedestrian infrastructure facilities are observed to raise safety concerns.
6. The problems arising due to roadside encroachments are more pronounced in the peak leading to traffic congestion.
7. Increase in vehicular growth has resulted in air quality concerns during the peak hours.
8. Significant share of two-wheeler and auto rickshaws indicate the inadequacy of city based public transport facilities.

In order to further quantify the above observations and analyse the transportation system in the city several primary surveys have been undertaken. The details of the surveys and survey results are discussed in the following Chapter 3 and Annexure.

Chapter 3

EXISTING TRAVEL AND TRAFFIC SCENARIO



3 EXISTING TRAVEL AND TRAFFIC CHARACTERISTICS IN NELLORE CITY

3.1 INTRODUCTION

The primary traffic surveys are conducted to analyse in detail the traffic volumes and travel characteristics in the city. In case of Nellore the following surveys have been conducted as shown in Table 3.1-1.

Table 3.1-1 PRIMARY SURVEYS LIST FOR NELLORE LCMP

Sl.No	ITEMS
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 Nellore the existing 54 wards are considered as the TAZ boundaries. The TAZ boundaries and TAZ list is as show in Annexure B and Figure 3.1.1.

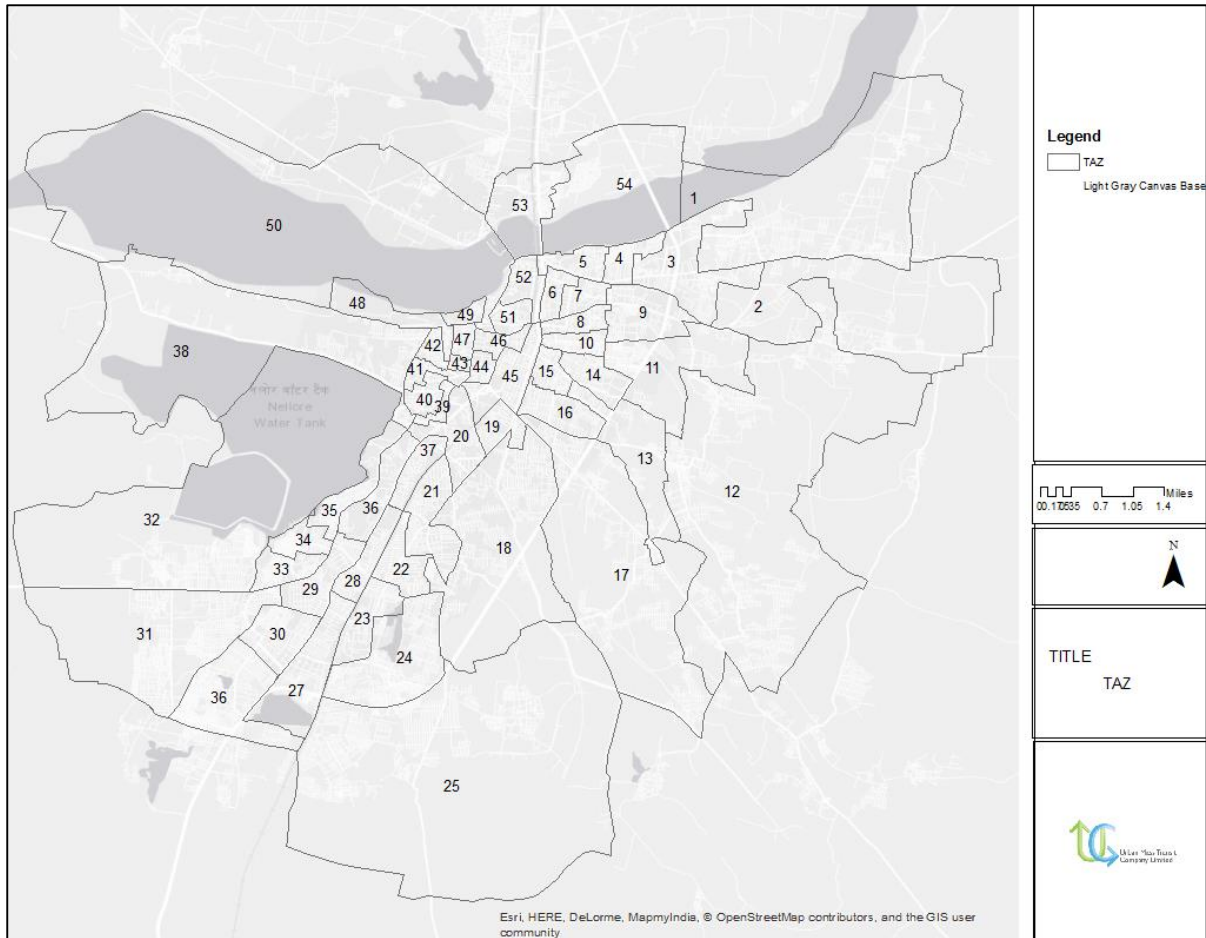


Figure 17 TAFFIC ANALYSIS ZONES FOR NELLORE

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. The network structure in the city is largely linear with few radials connecting the sub-urban places around the city.
2. The network is observed to be dense on the northern side of the city. Inequity in the urban spread.
3. Major parking activities are observed along RR Street and Children’s Park Road and Grand Trunk Road.
4. The average journey speed along the network is observed to 22.4kmph. The delays in travel speeds are caused largely due to traffic and delay at intersections.

5. Highest volume of traffic at internal and external interactions are observed at outer cordon locations OC-3 along the Chennai-Vijayawada Highway due to its proximity to Guduru and its connectivity to Chittoor and Chennai.
6. The screen line location SL2-1 has highest traffic volume due to its connectivity to Trunk Road and Mini-Bypass Road and close proximity to important transit nodes such as Annamaya Circle and SP office zone. Though the urban growth is envisaged to be somewhat linear in north-south direction, overall higher volumes of traffic movement is observed in east west direction in the northern part of the city, indicating its interaction with the land use use(Mixed).
7. Two wheelers contribute to the highest share of traffic composition in the city, followed by auto rickshaws.
8. Highest traffic volume is observed at Muthukur Road Junction due to its interaction with the Ballary-Krishnapatnam Highway and Muthkur-Children's park Road, connecting important activity nodes of the city.
9. The majority of the trips captured at terminal locations were work based trips (45%) directing towards the dependency of sub-urban areas to the city.
10. Auto rickshaws are used as the major mode of dispersal and access at the terminals.
11. Shared auto-rickshaws are observed to provide end to end connectivity ply on all major routes.
12. The KVR petrol pump circle and Muthukur Junction requires immediate attention in terms of pedestrian crossing infrastructure facilities such as signalised pedestrian crossings while the Potti Sree Ramulu Statue Circle and VRC junction require design based interventions in terms of crossing facilities to minimise the degree of pedestrian conflicts.
13. The majority of the goods trips are made on daily basis within the city and to the nearby towns.
14. The Per Capita Trip Rate (PCTR) for Nellore was observed to be 1.29 including the walk trips and 1.08 excluding the walk trips. The PCTR for motorised trips is about 1.05.

15. The major modes of travel in Nellore are observed to be auto rickshaw and two wheelers with a modal share of 33% and 26% respectively.
16. The Non-Motorised Transport comprises about 19% including 16% of walk trips.
17. The average trip length in the Nellore is observed to be 5.8km including the walk trips and 6.7km excluding the walk trips.
18. Variations were observed in supply and demand gap at surveyed on and off parking locations. The off street parking places were observed to be underutilized when compared to the off street parking demand.
19. The users prefer over 25% reduction in travel time and cost to favour the use of new and improved public transit system and the waiting time is observed to be negotiated over the total travel time and cost as in case of Nellore.
20. 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.
21. The citizens are observed to be largely inclined towards indirect funding such as increased municipal taxes, vehicle costs and registration charges, high compounding fee or high penalty for the traffic violators to promote travel and traffic fund.
22. 64% of the users desired improved footpaths and cycle tracks while 36% desire enforcement of safety laws to enhance the quality of Non-Motorised Transport travel experience within the city.
23. Safety is perceived to a major concern in regard to all the public transit modes.
24. The fares of share auto rickshaws and cycle rickshaws are perceived to be affordable compared to the bus services as the nature of bus services is largely sub-urban services.
25. The other major concerns with respect to travel within the city are the bus based public transit connectivity, safety of pedestrians, chaotic intersections during peak hours.

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 Nellore and set benchmarks for achieving the same.

3.3.2 PERFORMANCE BENCH MARKS FOR URBAN TRANSPORT

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:

1. Public transport facilities
2. Pedestrian infrastructure facilities
3. Non Motorized Transport (NMT) facilities
4. Level of usage of Intelligent Transport System (ITS) facilities
5. Travel speed (Motorized and Mass Transit) along major corridors
6. Availability of parking spaces
7. Road safety
8. Pollution levels
9. Integrated land use transport system

3.3.3 COMPUTATION OF INDICES

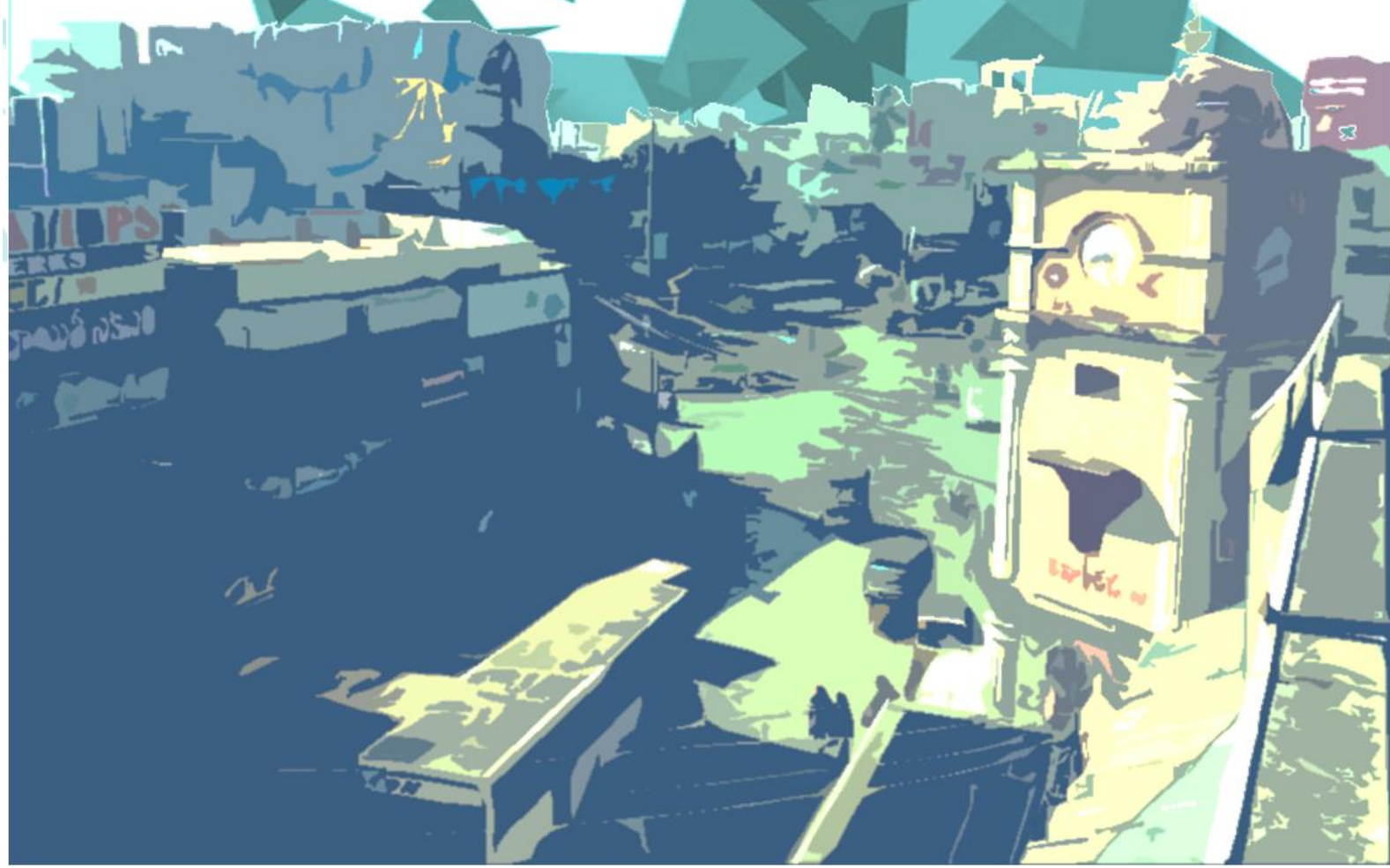
The consolidated benchmarking of the existing scenario of the study area is as shown in Table 3.3-1. The Level of Service (LOS) is given on a scale of 4 wherein 1 indicates “Good-To be Maintain” and 4 indicates “Needs immediate improvement”.

Table 3.3-1: 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	2	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.

Chapter 4

ENVISIONING NELLORE



4 ENVISIONING NELLORE

Low Carbon Mobility Plan is a long-term vision for the development of transport in Nellore 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 Nellore 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 Nellore.

4.1 VISION

As stated earlier, the LCMP is a long-term vision for desirable accessibility and mobility pattern for people and goods in Nellore. 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 Nellore 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”

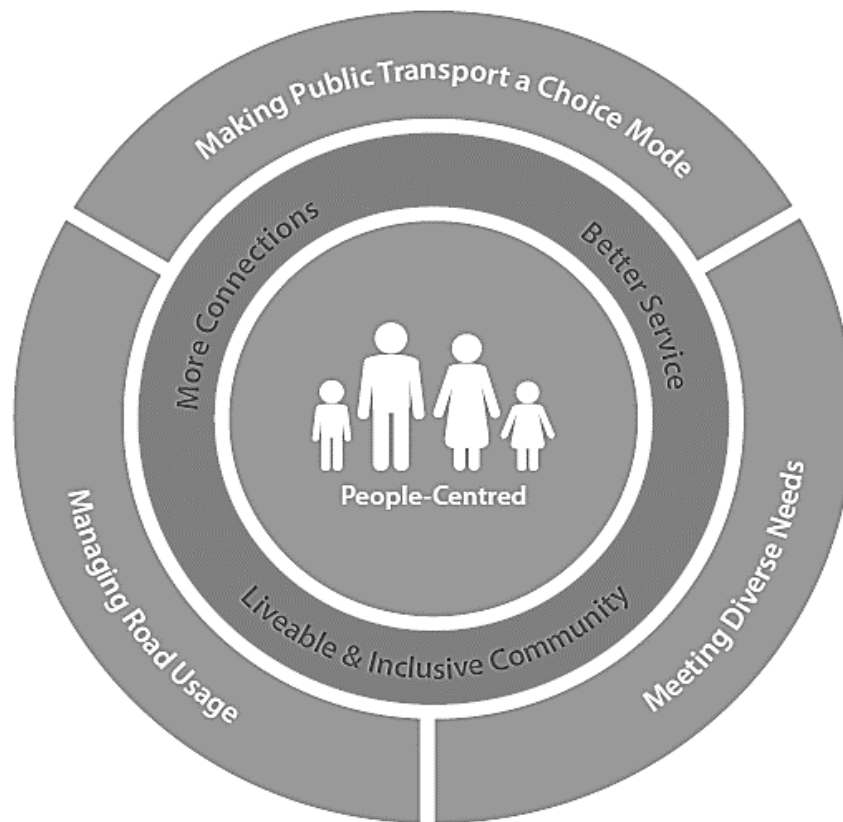


Figure 18 PEOPLE CENTRIC VISION AS ENVISAGED FOR NELLORE

4.2 GOALS

Based on the vision, various goals have been targeted for the horizon year under certain scenarios. A Master Plan was prepared for Nellore 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 4.2-1 shows the goals set to be achieved in the horizon year by implementing all the proposals recommended in this study.

Table 4.2-1: ENVISAGED GOALS

Name of the Impact	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038) – Target
Non-Motorised Trips	18.8%	12.2%	>20%
Private Transport (PVT) Trips	42.0%	52.1%	<40%
Public Transport Trips	17.1%	9.6%	>15%
Avg. Network Speed (kmph)	25	20	>30
% of city covered with Footpaths (Arterial and Sub-Arterial)	6%	6%	100%
Local Emissions (Tonnes/day)	7.4	7.6	Reduce by 50%
GHG Emissions (Tonnes/day)	175.1	235.8	Reduce by 50%
Vehicle-km travelled (PVT) in Thousands	1196	2661	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.

4.3 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.

4.3.1 LANDUSE

The proposed land use as per Master plan for 2031 is as shown in Table 4.3-1. The land use under transportation is marginally below the URDPFI guidelines. The growth pattern of the city is largely envisaged towards the eastern side shown in the Figure 4.3-1. Based on this the land use structure for the BAU and SUT scenarios have been developed.

Table 4.3-1: LAND USE BY CATEGORIES

Category	URDPFI Guidelines	Proposed (2031)
Residential	36-38%	33.61%
Commercial	5-6%	1.41%
Industrial	7-8%	3.40%
Public & Semi Public	10-12%	3.18%
Recreational	14-16%	0.92%
Transportation	12-14%	13.50%

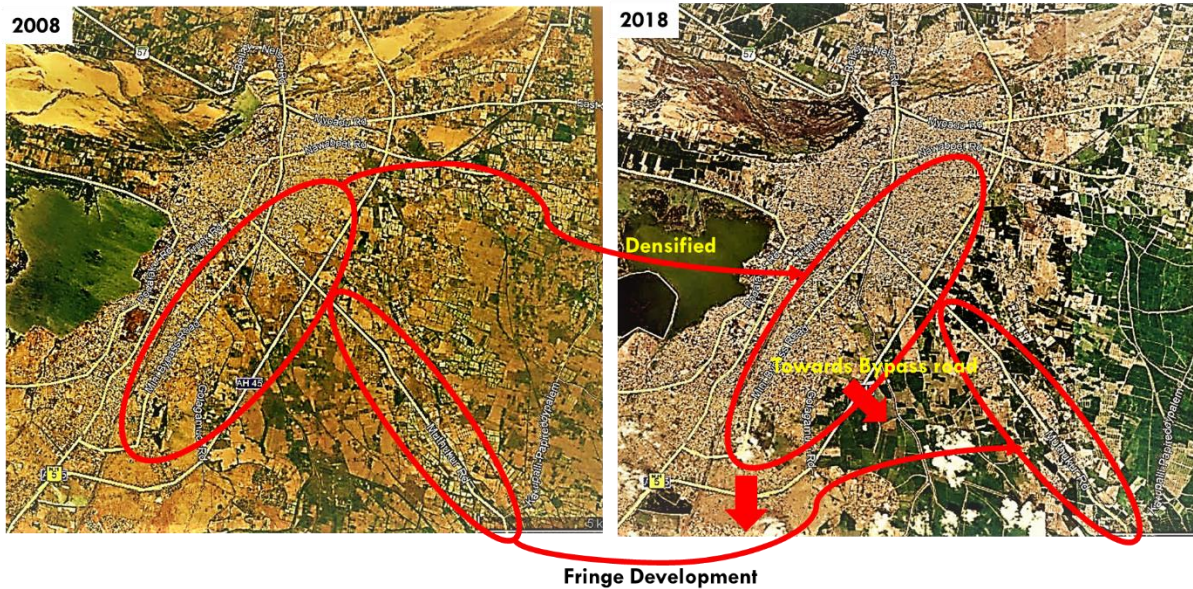


Figure 19 GROWTH PATTERN

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 eastern side i.e. Towards bypass road. 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 considers 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.

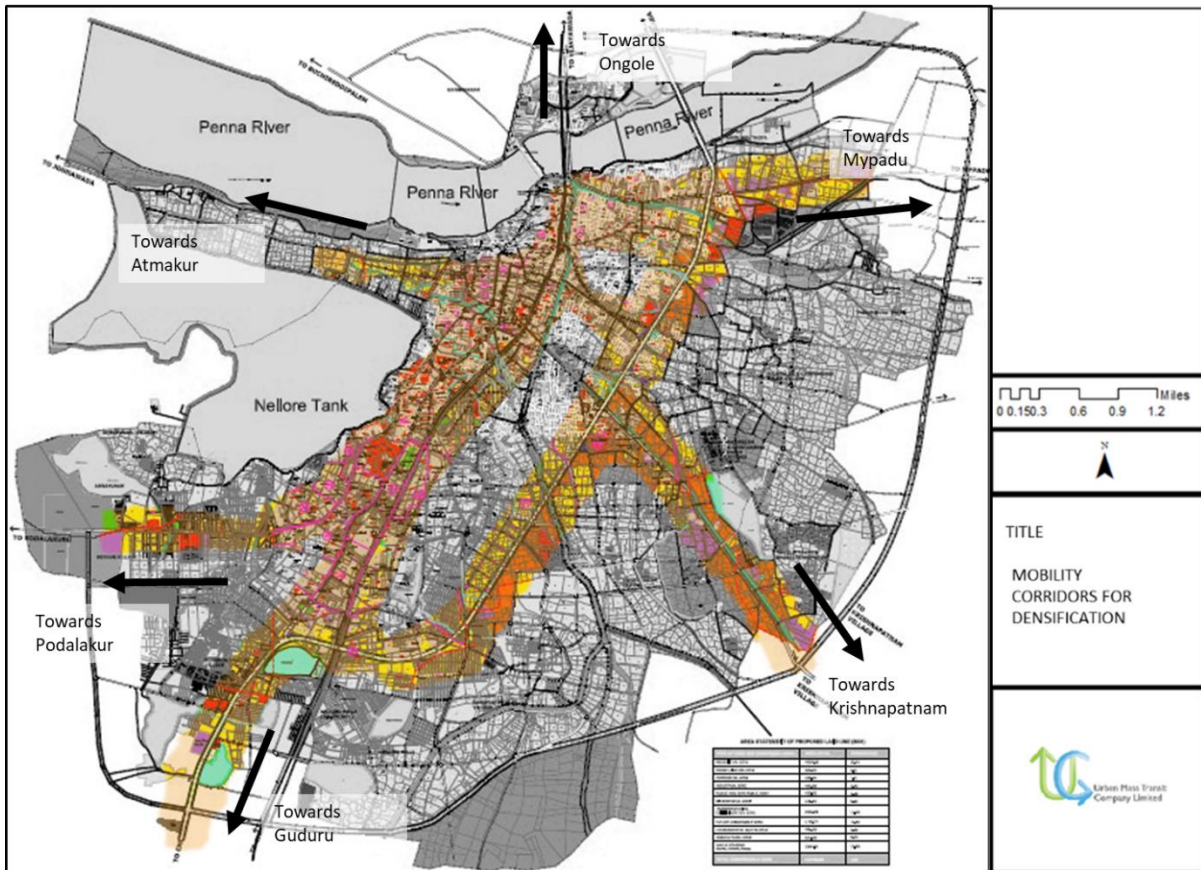


Figure 20 MOBILITY CORRIDORS FOR DENSIFICATION

4.3.2 POPULATION & EMPLOYMENT PROJECTIONS

4.3.2.1 POPULATION PROJECTIONS

According to the census the population since 1991 to 2011 is increased at growth of around 33%. 1991 to 2001 the actual population was increased from 3,16,605 to 6,00,869. 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 Nellore and considering the present stature of NMC, future developments, the incremental increase method has been taken into consideration. The Population and Employment projections for future years for

Nellore city area has been worked out in three different methods for horizon year 2038. As per master plan General Town planning scheme for NMC (Master Plan -2031) the projected population is 8,28,973 for 2031 which was projected in the year 2007.

After examining the available methods for projecting the population in Nellore and other factors the Incremental Increase Method has been taken into consideration. The details of Population projection are

Table 4.3-2: POPULATION PROJECTIONS⁸

Year	Arithmetic Increase Method	Incremental Increase Method	Geometric Increase Method
2018	670,043	757,137	688,090
2023	719,452	893,069	759,491
2028	768,862	1,053,405	838,474
2033	818,271	1,242,527	925,040
2038	867,681	1,465,602	1,019,189

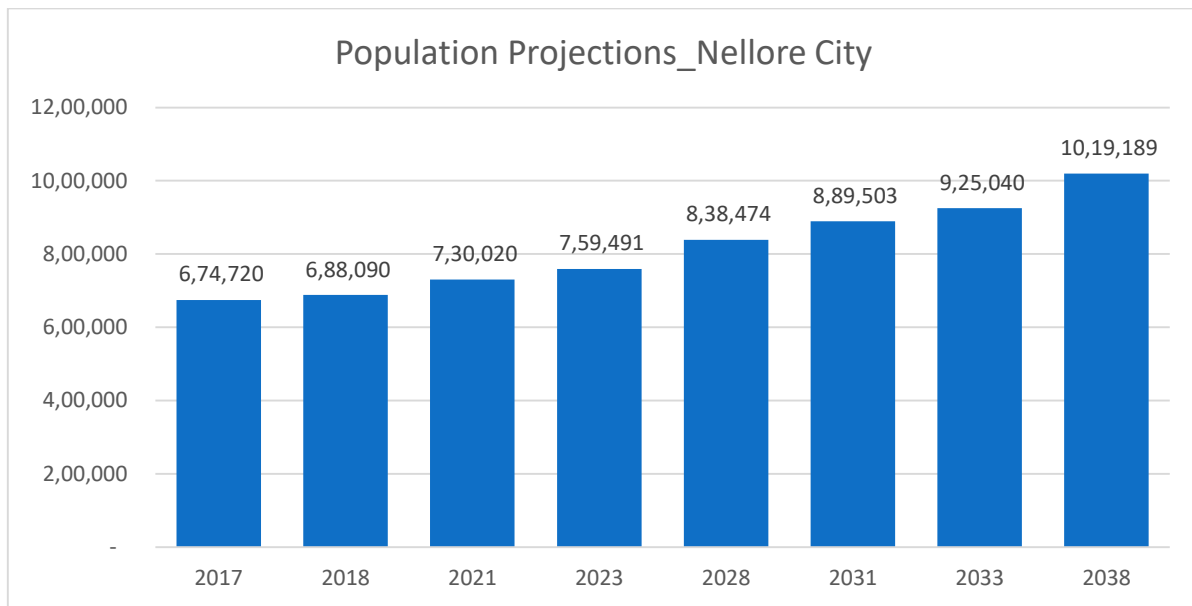


Figure 21 PROJECTED POPULATION FOR 2038

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

⁸ Source: Census of India and UMTC Projections

and employment for the entire study area is considered same as in BAU scenario. The distribution of population within the study for BAU and SUT scenario are as shown in Figure 4.3-4 and Figure 4.3-5.

4.3.2.2 EMPLOYMENT PROJECTIONS

Proximity to the sea and fertile land towards the east has led to agriculture and aquaculture being the backbone of the economy. The district has a cultivable area equal to 41.3% and the crops which are most commonly grown in the district are paddy, jowar, bajra along with tobacco, chillies, groundnut and sugarcane. Handloom, mica mines, thermal power generation and handmade jewellery are other industries that contribute to the economic development. Also salt production is the most popular in Nellore District mostly in Gogulapalli, Iskapalli and Ramathirdam villages. For the salt production Krishnapatnam port takes the top position in Andhra Pradesh which is located around 20 km from the city serving major economic activities to the city and district as whole. The other factors that help the Nellore is the education sector with about 185 schools in the municipal area. As per Census of India, 2011 the total worker population in Nellore accounts to 32% of the total population. The workforce details are as shown in

Table 4.3-3: POPULATION AND EMPLOYMENT FOR HORIZON YEARS (2016-2036)

Year	Population	Employment
2011	600,869	194,214
2018	688,090	222,406
2028	838,474	271,013
2038	1,019,189	329,424

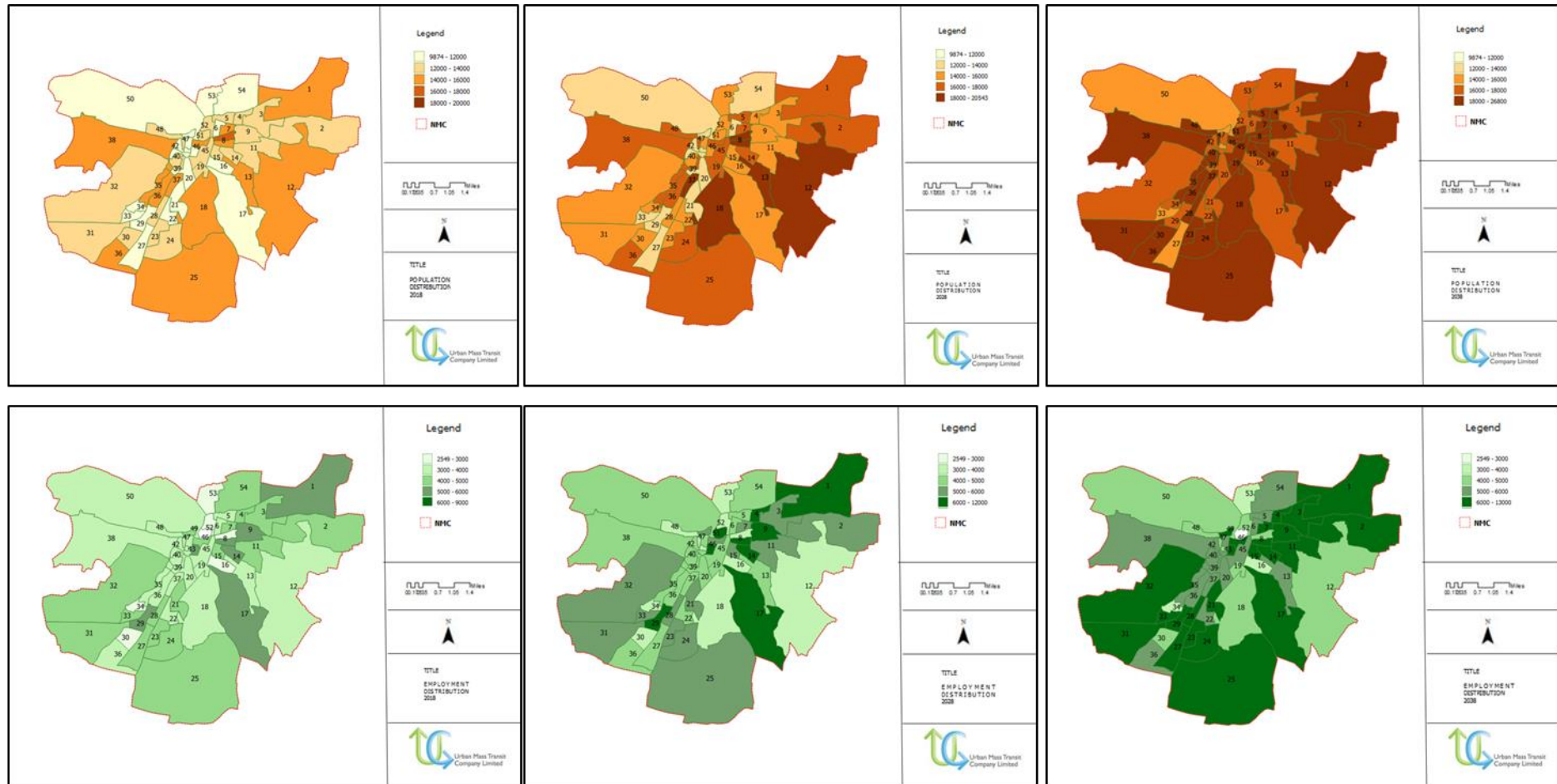


Figure 22 POPULATION (TOP) AND EMPLOYMENT (BELOW) PROJECTIONS FOR 2018, 2028, 2038 (BAU SCENARIO)

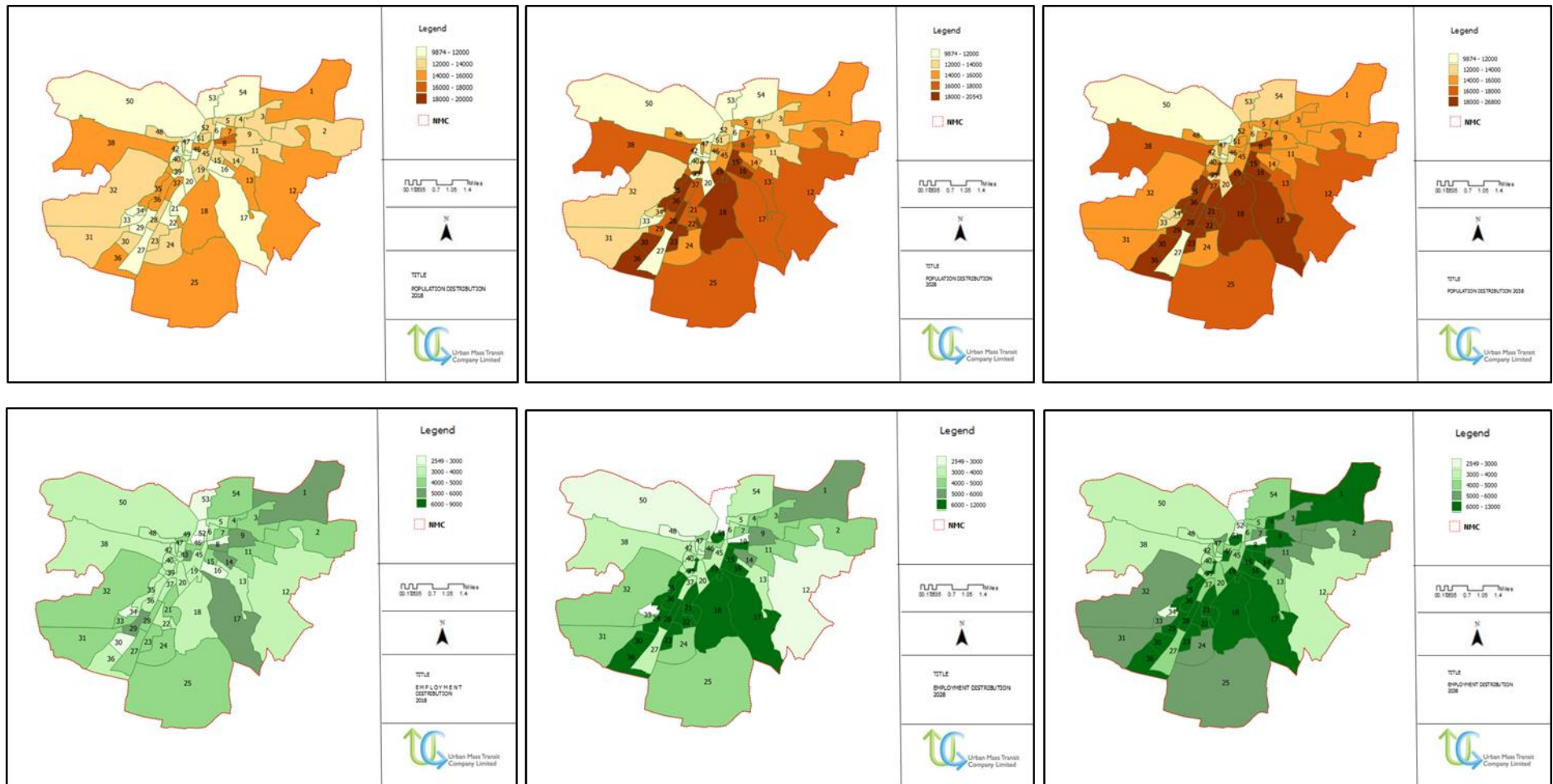


Figure 23 POPULATION (TOP) AND EMPLOYMENT (BELOW) PROJECTIONS FOR 2018, 2028, 2038 (SUT SCENARIO)

4.4 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 4.4-1: 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 4.4-2 summarizes the trips obtained from the matrices.

Table 4.4-2: SUMMARY OF BASE YEAR PASSENGER TRIPS

MODE	I-I	I-E	E-I	E-E
2W	88.3%	4.4%	4.9%	2.5%
Car	46.0%	15.2%	16.9%	21.9%
IPT	80.9%	10.5%	5.7%	2.8%
PT	68.5%	7.2%	21.9%	2.4%
NMV	93.4%	2.4%	4.1%	0.0%
Walk	93.6%	3.6%	2.8%	0.0%

Table 4.4-3: SUMMARY OF BASE YEAR PASSENGER TRIPS

MODE	I-I	I-E	E-I	E-E
2W	60.9%	25.9%	21.9%	30.9%
Car	6.7%	19.0%	15.8%	58.0%
IPT	32.0%	35.8%	14.6%	20.1%
PT	27.4%	24.7%	56.6%	17.6%
NMV	3.3%	0.7%	0.9%	0.0%
Walk	30.3%	10.1%	5.9%	0.1%
Total	100%	100%	100%	100%

The trip interactions of various modes were assessed based on the intercity and intracity movements. The Desire line diagram of Base Year Trips (excluding intra-zonal trips) is presented in Figure 4.4-1 and Figure 4.4-2.

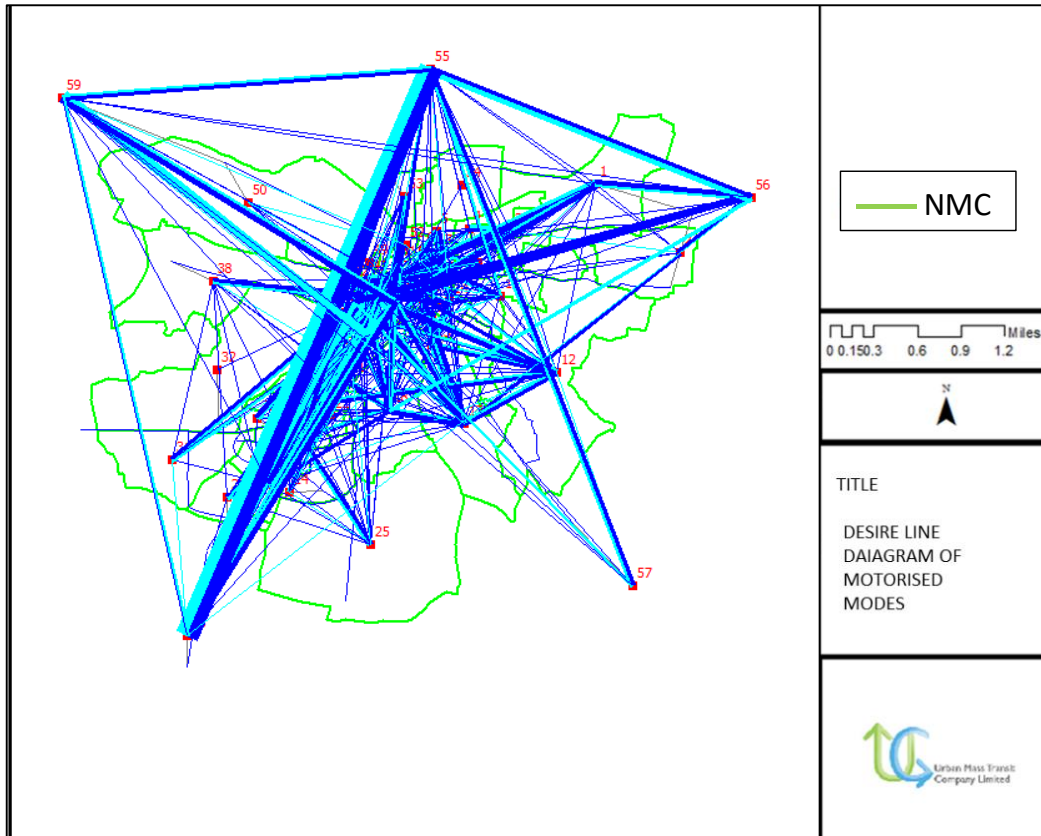


Figure 24 DESIRED LINE DIAGRAM OF MOTORIZED MODES

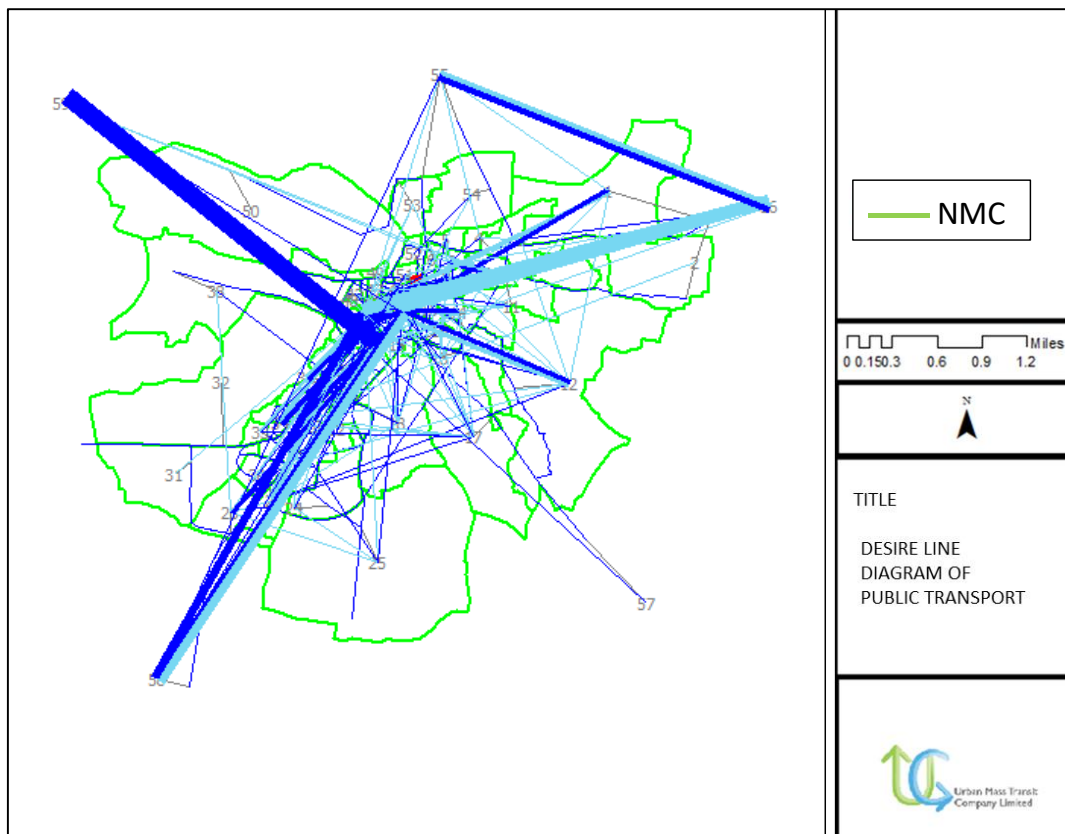


Figure 25 DESIRED LINE DIAGRAM OF PUBLIC TRANSPORT

4.5 COMPARISON 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

4.5.1 NETWORK CHARACTERISTICS

A comparison of traffic and travel characteristics in Business as Usual Scenario and Sustainable Urban Transport Scenario is presented in Table 4.5-2

Table 4.5-1: SUMMARY OF BASE YEAR PASSENGER TRIPS

Network Characteristics	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Walk	18.8%	12.2%	36.7%
Car	4.2%	5.2%	3.0%

Network Characteristics	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Two wheeler	37.8%	47.0%	17.8%
Auto Rickshaw	19.9%	24.7%	16.8%
Public Transport	17.1%	9.6%	20.3%
NMV (Cycle +Cycle Rickshaw)	2.2%	1.4%	5.3%
Avg. Network Speed (kmph)	25	20	25
Avg. Volume-Capacity (V/C) Ratio	0.43	0.82	0.61

It is observed that the share of Public Transport in Sustainable Urban Transport scenario has increased 2 times when compared to Business as Usual Scenario. Also, average V/C ratio has reduced by 25% and average network speed has increased by 25% in Sustainable scenario. Sustainable scenario is selected for proposing various transport improvement proposals.

4.5.2 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 4.5-2

Table 4.5-2: V/C and PT PHPDT ON MAJOR ROADS for HORIZON YEAR 2038

S.No.	ROAD NAME	V/C		PHPDT	
		BAU	SUT	BAU	SUT
1	Atmakur Bus Stand Road	1.04	0.78	5953	15547
2	Auto Nagar Main Road	0.87	0.65	1298	2979
3	Chintareddypalem Road	0.90	0.67	303	1416
4	Fatekhanpet Main Road	1.15	0.86	982	3866
5	Grand Trunk Road	1.26	0.94	6594	16380
6	Muthukur Road	1.29	0.97	4352	8623
7	Nawabpet Road	0.98	0.73	3404	8669
8	Nellore - Koovur Road	1.33	0.99	5196	14017
9	NH-16	1.20	0.90	211	1158
10	Somashaperapuram	1.09	0.82	603	2634
11	Walkers Road	1.32	0.99	1583	5346
12	Mini Bypass Road	1.19	0.65	4564	10340

The V/C ratio on major roads has reduced by 25% in SUT scenario compared to BAU. PT PHPDT on major roads has increased by approximately 2 times in SUT scenario compared to BAU.

4.5.3 RIDERSHIP FOR IMPROVED PUBLIC TRANSIT SYSTEM

The PHPDT of the public transport corridors were arrived at using the travel demand and and has been summarized in Table 4.5-3. 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 4.5-3: 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	Bellari KP Hwy	3220	3148	7997	3999
2	Mulapet Road	1004	982	1647	823
3	Muthukur Road	4452	4352	8623	4312
4	Mypady Road	602	589	3374	1687
5	Navabu Road	3482	3404	8669	4335

The major public transport mobility corridors identified are as represented in the Table 4.5-4.

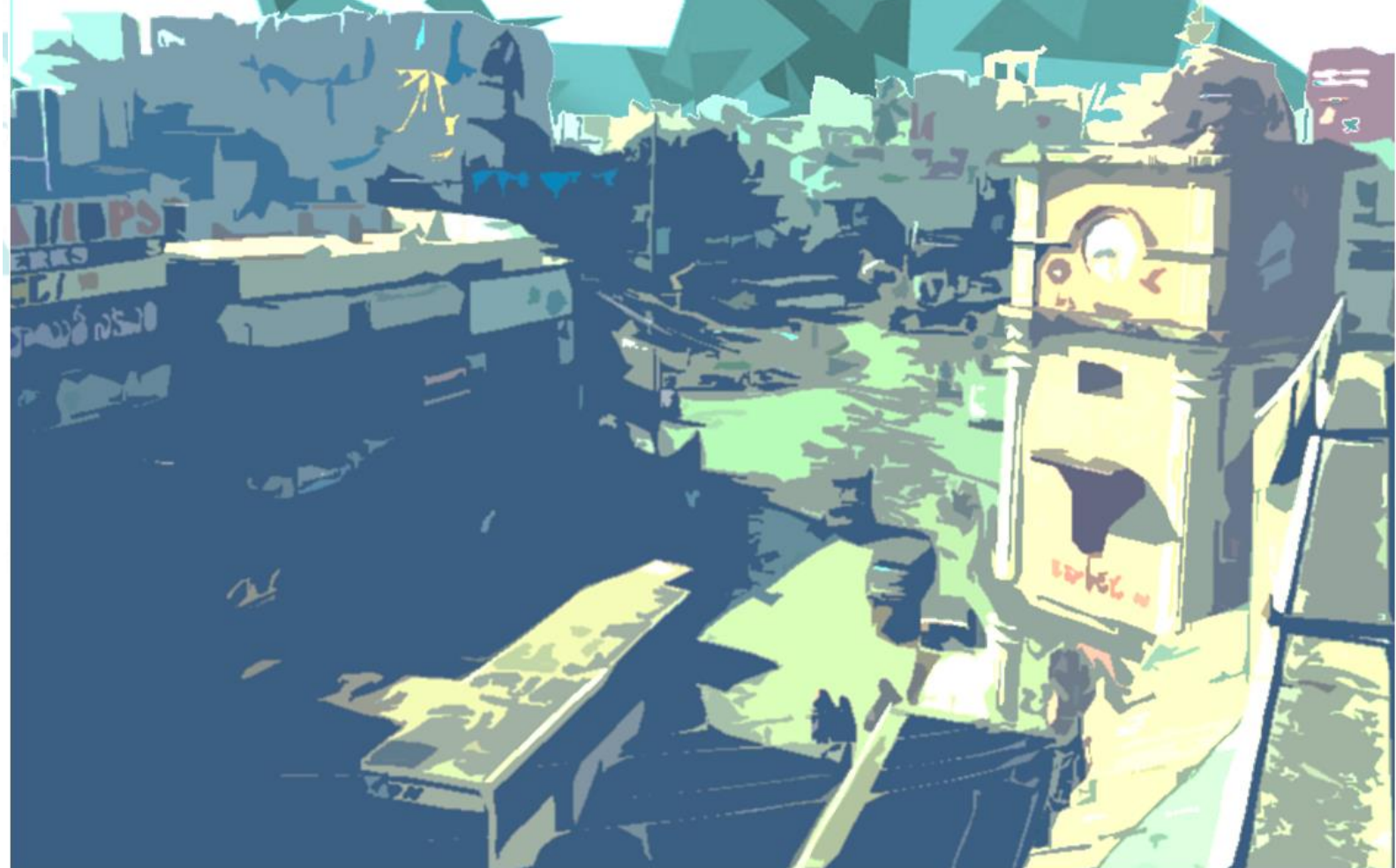
Table 4.5-4: MAJOR PT MOBILITY CORRIDORS IN NELLORE

S.No.	ROAD NAME	BASE (2018)	BAU (2038)	SUT (2038)
1	Abuhdnita Mosque	3855	3769	10908
2	Atmakur Bus Stand Road	6089	5953	15547
3	Auto Nagar Main Road	1327	1298	2979
4	Chintareddypalem Road	310	303	1416
5	Fatekhanpet Main Road	1004	982	3866
7	Mulapet Road	1004	982	1647
8	Police Office Road	514	502	2857
9	Railway Station Road	3180	3109	8389
10	Somasekara puram	617	603	2634

Considering the improved situation in volume by capacities and improved PHPDT Sustainable Urban Transport scenario has preferred. The following Chapter 5, discusses the improvements to consider for SUT scenario. The benefits in terms discussed in detail under Section 6.2.

Chapter 5

URBAN MOBILITY PLAN



URBAN MOBILITY PLANS

The mobility goals for Nellore 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 Nellore.

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 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 Nellore are as follows,

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

5.1.1 MULTI NODAL TRANSIT CONCEPT FOR NELLORE

The urban form and its spatial structure are linked by the nodes and linkages. The nodes are the activity centres of the city which are linked together by the transport infrastructure such as roads and public transport system.

In multi nodal concept the activity centres are dispersed from the city centre to all around the city, so that those centres can be accessed easily with less travel such as by 5 to 10-minute walk or by boarding a transit system.

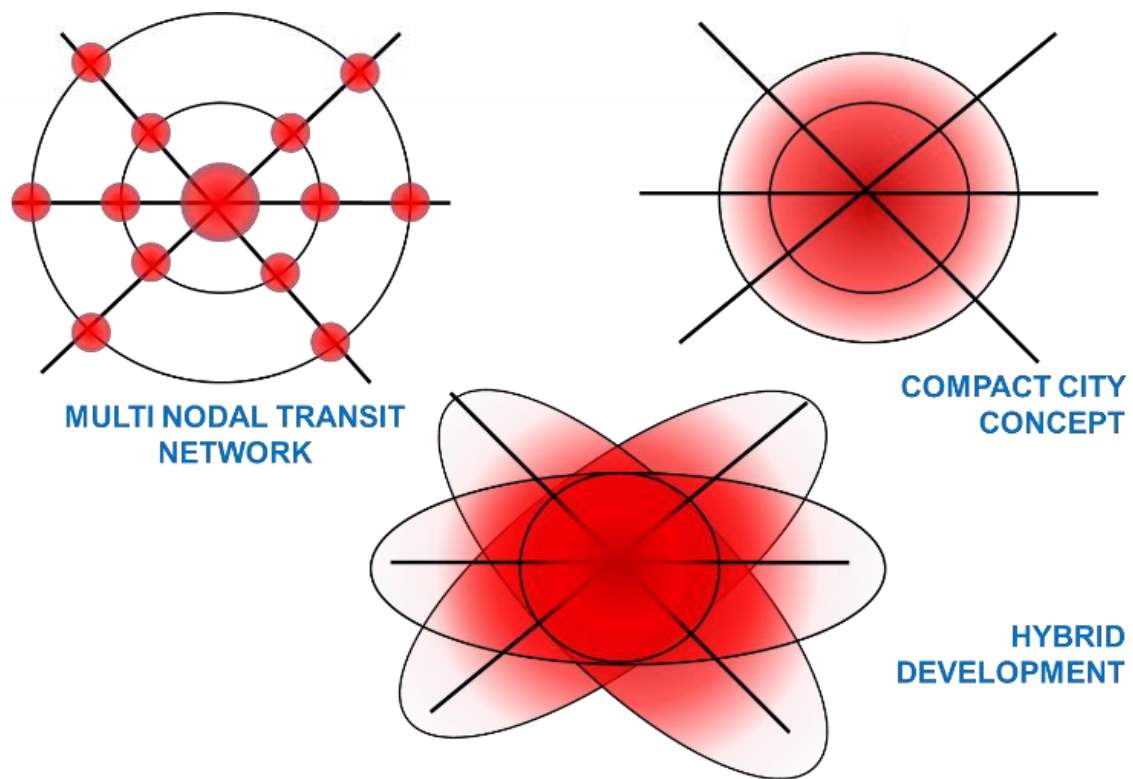


Figure 26 **MOBILITY CORRIDOR PATTERNS CONCEPT**

The concepts are Multi nodal transit network where there are major transit corridors and different nodes dispersed around the main city centre Figure 5-1-1 compact development like Barcelona, Curitiba where the development of the city region is restricted up to certain limits and a hybrid concept which is a combination of dispersed and compact development.

In Nellore the sub-centres can be places around the city, which are within immediate proximity to public transport system. The activity centres that are to be developed as a multi nodes are,

Table 5.1-1: PROXIMITY OF CORE AND SUB-CENTRES

Immediate Proximity (Along Proposed HC PT System)	Low Proximity (Along PT Routes to be Improved)
1. Nawab Pet	A. Chinta Reddy Palem
2. ISKON City	B. Narayana Reddy Pet
3. Padurupalli	C. Venkateswarapuram
4. Buranpur	D. Vollur Colony
	E. Vengalrao Nagar

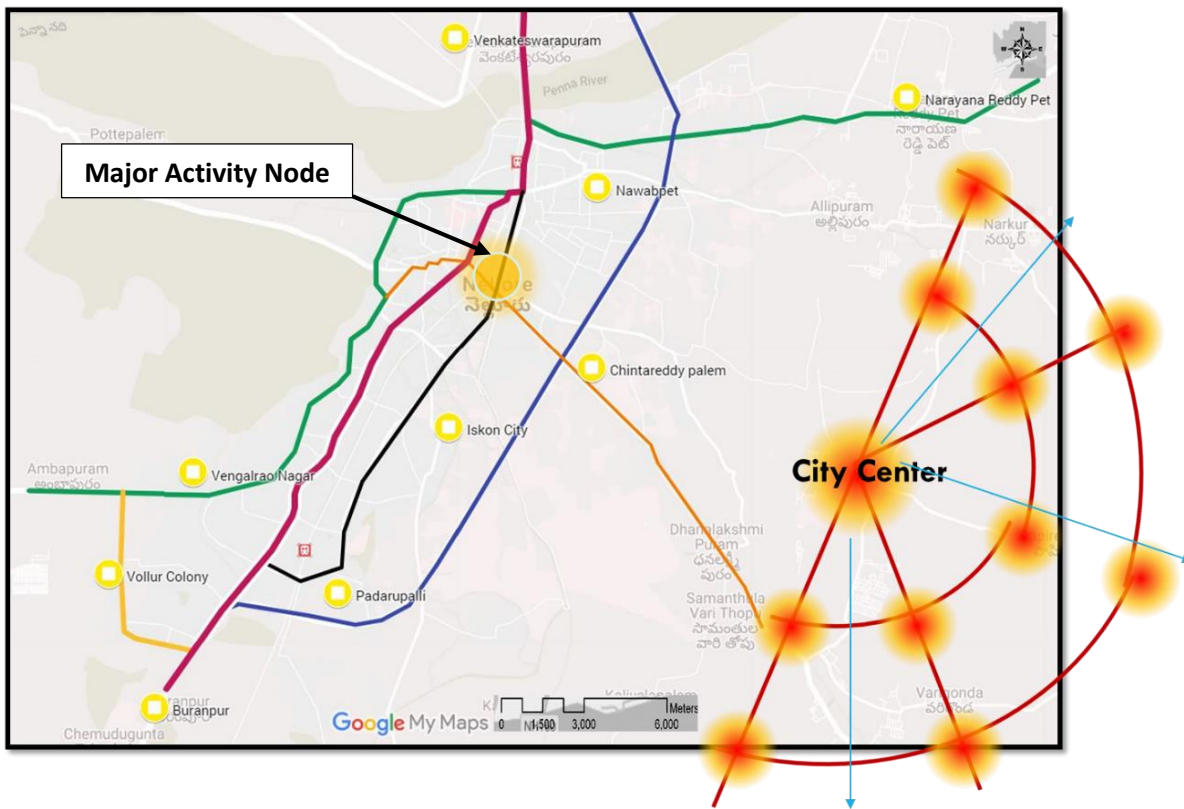


Figure 27 ROAD NETWORK DEVELOPMENT VS ECONOMIC NODES IN THE CITY

All the above-mentioned nodes must be developed a transport strategy so that the need for travel is minimised, resulting in less trip length.

