Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

LOW CARBON MOBILITY PLAN

ANANTAPUR

FINAL REPORT

QUALITY MANAGEMENT

Revision	Revision 0
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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
MoUD	Ministry of Urban Development
MRTS	Mass Rapid Transit System
APSRTC	Andhra Pradesh State Road Transport Corporation
NCC	Net Cost Contract
NH	National Highway
NMT	Non-Motorized Transport
PBS	Public Bike Sharing Schemes
PHPDT	Peak Hour Peak Direction Trips
PT	Public Transport
SEZ	Special Economic Zone
SH	State Highway
SPV	Special Purpose Vehicle
UMTC	Urban Mass Transit Company
URDPFI	Urban and Regional Development Plans Formulation and Implementation

Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

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. Anantapur 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.

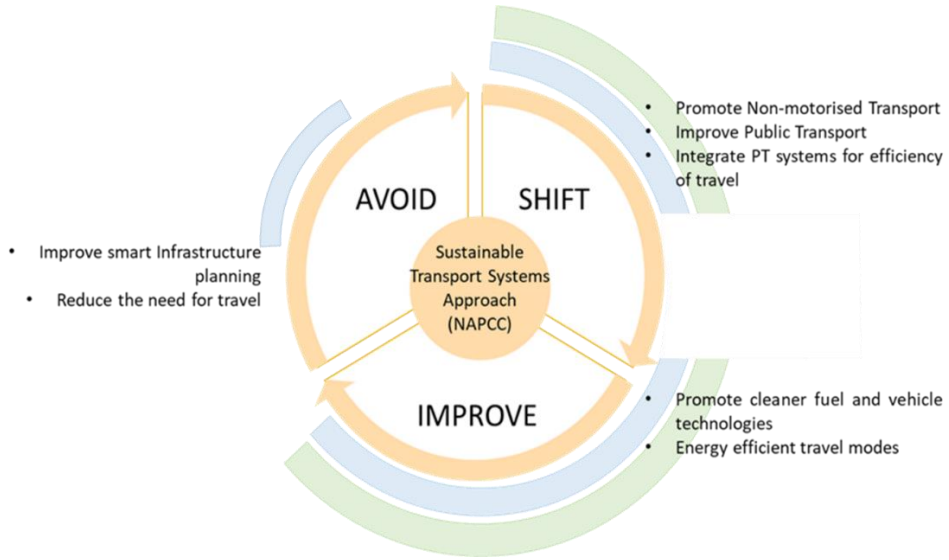

Figure 1.2.1 GENERALISED LCMP APPROACH

1.3 LCMP SCOPE

The low carbon mobility plan focusses on,

a. Providing sustainable access option for all kind of residents in Anantapur.
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 Anantapur.
4. Secondary data collection and analysing the existing transport and environmental needs with respect to the land use patterns and population densities for Anantapur.
5. Conducting primary traffic surveys to assess the current travel patterns and behaviour in the Anantapur.
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.

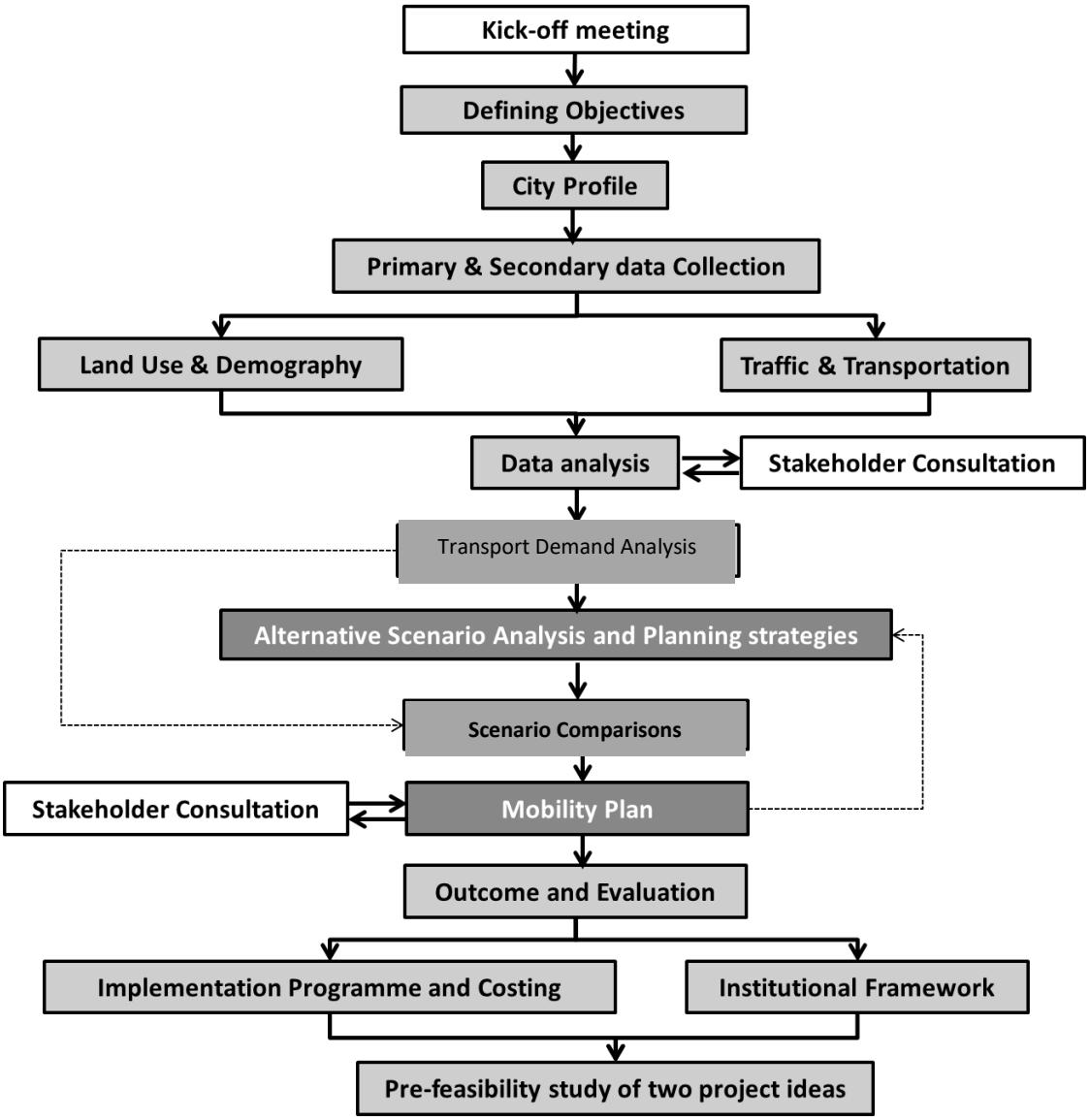

Figure 1.6-1 METHODOLOGY

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 Anantapur Municipal Corporation area consisting of 50 administrative wards. These wards have been as delineated traffic analysis zones as depicted in 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 four horizon periods are defined as follows:

1.1 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. 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.

1.2 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 Anantapur, 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 Anantapur
- Review of Existing Transport Infrastructure for Anantapur
- 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 Anantapur.

1.6.4 TASK-4: DEVELOP AND ANALYSE ALTERNATE SCENARIOS

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

1.6.4.1.1 *IMPROVEMENTS IN PUBLIC TRANSPORT*

Improving public transport involves infrastructural improvements like reserving bus-lanes and tracks, improving location and design of stops and operational improvements. The improvement in level of service is likely to not only result in retaining the existing modal share of public transport but also cause a shift from other modes to the use of public transport. The following scenarios will be developed:

- **City-Wide Bus Transport System:** A comprehensive citywide bus network will be developed to meet the travel demand. This network shall be evaluated against emissions and low carbon objectives.
- **Adaptive Transit:** Change in Land-use is usually very tough to implement in developed and old areas of the city. Keeping in mind the nature of all areas with such Land-use, suitable transit such as minibuses, para-transit and motor and cycle rickshaws will provide connectivity in the short and medium term.
- **Transit-Oriented Development:** Major travel corridors will be identified in the city and mass **transit** modes will be provided along these corridors. The rest of the road

network built around these major corridors by providing feeder services to them. The development along the mass transit corridors will triggered by designing various strategies like, increasing the FSI and etc.

- **Combination of Transport Modes:** A combination of the afore-mentioned three strategies will be adopted.

1.6.4.1.2 *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 *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 CO_2 emissions that will be produced for each horizon period. Long-term national CO_2 goals will be compared against the forecasted emissions through the back-casting approach for short and medium horizon periods. Based on this comparison, mitigation measures will be proposed in order to meet the national CO_2 goals.

1.6.6 PRIORITIZATION OF PROJECT IDEAS

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

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

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

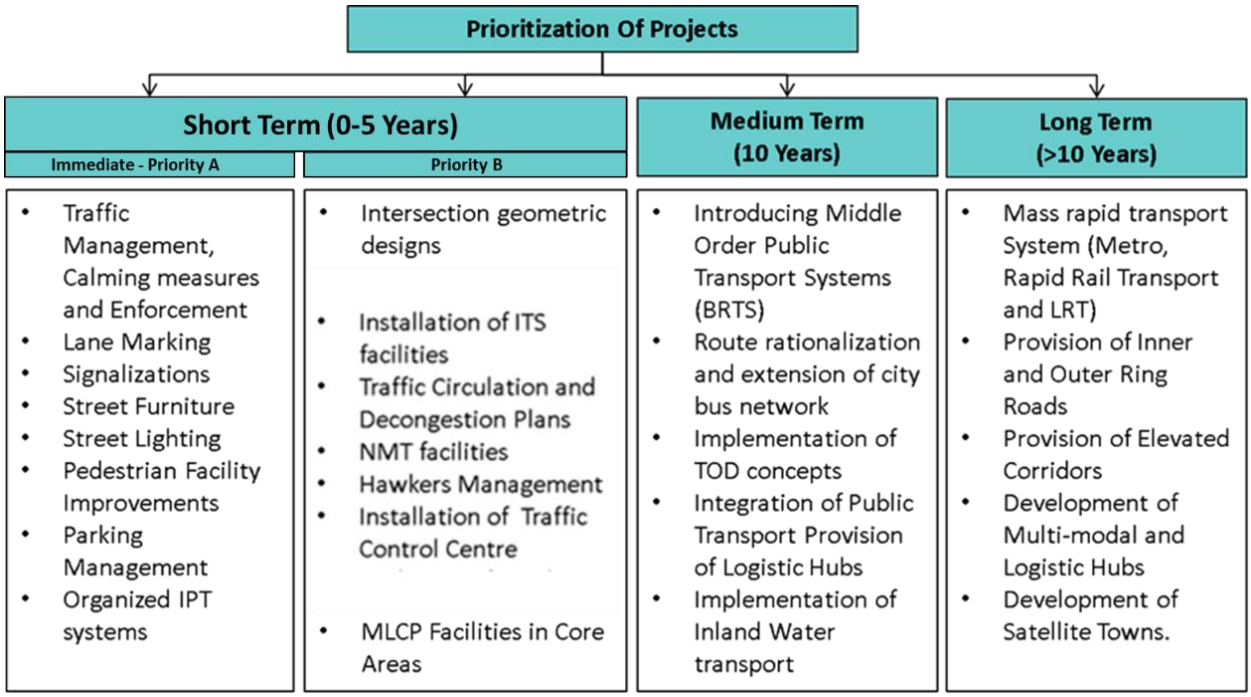

Figure 1.6-2 PROJECT PRIOIRITIZATION

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Chapter 2
CITY PROFILE

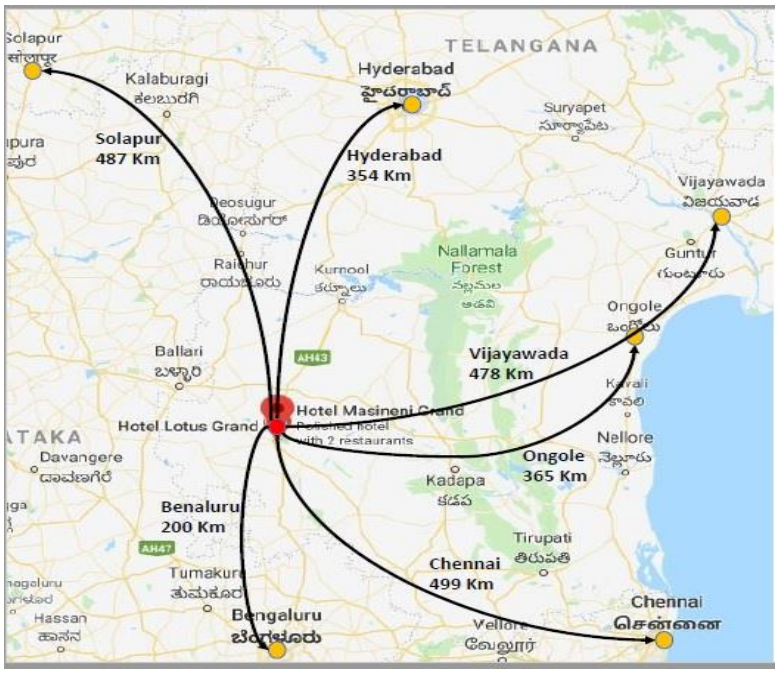
2 ANANTAPUR CITY PROFILE

2.1 INTRODUCTION

Anantapur town is the Headquarters of the district. It is part of Rayalaseema region on the state of AP, India. Its northern and central portions are a high plateau, generally undulating, with large granite rocks or low hill ranges rising occasionally above its surface. It is known as Groundnut City in reference to the neighbouring Bangalore being called as Garden City.

Figure 2.1-1 ANANTAPUR CITY VIEW

2.2 LOCATION AND REGIONAL LINKAGES



Anantapur is located at LAT 14º 68' N and LONG 77º 60' E. It is the Headquarters of the district and is situated at a distance of 354 km from Hyderabad, 200 km from the neighbouring state capital of Bangalore. Anantapur connects Hyderabad and Bangalore through National Highway 7.

Figure 2.2-1 LOCATION AND REGIONAL CONNECTIVITY OF ANANTAPUR

2.3 ADMINISTRATION

Anantapur Municipal Corporation is the civic body governing Anantapur. The corporation is spread over an area of 16.35 square kilometre. It has 23 revenue wards and 50 election wards. Which are as shown in figure 2.3.1

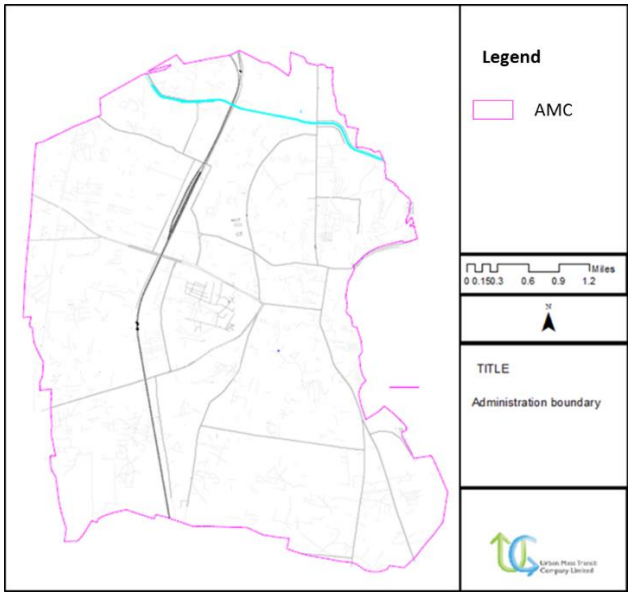


Figure 2.3-1 ANANTAPUR ADMINISTRATION BOUNDRY

2.4 GROWTH PATTERN

The growth pattern of the town is observed to be semi-radial. The initial growth of Anantapur city along the major roads, highways and railway line while the growth in the recent years is seen to be concentrated within the major network blocks though spatial densification. Urban growth is observed in two stage; initial stage spreading between northern side of railway line and old NH7 and railway line and second stage spreading new NH7 towards SH 17, SH 30. The figure 2.4.1 depicts the growth pattern of Anantapur over last 28 years.

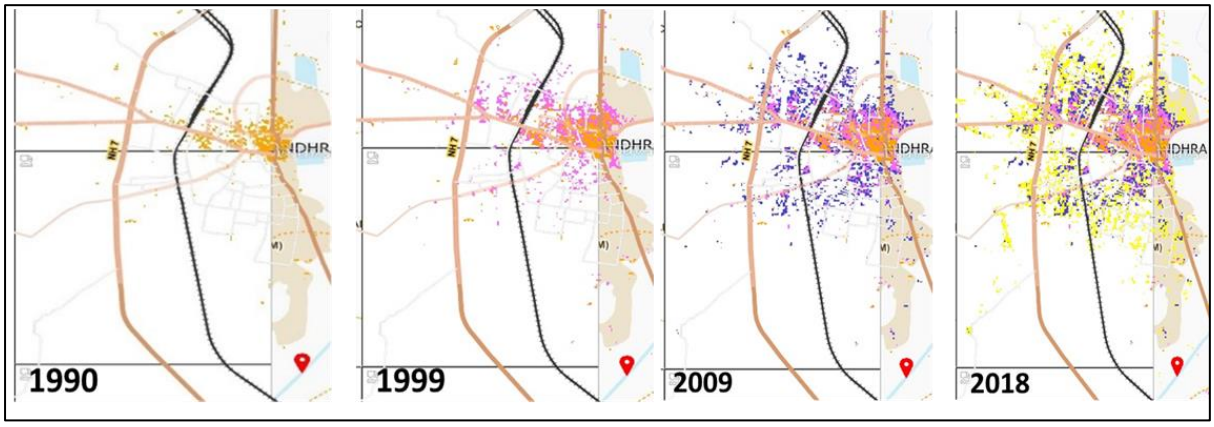


Figure 2.4-1 ANANTAPUR GROWTH PATTERN

2.5 LANDUSE

The existing land use of Anantapur indicates 52% of land use under residential. The area under transportation accounts to 11% while the area under commercial and industrial land use accounts to 2.2% and 0.35% respectively. The Figure 2.5-1 shows the existing land use distribution of Anantapur city.

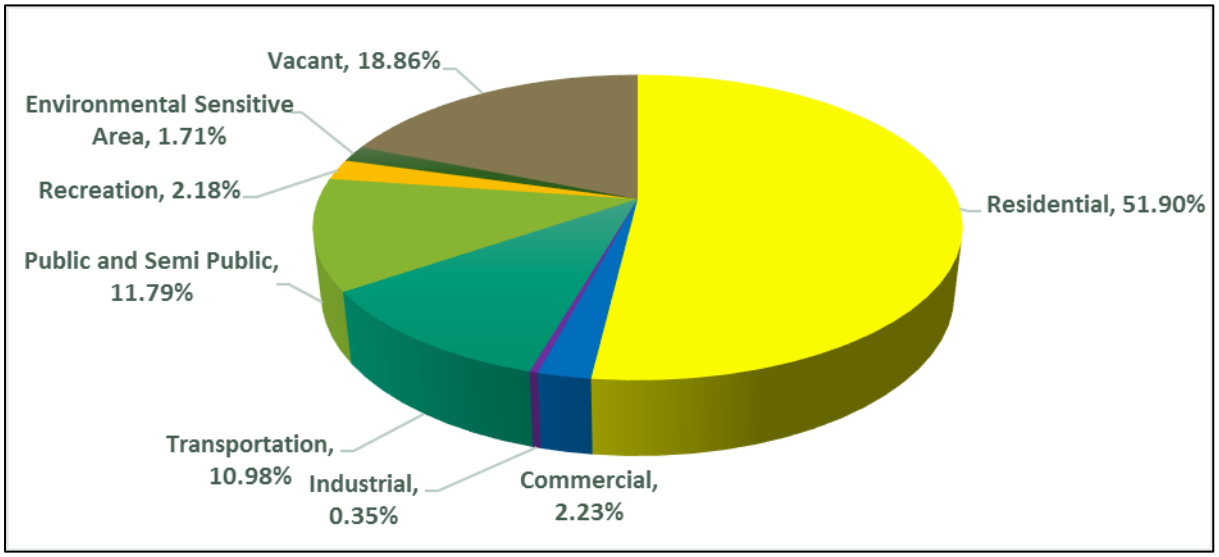


Figure 2.5-1 ANANTAPUR EXISTING LANDUSE DISTRIBUTION

The land use in the town is largely residential with commercial activity mostly concentrated at the core and industrial unit's developments due to its strategic location such as Bangalore - Chennai and Bangalore - Hyderabad routes and industrial units such as cement, handloom industries.