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 5.1-3.

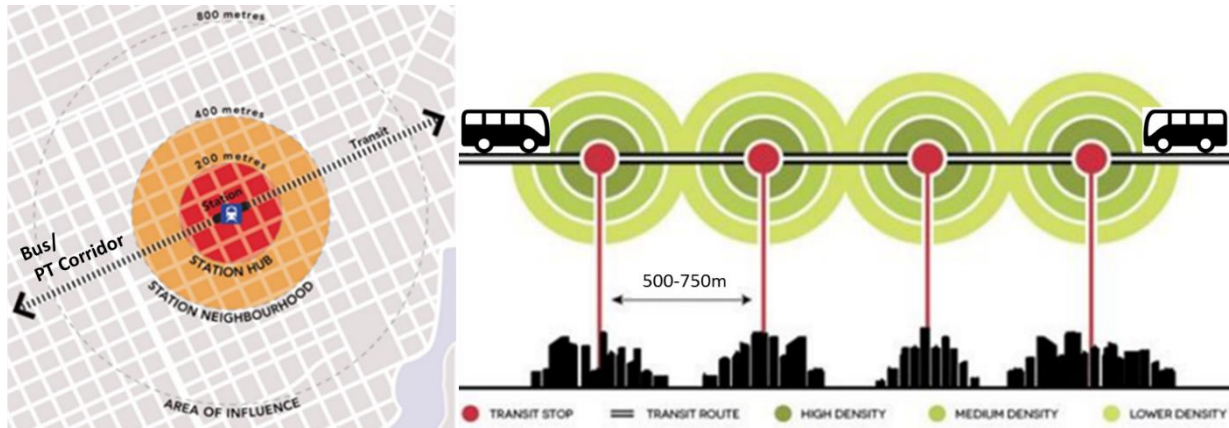


Figure 28 CONCEPT OF TRANSIT ORIENTED DEVELOPMENT⁹

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 (**Error! Reference source not found.**).
- 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.

⁹ www.Wordpress.org accessed on 27th September 2016

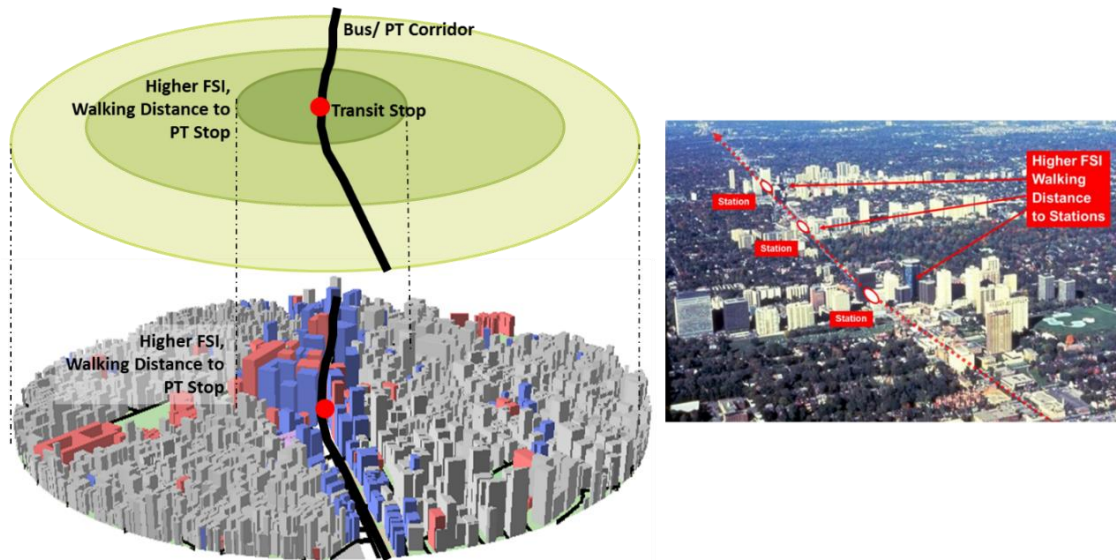


Figure 29 BUILDING HEIGHT AND SCALE IN TOD

The corridors which are proposed for public transport improvements shall be developed based on a concept of transit-oriented development, where the high dense development, such as increased FSI along that corridor will make the people to increase the public transport utilisation, and mixed development along the corridor can decrease the need for travel.

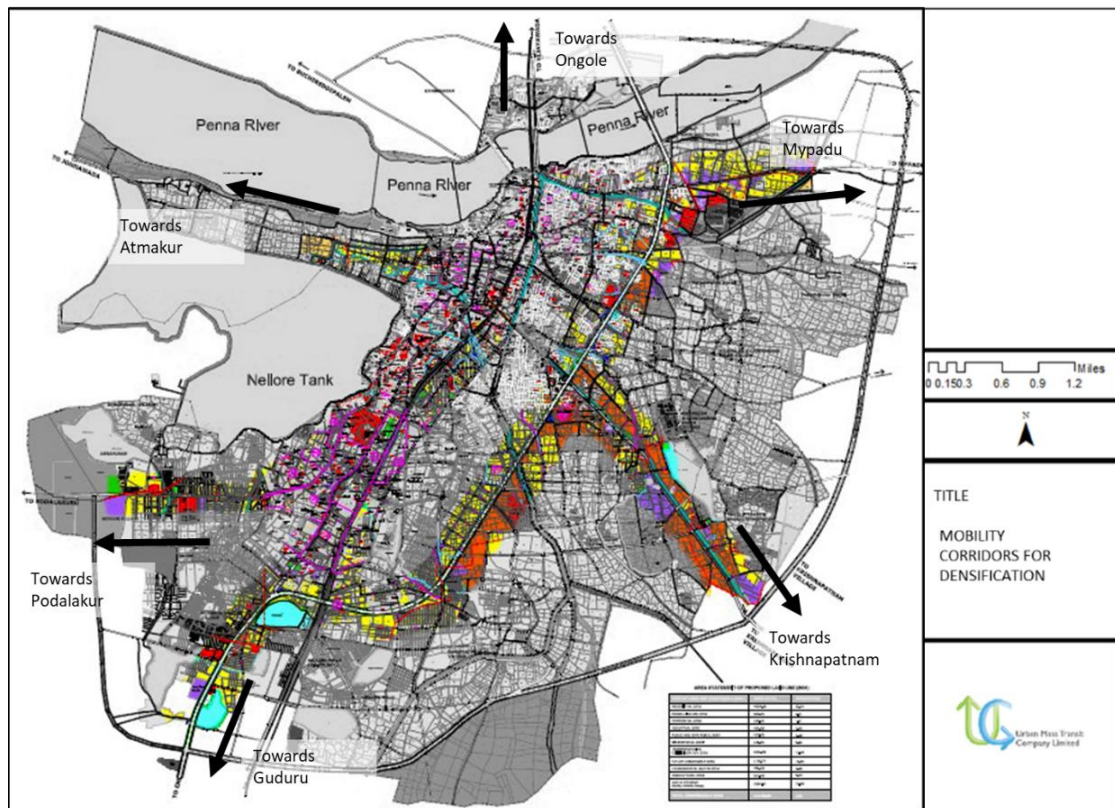


Figure 30 MAJOR MOBILITY CORRIDORS FOR TRANSIT ORIENTED DEVELOPMENT

As Nellore is one of largest city in the state, it 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 5.1-5.

- 1) Chennai-Srikakulam Highway
- 2) Mini-Bypass Road
- 3) Trunk Road
- 4) Podalakur Road
- 5) Muthukur-Childrens Park Road
- 6) Nawabpet Road
- 7) PR Colony Road
- 8) Walkers Road

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 bus is the only public transit system available in Nellore for intra city transport. APSRTC (Andhra Pradesh State Road Transport Corporation) provides the public transport services. At present, there are 153 Telugu Velugu Buses operating in the city for intra city public transit.

The public transport system for Nellore should be convenient, efficient, affordable, reliable and integrated. Public transport system planning for Nellore 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 Nellore are:

- 1) Development of efficient bus based Public Transport systems.
- 2) Higher Order Bus Systems (Mass Transit Systems)
- 3) Intermediate Public Transit/ Feeder System
- 4) Multi-modal integration in public transport
- 5) Providing adequate infrastructure facilities for public transport in terms of intermodal mobility hubs and bus stops
- 6) Implementation of ITS to improve the reliability of public transport systems
- 7) Promoting public participation and campaigning mass awareness programs

5.2.1 CITY BUS SYSTEM

Based on the results of trip interactions obtained from various Origin and Destination (OD) surveys, the prominent trip patterns and trip generators were identified. The Desire line diagram of the motorised trips and public transport trips are shown in Figure 5.2-1.

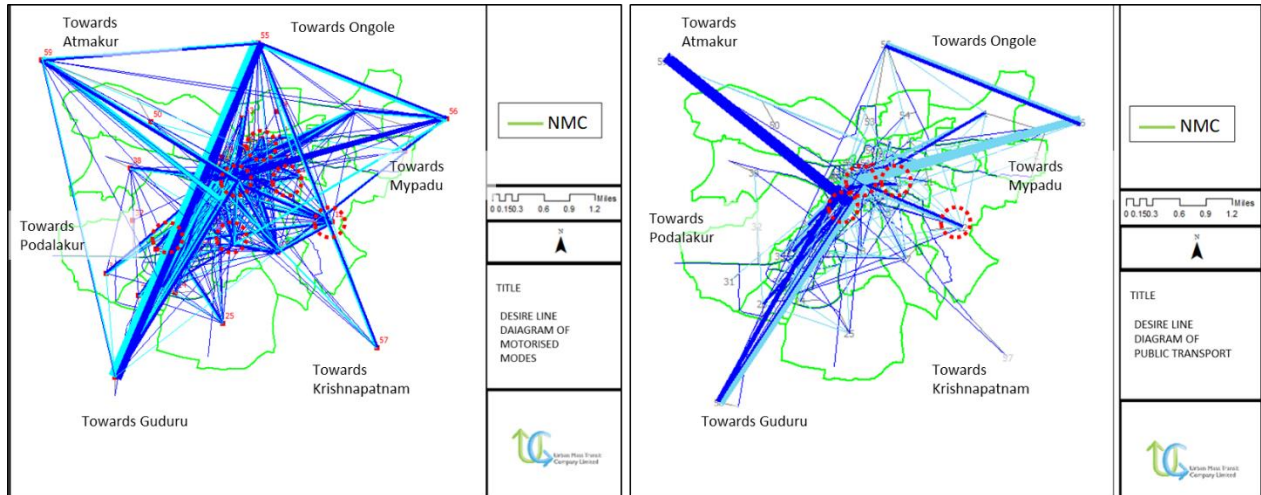


Figure 31 DESIRE LINE DAIGRAMS OF MOTORISED (LEFT) AND PT (RIGHT) TRIPS IN NELLORE

Further the demand on the mobility corridors was assessed as discussed in Section 4.5.2 and Table 4.5-4 and the Bus routes shown in below figure were identified by as public transport corridors for augmentation of buses.

Table 5.2-1: PT PHPDT ON MOBILITY CORRIDORS IN NELLORE

S.No.	ROAD NAME	PHPDT			Corridor Length
		Base (2018)	BAU (2038)	SUT (2038)	
1	Grand Trunk Road	6745	6594	16380	16
2	Mini Bypass Road	1942	1898	7300	8.3
3	NH-16	1281	1253	3325	20
4	Podalakur Road	3821	3736	9171	12.5
5	Krishnapatnam-Highway	3540	3461	7512	9.0
6	Mypadu Road	516	505	2854	8.5

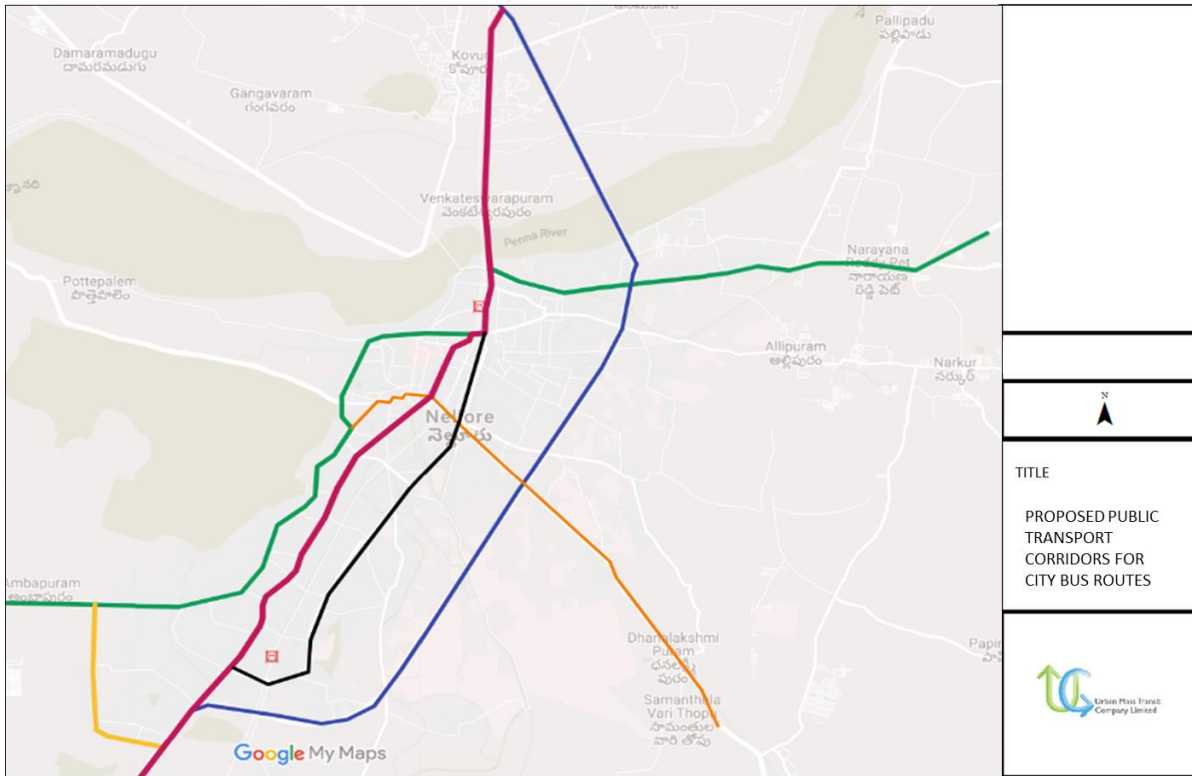


Figure 32 PT CORRIDORS FOR CITY BUS ROUTES IN NELLORE

Better public transport system speaks about the level of transport in the city. As discussed earlier there are 154 TV buses operated by APSRTC for intra city and intercity service. As per CIRT norms it is required to provide 0.4 buses per thousand population. The projected population for the base year 2018 is 6.88 lakhs requires a total number of 275 buses as per CIRT norms, hence by the year 2038, the city bus system for Nellore is envisaged to be operating with a fleet of 408 buses on the above identified transit corridors.

5.2.2 HIGHER ORDER MASS TRANSIT SYSTEM

A Mass Transit System is designed to move large numbers of people at one time. Mass Rapid Transit system usually runs in special guideways which will lead to lower travel time, and decreased congestion.



Figure 33 **THE AMOUNT OF SPACE REQUIRED TO TRANSPORT THE SAME NUMBER OF PASSENGERS: CAR, BICYCLE, AND BUS.**¹⁰

A number of technologies are available for public transport and as some of the technologies, especially metro rail, are highly capital intensive, it is necessary to have certain guidelines for choice of different transit modes. The selection of higher order system is based on the Passengers per Hour per Direction (PPHPD) and feasibility of implementation, along with other parameters as mentioned below.

The guidelines for selection of mass rapid transit choice for the city is given in Table 5.2-2 as specified by working group on Urban Transport for 12th Five Year Plan of India.

Table 5.2-2: SELECTION OF MASS RAPID TRANSIT CHOICE

Mode Choice	Desirable PPHPD	Population (Million)	Average Trip Length (km)
Metro Rail #	>15000 for at least 5 km continuous length	>=2	>7-8
LRT primarily at grade	<=10000	>1	>7-8
Monorail	<=10000	>1	About 5-6
BRT	>=4000 and up to 20000	>1	>5
Organized City Bus Service as per urban bus specifications		>1 lac, 50,000 in case of hilly towns	>2 to 3

¹⁰ Source: Poster displayed at the City of Muenster Planning Office, August 2001

The urban transport model developed for Nellore has evaluated the PHPDT values on all major corridors of Nellore (i.e. mobility corridors) for 2038. The PHPDT values along the mobility corridors are tabulated below. The Bus routes to be improved immediately (2018) and to be developed as a PT exclusive lane in 2038 are shown in Figure 5.2-4

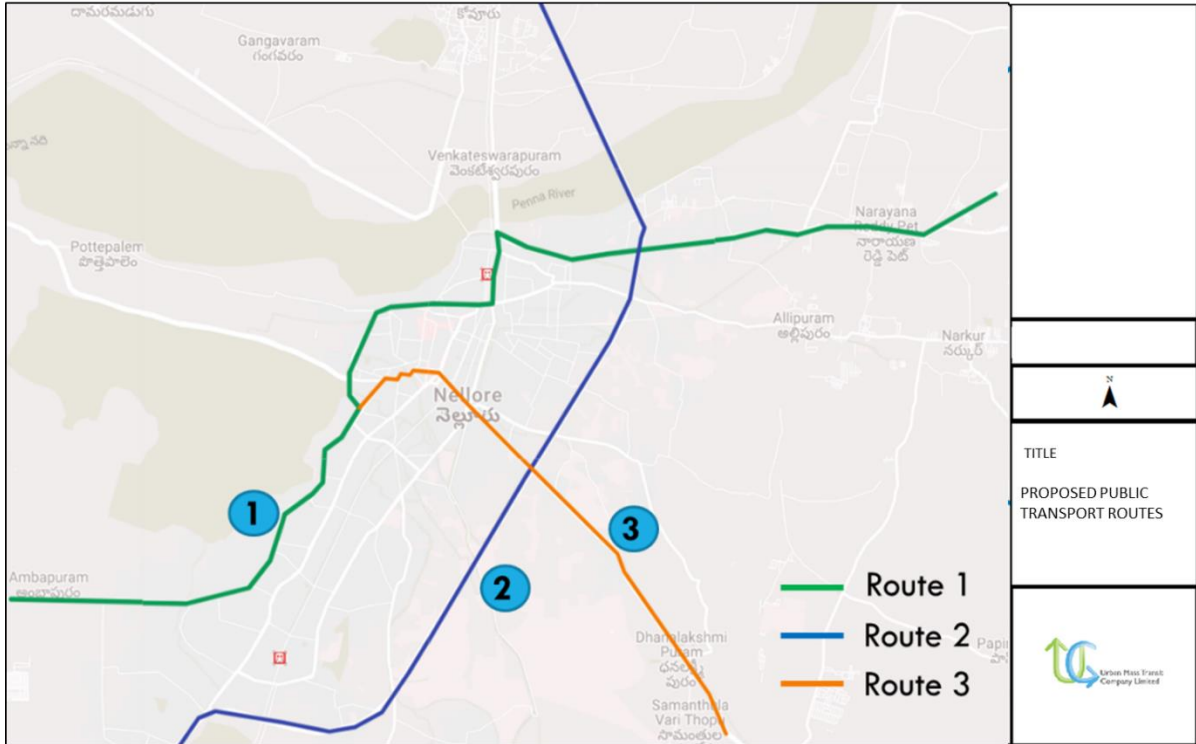


Figure 34 BUS ROUTES TO BE IMPROVED

Route 1: Podalakur Road – Walkers Road – Mypadu Road via Nellore Kovur Road

Route 2: NH 16 (Chennai Vijayawada Hwy)

Route 3: Muthukur Road

The evaluated PHPDT from the model for the above routes are,

Table 5.2-3: **Estimated PHPDT for Medium Capacity System**

Route no	2018	2038	Estimated MRT PHPDT
Route 1	Improve Buses	Exclusive PT lane	2854
Route 2	Improve Buses		3325
Route 3	Improve Buses	Exclusive PT lane	4500

The routes proposed for high capacity public transport system are shown in Figure 5.2-5.

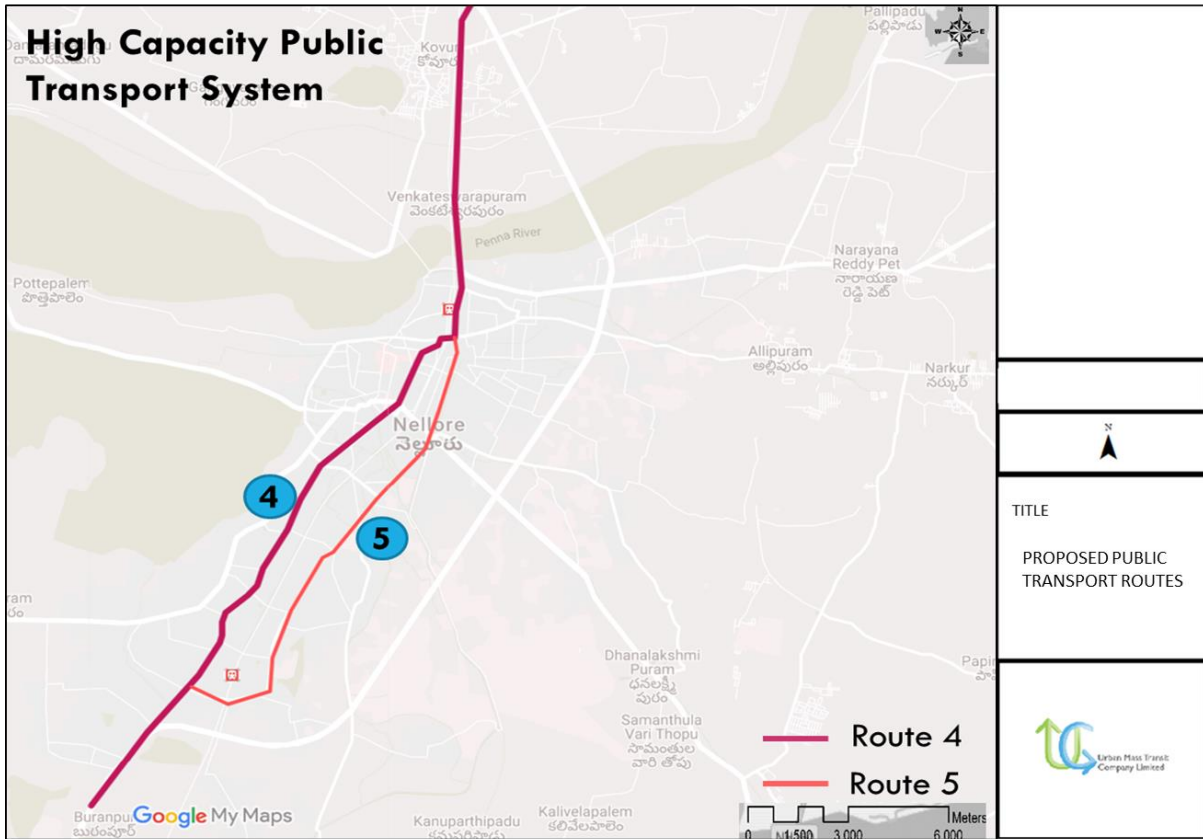


Figure 35 HIGH CAPACITY PUBLIC TRANSPORT CORRIDORS

Route 4 (HC PT 1): Along Grand Trunk (GT) Road connecting North South extremes of Nellore

Route 5 (HC PT 2): Along Mini Bypass Road

In Future for east west connectivity HC PT system can be implemented to promote tourist attraction. The estimated ridership for the proposed high capacity public transport system is tabulated in Table 5.2-4.

Table 5.2-4: Estimated Ridership for High Capacity Public Transport System

Route	Estimated Ridership (PHPDT) in 2038
Route 4: HC PT 1	10800
Route 5: HC PT 2	7300

Based on the PHPDT values, the implementation of an appropriate Mass Transit System is recommended on following routes. However, feasibility studies and DPRs need to be carried in order to identify appropriate mass transit systems on the mobility corridors. However, this

study will indicate the possible systems to be implemented on the mobility corridors based on the forecasted PHPDT numbers and the right-of-way considerations.

5.2.3 BUS TERMINALS

At present RTC bus stand and PSR bus stand are operating as a major terminal for regional and city buses. As proposed in master plan 2031, a new bus terminal shall be located in the outer boundary of the city, at the intersection of Golgamudi road and Bypass Road (NH 16) so that the regional buses do not congest the city. The proposed bus terminus is shown in Figure 5.2-6.

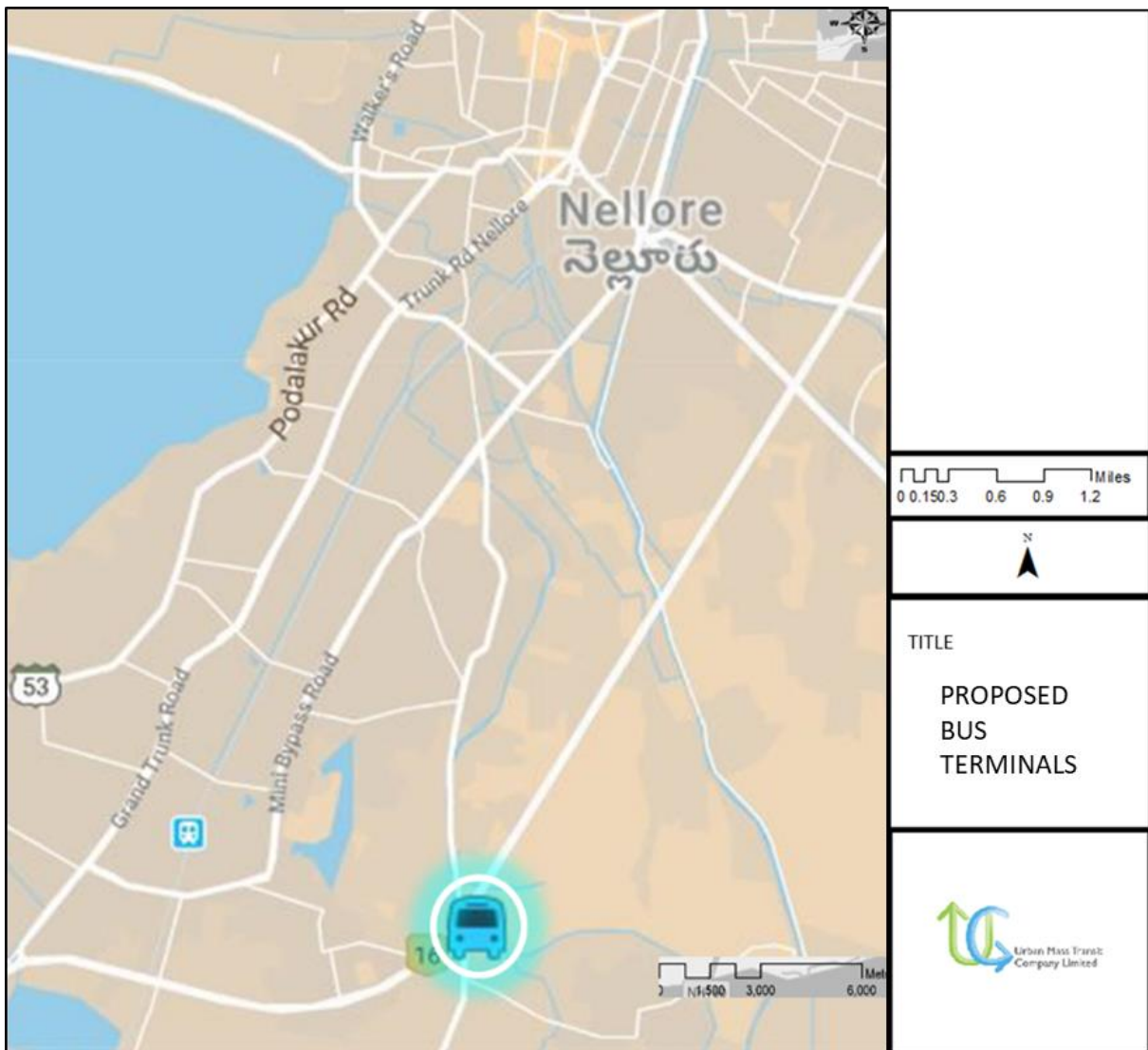


Figure 36 PROPOSED BUS TERMINUS

5.2.4 INTERMEDIATE PUBLIC TRANSPORT

Unreliable last mile connectivity impacts the overall quality and usage of mass transit and results in a mode share shift of public transport. While efforts are being made to enhance mass public transport, last mile connectivity has to be improved and linked into existing services.

An integrated system will aid ease of access for users. Auto-rickshaws and cycle-rickshaws not only act as good feeder services to these mass transit options but can also be a mode of choice for occasional or short trips. 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.

In Nellore, the IPT routes operated overlap with the major trunk PT corridors. Although improving public transport in Nellore would be a key strategy, it is also important to ensure that auto-rickshaw services fulfil their intended role as feeder services instead of competing with public transport for long-distance trips. Five new IPT routes are proposed to be improved in Nellore, which will feed the major trunk corridors.

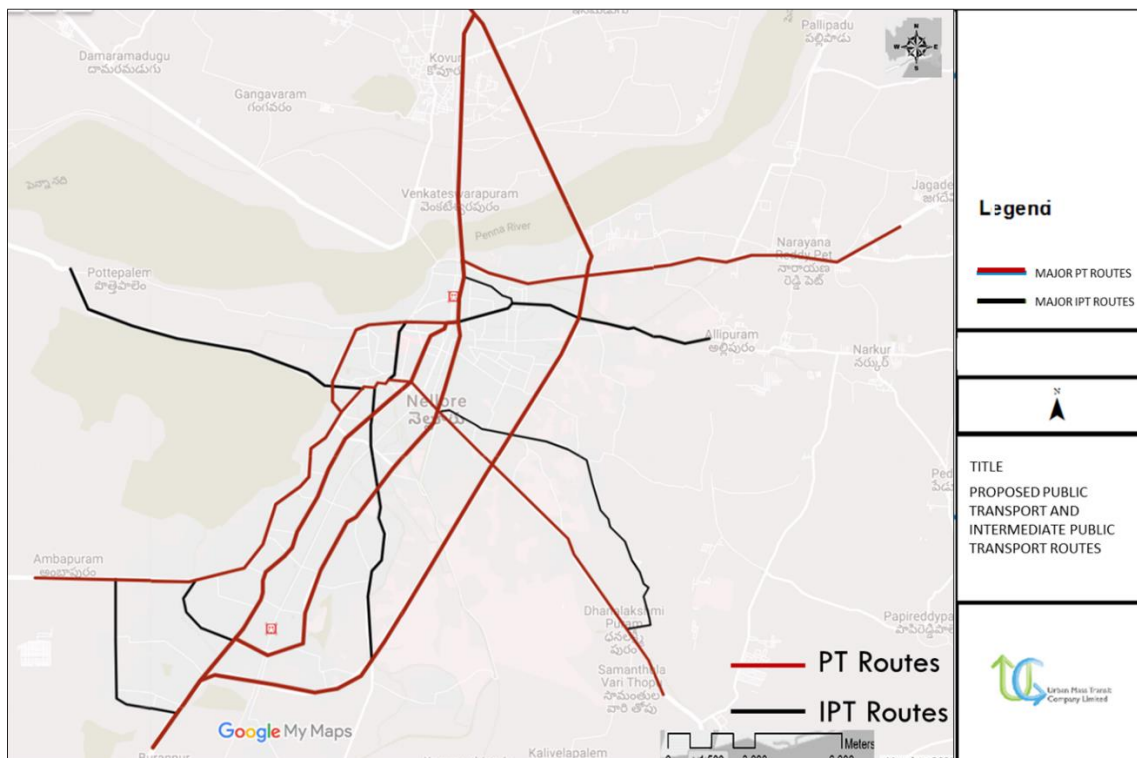


Figure 37 KEY IPT ROUTES IN NELLORE

The IPT Routes proposed are as follows,

1. Pottepalem Main Road connecting Walkers road

2. Childrens Park Road to Alagiri Nagar- Vaviltipadu road connecting Mydukur-Krishnapatnam Road
3. Golgamudi Road connecting across GT Road, Mini Bypass Road and Bypass Road
4. Narkur Road connecting GT Road
5. Vollur Colony Road connecting Podlakur Road and GT Road in Southern Part of Nellore.

5.2.5 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 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 Figure 5.2-5.

Table 5.2-5 MULTI MODAL HUBS

S.NO.	LOCATION	TYPE	INTEGRATION
1	APSRTC Complex	Major	Bus, IPT, NMT
2	Atmakur Bus Stand	Major	Bus, IPT, NMT
3	Railway Station	Major	Train, Bus, IPT, NMT
4	VRC Junction	Major	Bus, IPT, NMT
5	Childerens Park Junction	Minor	Bus, IPT, NMT
6	Hotel Aditihi Center	Minor	Bus, IPT, NMT
7	Annamaya Circle	Minor	Bus, IPT, NMT
8	Sundariah Circle	Minor	Bus, IPT, NMT

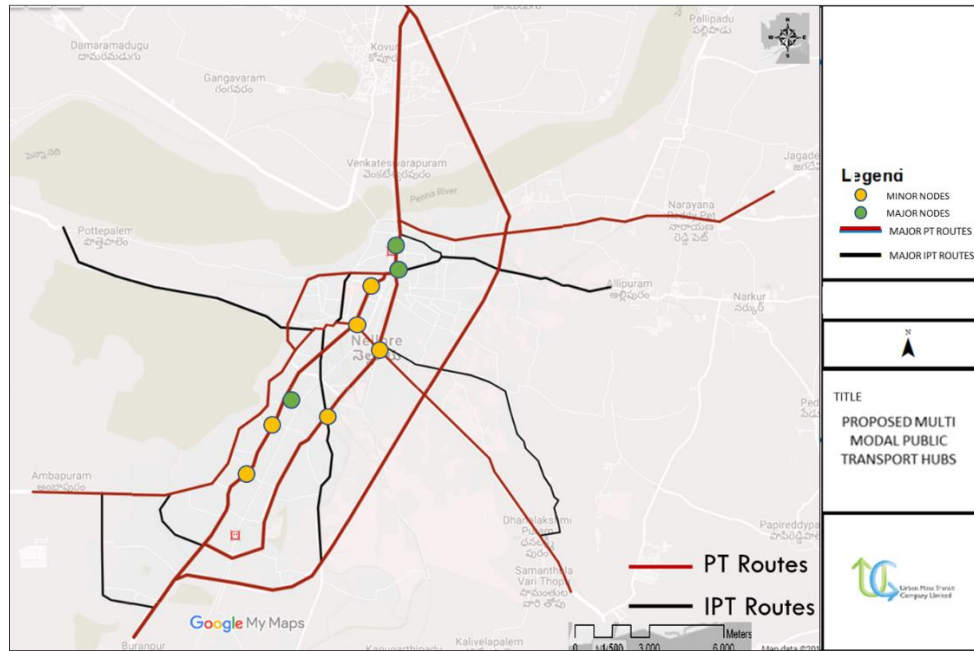


Figure 38 PROPOSED MULTI MODAL HUBS IN NELLORE

5.2.6 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.



Figure 39 CAR FREE DAY AND CYCLE DAY INITIATIVES IN UP AND BANGLORE¹¹

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/Upgradation
- Development of Missing links/New Links/Ring Roads
- Road Infrastructure Development (ROBs)

¹¹ SOURCE: Getty Images and Citizen Matters

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 major highways shall be provided with service lane to reduce multiple entry/exit points. Mobility corridors are proposed to have 2-lanes exclusively for public transport (i.e. buses) on kerb side or median.

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.

The required lane configuration for the year 2038 is given in Table 5.3-1

Table 5.3-1 LANE CONFIGURATION OF ROADS TO BE WIDENED

Major Mobility Corridor			
Road Name	Length, Km (Approx)	Lane Configuration	
		2018	2038
GT Road	9.6	4	6
NH 16	18	4	6
Podalakur Road and Walkers Road	9.5	2	4
Mypadu Road	9.5	2 UD	4 D
Other Roads			
Road Name	Length, Km (Approx)	Lane Configuration	
		2018	2038
Railway Station Feeder Road	1.30	2	3 (slight increase in capacity to augment the increase in volume)
Railway Station Road	0.80	2	4

Mulapet Road	1.36	2	4
Magunta Layout Road	0.50	2	4
Atmakur Bus Stand Road, Nellore - Kovur Rd, KP Port Hwy	0.50	4	5 (Slight Widening required)

Since these corridors include all the major spines within Nellore, they should be designed based on the standards. Nellore 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 5.3-1 to Figure 5.3-4 shows the indicative cross sections of various ROWs of roads to be followed for mobility corridors and other corridors

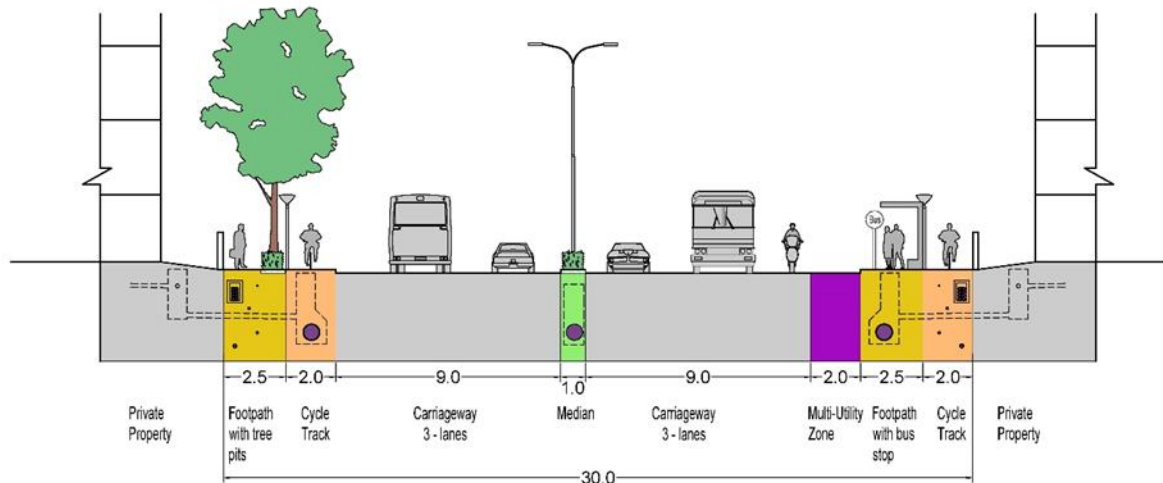


Figure 40 TYPICAL SECTION OF 30M WIDE ROAD

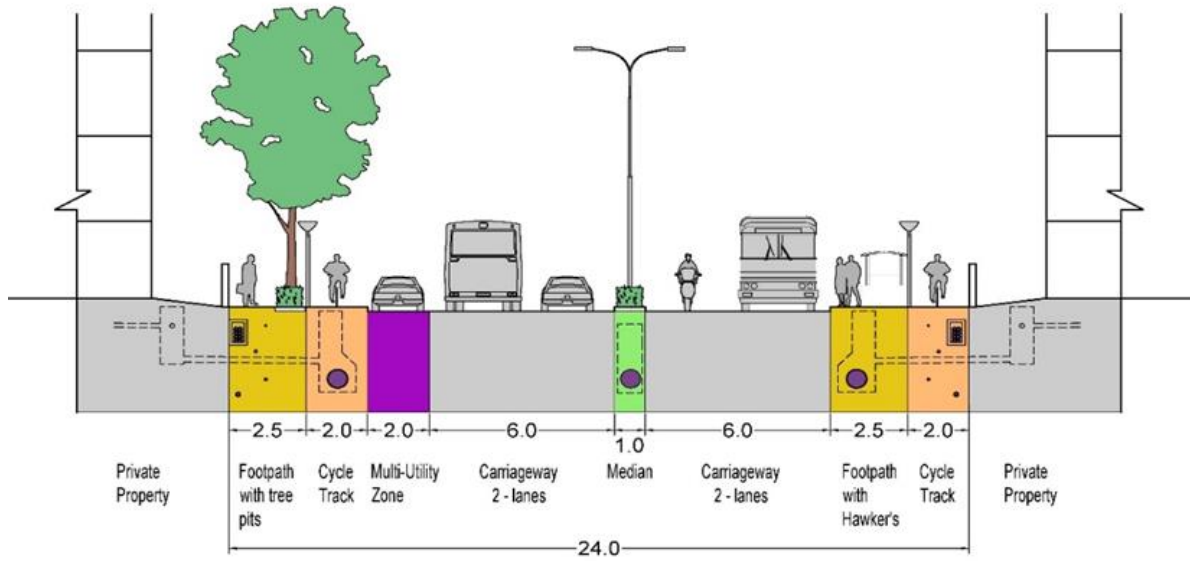


Figure 41 TYPICAL SECTION OF 24M WIDE ROAD

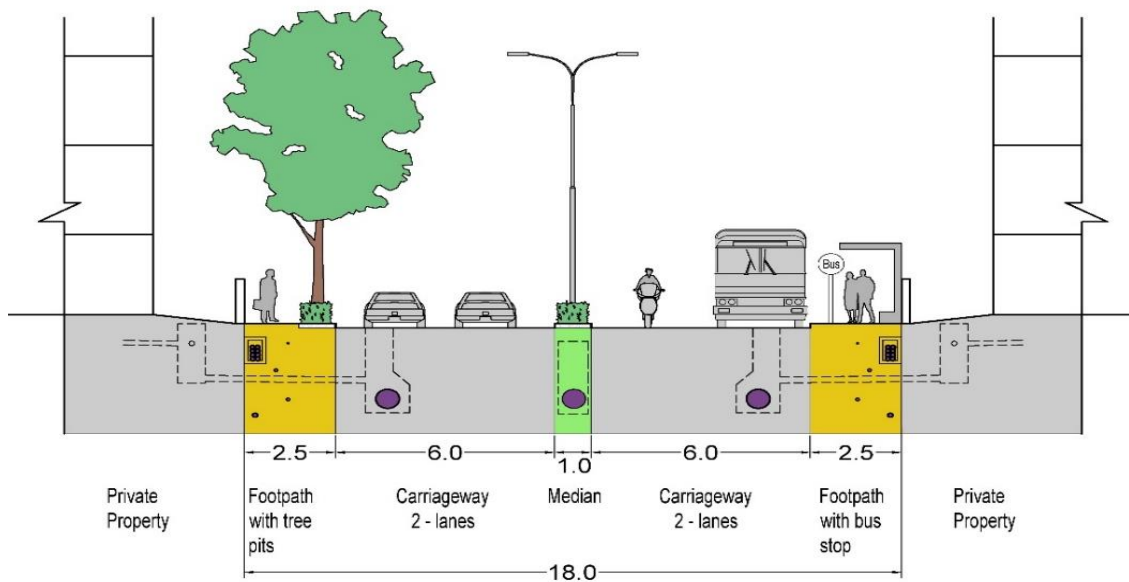


Figure 42 TYPICAL SECTION OF 18M WIDE ROAD

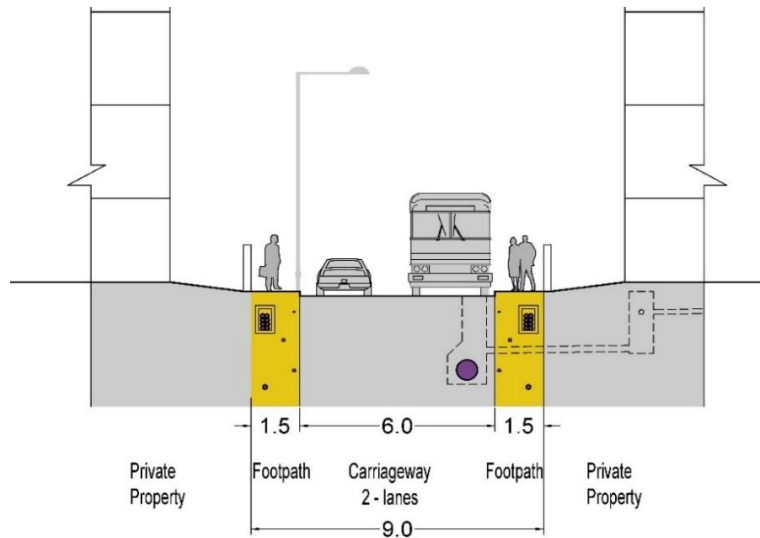


Figure 43 TYPICAL SECTION OF 9M WIDE ROAD

5.3.2 DEVELOPMENT OF RING ROAD

The road network in Nellore is largely linear. Accessing Krishnapatnam Road from Podalukur road and Chennai Vijayawada highway is possible only by entering through city, which could be diverted by introducing a ORR connecting ‘Podalukur Road’, ‘Chennai Vijayawada highway’ and ‘Nellore Krishnapatnam Road’. In Nellore the proposed of outer ring road is shown in Figure 5.3-5.



Figure 44 PROPOSED OUTER RING ROAD (ORR)

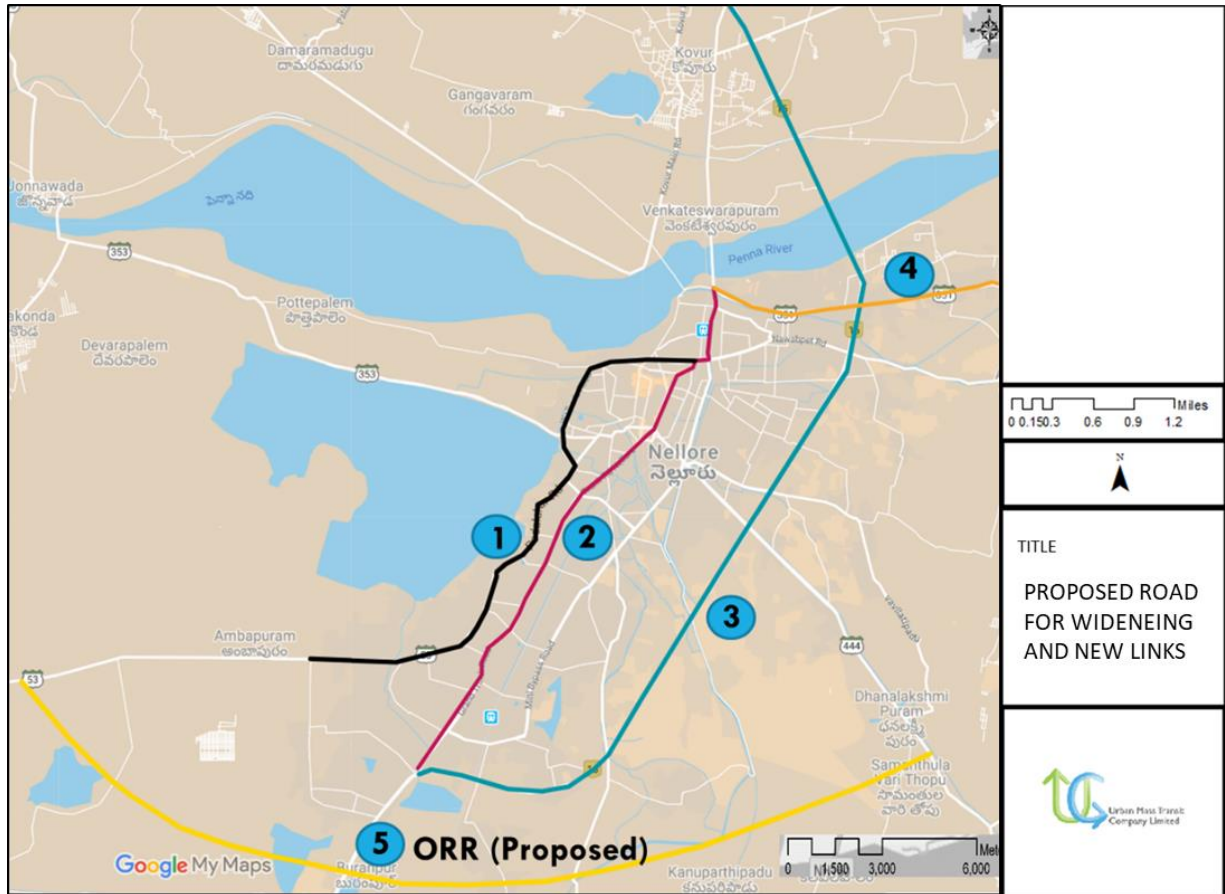


Figure 45 PROPOSED ROAD WIDENING AND MISSING LINKS

5.3.3 ROAD INFRASTRUCTURE DEVELOPMENT (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. Nellore city is bisected into two half by railway line, the roads crossing these rail line need to be provided for safe crossing such as rail under bridge (RUB).

In Nellore flowing locations are identified for providing RUBs, they are,

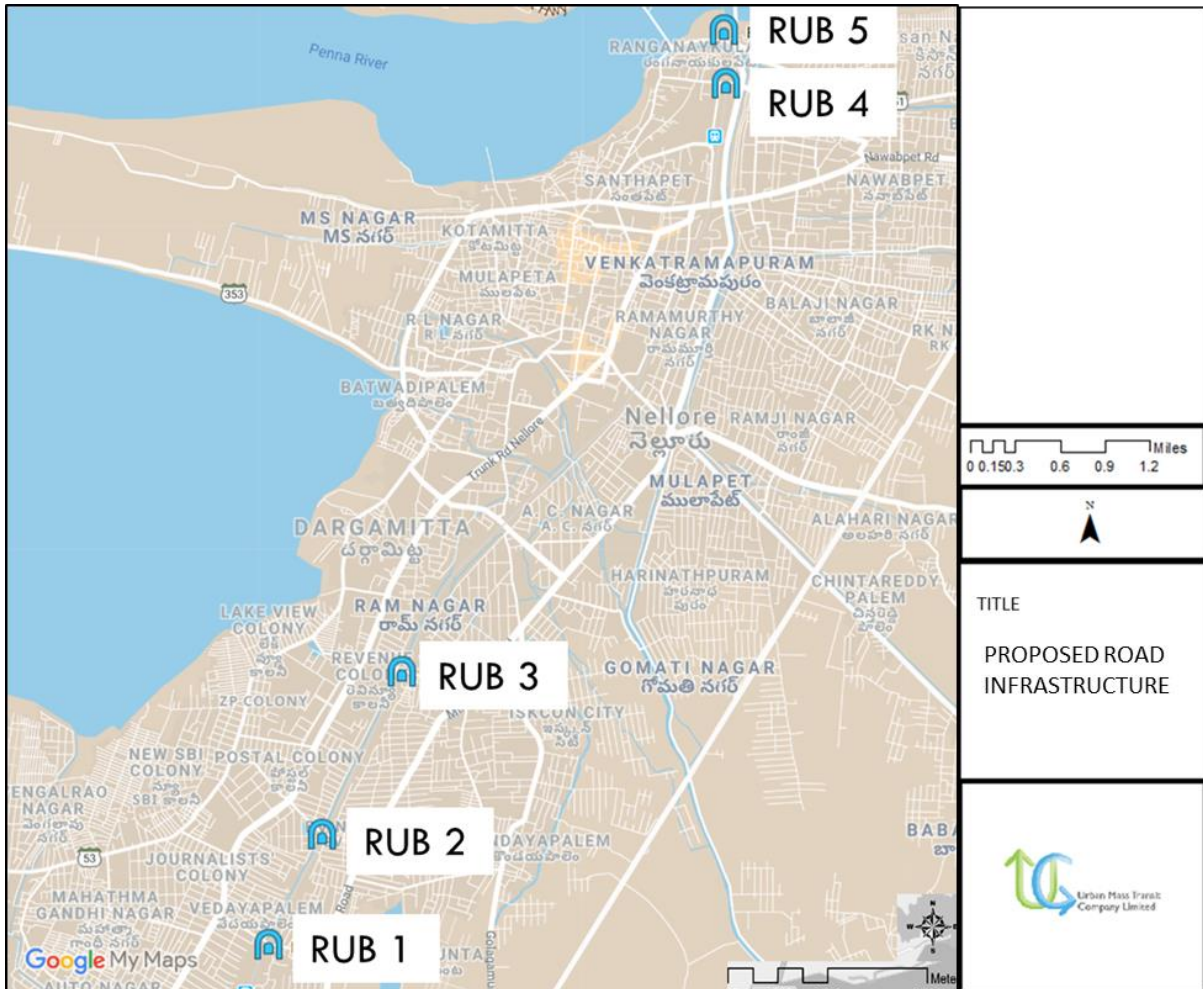


Figure 46 PROPOSED RAIL UNDER BRIDGES

Table 5.3-2 PROPOSED RAIL UNDER BRIDGE CROSSINGS

RUB No	Crossing
RUB 1	Near Vedayapalem Railway Station
RUB 2	BV Nagar main Road
RUB 3	Kondayapalem gate Main Road
RUB 4	Gopuram Street
RUB 5	Penna River Vaaradhi

5.4 NON-MOTORISED TRANSPORT PLAN

The LCMP envisions Nellore as a city with a general sense of well-being through the development of quality and dignified environment where people are encouraged to walk and cycle; equitable allocation of public space and infrastructure; and access to opportunities and mobility for all residents in Nellore. Nellore Municipal Corporation (NMC) 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 Nellore 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.)

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 47 **IMAGES SHOWING CONCEPTS OF LOCAL STREET DESIGNS**

5.4.1.2 DEVELOPMENT OF FOOTPATH

Low Carbon Mobility Plan for Nellore has identified all the major spines of Nellore for immediate need for footpaths. All the junctions in Nellore should be designed with due consideration for pedestrians.

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 5.4-2.

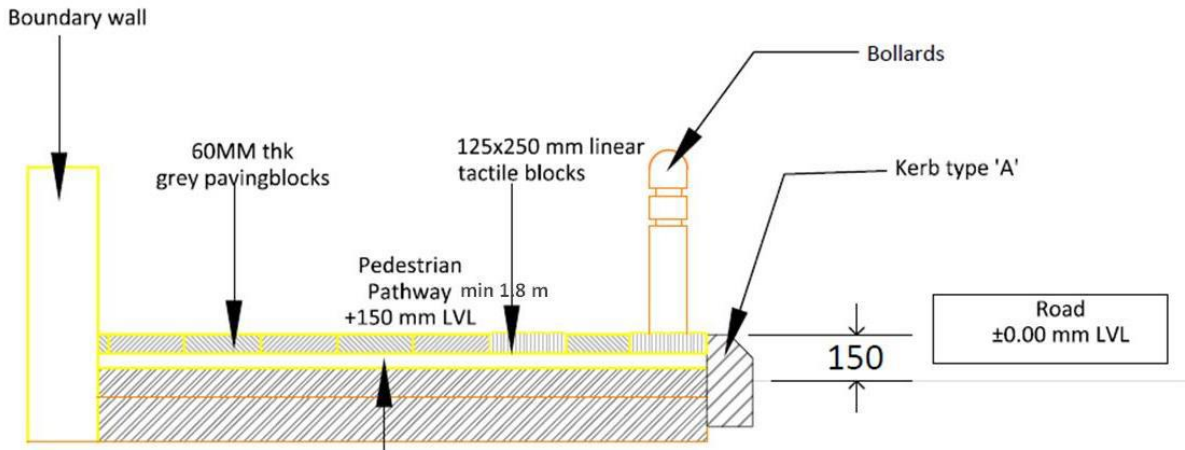


Figure 48 DETAILED CROSS SECTION OF FOOTPATH DESIGN

There are about 32km of road within NMC where the footpaths have to be built. Here, certain routes for improving footpaths has been identified, and are shown in Figure 5.4-2.

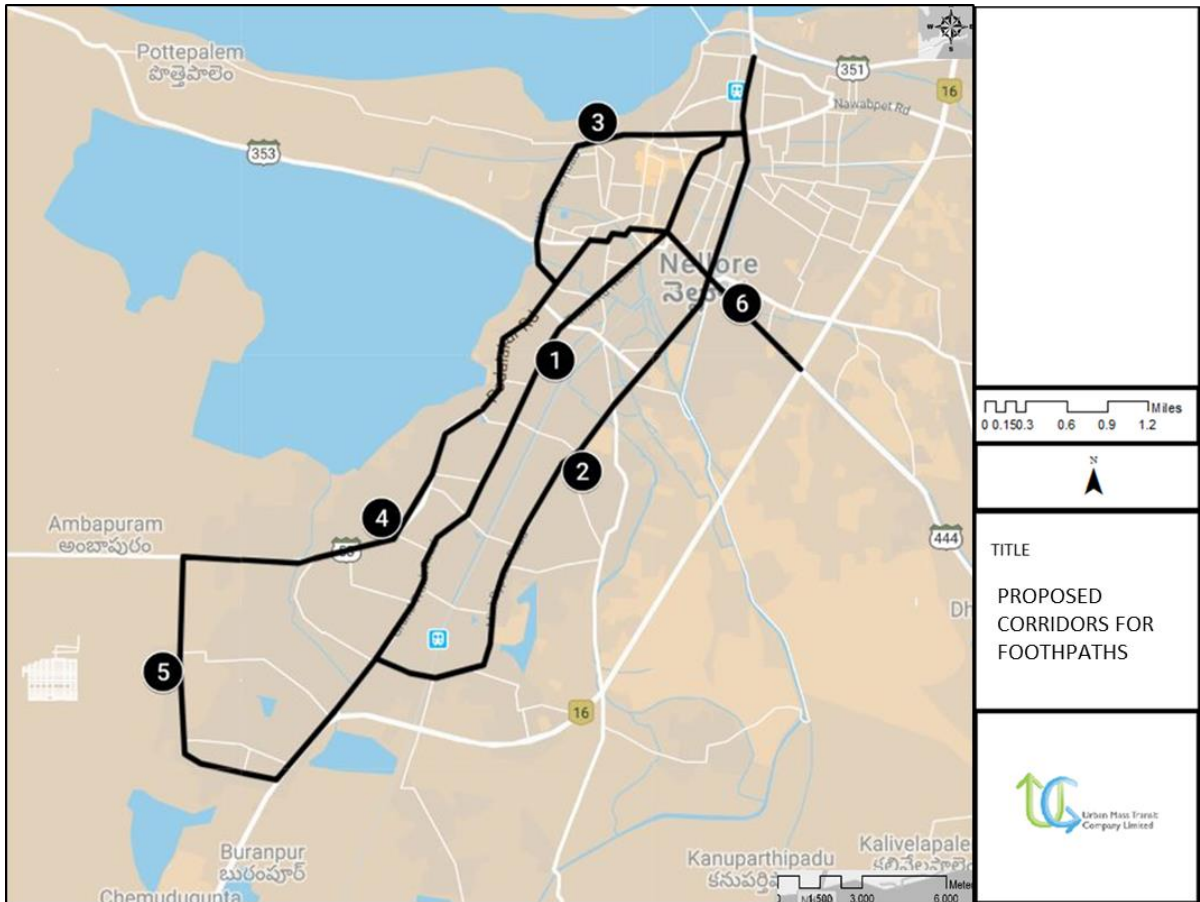


Figure 49 PROPOSED FOOTPATH IMPROVEMENT

Table 5.4-1 Proposed Footpath Improvement

S.no	Name	Stretch	Length (km)
1	Grand Trunk Road	PSR Statue to NHA Office	8.30
2	Mini Bypass Road	Intersection of Mini Bypass road with GT road at Weavers colony	9.2
3	Walkers road	Sindura Nursing Home st to S.Bose Statue	3.4
4	Podlukur Road	Sindura Nursing Home st to AP TRANSCO Junction	6.0
5	Vollur Colony Road	AP TRANSCO to NH 16	3.3
6	Muthukur Road	Ambedker Statue to NH 16	2.2

In the immediate action the footpath along GT road within the City Centre need to be carried out.

5.4.2 DEVELOPMENT OF CYCLIST-FRIENDLY STREETS



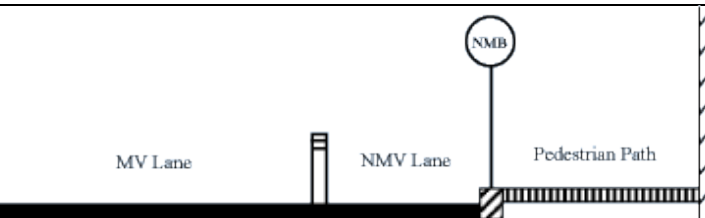
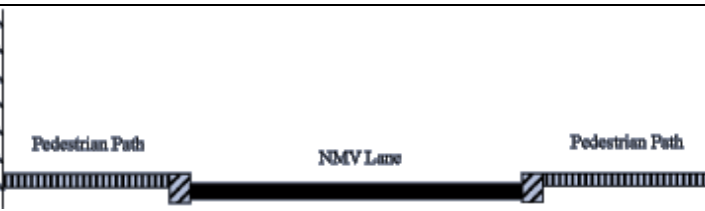
Cycling is increasingly recognized as a clean, sustainable mode of transport and an essential part of an inter-modal plan for sustainable urban travel. More cycling in place of car use could contribute to less energy consumption from travel activity and reduced congestion. Increasing cycling could be 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. Nellore 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 5.4-2.

Table 5.4-2 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 Nellore

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 Nellore.

A total of **32 km bicycle tracks** is proposed in the plan connecting important activity centres and trip attractors and are shown in Figure 5.4-5. Nellore needs to improve the infrastructure to create a safe environment for its cyclists.

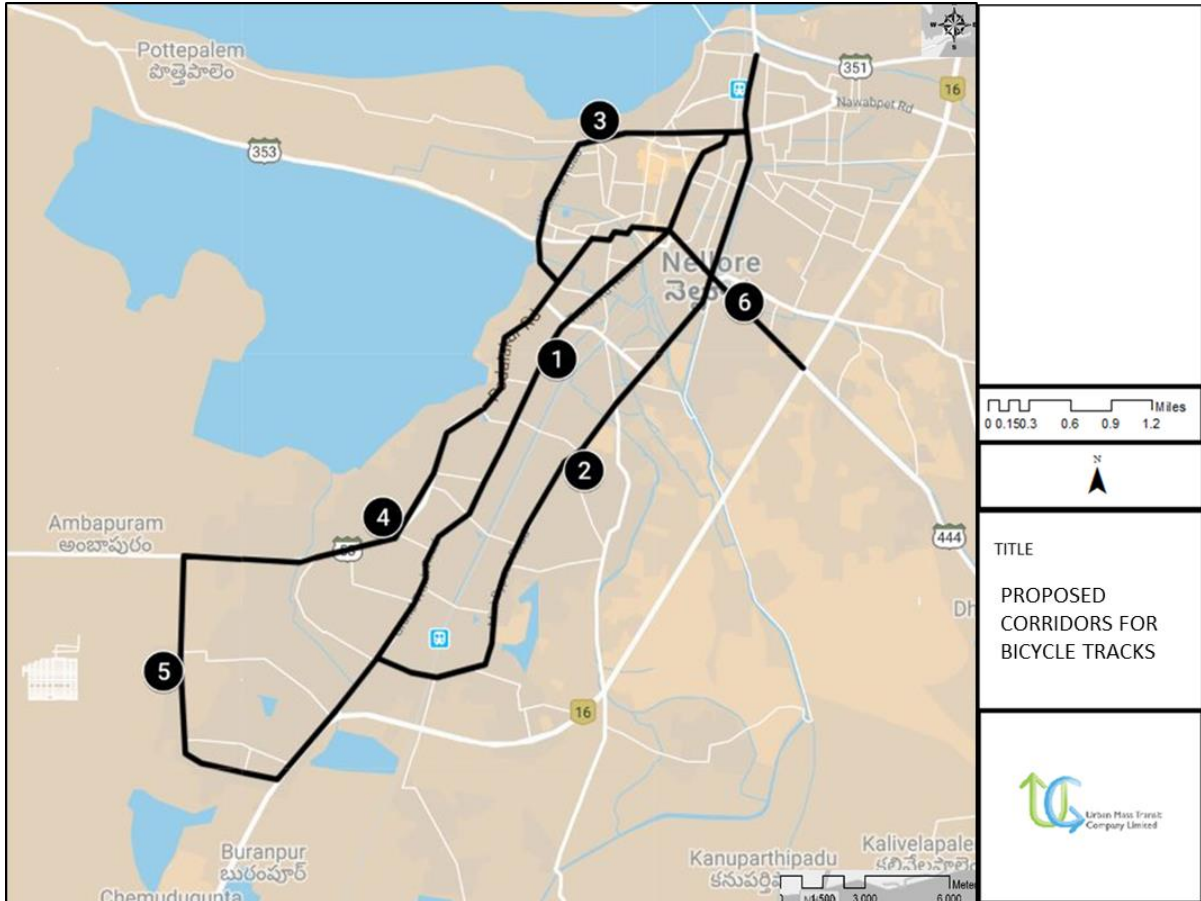


Figure 50 PROPOSED FOOTPATH IMPROVEMENT

Table 5.4-3 PROPOSED FOOTPATH IMPROVEMENT

S.no	Name	Stretch	Length (km)
1	Grand Trunk Road	PSR Statue to NHA Office	8.30
2	Mini Bypass Road	Intersection of Mini Bypass road with GT road at Weavers colony	9.2
3	Walkers road	Sindura Nursing Home st to S.Bose Statue	3.4
4	Podlakur Road	Sindura Nursing Home st to AP TRANSCO Junction	6.0
5	Vollur Colony Road	AP TRANSCO to NH 16	3.3
6	Muthukur Road	Ambedker Statue to NH 16	2.2

5.5 FREIGHT MANAGEMENT PLAN

A safe, reliable and efficient movement of freight and servicing trips to, from, within and through Nellore 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 Nellore 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.

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. Freight policy principles adopted for Nellore 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.

Due to the proximity of Krishnapatnam Port and Chennai to Nellore, goods vehicles cross the Nellore in considerable proportions, hence locations have been identified the outer cordon boundaries.

At present there is no truck terminals in the surrounding of the city, hence it is necessary to propose a new truck terminal for freight vehicles.

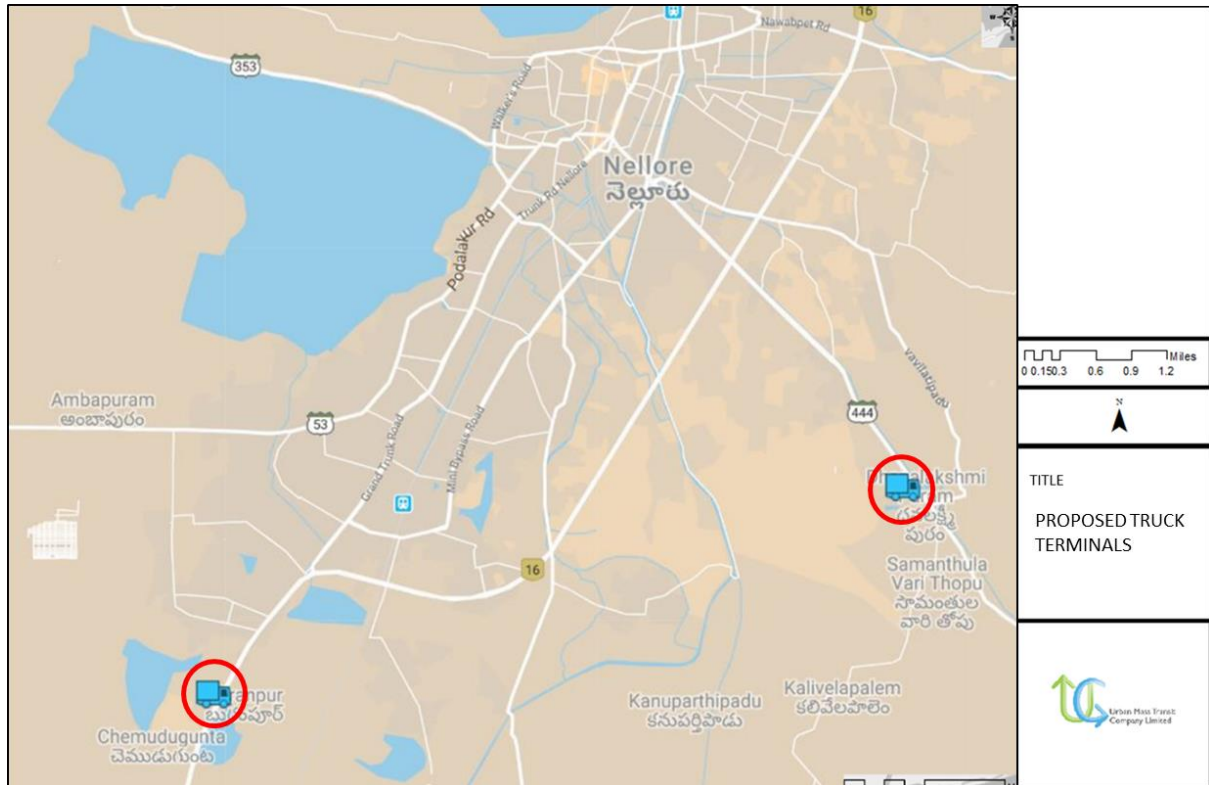


Figure 51 PROPOSED TRUCK TERMINALS

Truck Terminal 1: Serving for trucks utilising Chennai Vijayawada Road

Truck Terminal 2: Serving for trucks using Nellore-Krishnapatnam Road

Prevailing Goods Movement Restrictions in Morning and Evening Peak Hours shall be continued.

5.6 TRAFFIC ENGINEERING AND MANAGEMENT PLAN

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.

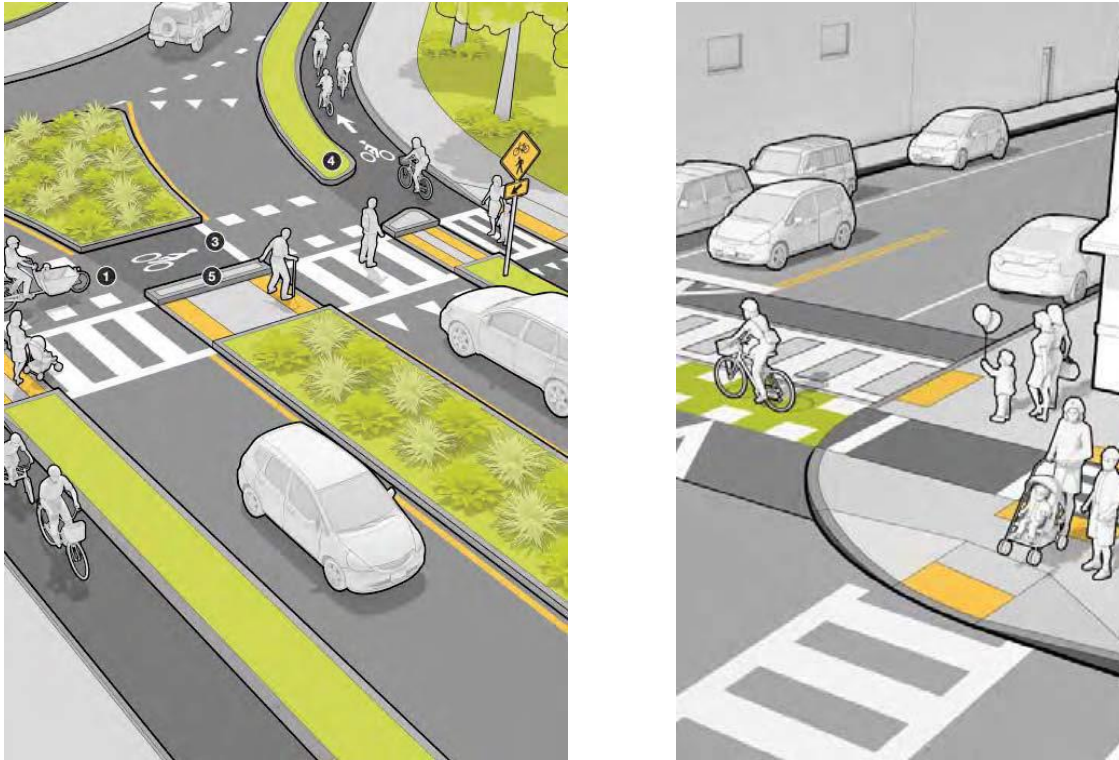


Figure 52 **DESIGN CONCEPTS AS PART OF TRAFFIC ENGINEERING MEASURES¹²**

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 includes following elements,

- Provision of adequate sight distance
- Providing adequate corner radii
- Providing sufficient turning radii
- Flaring approaches towards intersections
- Providing channelizers/division islands

¹² Image Source: <https://www.mass.gov.pdf>

- Provision of Pedestrian Crossing Facility
- Smart Signalisation and Grade Separation
- Parking Proposals
- Providing Road Signs/ Markings
- 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.

Typical junction improvement measures are shown in Figure 5.6-2.

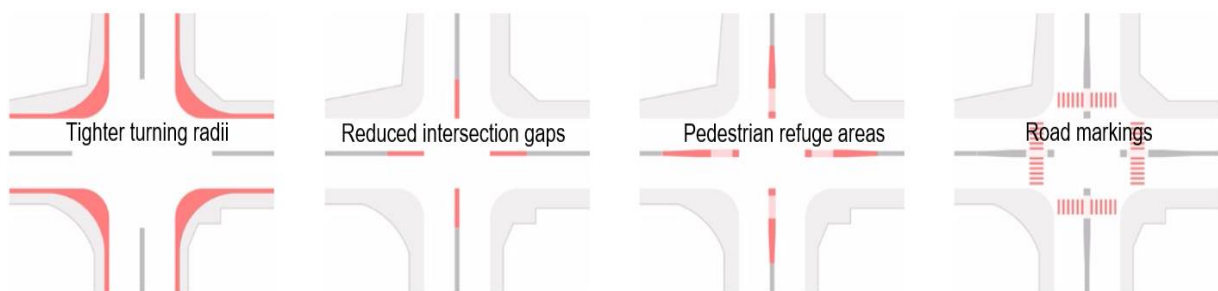


Figure 53 **TYPICAL JUNCTION IMPROVEMENT MEASURES**

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 5.6-2.

Table 5.6-1 JUNCTIONS IDENTIFIED FOR GEOMETRIC CORRECTIONS

S. No	Name of the Junction
1	VRC Junction
2	Muthukur Road Junction
3	PSR Circle
4	Gandhi Bomma Junction

Maximum Number of pedestrians are observed at VRC Junction with almost 38,000 pedestrians in a day (3,115 /Hr), followed by PSR Circle of 29,000 pedestrians per day. Table 11 shows the calculation of $PV^2 / 2 * 10^8$ at important junctions for pedestrians' movement.

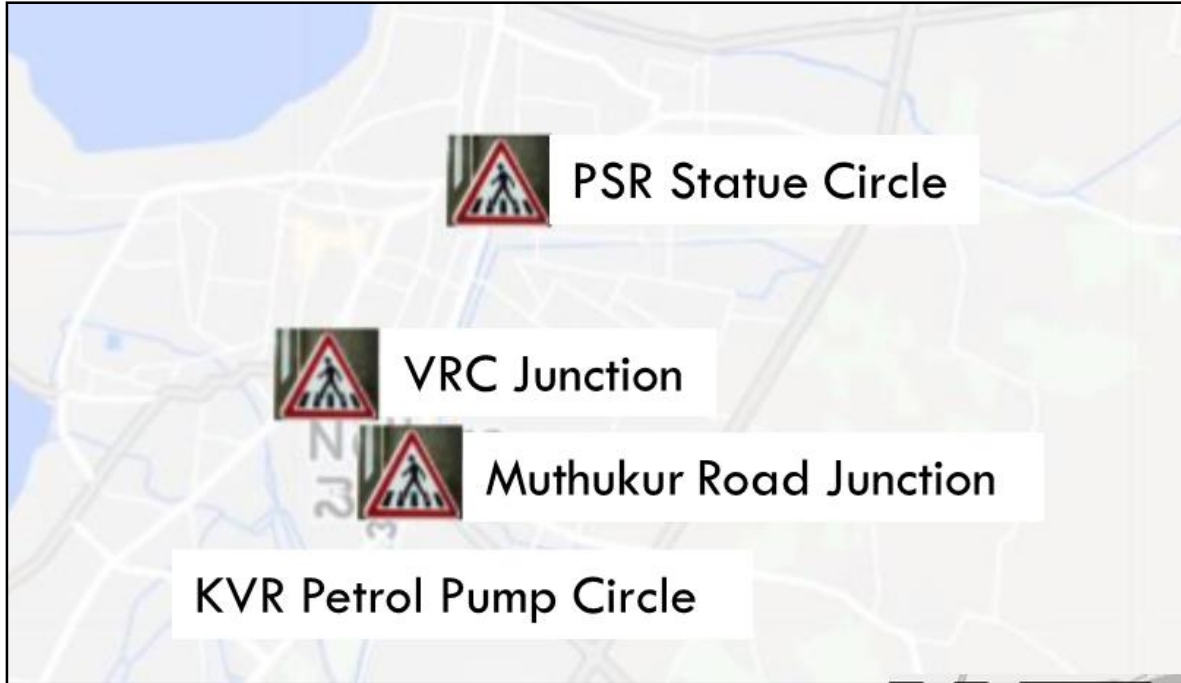


Figure 54 PROPOSED JUNCTIONS FOR PEDESTRIAN CROSSING IMPROVEMENT

Table 5.6-2 PV^2 ANALYSIS FOR VARIOUS JUNCTION IN NELLORE

LOCATION	$PV^2/10^8$	Warrant for Improvement	Proposed Improvement
Potti Sree Ramulu Statue Circle	2.1	Yes	Signalised
VRC Junction	1.1	Yes	Signalised
KVR Petrol Pump Circle	1.5	Yes	Signalised
Grand Trunk Road & Mini Bypass Road Circle	0.68	Yes	Zebra Crossing
Muthukur Road Junction	3.3	Yes	Signalised
Annamayya Circle	0.6	Yes	Zebra Crossing

In terms of PV² value, Muthukur junction is having the higher value, hence much attention needs to be given, followed by PSR Circle, VRC Junction, KVR Petrol Pump Circle.

Signalisation serves for short term and grade separation serves for long term. Figure 5.6-3 shows the locations where the signalisation and grade separation need to be carried out.

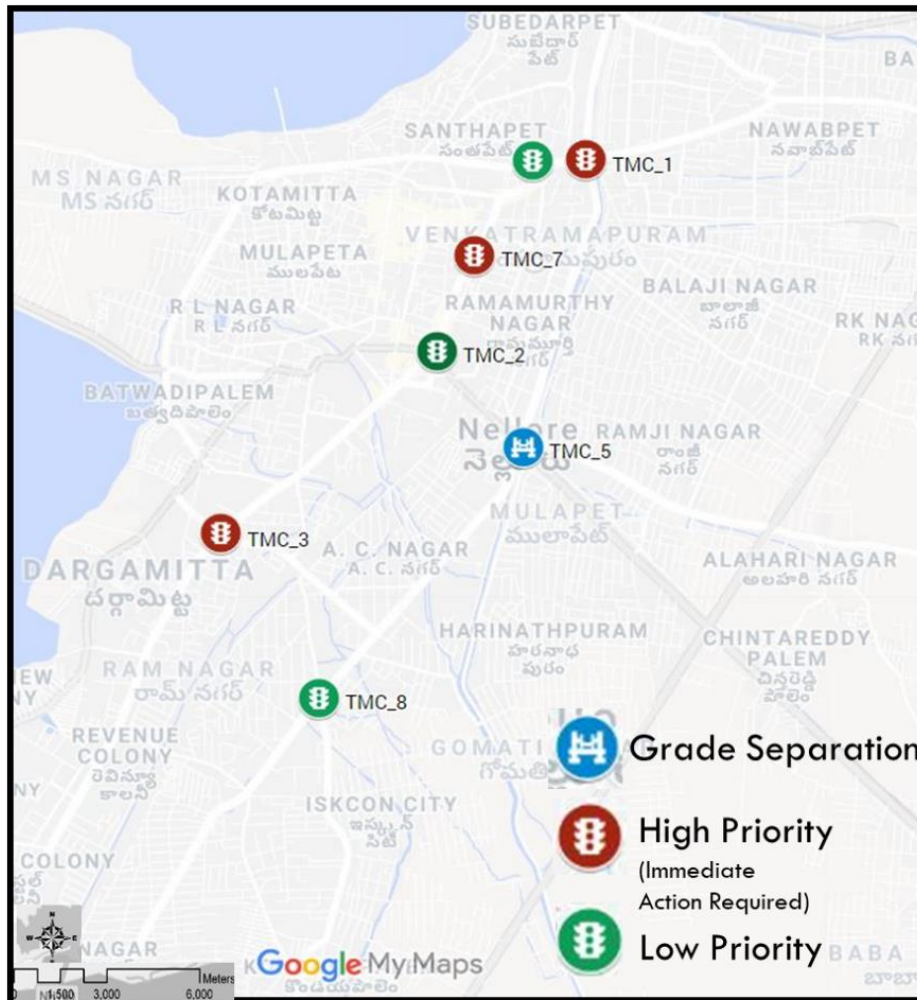


Table 5.6-3 SIGNALISATION AND GRADE SEPARATION LOCATIONS

Table 5.6-4 SIGNALISATION AND GRADE SEPARATION LOCATIONS

CODE	LOCATION
TMC_1	Potti Sree Ramulu Statur Circle
TMC_2	VRC Junction
TMC_3	KVR Petrol Pump Circle
TMC_5	Muthukur Road Junction
TMC_6	Bose Bomma Jn

TMC_7	Gandhi Bomma Jn
-------	-----------------

PSR Circle, KVR Petrol Pump Circle and Gandhi Bomma Junction requires immediate attention in terms of signalisation, Muthukur Junction needs grade separation over long term operation.

5.6.2 TRAFFIC MANAGEMENT PLAN

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.

5.6.3 ONE-WAY STREET SYSTEM

One-way Street system is one of the cost effective and efficient way of traffic management measure, which augments the extra lanes from the opposite direction which is requires more capacity. In Nellore One way street system shall be implemented from Leela Mahal Center to

Kanaka Mahal Center Bus Stop, the parallel road from Raghava Cine Complex Road and S2 Multiplex Road shall be used for opposite direction flow of GT road.

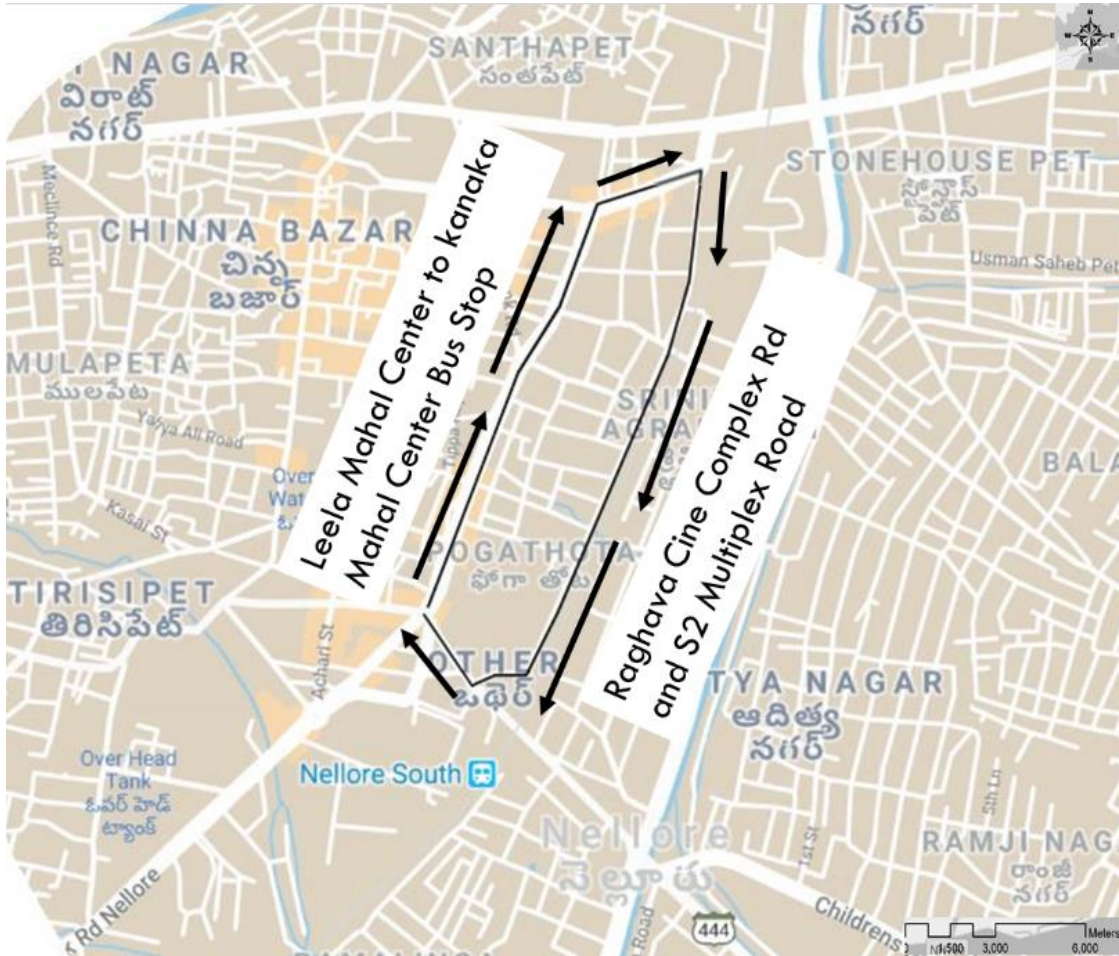


Table 5.6-5 Proposed One-Way Street System

5.6.4 PARKING PROPOSALS

On street and Off street parking shall be implemented as in master plan proposed for Nellore.

Off street parking shall be constructed near district court building and On street parking shall be implemented in north direction of RTC bus stand, to avoid the parking chaos in front of RTC bus stand.

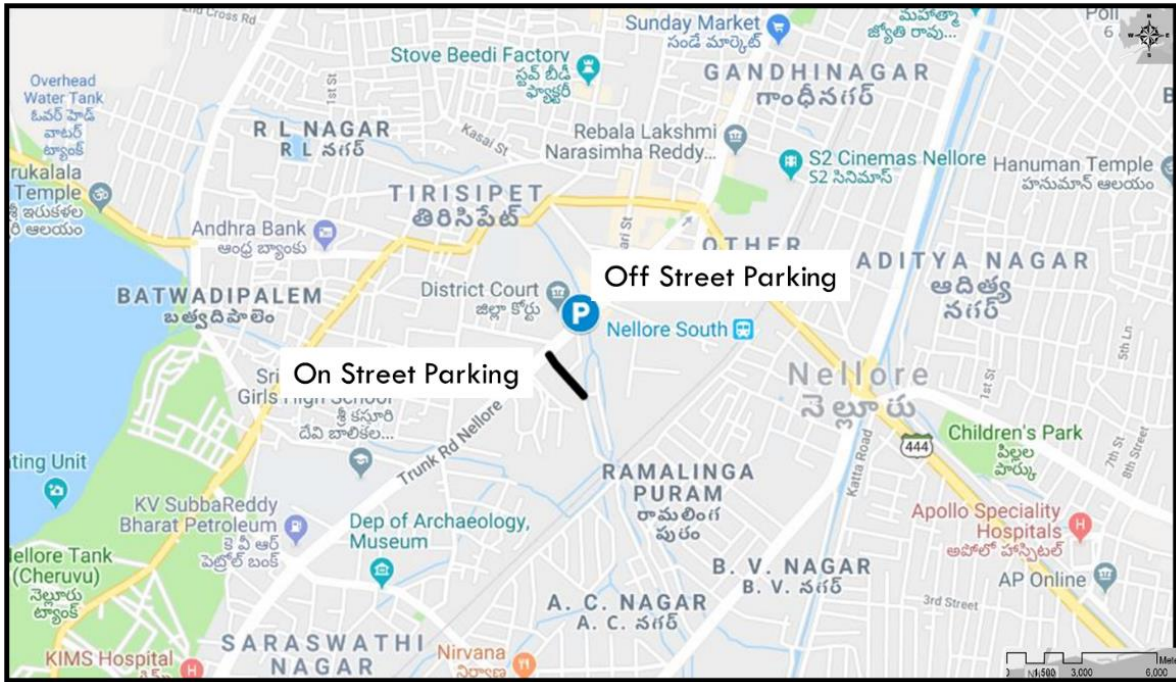


Table 5.6-6 PARKING PROPOSAL LOCATIONS

5.6.5 PAVEMENT MARKINGS AND SIGNAGES

Even though road signs and markings are provided on major road stretches of Nellore, 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.
- b) **Cautionary/Warning Signs:** To caution the road users of certain hazardous condition either on or adjacent to the roadway. Some examples are Hairpin bend, Narrow Bridge etc.
- c) **Informatory Signs:** These signs are used to provide information and to guide road users along routes. The information could include name of places, sites, direction to the destinations etc.
- d) **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 55 MANDATORY SIGNS



Figure 56 CAUTIONARY OR WARNING SIGNS



Figure 57 INFORMATORY SIGNS

5.7 TRAVEL DEMAND MANAGEMENT STRATEGY

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 07:00 hrs and 22:00 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 CBD/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
 - 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

Though it will be tough to implement such enforcement measures in small city like Nellore, it could be considered in future for managing the demand.

The parking must be severely restricted in along GT road and must be allowed to park only in designated locations, must be restricted strictly along 100 metre from road intersections.

5.7.2 ON-STREET PARKING- DEMAND MANAGEMENT

1. Many of the on-street parking locations show a parking index of less than 50%. NMC 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. NMC 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 58 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 TECHNOLOGY 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 SYSTEM

ITS encompasses all modes of transportation- air, sea, 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:

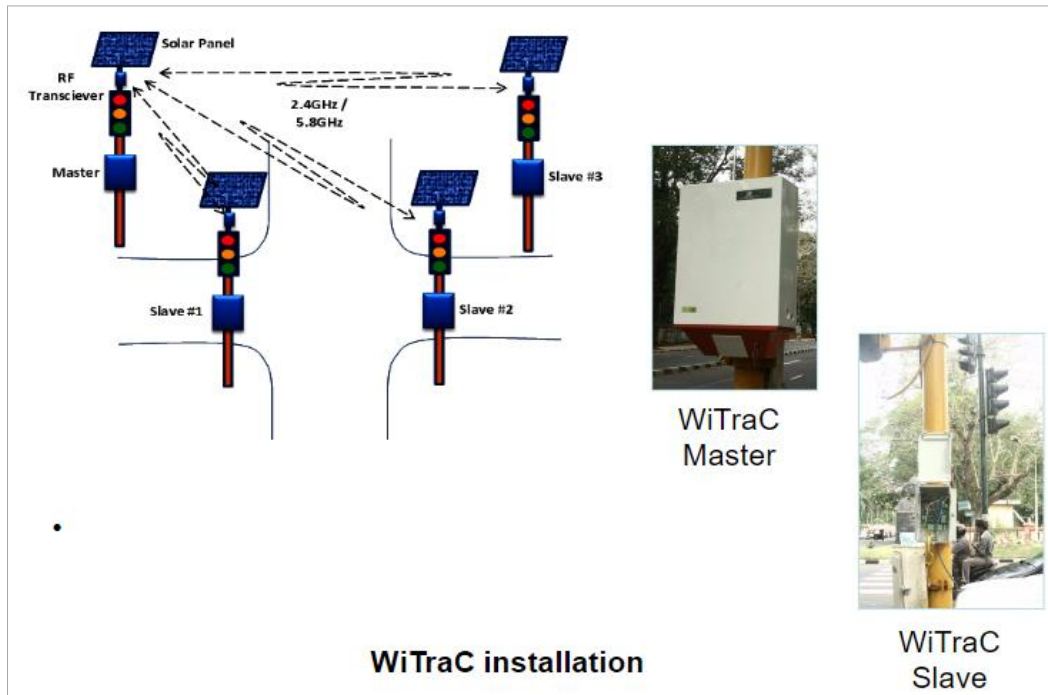


Figure 59 **WITRACC INSTALLATION**

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

Table 5.8-1 CITIES WITH WITRAC SYSTEMS IMPLEMENTED

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



Figure 60 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%

5.8.2 ATCS FOR NELLORE CITY

ATCS as a smart feature, can be implemented on a proposed major PT corridors along GT road on pilot basis for long term. Three junctions shall be considered for implementing the ATCS on pilot basis, they are

S. Bose Statue Jn, Gandhi Statue Jn, Sri Magunta Subbarami Reddy Statue Jn.

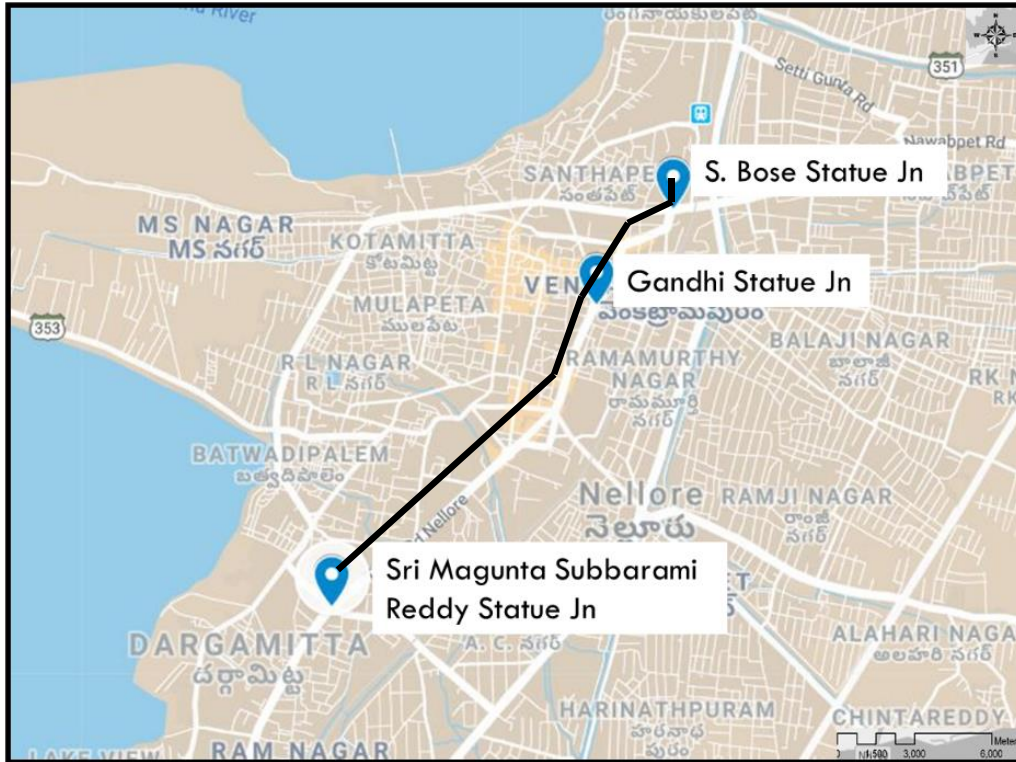


Figure 61 Proposed Pilot Corridor & Junctions for ATCS

The system can be implemented and impact assessment can be done for the same. Given the assessment shows the considerable improvement, the system can be implemented citywide in a phased manner.

5.8.2.1 PASSENGER INFORMATION SYSTEMS (PIS)

In the case of public transit, PIS refers to an information system, which provides real-time, dynamic information for passengers. This may include both predictions about arrival and departure times, and information about the nature and causes of disruptions. The system utilizes vehicle location data from AVL systems to disseminate information on the current location of the bus to passengers and predict arrival times at bus stops (Green City Streets n.d.). This is particularly useful on low-frequency routes and when buses deviate from scheduled times due to unforeseen circumstances¹³.

¹³ Source: Bus Karo 2.0

The first generation of PIS involved the use of light-emitting diode (LED) display boards at bus stops to indicate estimated arrival times for the next bus. Through the urban bus specifications recommended by the Ministry of Urban Development (MoUD), this system was used inside buses to announce next-stop information; however, general observations (EMBARQ India 2014) indicate that several systems remain unused or non-functional. Few cities experimented with the option of communicating this information via SMS, but with limited success. Current advancements in telecommunications, such as smart phones, create the potential to track buses in real time through mobile phone Apps, which is currently being adopted by BMTC in Bangalore for their city bus systems.



Figure 62 PIS SYSTEMS RECOMMENDED FOR NELLORE



Figure 63 PIS SYSTEMS AND APP AND WEBSITE APPLICATION OF BMTC

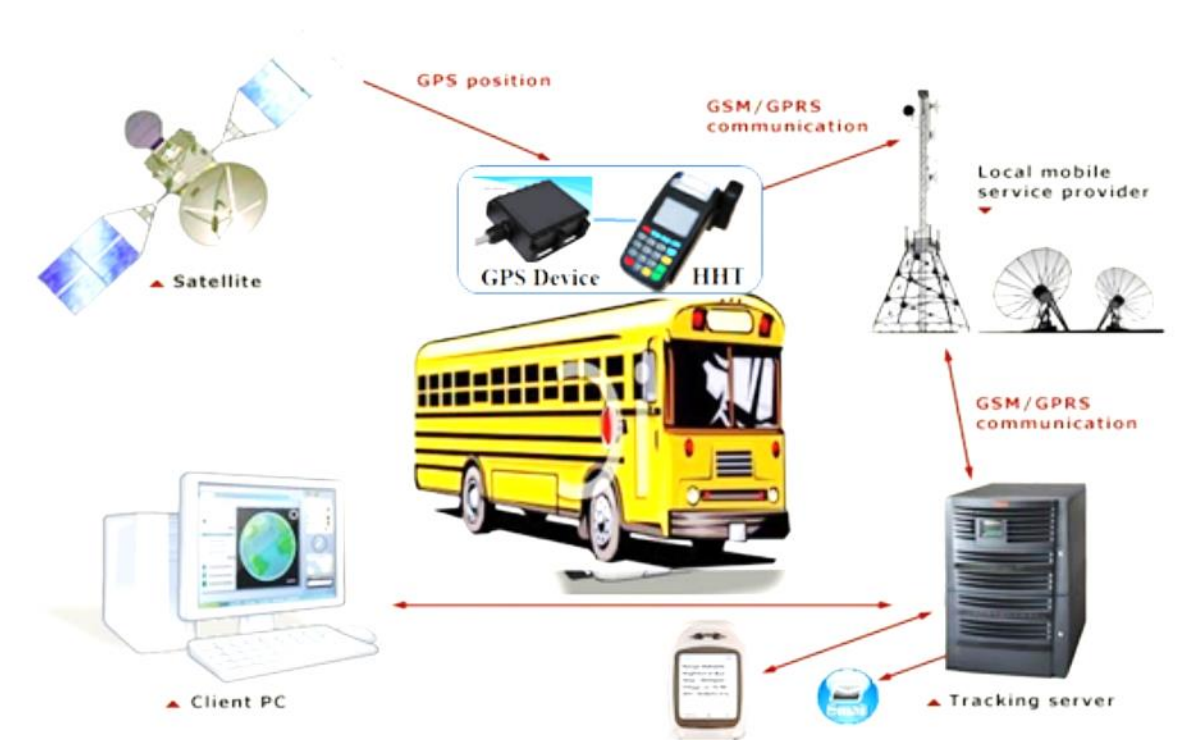


Figure 64 PIS SYSTEMS

In case of Nellore, 408 Buses proposed for city bus services shall be embedded with PIS facilities and all the terminals and bus stops shall display real time information and similar user interface model in form of mobile application is suggested to be developed.

5.8.3 VEHICLE TECHNOLOGY

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

5.8.3.1 Compressed Natural GAS (CNG) Buses and Auto Rickshaws:

Natural gas vehicles are increasingly used in Delhi, and other large cities like Ahmedabad, Mumbai, Pune, Kolkata—as well as cities such as Lucknow, Kanpur, etc. In response to high fuel prices and environmental concerns, CNG is starting to be used also in pickup trucks, transit and school buses. The CNG vehicles have the following advantages,

- Natural gas vehicle have lower maintenance costs than other hydrocarbon-fuel-powered vehicles.
- Being a gaseous fuel, CNG mixes easily and evenly in air.
- CNG is less likely to ignite on hot surfaces, since it has a high auto-ignition temperature (540 °C), and a narrow range (5–15 percent) of flammability.

- CNG-powered vehicles are considered to be safer than gasoline-powered vehicles.
- Less pollution and more efficiency:
 - CNG emits significantly less pollution directly than gasoline or oil when combusted (e.g., carbon dioxide (CO₂), unburned hydrocarbons (UHC), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x) and PM (particulate matter)). For example, an engine running on petrol for 100 km emits 22 kilograms of CO₂, while covering the same distance on CNG emits only 16.3 kilograms of CO₂.¹⁴
 - Due to lower carbon dioxide emissions, switching to CNG can help mitigate greenhouse gas emissions.¹⁵ However, natural gas leaks (both in the direct use and in the production and delivery of the fuel) represent an increase in greenhouse gas emissions. The ability of CNG to reduce greenhouse gas emissions over the entire fuel lifecycle will depend on the source of the natural gas and the fuel it is replacing.



Figure 65 **CNG VEHICLES IN INDIA**

In Case of Nellore, the complete proposed fleet of 408 Buses if proposed to be CNG Buses. And is advised to make regulations and policies for Auto Rickshaws plying in city to adopt to CNG vehicles by 2022. The impact of the same is accessed under the Section 6.2.2.

5.8.3.2 ELECTRIC Buses and Auto Rickshaws:

India is in the process of tackling its ambitious objective of having a 100 per cent zero-emissions, electric vehicle fleet by 2030, as envisaged by NITI Aayog. Consequently, experiments on the operational feasibility of all vehicle types, including buses, cars, two-wheelers, rickshaws, taxis and goods vehicles, are beginning. The Indian government understood the environmental need to switch to electric vehicles and to ensure it is a success, a number of initiatives are being implemented.

¹⁴ "Archived copy". Archived from the original on 2012-11-17. Wikipedia.

¹⁵ "Gas South: Compressed Natural Gas". www.gas-south.com.

Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles (FAME Scheme) is one of said initiatives. FAME provides subsidies as a financial incentive to buyers of electric vehicles. The scheme allocated approximately INR155 crore for demand incentives in 2015-2016 and around INR340 crores between 2016-2017. As a result, each mode of transport has experienced some acceleration towards electrification.



Figure 66 **ELECTRIC VEHICLES**

In comparison to conventional CNG or diesel buses, electric buses are very costly. The cost of an electric bus available in the Indian market is typically three to four times the price of a CNG or diesel bus. Though it is suggested to shift to electric vehicles by 2038, CNG bus are opted as city based public transportation system being new introduced in Nellore.

Whereas, 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 are to provide connectivity to provide connectivity.

As E-Rickshaws come in various adoptive sizes they act as a viable and sustainable intermediate public transit option in the core areas. The impact of the same is accessed under the Section 6.

Chapter 6

**PROJECT IMPACT
ASSESSMENT**



6 PROJECT IMPACT ASSESSMENT

6.1 PHASING AND PRIORITIZATION 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:

1. Mobility
2. Accessibility
3. Safety
4. Energy
5. Environment
6. Carbon-di-Oxide Mitigation
7. Project Cost

6.1.1 PROPOSAL 1: PUBLIC TRANSPORT SYSTEM

Table 6.1-1 PHASING AND PRIORITIZATION OF PUBLIC TRANSPORT 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 6.1-2 PHASING AND PRIORITIZATION OF PEDESTRIAN FACILITY PROPOSALS

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

Table 6.1-3 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 6.1-4 PHASING AND FREIGHT MANAGEMENT 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 6.1-5 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 6.1-6 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 6.1-7 PHASING AND PRIORITIZATION OF ROAD NETWORK PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
Flyovers	Desirable	High	Phase III
ROB's/RUB's	Critical	Low	Phase III
New Links	Critical	Low	Phase III
Road Widening and Upgradation of the Existing Roads	Desirable	Medium	Phase II
Junctions for Geometric Improvements	Critical	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 Nellore are shown in Table 6.1-8, Table 6.1-9 and Table 6.1-10.

6.1.7 SHORT TERM PROPOSALS

Table 6.1-8 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
7	Improved Bus System

6.1.8 MEDIUM TERM PROPOSALS

Table 6.1-9 LIST OF MEDIUM-TERM PROPOSALS

S. No	Projects
1	Upgradation of Existing Roads

S. No	Projects
2	Flyover
3	Shared Cycle Tracks
4	Dedicated Cycle Tracks
5	New Bus Terminal
6	Improved Bus System
7	Proposed Truck Terminals
8	Off-Street Multi-Level Parking
9	ITS Systems

6.1.9 LONG TERM PROPOSALS

Table 6.1-10 LIST OF LONG-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 6.2-1.

Table 6.2-1 IMPACT OF PROPOSED PROJECTS

Name of the Impact	Base Year (2016)	BAU Scenario (2038)	SUT Scenario (2038)
Walk Trips	18.8%	12.2%	36.7%
Private Transport (PVT) Trips	42.0%	52.1%	20.9%
Intermediate Public Transport (IPT) Trips	19.9%	24.7%	16.8%
Public Transport Trips	17.1%	9.6%	20.8%
Cycle Trips	2.2%	1.4%	5.3%
Avg. Network Speed (kmph)	25	20	25
Avg. Trip Length on Public Transport (km)	9.8	9.0	10.5

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 6.2-2.

Table 6.2-2 BROAD IMPACT OF PROPOSED PROJECTS

Project	ROW/Land Acquisition	Improve Mobility	Reduction in Travel Time
Improved Bus Systems	No	Yes	Yes
Bus Terminals	Yes	Yes	NA
Freight Terminals	Yes	Yes	NA
RUBs/ New Roads/Flyovers	Yes	Yes	Yes
Bypass/Ring Roads	Yes	Yes	Yes
Foot Path	Yes	Yes	NA
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 6.2-3.

Table 6.2-3 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

	Project	Sub Components	Impacts
			<p>on adjacent land-uses and land acquisition.</p> <p>Construction stage impacts include the increase in air and noise pollution.</p> <p>Contamination of road runoff with stacked construction materials.</p> <p>Improvement of traffic conditions during operation stage causing reduction in air and noise pollution.</p> <p>Temporary interruption to traffic and increases of emissions from vehicles due to higher idling times</p> <p>Temporary increase of noise levels due to idling and traffic snarls</p> <p>Alternate traffic diversion routes increasing route length and consequently emissions</p> <p>Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air / noise pollution.</p>
4	Road Network Improvements	Road Widening/New Link/Flyovers	<p>Land acquisition causes loss of livelihood, property dismantling etc.</p> <p>Temporary interruption to traffic and increases of emissions from vehicles due to higher idling times</p> <p>Temporary increase of noise levels due to idling and traffic snarls</p> <p>Alternate traffic diversion routes increasing route length and consequently emissions</p> <p>Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air / noise pollution</p>
		Junction Improvements	<p>May cause removal / displacement of squatters & Encroachers.</p> <p>Air and noise pollution from construction impacts</p> <p>Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth</p>
5	Others-Road Infrastructure	Banning and restrictions	<p>Reduction in urban congestion due to banned movement of freight in the day hours</p> <p>Improved speeds in core area due to reduction in congestion</p>
6	Freight Management	Creation of new freight terminal	<p>Acquisition of land in the peripheries</p> <p>Contamination of runoff from road with construction material as sand / cement/ silt from stacked excavated earth</p>

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 Nellore, there would be:

1. A change in fuels due to greater use of CNG (predominantly in buses), and cleaner petrol and diesel; more efficient engines.
2. More electricity for transportation such as buses, e-rickshaws well as promoting electric vehicles.

The impact of the proposed projects from the environmental effects is analysed at a broader perspective. Very few projects have significantly less impact with respect to air and noise pollution. Some of the broad indicators for environmental impact changes are quantified and are presented in Table 6.2-4 and Table 6.2-5.

Table 6.2-4 ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS

Name of the Impact	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Local Emissions (Tonnes/day)	7.4	7.6	1.8
GHG Emissions (Tonnes/day)	175.1	235.8	87.1
Exposure to Transport Noise	>75	>75	<75
Percent of public transport fleet in compliance with Indian emissions standards	0	0	80%

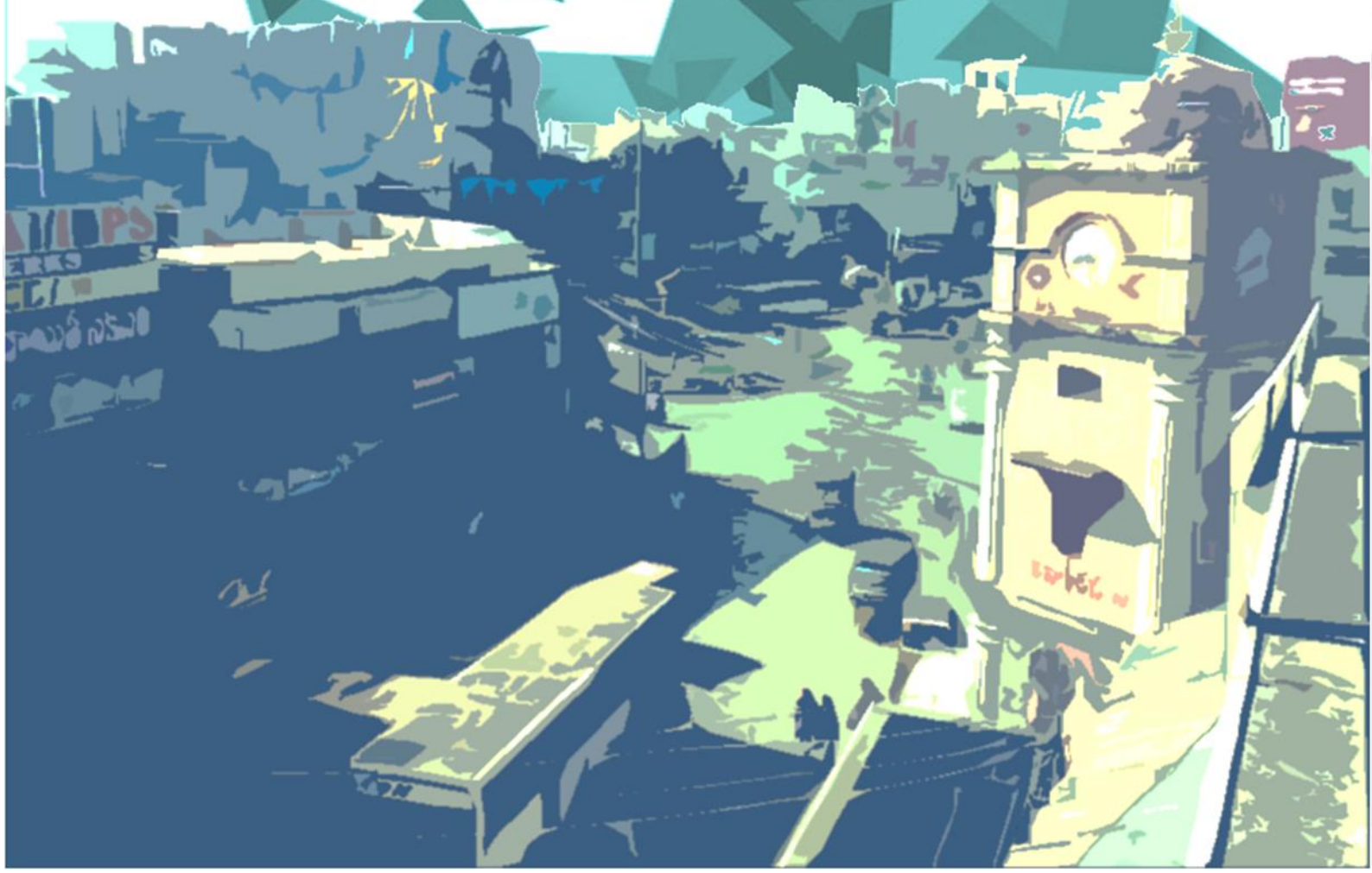
Table 6.2-5 MODE-WISE ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS

Emission Type	Local Emissions				CO ₂ /GHG Emissions			
	Base-2018	BAU-2038	SUT-2038	% Reduction	Base-2018	BAU-2038	SUT-2038	% Reduction
Vehicle Type	Tonnes/Day				Tonnes/Day			
Cars	0.3	0.5	0.1		-83%	13.6	26.4	
2Ws	3.2	5.1	0.6	-88%	50.9	96.7	13.9	-86%
3Ws	1.4	0.9	0.2	-75%	36.6	65.6	18.6	-72%
Buses	2.5	1.2	0.9	-28%	73.9	47.0	49.5	5%
All Modes	7.4	7.6	1.8	-77%	175.1	235.8	87.1	-63%

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

Chapter 7

**IMPLEMENTATION
PLAN**



7 PROJECT 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 240.62 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 260.45 crores. The long-term projects will cost around 721 crores. The detail costing is represented in Table 7.1-1 and Table 7.1-2.