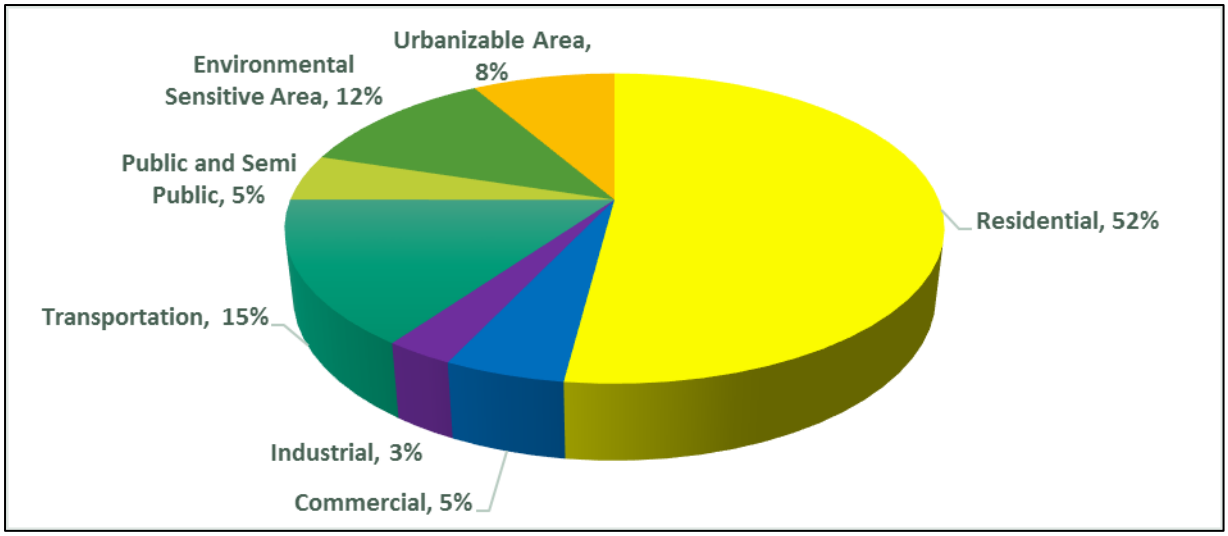


Figure 2.5-2 ANANTAPUR PROPOSED LANDUSE DISTRIBUTION (2031)

The proposed master plan indicates increase in transportation share to 15%, commercial to 5% and industrial to 3%. The total share of future urbanizable area is 8%. The Figure 2.5-2 represents the distribution of land use as per Master Plan 2031. The Figure 2.5-3 represent the spatial representation of the same within the municipal corporation limits.

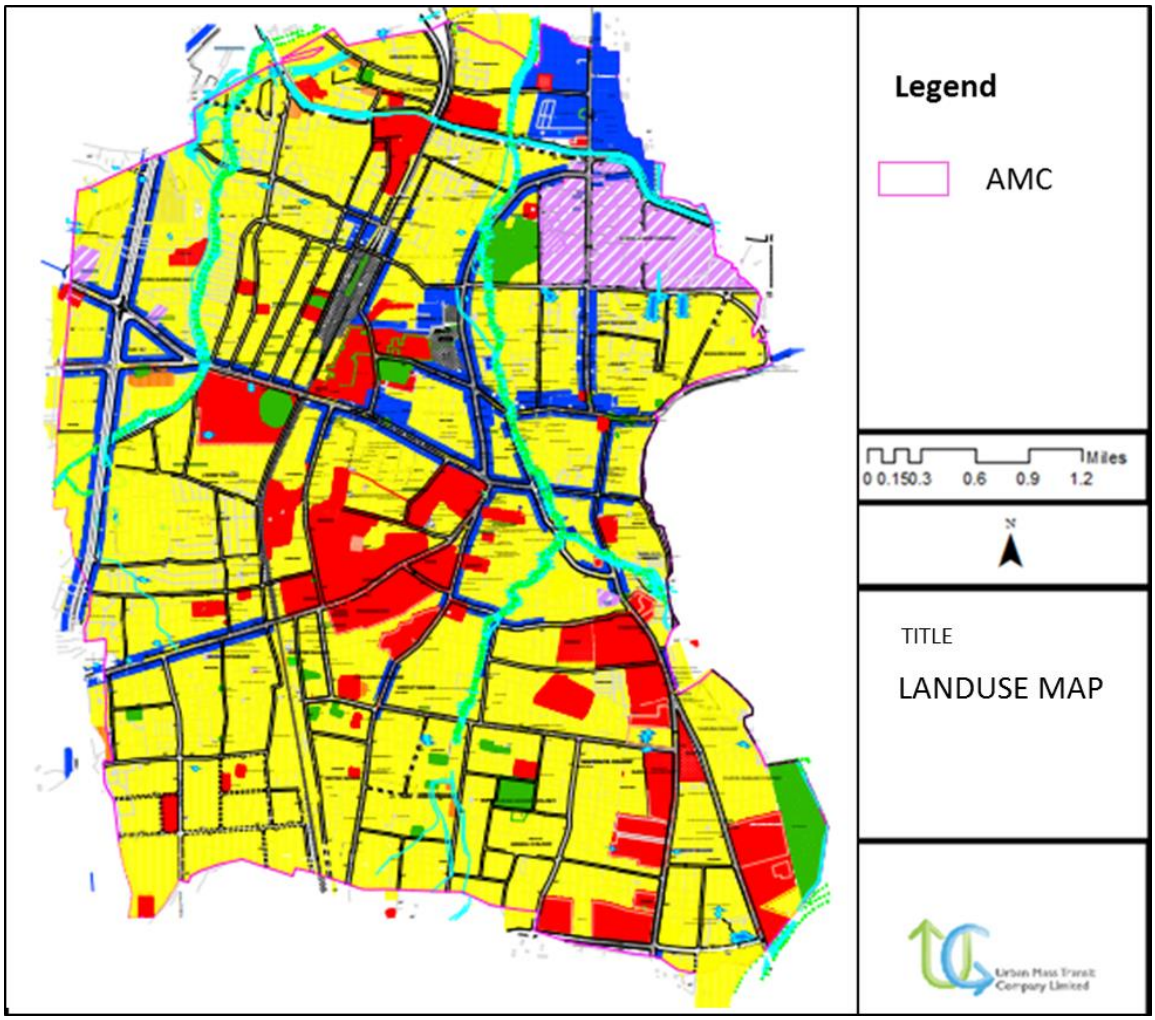


Figure 2.5-3 ANANTAPUR PROPOSED LANDUSE MAP (2031)

2.6 DEMOGRAPHIC PROFILE

As of 2011 Census of India, Anantapur had a population of 2,61,004 and present population is about 3.0 lakh. The total population constitute 130,777males and 130,227 females with a sex ratio of 977 female per 1000 males, higher than the national average of 940 per 1000. The growth rate over the last decade is observed to be 12.16%. The increase in commercial activity over the last decade has boosted the population growth rate compared to the last two decades.

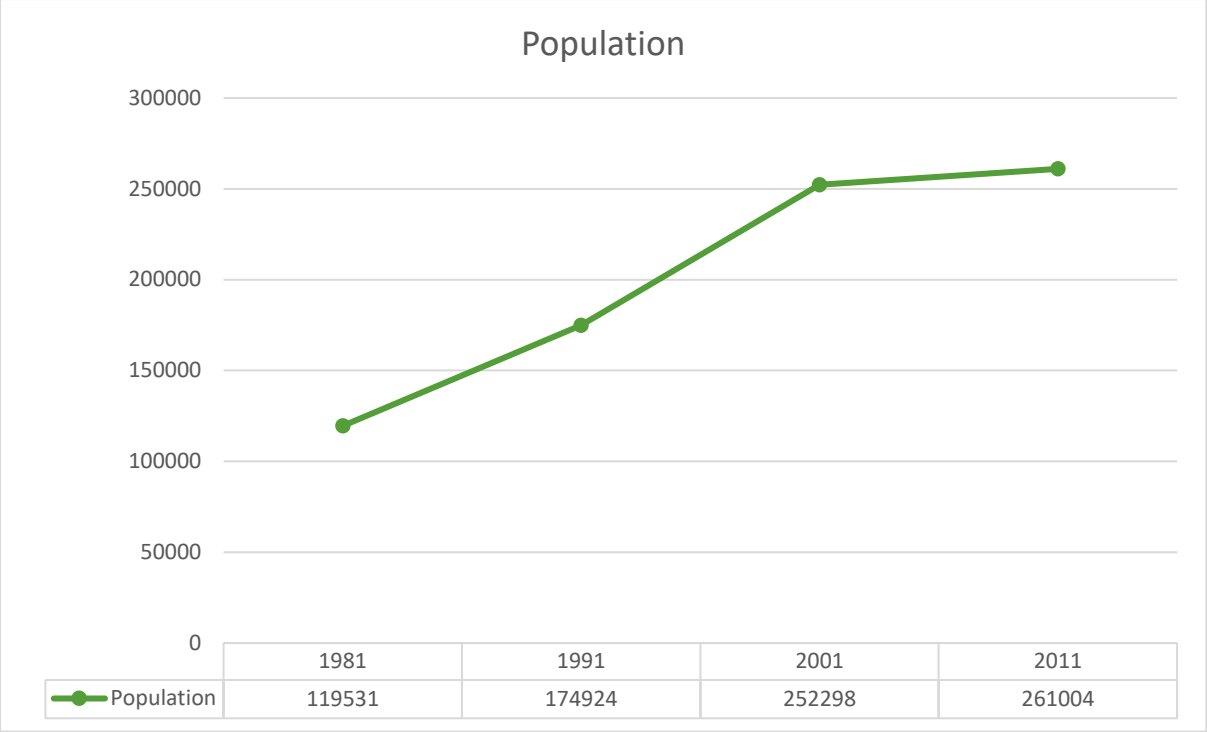


Figure 2.6-1 POPULATION OF ANANTAPUR

2.7 ECONOMIC PROFILE

As per Census of India, 2011 the total worker population in Anantapur accounts to 37% of the total population. The workforce details are as shown in Table 2.7-2

Table 2.7-1 WORKER POPULATION

	Population (Lakh)	%
Worker Population	1.72	37%
Non-Worker Population	2.88	63%
Total Population	4.60	100%

2.8 TRANSPORTATION PROFILE

2.8.1 ROAD NETWORK:

The city located on National Highway 44. Anantapur is well connected to the nearby major cities with National Highway 7 and National Highway 205 of National Highway network of India. The NH–7 connects it to Bangalore and NH–205 connects it to Chennai via Renigunta. The city has a total road length of 298.12 km.

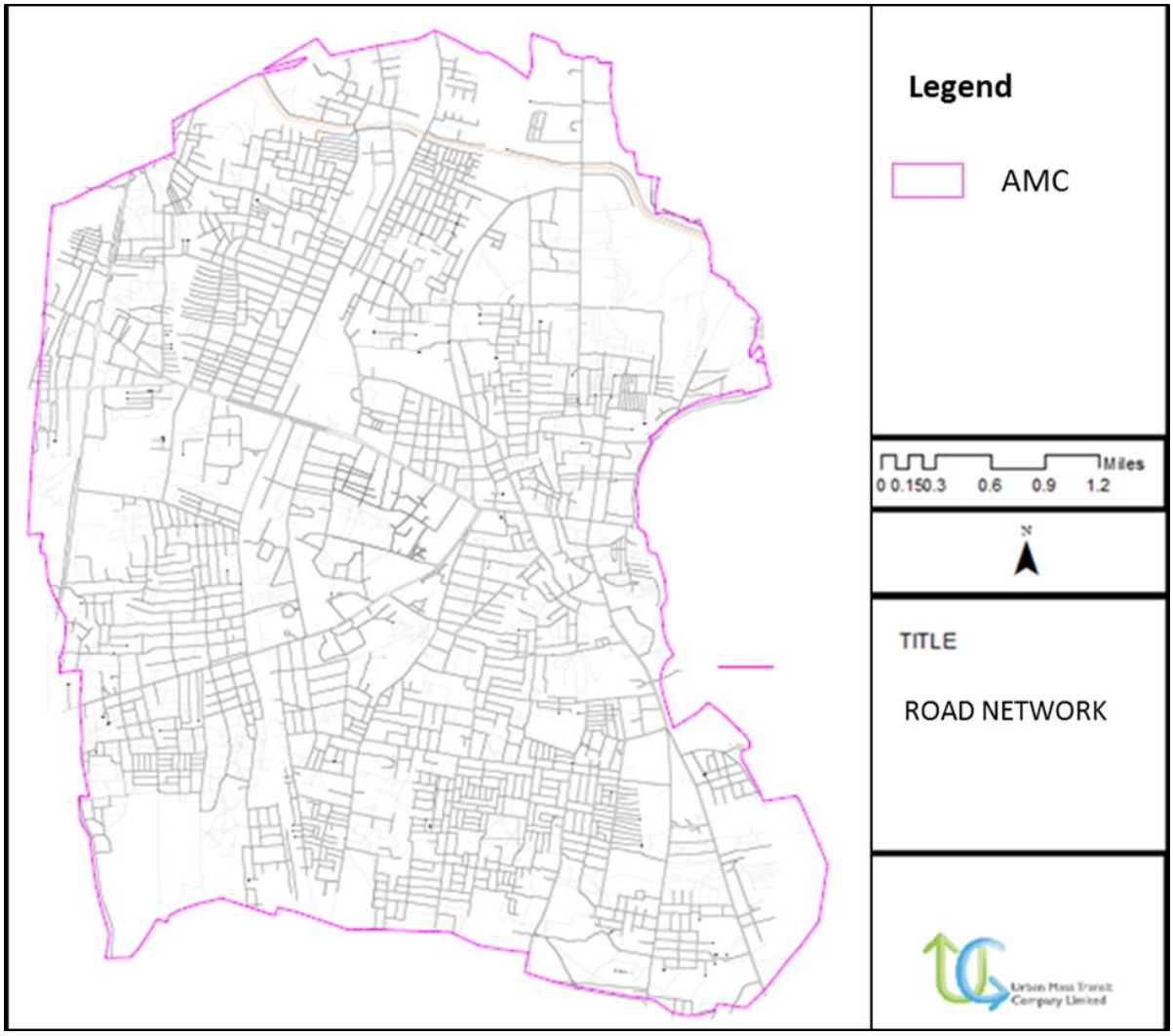


Figure 2.8-1 ANANTAPUR ROAD NETWORK

2.8.2 AIR AND RAIL CONNECTIVITY:

There is no direct flight connectivity, however, to Anantapur. Some 190 km away is the Kempe Gowda International Airport in Bengaluru, which is the nearest airport that connects Anantapur to the rest of India. There is an airport in the district located in Puttaparthi, known as Sri Sathya Sai Airport; however this airport currently has no scheduled service. Bangalore International Airport is nearest commercial airport to Anantapur District.

Anantapur is classified as an *A–category* station in the Guntakal railway division. Anantapur has 2 platforms and each can handle a train with more than 21 coaches. Daily 41 pairs of passenger trains pass through this station with halt times more than 2 minutes. Anantapur railway station is located in Anantapur district in the Indian state of Andhra Pradesh and serves Anantapur city.

2.8.3 PUBLIC TRANSPORT:

The Andhra Pradesh State Road Transport Corporation operates services from Anantapur bus station. The city is catered through sub-urban services as there are no city bus services currently operating in the city.

2.8.4 INTERMEDIATE PUBLIC TRANSPORT:

The public transport carting to the system is largely through intermediate modes of public transport offered by auto rickshaws and cycle rickshaws. The shared auto rickshaws are observed to ply on along the major commercial in the town especially along the Anantapur Main Road. In the absence of the city bus services the residents were forced to depend on other modes of transportation such as auto rickshaws and two-wheelers. This resulted in drastic increase in auto rickshaw (19158) and two-wheeler vehicle strength.

2.8.5 ROAD SAFETY:

Based on the data collected form the Traffic Police Department, Anantapur the quantum of accidents with in the study area is as shown in Figure 2.8.4.

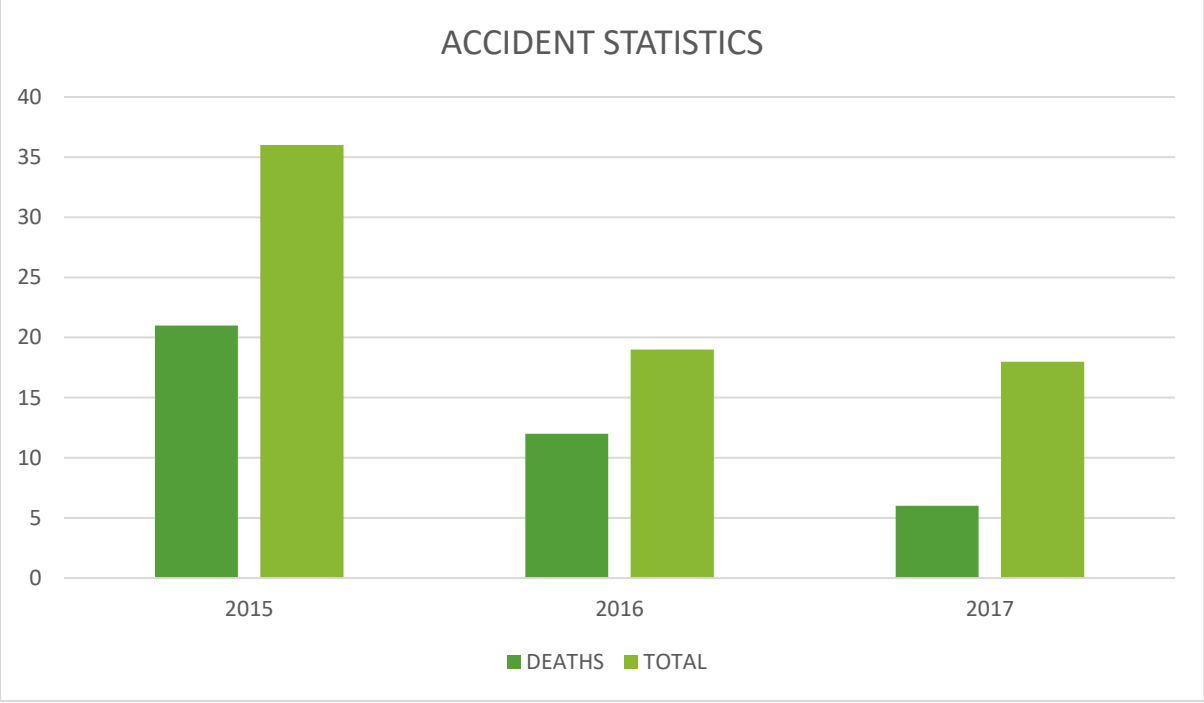


Figure 2.8.2 ACCIDENTS DATA

2.9 ENIRONMENTAL QUALITY

The air quality measure at air pollution monitoring station near the paper mill units is as shown in the Table 2.7-1 and Table 2.8-2. 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	Standard
Public	NH3	21 ug/m3	400 ug/m3
Public	NOx	38.3 ug/m3	80 ug/m3
Public	PM10	101 ug/m3	100 ug/m3
Public	SO2	4.4 ug/m3	80 ug/m3

Table 2.8-2 Industry CAAQM Station-Ambient

Monitoring Station Name	Parameter Name	Current value	Standard
AAQMS_1	PM2.5	23 ug/Nm3	1000 ug/Nm3
AAQMS_2	NOx	3.35 ug/Nm3	1000 ug/Nm3
AAQMS_2	PM10	55 ug/Nm3	1000 ug/Nm3
AAQMS_2	SO2	4.62 ug/Nm3	1000 ug/Nm3
AAQMS_1	CO	1.14 mg/m3	100 mg/m3
AAQMS_1	NO	3.03 ug/m3	100 ug/m3
AAQMS_1	NO2	5.13 ug/m3	100 ug/m3
AAQMS_1	NOx	8.16 ug/m3	100 ug/m3
AAQMS_1	PM10	49.12 ug/m3	100 ug/m3
AAQMS_1	PM2.5	17.92 ug/m3	100 ug/m3
AAQMS_1	SO2	19.43 ug/m3	100 ug/m3
AAQMS_2	CO	0.86 mg/m3	100 mg/m3
AAQMS_2	NO	1.19 ug/m3	100 ug/m3
AAQMS_2	NO2	7.36 ug/m3	100 ug/m3
AAQMS_2	NOx	8.55 ug/m3	100 ug/m3
AAQMS_2	PM10	89.25 ug/m3	100 ug/m3
AAQMS_2	PM2.5	53.23 ug/m3	100 ug/m3
AAQMS_2	RH	29.39 %	100 %
AAQMS_2	Rain	0 mm	100 mm
AAQMS_2	SO2	17.86 ug/m3	100 ug/m3
AAQMS_2	Temperature	32.94 Degree	100 Degree
AAQMS_2	Wind_Direction	192.63 Degree	Degree
AAQMS_2	Wind_Speed	0 m/s	100 m/s
MINES	CO	0.27 mg/m3	4 mg/m3

Monitoring Station Name	Parameter Name	Current value	Standard
MINES	NO	5.41 ug/m3	80 ug/m3
MINES	NO2	2.03 ug/m3	80 ug/m3
MINES	NOx	9.89 ug/m3	80 ug/m3
MINES	PM10	40 ug/m3	100 ug/m3
MINES	PM2.5	34.8 ug/m3	60 ug/m3
MINES	SOx	5.08 ug/m3	80 ug/m3
CAAQMS01	NOx	5.44 mg/Nm3	1000 mg/Nm3
CAAQMS01	PM10	177 mg/Nm3	1000 mg/Nm3
CAAQMS01	PM2.5	47 mg/Nm3	1000 mg/Nm3
CAAQMS01	SOx	6.71 mg/Nm3	1000 mg/Nm3
CAAQMS02	PM10	985 mg/Nm3	1000 mg/Nm3
CAAQMS02	PM2.5	56 mg/Nm3	1000 mg/Nm3

The air pollution values within the city centre indicate higher levels of PM10 particles.