Table 7.1-1 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	316.67	9.03	164.89	142.74
2	Improvement of Non-Motorised Transport Facilities	38.36	38.36	0.00	0.00
3	Improvement of Public Transport System	701.79	110.24	48.35	543.20
4	Improvement of Freight Transportation System	116.59	79.93	36.66	0.00
5	Intelligent Transportation System Facilities	47.95	2.33	10.55	35.06
6	Improvement of Parking Facilities	0.72	0.72	0.00	0.00
Overall LCMP Proposals		1222.08	240.62	260.45	721.00

Table 7.1-2 PHASE WISE COSTING OF THE PROPOSED PROPOSALS

Sl.No	Projects	Unit	Total Quantity	Project Phasing Quantities			Unit Rate (in Crores)	Phasing Rs (in Crores)			Total Cost (in Crores)
				2018-2022	2022-2032	2032-2038		2018-2022	2022-2032	2032-2038	
Improvement of Road Network											
1	Upgradation of Existing Roads	Km.	62.2	2.50	5.85	53.80	2.653	6.63	15.52	142.74	164.89
2	New 4-Lane Roads (Proposed Outer Ring Road)	Km.	16.0	0.00	16.00	0.00	5.041	0.00	80.66	0.00	80.66
3	Flyover (4-Lanes)	No.	1.0	0.00	1.00	0.00	7.694	0.00	7.69	0.00	7.69
4	Rail Under Bridges (4-Lanes)	No.	5.0	0.00	5.00	0.00	12.205	0.00	61.02	0.00	61.02
5	Junction Improvements	No.	4.0	4.00	0.00	0.00	0.600	2.40	0.00	0.00	2.40
Total Proposal Cost								9.03	164.89	142.74	316.67
Improvement of Non-Motorised Transport Facilities											
1	Footpath	Km.	32.0	32.00	0.00	0.00	1.167	37.36	0.00	0.00	37.36
2	Shared Cycle Track	Km	10.0	10.0	0.00	0.00	0.019	0.19	0.00	0.00	0.19
3	Dedicated Cycle Track	Km	22.0	22.0	0.00	0.00	0.037	0.82	0.00	0.00	0.82
Total Proposal Cost								38.36	0.00	0.00	38.36
Improvement of Public Transport System											
1	Bus Fleet Augmentation-(Diesel & CNG Buses)	No.	256.0	151.00	67.00	38.00	0.722	108.97	48.35	27.42	184.74
2	New Bus Terminal (Area = 49552.25 Sq.m)	No.	1.0	1.00	0.00	0.00	1.274	1.27	0.00	0.00	1.27
3	Bus Rapid Transit System	Km.	24.3	0.00	0.00	24.30	21.225	0.00	0.00	515.77	515.77
Total Proposal Cost								110.24	48.35	543.20	701.79
Improvement of Freight Transportation System											
1	Proposed New Truck Terminals	Sq.m	137325.3	94146.28	43178.97	0.00	0.001	79.93	36.66	0.00	116.59

Sl.No	Projects	Unit	Total Quantity	Project Phasing Quantities			Unit Rate (in Crores)	Phasing Rs (in Crores)			Total Cost (in Crores)
				2018-2022	2022-2032	2032-2038		2018-2022	2022-2032	2032-2038	
Total Proposal Cost								79.93	36.66	0.00	116.59
Intelligent Transportation System Facilities											
1	New Signal Installations	No.	6.0	3.00	3.00	0.00	0.425	1.27	1.27	0.00	2.55
2	Area Traffic Control System	Km.	3.0	0.00	0.00	3.00	0.637	0.00	0.00	1.91	1.91
3	ITS control Centre, PIS, Common Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras)	Km.	102.5	2.50	21.85	78.10	0.425	1.06	9.28	33.15	43.49
Total Proposal Cost								2.33	10.55	35.06	47.95
Improvement of Parking Facilities											
1	On street Parking	Km.	1.0	1.00	0.00	0.00	0.464	0.46	0.00	0.00	0.46
2	Off street Parking (Surface)	No.	1.0	1.00	0.00	0.00	0.258	0.26	0.00	0.00	0.26
Total Proposal Cost								0.72	0.00	0.00	0.72
Overall Low Carbon Mobility Plan Proposals											
Total Project Cost								240.62	260.45	721.00	1222.08

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 Gol 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:

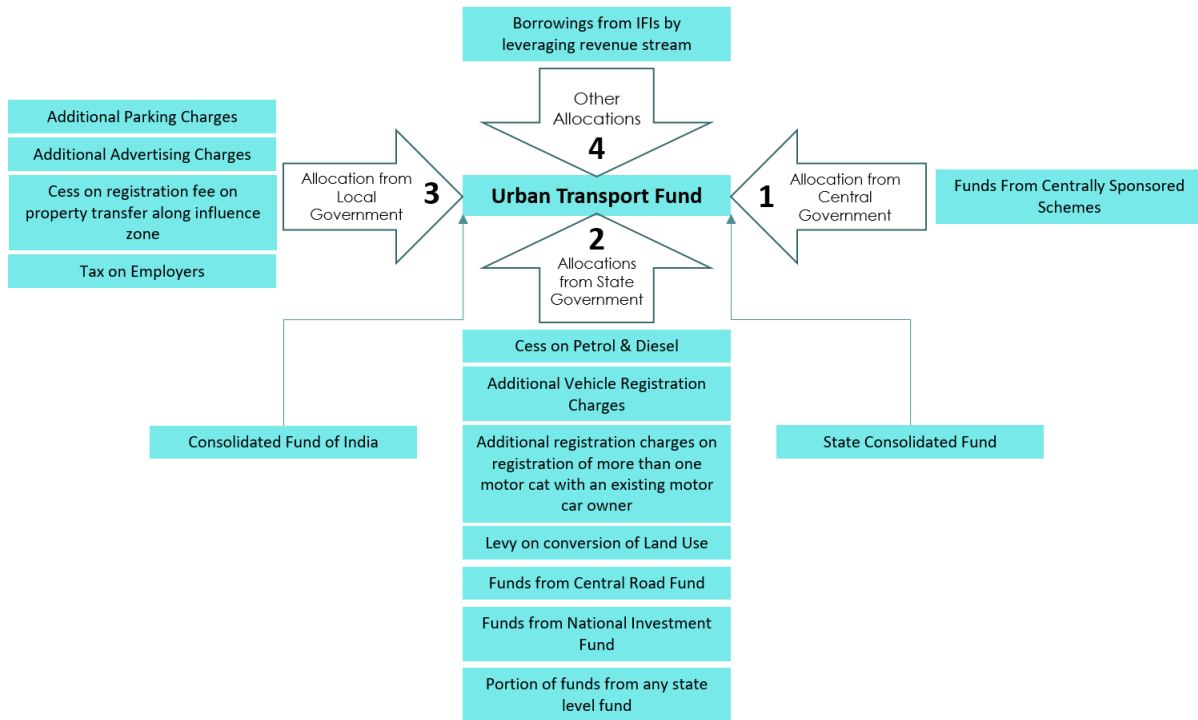


Figure 67 SOURCES OF FUNDS FOR URBAN TRANSPORT FUND

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 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

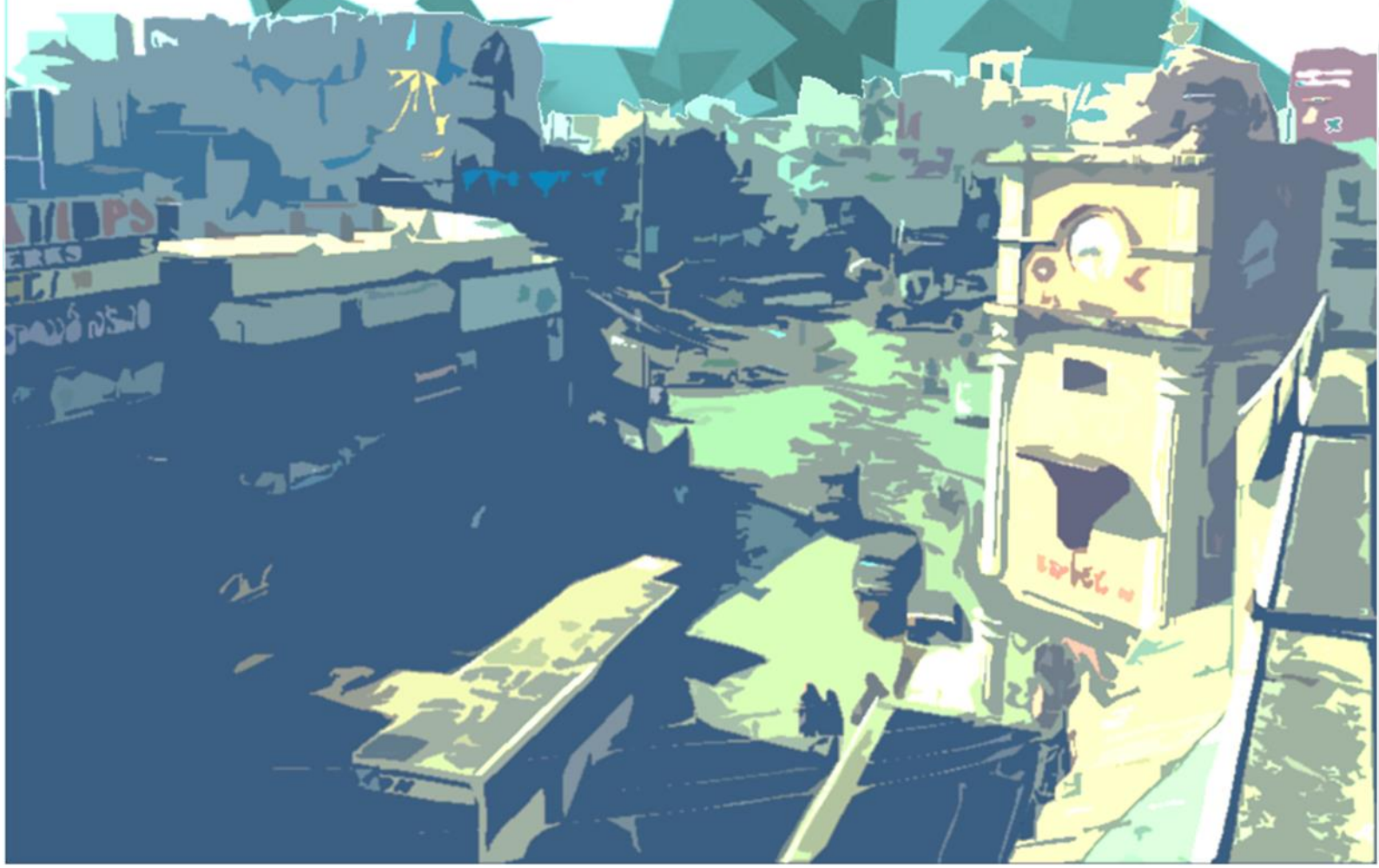
This is another important source of revenue for the city. When properly utilised, this source can be of immense value in supporting sustainable urban transport measures in a city. The revenues from advertising in the city can be used to improve the existing transport system and/or create new schemes 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.

Chapter 8

**INSITUTIONAL
PLAN**



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 Nellore.

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

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.

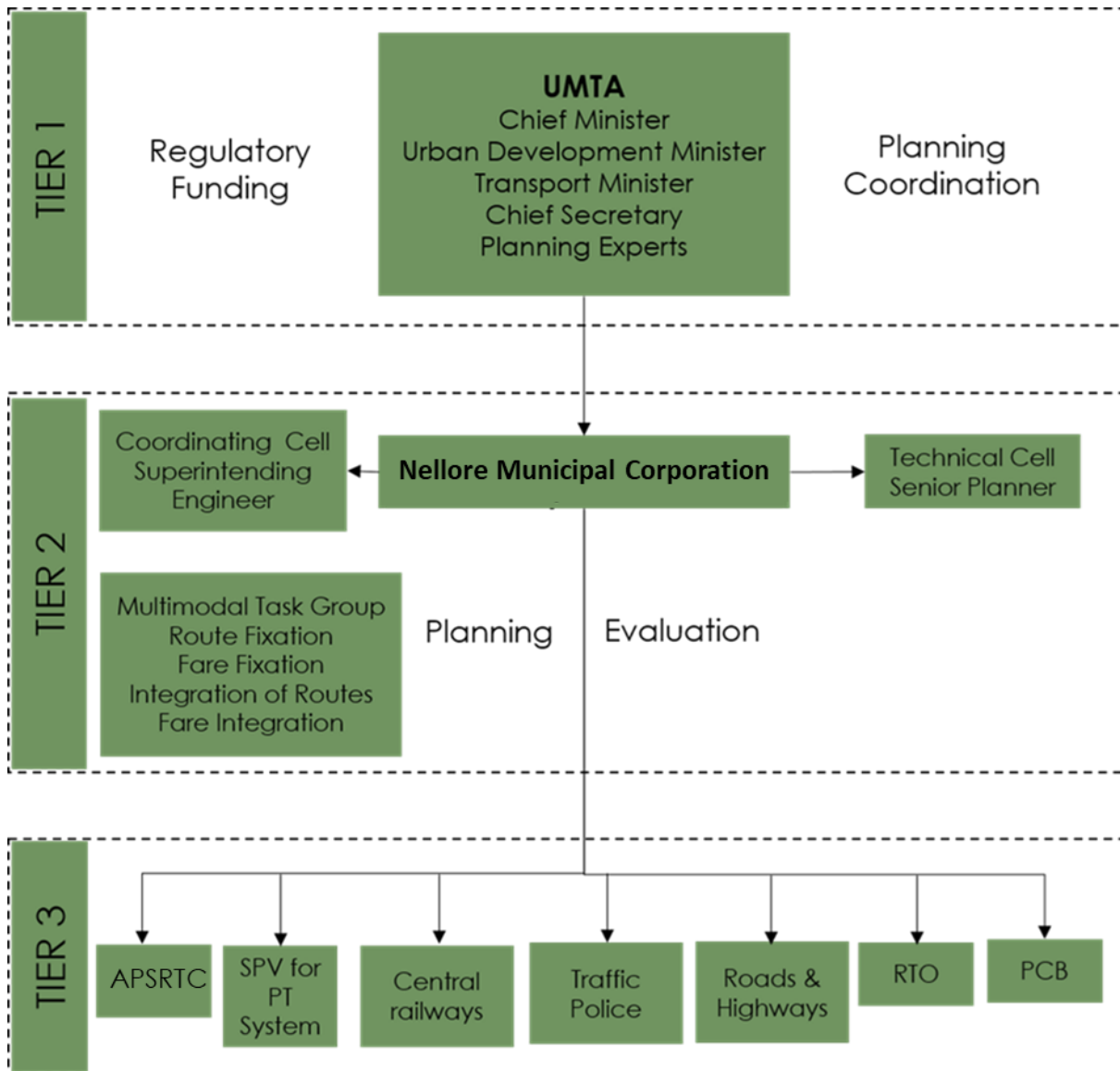


Figure 68 RECOMMENDED STRUCUTRE FOR UMTA SETUP

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 12-1.

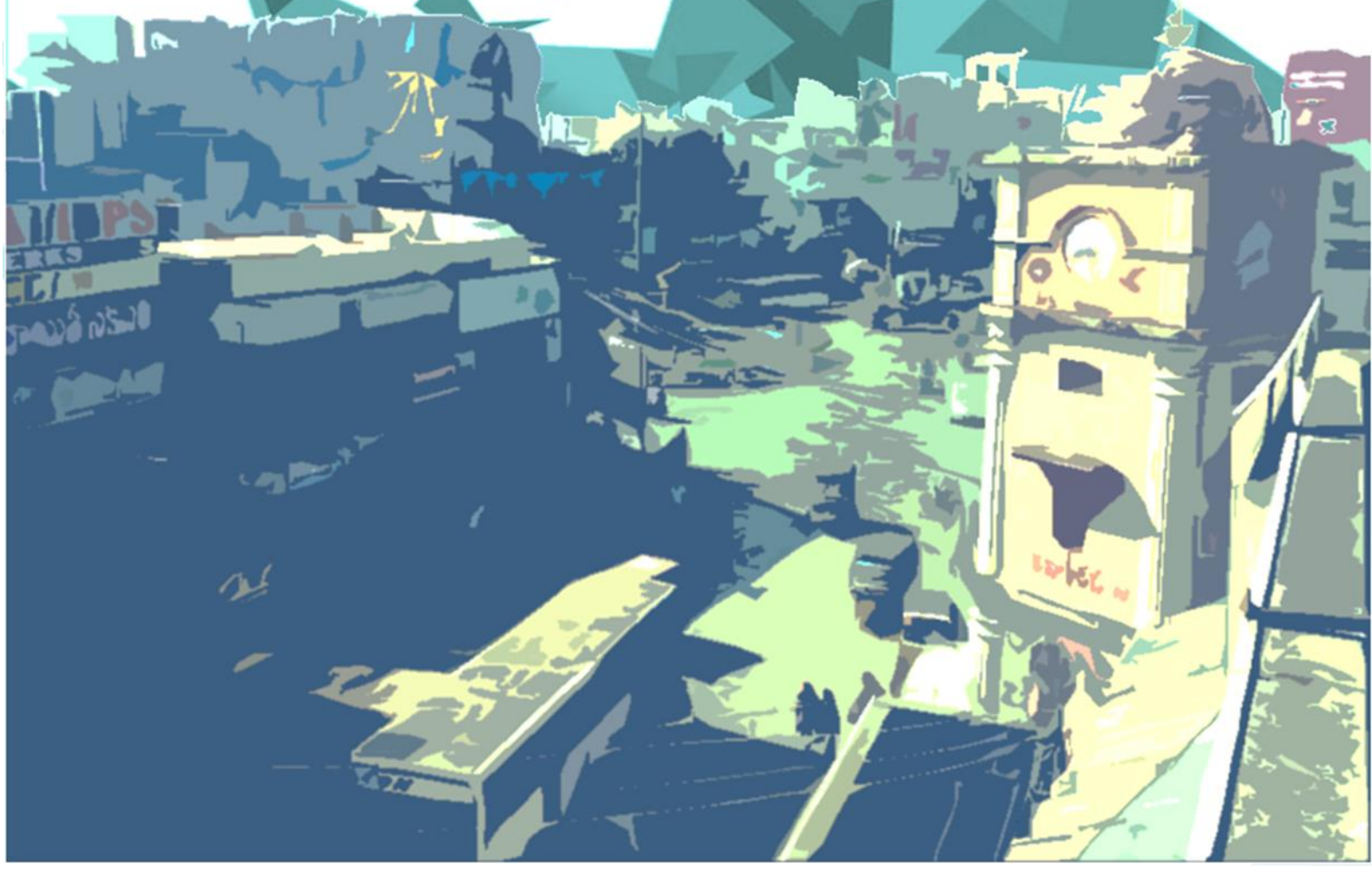
Table 8.5-1 DETAILS OF IMPLEMENTATION AGENCY

Sl.No	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
Improvement of Road Network				
1	Upgradation of Existing Roads	PWD/NHAI/NMC	PWD/ NHAI / Private	PWD / NHAI / Private
2	New Links	PWD/NHAI/NMC	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/NMC	PWD/ NHAI / Private	PWD / NHAI / Private
6	Junction Improvements	PWD / NMC / State Govt. / NHAI	State Govt. / NMC	PWD / NHAI
Improvement of Non-Motorised Transport Facilities				
1	Footpath	NMC / PWD	PWD / NMC/ Traffic Police	NMC / PWD/ Traffic Poilice
2	NMT Only Lanes	NMC / PWD	PWD / NMC	NMC / PWD
5	Shared Cycle Tracks	NMC / PWD	PWD / NMC	NMC / PWD
6	Dedicated Cycle Tracks	NMC / PWD	PWD / NMC	NMC / PWD
Improvement of Public Transport System				
1	Bus Fleet Augmentation-(Diesel & CNG Buses)	APSRTC	State Govt.	APSRTC
3	Bus Shelters	APSRTC/NMC	APSRTC/NMC/PPP	APSRTC/NMC/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 /NMC/traffic police	Gol / State Govt. / NMC	Public Education and awareness program
Improvement of Freight Transportation System				
2	Proposed New Truck Terminals	State Govt. / NMC / Traffic Police	State Govt. / Private	Private

Sl.No	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
Intelligent Transportation System Facilities				
1	New Signal Installations	NMC/Traffic Police	Traffic Police/NMC/PPP	Traffic Police/NMC/PPP
2	Area Traffic Control System	NMC/Traffic Police	Traffic Police/NMC/PPP	Traffic Police/NMC/PPP
3	ITS control Centre, PIS, Common Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras)	NMC/Traffic Police	Traffic Police/NMC/PPP	Traffic Police/NMC/PPP
Improvement of Parking Facilities				
1	On street Parking	NMC/Traffic Police /respective and owner/PWD	NMC/Traffic Police	NMC/Traffic Police
2	Off street Parking (Surface)	NMC/Traffic Police /respective and owner/PWD	NMC/Traffic Police /Private	NMC/Traffic Police /Private
3	Off street Parking (Multi-Level-Car-Parking)	NMC/Traffic Police /respective and owner/PWD	NMC/Traffic Police /Private	NMC/Traffic Police /Private
4	Parking Policy	Traffic Police/NMC		Traffic Police/NMC

Chapter 9

STAKEHOLDER CONSULTATION



9 STAKEHOLDER CONSULTATION

The Stakeholder workshop on Low Carbon Mobility Plan for Nellore 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 Nellore 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 Nellore 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. Karikal Valaven	Principal Secretary to Govt., MA&UD
Mr. N.P.Ramakrishna Reddy	Managing Director, AMRC
Mr. V. Ramudu	Director, Town and Country Planning
Mr. Prakash Ghaur	CEO, APUIAML
Mr. Mutyala Raju Revu	District Collector, Nellore
Mr. M.V. Krishna Rao	Dy. Chief Traffic Manager, APSRTC
Mr. J. Suraj Kumar	Dy. City Planner, NMC
Mr. N. Siva Ram Prasad	Dy. Transport Commissioner, RTA
Mr. S. Rama Krishna	Sr. Vice President, UMTC
Mr. Ankush Malhotra	Vice President, UMTC
Mr. J. Siva Niranjana	Manager, UMTC
Mrs. Harshita Sarma	Asst. Manager, UMTC
Mr. Rakesh Jinka	Project Officer, UMTC
Ms. Sri Navya Annem	Sr. Office, UMTC



FIGURE 69: IMAGES OF THE STAKEHOLDER CONSULTATION MEETING

A detailed presentation on the Comprehensive Mobility Plan for Nellore 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.

The Following observations made by the stakeholders:

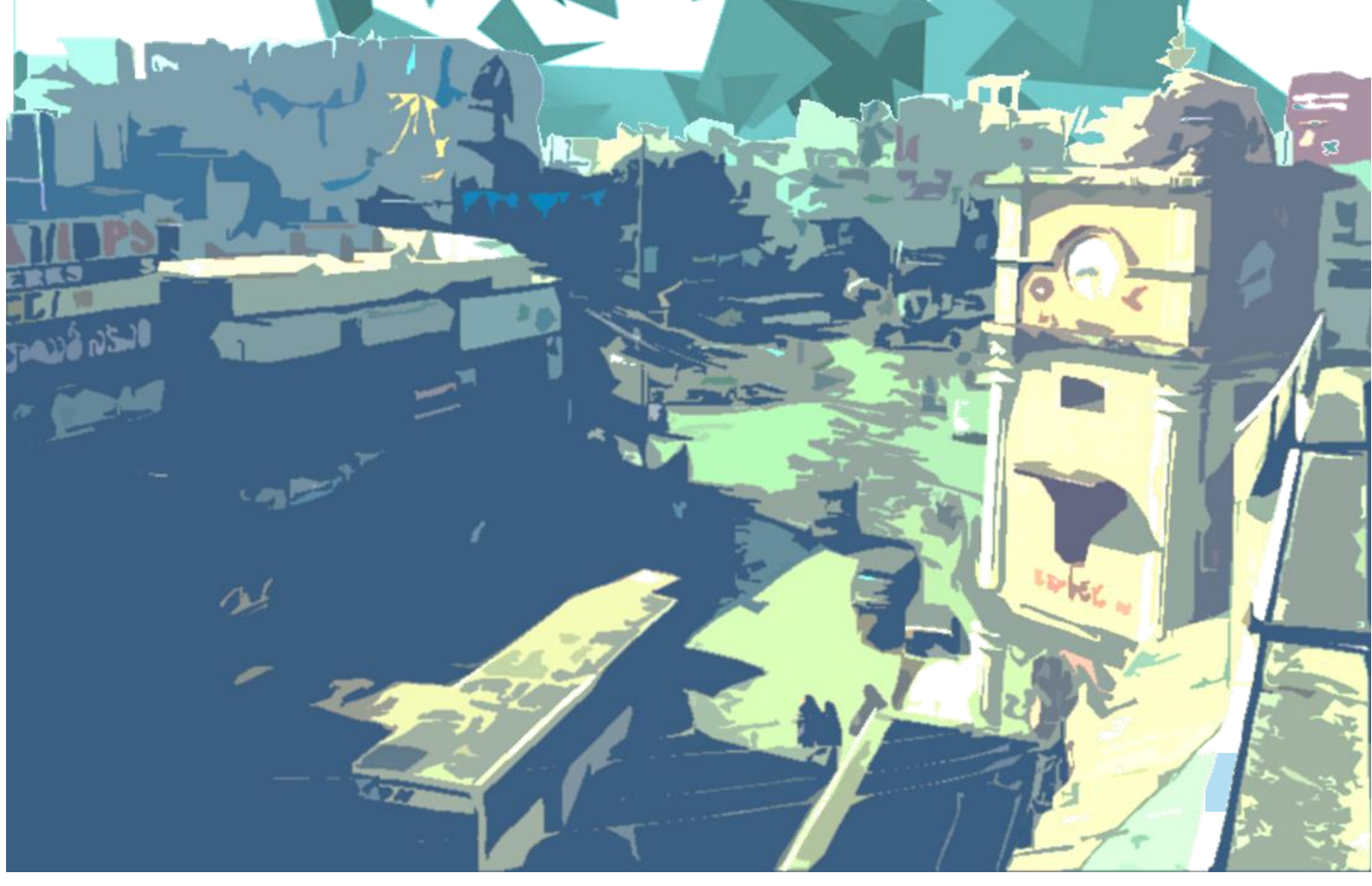
- Mr. Prakash Gaur, CEO, APUIAML stated that APUIAML has already taken up the NMT improvements, ITS Facilities, Smart Retail Parking and Junction Improvements as part of Nellore Smart City Project. The same may be compiled while finalising the CMP report. UMTC team has agreed with the suggestion made by CEO, APUIAML.
- Mr. Mutyala Raju Revu, District Collector, Nellore has suggested the following,

- To shift the APSRTC Bus Stand from the city towards the National Highway.
- The need to propose small bus stands around the city limits to terminate the regional services (bus and auto-rickshaws) entering the city.
- He discussed about the recent initiatives undertaken for prohibiting the auto-rickshaws registration in the city and opined the need for long-term to measures and to provide suggestions without any limitations.
- The need for parking at ACSR Vegetable Market and availability of land in its premises for Multi-level parking and suggest to consider the practicality of the location.
- The requirement for junction improvements and the required land acquisitions especially along KVR Junction, Gandhi Bomma Junction, Bose Bomma Junction etc.

UMTC team explained that the same were already incorporated in the CMP and has agreed to review and incorporated the suggestions. On further discussion District Collector, Nellore and other stakeholders agree upon the need for Parking Master plan in the city.

- Mr. N. Siva Ram Prasad, Dy. Transport Commissioner, has expressed the strong need for regulating Auto-Rickshaw restrictions and suggestions for modifications in the Permits. UMTC team explained that the same were already incorporated in the CMP and has agreed to review and incorporated the suggestions.
- Mr. J. Suraj Kumar, City Planner - NMC has expressed the need for decentralization of activity nodes in the city and agrees with the proposed integrated Land-use Transport and Transit Oriented development strategies along the identified major mobility corridors. He highlighted the congestion issues in Pogathota area and suggests the consultants to provide solutions for the same. UMTC team agreed to incorporate the same in the Final Report.
- Dy. Traffic Manager, APSTRC, Nellore has put forward the concerns regarding the sustainability of City Bus Services and also suggested to include the options for Waiver of Taxes. It has been agreed to incorporate the suggestion in the CMP and Govt. have to take a Policy decision in the matter.
- Mr. N.P Rama Krishna Reddy, Managing Director, AMRC has suggested to incorporate the type of Bus Sizes required for Nellore as the in case of Bhopal. He also recommended to classify the proposals based on funding agencies. UMTC agreed to incorporate the same.

ANNEXURE



ANNEXURE 1 –TRAFFIC ANALYSIS ZONES

TAZ NO.	AREAS
1	Koduru padu, Narayanareddy peta , Navalakula garden part, Mipadu road North
2	Gudipallipadu, Allipuram, Mangaladibba, Donka road, 4th mile, Navalakula garden part
3	Kissn nagar, Kissan nagar school area, venugopal nagar, soap factory, pipe factory, Dindayal nagar, Navalakula garden part, sadavari palem, Jaffar saheb channel, Mipadu road, Peddavangalreddy nagar, Prasanthi nagar.
4	Srinivas Nagar, Sriram nagar, Kissan nagar, Jakeer hussian nagar old colony, Madura nagar, Mipadu road, Jakeer saheb channel , Rajiv Gandhi colony.
5	Barmashel Gunta, Ahamed nagar, Bodigoda thota, Satyanarayanapuram, Vikuntapuram, Srinivasa nagar, Mipadu road, Jaffar Saheb nagar.
6	Setty Gunta road, Narukur road, Railway quarters, Shivaji nagar, Papula street, Sali street, Kumari street, Arunachalam street, Weavers colony, Harijanapalem.
7	Vengamamba street, Nagendra nagar, settygunta road, Chakali street, Bhaskar rangaiah street, Kothapeta, Lingabalija street, Nawabpet, Lakshmipuram, Arunachalam street, Narukur road, Paruchuruvari street.
8	Rebala street, Narukur road, C.R.P.Donka, Lakshmi nagar, Sri Rangarajapuram, R.S.R.School, Arundatipalem, Kamati Harijanawada, Ramachandrapuram, Police lines, Bujjama thota, Mukundapuram, Rayapu Harijanawada road, R.K.Nagar
9	Banglathota, Ramakrishna Nagar, Yanamalapalem, Kusuma Harijanawada, Narukur road, Pullama Satram, Nawabpet, Nazeerthota, F.C.I Colony, Shiridi sai nagar extension, Rayapupalem road.
10	Usman Saheb peta, Vanisri street, Chintareddypalem Donka road, Ram nagar, Saraswathi nagar, Girijana colony, S.B.S.Kalyanamandapam, S.L.S.N.Swamy nagar, Ramachandrapuram, Arundatipalem, Ram Nagar road,
11	Saraswathi nagar, Rayapupalem, N.T.R..Nagar, Cherukuthota, Pallipalem, Rajupalem road, Narukur road, Peddacherukuru part, R.K.Nagar Layout.
12	
13	Balaji nagar, Pragathi school, Vunnuruvari Layout, Bipass road, Chintareddypalem road, Padmavathi Green city, Yalamavari Dinnae, Rajiv Gandhi colony, Balijapalem, Pathamittapalem, Korivivari khandriga.
14	A.C Statue, A.C Nagar, Mavila Sanjeevaiah school, A.C Nagar Municipal quatress
15	Chintareddypalem road, Bajithota, Ram Nagar, Masjeed centre, Annapurna Appartment, Surveypalli Kaluva katta, Chippurakatta sangam, C.P.M Office, Saidass Convent, Balaji nagar, Andhrabank , Lakshmi Nagar, B.S.N.L Office, Balija Study centre area, A.V.K.Layout.



TAZ NO.	AREAS
16	Aditya Nagar, Lakshmi Nagar, Swamydoss convent area, Pulimi Nagar, Baliya Nagar, Geethanjali school, Ramji Nagar, Gurralamadugu Sangam, Jagadeep nagar, Chintareddypalem road, A.V.K.Layout, Chappals Factory area, 200 SQ.Feet Bypass Road.
17	Chilaka sangam, Thummala setty sangam, Chintareddypalem Road, Childrens Park, Krishnapatnam road, Prabhakar Reddy Layout, Saibaba Temple, Appolo Hospital, Surya Nagar, Sramika Nagar, Thummala Subbareddy Layout, Balram Nagar, Akuthota Harijanawada, Kothamittapalem, Yakonagar, Parthasaradhi Layout, Washington Layout, Annam Venkatareddy
18	Harinadhapuram Part, Surveypalli kaluva katta, Annam Venkatreddy colony, Minibypass Road, Gomathi Nagar, Srinagar colony, Kondayapalem Donka road, Iskon city, K.B.R.Layout, Kondayapalem, Bypass road, Kanuparthipadu road, Nakkalagunta, Anand Nagar.
19	Ramalaingapalem, Muthyalapalem, Srivari Nagar, P.R.Layout, Harinathapuram 2nd mainroad, Bagya Nagar, Ramalayam Street, P.W.D.Colony.
20	Aravinda Nagar extension, Aravind Nagar, Sodhan Nagar, A.P.S.R.T.C, Magunta Layout, Tekkamitta, Biragimattam, Gilakabavisangam, Minibypass, Kondayapalem Donka 60-00 Road, Indane gas godown, Kasthuridevi School, Police Office Road, Podalakur road, Santhi Nagar, Sindhura Nursing Home, Arabic college, Nunae Mallikarjuna Layout, Irrigation drain(Fathekhanpet), Ramesh Reddy Layout, C.A.M High school, Trunk road.
21	Magunta Layout, Ravindra Nagar, Minipass, Umareddy Gunta, Teachers Colony, N.G.O Colony, Vananthopu, Sneha Nagar, Steel Factory, Kondayapalem road,Gazetted Officers Layout, Dileep Nagar, Old age home.
22	Kondayapalem Gate, Umareddy Gunta, N.G.O.Colony, Teachers colony, Minibypass, Motherterisa home, New SBI Colony, Sangamitra School area, Shar Layout, Kondayapalem B.T.Road
23	B.V.Nagar Mainroad School area, Bhaskar Layout, Steel factory area, Sneha Nagar, B.V.Nagar D.Block, R.T.O Office, Raju complex, Jana Shakti nagar, Old Vedayapalem, O.L.Narayan Layout, Arundatipalem, Saptagiri colony, N.G.O.Colony
24	Padarupalli, P.H.C Colony, Sundaraya Colony part, Bypass road, Municipal employees Layout, Maruthi Nagar, Dwaraka Layout, M.G.Brothers Layout, Anagunta Kalyan Nagar, Bank colony, L.I.C.Colony, Mallithota, Minibypass road, Kalyan Nagar, Somireddy Chandramohanreddy Nagar.
25	Kallurupalli, Kanuparthipadu, Sundaraya colony part 200-0 wide Bypass road North part, South part, M.G.Brothers Layout, Housing Board colony.
26	Bujabuja Nellore area
27	Chandramouli Nagar, Thyagaraja Nagar, Vedayapalem, Teachers colony, Jyothi Nagar, Minibypass road, Drivers colony, Wood complex



TAZ NO.	AREAS
28	Stadium area, Siromani Nagar, Revenue colony, Z.P. Colony, Police Colony, Gayatri Nagar, Ritwik Layout, Chandramouli Nagar, Savitri Nagar.
29	Postal colony, Rajeswari temple, Kesavulu Nagar, A.K.Nagar, SBI Colony, Industrial Estate, Housing board colony, New Military colony, Gernalist colony, Vedayapalem, Simhapuri center, Thikkavarapu Ramireddy Layout, Podalakur Road, G.N.T.Road.
30	Gandhi Nagar, Venkatreddy Nagar, Auto Nagar, F.C.I Godowns, Weavers colony, Subashchandrabose Nagar, Ramchandra reddy Nagar, V.M.R.Nagar.
31	Podalakur Road South, Teachers Colony, Police Colony, Telugu Ganga Colony, Electrical Substation, Kothur Rajiv Gruhakalpa.
32	Podalakur Road North, Tailors Colony, K.B.R.Colony, Kothur, Ambapuram, Church area, Indiramma Houses, Akkacheruvupadu, Ogurupadu, Ramakotaiah Nagar.
33	Podalakur Road, Dycus Road center, N.C.C.Colony, Sanjay Gandhi Nagar, Bank Colony, Thippa area, Water tank road, Vengalrao Nagar, N.B.T.Colony, Church road, Municipal School area.
34	Netaji Nagar, K.V.R.Layout, Chinnaiah Mechaine Road, Netaji Nagar Donka, Vengalrao Nagar, Water tank road, A,b,c Blocks.
35	Netaji Nagar, Pragathi Nagar, Pipe line road, Dongala bavisangam, Lakeview colony, Lakshmi Narasimhapuram, Incometax colony, S.P.Office Opposite road, Barashahid Dharga, Podalakur road.
36	Postal colony, Z.P.colony, D.S.R.Govt Hospital area, Sujathamma colony, J.V.R.colony, Aadarsh Nagar, L.I.C.Office, Dhargamitta, G.N.T.Road, Prasanthi Nagar, Podalakur Road, Ambedkar Nagar, Bramanandhapuram, Police Ground, Kumar nursing home, Police office road.
37	Kondagapalem Road, Military colony, C.C.S.Nagar, Vemalasetty Bavi sangam, Ram Nagar Saraswathi Nagar, Kranthi Nagar, Rajagopalapuram, 60-00 road Venugopalaswamy lands, yarakatta Harijanawada, Tekkamitta road, Indane Gas road,
38	Jonnawada road, Parameswari layout, Putha Estate, Rajiv Gruhakalpa, Irugalamma Temple area, D.K.W.College, Nilagiri sangam, Habibulpet, Arundatipalem, Pottepalem.
39	G.N.T Road, Biragimattam area, Rithubazar, Fathekhanpet, Sakilavari Street, Arigalavari street, Pension line, Traverspet, Besta Street, Ramalayam Street, Santhi Nagar, Batwadipalem, Kasthurdevi school compound, Arabic school.
40	Moolapet, Rajagarivari street, Ramayabadi, Police quartress (fathekhanpet), C.A.M.High school road, Bramana Street, E.S.R.M School, Kondadibba, Mallikarjun Nagar, Bhuvanewara Agraharam, K.Ramaya Street, Rajagari Bangla, Chamandivarithota, Podalakur Road, Thummala Vari Street, Nandithota, Muniyappa Pille Street.

TAZ NO.	AREAS
41	Yadava Street, Ravichette Street, Rajagiri Layout, Pillamitta, Konetimitta, Lalathota, Mansoon Nagar, Kondadibba part, kuddus Nagar, Dycus road, Gaykasayee Street, Traverspet (Tirisipet), C.A.M Road, Market Road, Market area.
42	Konetimitta, Mecleans road, Walkers road, Virat Nagar, Mansoor Nagar part, Kuddus nagar part, Kotamitta down, current office area.
43	Dycus road, Pedda bazar, Kotamitta road, Dandi Street, Bondili Street, Panagal Raja road, Janda vari area, 1 Town Police Station area.
44	Adyakshamvari Street, Sikaramvari street, Mungamurivari street, Rayaji Street, Thipparajuvari Street, Chakalivari street, Achari Street, Danduvari Street, State Bank Of India Main branch, Bestavari street, Baracks, Justice Ansari road, mahaboob khan park area, Langarkhan, Collector Office, Karnala Street.
45	Atmakur Bustand, Jamesgarden, Venkataramapuram, Srinivasa Agraharam, Rammurthy Nagar, Karnalamitta, Vuyallakaluva, Malapakaluva, Krishnapatnam road, V.R.College, Pogathota, Kasikala Agraharam, Kasturdevi Nagar, Gandhi Nagar Complex road, Sankara Agraharam, Jublee Hospital Road, Wahabpet, Anil hall Area,
46	S.C.S.Road, R.R.Road, G.N.T.Road, Athithota Agraharam, Jonnalagadavari Street, Brundavanam, Kapustreet, Anamvari Street, Gaddamvari Street, Mandapalavari Street, Vemuguntavari street, Chinnabazar, Kakarlavari street, Pannuthulavari Street, Mungamurivari Street, M.V.Agraharam, Thipparajuvari Street, Gandhi Statue, Thipparaju satram, Madhyapathivari Street, Gandhi Nagar.
47	Old Govt.hospital road, Narayanarao pet, Rajendra Nagar, Kukulagunta, VuyalaKaluva katta, Savarala Street, Giddangi Street, Chinnabazar, Krishnamandiram Street, Kamati Street, Bogula Street, Jandaveedhi Part, Andhrabank road, Kamsali Street, Guptapark Street, Munumudi Bustand area.
48	Vigneswarapuram, Anamvenkatreddy Municipal workers colony, Mecleans road, Old Govt Hospital road, Jayalalitha Nagar, Porlakatta, Pottepalem Road, D.M.H.O Quatress, Old Municipal Office area.
49	G.V.Subbareedythota, Edgamitta, Old Govt Hospital road, Narayanarao pet, B.E.D.College area, Brahamanavari street, Bomma Kesavulu Hospital area, Srinivasa Nagar, Thukumanumitta, Metlarevu, Santhapet.
50	Santhapet, Kataripalem, A.C.Subbreddy road, Archana cinema hall, Vinayaka hall area, Old Govt hospital road, Anakata Road, Sudarsanam vari street, Anjaneyaswami temple street, Thukumannumitta, Magunta subbaramireddy Colony, Doobikana, Bujjammarevu, Kamakshi nagar.
51	Kapadipalem, Railway feeders Road, Isakadonka road, Anakata road, Subashchandrabose road, A.B.M.Compound, Mandala Revenue Office, Merinaidu Street, Subedarpet road, R.R.Street, Old Trunk road.



TAZ NO.	AREAS
52	Ranganayukalpet, Isakadonka, Yadava street, Gopuram Street, Peddathota, Railway street, Railway quatress, Americans hospital, Saint peters school road, Anakata road, Pennanadi band, Wood house sangam, Settygunta road.
53	Saluchinthala, Government Poltechnique college, Bombay road, Doctors Layout, F.C.I Gardens, Gandhi Girajana Colony, Govt. I.T.I area, Venkateswara swamy temple area, Santhi Nagar, Masjeed area, Milk diary, G.N.T.Road, Railway track road, Venkateswarapuram School, Islampet road.
54	Venkateswarapuram School area, Ambedkar Colony, Janardhan Reddy Colony, Bhaghat singh 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. 140 km in Nellore (Figure 1).

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

CARRIAGE WAY

Distribution of network according to their carriage way width is given in Figure Majority of the roads have 4 lanes and 6 lanes having 87% share of total length. Remaining are Single Lane, Intermediate Lane (IL) and 2 lane with divided/undivided roads.

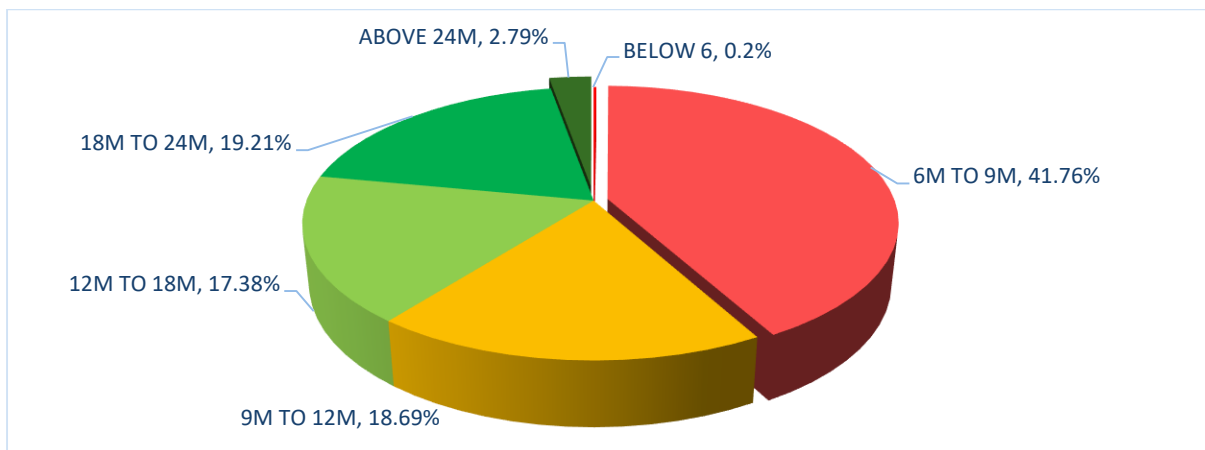


Figure 1 DISTRIBUTION OF EXISTING ROAD NETWORK CLASSIFICATION BASED ON CARRIAGE WAY

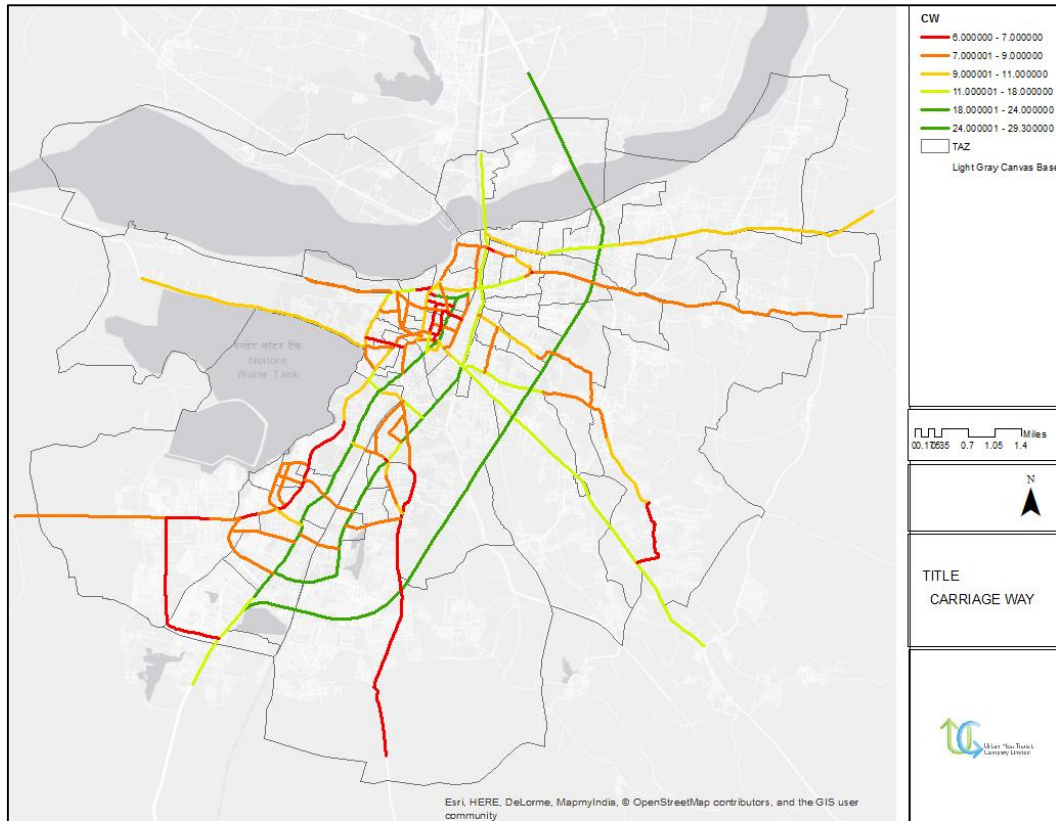


Figure 2: EXISTING ROAD NETWORK CLASSIFICATION BASED ON CARRIAGE WAY

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 54% if flexible in nature and 44% 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 VRC to Bus Stand Road, Dr Uttam to Muthukur Road and VR College Road.

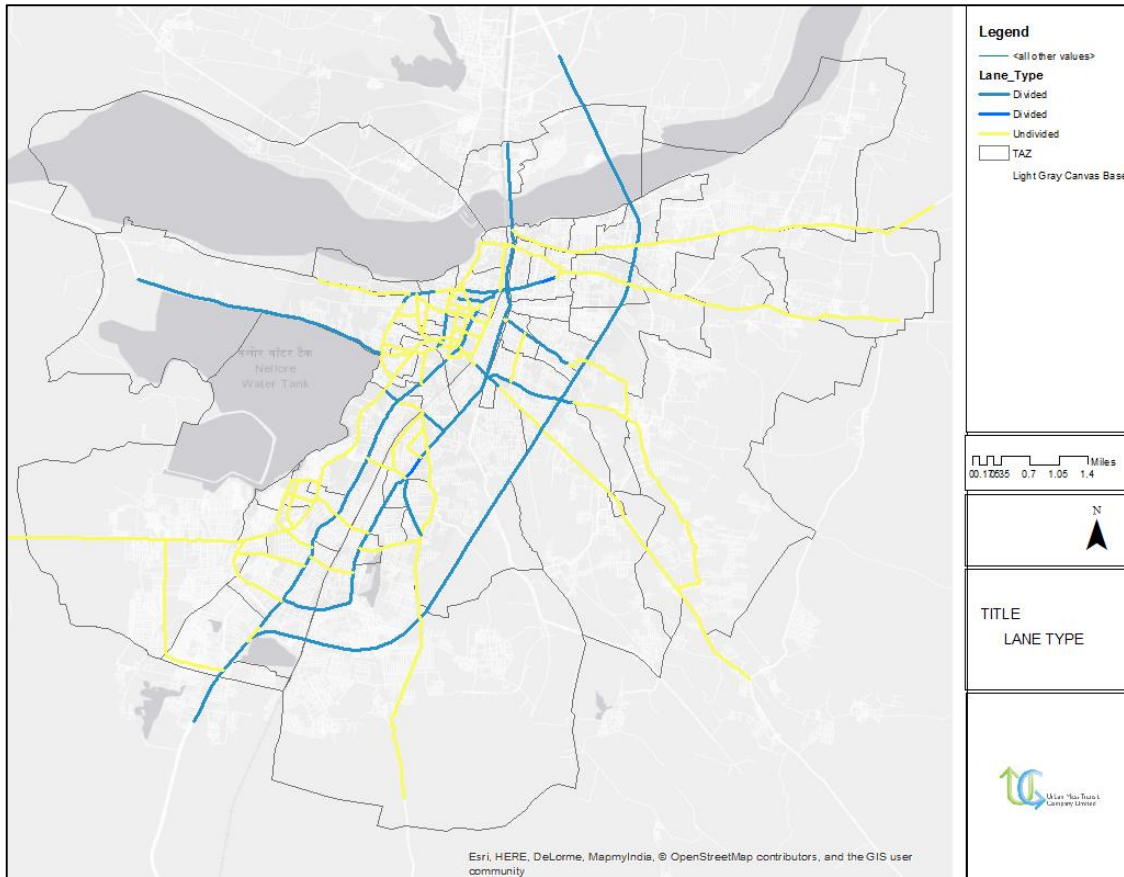


Figure 3 EXISTING NETWORK CLASSIFICATION BASED ON LANE TYPOLOGY

39% of the survey network is divided while the remaining 61% is undivided. It is observed that the divided lanes are observed on the arterial roads and few sub arterial roads which are the Grand Trunk Road and the Mini Bypass Road, indicating the infrastructure supporting higher speeds for the external movement in the city. The collector roads are undivided with 2 lanes. It is observed that 58% of the survey network is 2 laned in nature.

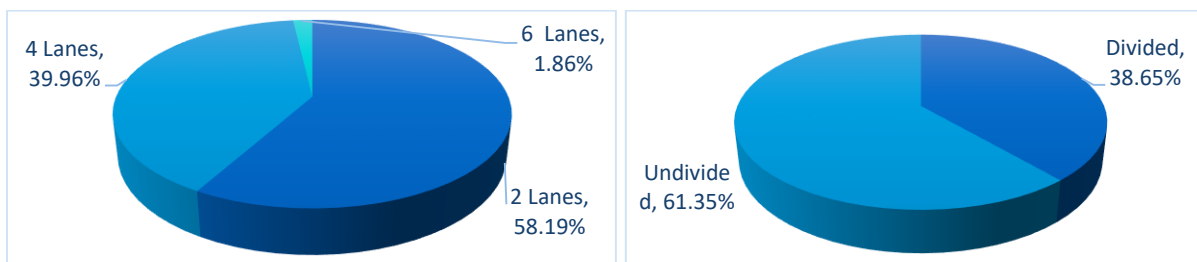


Figure 4: CLASSIFICATION BASED ON NUMBER OF LANES AND LANE TYPOLOGY

It is observed that 74% of the surveyed network has shoulder space available to cater the needs of the future traffic and transport demand. 71% of the potential roads with are the sub arterial and collector roads varying between 12m to 24 m which are essential improve the movement within city have about 2.4m to 6m wide space available to improve the urban fabric of the streets and the movements.