2.10 OBSERVATIONS

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

1. Significant share of two-wheeler and auto rickshaws.
2. Lack of pedestrian infrastructure
3. Lack of NMT safety measures
4. Lack of formal transportation modes for intracity travel.
5. Issues regarding network capacity.

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CHAPTER 3
EXISTING TRAVEL AND TRAFFIC SCENARIO

3 EXISTING TRAVEL AND TRAFFIC SCENARIO

3.1 INTRODUCTION

The list of Primary Surveys planned for the LCMP Anantapur study is as provided in the Table 4.1-1.

Table 3.1-1 PRIMARY SURVEYS LIST FOR ANANTAPUR 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 - 24hrs
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 Anantapur the existing 50 wards are considered as the TAZ boundaries. The TAZ boundaries Figure 3.1.1.

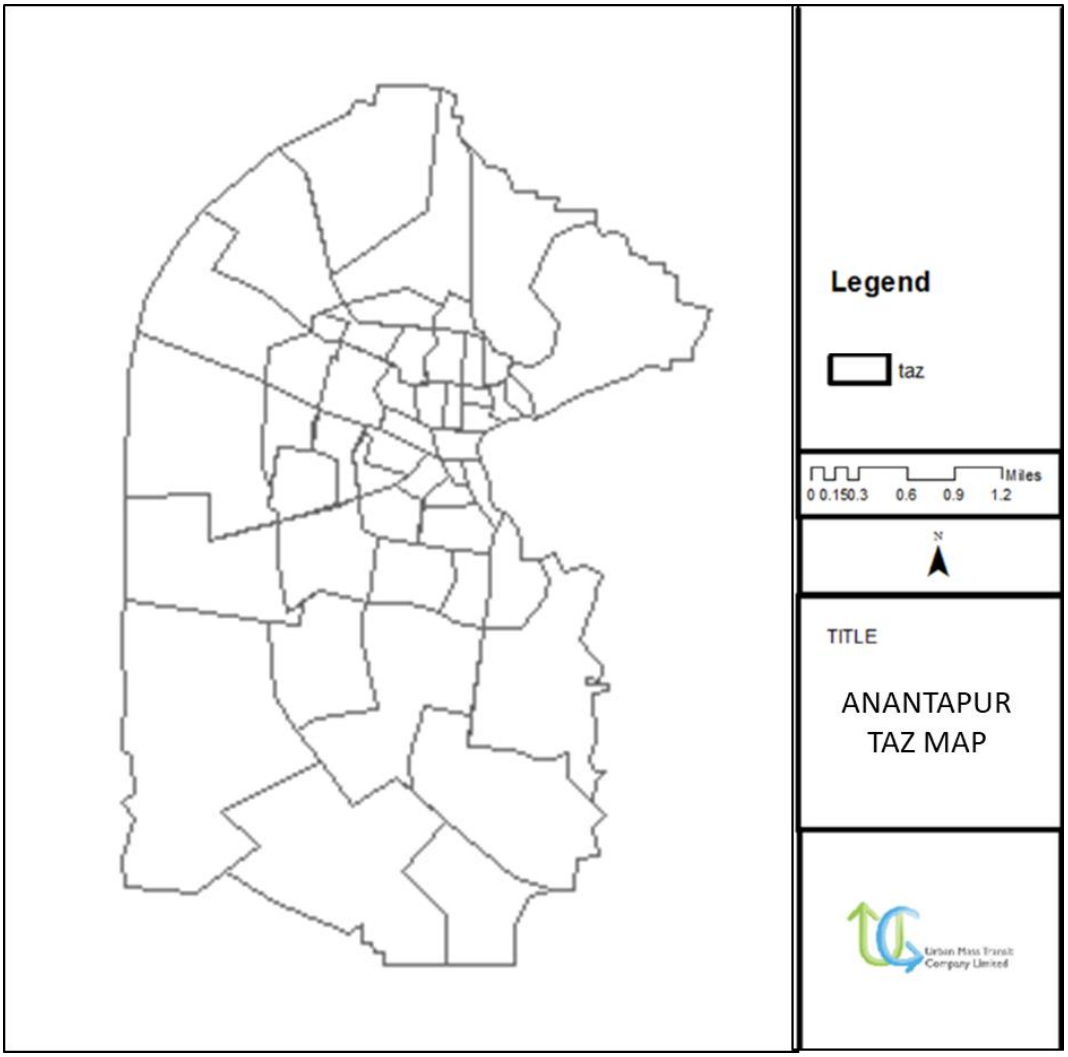

Figure 3.1-1 TAFFIC ANALYSIS ZONES FOR ANANTAPUR

3.2 EXISTING TRAFFIC AND TRAVEL CHARACTERISITCES

4 The network structure in the city is the form of incomplete rind and radials, with few radials connecting the sub-urban places around the city.

5 The average journey speed along the network is observed to 27 kmph. The delays in travel speeds are caused largely due to traffic and chaotic movement of vehicles.

6 Highest volume of traffic at internal and external interactions are observed at outer cordon locations connecting Ballari, Vijayawada and Hyderabad. Higher share of goods movement is observed towards Bellary.

7 The screen line location SL2 has highest traffic volume due to its location along the Highway.

8 Two wheelers contribute to the highest share of traffic composition in the city, followed by auto rickshaws.

9 Highest traffic volume is observed at Sapthagiri Circle and Clock tower circle.

10 Highest share of two wheelers are observed at Clock tower circle, the highest share of auto rickshaws is observed at Sapthagiri circle and Galam Street junction has highest share of cars.

11 The majority of the trips captured at terminal locations were work based trips directing towards the dependency of sub-urban areas to the city.

12 Auto rickshaws are used as the major mode of a dispersal and access at the terminals.

13 Shared auto-rickshaws are observed to provide end to end connectivity ply on all major routes.

14 Collector Office bus stop is observed to have higher footfalls with respect to the boarding and alighting.

15 Intercity or the sub-urban bus services are providing the inter-city and intra city services in Anantapur.

16 Clock tower circle is observed to have highest pedestrian footfall amongst all the surveyed locations and it requires immediate attention in terms of pedestrian crossing infrastructure facilities such as signalised pedestrian crossings.

17 Chemicals and Fertilizers contribute to the highest share in commodity type transported through goods.

18 The Per Capita Trip Rate (PCTR) for Anantapur was observed to be 1.01 including the walk trips and 0.9 excluding the walk trips. The PCTR for motorised trips is about 0.95.

19 The major modes of travel in Anantapur are observed to be auto rickshaw and two wheelers with a model share of 18% and 55% respectively.

20 The Non-Motorised Transport comprises about 11% including 10% of walk trips.

21 The average trip length in the Anantapur is observed to be 3.6km including the walk trips and 3.61km excluding the walk trips.

22 The work and education-based trips account to 45.45% and 2.43% of the total trips respectively.

23 The Average Trip Length (ATL) for work trips is observed to be 3.64 and 2.58 for educational trips.

24 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.

25 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 Anantapur.

26 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.

27 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.

28 Safety is perceived to a major concern in regard to all the public transit modes.

29 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.

30 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 Anantapur 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:

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

3.3.3 SUMMARY TABLE

The consolidated benchmarking of the existing scenario of the study area is as shown in Table 4.4-42.

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	3	The city has minimal pedestrian facilities which need immediate improvements especially at intersections and unobstructed footpaths it.
3	Non-Motorized Transport Facilities	3	The city lacks adequate NMT facilities.
4	Level of usage of Intelligent Transport System(ITS) Facilities	4	The city lacks adequate ITS facilities.
5	Travel speed (Motorized and Mass transit)	2	The city has considerable travel speeds for the existing but with small increase in flow may cause substantial increases in approach delay and hence decrease in arterial speed in the horizon years.
6	Availability of Parking places	4	The city authorities need to initiate immediate actions with respect of providing paid parking spaces and demand management for parking.
7	Road safety	3	Need considerable improvements in road design and available road infrastructure, traffic management and other such reasons which contribute significantly to road safety.
8	Pollution levels	3	Level of pollution in a city is very low, the quality can be adopted by encouraging and introduction the usage of public modes rather than the private modes.
9	Integrated land use Transport system	4	Faint coherence between study area structure and public transport system.

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CHAPTER 4

ENVISIONING ANANTAPUR

4 ENVISIONING ANANTAPUR

The goals and objectives set for the transportation needs of Anantapur 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 Anantapur.

4.1 VISION

As stated earlier, the LCMP is a long-term vision for desirable accessibility and mobility pattern for people and goods in Anantapur. 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 Anantapur 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 3.3-1 **PEOPLE CENTRIC VISION AS ENVISAGED FOR ANANTAPUR**

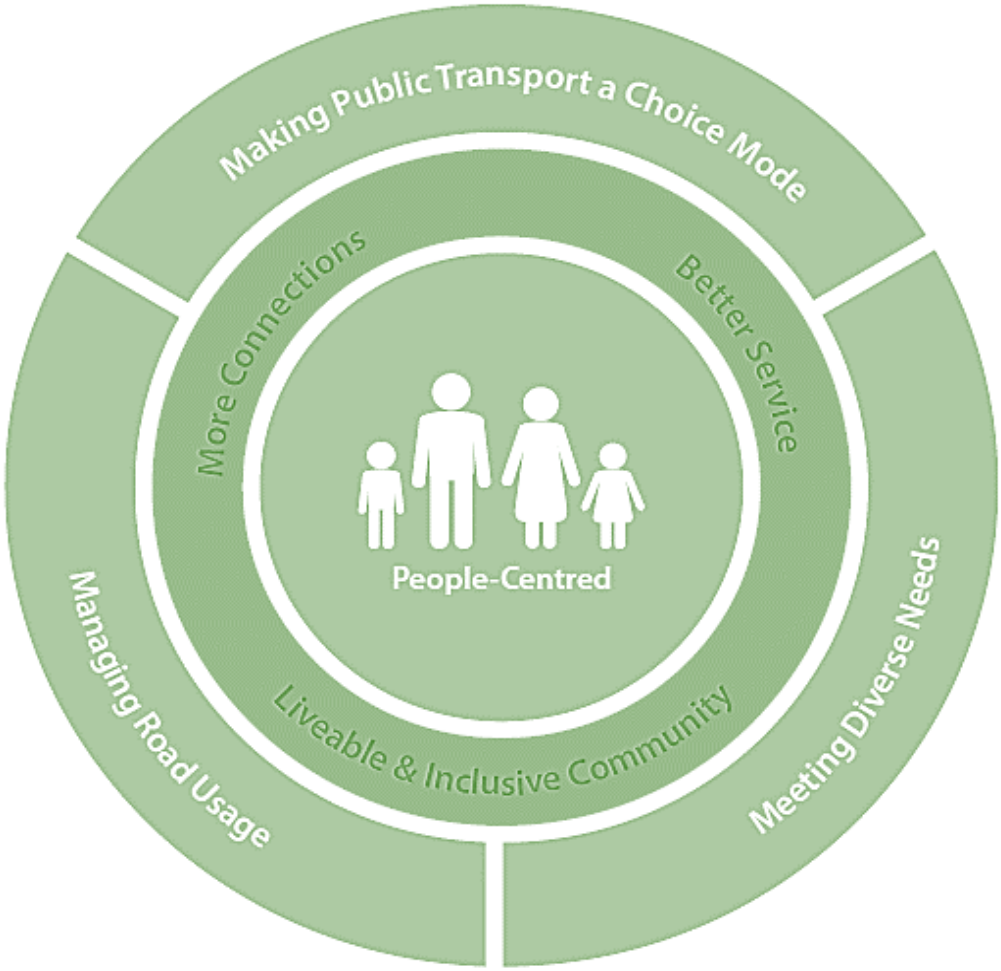

Figure 3.3-2 **PEOPLE CENTRIC VISION AS ENVISAGED FOR ANANTAPUR**

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 Anantapur 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	11.6%	3%	>20%
Private Transport (PVT) Trips	51.7%	56%	<40%
Public Transport Trips	4%	1%	>15%
Avg. Network Speed (kmph)	27.2	20.8	>30
% of city covered with Footpaths (Arterial and Sub-Arterial)	12%	12%	100%
% of city covered with Cycle Tracks (Arterial and Sub-Arterial)	0%	0%	>50%
Local Emissions (Tonnes/day)	3.10	3.89	Reduce by 50%
GHG Emissions (Tonnes/day)	67.86	74.7	Reduce by 50%

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, liveable 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 document 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 and western side as 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: LANDUSE BY CATEGORIES

Category	URDPFI Guidelines	Proposed (2031)
Residential	36-38%	52%
Commercial	5-6%	5%
Industrial	7-8%	3%
Public & Semi Public	10-12%	5%
Recreational	14-16%	2%
Transportation	12-14%	15%

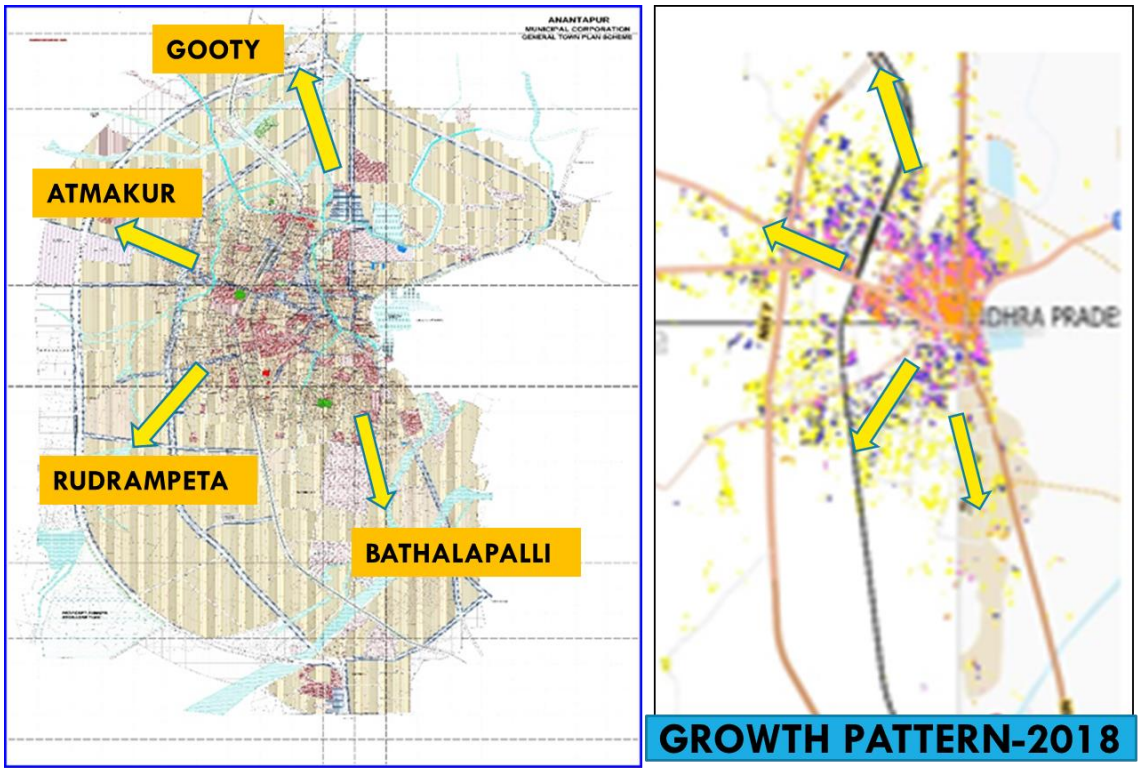

Figure 4.3-1 **LANDUSE AND GROWTH PATTERN**

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 west i.e. towards Atmakur and Rudrampeta. Thus, similar land use and growth structure is adopted in BAU scenario.

4.3.1.2 SUSTAINABLE URBAN TRANSPORT (SUT) SCENARIO

As per Ministry of Urban Development guidelines and RFP, a sustainable scenario has to be considered to reduce congestion and pollution, while conserving resources like urban space and capital expenditure. Hence, a scenario has been developed that achieves the goals stated in the earlier chapter in line with LCMP vision. The Sustainable Urban Transport scenario considerers the outputs of BAU scenario and secondary reports while prioritizes interventions based on Transit Oriented Development along mobility corridors, Development of Public transit corridors, Augmentation of buses, Network Development (i.e. missing links, Hierarchy road system, part of public transit corridor). Thus, in SUT scenario, mixed land use development is considered along identified mobility corridors. Additional population and employment will be achieved by densification (i.e. allowing higher FSI) along the mobility corridors which is termed as Transit Oriented Development (TOD). Corridors considered for transit-oriented development are as discussed under Section 5.1.2.

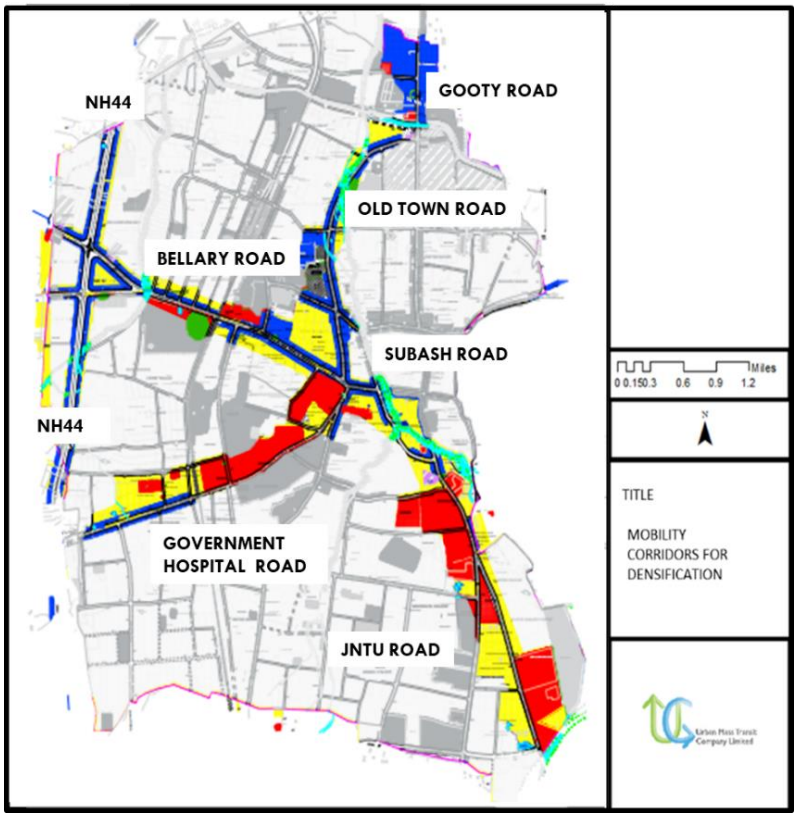

Figure 4.3-2 **MOBILITY CORRIDORS FOR DENSIFICATION**

4.3.2 POPULATION & EMPLOYMENT PROJECTIONS

4.3.2.1 POPULATION PROJECTIONS

The population projection methods namely, arithmetic progression, geometric progression and incremental increase method have been considered to forecast the future population. Due to the decrease in percentage (%age) growth of population; Geometric Progression Method was not suitable. After examining the available methods for projecting the population in Anantapur and considering the present stature of AMC, future developments, the Incremental Increase Method has been taken into consideration. The details of Population projection are as shown in Table 4.3-2 and Figure 4.3-3.

Table 4.3-2: POPULATION PROJECTIONS[1]

Year	Arithmetic Increase Method	Incremental Increase Method	Geometric Increase Method
2011	2,68,503	2,68,503	2,68,503
2018	3,01,187	2,96,906	3,19,029
2028	3,47,878	3,31,366	4,08,134
2038	3,94,569	3,58,630	5,22,126

[1] Source: Census of India and UMTC Projections

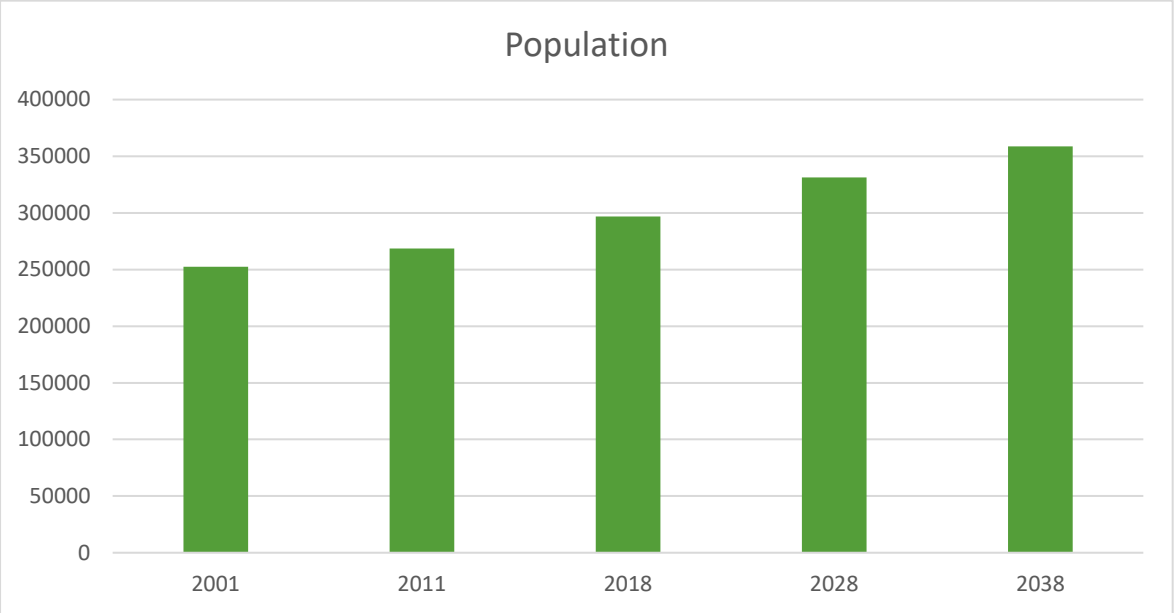

Figure 4.3-3 **PROJECTED POPULATION FOR 2038**

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 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.

EMPLOYMENT PROJECTIONS

Taking into consideration the proposed master plan proposals to strength the economic growth and accessing the current growth patterns the employment was forecasted which is hown in Table 4.3-3.

Table 4.3-3: POPULATION AND EMPLOYMENT FOR HORIZON YEARS (2018-2038)[2]

Year	Population	Employment
2011	2,68,503	91,579
2018	2,96,906	1,01,266
2028	3,31,366	1,13,019
2038	3,58,630	1,22,318

[2] Source: Census of India and UMTC Projections

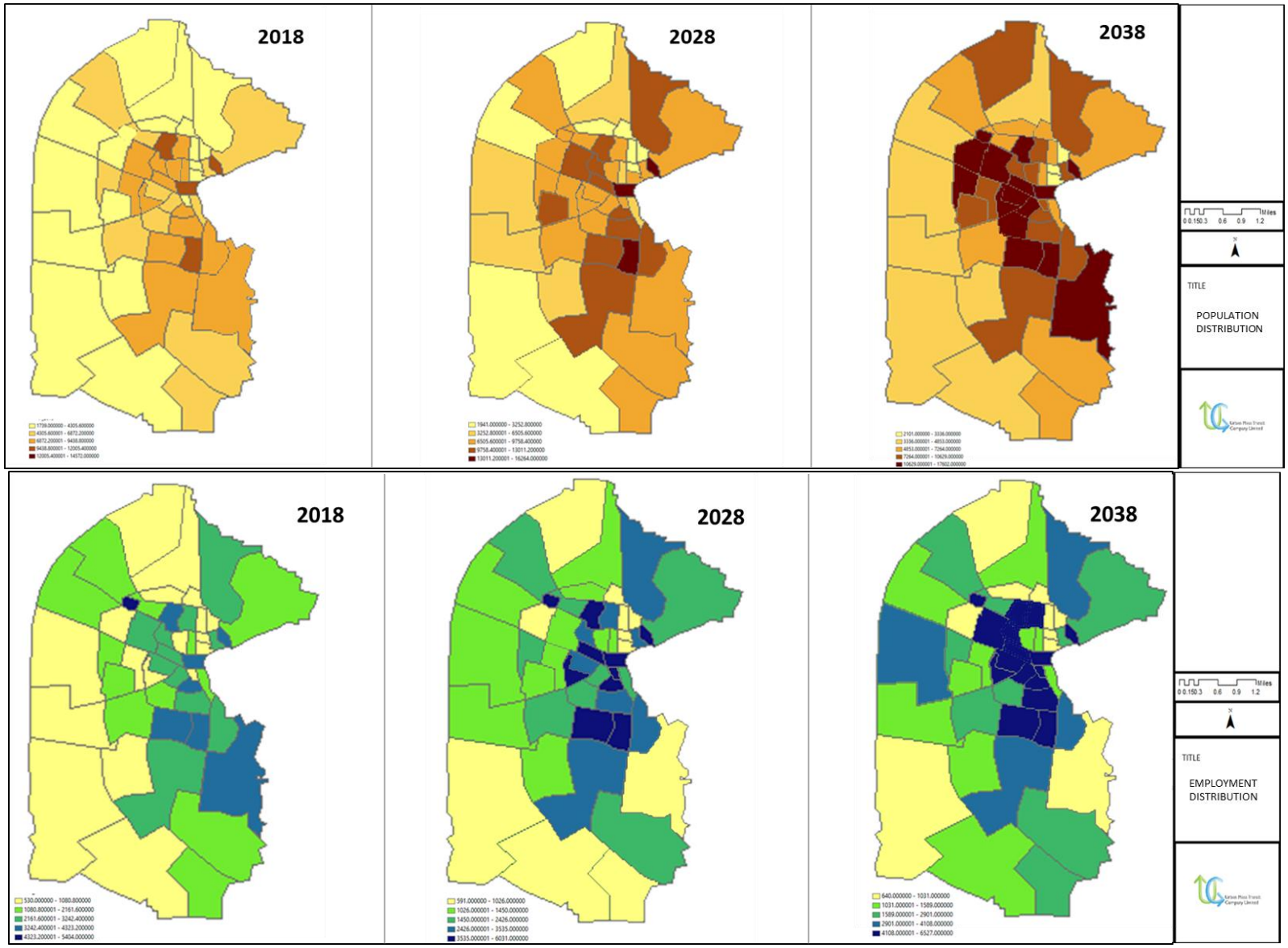

Figure 4.3-4 **POPULATION (TOP) AND EMPLOYMENT (BELOW) PROJECTIONS FOR 2018, 2028, 2038 (BAU SCENARIO)**

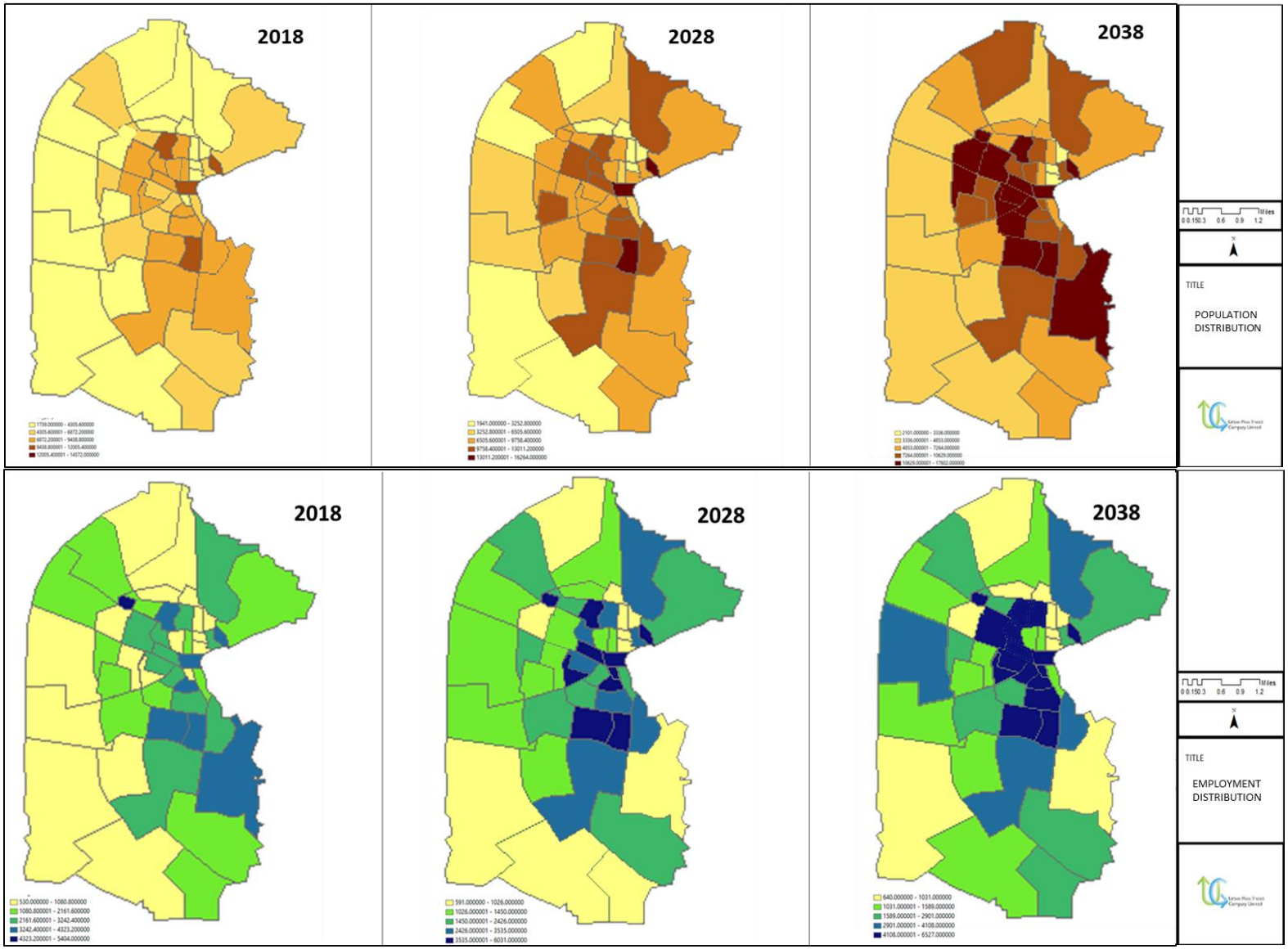

Figure 4.3-5 **POPULATION (TOP) AND EMPLOYMENT (BELOW) PROJECTIONS FOR 2018, 2028, 2038 (SUT SCENARIO)**

4.4 TRAVEL DEMAND CHARACTERISTICES

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	Total
2W	71%	28%	2%	100%
Car	26%	59%	15%	100%
IPT	87%	12%	1%	100%
PT	11%	69%	20%	100%
NMV	80%	20%	0%	100%
Walk	100%	0%	0%	100%

Table 4.4-3: SUMMARY OF BASE YEAR PASSENGER TRIPS

MODE	I-I	I-E & E-I	E-E
2W	46%	52%	14%
Car	5%	10%	19%
IPT	32%	11%	8%
PT	4%	26%	59%
NMV	1%	1.%	0%
Walk	11%	0%	0%
Total	100%	100%	100%

The trip interactions of various modes were assessed based on the intercity and intracity movements.

4.5 COMPARISION OF SCENARIOS

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

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

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

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

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

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

1. Network Characteristics
2. V/C Ratio
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	11%	2.4%	18%
Car	5%	6%	3%
Two wheeler	46%	50%	30%
Auto Rickshaw	32%	40%	26%
Public Transport	4%	1%	17%
NMV (Cycle +Cycle Rickshaw)	1%	0.6%	6%
Avg. Network Speed (kmph)	27.2	20.8	31.1
Avg. Volume-Capacity (V/C) Ratio	0.92	1.54	0.78

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

4.5.2 V/C RATIO

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		
		Base (2018)	BAU (2038)	SUT (2038)
1	SH-32	1.04	1.77	0.76
2	Govt. Hospital Road	0.94	1.61	0.69
3	Bellary Road-Ananthapur Road	1.02	1.29	0.71
4	Ramachandranagar Flyover	0.98	1.25	0.63
5	JNTU Road	0.93	1.14	0.66
6	Gooty Road	0.66	0.78	0.74

The V/C ratio on major roads has reduced by 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 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	SH-30 Tadipratri	1676	1755	2450	1225
2	Bellary Road-Ananthapur Road	305	318	2094	1047
3	Anathapur Tirupathi Highway	1695	1714	2477	1239
4	Subash Road	476	512	2320	1160

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CHAPTER 5

URBAN MOBILITY PLAN

5 URBAN MOBILITY PLAN

The mobility goals for Anantapur 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 Anantapur.

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

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

5.1 LAND USE AND TRANSPORT PLAN

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

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

The land use transport strategies adopted for Anantapur are as follows,

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

5.1.1 NETWORK STRUCTURE-MULTI NODAL TRANSIT CONCEPT

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

5.1.1.1 NODES

Nodes are reflected in the centrality of urban activities - can be related to the spatial accumulation of economic activities or to the accessibility to the transport system. Terminals, such as bus stations, railyards, and airports, are important nodes around which activities agglomerate at the local or regional level. Nodes have a hierarchy related to their importance and contribution to urban functions, such as production, management, retailing and distribution. The lowest level of linkages includes streets, which are the defining elements of the urban spatial structure.

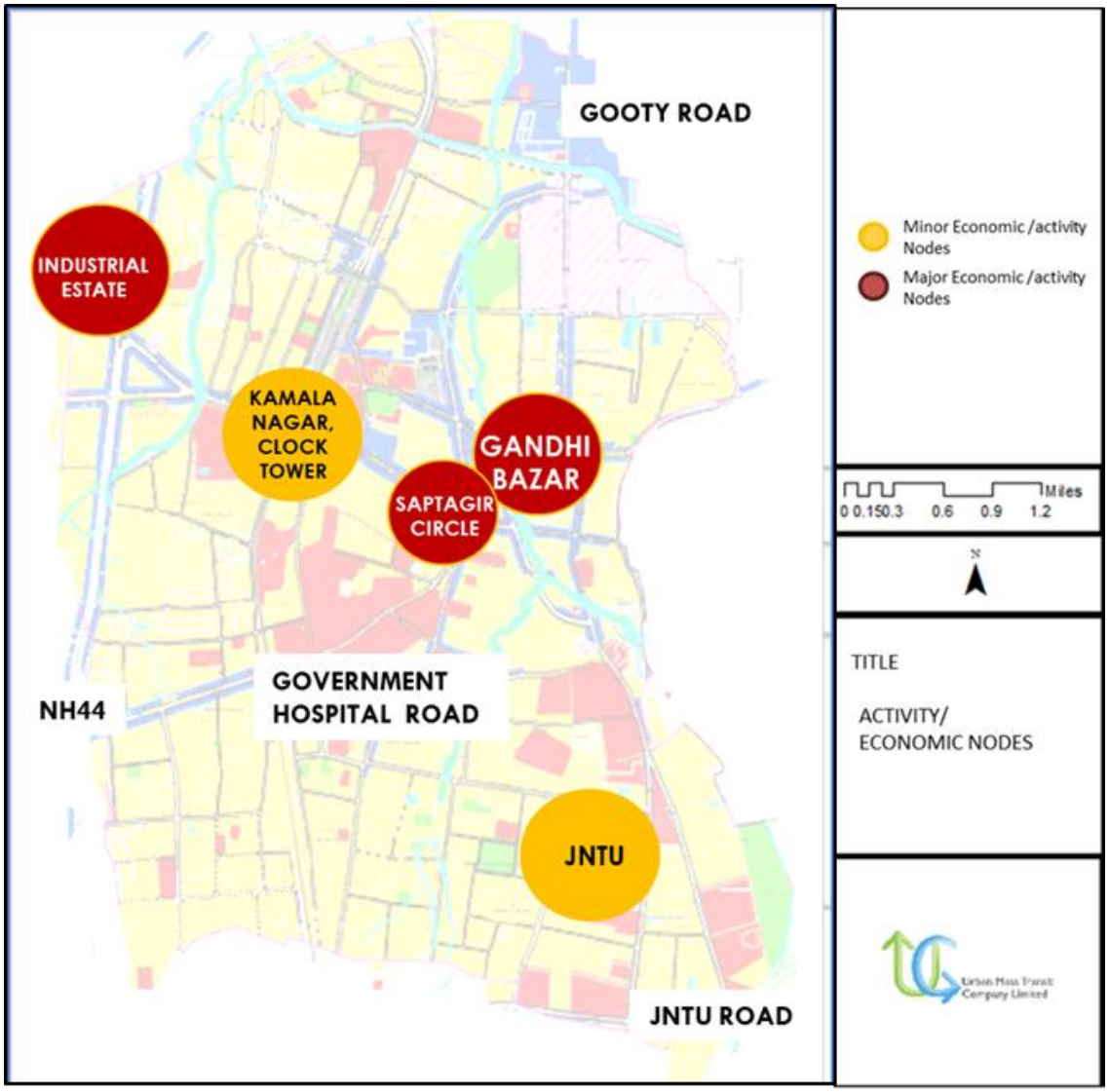


Figure 5.1-1 **ACTIVITY/ECONOMIC NODES IN ANANTAPUR**

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

- The commercial area of the city mainly lies within the core area of the city. It includes the Gandhi road, Saptagiri Circle and Old Town Road Area. The recent developments are observed along the Subhash Road, JNTU Road and Kamala Nagar Area. The other recent commercial establishments developments are observed along the NH-16.

-The industrial zone is mainly located in the exteriors of the city near the Industrial estate. The recent establishment of KIA Motors has led to concentration of activities around it.

The partial ring radial road network of the city ensures linkage of these nodes with minor ones. The National highway 16 is the major spine strengthen the movement along the nodes. The Figure 5.1-1 represents the distribution of activity nodes in and around the city.

5.1.1.2 LINKAGES

Various transit network concepts are developed world wide and have been implemented across the world. The Multi nodal transit network is one such concept where the major transit corridors and economic activity nodes are dispersed around the main city centre. Another concept is the compact development observed in cities like Barcelona, Curitiba where the development of the city region is restricted up to certain limits and a hybrid concept is a combination of dispersed (Mutli nodal) and compact development. The Figure 5.2-1 represents the conceptual mobility corridor patterns.

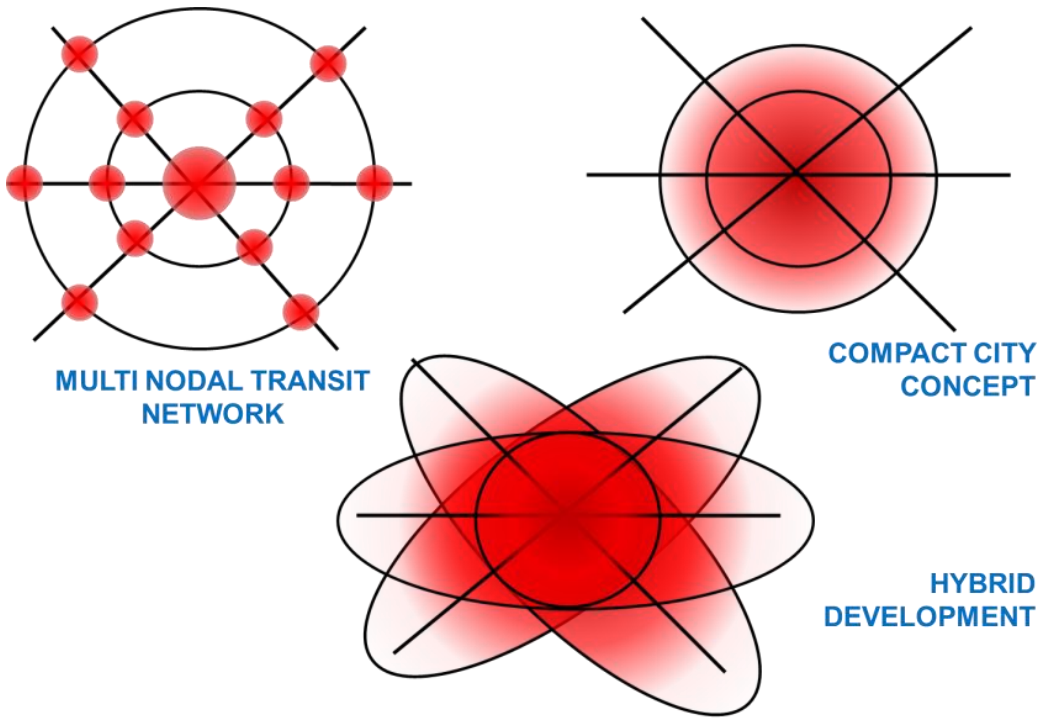


Figure 5.1-2 **MOBILITY CORRIDOR PATTERNS CONCEPT**

Anantapur is already a multi nuclei city with different nodes around the city. The transport infrastructure in the smaller nodes should substantiate the land use development and should complement the development. Anantapur Core area is the major node in the city. Saptagiri circle, kamala Nagar, Government Hospital area, JNTU and Industrial Estate areas are the minor nodes around Anantapur. In order to decongest the core city area and for efficient and equitable distribution of transport demand throughout the city, it is imperative to develop sub-city centre in different places of the city. The LCMP has proposed the development of sub-city centres at the areas where different transport modes intersect with each other (Figure 5.1-3).