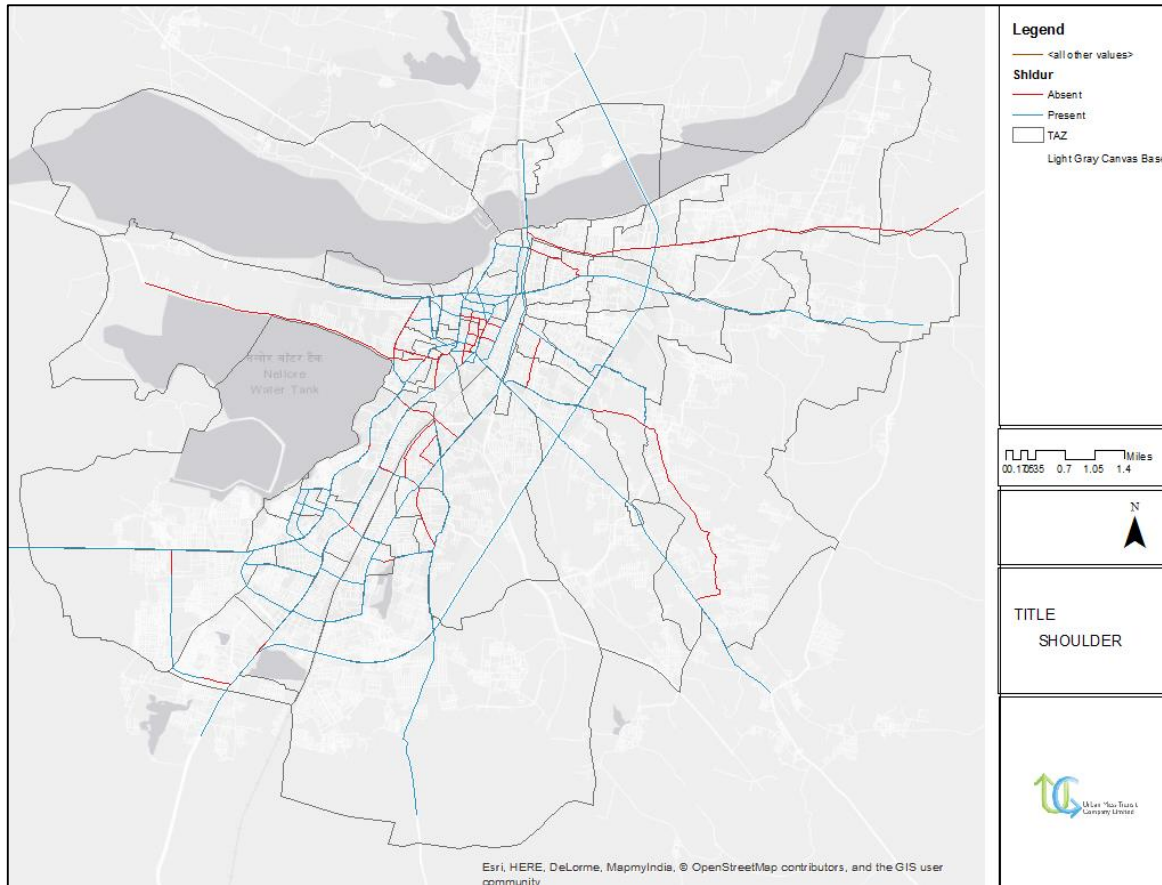


Figure 5: EXISTING ROAD NETWORK CLASSIFICATION BASED ON AVAILABILITY OF SHOULDER

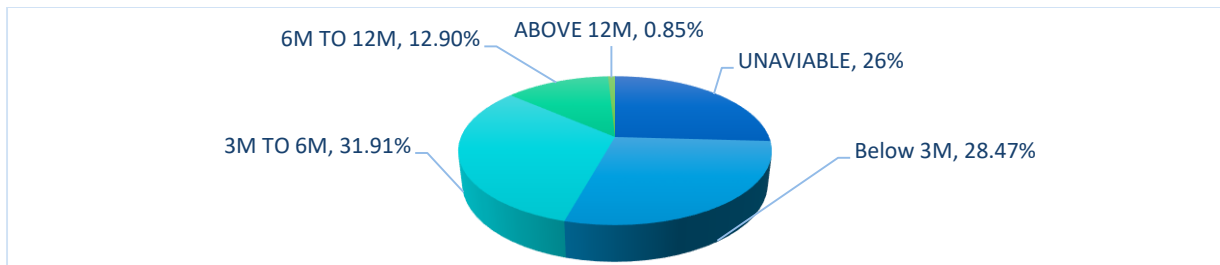


Figure 6: DISTRIBUTION OF EXISTING ROAD NETWORK CLASSIFICATION BASED ON SHOULDER WIDTH

PEDESTRIAN FACILITIES

From the surveyed Road Network Inventory Analysis it is observed that only 2% of the network has facilities (footpath) to support safe pedestrian movement. While the remaining 98% of the network has no provisions for pedestrian facilities.

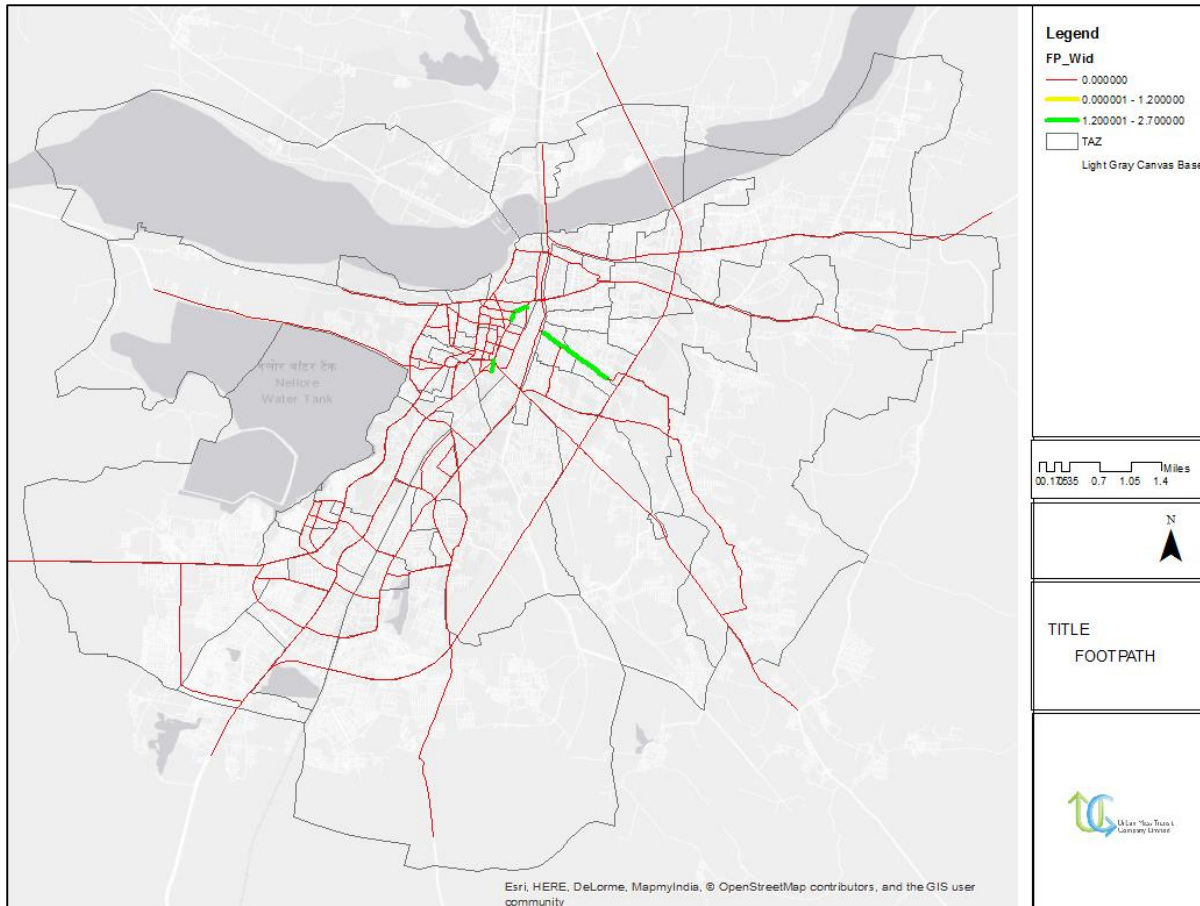


Figure 7: EXISTING ROAD NETWORK CLASSIFICATION BASED ON AVAILABILITY OF FOOTPATH WITH A CLEAR WALKING SPACE

NON-MOTORIED 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 14% of the survey network has on street parking activates). Though the number of on street parking zones are restricted, the intensity of parking is observed to be high. The zone with high on street parking facilities are Theater Road (RR Street Parking), VRC center to M Bus stand road, Children's Park Road and certain stretches along Grand Trunk Road.

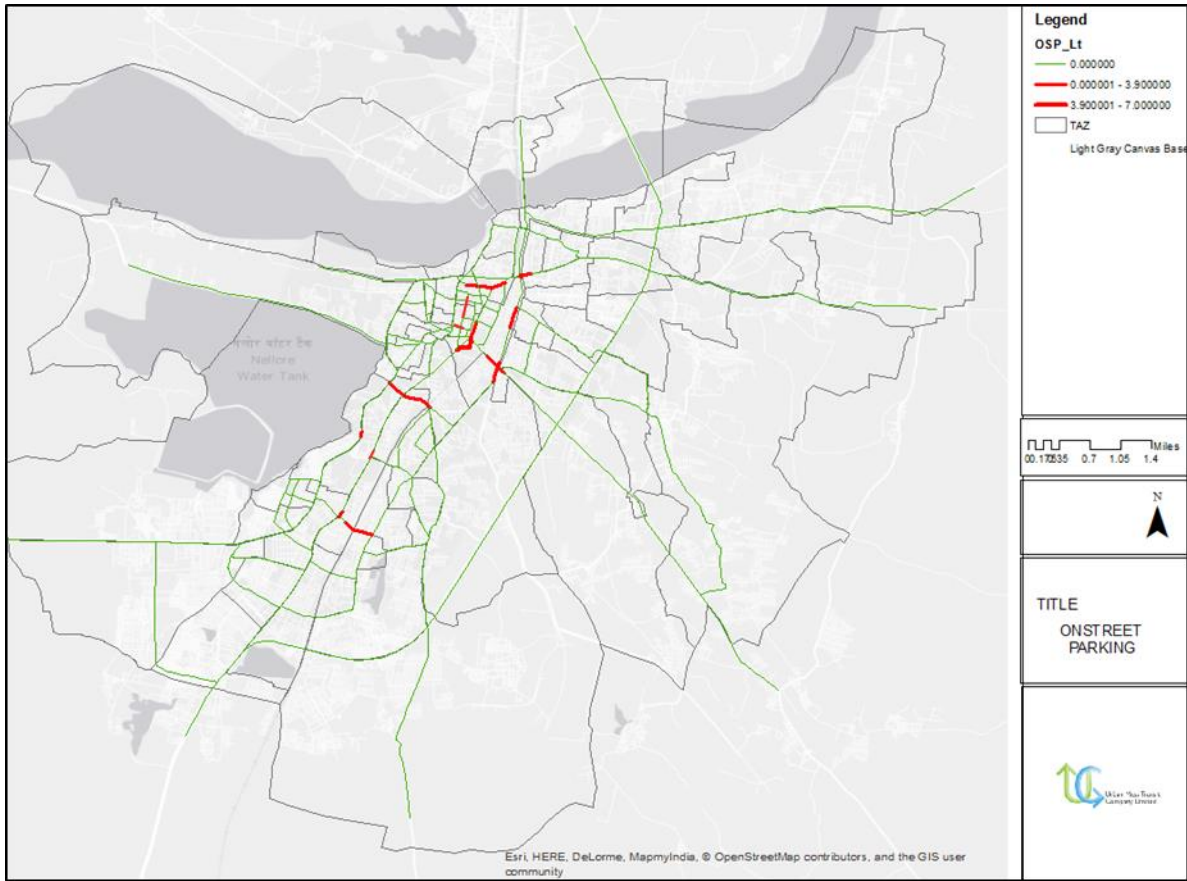


Figure 8: EXISTING ROAD NETWORK CLASSIFICATION BASED ON STREET PARKING ACTIVITES



Figure 9: ON STREET PARKING IN NELLORE

INTERSECTIONS

In the Nellore due to the heavy traffic flow at peak hours, most of the junctions especially to the northern side are highly congested. The Major Intersections within the Nellore Study are Atmakur Bus Stand Junction, Gandhi Bomma Junction, VCR Junction, Bose Bomma Junction, Sundaraiah Junction, AC Center, Annamayya Center, Gopal Reddy Center, SP Office junction and so on. It is observed that there are about 18 notable junctions of which 6 are signalized junctions while the rest are unsignalised.



Figure 10: INTERSECTIONS IN NELLORE

Key Inferences:

1. The network structure in the city is largely linear with few radials connecting the sub-urban places around the city.
2. The network is observed to be dense on the northern side of the city. Inequity in the urban spread.
3. 49% of the surveyed network has Right of Way (ROW) below 12m.
4. About 60% of the survey network has carriage way below 12m.
5. Only 2% of the surveyed network is facilitated with pedestrian infrastructure.
6. The city has no designated infrastructure facilities for non-motorised vehicles.
7. On street parking activities in the city are observed to be largely restricted.
8. Major parking activities are observed along RR Street and Children's Park Road and Grand Trunk Road.
9. Two-wheelers constitute to a greater share of on street parking along the major roads, while cars constitute a larger share in designated parking spaces like in RR Street Parking area.

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. 140 km in Nellore similar to the road network inventory was surveyed.

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

TRAVEL SPEED

The average speed within the city is observed to 22.4kmph. The average speed along observed along the National Highway, Chennai-Vijayawada Highway passing out of the city is 54kmph and Ballary Krishnapatnam Port Highway (Mini Bypass Road) passing through city is observed that 28kmph. The speed of other important roads within the city range between 20kmph to 40kmph.

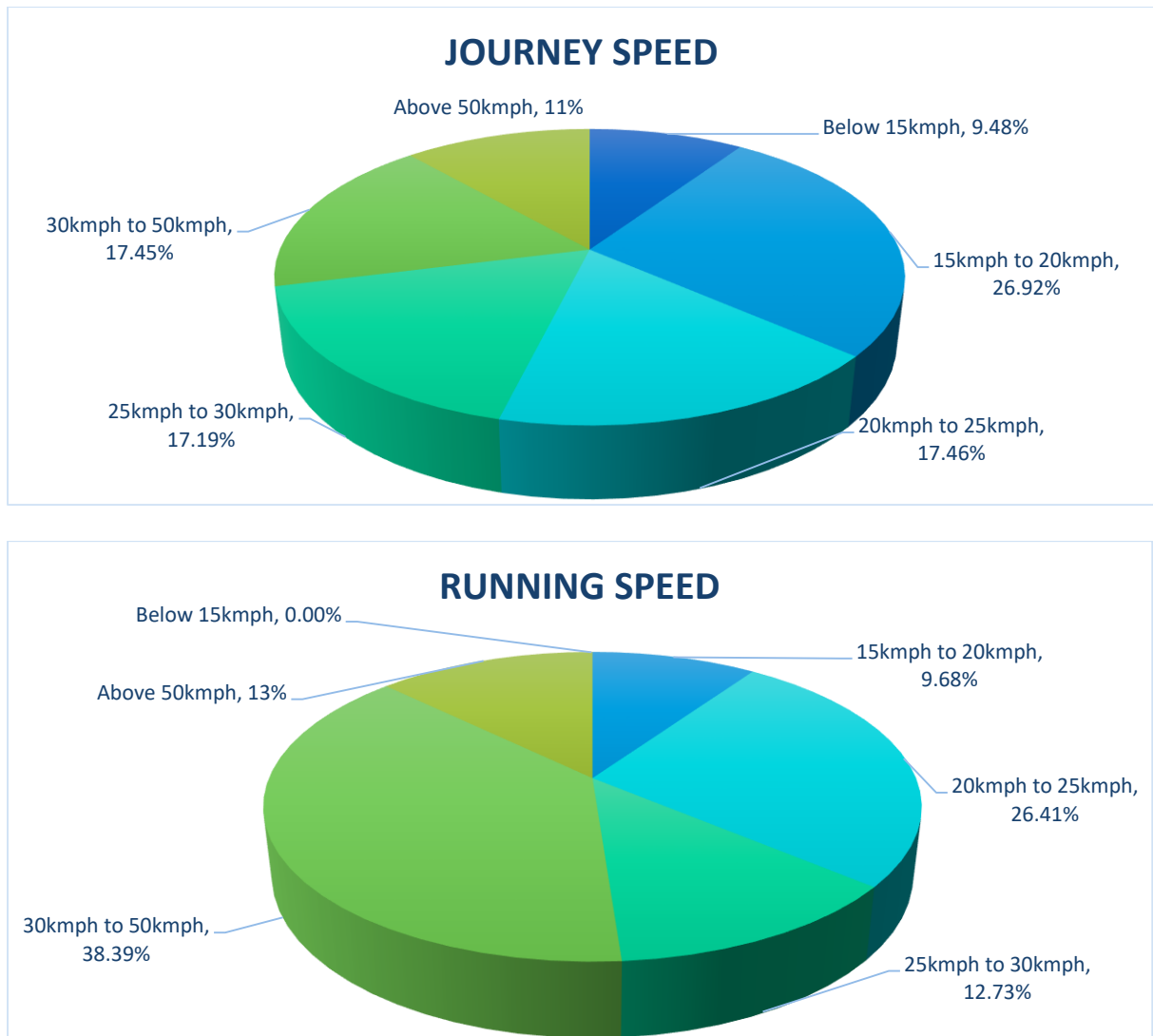


Figure 11: DISTRIBUTION OF JOURNEY AND RUNNING SPEEDS ALONG THE NETWORK

Table represents the summary of the speed and delay survey in Nellore.

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	Nh-16 (Chennai-Vijayawada Highway)	15.97	53.48	55.16
2	Nellore - Koovur Road (Ballary-Krishnapatnam Port Highway)	2.86	28.42	27.45
3	Grand Trunk Road	10.24	25.91	32.36
Arterial Roads		29.07	35.94	38.32
1	Atmakur Bus Stand Road	1.22	15.40	16.00
2	Minibypass Road	8.30	33.08	42.51
3	Police Office Road	1.50	22.70	35.90
4	Podalakur Road	9.19	28.50	34.50
5	Muthukur Road/Nellore - Port Road	9.93	30.50	34.80
6	Childrens Park Road	2.10	18.80	22.30
7	Stonehousepet Road/Nawabpet Road	7.80	15.20	24.80
8	Mypady Road	8.25	14.60	28.40
9	Vanam Thopu - Kondayapalem Road	1.20	19.40	21.45
10	B.V Nagar Main Road	0.50	16.23	20.00
11	Railway Station Road	1.00	22.41	25.40
12	Railway Feeda Road/Pedda Bazaar Road	1.50	13.11	20.00
13	Dycus Road	0.80	15.12	18.24
14	Parameshwari Nagar Road	1.80	28.80	32.43
15	Potte Palem Road	4.84	28.42	34.36
16	Mulapet Road	4.03	18.40	26.50
17	Leela Mahal Road	1.00	14.90	20.00
18	Golagamudi Road	3.80	26.80	28.13
19	Venagal Roa Nagar Road	1.00	20.10	24.00
20	Netaji Nagar Road	1.00	18.21	23.21
21	3RD STREET Sanjay Gandhi Nagar	1.00	18.21	23.21
22	Polerumma Temple Approach Road	1.20	22.1	23.4
23	Cherukupalli Kalyan Mandapam Road	0.80	23.02	24.5
24	Pn Road	3.30	18.42	20.54
25	R.R Street	1.30	15.3	20.4
26	A.T. Agran	0.87	15.5	18.3
27	Acharivedhi	1.00	18.1	20.25
28	B.V Nagar Main Road	0.70	16.2	19.82
29	Kumareddy Gunta	1.00	16.2	19.82
30	Msa Nagar 1St Mainroad	1.30	18.4	22.3
31	Bus Stand Road	0.50	22.6	25.4
32	Mandapalli Street	0.50	17.51	21.6
33	Katharipallem	0.90	14.2	18.4
34	Kamti Street	2.40	17.2	20.7
35	Bhramin Street	0.624	18.1	22.3
36	Meclince Road	2.18	22.2	24.6
37	Auto Nagar Main Road	4.25	20.1	23.8
Sub-Arterial Collector Roads		94.58	20.1	24.82
Local Roads		16.79	16.8	19.5

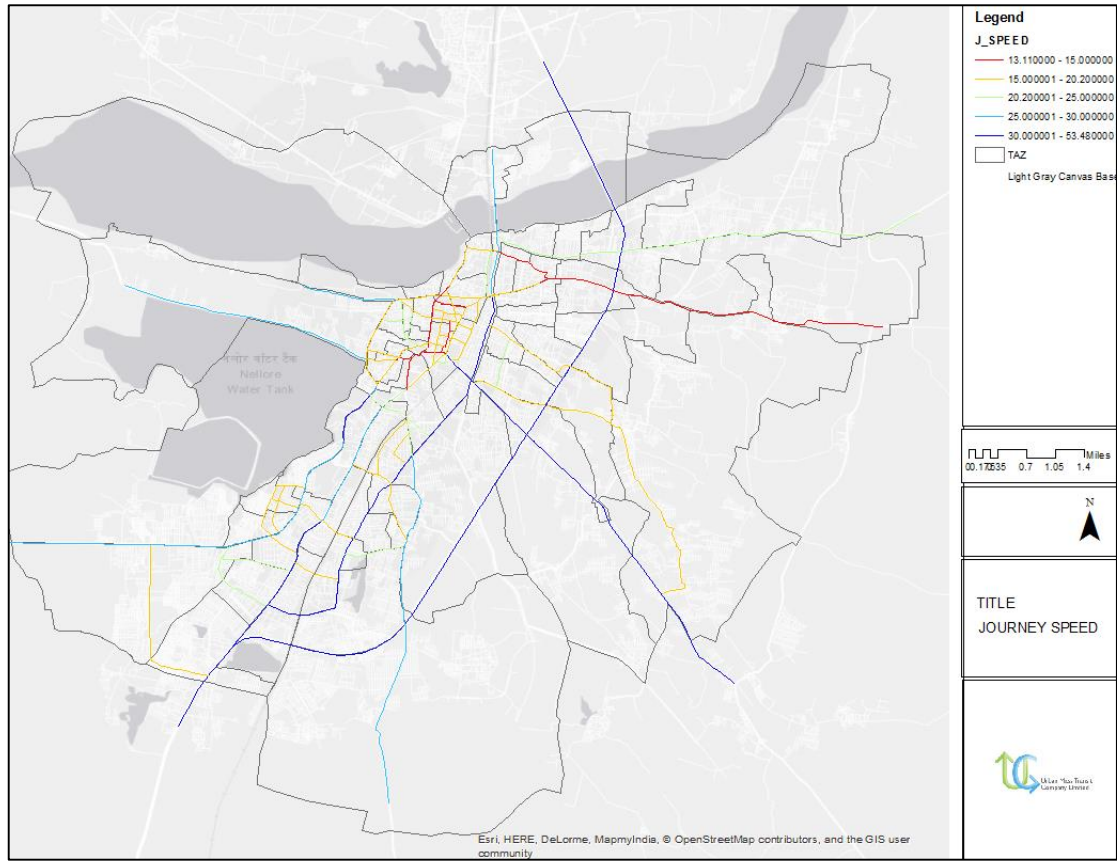


Figure 12: JOURNEY SPEEDS ALONG THE NETWORK

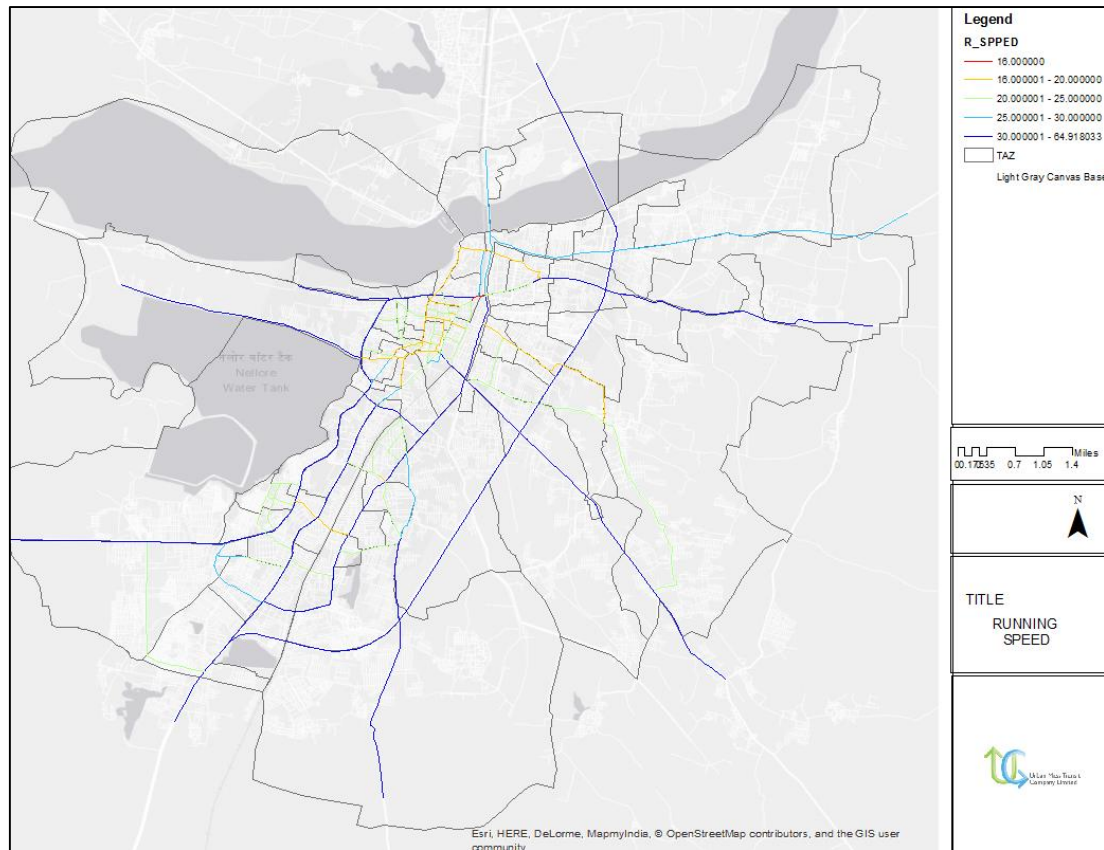


Figure 13: RUNNING SPEEDS ALONG THE NETWORK

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 shows the share of cause of delays along the surveyed network.

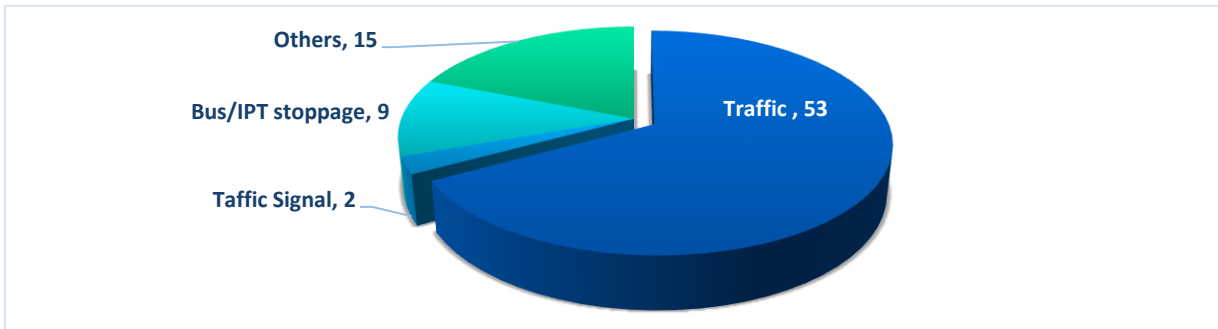


Figure 14: DISTRIBUTION OF CAUSES OF DELAY ALONG THE NETWORK

Key Inferences:

1. The average journey speed along the network is observed to 22.4kmph.
2. The average speed along the arterial roads is observed to be over 35kmph, while along the sub-arterial roads ranges between 20kmph to 30kmph.
3. The speed along the collector and local roads varies between 15kmph to 25kmph.
4. The delays in travel speeds are caused largely due to traffic and delay at intersections.

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 Nellore.

Table 2: OUTER CORDON LOCATIONS

CODE	LOCATION
OC_1	Near Kotha Kaluva Petrol Pump, Mypadu Road, State Highway 57
OC_2	Near Renukamma Temple, Mydukur-Krishnapatnam Road
OC_3	Near RTC Garage, Venkatachalam, NH 16
OC_4	Near Kovur toll Plaza
OC_5	near Sai Teja Crates Velding works, Chennai- Srikakulam Highway

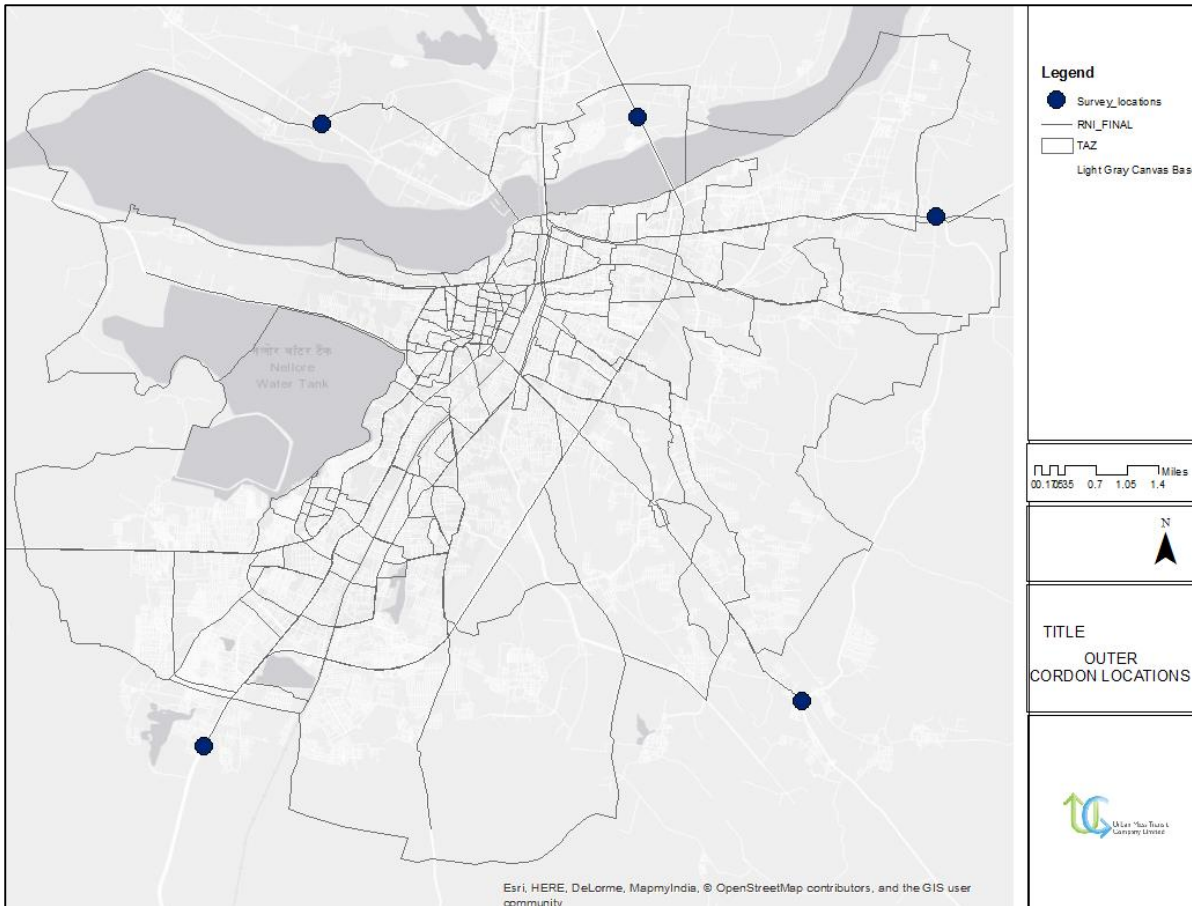


Figure 15: OUTER CORDON LOCATIONS

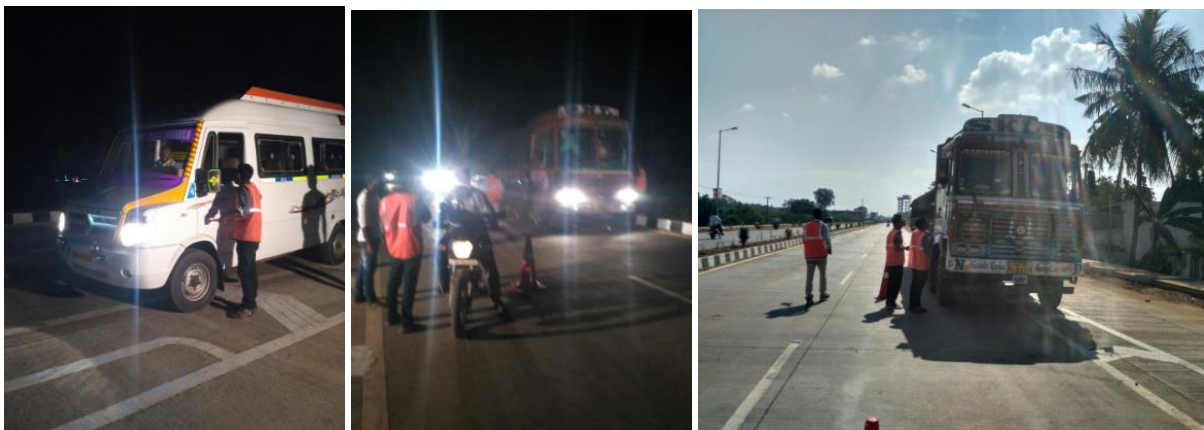


Figure 16: IMAGES WHILE CONDUCTING THE OD SURVEY

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 work based trips, accounting to 42% and 35% of the trips 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).

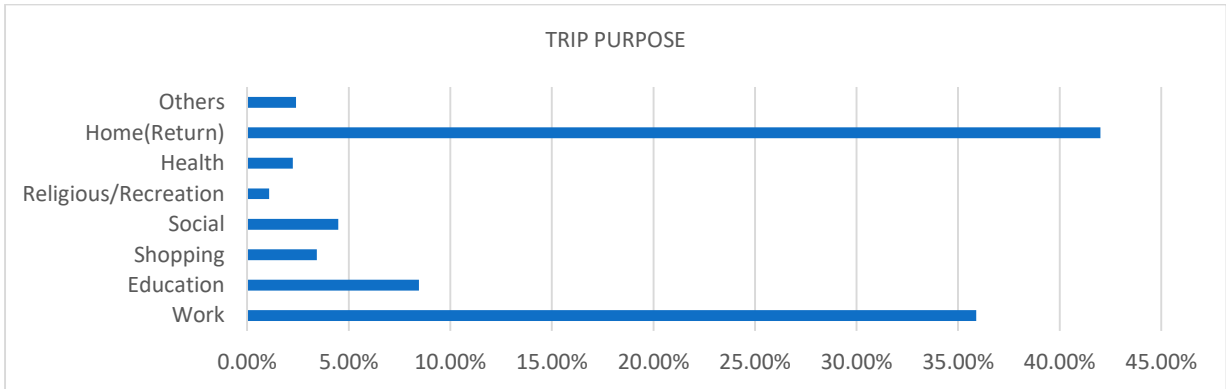


Figure 17: TRIP PURPOSE FOR PASSENGER VEHICLES AT OUTER CORDON LOCATIONS

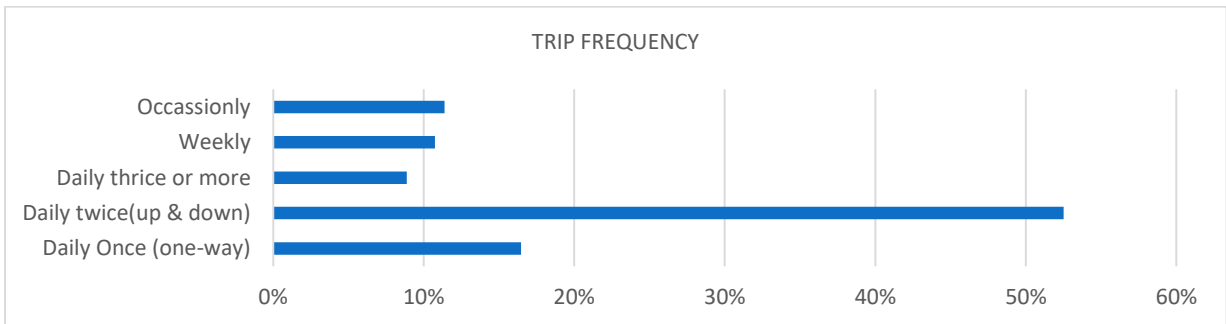


Figure 18: TRIP FREQUENCIES FOR PASSENGER VEHICLES AT OUTER CORDON LOCATIONS

It has been observed that the city has greater share of interactions with surrounding town and villages such as Buchireddy Palem, Gangavaram, Kodurupadu, Kovvuru, Mdaraju Guduru, Guduru, Muthukur, Narayanareddypeta, Rajupalem, Venkatachalam and Maipadu. These trips are mostly work based trips indicating that Nellore 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 the Figure below:

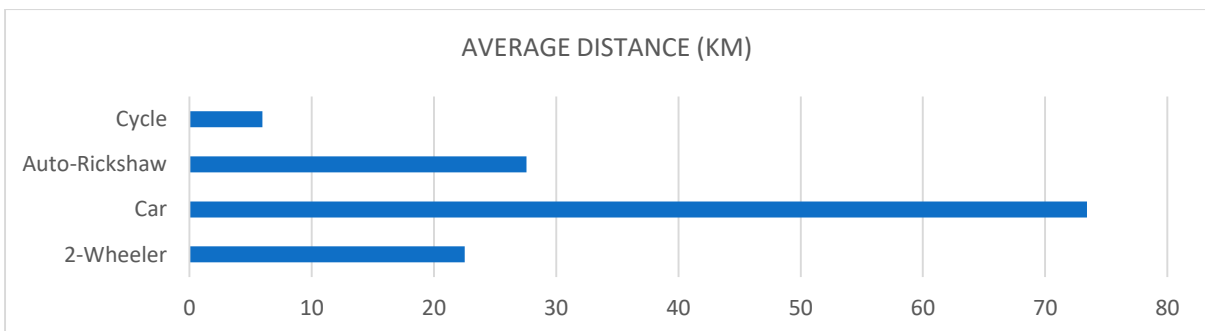


Figure 19: AVERAGE TRAVEL DISTANCES AT OUTER CORDON LOCATIONS

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 and Table

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 represents the daily traffic volume at outer cordon.

Table 3: DAILY VOLUME AT OUTER CORDON LOCATIONS

Location ID	Towards Nellore		Away From Nellore		Total		% Incoming PCU	% Outgoing PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
OC 01	5,968	8,689	7,533	11,642	13,501	20,331	43%	57%
OC 02	4,414	4,799	5,793	7,963	10,207	12,762	38%	62%
OC 03	9,154	13,551	12,059	21,626	21,213	35,177	39%	61%
OC 04	5,942	9,269	4,071	5,313	10,013	14,582	64%	36%
OC 05	9,449	16,452	8,922	16,038	18,371	32,490	51%	49%

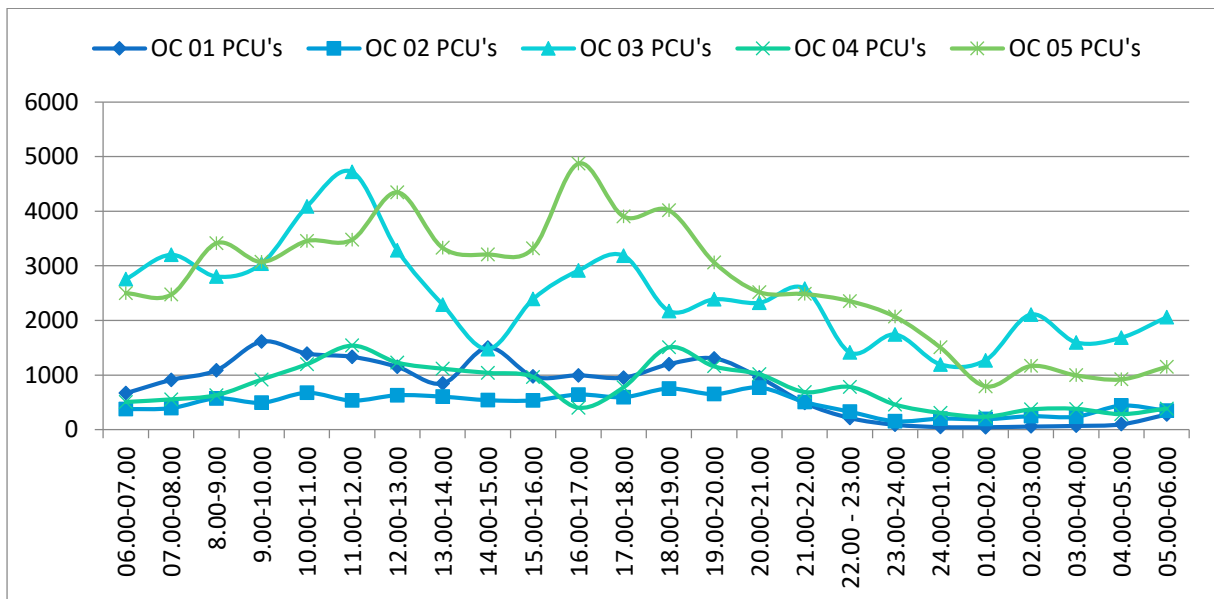


Figure 20: HOURLY VARIATIONS OF PCUS AT OUTER CORDON LOCATIONS

Table 4: PEAK HOUR VOLUMES AT OUTER CORDON LOCATIONS

Location ID	Peak Hour	Towards Nellore		Away From Nellore		Total	
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
OC 01	9.30-10.30	537	690	666	976	1,203	1,667
OC 02	20.00-21.00	926	1,001	751	1,045	1,677	2,046
OC 03	11.00-12.00	872	1,213	1,192	1,806	2,064	3,019
OC 04	11.15-12.15	563	595	493	615	1,056	1,210
OC 05	16.15-17.15	779	1,260	772	1,268	1,551	2,528

Table 5: PEAK HOUR VOLUME SHARES AT OUTER CORDON LOCATIONS

ID	Location	Peak Hour PCUs	Daily PCUs	Share
OC 01	Near Kotha Kaluva Petrol Pump, Mypadu Road, State Highway 57	1,667	20,331	8%
OC 02	Near Renukamma Temple, Mydukur-Krishnapatnam Road	2,046	12,762	16%
OC 03	Near RTC Garage, Venkatachalam, NH 16	3,019	35,177	9%
OC 04	Near Kovur toll Plaza	1,210	14,582	8%
OC 05	near Sai Teja Crates Velding works, Chennai- Srikakulam Highway	2,528	32,490	8%

It is observed that two-wheelers and goods constitute the highest accounting to about 35% and 33% of the modal share at outer cordon locations. The high share of the goods movement is due to its proximity to the Krishnapatnam Port and Chennai. The modal share for the same are as shown in Figure and Table

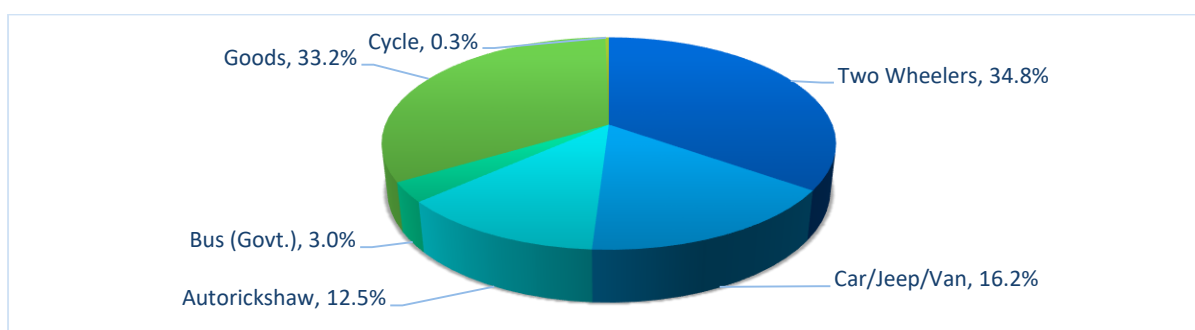


Figure 21 OVERALL DAILY TRAFFIC COMPOSITION AT OUTER CORDON LOCATIONS

Table 6: LOCATIONWISE CLASSIFICATION OF DAILY TRAFFIC

MODE	OC_1	OC_2	OC_3	OC_4	OC_5
Two Wheelers	49.4%	60.8%	22.8%	41.5%	19.9%
Car/Jeep/Van	5.1%	16.9%	22.8%	16.2%	16.4%
Auto Rickshaw	32.2%	10.1%	8.3%	14.2%	3.1%
Bus (Govt.)	2.6%	2.3%	3.9%	6.9%	0.5%
Goods	9.6%	9.6%	42.0%	20.7%	60.0%
Cycle	49.4%	60.8%	22.8%	41.5%	19.9%
Total	100%	100%	100%	100%	100%

Key Inferences:

- 1 The outer cordon locations OC-3 has highest traffic volume due to its proximity to Guduru and its connectivity to Chittoor and Chennai.

- 2 Goods and two-wheelers contribute to the highest modal share (33% and 35% respectively) at the survey outer cordon locations.
- 3 Highest volume at peak is observed along the Nellore-Krishnapatnam Highway.

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 line points along the two north-south and east-west screen lines as shown in Figure.

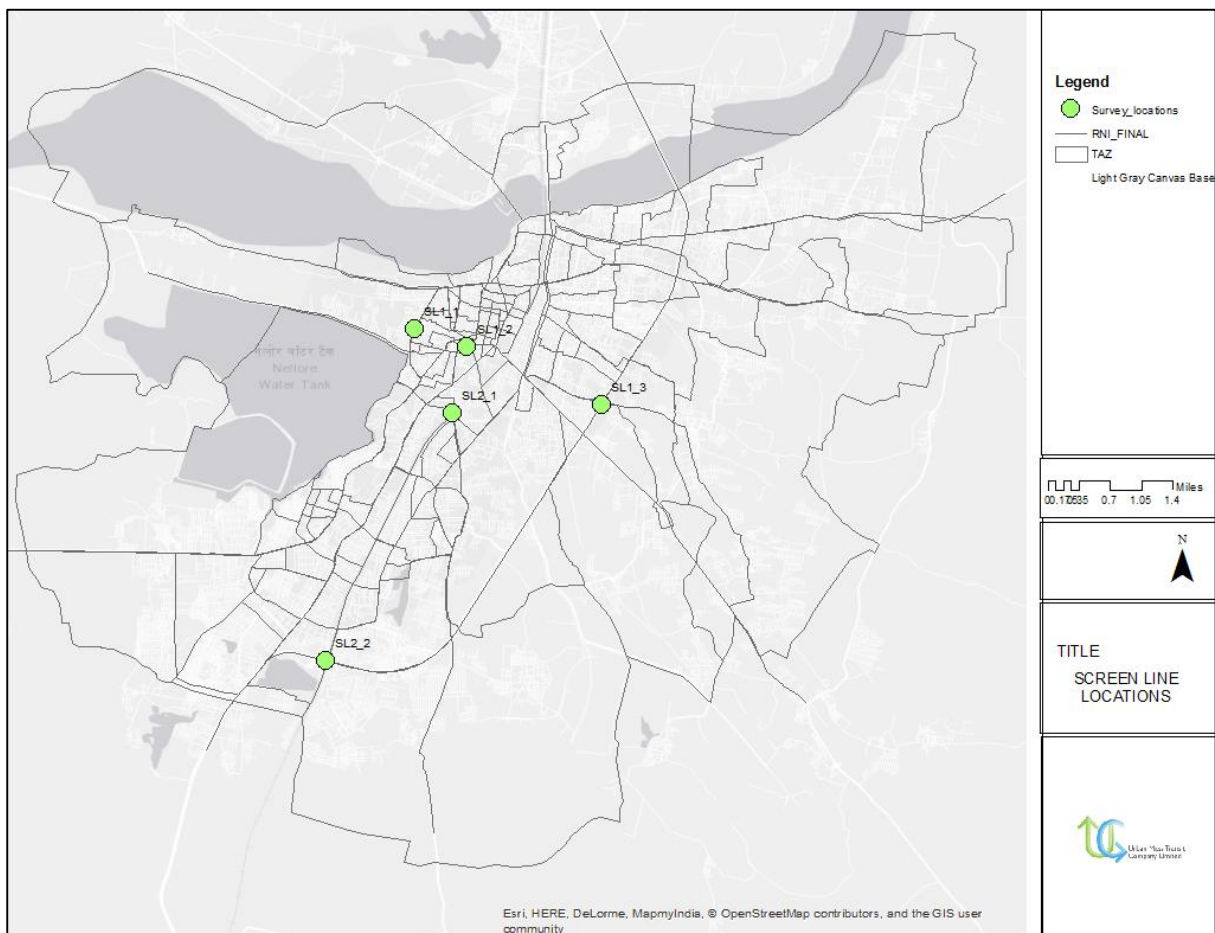


Figure 22 SCREEN LINE LOCATIONS

Table 6: SCREEN LINE LOCATIONS

CODE	LOCATIONS
SL1_1	Canal Crossing at Parameshwari Nagar, Near Sri Krishna Dharmaraju Swamy temple
SL1_2	Canal Crossing at Mulapet Rd, Near CAM High School

SL1_3	Canal Crossing at Childrens Park Junction
SL2_1	Railway Crossing at More Super Market Main Road, Near Archaeology Museum
SL2_2	Railway Crossing at Vijayawada-Chennai Highway, Drivers Colony

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 represents the daily traffic volume at outer cordon.

Table 7: DAILY VOLUME AT SCREEN LINE LOCATIONS

Location ID	East Bound		West Bound		Total		% Incoming PCU	% Outgoing PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
SL2-1	26,296	25,562	20,451	20,017	46,747	45,579	56%	44%
SL2-2	7,089	10,223	8,311	12,049	15,400	22,272	46%	54%
Location ID	North Bound		South Bound		Total		% Incoming PCU	% Outgoing PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
SL1-1	13,674	14,105	12,224	12,455	25,898	26,560	53%	47%
SL1-2	15,892	13,703	14,475	13,701	30,367	27,403	50%	50%
SL1-3	18,526	17,394	19,579	18,331	38,105	35,725	49%	51%

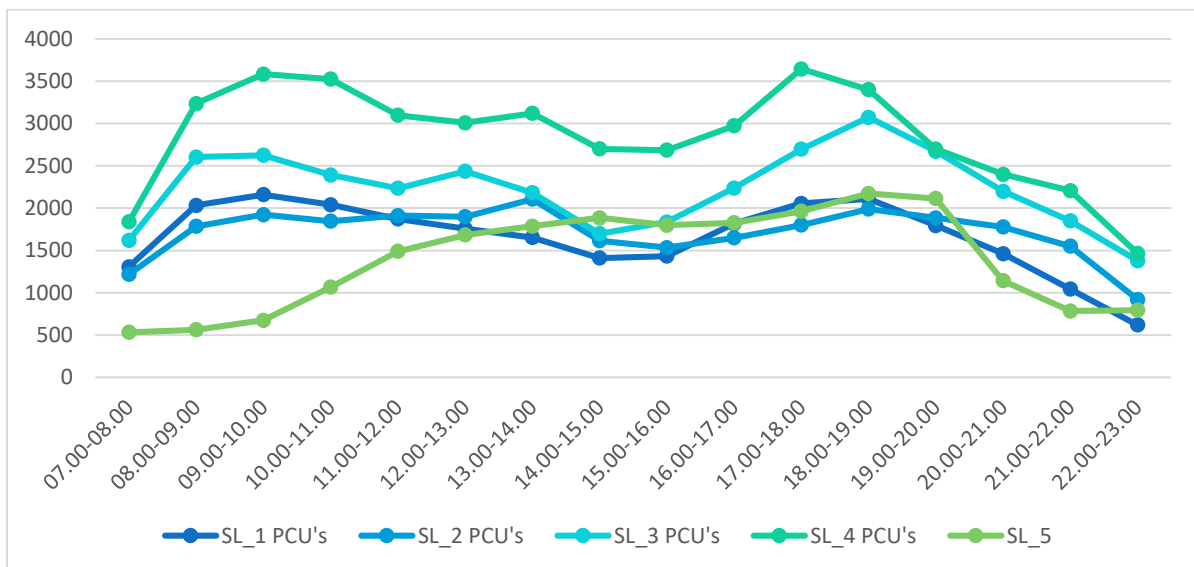


Figure 23: HOURLY VARIATIONS OF PCUS AT SCREEN LINE LOCATIONS

Table 8: PEAK HOUR VARIATIONS AT SCREEN LINE LOCATIONS

Location ID	Morning Peak Hour	Total		Evening Peak Hour	Total	
		Vehicles	PCUs		Vehicles	PCUs
SL1_1	09.15-10.15	1,108	1,058	1,071	1,011	2,179

SL1_2	13.00-14.00	1,228	1,460	878	1,006	2,105
SL1_3	17.45-18.45	1,570	1,718	1,518	1,672	3,089
SL2_1	17.00-18.00	1,538	1,521	2,107	1,964	3,644
SL2_2	18.15-19.15	921	613	1,275	865	2,196

Table 9: PEAK HOUR SHARE AT SCREEN LINE LOCATIONS

ID	Location	Peak Hour PCU	Daily PCU	Share
SL1_1	Canal Crossing at Parameshwari Nagar, Near Sri Krishna Dharmaraju Swamy temple	2,069	26,560	8%
SL1_2	Canal Crossing at Mulapet Rd, Near CAM High School	2,466	27,403	9%
SL1_3	Canal Crossing at Childrens Park Junction	3,390	35,725	9%
SL2_1	Railway Crossing at More Super Market Main Road, Near Archaeology Museum	3,485	45,579	8%
SL2_2	Railway Crossing at Vijayawada-Chennai Highway, Drivers Colony	1,478	22,272	7%

It is observed that two wheelers constitute the highest accounting to about 65% of the modal share at outer cordon locations, followed by cars with 13%. The modal share for the same are as shown

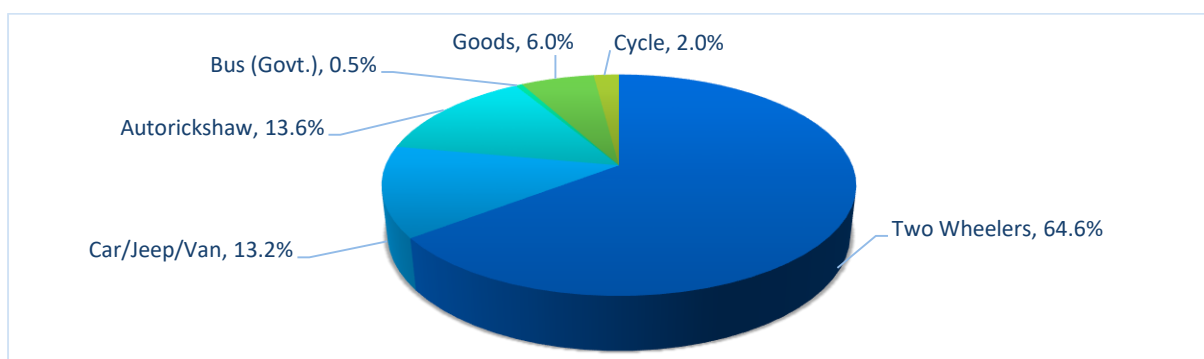


Figure 24: OVERALL DAILY TRAFFIC COMPOSITION AT SCREEN LINE LOCATIONS

Table 10: LOCATION WISE CLASSIFICATION OF DAILY TRAFFIC

Vehicle Type	SL1_1	SL1_2	SL1_3	SL2_1	SL2_2
Two Wheelers	66%	79%	67%	66%	21%
Car/Jeep/Van	6%	2%	16%	15%	35%
Autorickshaw	21%	13%	12%	15%	2%
Bus	0%	0%	1%	1%	1%
Goods	3%	1%	2%	2%	41%
Cycle	3%	4%	2%	1%	0%

Key Inferences:

- 1 The screen line location SL2-1 has highest traffic volume due to its connectivity to Trunk Road and Mini-Bypass Road and close proximity to important transit nodes such as Annamya Circle and SP office zone.
- 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 the occupancy for 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 five screen line points as shown in Figure and Table

Analysis: From the table it is observed that bus occupancy varies from 18 to 28.8 and averages out at 24.9. Average occupancy for cars and two wheelers is found to be 3.4 and 1.5 respectively. The Auto Rickshaw has an average occupancy of 3.8.

Table 11: OCCUPANCY AT SCREEN LINE LOCATIONS

CODE	Direction	Two Wheeler	Car	Auto Rickshaw	Bus	Cycle	Cycle Rickshaw
SL1_1	North bound	1.3	2.9	3.8	23.8	1.1	0.0
	South Bound	1.4	3.0	3.7	25.0	1.0	0.0
SL1_2	North bound	1.6	4.5	4.7	28.8	1.1	2.0
	South Bound	1.3	4.4	4.8	28.1	1.0	0.0
SL2_3	North bound	1.8	2.7	2.5	-	1.3	0.0
	South Bound	1.6	2.9	3.2	28.8	1.1	0.0
SL2_1	East Bound	1.3	4.6	4.2	21.8	1.0	0.0
	West Bound	1.4	3.3	3.8	18.4	1.0	1.0
SL2_1	East Bound	1.5	3.1	3.4	25.0	1.2	0.0
	West Bound	1.6	2.8	3.4	-	0.0	0.0
Overall		1.5	3.4	3.8	24.9	1.0	0.3

Key Inferences:

1. The average occupancy of two wheelers is observed to be 1.5.
2. The average occupancy of 3 seater auto rickshaw was observed to be 3.3, while the average occupancy of shared auto rickshaw (7seater) is observed to be 4.3.
3. Highest two wheeler occupancy was observed at SL1_3 near Children's Park Junction, while the highest occupancy of cars, auto rickshaws and buses were observed along Mulapet Road between VRC Center and CAM High School.

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: Eight critical intersections were identified as shown in Figure and Table

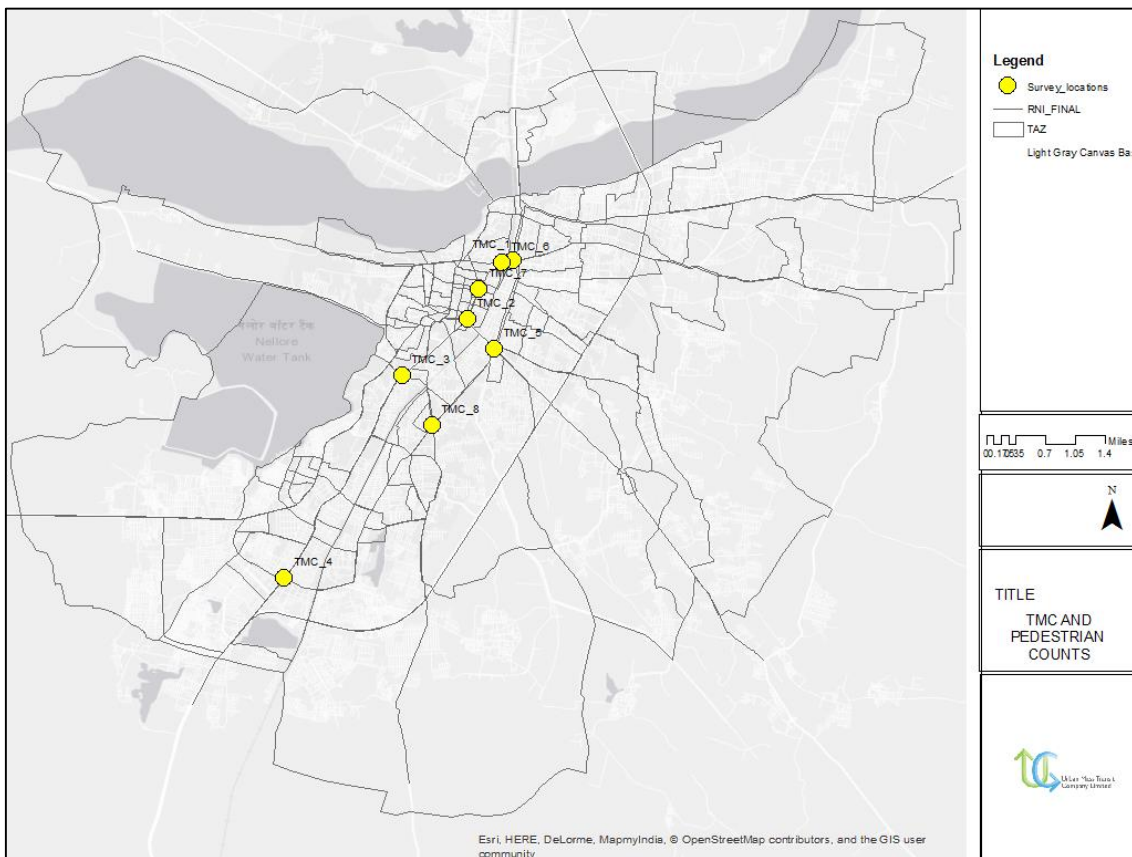


Figure 25: TMC LOCATIONS

Table 12: TMC LOCATIONS

CODE	LOCATION
TMC_1	Potti Sree Ramulu Statur Circle
TMC_2	VRC Junction
TMC_3	KVR Petrol Pump Circle
TMC_4	Grand Trunk Road & Mini Bypass Road Circle
TMC_5	Muthukur Road Junction
TMC_6	Bose Bomma Jn
TMC_7	Gandhi Bomma Jn

CODE	LOCATION
TMC_8	AnnamayyaCircle

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 represents the daily traffic volume at the surveyed intersections.

Table 13: DAILY TRAFFIC VOLUME AT INTERSECTIONS

Code	Location	Total Vehicles	Total PCUs
TMC_1	Potti Sree Ramulu Statur Circle	92,382	1,20,815
TMC_2	VRC Junction	62,643	68,944
TMC_3	KVR Petrol Pump Circle	97,880	1,14,401
TMC_4	Grand Trunk Road & Mini Bypass Road Circle	63,424	67,536
TMC_5	Muthukur Road-Childrens Park Junction	1,51,412	1,84,344
TMC_6	Bose Bomma Jn	69,523	85,655
TMC_7	Gandhi Bomma Jn	75,322	96,045
TMC_8	AnnamayyaCircle	75,912	80,203

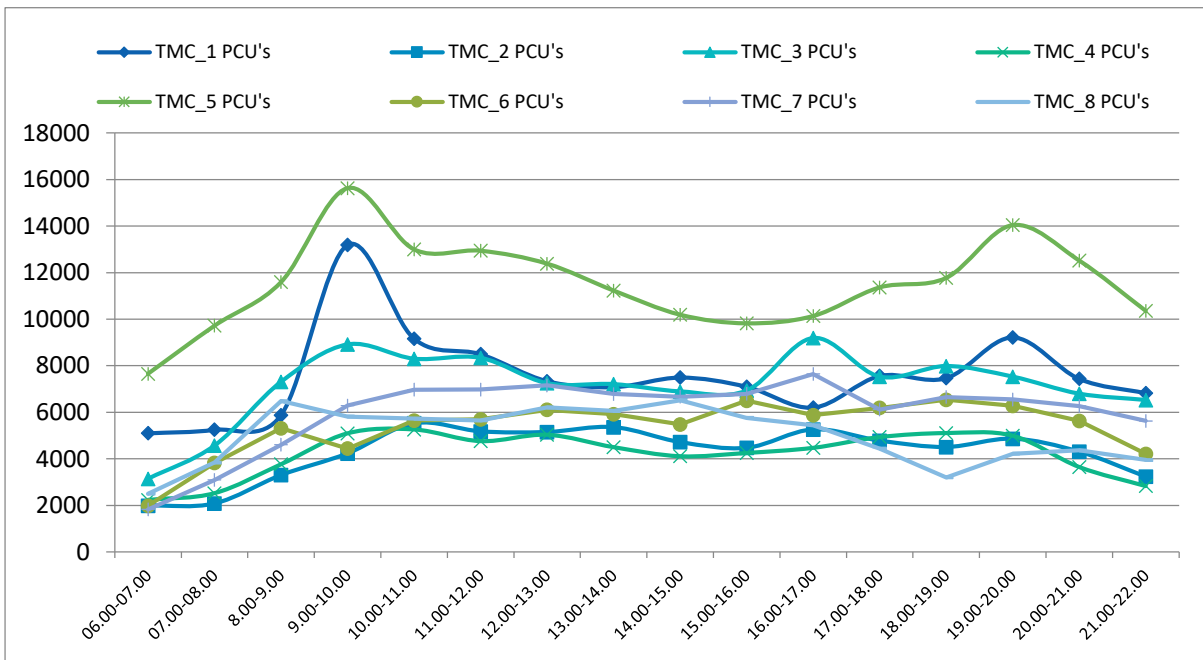


Figure 26: HOURLY VARIATIONS OF DAILY TRAFFIC VOLUMES

Table 14: PEAK HOUR TRAFFIC VOLUMES

Location ID	Location	Peak Hour	Morning Peak		Peak Hour	Evening Peak		Daily Total PCUs
			PCUs	PH%		PCUs	PH%	
TMC_1	Potti Sree Ramulu Statur Circle	09.00-10.00	13,188	11%	19.00-20.00	9,217	8%	1,20,815
TMC_2	VRC Junction	10.00-11.00	5,526	8%	16.15-17.15	5,373	8%	68,944

TMC_3	KVR Petrol Pump Circle	09.00-10.00	8,913	8%	16.00-17.00	9,189	8%	1,14,401
TMC_4	Grand Trunk Road & Mini Bypass Road Circle	10.00-11.00	5,262	8%	17.45-18.45	5,222	8%	67,536
TMC_5	Muthukur Road-Childrens Park Junction	09.00-10.00	15,630	8%	19.00-20.00	14,040	8%	1,84,344
TMC_6	Bose Bomma Jn	10.45-11.45	6,131	7%	18.30-19.30	6,848	8%	85,655
TMC_7	Gandhi Bomma Jn	09.30-10.30	7,084	7%	16.00-17.00	7,645	8%	96,045
TMC_8	Annamayya Circle	08.00-09.00	6,481	8%	16.00-17.00	5,447	7%	80,203

It is observed that two wheelers constitute the highest accounting to about 50% of the modal share at survey intersections, followed by auto rickshaws with 30%. The modal share for the same are as shown

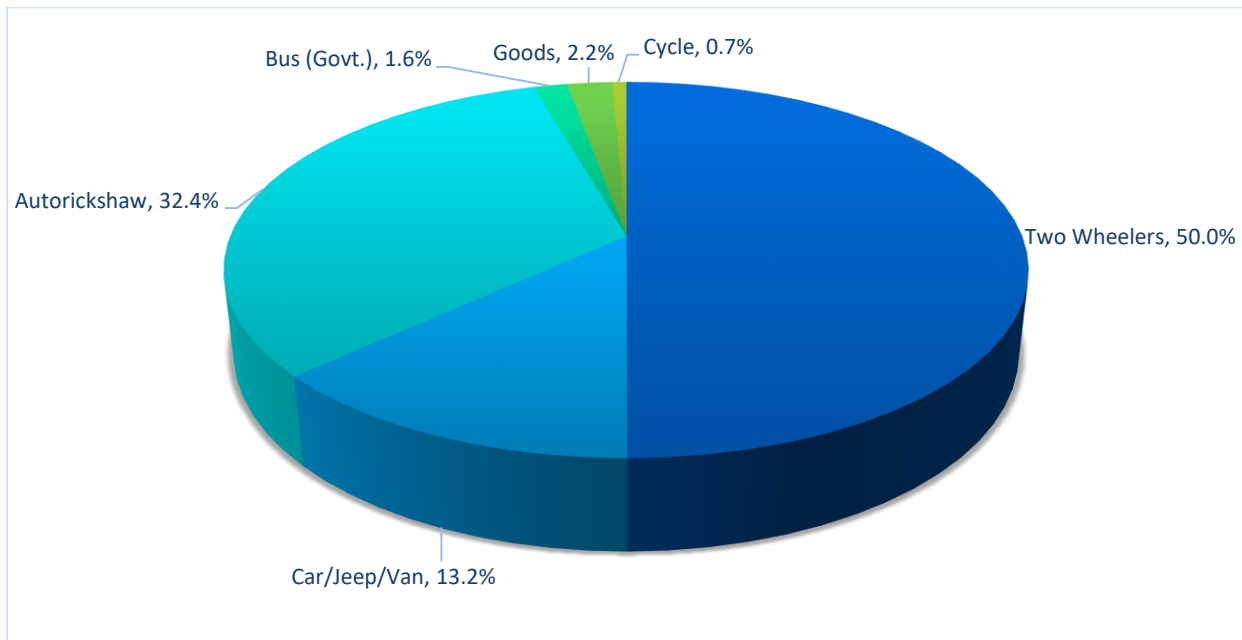


Figure 27: TRAFFIC COMPOSITION AT TMC LOCATIONS

Table 15: LOCATION WISE TRAFFIC COMPOSITION FOR INTERSECTIONS

MODE	TMC_1	TMC_2	TMC_3	TMC_4	TMC_5	TMC_6	TMC_7	TMC_8
Two Wheelers	36%	63%	53%	62%	40%	52%	50%	59%
Car	12%	8%	14%	13%	22%	4%	5%	17%
Auto rickshaw	46%	26%	29%	15%	34%	38%	42%	20%

Bus	2%	1%	3%	3%	1%	1%	1%	1%
Goods	2%	1%	2%	6%	2%	2%	1%	2%
Cycle	1%	1%	0%	1%	0%	2%	1%	0%

Key Inferences:

1. Highest traffic volume is observed at Muthukur Road Junction (TMC_5) due is interaction with the Ballary-Krishnapatnam Highway and Muthkur-Children’s park Road, connecting important activity nodes of the city.
2. Two wheelers contribute to the higher share of traffic composition in the city, followed by auto rickshaws.
3. Highest share of two wheelers is observed at VRC Junction, the highest share of cars, auto rickshaws and goods are observed at Muthkur- Children’s park Junction.

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 three public transit terminals present in in Nellore.

Table 16: TERMINAL SURVEY AND COUNTS LOCATIONS

CODE	LOCATION
TC_1	Atmukur Bus Stand
TC_2	Nellore RTC Bus Stand
TC_3	Nellore Railway Station

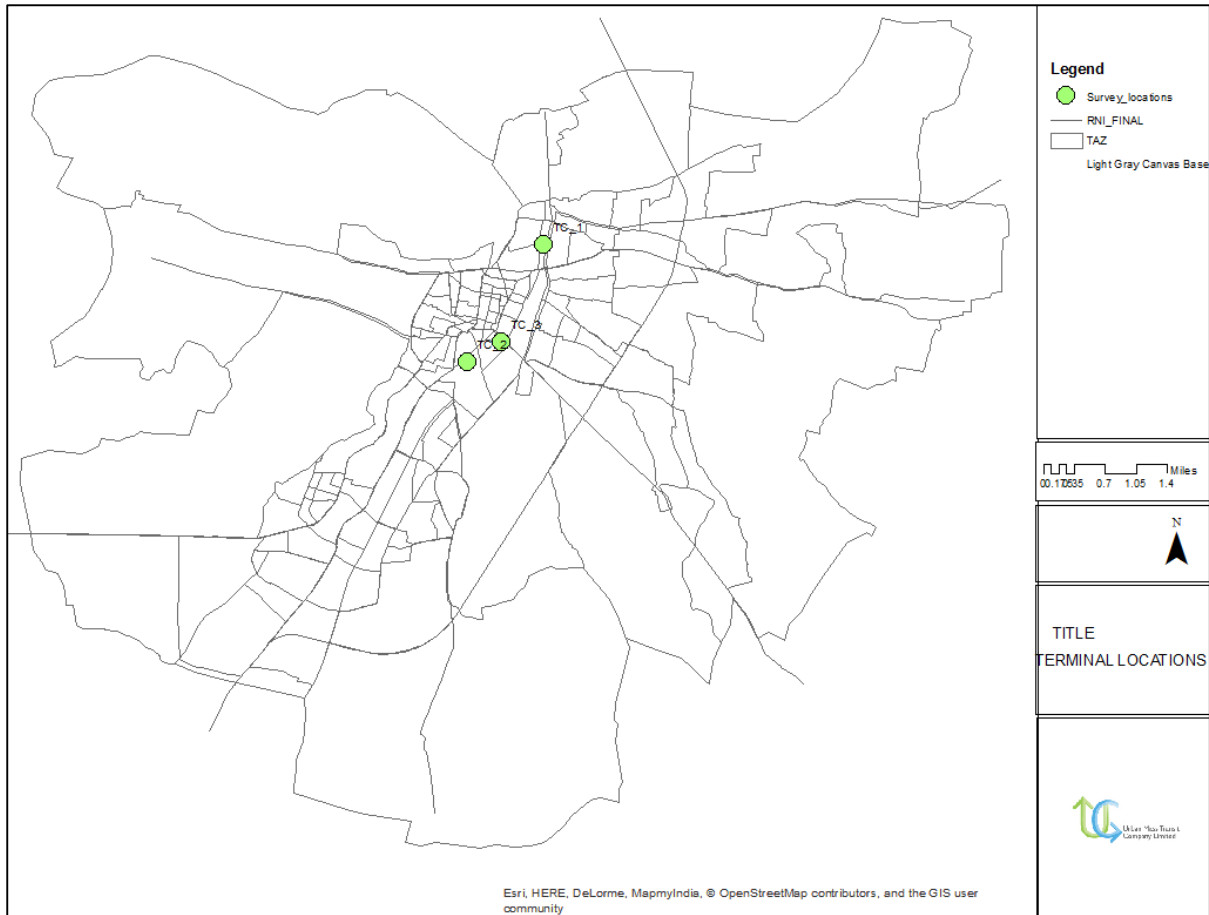


Figure 28: TERMINAL SURVEY LOCATIONS

Analysis: The terminal passenger surveys indicate that Nellore Bus Stand has the highest share of passenger volume accounting up to 55%, followed by Nellore Railway Station. The in and out flow volumes are shown. The hourly variations at these terminals are as shown.

Table 17: TERMINAL PASSENGER VOLUMES

S. No.	Code	Name of the Terminal	Buses			Passengers			Occupancy	% Share of Overall Passengers
			In	Out	Both	In	Out	Both		
Bus Station										
1	TC_1	Atmakur Bus Station	631	526	1157	3553	3989	7542	6.5	18%
2	TC_2	Nellore Stand Bus	669	886	1555	11327	11951	23278	15.0	55%
Total			1300	1412	2712	14880	15940	30820	11.4	72%
Railway Station										
3	TC_3	Nellore Railway Station				6669	5063	11732		28%
Total						6669	5063	11732		28%
Grand Total						21549	21003	42552		100%

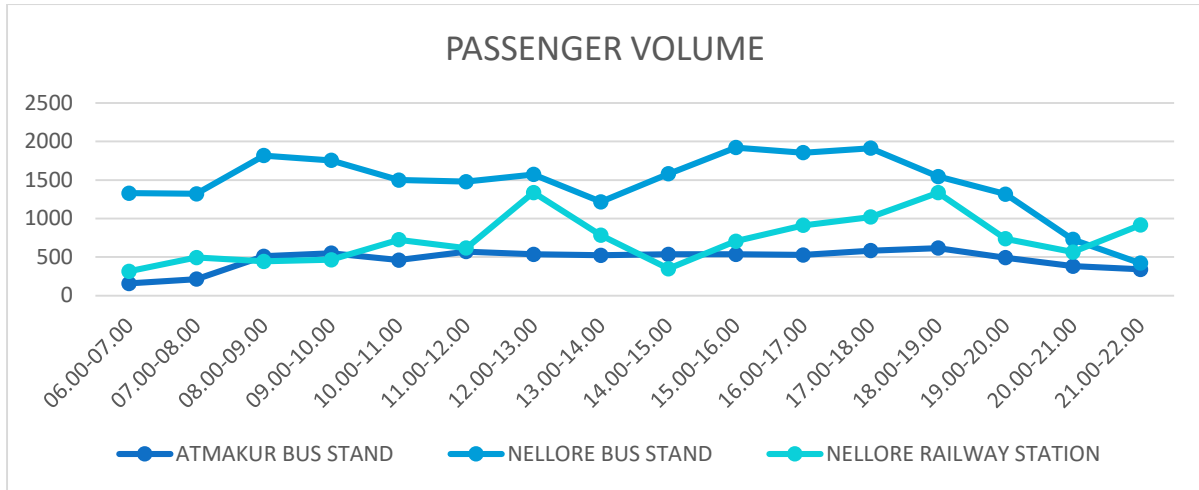


Figure 29 HOURLY VARIATIONS OF PASSENGERS AT TERMINAL LOCATIONS

It is observed that the peak hour for the Bus based transit is between 5pm to 7pm, and afternoon 12pm to 1pm for the rail based transit. The peak hour volumes are shown in Table

Table 18: 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	Atmakur Bus Station	17.45-18.45	325	305	630	9%	8%	8%
2	TC_2	Nellore Bus Stand	17.15-18.15	1028	993	2021	9%	8%	9%
Railway Station									
3	TC_3	Nellore Railway Station	12.00-13.00	592	746	1338	9%	15%	11%

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 43% of the total trips, which is observed to be justified by tip frequency distribution wherein 50% of the trips are made on daily basis

Table 19: DISTRIBUTION OF TERMINAL PASSENGER TRIPS BASED ON PURPOSE

PURPOSE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Work	43%	42%	48%
Education	8%	6%	13%
Shopping	3%	4%	1%
Social	10%	11%	5%
Religious/Recreation	6%	7%	0%
Health	5%	6%	2%
Home(Return)	7%	6%	9%
Others	18%	17%	20%

Table 20: DISTRIBUTION OF TERMINAL PASSENGER TRIPS BASED ON FREQUENCY

FREQUENCY	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Daily once(one-way)	9%	11%	4%
Daily twice(up & down)	18%	21%	9%
Daily thrice or more	23%	1%	0%
Weekly	23%	23%	23%
Occasionally	49%	44%	64%

The access and egress modes of the terminal passengers were analysed and it was observed that auto rickshaws 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 21: MODE WISE DISPERSAL OF TERMINAL PASSENGERS

DISPERSAL MODE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
2-wheeler	15%	16%	13%
Car/Jeep/Van	14%	15%	13%
Auto Rickshaw	57%	53%	71%
Bus	10%	12%	4%
Cycle	0%	0%	0%
Cycle Rickshaw	0%	0%	0%
Walk	3%	4%	0%

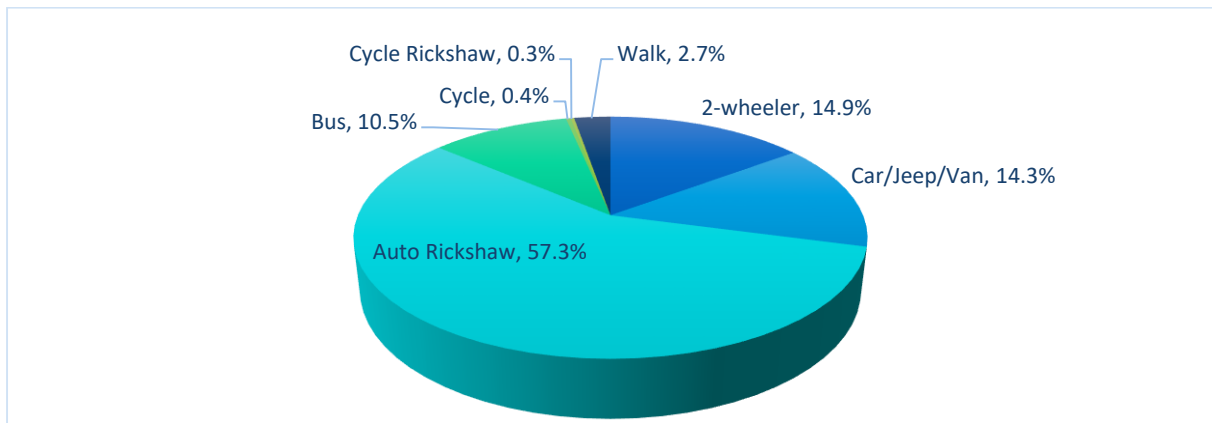


Figure 30: DISTRIBUTION OF DISPERSAL MODES OF TERMINAL PASSENGERS

It is observed that the average access and dispersal time of terminal passengers is observed to be around 16 minutes and the average distance accounts to about 7kms. It is observed that bus is used as a prominent mode to access the terminals by passengers travelling from the surrounding villages. While auto rickshaws are widely used by passengers in the city due to its availability and fare as in case of shared auto rickshaws. The Figure and Table represent the access and egress trip characteristics in terms of distance, time and costs.

Table 22: MODE WISE TERMINAL PASSENGER ACCESS AND EGRESS TRIP CHARACTERISTICS

ACCESS/EGRESS MODE	AVERAGE TIME	AVERAGE DISTANCE	AVERAGE COST
2-wheeler	12.40	4.19	13.27
Car/Jeep/Van	20.78	7.41	19.69
Auto Rickshaw	14.91	6.40	11.74
Bus	44.37	16.5	35.82
Cycle	5.00	2.60	0.00
Cycle Rickshaw	0.00	0.00	0.00
Walk	8.08	2.71	0.00

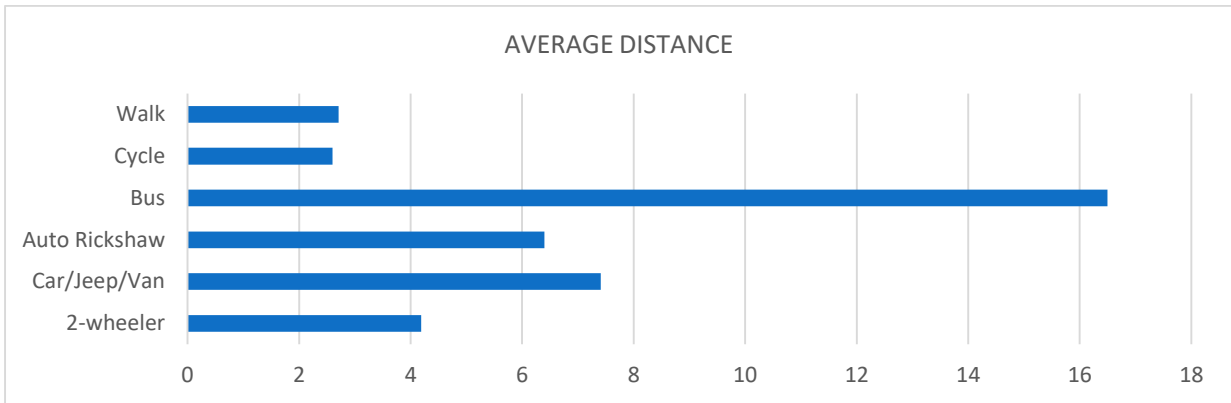


Figure 31: MODE WISE AVERAGE DISTANCE OF TERMINAL PASSENGER ACCESS AND EGRESS

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 10 bus stop locations as shown in Table and Figure

Table 23: BOARDING AND ALIGHTING SURVEY LOCATIONS

CODE	LOCATIONS
BS_1	Vijay Mahal Center Bus Stop
BS_2	Muthukur Center Bus Stop
BS_3	Childrens Park Bus Stop
BS_4	DKW College Bus Stop
BS_5	Current Office Bus Stop
BS_6	Nippo Center Bus Stop
BS_7	Vanamthopu Bus Stop
BS_8	Podalakur Road Center Bus Stop
BS_9	Kanaka Mahak Center Bus Stop
BS_10	Dycas Center Bus Stop

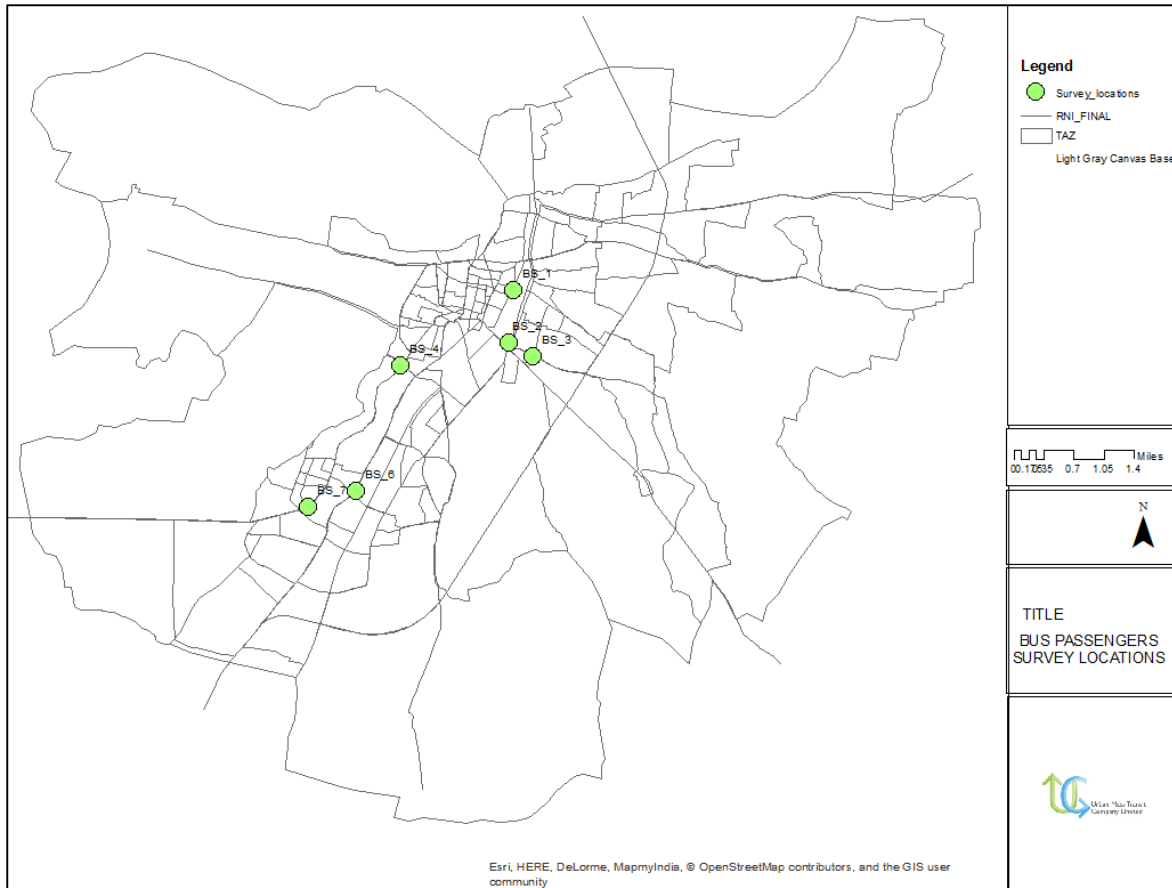


Figure 32: BOARDING AND ALIGHTING SURVEY LOCATIONS

Analysis: The results boarding and alighting survey indicates that Vijay Mahal Centre Bus Stop has the highest number of passengers boarding and alighting amongst all the surveyed locations. The highest number of boarding are observed at Vijaya Mahal Center stop and alighting at Muthukur Stop. The following Table represents the location wise boarding and alighting at surveyed locations.

Table 23: BOARDINGS AND ALIGHTINGS AT SURVEYED LOCATIONS

CODE	LOCATIONS	PB	PA	Total PB+PA	Average Dwell Time (min)
BS_1	Vijay Mahal Center Bus Stop	1066	621	1774	1.26
BS_2	Muthukur Center Bus Stop	222	629	851	1.23
BS_3	Children’s Park Bus Stop	116	115	231	1.29
BS_4	DKW College Bus Stop	350	242	592	1.35
BS_5	Current Office Bus Stop	141	136	277	1.24
BS_6	Nippo Center Bus Stop	250	250	500	1.50
BS_7	Vanamthopu Bus Stop	274	276	550	1.39
BS_8	Podalakur Road Center Bus Stop	336	220	556	1.29
BS_9	Kanaka Mahak Center Bus Stop	404	481	885	1.44
BS_10	Dycas Center Bus Stop	517	402	919	1.66
Total		4297	2838	7135	1.34

Table 24: MODE WISE BOARDINGS AND ALIGHTINGS

Mode	PB	PA	Total PB+PA	PB	PA	Dwell Time (min)	Sitting	Stan - ding	Total	% Share in Overall PB	% Share in Overall PA	% Share in Overall Total PB+PA
Intercity Bus	3152	1979	5131	61%	39%	1.3	28	0	28	46%	29%	75%
Chartered Bus	294	92	386	76%	24%	1.2	25	0	26	4%	1%	6%
Mini/Midi Bus	721	644	1365	53%	47%	1.4	25	0	25	10%	9%	20%
All Modes	4167	2715	6882	61%	39%	1.3	27	0	27	61%	39%	100%

The major mode of public transport in the city is through sub-urban bus services and auto-rickshaws. The sub-urban services account to 752% of all the public transit modes. The survey captures the boarding and alighting's at the identified bus stop location, thus the share of auto-rickshaw observed in the above table constitute the auto-rickshaws stopping at bus stops to pick up the transit passengers. The Table represents the mode wise boarding and alighting details at surveyed locations.

Key Inferences:

1. Vijay Mahal center bus stop is observed to have higher footfalls with respect to the boarding and alighting.
2. Intercity or the sub-urban bus services are provide the inter-city and intra city services in Nellore.

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 8 TMC locations as discussed in the following section.

Analysis: The stated preference data represented a reasonable share of sample form all the modes and was observed to be in ordinance with the vehicular share observed through turn movement counts conducted to the junctions

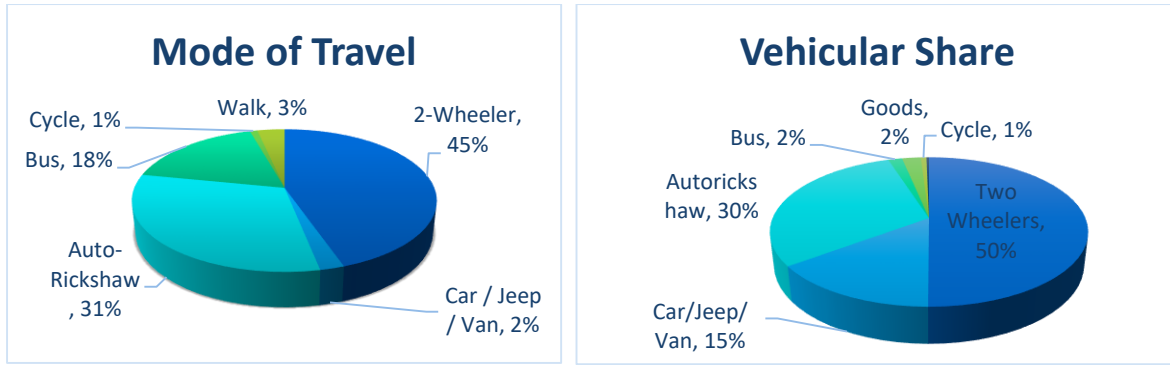


Figure 34: MODE OF TRAVEL OF SP RESPONDEES (LEFT) & VEHICULAR SHARE AT TMC LOCATIONS (RIGHT)

It is observed that 49% 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 details out the results of users preferences.

Table 25: 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	28%	18%	14%	24%	20%	18%	11%	36%	21.1%
2	Probably Existing	8%	8%	24%	28%	16%	15%	21%	10%	16.2%
3	Can't Say	11%	32%	13%	11%	9%	18%	7%	7%	13.5%
4	Probably Improved System PT	30%	23%	25%	17%	17%	24%	30%	18%	23.0%
5	Definitely Improved System PT	22%	20%	24%	21%	38%	25%	31%	29%	26.2%
Total		100%	100%	100%	100%	100%	100%	100%	100%	100.0%

Key Inferences:

- Over 25% reduction in travel time and cost is preferred to use a new and improved public transit system.
- The waiting time is observed to be negotiated over the total travel time and cost as in case of Nellore.

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 show in the survey format in Annexure A.

Location: The survey is conducted at across the 8 TMC locations which were observed to be the major IPT catchments nodes in Nellore.

Analysis: It is observed that majority of the IPT trips were work based trips followed by educational trips. The average distances commuted by the surveyed passenger's trip purposes are as shown. It is observed that, for the surveyed passengers the average distance of work trips is about 6km and over 7km for educational and social trips and about 4.7 km for the remaining trips.

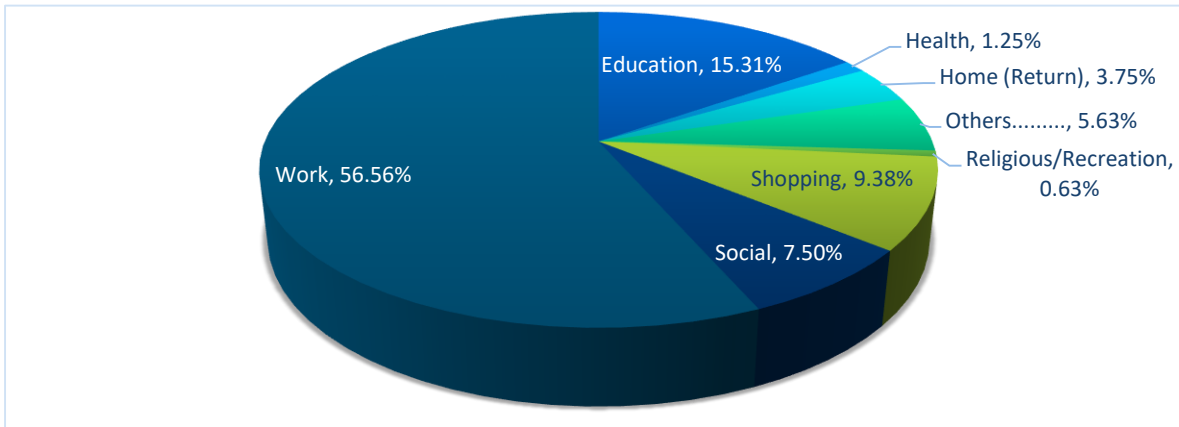


Figure 35: DISTRIBUTION IPT COMMUTER TRIPS BASED ON TRIP PURPOSE¹⁶

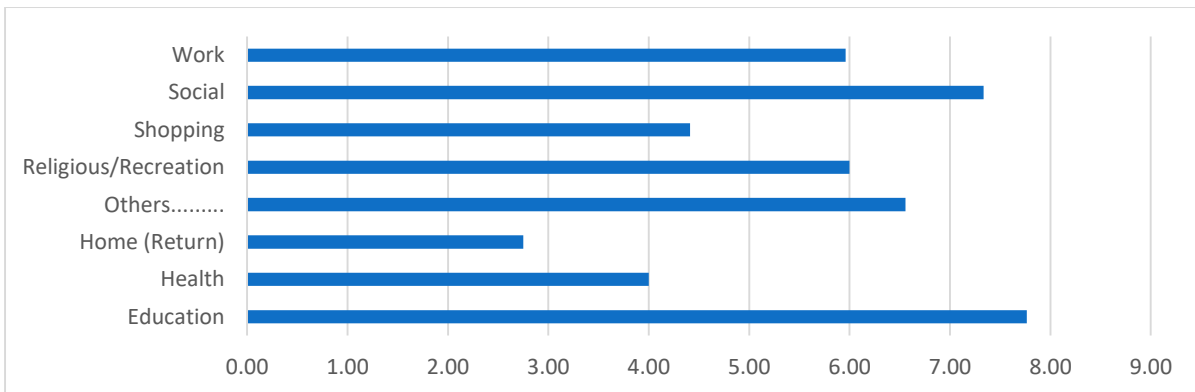


Figure 36: TRIP PURPOSE BASED AVERAGE TRIP DISTANCES ²

¹⁶ Distribution based on survey passengers, this share will later be computed with the household survey data to extract the overall travel characteristics.

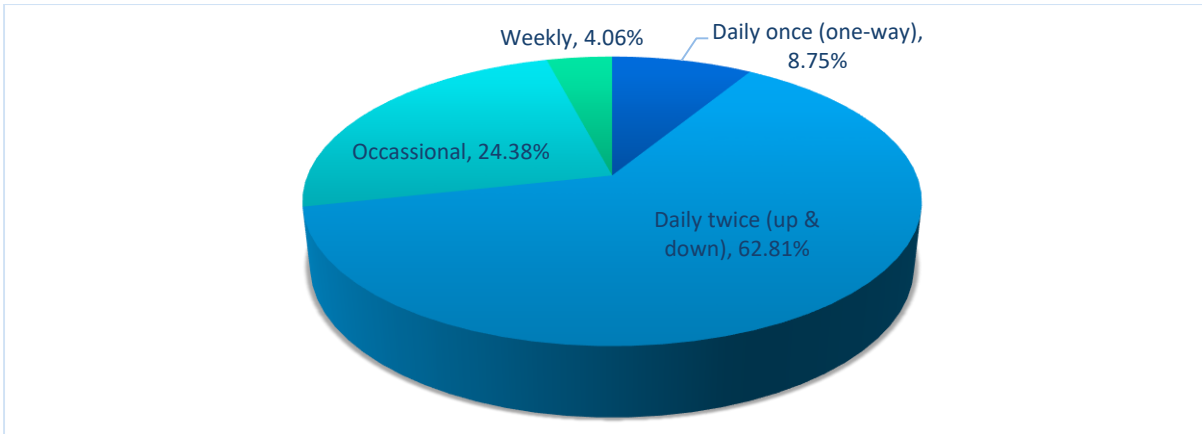


Figure 37: DISTRIBUTION IPT COMMUTER TRIPS BASED ON TRIP FREQUENCY¹⁷

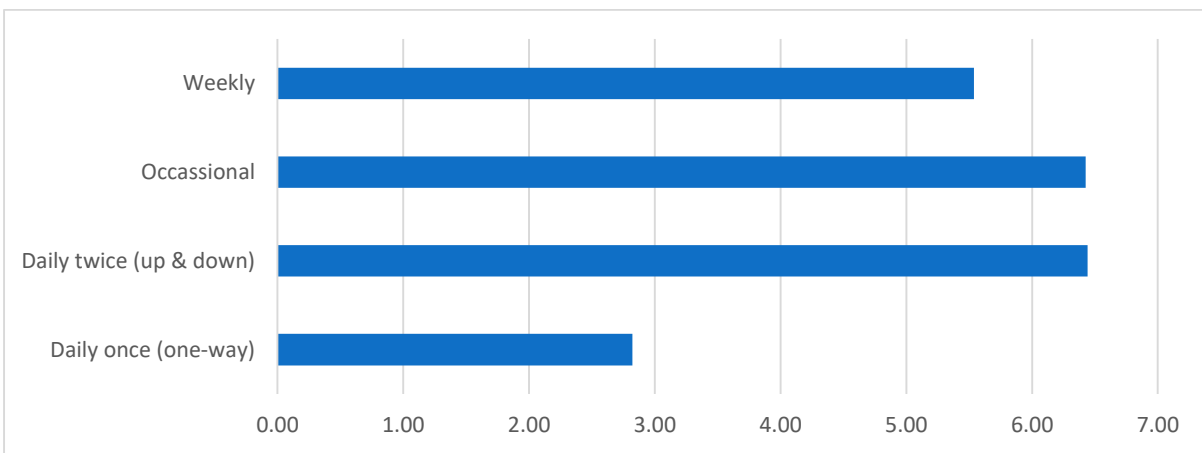


Figure 38: TRIP FREQUENCY BASED AVERAGE TRIP DISTANCES ³

About 71% of the surveyed IPT passenger trips were observed to be daily trips followed by occasional trip accounting to 24% of the total trips. The average trip distance of daily trips is about 4.6km while the occasional users is about 6.4km. Thus, the work based daily trips are made within a distance of 5kms. The Figure shows average trip lengths of survey passengers' base on the trip frequency.

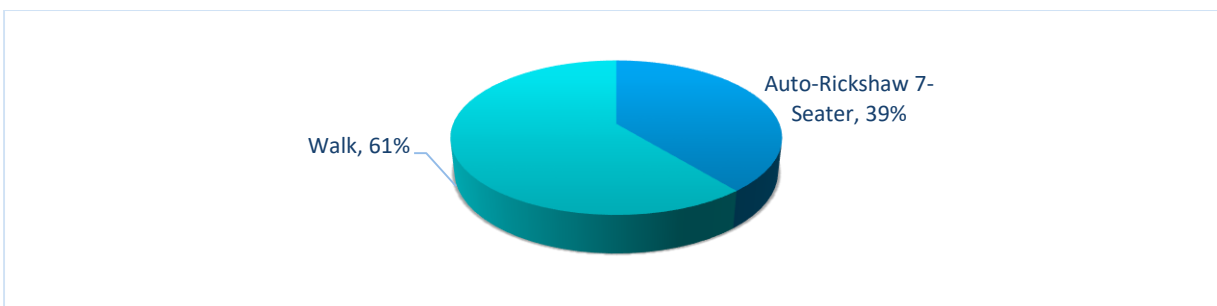


Figure 39: MODE WISE DISTRIBUTION OF ACCESS AND EGRESS TRIPS

¹⁷ Distribution based on survey passengers, this share will later be computed with the household survey data to extract the overall travel characteristics.

In case of Nellore, it is observed that walk is the major mode for last mile connectivity. The modal distribution of IPT users access and egress trips are as shown in Figure. From the share it is visible that auto rickshaws provide end to end connectivity. The last mile auto-rickshaw trips for the surveyed IPT users constitute about 39% of the total trips, indicating the possibility of transfers in the city. The trip characteristics of surveyed IPT passengers

Table 26: IPT COMMUTER ACCESS AND EGRESS TRIPS TRAVEL CHARACTERISTICS

ACCESS/ EGRESS MODE	AVERAGE TIME TIME (MIN)	AVERAGE TRAVEL COST (RS)
Auto-Rickshaw 7-Seater	5	12.3
Walk	7	0

Key Inferences:

- 1 50% of the IPT commuter trips are work based trips, followed by educational trips.
- 2 The work based daily trips are made within a distance of 5km indicating considerable distribution of land use in the city.
- 3 Shared auto-rickshaws are observed to provide end to end connectivity ply on all major routes.
- 4 The average travel time for last mile trips is about 12 minutes.
- 5 The average distances of last mile walk trips of IPT commuters is about 0.8km.

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 6 locations were identified for the same

Table 27: PEDESTRIAN COUNT LOCATIONS

CODE	LOCATION
TMC_1	Potti Sree Ramulu Statur Circle
TMC_2	VRC Junction
TMC_3	KVR Petrol Pump Circle
TMC_4	Grand Trunk Road & Mini Bypass Road Circle
TMC_5	Muthukur Road Junction
TMC_8	AnnamayyaCircle

Analysis: It is observed that VRC junction has the highest volume of footfall due to its strategic location connecting the Bus Stand, VR educational institutes, Pedda Bazaar, Nellore South Railway Station and other major educational institutes such as VS University, commercial and recreational nodes such as Leela Mahal Cinema, Indoor Stadium etc. The pedestrian daily volumes and peak hour volumes are as shown in Table and the hourly variations in daily volumes is shown in figure

Table 28: PEDESTRIAN VOLUMES

CODE	LOCATION	Daily Volume (Along+Across)	Peak Hour	Peak Hour Volume (Along+Across)
TMC_1	Potti Sree Ramulu Statue Circle	29234	10.00-11.00	1900
TMC_2	VRC Junction	37675	17.00-18.00	3115
TMC_3	KVR Petrol Pump Circle	18987	17.00-18.00	1673
TMC_4	Grand Trunk Road & Mini Bypass Road Circle	15729	9.45-10.45	1226
TMC_5	Muthukur Road Junction	18646	17.30-18.30	1656
TMC_8	AnnamayyaCircle	14324	17.30-18.30	1154

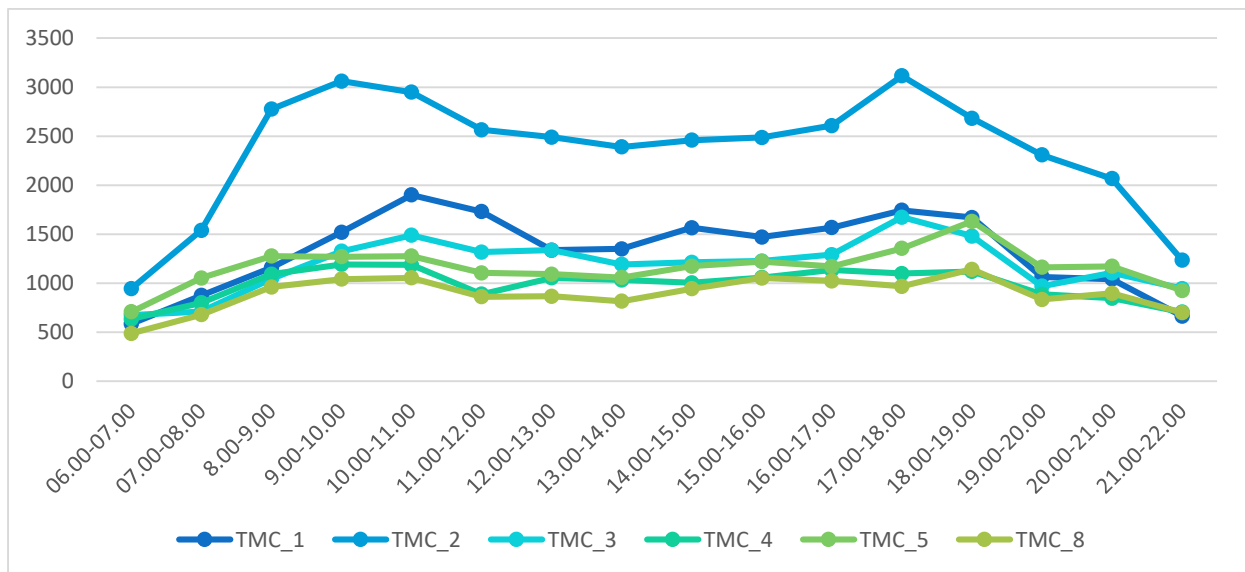


Figure 38: HOURLY VARIATIONS IN PEDESTRIAN VOLUMES

The degree of conflict between the pedestrians and vehicles is analysis and it observed that Muthukur requires immediate attention in terms of pedestrian crossing infrastructure facilities such as table top crossings while Potti Sree Ramulu Statue Circle and VRC junction require design based interventions in terms of crossing facilities. The Table exhibits the values for the PV square analysis.

Table 29: PV SQUARE ANALYSIS VALUES

CODE	LOCATION	PV Square/10 ⁸ Value
TMC_1	Potti Sree Ramulu Statue Circle	2.1
TMC_2	VRC Junction	1.6
TMC_3	KVR Petrol Pump Circle	1.5
TMC_4	Grand Trunk Road & Mini Bypass Road Circle	0.6
TMC_5	Muthukur Road Junction	3.3
TMC_8	AnnamayyaCircle	0.6

Key Inferences:

1. VRC junction is observed to have highest footfall amongst all the surveyed locations.
2. The morning peak hour for the pedestrian is observed between 10am to 11am and evening peak between 5:30pm to 6:30pm.
3. It is analysed that Muthukur requires immediate attention in terms of pedestrian crossing infrastructure facilities such as table crossings.
4. Potti Sree Ramulu Statue Circle and VRC junction require design based interventions in terms of crossing facilities to minimise the degree of pedestrian conflicts.

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 suvery was conducted in the following three location as shown in Figure and Table

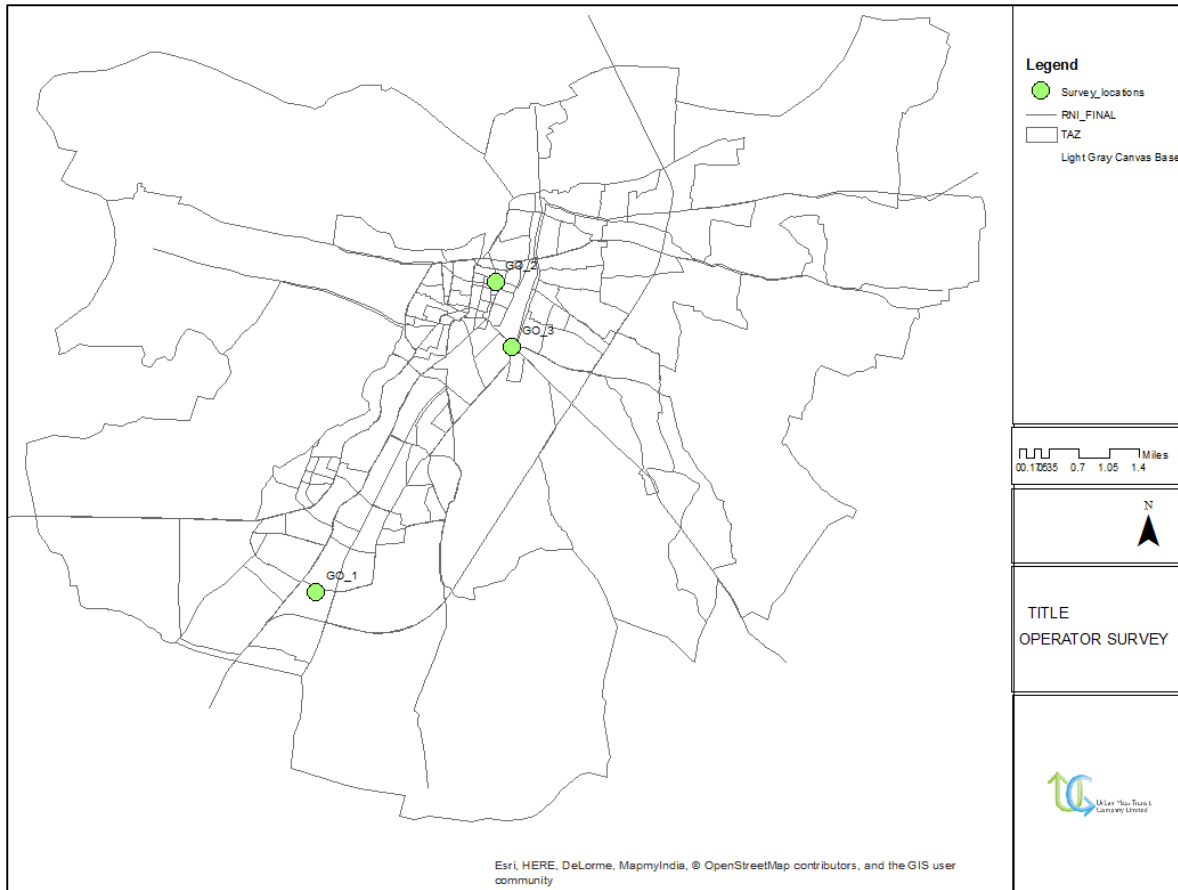


Figure 39: GOODS OPERATOR SURVEY LOCATIONS

Table 30: GOODS OPERATOR SURVEY LOCATIONS

CODE	LOCATION
GO_1	VRI Logistics Ltd Area, Ayyapa Temple, Joythi Nagar
GO_2	DRL Logistics Pvt Ltd Area, Near VRC Center
GO_3	Along Ballari- krishnapatnam port Highway, Ramalinga Puram

Analysis: It is observed that majority of the trips are daily trips, commuting with in the city and nearby towns. The trip frequencies of goods vehicles captured through Goods Operator Survey is as shown in Figure.

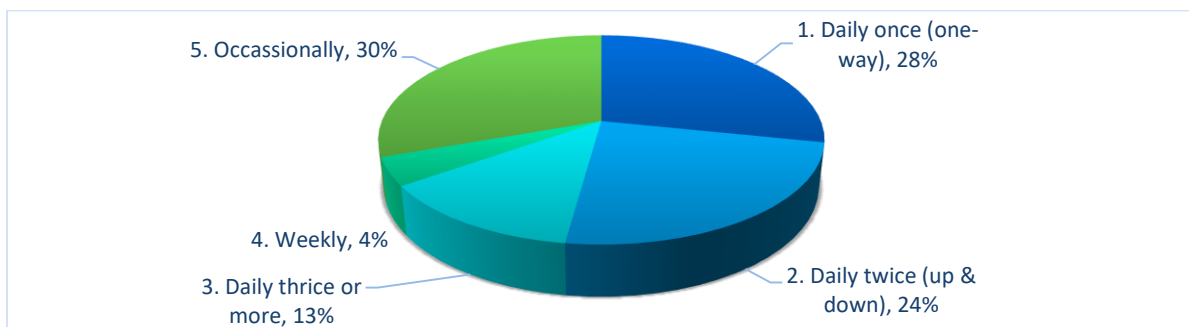


Figure 40: TRIP FREQUENCIES OF GOODS VEHICLES

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

Table 31: FREQUENT ROUTES OPERATED FOR GOODS VEHICLES IN THE CITY

S.NO.	GOODS VEHICLE ROUTES
1	ATHMAKUR BUS STOP TO NHAI OFFICE ADDA
2	AYYAPPA TEMPLE TO RAILWAY STATION
3	CHENNAI TO GVK KALYANA MANDAPAM
4	HARINADHAPURAM
5	KOVVURU TO NHAI OFFICE PORT BUNK
6	KURNOOL(GADWAL)
7	KVR PUMP LINE
8	MINI BYPASS ROAD
9	MUTTHUKURU ROAD
10	PODHALAKURU ROAD
11	TRUNK ROAD
12	VRC ROAD
13	6TH MILE ROAD
14	MULAPETA

The survey indicates that 43% of the goods operators do not own designated parking areas. It was observed 61% of the operators own vehicle parking area below 500sqft, while 33% of the operators own vehicle parking area over 2000sqft. The nature of parking facilities employed by 61% of the surveyed operators is on-street parking. It was stated that the average unloading time with the city is about 2 hours. The average number of goods trips per month is 31. The nature and share of commodity type are as shown in Table

Table 32: NATURE OF COMMODITIES

COMMODITY	SHARE
Vegetable/Fruit/Milk/Fish	18%
FoodGrains/Rice/Wheat/Jowaretc	7%
Sand/Brick/Cement/Steel/Aggregate	5%
Petrol/Diesel/Gas/LPG	20%
ForestProducts(Wood/Rubberetc)	9%
Textiles	5%
ConsumerGoods	29%
Chemicals&Fertilizers	7%

Key Inferences:

1. The majority of the trips observed are daily trips made within the city and to the near by towns.

2. 61% of the operation are engaged in on-street parking of vehicles adjoin their plots.
3. The average unloading time within the city is observed to 2 hours.
4. Consumer goods contribute to the highest share (29%) in commodity type, followed by petrol and diesel.
5. The average number of trips made by the goods vehicle is observed to be 31 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 Nellore.