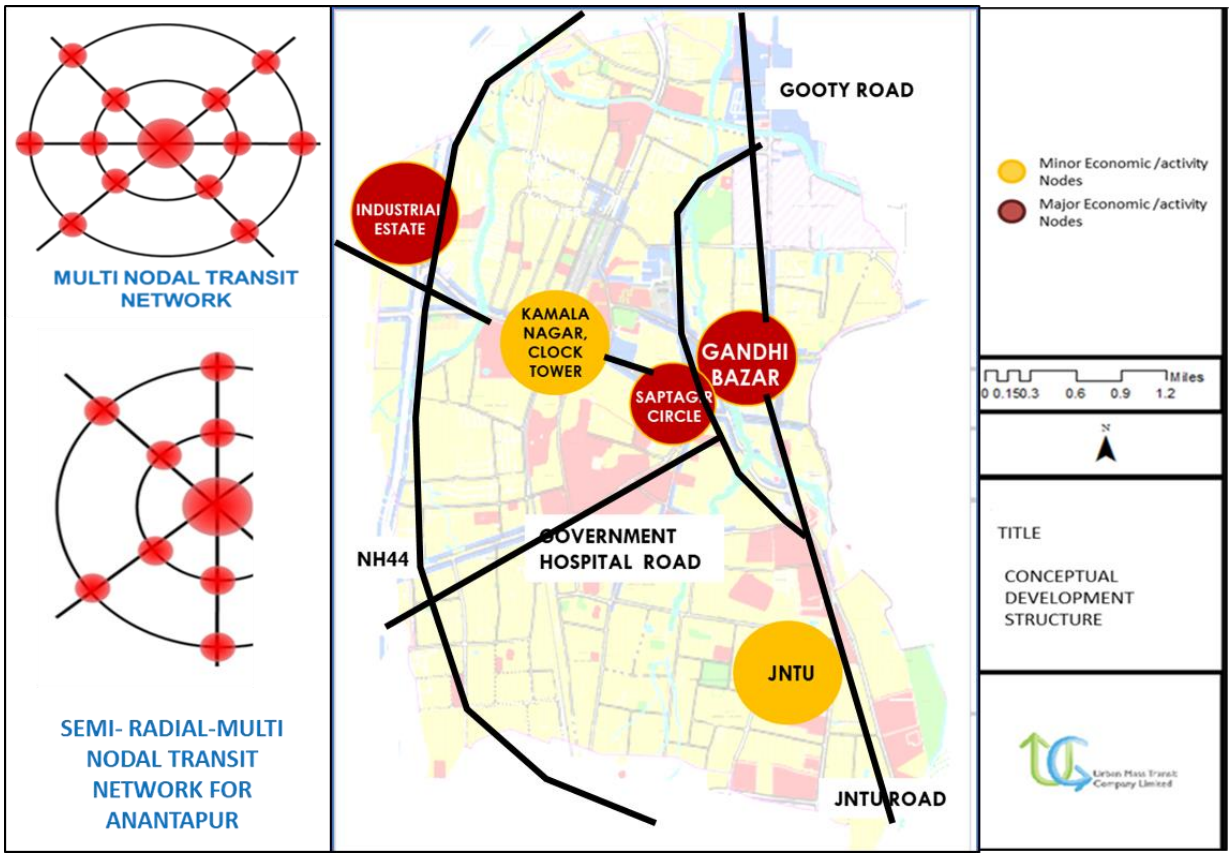


Figure 5.1-3 **MULTI NODAL TRANSIT NETWORK CONCEPT FOR ANANTAPUR**

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

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

Core Area	• Gandhi Bazar, • Saptagiri Circle
Immediate Proximity (Along Inner Ring)	• Kamalanagar- Clock Tower, • JNTU Road, • Government Hospital Area
Medium Proximity (Along Outer Ring Road)	• Industrial Estate

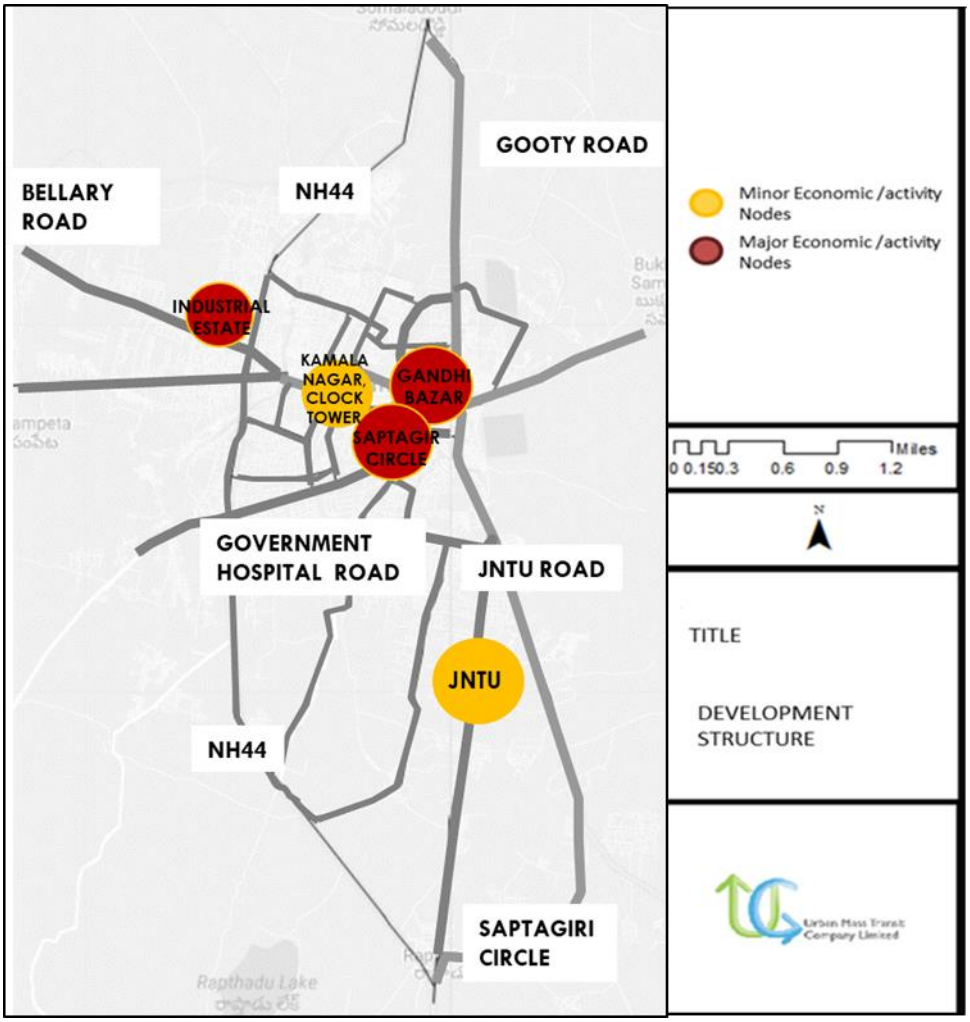


Figure 5.1-4 **ROAD NETWORK DEVELOPMENT VS ECONOMIC NODES IN THE CITY**

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

5.1.2 TRANSIT ORIENTED DEVELOPMENT

The semi ring-radial network is designated as the structure for mobility corridors. To maximize the passenger throughput, these corridors should be developed on the concepts of transit-oriented development. Mixed use development that is cognizant of the low-income users of the transit system is important. It is necessary to create environments where walking and transit are viable transportation options by making it easier to go from one transportation mode to another, the connection between community and development is enhanced ensuring that a community is accessible to all. Resilient neighbourhoods will provide the needs of daily living, within walking distance (1/2 to 1 km radius) as shown in Figure 5.1-5.

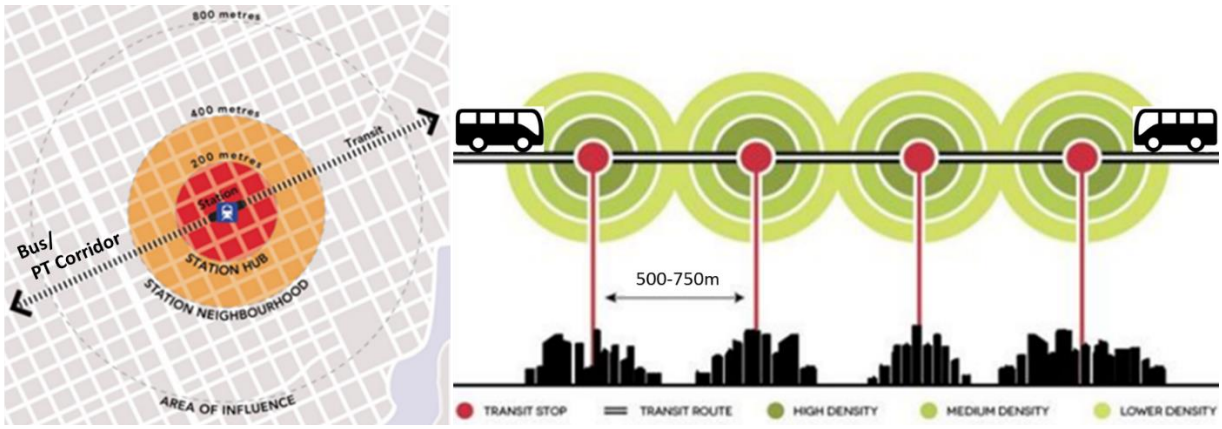


Figure 5.1-5 **CONCEPT OF TRANSIT ORIENTED DEVELOPMENT**[3]

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.

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

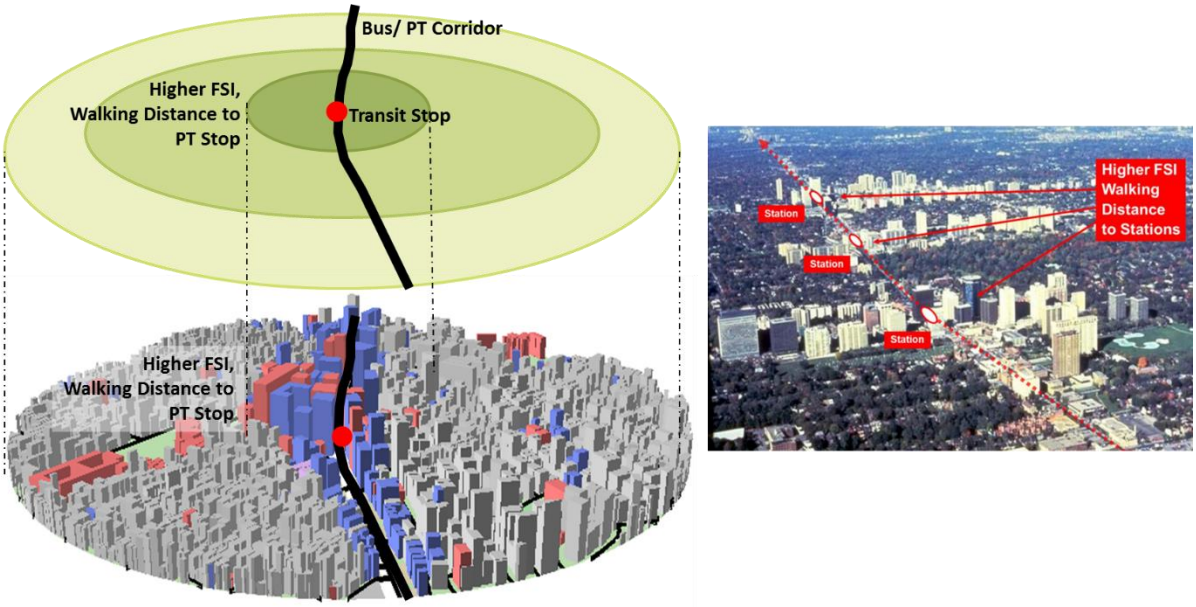


Figure 5.1-6 **BUILDING HEIGHT AND SCALE IN TOD**

As Anantapur is one of the important city in the state has the potential to adopt TOD principles to retain as well as enhance the Non-Motorised Transport (NMT) share and would strength the usage of proposed Public Transport (PT)systems. Following corridors are considered for transit-oriented development (i.e. increase in population density by increasing FSI) and are shown in Figure 5.1-7

1. Subash Road-Bellary Road
2. Government Hospital Road
3. JNTU Road
4. Gooty Road-Old Town Road
5. NH 44

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.

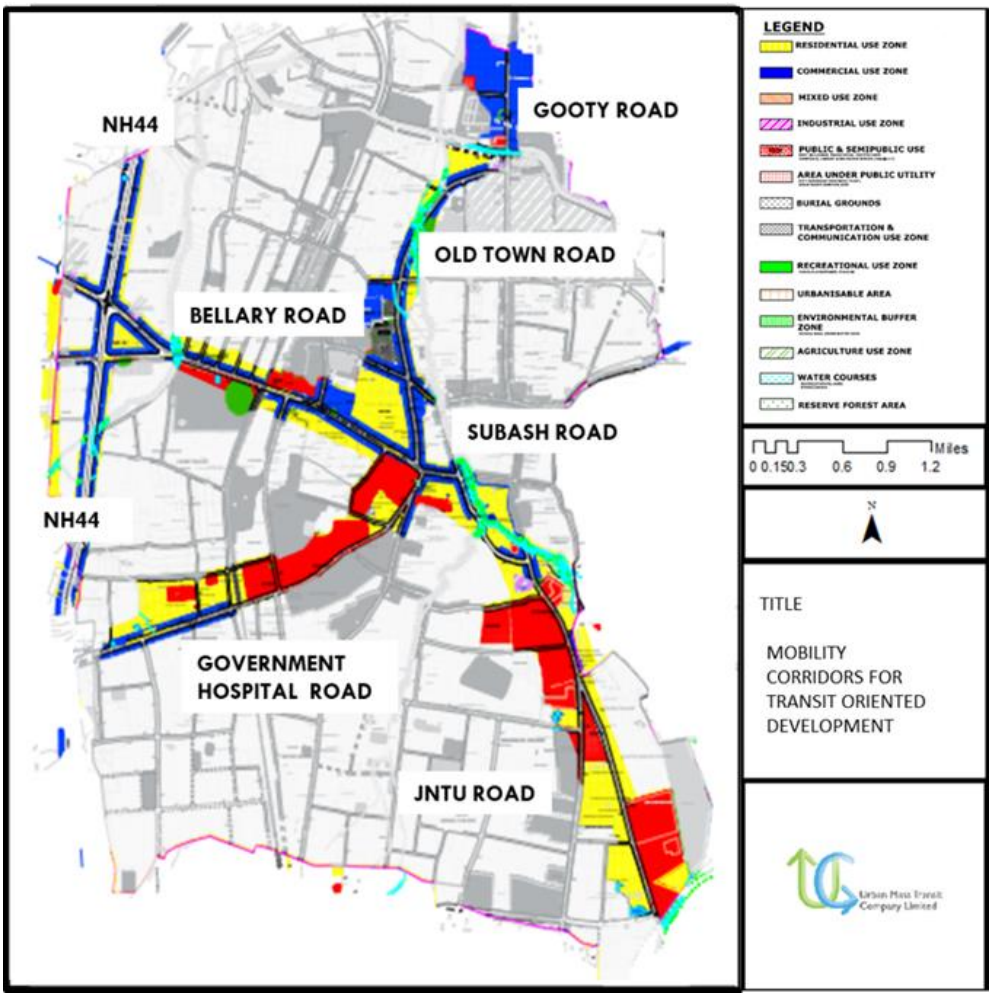


Figure 5.1-7 **MAJOR MOBILITY CORRIDORS FOR TRANSIT ORIENTED DEVELOPMENT**

5.2 PUBLIC TRANSPORT IMPROVEMENT PLAN

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

Public transport strategy includes following action plans:

1. Proposal for transit corridors with NMT access facilities.
2. Rationalization of existing city bus routes.
3. Phased expansion of bus fleet.
4. Creation of adequate infrastructure in the form of depot, terminals, bus queue shelters and signage.

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

At present, sub-urban bus transport is the sole public transport system in operation in Anantapur. APSRTC (Andhra Pradesh State Road Transport Corporation) provides the public transport services. At present, the Anantapur Depot operates sub-urban (Palle Velugu), providing services from Anantapur to nearby towns and cities. Anantapur has no designated city bus services. The sub-urban services provide certain level on intra city connectivity. The major bus stops and stands in Anantapur are:

1) Anantapur Bus Stand
2) Mayur Bus Stop
3) Subash Nagar Bus Stop
4) Clock Tower Bus Stop
5) Old Bus Stand
6) Chowrasta Bus Stop
7) Dharmavaram Bus Stop
8) Housing Board Colony Bus Stop
9) PTC Bus Stop
10) MG Bus Stop
11) Gooty Road Bus Stop
12) RF Road Bus Stop
13) Venkateshwara Theater Bus Stop
14) Neelam Theater Bus Stop
15) Sri Kantam Bus Stop

Figure 5.2-1 MAJOR **BUS STANDS AND BUS STOPS IN ANANTAPUR**

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

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

5.2.1 CITY BUS SYSTEMS

Based on the results of trip interactions obtained from various Origin and Destination (OD) surveys, the prominent trip patterns and trip generators were identified.BFurther the demand on the mobility corridors was assess 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 ANANTAPUR

S.No.	ROAD NAME	BASE (2018)	BAU (2038)	SUT (2038)
1	NH-42	19	19	385
2	NH-44 Rapthadu	876	886	1280
3	SH-82	571	578	835
4	SH-32	895	905	1308
5	SH-30 Tadipratri	1676	1695	2450
6	Govt. Hospital Road	495	501	724
7	Bellary Road-Ananthapur Road	305	308	2094
8	Ramachandranagar Flyover	705	713	1030
9	Govt. Hospital Road	0	0	781
10	Anathapur Tirupathi Highway	1695	1714	2477
11	Subash Road	895	905	1308
12	Gooty Road	209	212	1113
13	Old Town Road	419	424	612

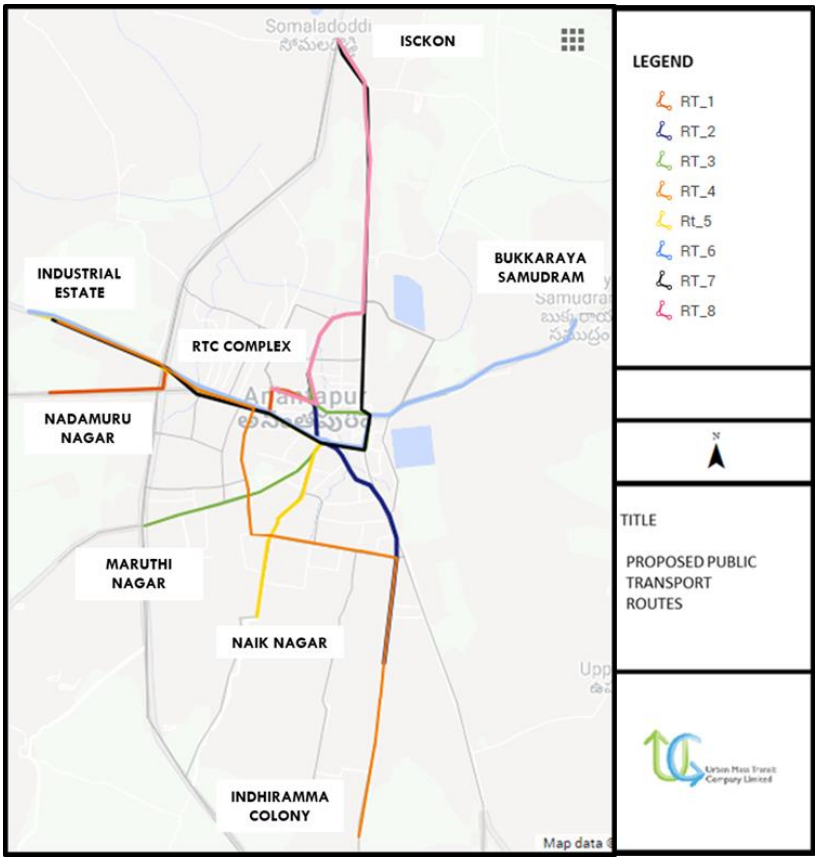


Figure 5.2-2 **PT ROUTES IDENTIFIED FOR ANANTAPUR**

On the basis of the travel patterns, interactions of major trip productions and trip attractions and travel demands a total of 8 potential routes are suggested for operational. A detail study should be carried out for the viability and fleet choice of the system. A fleet of about 121 buses (for 2038) have been estimated for implementation on above routes and their details are listed below. For base year 40 buses with a heady of 15 is proposed for Anantapur.

Table 5.2-2 PROPOSED BUS ROUTES AND FLEET DETAILS FOR HORIZON YEAR 2038

S. No.	Name	Route Length (km)	Proposed Peak Hour Headway (min)-2019	Proposed Fleet (2019)
1	RTC Bus Stand to Nadamurunagar	4.2	15	5
2	RTC Bus Stand to JNTU	4.0	15	5
3	RTC Bus Stand to Maruthinagar	5	15	5
4	Indhiramma Colony to Industrial Estate	10.6	15	5
5	Naiknagar to Industrial Estate	6.7	15	5
6	Industrial Estate to Bukkaraya Samudram	8.9	15	5
7	Industrial Estate to Iskcon Temple	8.9	15	5
	RTC Bus Stand to Iskcon Temple	4.1	15	5
All Routes				40

Source: UMTC Estimates

5.2.2 PUBLIC TRANSPORT TERMINALS

BUS TERMINAL

The main bus terminals in Anantapur are as follows,

1. RTC Complex,

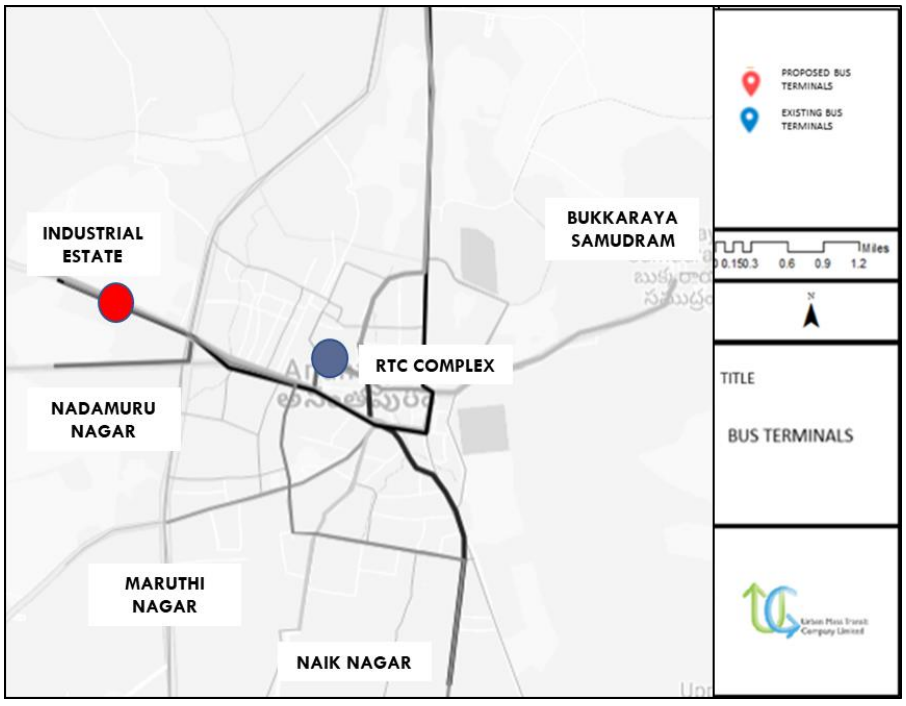


Figure 5.2-3 **EXISTING AND PROPOSED BUS TERMINALS IN ANANTAPUR**

It is proposed to develop the smaller bus Stand and terminate the intercity city bus plying to Anantapur via Rapatadhu to decongest the RTC Complex. An addition to the existing terminals, a new bus terminal is proposed near Industrial Estate. A feasibility study is needed for checking the viability of the project.