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. It observed that, Nellore has a good share of younger population aged below 35%. The working age group contribute to about 60% of the total population. The age-sex pyramid is as shown in Figure. The share of females is higher in age groups between 25 years to 45 years. The sex ratio derived from the house hold survey is 946. It is observed that ratio between the male and females across all the age groups is well distributed.

Table 33: AGE WISE DISTRIBUTION OF POPULATION

Code	Age	All	Male	Female
1	0-5	7%	7%	7%
2	5-17	17%	18%	16%
3	18-24	17%	17%	16%
4	25-34	19%	18%	21%
5	35-44	18%	17%	19%
6	45-58	15%	16%	15%
7	59-64	3%	3%	3%
8	65-74	3%	3%	3%
9	>75	1%	1%	1%

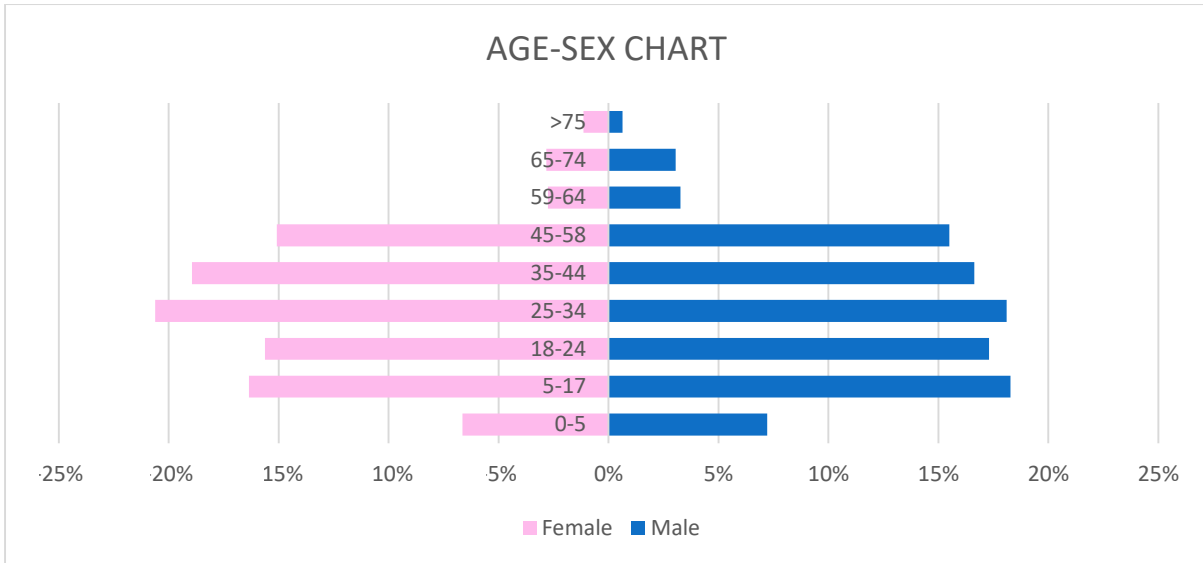


Figure 41: AGE-SEX PYRAMID

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. Similarly, the distribution based on occupational status and employment sector are shown below in Figures and. It is observed that 34% of the population are students, 40% are employed in various sectors as shown in Figure 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 educational sector with 43% followed by service sector with a share of 13%. The manufacturing sector contributes to 14% while informal sector contributes about 3% and agricultural sector about 4%. This, service and educational sectors are the major sectors of employment in the city. The average number of students per household is observed to be 2.

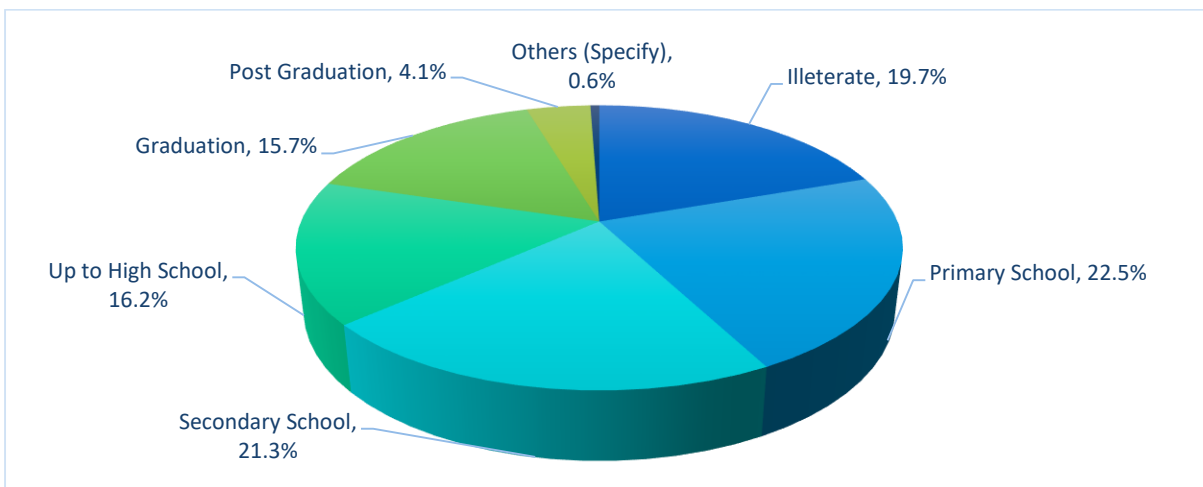


Figure 42: DISTRIBUTION BASED ON EDUCATIONAL QUALIFICATION

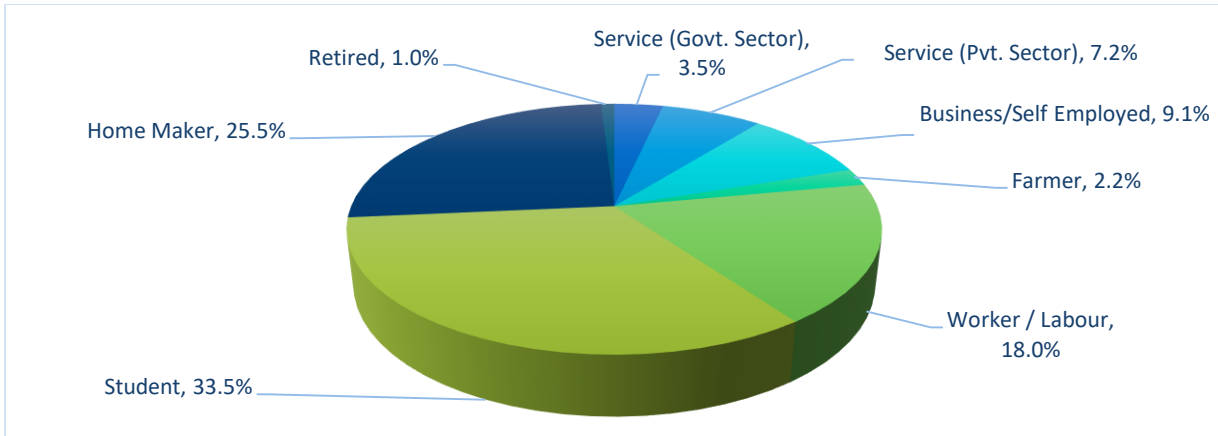


Figure 43: DISTRIBUTION BASED ON OCCUPATIONAL STATUS

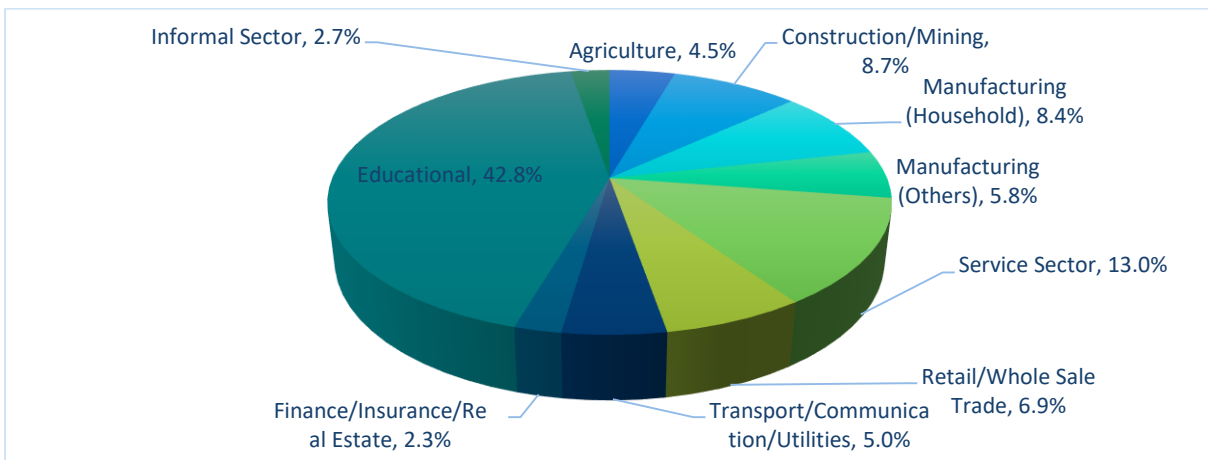


Figure 44: DISTRIBUTION BASED ON EMPLOYMENT SECTOR

The average monthly income as per the Household survey in Nellore is about INR 14,307. The distribution of households based on monthly income is as show in Table. About 50% of households have monthly income below INR 10,000 and 23% 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. 1.3). It was also observed that 88% of the households owning a vehicle own two wheelers while only 6% of the households own cars. The distribution is as shown in figure.

Table 34: DISTRIBUTION BASED ON AVERAGE MONTHLY INCOME

Code	Category	Monthly HH Income	% Distribution	Avg. Monthly HH Income (INR)
1	EWS	<5000	8%	4615
2	LIG	5001-10000	42%	9104
3	MIG	10001-15000	27%	14055
4	HIG	>15000	23%	25170
Total			100%	14307

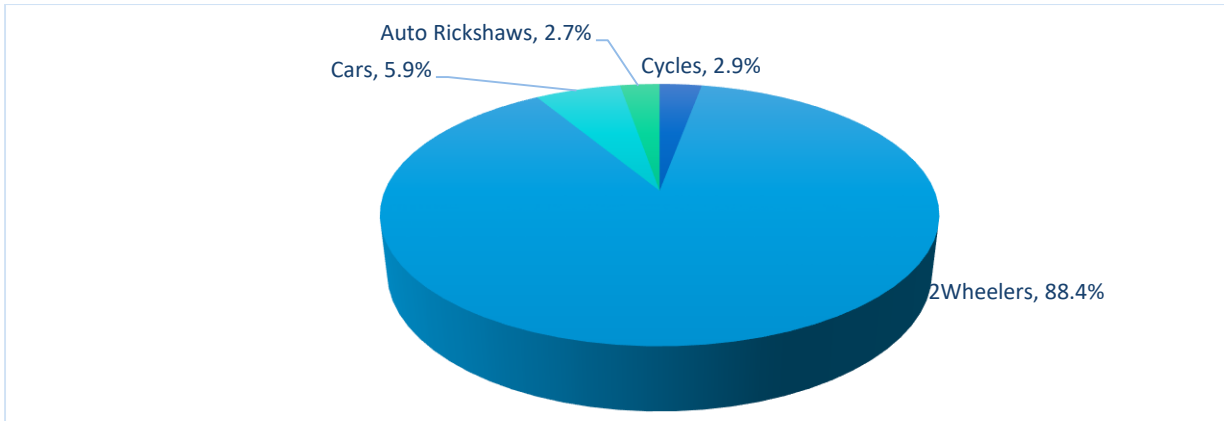


Figure 45: VEHICLE OWNERSHIP COMPOSITION

The classification based on the category of vehicles owned indicates that 49% of the households own only two wheelers, while only 3% of the households own only cars. 37% of the households do not any cycles while only 1% of the population own only cycles. The detailed classification is as shown in Figure.

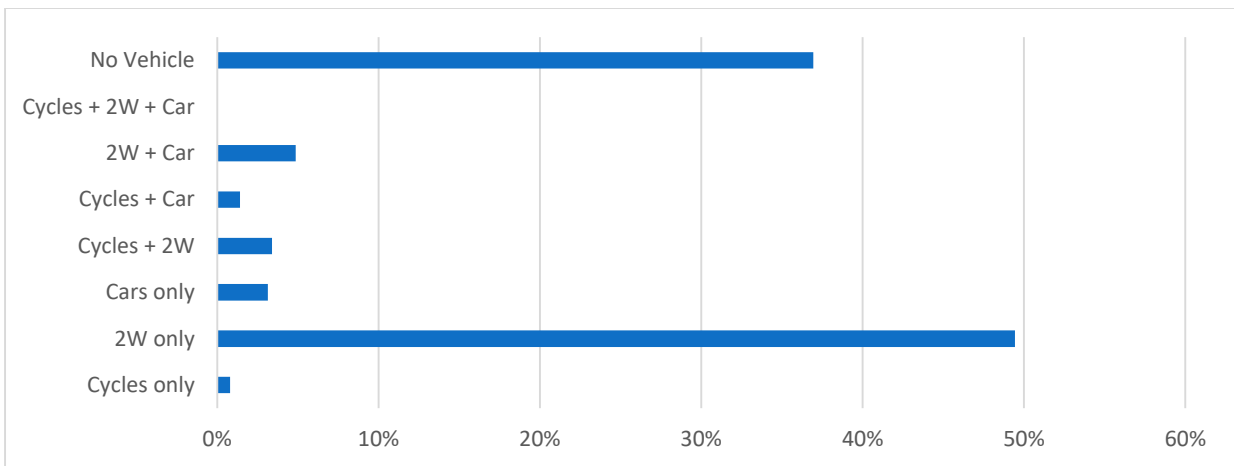


Table 35: DISTRIBUTION HOUSEHOLDS BASED ON VEHICLE OWNERSHIP

It is observed that only 52.2% 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 36: PARKING AVAILABILITY WITHIN THE PROPERTY PREMISES

Code	Parking Availability	% Dist.
1	Yes	52.2%
2	No	47.8%
Total		100%

Table 37: DISTANCE BASED DISTRIBUTION OF HOUSEHOLDS TO DAILY NEEDS

Code	Distance to Daily needs	To Shop	Educational Needs	Medical Needs
		% Dist	% Dist	% Dist
1	<250	20%	9%	1%
2	251 to 500	20%	7%	2%
3	501 to 750	42%	23%	10%
4	751 to 1000	9%	11%	4%
5	1001 to 1500	5%	32%	27%
6	>1500	4%	18%	55%
	Total	100%	100%	100%

It is observed that 40% of the households travel below 500m to access their daily household errands. 49% of the household travel up to 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 educational and medical needs. The detailed analysis on the trip purposes and travel distances is discussed in following Section 3.15.2.

TRAVEL CHARACTERISTICS

Based on the travel diary information collected as a part of the household survey, the Per Capita Trip Rate (PCTR) for Nellore was observed to be 1.29 including the walk trips and 1.08 excluding the walk trips. The PCTR for motorised trips is about 1.05. The distribution of trips based on the major mode of travel is as shown in Figure. The major modes of travel in Nellore are observed to be auto rickshaw and two wheelers with a modal share of 19% and 39% respectively. The share of bus based public transport accounts to 18%. The Non-Motorised Transport comprises about 19% including 17% of walk trips. Thus, the clearly indicating that auto rickshaw is a dominating mode over public buses.

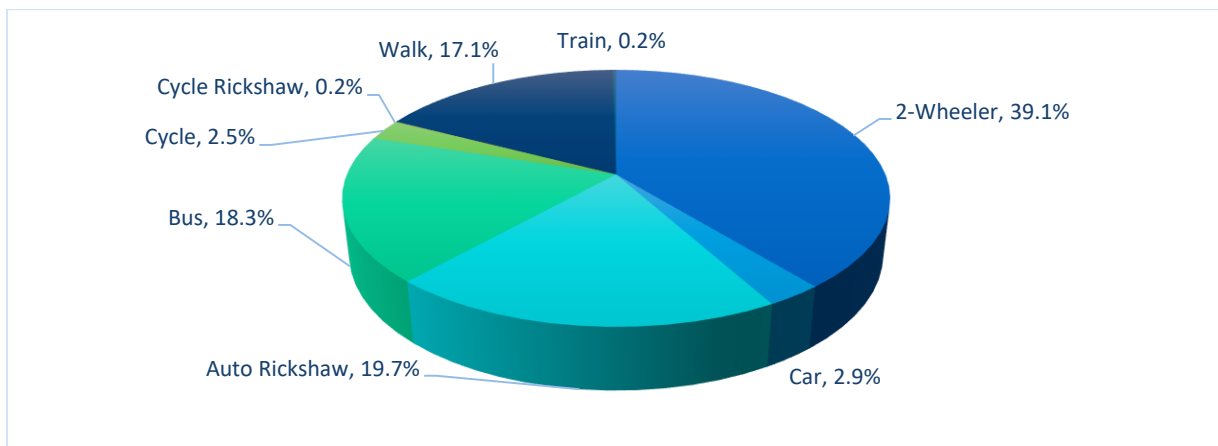


Figure 46: MODE SHARE

Table 38: AVERAGE TIME

Code	Mode	Avg. WT (Mins)
------	------	----------------

1	Public Bus	7.2
2	Auto Rickshaw	4.8
3	Cycle Rickshaw	4.1
Total		7.8

The average waiting time to access the public transport services in 7.8 minutes. The longest waiting time is observed for buses with a wait time of 7.2 minutes. The average wait times of all the public transport modes are shown in Table. The average trip length in the Nellore is observed to be 5.8 including the walk trips and 6.7 excluding the walk trips. The mode wise trip length are as shown in Figure. The mode wise and distance-based classification of trips are shown in Figure.

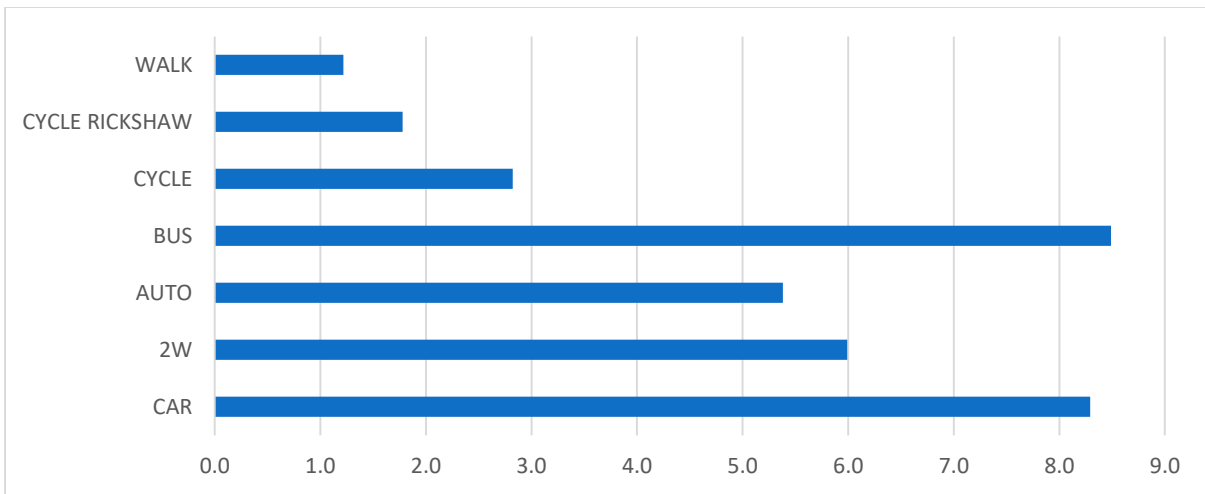


Figure 47: MODE WISE TRIP LENGTHS

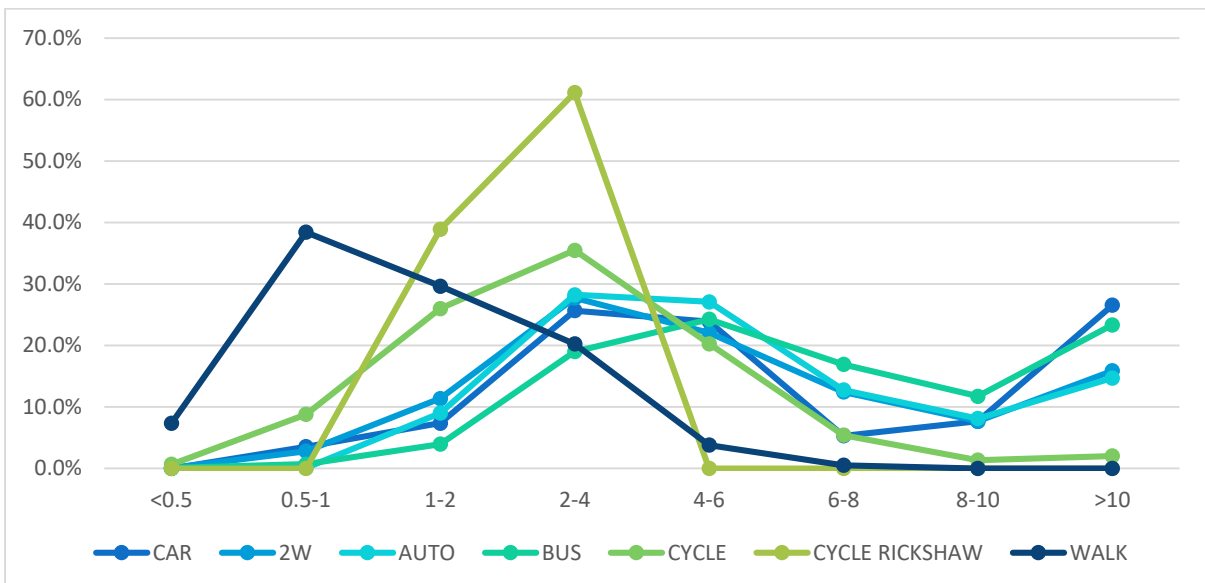


Figure 48: MODE-WISE AND DISTANCE BASED DISTRIBUTION OF TRIPS

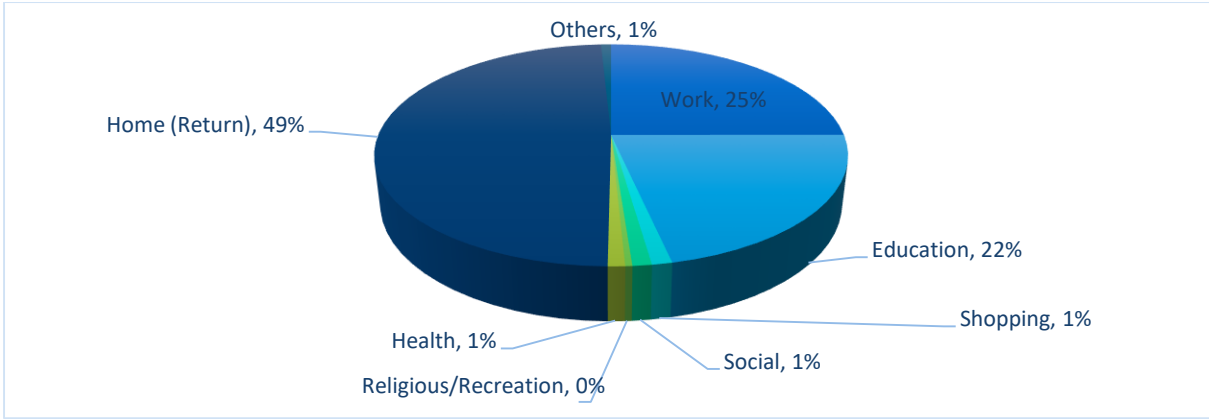


Figure 49: DISTRIBUTION OF TRIPS BASED ON TRIP PURPOSE

The purpose wise distribution of trips are as shown in Figure. It is observed that major share of trips are work based and education trips accounting to 25% and 22% respectively. A similar share is observed in the home (return) trips. The Average Trip Length (ATL) for work trips is observed to be 6.8 and 4.8 for educational trips. The longest trips lengths is observed for social or recreational trips with an average length of 7.4. The Distribution of trips and ATL based on trip purpose are as shown in Figure and Figure respectively.

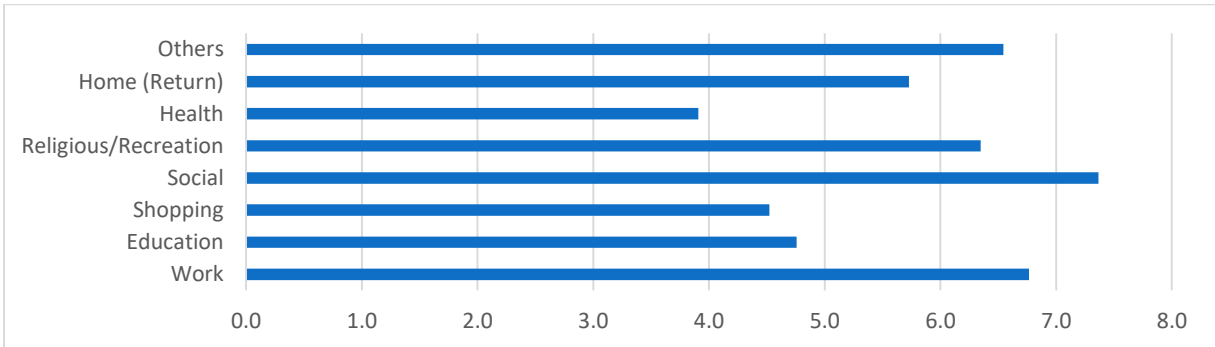


Figure 50: AVERAGE TRIP LENGTHS BASED ON TRIP PURPOSE

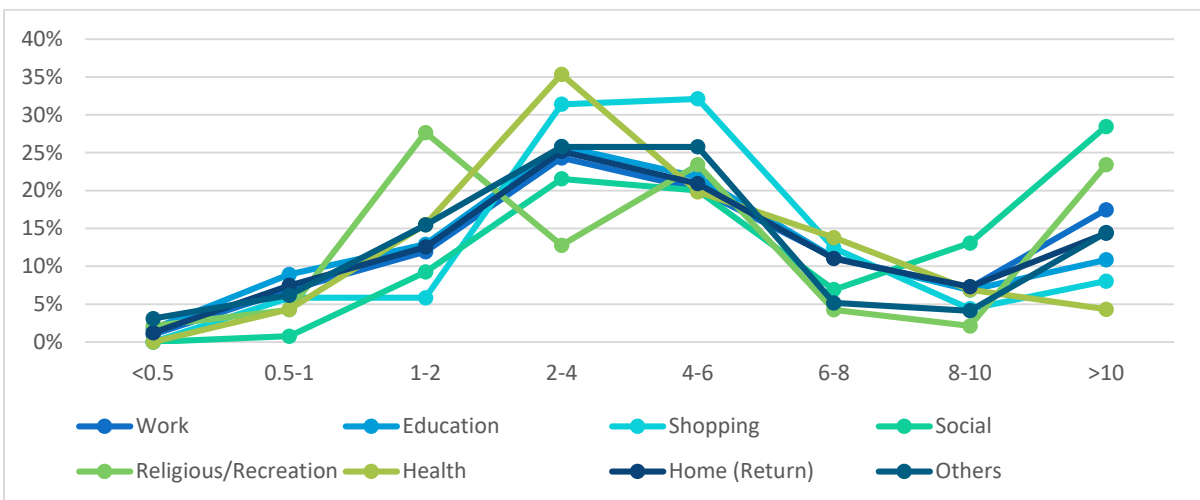


Figure 51: DISTRIBUTION OF TRIPS PF TRIPS BASED ON TRIP LENGTHS AND TRIP PURPOSE

The distribution of trips based on trip purpose are as shown in Figure. It is observed that a major share of trips are made on daily basis which are over 90%. The average trip length of daily trips is 5.3. The ATL based on trip Frequency is as shown in Figure .

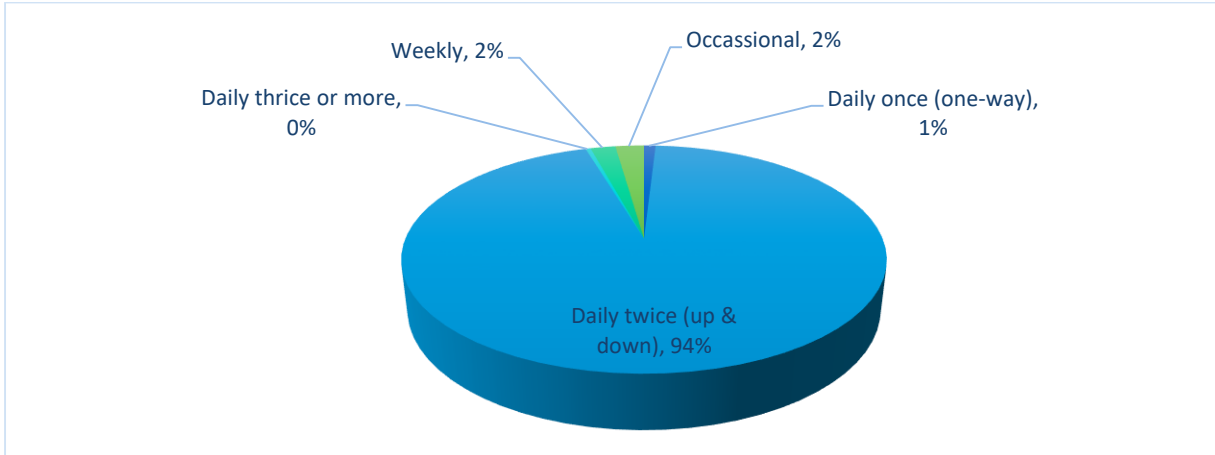


Figure 52: DISTRIBUTION OF TRIPS BASED ON TRIP FREQUENCY

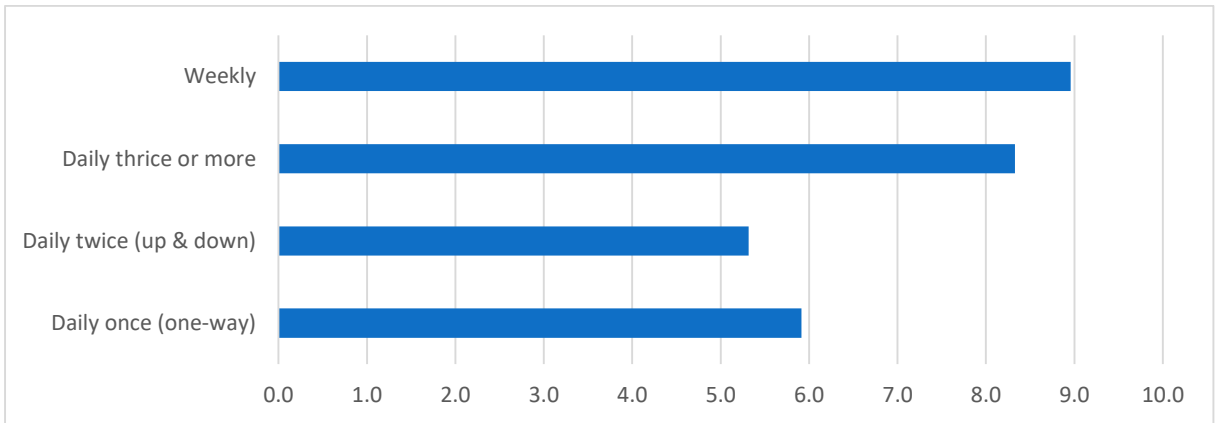


Figure 53: AVERAGE TRIP LENGTHS BASED ON TRIP FREQUENCY

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 0.7km which is considered as a comfortable walking distance. Similarly, the average time taken to reach the PT or IPT stops in 6.4 minutes. The mode wise distances and access time to PT and IPT stops are as shown in Table

Table 39: ACCESSIBILITY TO PT OR IPT STOPS

Code	Mode	Nearest Stop (km)	Time taken to reach (min)
1	Public Bus	0.7	10.0
2	Shared Auto	0.7	2.0
3	Cycle Rickshaw	0.6	3.0
Total		0.7	6.4

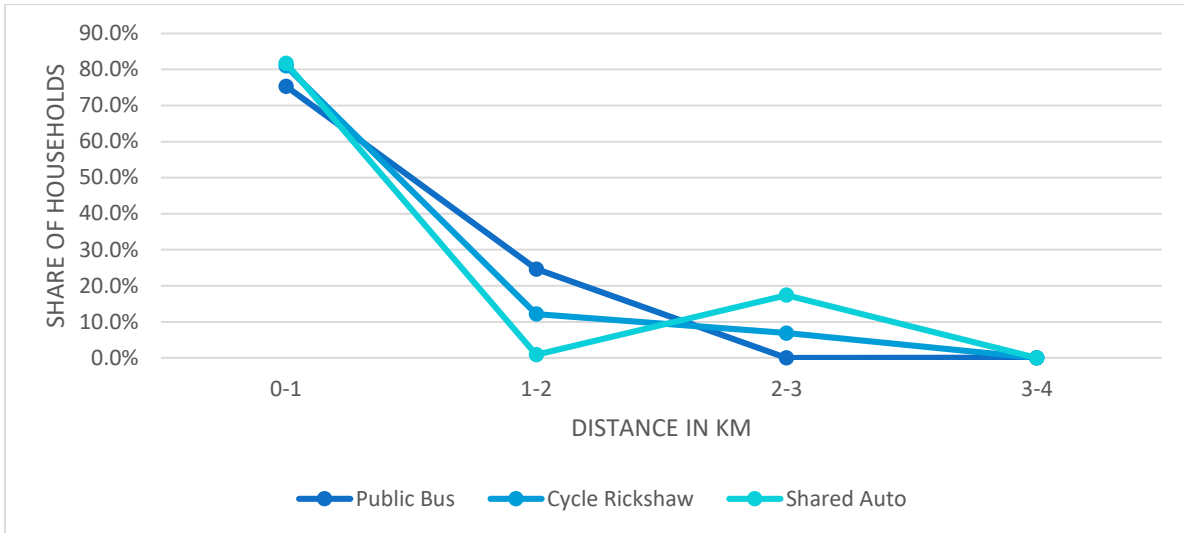


Figure 54: DISTRIBUTION BASED ON ACCESS TO IPT AND PT STOPS

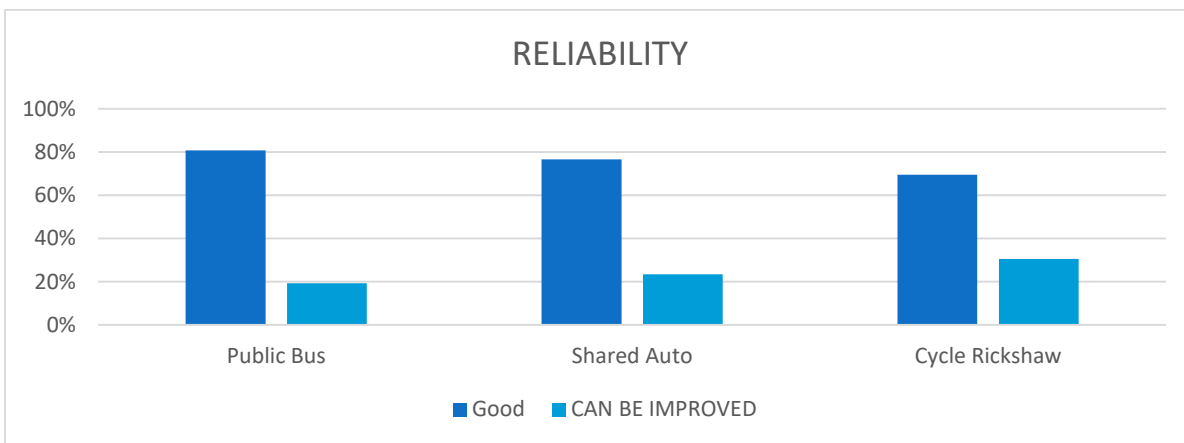


Figure 55: USERS OPINION ON RELIABILITY OF PT AND IPT MODES

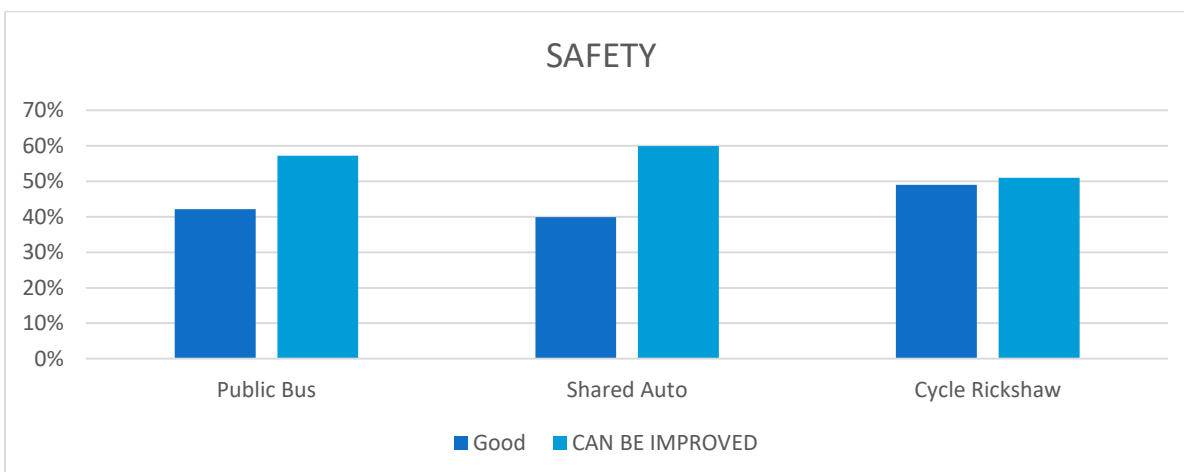


Figure 56: USERS OPINION ON SAFETY OF IPT MODES

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 share auto rickshaws and cycle rickshaws are perceived to be affordable compared to the bus services as the nature of bus services is largely sub-urban services.

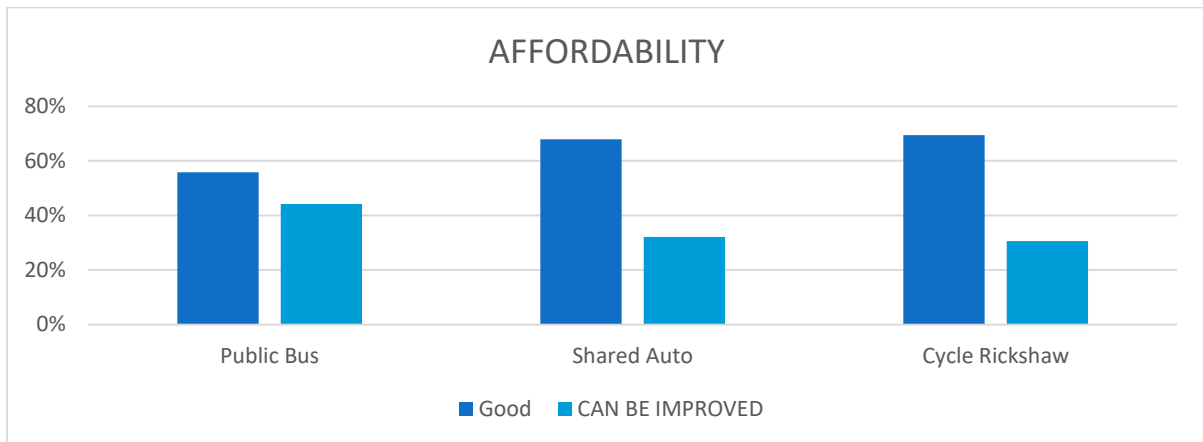


Figure 57: USERS OPINION ON AFFORDABILITY OF IPT MODES

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.

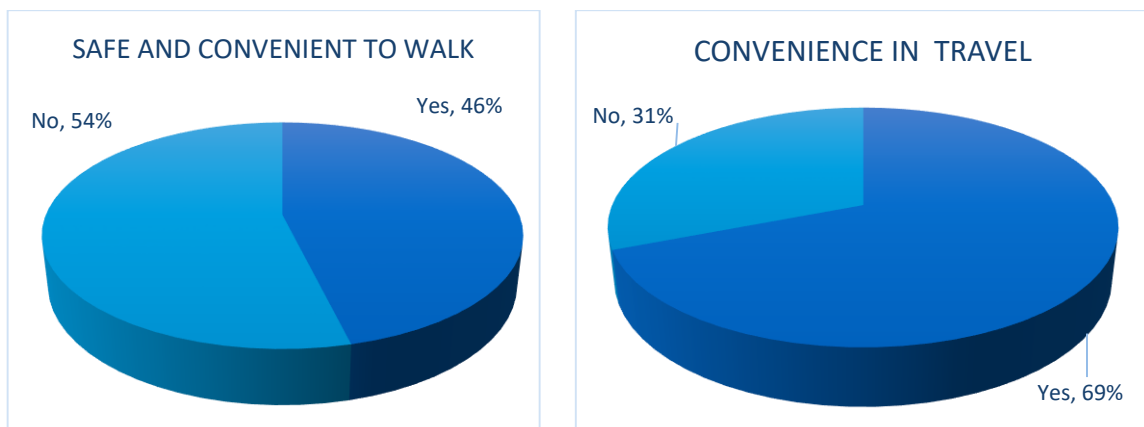


Figure 58: PECEPTION OF TRAVEL CONDITIONS IN THE CITY

Key Inferences:

1. The sex ratio derived from the house hold survey is 946.
2. The average monthly income as per the Household survey in Nellore is about INR 14,307 with the average number of earning members per house hold being 1 (Approx. 1.3).
3. The Per Capita Trip Rate (PCTR) for Nellore was observed to be 1.29 including the walk trips and 1.08 excluding the walk trips. The PCTR for motorised trips is about 1.05.

4. The major modes of travel in Nellore are observed to be auto rickshaw and two wheelers with a modal share of 33% and 26% respectively.
5. The Non-Motorised Transport comprises about 19% including 16% of walk trips.
6. The average trip length in the Nellore is observed to be 5.8km including the walk trips and 6.7km excluding the walk trips.
7. The work and education based trips account to 25% and 22% of the total trips respectively.
8. The Average Trip Length (ATL) for work trips is observed to be 6.8km and 4.8km for educational trips.
9. The average trip length on daily trips is 5.3km.
10. The average distance travelled by the house hold to access the near PT or IPT stop is 0.7km which is considered as a comfortable walking distance.
11. Safety is perceived to a major concern in regard to all the public transit modes.
12. The fares of share auto rickshaws and cycle rickshaws are perceived to be affordable compared to the bus services as the nature of bus services is largely sub-urban services.
13. The other major concerns with respect to travel within the city are the bus based public transit connectivity, safety of pedestrians, chaotic intersections during peak hours.

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 6 on street Parking locations as shown in Figure and Table.

Table 40: ON STREET PARKING LOCATIONS

CODE	LOCATIONS
ONSP_1	Grand Trunk Road, VRC center Area
ONSP_2	KVR Petrol Pump Area
ONSP_3	Bezwada Gopal Reddy Circle

ONSP_4	Vanamthopu Centre
ONSP_5	YSR Statue Center, Grand Trunk Road
ONSP_6	Narthaki Theater –Siri Square Street

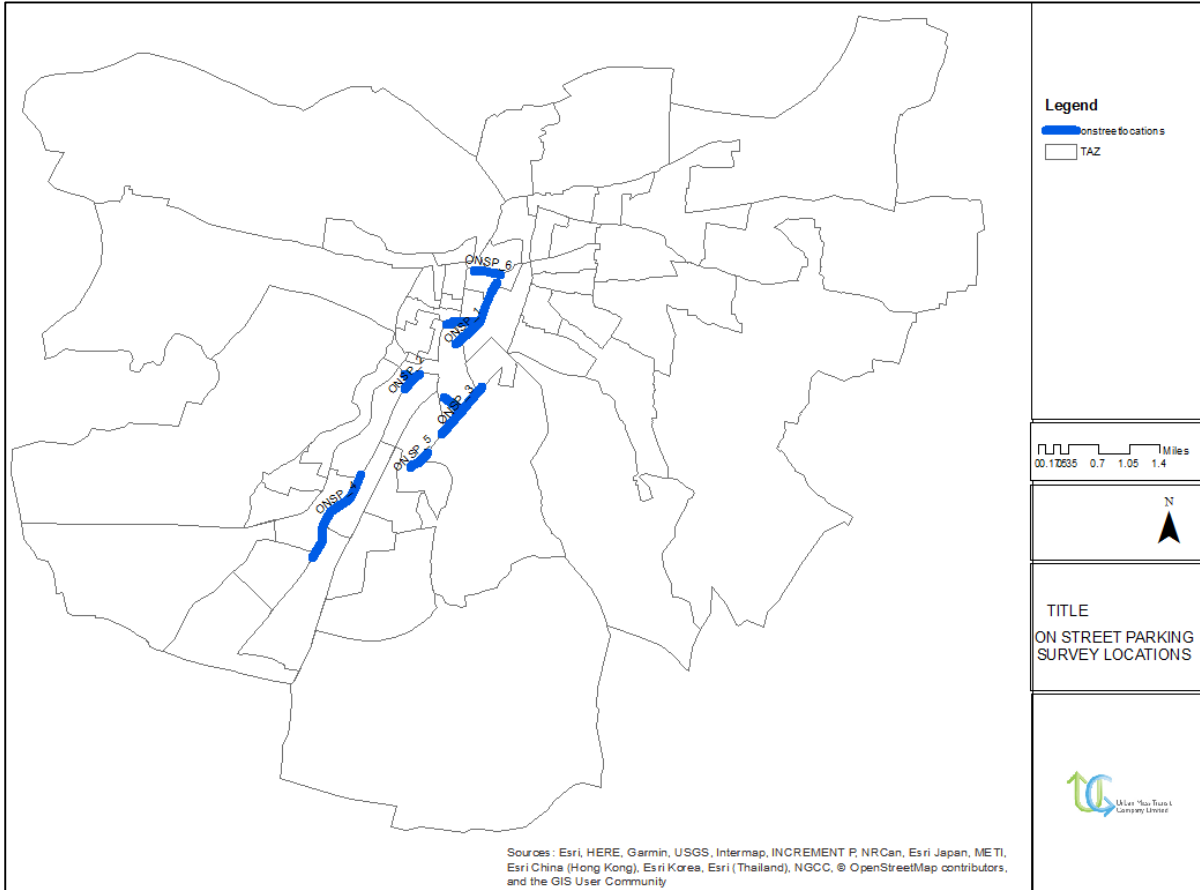


Figure 59: ON STREET PARKING LOCATIONS

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 6 near Narthaki Theater and Siri Square followed by Bezawada Gopal Reddy Circle and Grand Trunk road –VRC Center area. The peak hour accumulation is observed to be 10% to 15% of the daily accumulation. The parking durations is observed to vary between 10mins to 30min. The longest parking duration at peak hour is observed at Narthaki theatre due to the concentration of commercial and recreational activities, while the highest turnover rates are observed at KVR Petrol Pump Area and Gopal Reddy Circle Area.

The details of the parking survey analysis is as shown in Table

Table 41: ON STREET PARKING ANALYSIS

PARKING ANALYSIS	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6
	ECS	ECS	ECS	ECS	ECS	ECS

Parking Accumulation (Daily)	423.8	457.35	273.95	533.7	425	871.75
Parking Accumulation (Peak)	50.5	70.25	31.25	57.5	42	97.25
PEAK HOUR						
Peak Period	11.00-12.00	10.15-11.15	13.00-14.00	16.30-17.30	11.45-12.45	17.15-18.15
PH%	12%	15%	11%	11%	10%	11%
Parking Load (Veh-Hr)	34	49	18	83	34	87
Parking Duration (Minutes)	131	84	80	143	106	271
Parking Turnover (Veh/Hr/Bay)	2	4	1	4	2	2
Parking Index	3.6	5.1	1.9	8.7	3.5	9.0

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

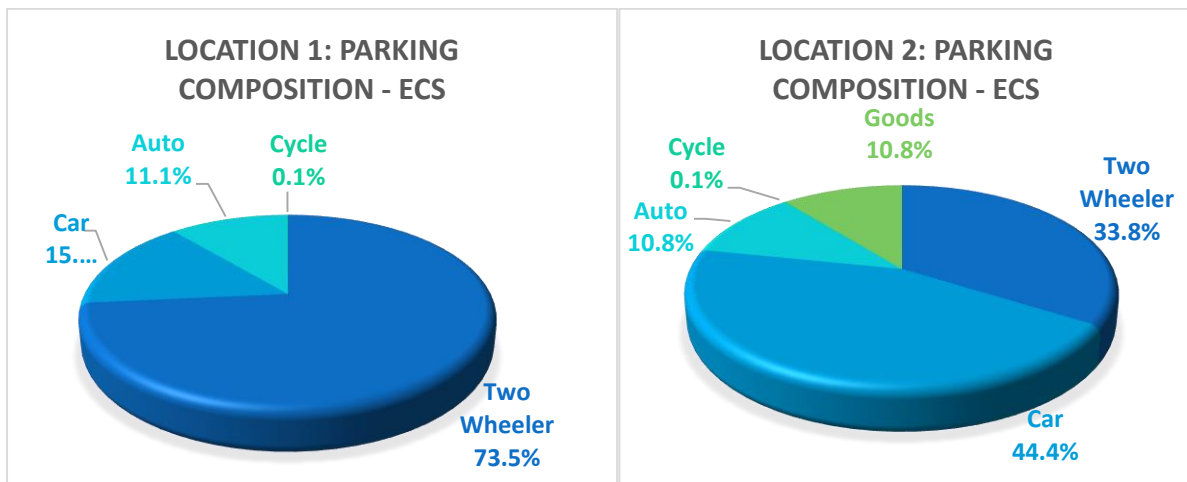


Figure 60: PARKING COMPOSITION AT LOCATIONS ONSP1 AND ONSP2

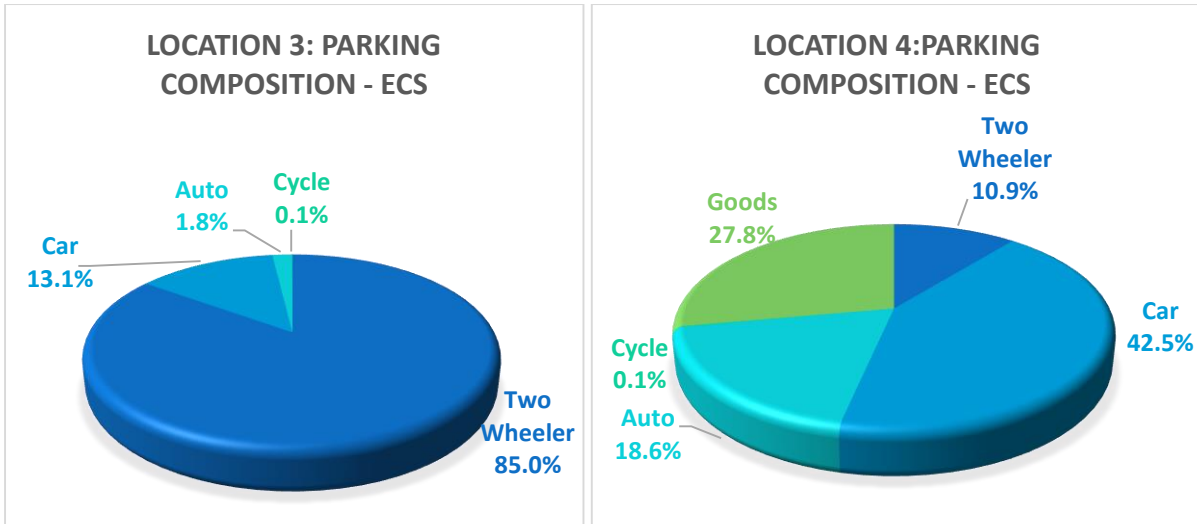


Figure 61: PARKING COMPOSITION AT LOCATIONS ONSP3 AND ONSP4

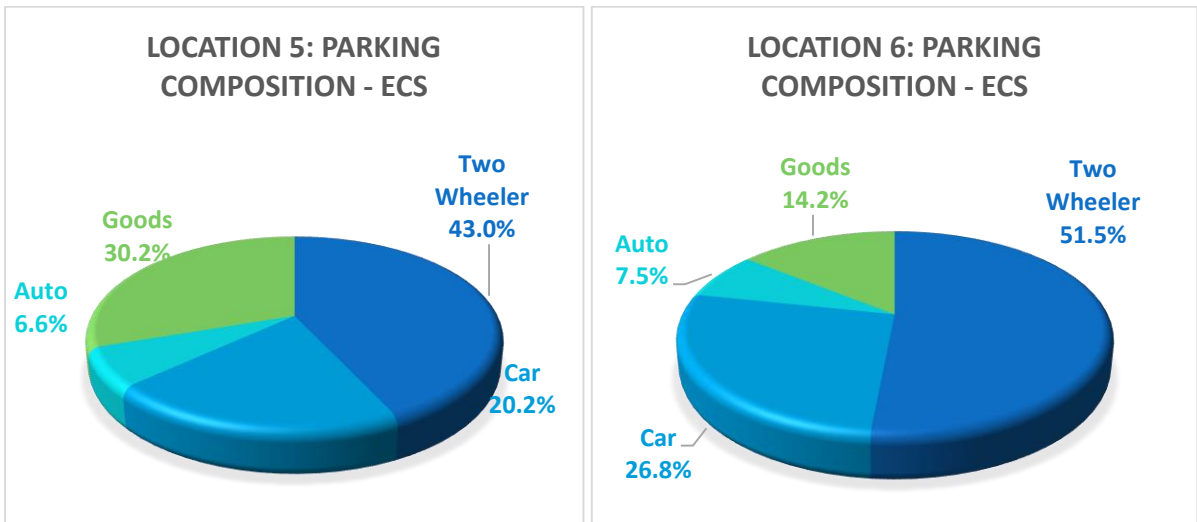


Figure 62: PARKING COMPOSITION AT LOCATIONS ONSP5 AND ONSP6

OFF STREET PARKING NUMBER PLATE SURVEYS

Objective: The principal objective of the study is to assess the demand for parking and characteristics of the parked vehicles.