RAIL TERMINAL

Anantapur Municipal area has one railway stations namely Anantapur Railway Station. Average daily outflow passengers are presented below (Primary Survey conducted for 16 hours).

Table 5.2-3 DAILY PASSENGERS AT RAIL TERMINALS

S. No.	Code	Name of the Terminal	Daily Passengers
1	TC_1	Railway Station	5392

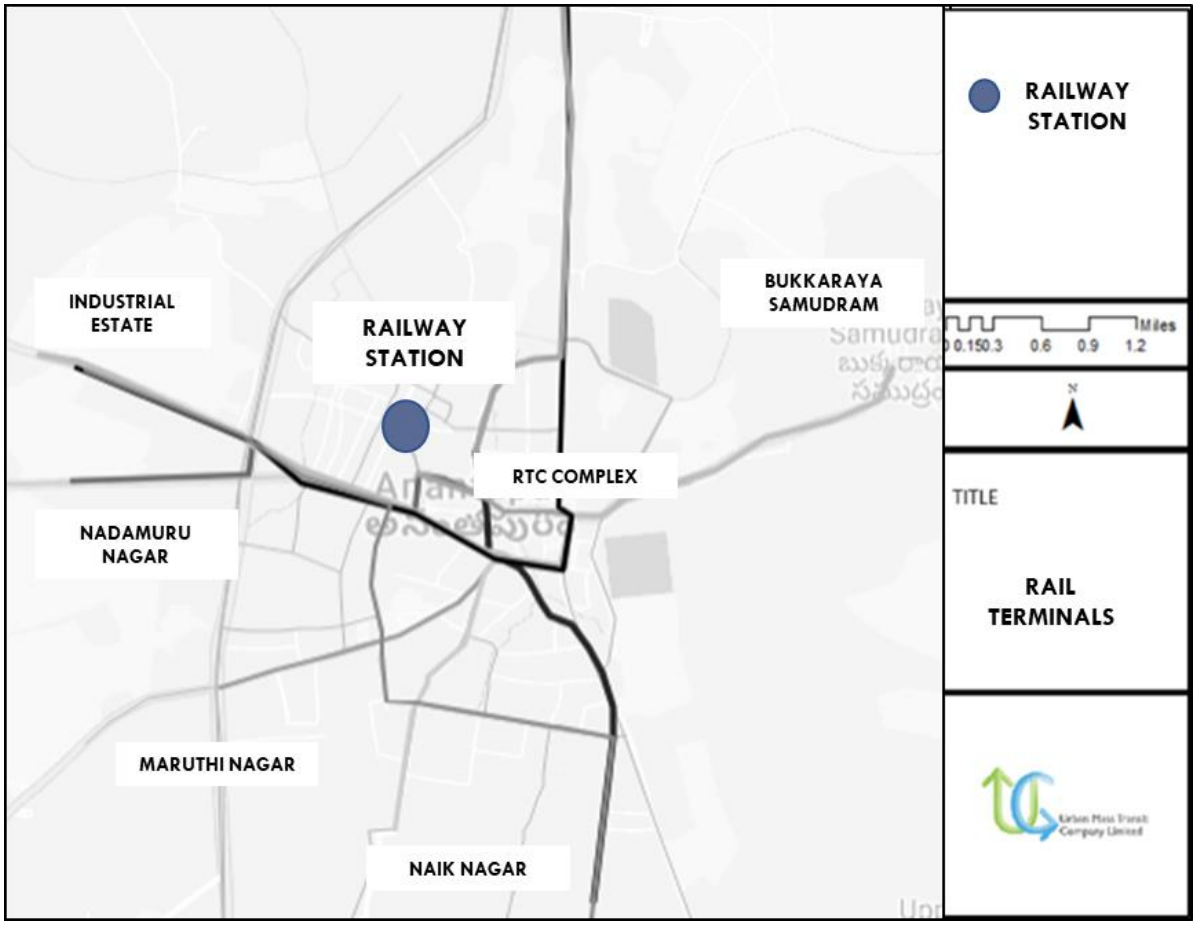


Figure 5.2-4 **EXISTING RAIL TERMINALS IN ANANTAPUR**

From primary surveys, it is observed that about 5392 passengers are using Anantapur railway station in the base year (2018) during 16 hours. Summary of peak hour passenger at Anantapur railway station is shown below.

Table 5.2-4 PORJECTED PEAK HOUR PASSENGERS AT RAIL TERMINALS

S. No.	Name of the Terminal	2018	2028	2038
1	Anantapur Railway Station	5392	7009.	10163

As per Indian Railway Manual-2009, allocated space per passenger for various components in the terminal area at Level of Service 'C' is used for station planning. Based on the forecasted demand, below table provides total required area for passengers using the terminal area. However as per the Master Plan, the total area of Railway Terminus & Allied Activities is sufficient.

5.2.3 INTERMEDIATE PUBLIC TRANSPORT/ FEEDER SYSTEMS

Auto Rickshaw is the major mode of public transportation system in Anantapur. In the absence of city bus services auto rickshaws provide end to end connectivity. Auto-rickshaws and cycle rickshaws can act as efficient feeder services for the proposed public transport systems. Thus, an integrated system will aid ease of access for users. They play a key role in improving sustainability for urban transport. There is a need to introduce new models of regulation and reforms that can be adopted for a more efficient and safer system that enable the rickshaw to have an optimal role in the transport mix.

Due to the restrictive policies, IPT providers largely operate informally

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

Passenger service is also often poor

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

Attempts need to be made to organize IPT

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

Key Challenges

Competition of Auto-Rickshaw Services with Public Transport

Current trends in urban transport highlight the usage of IPT modes (i.e. auto-rickshaws and taxis) in cities for daily commute trips, because of the poor quality of public transport. Thus, improving public transport in cities would be a key strategy in ensuring that auto-rickshaw services fulfil their intended role as feeder services instead of competing with public transport for long-distance trips.

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

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

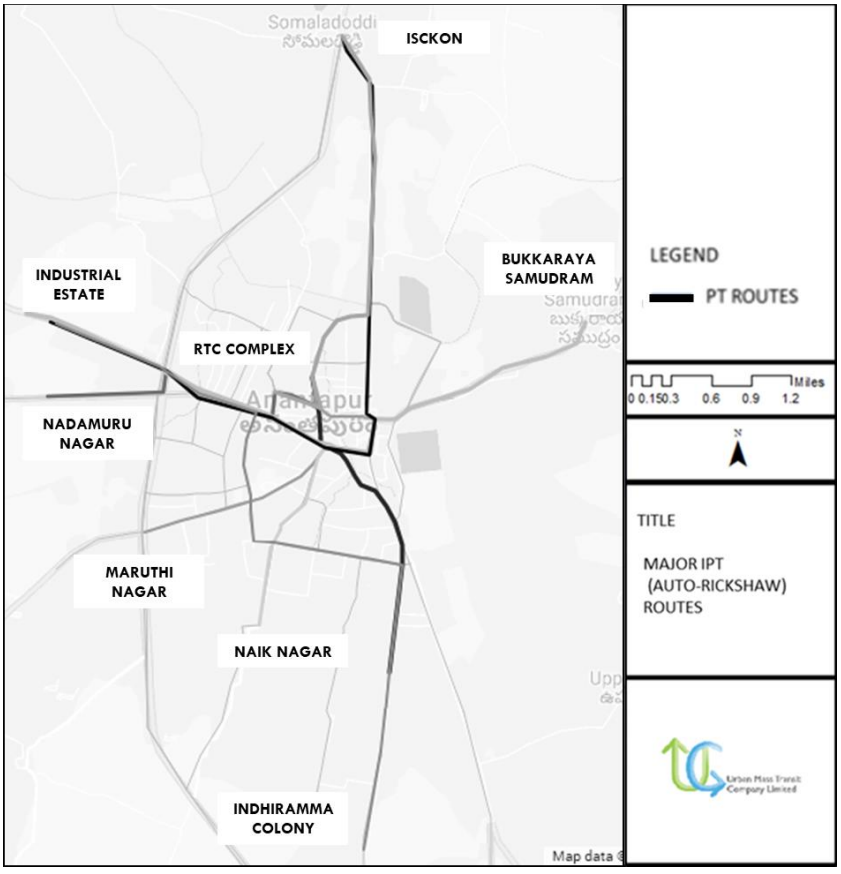


Figure 5.2-5 MAJOR **IPT ROUTES IN ANANTAPUR**

In Anantapur, the major IPT routes are operated along the commercial areas and along the transit stations. Majority of the auto-rickshaws provided end to end connectivity.

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

Auto-Rickshaws or updated E-Rickshaws can be rationalized to provided sustainable mobility solutions in the core city, especially along the Old Town Road and Subhash Road.

Auto-Rickshaws or updated E-Rickshaws can be rationalized to provided sustainable mobility solutions in the core city, especially along the Market Roads, Nehru Road wherein the right of way is below 9m.

The following IPT routes are proposed as major IPT corridors as shown in Figure 5.2-6. These IPT routes which will feed to the major trunk PT corridors. The major PT routes operate on the radials which are the arterial and sub-arterial corridors while IPT major routes form the rings connecting the PT corridors and providing access to area where PT services aren't available. The details of the routes are given in Table 5.2-6.

Table 5.2-5 IPT ROUTE DETAILS

Route No.	ROUTE
1	Narayanpuram Road
2	2nd Road
3	4th Road
4	1st Road- Railway Station Road
5	Gandhi Bazaar Road
6	Court Road
7	PTC Road
8	CVR School Road
9	Housing Board Colony Road
10	Ashok Nagar Main Road
11	E-Seva Road
12	RTC Bus Stand Road

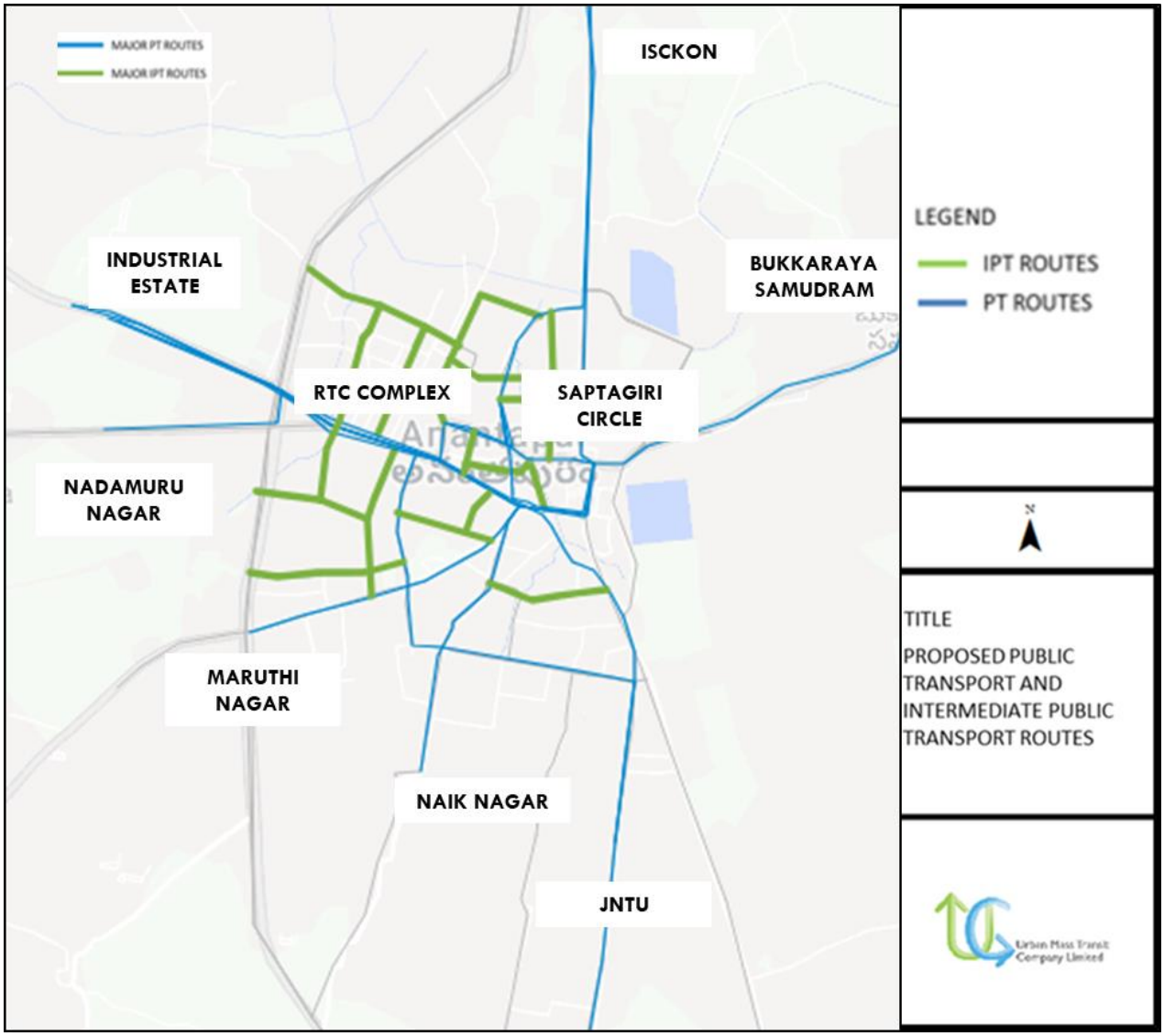


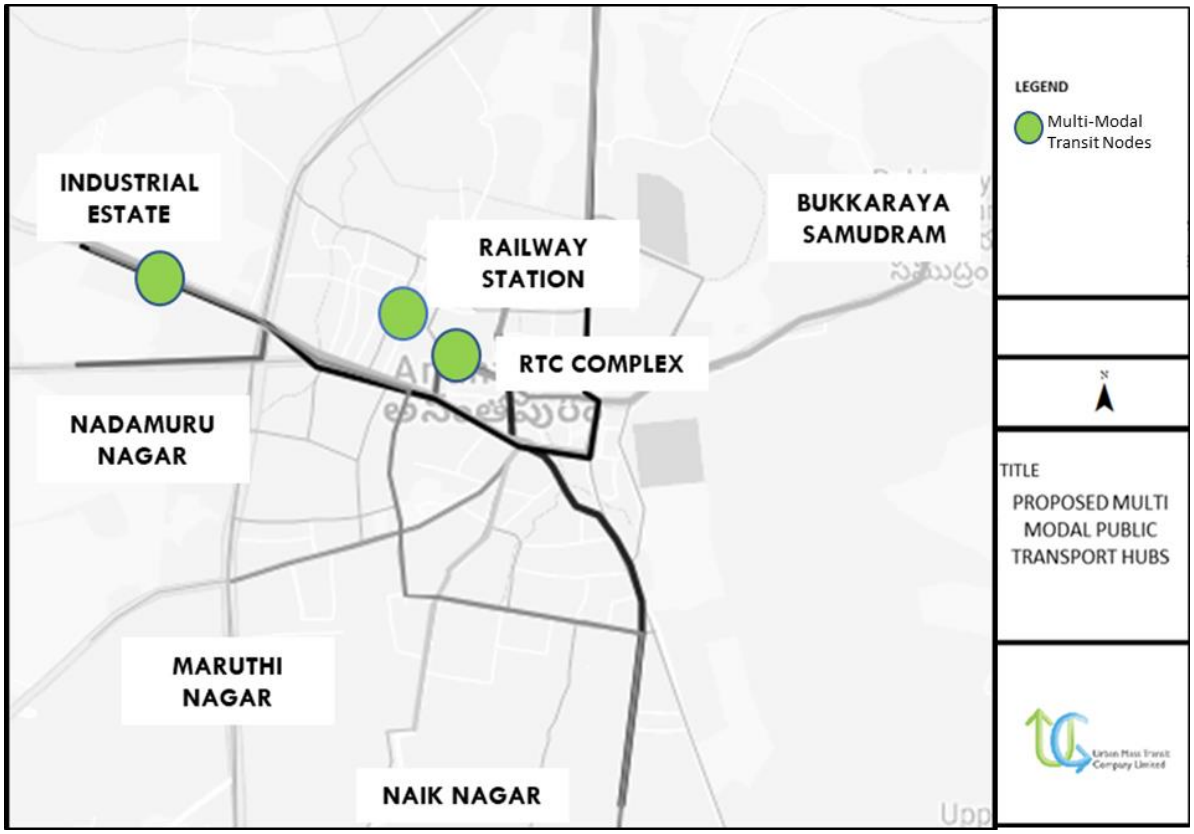
Figure 5.2-6 **PROPOSED IPT ROUTES IN ANANTAPUR**

5.2.4 MULTI-MODAL INTEGRATION PROPOSALS

At the intersection of each mobility corridor/ transit corridor with the major road of the city, a transfer terminal should be facilitated. The transfer terminal is technically called as Transport and Traffic Management Centres (TTMC) or Multi-Modal Transit Hubs. The main objective of these are to provide Urban Transport Infrastructure with several amenities under one roof. Commuters can come from their places in personal vehicles to the public transport mode and make use of all the public amenities provided and return to their destinations. They get all their daily requirements at a single place. This will 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 5.2-7.

Table 5.2-6 MULTI MODAL HUBS

S.NO.	LOCATION	TYPE	INTEGRATION
1	RTC Bus Stand	Major	Bus, IPT, NMT
2	Anathapur Railway Station	Major	Train, Bus, IPT, NMT
4	New Bus Terminnal	Major	Bus, IPT, NMT



5.2.5 PROMOTING PUBLIC TRANSPORT-OUTREACH PROGRAMMES

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

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

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

Following strategies can be adopted for an effective public outreach

1) Create a network of allies and provide platforms for them to actively participate as disseminators of project benefits
2) Use proactive and creative communication media to promote key messages. Communication media can be print, broadcasts, short films, event marketing etc.
3) Programmes can be conducted in schools and colleges advocating the need for public transport. Events like Car Free Day, Happy Streets, Cycle Day can also be promoted.

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

Figure 5.2-7 **CAR FREE DAY AND CYCLE DAY INITIATIVES IN UP AND BANGLORE**[4]

[4] SOURCE: Getty Images and Citizen Matters

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 (River/Canal Bridges and ROBs)

5.3.1 ROAD WIDENING/UPGRADATION

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

- Development of Mobility Corridors

5.3.1.1 Development of Mobility Corridors (Ring and Radial Roads)

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

The streets need to be classified into primary, secondary and tertiary so as to provide uniform standards of road geometry and public transit services. We can consider radial lines as primary transit network served by bus-based PT systems and rings as secondary transit network served by IPT based PT systems. These primary and secondary transit network together constitute the major mobility corridors for the city.

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

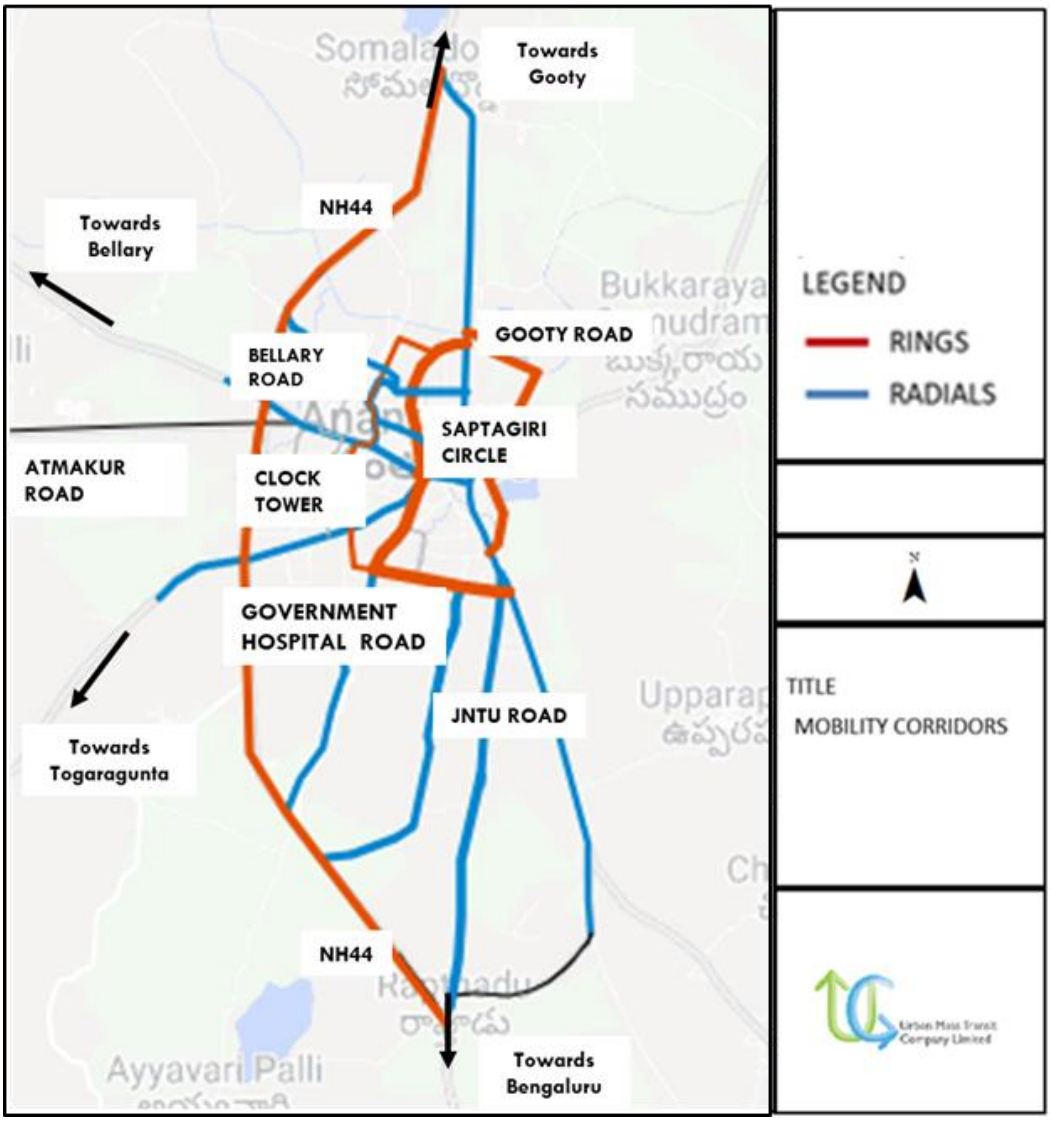


Figure 5.3-1 **MOBILITY CORRIDORS IN ANANTAPUR**

The Radial Corridors are,

1. Bellary Road
2. JNTU Road
3. Gooty Road
4. Government Hospital Road

The rings binding these radials are as follows,

1. Inner Ring Road
    a. Raju Road
    b. Sai Nagar Road
    c. 60 FEET Road
    d. Old Town Road

2. Outer Ring Road
    a. National Highway 44

Since these corridors include all the major spines within Anantapur, they should be designed based on the standards. Anantapur 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 5.3-2 to Figure 5.3-6 shows the indicative cross sections of various ROWs of roads to be followed for mobility corridors and other corridors

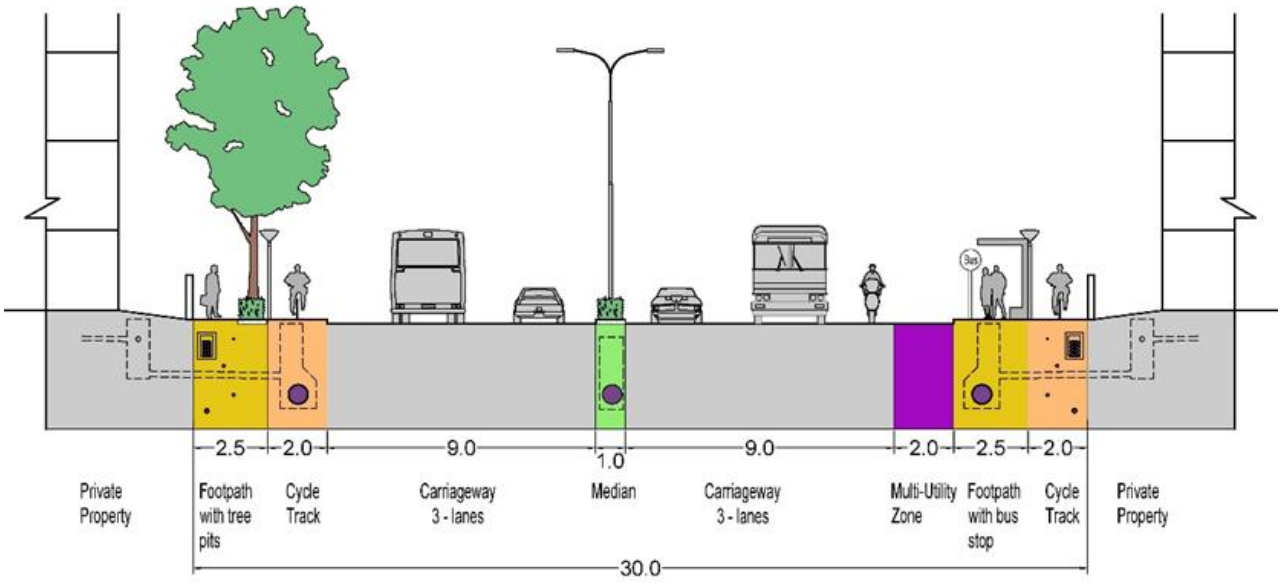


Figure 5.3-2 **TYPICAL SECTION OF 30M WIDE ROAD**

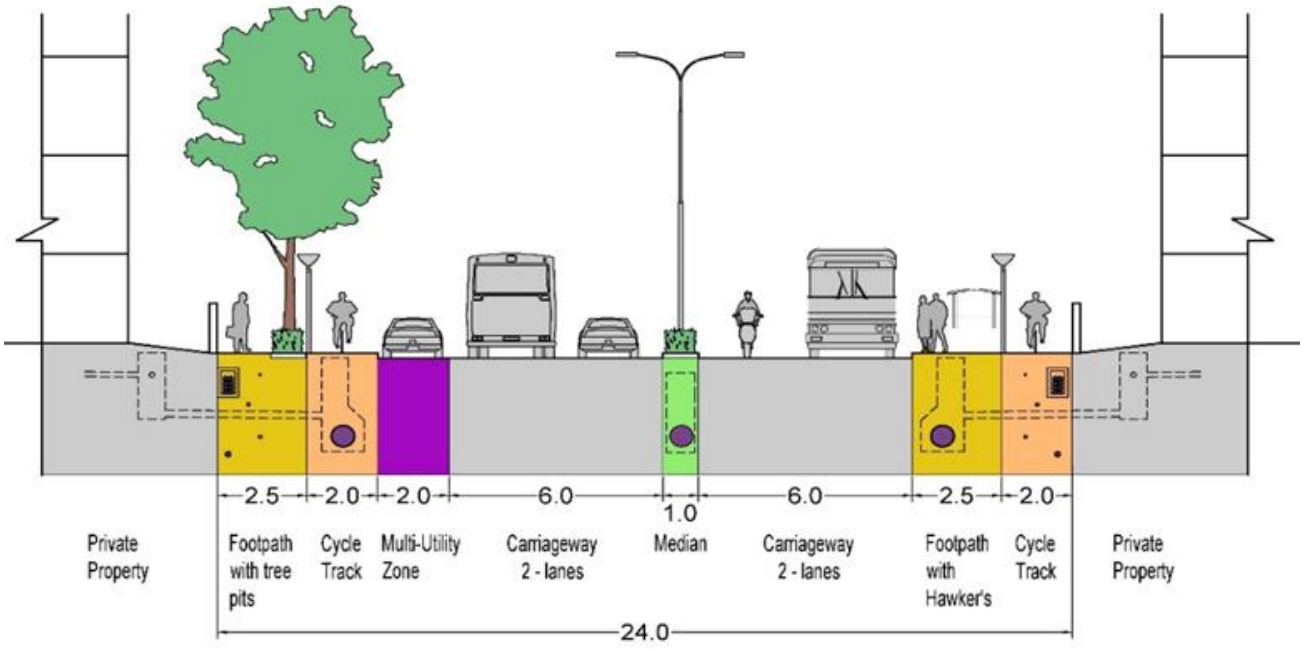


Figure 5.3-3 **TYPICAL SECTION OF 24M WIDE ROAD**

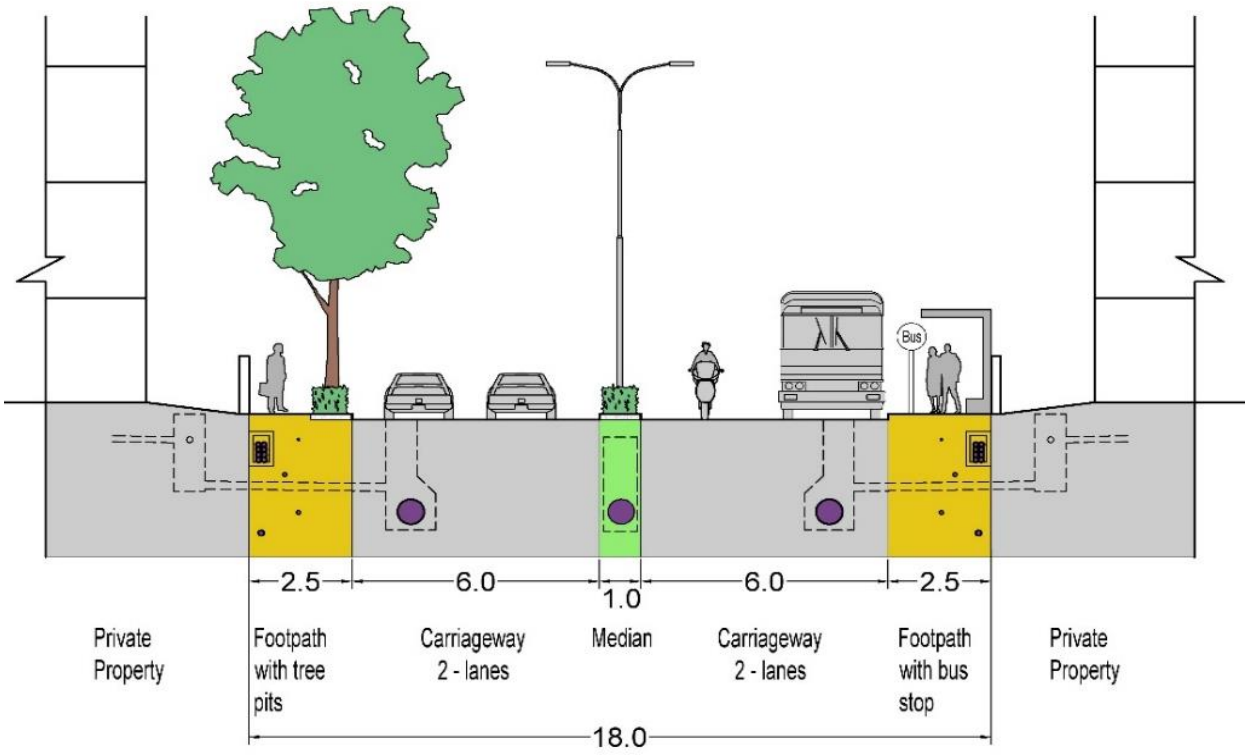


Figure 5.3-4 **TYPICAL SECTION OF 18M WIDE ROAD**

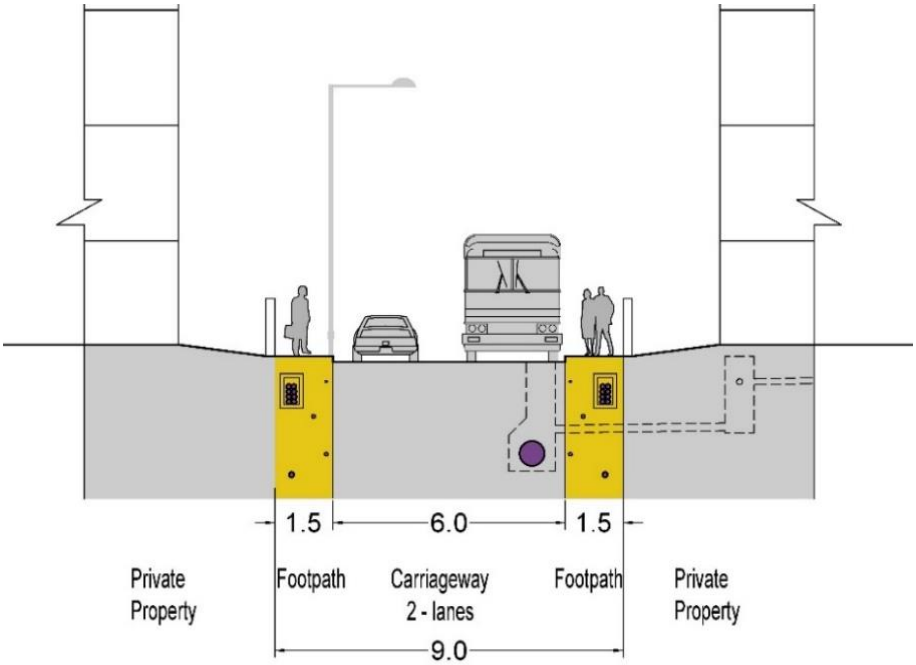


Figure 5.3-5 **TYPICAL SECTION OF 9M WIDE ROAD**

On analysing the existing and future volume by capacity ratio on the major corridors the lane configurations required for the future travel demand has been estimated. Thereby, road widening required for the mobility corridors is presented in Table 5.3-1.

Table 5.3-1 ROAD WIDENING REQURIED FOR MOBILITY CORRIDORS

S.NO	NAME OF THE ROAD	LENGTH (KM)	BASE (2018)	SUT (2038)
1	NH-42	2.1	2	4
2	NH-44 Rapthadu	3	4	6
3	SH-82	3.9	2	4
4	SH-32	4	2	4
5	Govt. Hospital Road	2.7	2	4
6	Bellary Road-Ananthapur Road	0.6	2	4
7	Ramachandranagar Flyover	0.7	2	4

5.3.2 DEVELOPMENT OF MISSING LINKS/NEW LINKS/RING ROADS

. Various missing links have been assessed and identified to establish a clear structure and decongest the radials. The links to developed are as shown in Table and Figure 5.3-7.

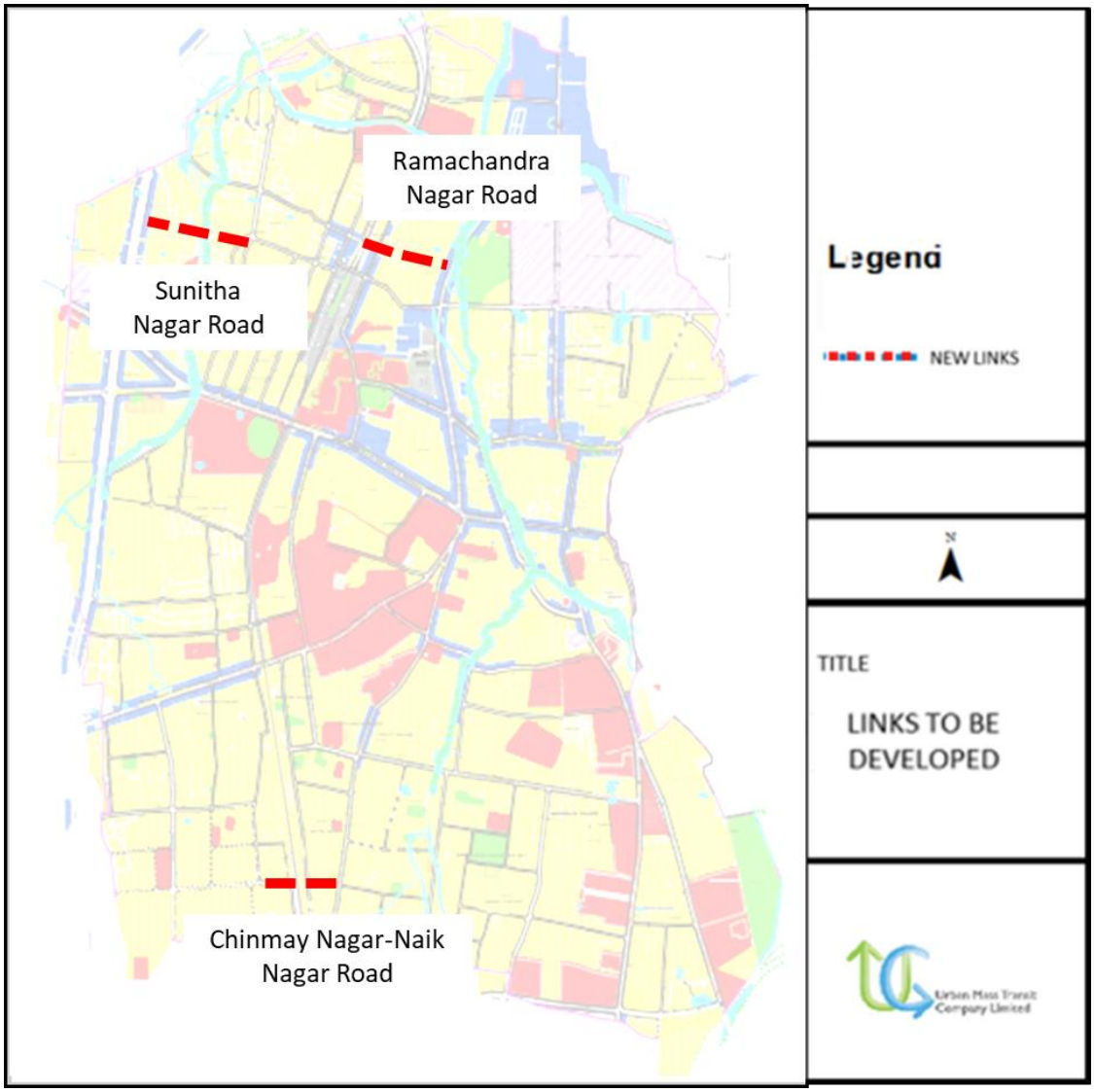


Figure 5.3-6 **INTERNAL NETWORK LINKS TO BE DEVELOPED**

Table 5.3-2 PROPOSED NETWORK LINKS

S. No	Link Information	Length (km)
1	Ramachandra Nagar Road	0.65
2	Sunitha Nagar Road	0.77
3	Chinmay Nagar -Naik Nagar Road	0.47

A feasibility study needs to be carried for fixing the alignment of Proposed ORR such that it directs the growth of the city.

5.3.1 ROAD INFRASTRUCTURE DEVELOPMENT (RIVER/CANAL BRIDGES AND ROBS)

Adequate and properly maintained road infrastructure is always necessary to support smooth flow of passengers. More efficient infrastructure will enable better mobility for people and goods as well as provide better connection between regions.

The study, recognizes that there is a need for ROB widening at Clock Tower and two ROB/RUB near Naik Nagar and Government Hospital-Rudrampeta Road facilitate the better connectivity and ease out the flow. The Figure 5.3-8 shows the proposed bridge location.

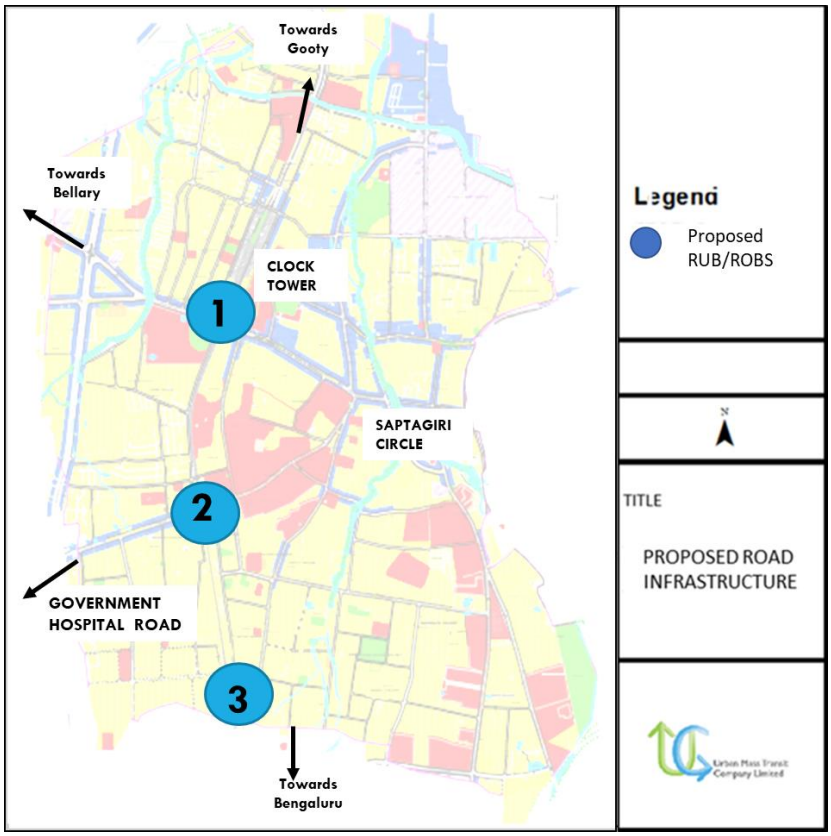


Figure 5.3-7 **PROPOSED ROAD INFRASTRUCTURE LOCATIONS**

5.4 NON-MOTORIZED TRANSPORT (NMT) PLAN

The LCMP envisions an environment where people are encouraged to walk and cycle in Anantapur through equitable allocation of public space and infrastructure; and access to opportunities and mobility for all residents. Anantapur Municipal Corporation (AMC) 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 Anantapur transport system through expanded use of zero pollution modes.
6. A changed culture that accepts the use of cycling and walking as acceptable and aspirational means to move around in the city.
7. Participation of local residents, businesses, and other stakeholders in the preparation of designs and standards in order to foster the community's active use and sense of ownership of these spaces.