Conduct: 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 5 off street Parking locations as shown in Figure and Table

Table 42: OFF-STREET PARKING LOCATIONS

CODE	LOCATIONS
OFSP-1	RR Street Parking

OFSP-2	Atmakur Bus Stand
OFSP-3	RTC Bus Stand
OFSP-4	MGB Felcity Mall
OFSP-5	Kancheepuran Vara Mahalakshmi Silks Road

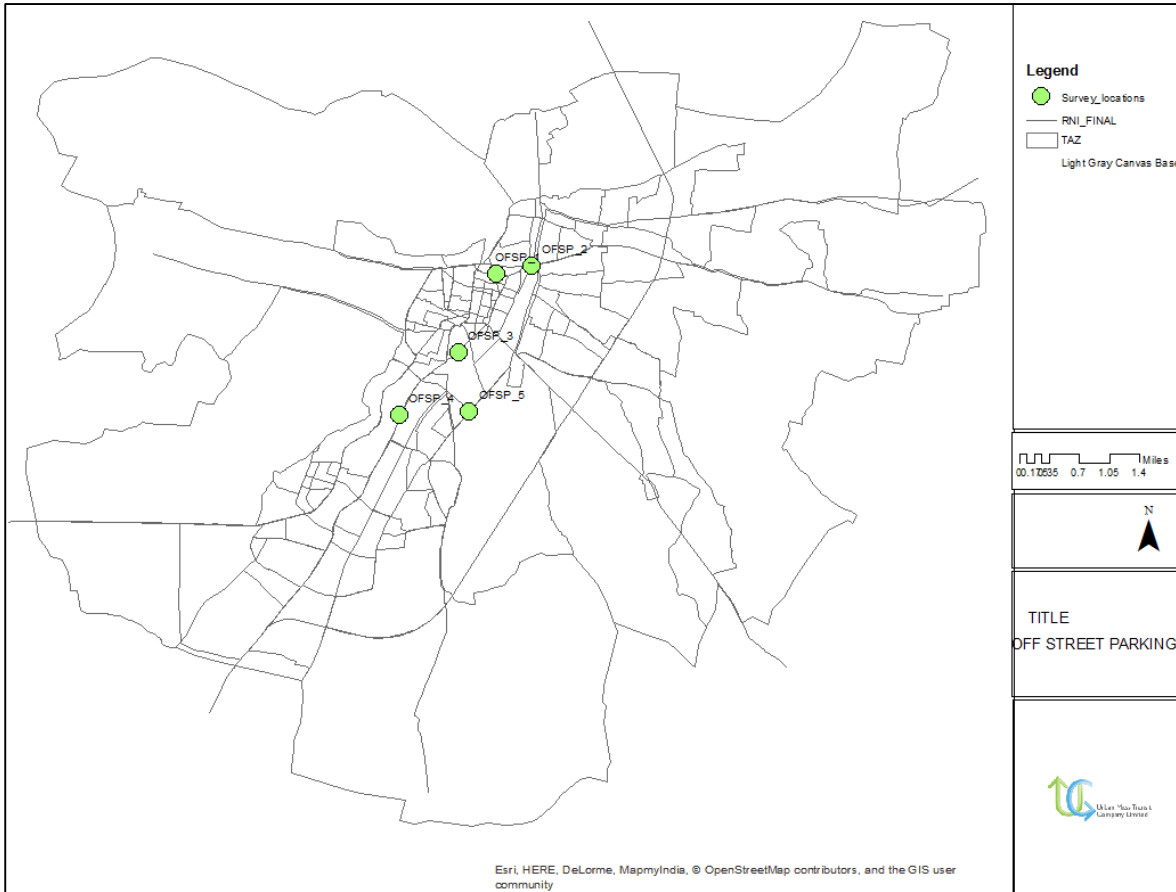


Figure 63: OFF STREET PARKING LOCATIONS

Analysis: The location with highest accumulation of parking is observed at RR Street Parking followed by RTC Bus Stand. The peak hour accumulation is observed to be 9% to 11% of the daily accumulation. The parking durations is observed to vary between 10mins to 16min which is less than the On Street Parking. The longest parking duration at peak hour is observed at RR Street Parking due to the concentration of commercial and recreational activities, while the turnover rates are observed to be similar at all the surveyed locations.

The details of the parking survey analysis is as shown in Table

Table 43: OFF STREET PARKING ANALYSIS

PARKING ANALYSIS	Location 1	Location 2	Location 3	Location 4	Location 5
	ECS	ECS	ECS	ECS	ECS
Parking Accumulation (Daily)	10274	5847	14110	6859	2021

Parking Accumulation (Peak)	340	114	270	90	83
PEAK HOUR					
Peak Period	16.00-17.00	16.00-17.00	16.00-17.00	16.00-17.00	16.00-17.00
PH%	3%	2%	2%	1%	4%
Parking Load (Veh-Hr)	85	29	67	22	21
Parking Duration (Minutes)	19	23	69	35	47
Parking Turnover (Veh/Hr/Bay)	1	0	1	0	1
Parking Index	203%	68%	120%	37%	104%

The composition of parked vehicles at each of the surveyed location is as shown in Figures. Two-wheeler constitute the highest share followed by cars across the locations while highest share of cars are observed at RR Street Parking area and MGB Felcity Mall.

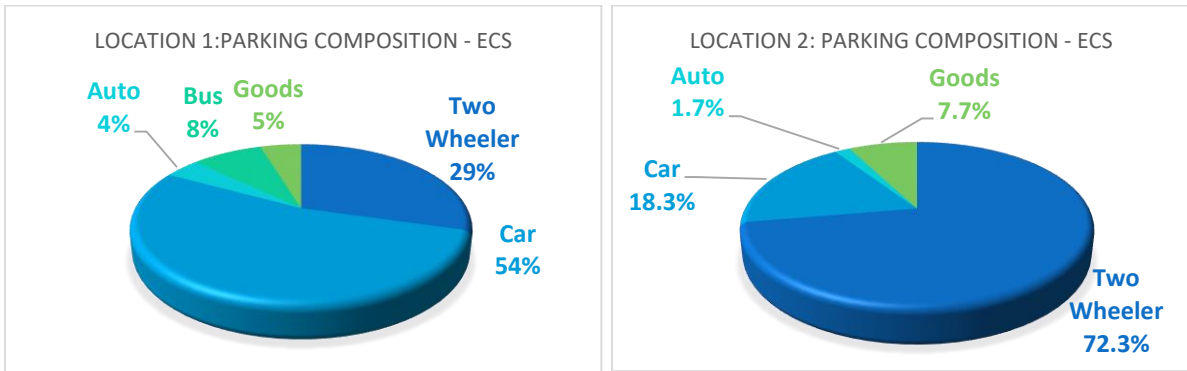


Figure 64: PARKING COMPOSITIONS AT OFSP_1 AND OFSP_2

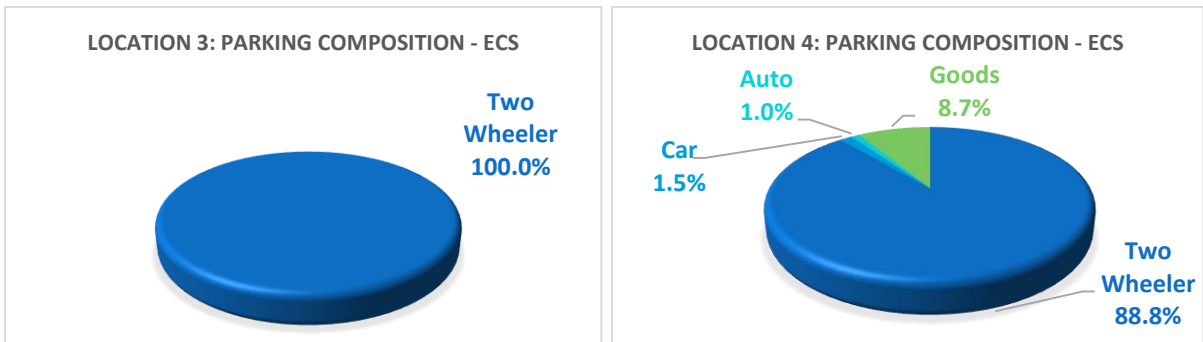


Figure 65: PARKING COMPOSITIONS AT OFSP_3 AND OFSP_4

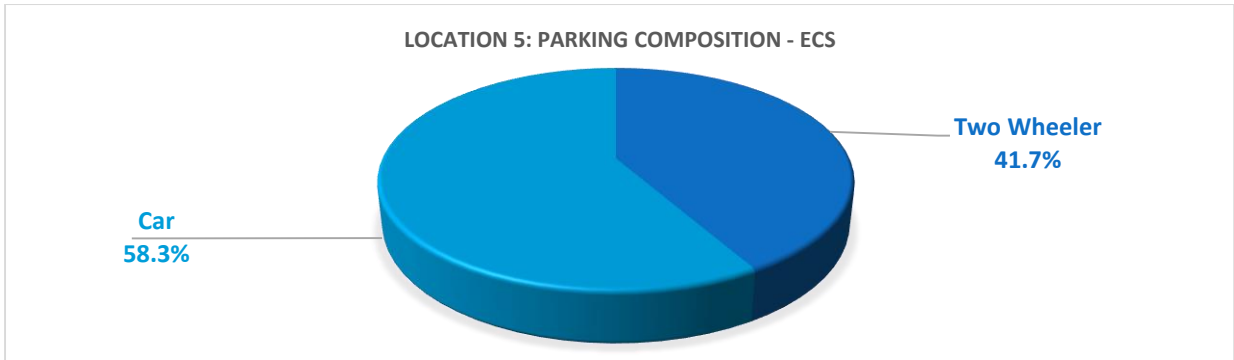


Figure 66: PARKING COMPOSITIONS AT OFSP_5

Key Inferences of On and Off 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, while the supply was under-utilized at the off street locations. 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.

Though Nellore has been monitoring the on street parking on certain locations, it is necessary to stratrzige a parking management plan and identify parking locations for the same.

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 eight bus stop locations were identified as shown in Table and Figure

Table 44: PASSENGER OPNION SURVEY LOCATIONS

CODE	LOCATION
BS_1	Vijay Mahal Center Bus Stop
BS_2	Muthukur Center Bus Stop
BS_3	Childrens Park Bus Stop
BS_4	DKW College Bus Stop
BS_5	Current Office Bus Stop
BS_6	Nippo Center Bus Stop
BS_7	Vanamthopu Bus Stop
BS_8	Podalakur Road Center Bus Stop

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

- Longer travel distances,
- Travel expenses of personalized modes
- Lack of public transport Connectivity
- Fares of public transport services
- Parking issues.

Due to the lack of city based public bus services, passengers especially aged below 20years (who are the dependent users) perceive 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

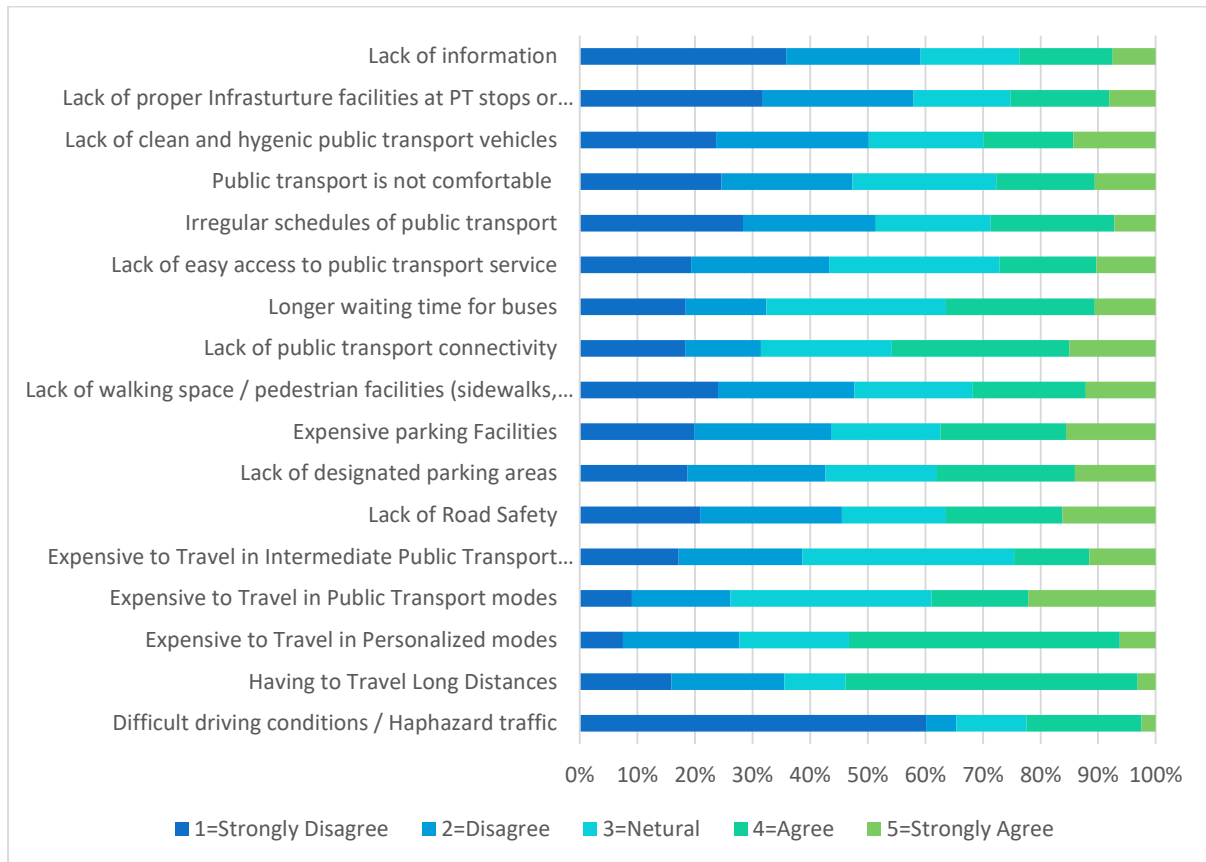


Figure 67: PERCEPTION OF PASSENGER TRAVEL CONCERNS

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

- Lack of Traffic sense
- High growth of personalised/private modes
- Traffic Management and Signage

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.

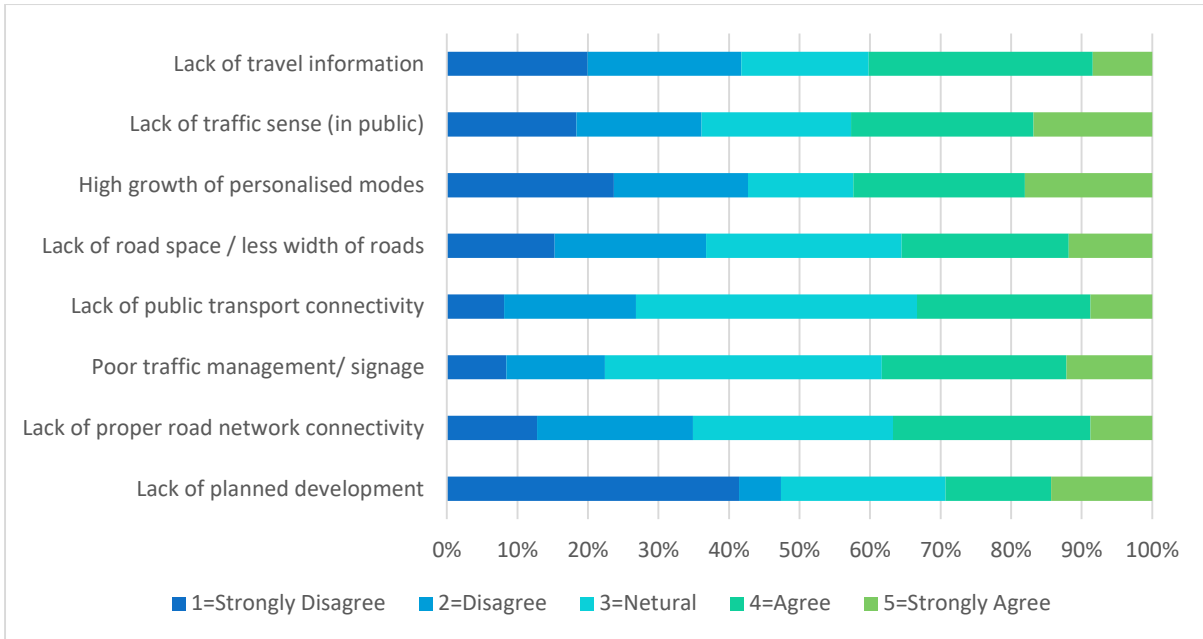


Figure 68: REASONS FOR TRAVEL CONCERNS AS PERCEIVED BY THE PASSENGERS

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

- Planning and Development Regulations
- Traffic education
- Improve public transit services and facilities
- Public parking facilities and corresponding regulations

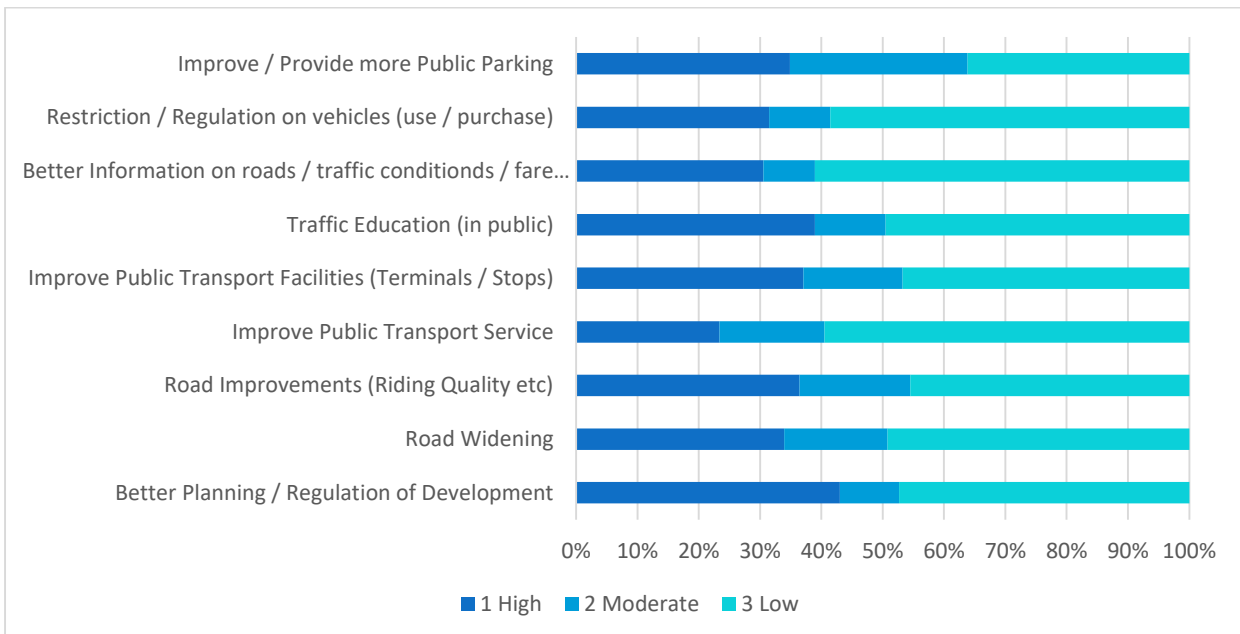


Figure 69: PASSENGER PERCEPTION IN REGARD TO IMPROVEMENTS

The passenger opinion on ways to promoted transport and traffic fund is as shown in Figure 3.18.4.

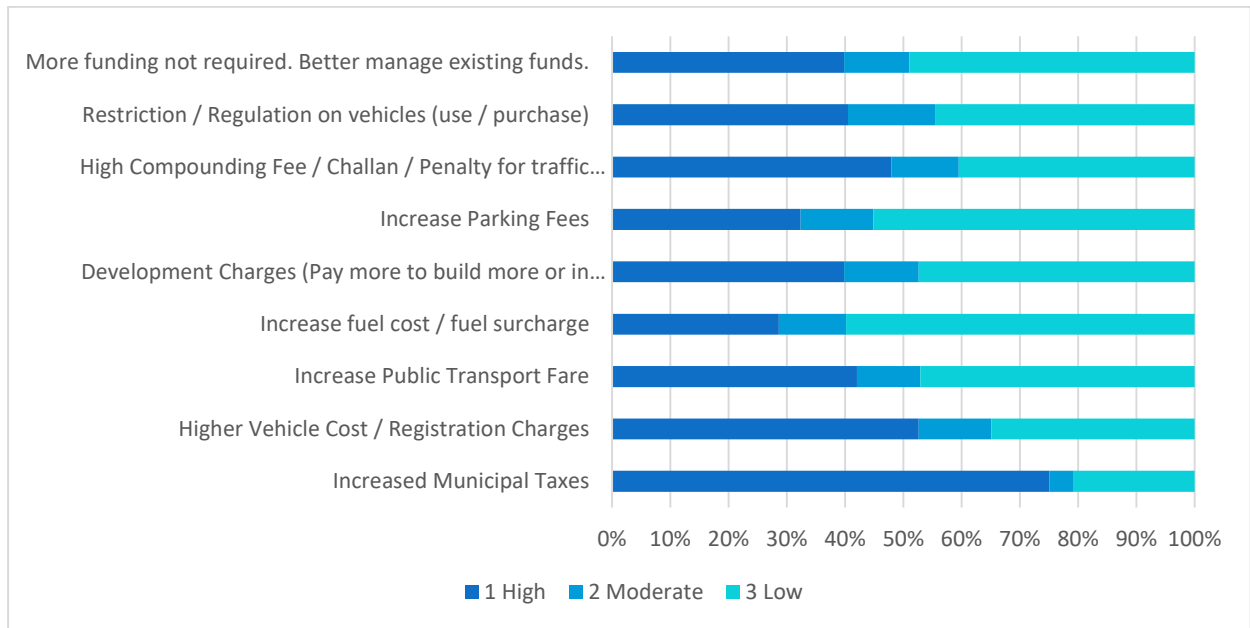


Figure 70: PASSENGERS OPINION ON WAYS TO PROMOTE TRAFFIC AND TRANSPORT FUND

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

- Increased Municipal Taxes,
- Vehicle costs and Registration charges
- High Compounding fee or High Penalty for the Traffic Violators

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. It was observed that 59% of the users perceive it reasonably good, while 38% of the users perceive it somewhat congested.

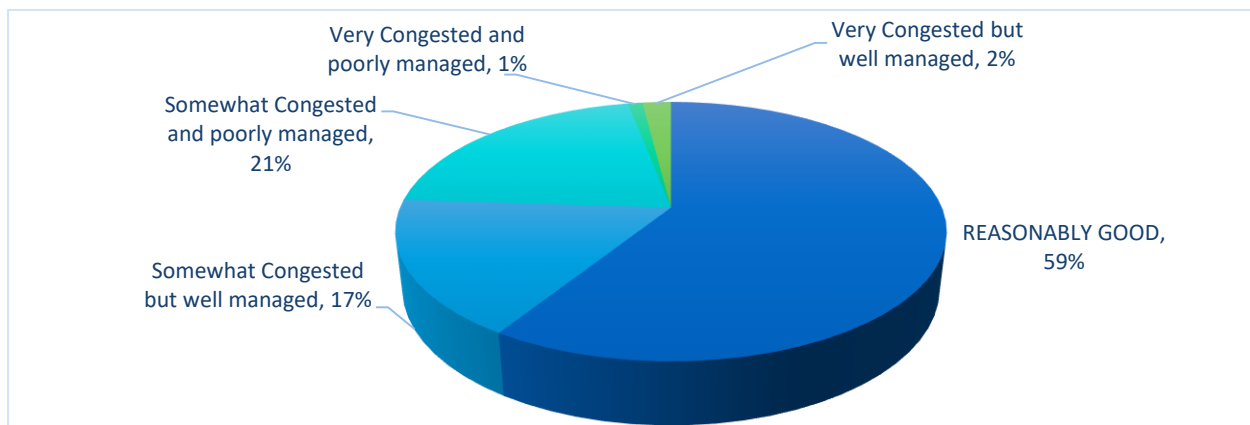


Figure 70: OVERALL EXPERIENCE OF ROAD TRAFFIC CONDITIONS

It is observed that the passengers are willing to pay for the improved services if the time savings are over 20 minutes. The willingness to pay with respect to the time saving are as shown in Figure.

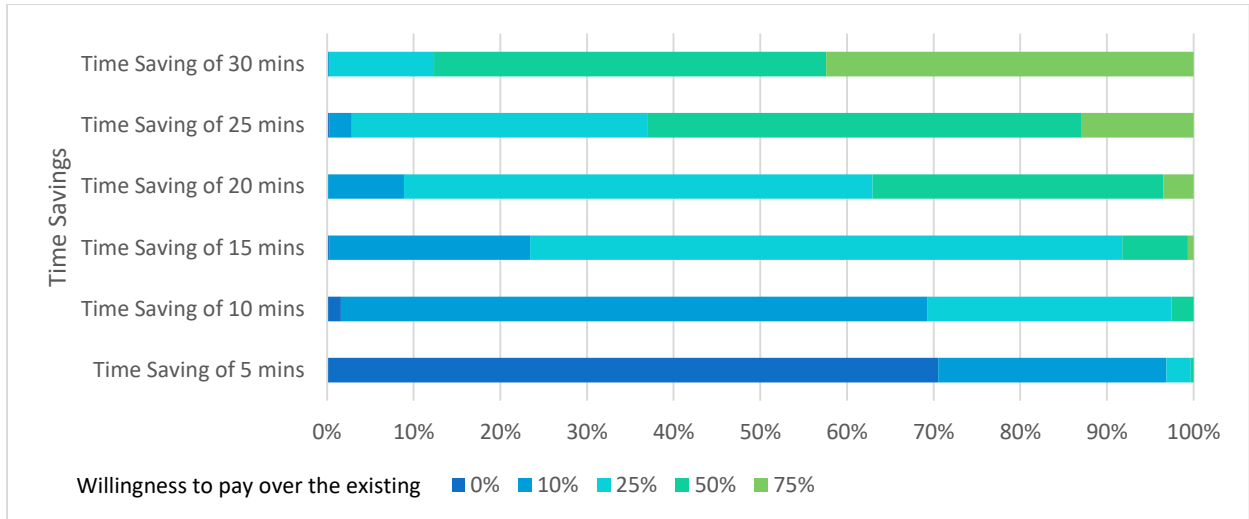


Figure 71: WILLINGNESS TO PAY WITH RESPECT TO TIME SAVINGS

The major concern of the Non-Motorised Transport users is observed to be the safety followed by comfort (Refer). 64% of the users desired improved footpaths and cycle tracks while 36% desire enforcement of safety laws to enhance the quality of Non-Motorised Transport travel experience (Refer).

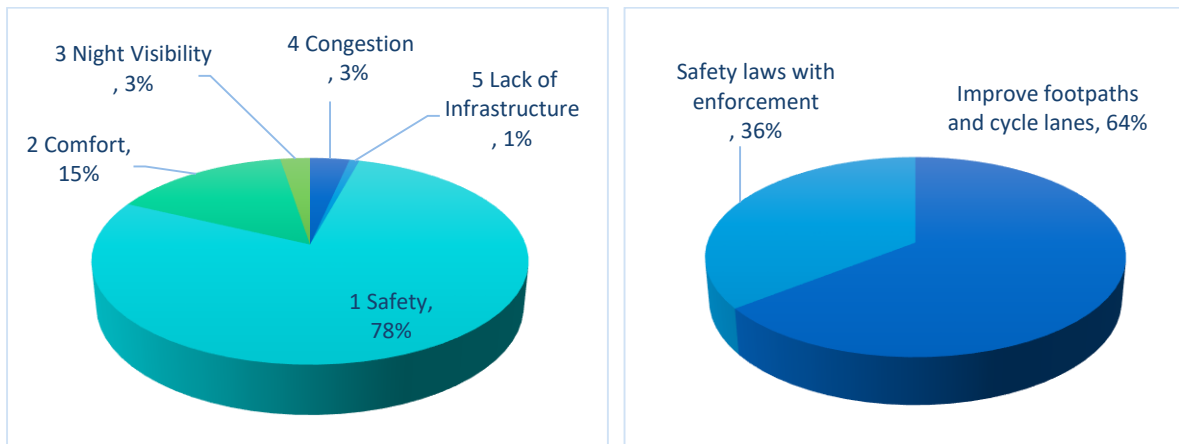


Figure 72: NMT USER CONCERS (LEFT) & DESIRED CHANGES FOR ENHANCED NMT USAGE (RIGHT)

The perceptions regarding the need for dedicated lanes for buses and cyclists was collected and analysed as shown in Figure. 38% of the passengers perceive the need for dedicated bus lanes and about 41% of the users perceive the need for dedicated bicycle lanes.

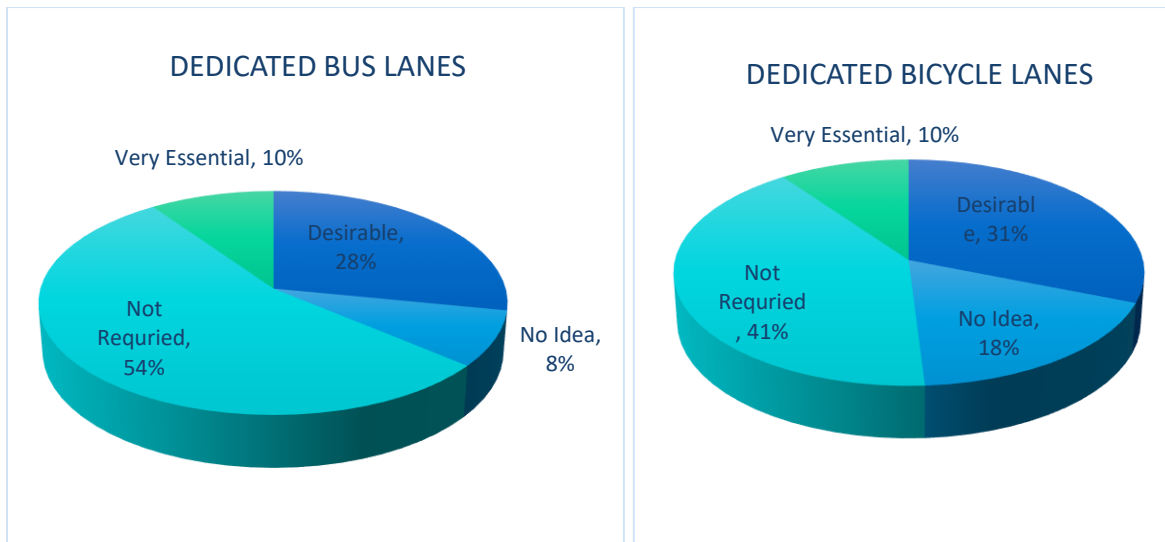


Figure 73: PERCEPTIONS REGARDING THE NEED FOR DEDICATED BUS AND BICYCLE LANES

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 increased municipal taxes, vehicle costs and registration charges, high compounding fee or high penalty for the traffic violators to promote travel and traffic fund.
3. 59% of the users perceive the overall experience of road traffic conditions reasonably good, while 38% of the users perceive it somewhat congested.
4. 64% of the users desired improved footpaths and cycle tracks while 36% desire enforcement of safety laws to enhance the quality of Non-Motorised Transport travel experience





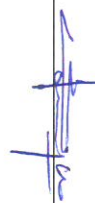


ANNEXURE 3: LIST OF ATTENDEES

Attendance Sheet

Preparation of Low Carbon Comprehensive Mobility Plan – Nellore

Dt: 10-12-2018

Sl.No.	Name	Designation	Signature
1	MUTHAARAJU REVU	DISTRICT COLLECTOR, NELLORE	R. Muthaalaraju
2	N. Siva Ram Prasad.	Dy. Transport Commissioner, Nellore	 9848528385
3	M.V. KRISHNA RAO	Dy. CHIEF TRAFFIC MANAGER	 9959225634
4	J. SURAJ KUMAR	Dy. City Planner Nellore	J. Suraj Kumar 9849906613
5	Prakash	CEO, APUDAML	
6	S. Rama Krishna	Sn. Vice - President, UMIT	S. R. Krishna 9600261085
7	Ankush Malhotra	Vice - President, UMIT	 9811330228
8	Siva Niranjn. J	Manager, UMIT	 9989437657
9	Harshita Sasma	Asst. Manager, UMIT	Harshita Sasma 9573810022
10	Rakesh Jinka	Project Officer, UMIT	Rakesh Jinka 9632794756
11	Sri Navya Anandam	Sn. Officer, UMIT	 924677642
12			
13			
14			
15			

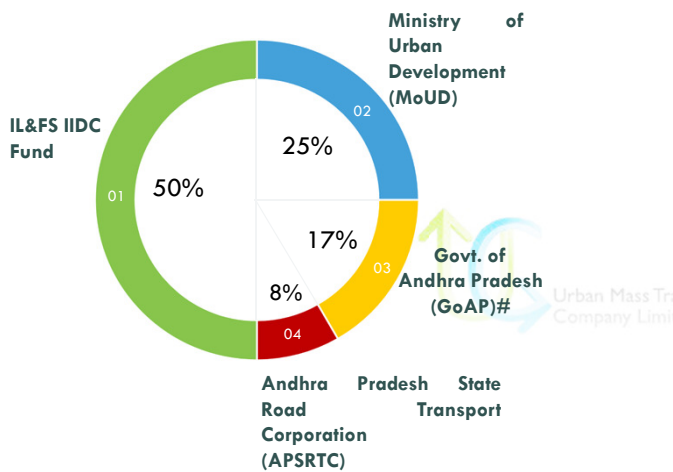


ANNEXURE 4- STAKEHOLDER CONSULTATION PRESENTATION

Preparation of **COMPREHENSIVE (LOW CARBON) MOBILITY PLAN** for **NELLORE**

DECEMBER 2018

About UMTC



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



Secretary, Urban Development, GoI is the Chairman of UMTC

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



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)



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Corporation Limited

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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



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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



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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

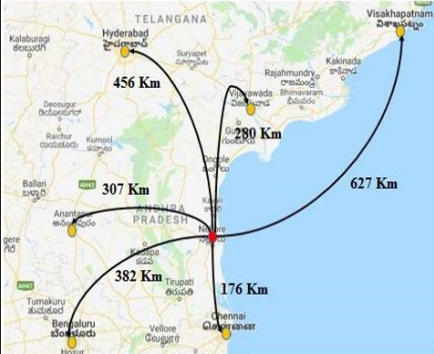


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CITY PROFILE



Strategic location connected to major Cities through National Highway

- NH-5 - Vijayawada, Tirupati and Chennai
- NH-45-Hyderabad
- NH-4- Bengaluru

State Capital Amaravati (279km) and Chennai Metropolitan city (168km)

Nellore Emerged as an crucial **industrial hub in the region**



6.0 LAKH (2011)

6.8 LAKH (2018)

32% WORKING POPULATION

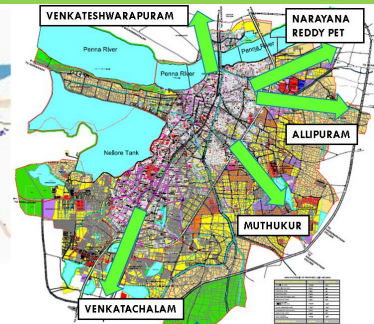
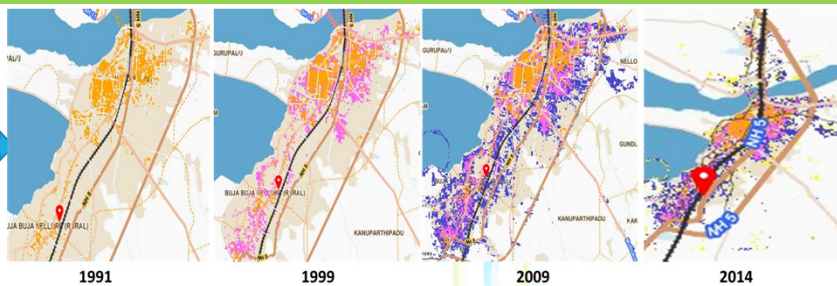


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CITY PROFILE

GROWTH PATTERN



LANDUSE



6.8 LAKH (2018)

149.2sqkm Municipal Corporation Limits

13.1% Area Under Transportation



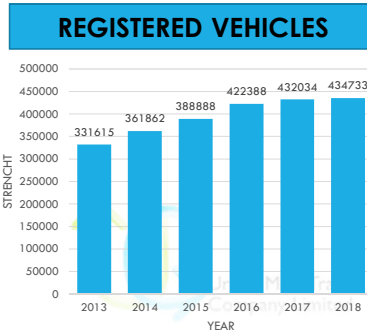
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CITY PROFILE



Due to Lack of enough RoW Resulting in Bottle necks Increasing Vehicles Increasing Safety Concern



Lack of Pedestrian Friendly Roads and Parking Chaos

No City Bus Services Operated Either By RTC Or Private Agencies

~6,000 Auto Rickshaws (Registered Vehicles till 2017, RTA)

12% CAGR – Vehicular Strength

4.1 Fatality Rate (per 1 Lakh Population)



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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



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Strategy 1

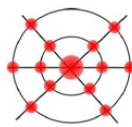
INTEGRATED LANDUSE TRANSPORT STRATEGY

- Multi-Nodal Transit Network
- Transit Oriented Development

LANDUSE AND TRANSPORT STRATEGY

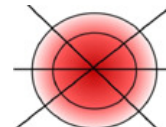
Land use and transport integration concepts

1



Multi-Nodal Transit Network Concept

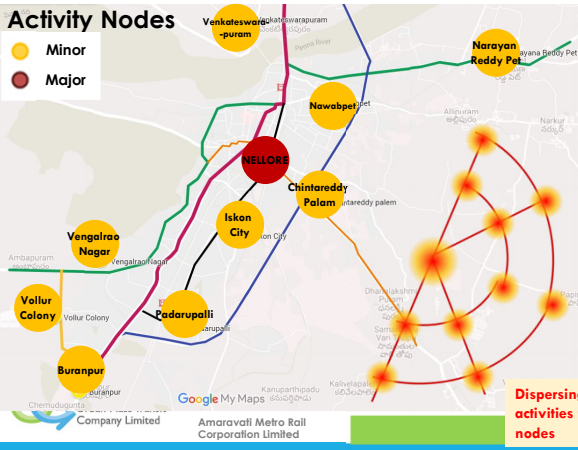
2



Compact City Concept

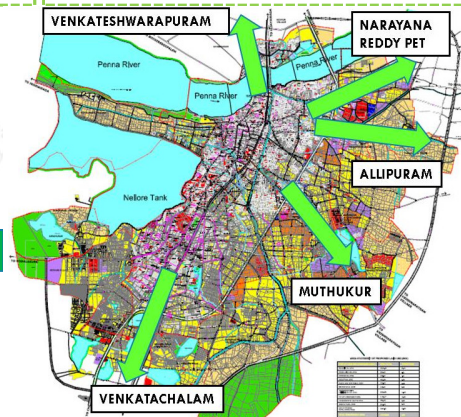
Activity Nodes

- Minor
- Major

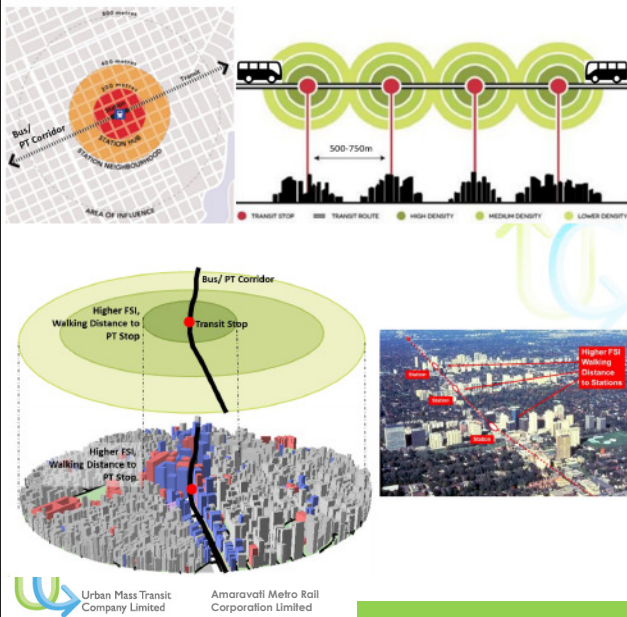


Urban M Company

Dispersing city center activities to multiple nodes



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

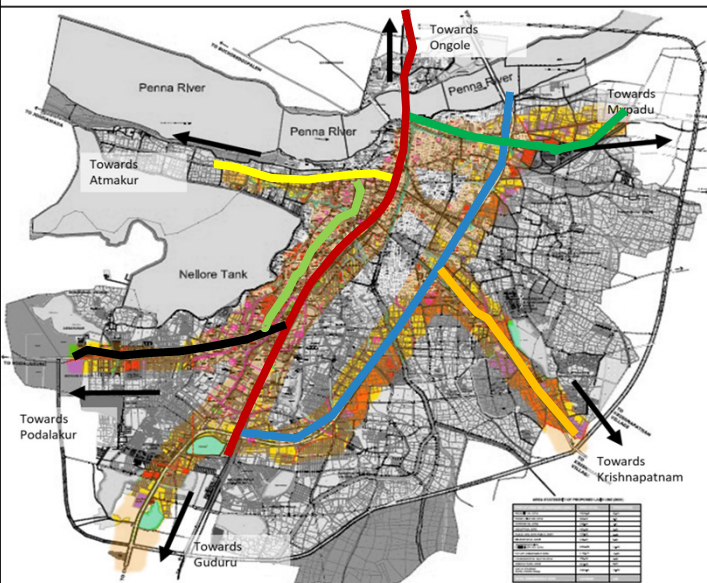
Components to Improve in TOD Zones

- Travel Connections
- Building Scale and Orientation
- Public Spaces
- Parking

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TRANSIT ORIENTED DEVELOPMENT

Corridors identified for densification



• The Proposed Public Transport corridors shall to be developed as a transit oriented development zone
• Along this routes high rise developments shall be allowed with mixed development

1. Chennai-Srikakulam Highway
2. Mini-Bypass Road
3. Trunk Road
4. Podalakur Road
5. Muthukur-Childrens Park Road
6. Nawabpet Road
7. PR Colony Road
8. Walkers Road

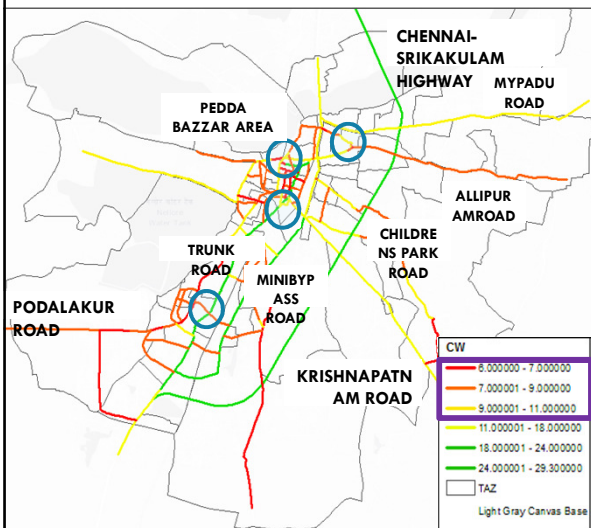
Strategy 2

ROAD NETWORK IMPROVEMENT STRATEGY

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

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EXISTING ROAD NETWORK SCENARIO



Increasing Private Vehicles resulting in
Increasing Congestion Levels
 Average V/C Ratio

0.79 **1.13**
 2018 2038

Value above 0.75 is considered to be congested

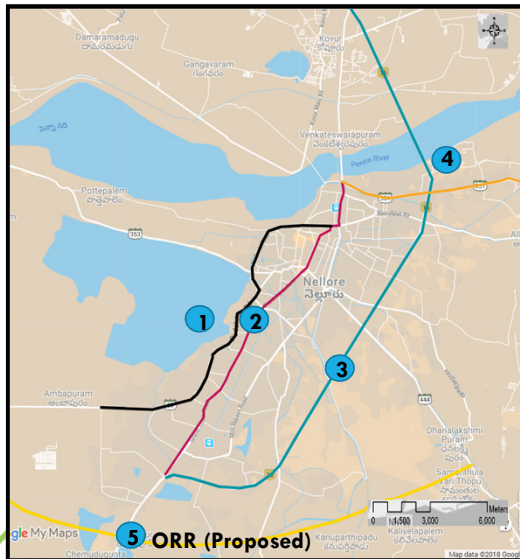
Decreasing Network Speeds
 Average Network Speed

22.4 **18.1**
 Km/hr Km/hr

ROAD NAME	v/c	
	BAU	SUT
Atmakur Bus Stand Road	1.04	0.78
Auto Nagar Main Road	0.87	0.65
Chintareddypalem Road	0.9	0.67
Fatekhanpet Main Road	1.15	0.86
Grand Trunk Road	1.26	0.94
Muthukur Road	1.29	0.97
Nawabpet Road	0.98	0.73
Nellore - Koovur Road	1.33	0.99
NH-16	1.2	0.9
Somashaperapuram	1.09	0.82
Walkers Road	1.32	0.99
Mini Bypass Road	1.19	0.65

18

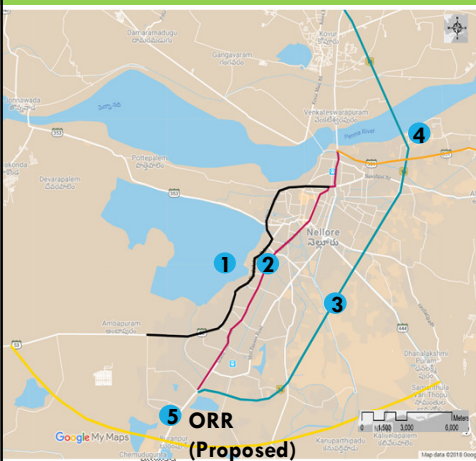
PROPOSED ROAD NETWORK STRATEGY



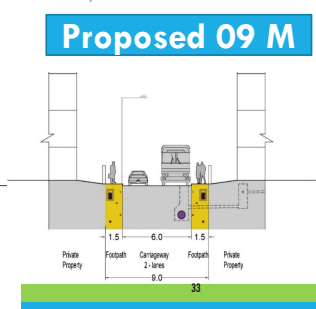
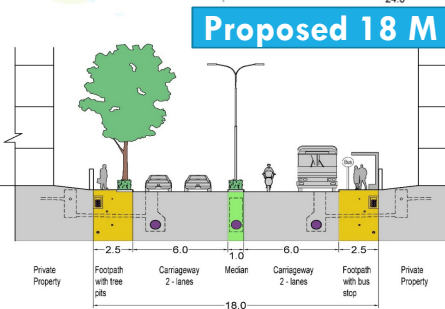
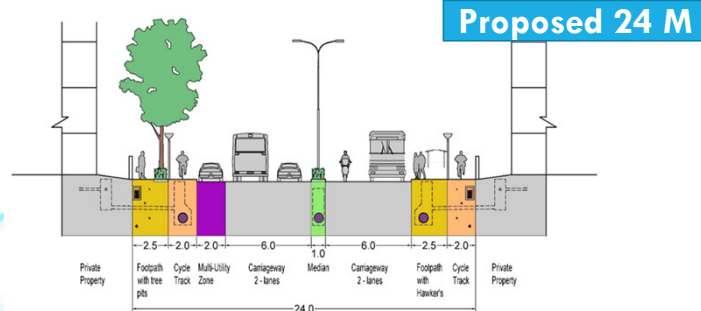
Sl. No.	Road Name	Road Length (Approx Km)
1	Podalukur Road - Walker Road	9.5
2	Grand Trunk Road	9.6
3	NH Bypass (Chennai Srikakulam Road)	18
4	Mypadu road	9.5
5	Outer Ring Road – between Podalukur Road to Nellore Krishnapatnam Road	16

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PROPOSED ROAD NETWORK STRATEGY



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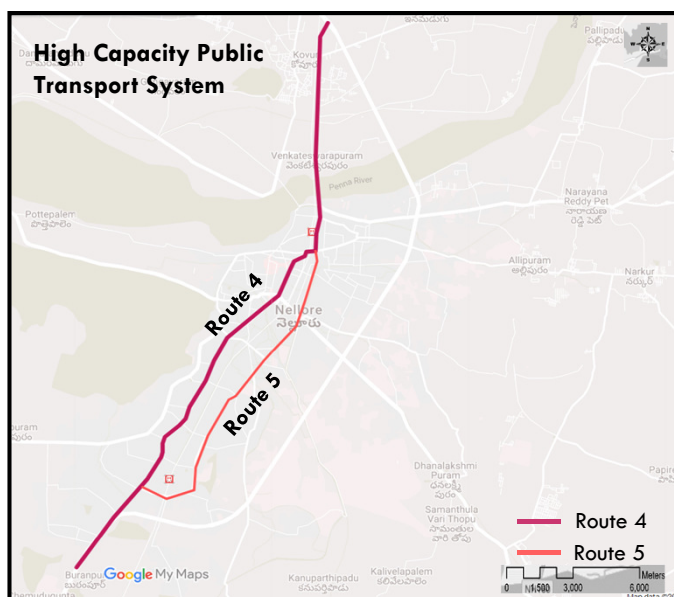
Strategy 3

PUBLIC TRANSPORT IMPROVEMENT STRATEGY

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

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PROPOSED CITY BUS NETWORK



High Capacity Public Transport (HC PT) System to be proposed along 2 corridors

Route 4 (HC PT 1): Along Grand Trunk (GT) Road connecting North South extremes of Nellore

Route 5 (HC PT 2): Along Mini Bypass Road

In Future Stages for east west connectivity HC PT system can be implemented to promote tourist attraction.

Route	Estimated Ridership (PHPDT) in 2038
Route 4: HC PT 1	10800
Route 5: HC PT 2	7300

PUBLIC TRANSPORT TERMINALS

Existing Terminal
Nellore RTC Bus Terminal

Proposed Terminal
At the Intersection of Golgamudi Road and NH 16 Bypass

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INTERMEDIATE PUBLIC TRANSPORT

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

Intermediate Public Transport - NELLORE

↓

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

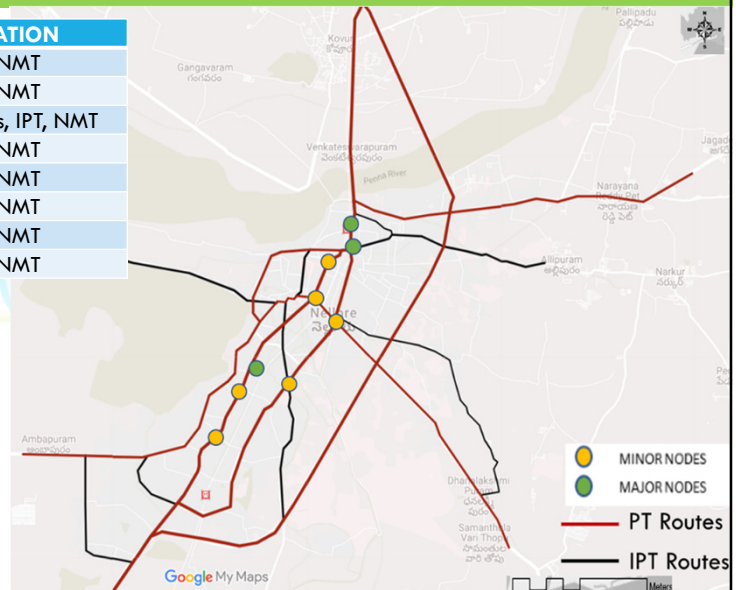
Sl. No	IPT Routes
1	Pottepalem Main Road connecting Walkers road
2	Childrens Park Road to Alagiri Nagar- Vaviltpadu road connecting Mydukur-Krishnapatnam Road
3	Golgamudi Road connecting across GT Road, Mini Bypass Road and Bypass Road
4	Narkur Road connecting GT Road
5	Vallur Colony Road connecting Podlakur Road and GT Road in Southern Part of Nellore.

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MULTI MODAL INTEGRATION NODES

S.NO.	LOCATION	TYPE	INTEGRATION
1	APSRTC Complex	Major	Bus, IPT, NMT
2	Atmakur Bus Stand	Major	Bus, IPT, NMT
3	Railway Station	Major	Train, Bus, IPT, NMT
4	VRC Junction	Major	Bus, IPT, NMT
5	Childerens Park Junction	Minor	Bus, IPT, NMT
6	Hotel Adithi Center	Minor	Bus, IPT, NMT
7	Annamaya Circle	Minor	Bus, IPT, NMT
8	Sundariah Circle	Minor	Bus, IPT, NMT

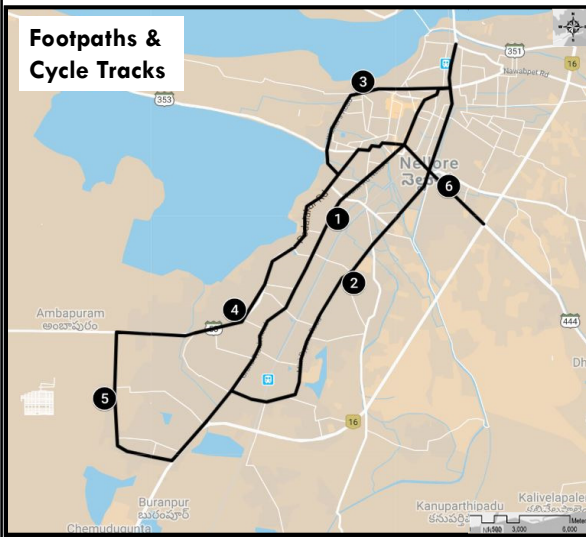


Strategy 4

NON-MOTORISED TRANSPORT STRATEGY

- Development of Footpath
- Development of Bicycle Friendly Streets

NON MOTORIZED TRANSPORT SCENARIO



S.no	Name	Stretch	Length (km)
1	Grand Trunk Road	PSR Statue to NHA Office	8.30
2	Mini Bypass Road	Intersection of Mini Bypass road with GT road at Weavers colony	9.2
3	Walkers road	Sindura Nursing Home st to S. Bose Statue	3.4
4	Podlakur Road	Sindura Nursing Home st to AP TRANSCO Junction	6.0
5	Vollur Colony Road	AP TRANSCO to NH 16	3.3
6	Muthukur Road	Ambedker Statue to NH 16	2.2

32 Kms
For Footpath and Cycle Track Development
2 m
Minimum Clear Walking Space for Footpaths

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** are to provide connectivity during the restricted vehicle hours to provide connectivity.

Strategy 5

TRAFFIC ENGINEERING AND MANAGEMENT

- Junction Improvements
- Traffic Management Plans
- Parking Proposals

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JUNCTION IMPROVEMENT PLANS

Smart Signalisation and Grade Separation

Tighter turning radii

Reduced intersection gaps

Pedestrian refuge areas

Road markings

CODE	LOCATION	Improvements
TMC- 1	Potti Sree Ramulu Statur Circle	High Priority
TMC- 2	VRC Junction	Low Priority
TMC -3	KVR Petrol Pump Circle	High Priority
TMC - 5	Muthukur Road Junction	Grade Separation
TMC -6	Bose Bomma Jn	Low Priority
TMC - 7	Gandhi Bomma Jn	High Priority

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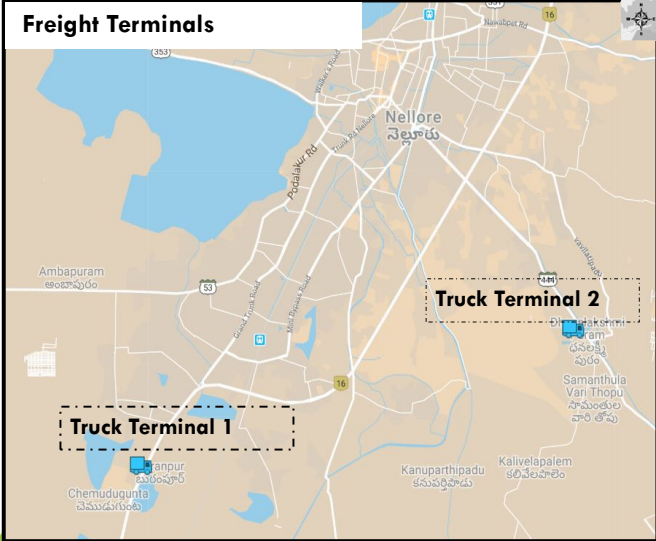
Strategy 6

FREIGHT MANAGEMENT

- Freight Policy
- Freight Terminals

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FREIGHT STRATEGY



Freight Terminals



Truck Terminal 1

Truck Terminal 2

Truck Terminal 1: Serving for trucks utilising Chennai Vijayawada Road

Truck Terminal 2: Serving for trucks using Nellore-Krishnapatnam Road

Prevailing Goods Movement Restrictions In Morning and Evening Peak Hours shall be continued.

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COMMENTS AND SUGGESTIONS

COMMENTS AND SUGGESTIONS FROM MEMBERS/ STAKEHOLDERS...



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Thank You



Urban Mass Transit Company Limited

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

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

Tel: +91 1244716300 Fax: +91 124 4716248

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

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**Amaravati Metro Rail
Corporation Limited**

Amaravati Metro Rail Corporation Limited (AMRCL), H.No. 40-3-8,
Gummadi Rao Street, Labbipet, Vijayawada



Urban Mass Transit Company Limited

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