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

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

5.4.1 DEVELOPMENT OF FOOTPATHS

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

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

5.4.1.1 Safe Route to Schools (SRTS)

This program aims to make it safe, convenient, and fun for children, to bicycle and walk to school. Many cities worldwide have taken initiative and have implemented such projects to improve the quality of travel for children in their cities. The main components of this strategy are as follows:

a) Identify safe routes connecting the institutions and residential areas.
b) Provide required infrastructure facilities for walking and bicycling.

c) Educate the students, schools and parents to use SRTS.
d) Encourage the schools to be a part of the program by incentivising them through grades, ranks, etc.

Some of the routes identified for the NMT infrastructure improvements are discussed in the later sections.

5.4.1.2 improvement of local streets

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

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

Figure 5.4-1 **IMAGES SHOWING CONCEPTS OF LOCAL STREET DESIGNS**

5.4.1.3 FOOTPATH DEVELOPMENT-NETWORK

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

1. Saptagiri Circle
2. Clock Tower Junction
3. Sri Kantam Circle
4. NTR Circle

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.

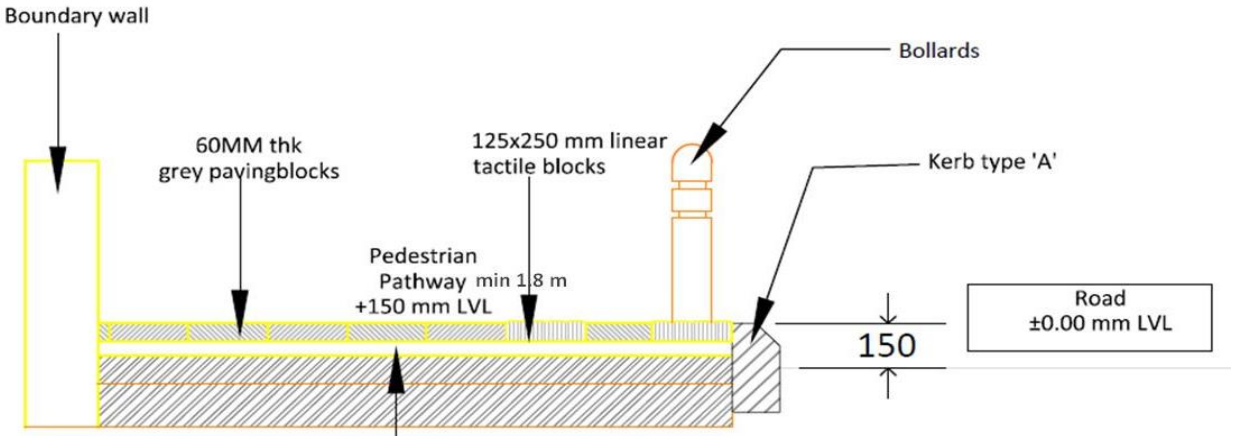


Figure 5.4-2 **DETAILED CROSS SECTION OF FOOTPATH DESIGN**

Accordingly, LCMP has identified about 51.7 km of roads within AMC where the footpaths have to be built immediately or the existing footpath should be reconstructed according to the design standards. The list of footpaths is given in Figure 5.4-4. In addition, local authorities should develop the footpaths in all other streets following the development of footpaths in the priority streets. Similarly, the core area has been identified for rejuvenation where in major spines shall act as NMT and PT only corridors for certain hours of the day (for instance, market hours 10am to 9pm). The corridor identified for NMT and PT only corridors are as shown in Figure 5.4-4. The Figure 5.4-3 depicts examples NMT and PT only streets.

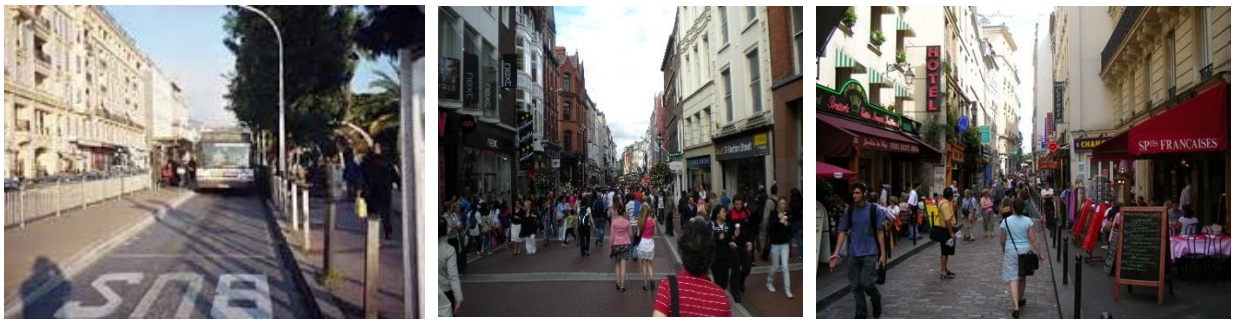


Figure 5.4-3 **EXAMPLES OF NMT ONLY AND NMT AND PT ONLY STREETS**[5]

[5] Source: http://en.qdnd.vn/social-affairs/news/more-pedestrian-only-streets-coming-in-hanoi-482149, https://temporarilylost.com/2011/08/13/landing-in-dublin-ireland/one-of-many-pedestrian-only-streets-in-dublin/

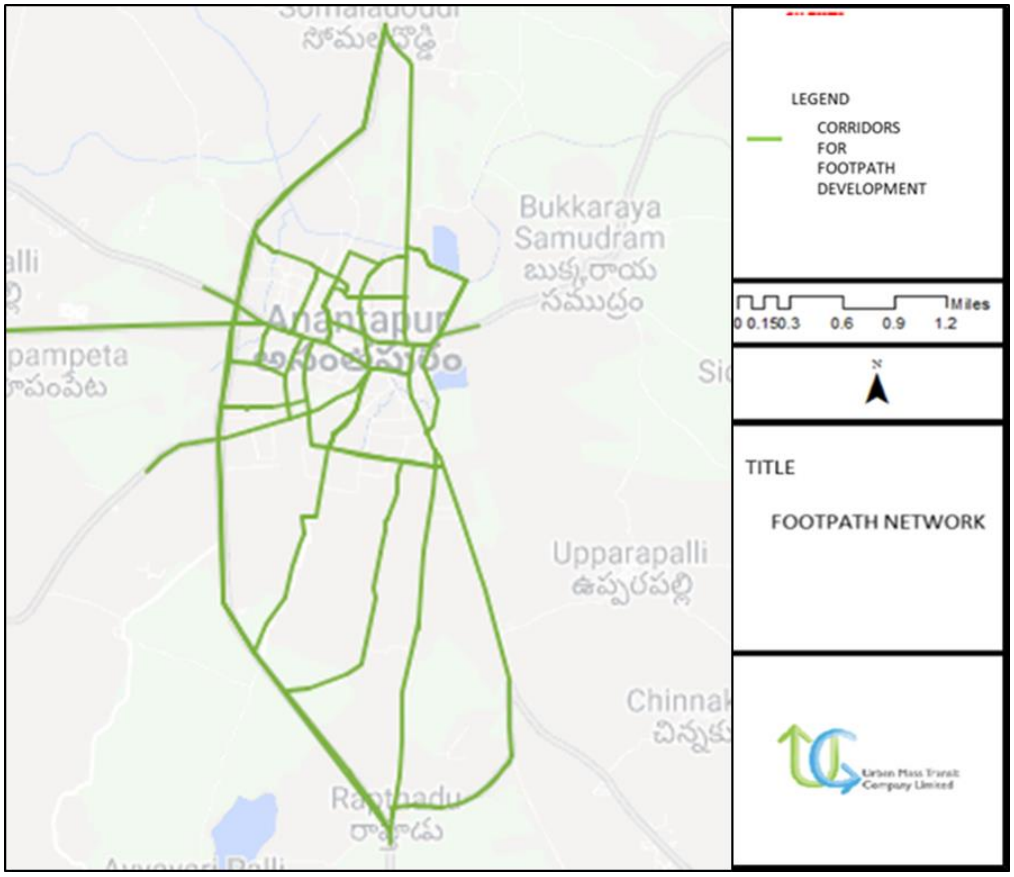


Figure 5.4-4 CORRIDORS FOR FOOTPATH DEVELOPMENT

Table 5.4-1 PROPOSED ROADS FOR FOOTPATH IMPROVEMENTS

S.No	Name	Length (km)
1	Governmnet Hospital Road	3.9
2	Subhash Road	1.4
3	Bellary-Anantapur-Tadipatri Road	5.0
4	Naik Nagar Road	4.5
5	Housing Board Colony Road	1.6
6	BhagyaNagar Road	4.5
7	JNTU road	5.7
8	Anantapur-Bengaluru Road	6.1
9	Housing Board Colony Road	1.6
10	Gooty Road	5.8
11	Neelam Theater Road	1.8
12	Arts College Road	1.6
13	Gandhi Bazar Road	1.8
14	NH 44	6

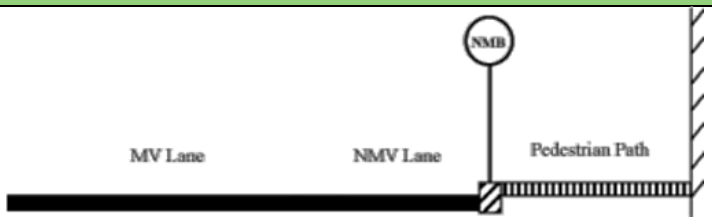
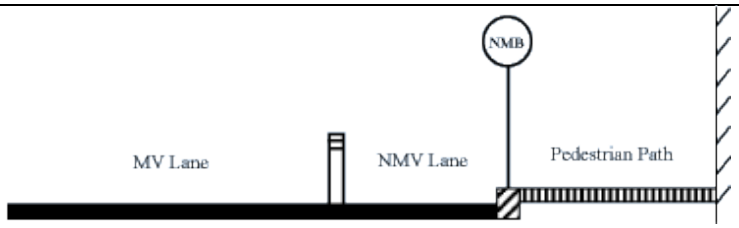
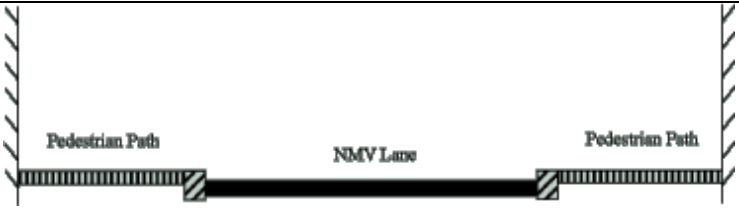
5.4.2 DEVELOPMENT OF CYCLIST-FRIENDLY STREETS

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. Anantapur 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 5.4-3.

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 ANANTAPUR

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 Anantapur.

A total of **25 km dedicated bicycle tracks** along with 26**km of shared NMT routes** are proposed in the plan connecting important activity centres and trip attractors and are shown in Figure 5.4-5. Anantapur needs to improve the infrastructure to create a safe environment for its cyclists.

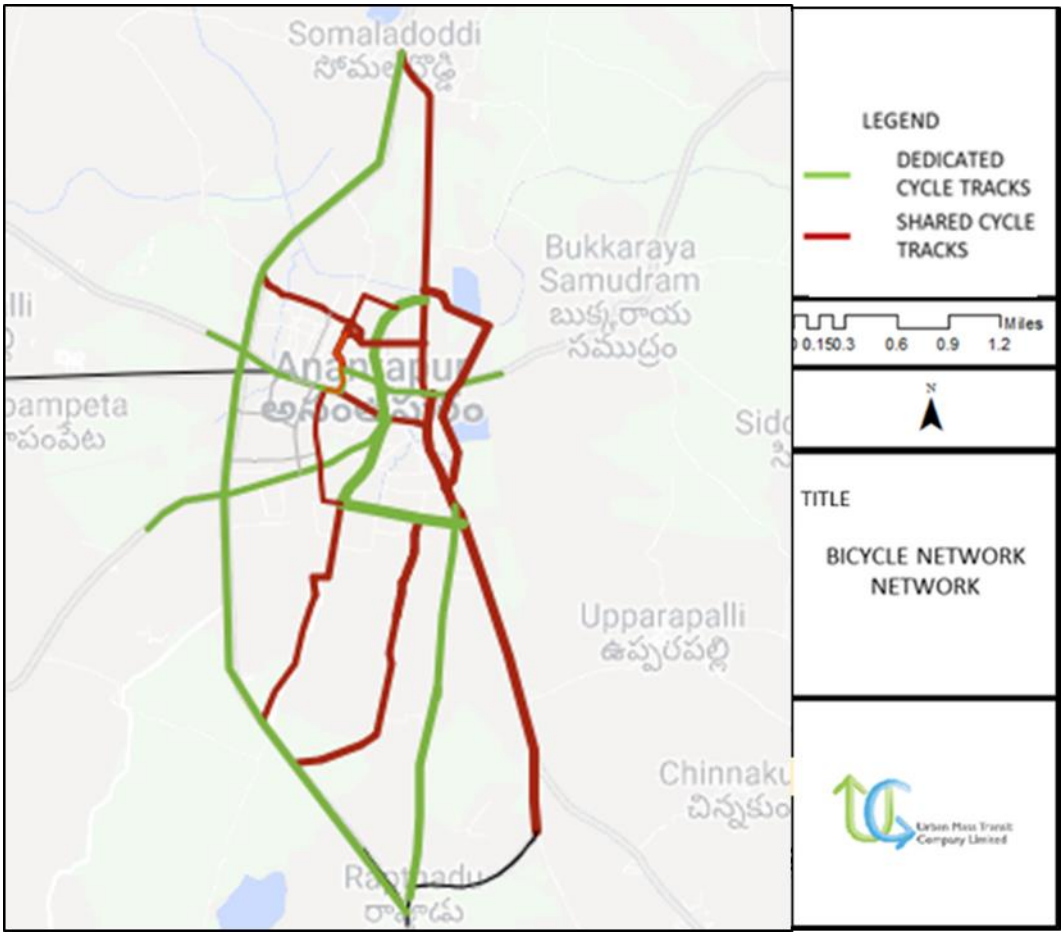


Figure 5.4-5 CORRIDORS FOR NMV INFTASTRUCTURE DEVELOPMENT

Table 5.4-1 presents list of proposed dedicated bicycle lanes and allied infrastructure.

Table 5.4-3 PROPOSED ROADS FOR NMV INFRASTRUCTURE IMPROVEMENTS

S.No	Stretch	Length (km)
CORRIDORS WITH DEDICATED LANES		
1	NH 44	6
2	JNTU road	5.7
3	Housing Board Colony Road	1.6
4	Old Town	3.6
5	Bellary-Anantapur-Tadipatri Road	5.0

S.No	Stretch	Length (km)
6	Governmnet Hospital Road	3.9
CORRIDORS WITH SHARED BICYCLE LANES		
9	Subhash Road	1.4
10	NaiK Nagar Road	3.5
11	BhagyaNagar Road	4.5
12	Anantapur-Bengaluru Road	6.1
13	Gooty Road	5.8
14	Neelam Theater Road	1.8
15	Arts College Road	1.6
16	Gandhi Bazar Road	1.8

5.5 FREIGHT MANAGEMENT PLAN

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

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

5.5.1 FREIGHT POLICY

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

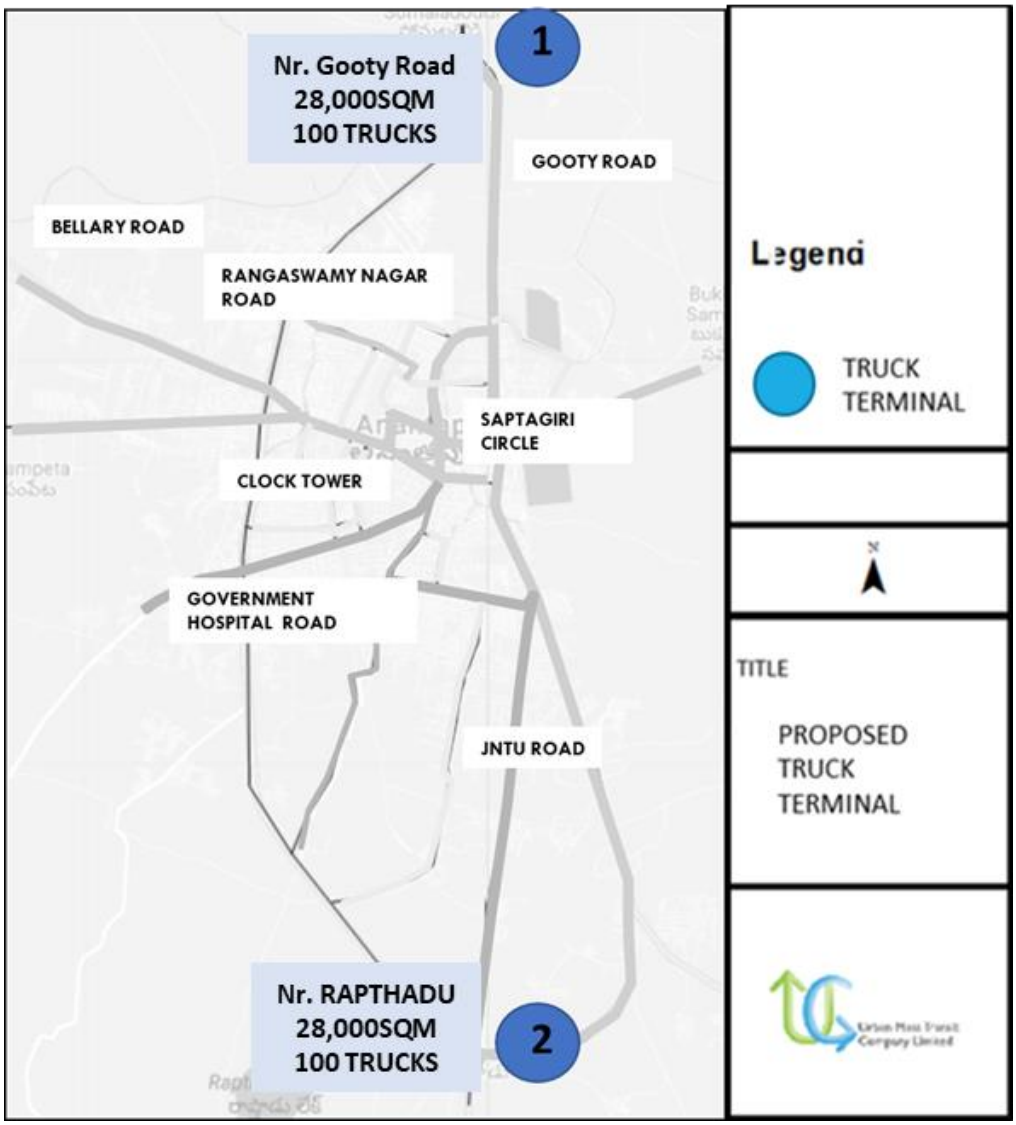


Figure 5.5-1 **PROPOSED TRUCK TERMINALS FOR ANANTAPUR**

Anantapur observes high freight movement due to its proximity to Hyderabad, Bengaluru and Bellary. High volumes of freight movement are observed along the Hyderabad-Bengaluru Highway and Tadipatri-Bellary Road. To reduce the conflict with city traffic and decrease the congestion during peak hours, freight traffic should be restricted in the city. The freight traffic should not be allowed in the city between 8am to 8pm, stopping most of carries outside city boundaries.

The LCMP identifies, two new truck terminal near Rapthadu and along Gooty Road based on goods traffic demand and are shown in Figure 5.5-1. The freight terminals are proposed along the National Highways so that the heavy vehicles coming to the city for loading and unloading could be parked during day time and if necessary smaller commercial vehicles could help for transition of the goods.

5.6 TRAFFIC ENGINEERING AND MANAGEMENT MEASURES

Traffic engineering aims at achieving safe and efficient movement of people and goods on roadways. It focusses on road geometry, sidewalks, crosswalks, cycling infrastructure, traffic signs, road surface markings, traffic signals etc. Traffic management includes various strategies adopted to efficiently manage the movement of vehicles like one-way systems, no parking zones, etc.

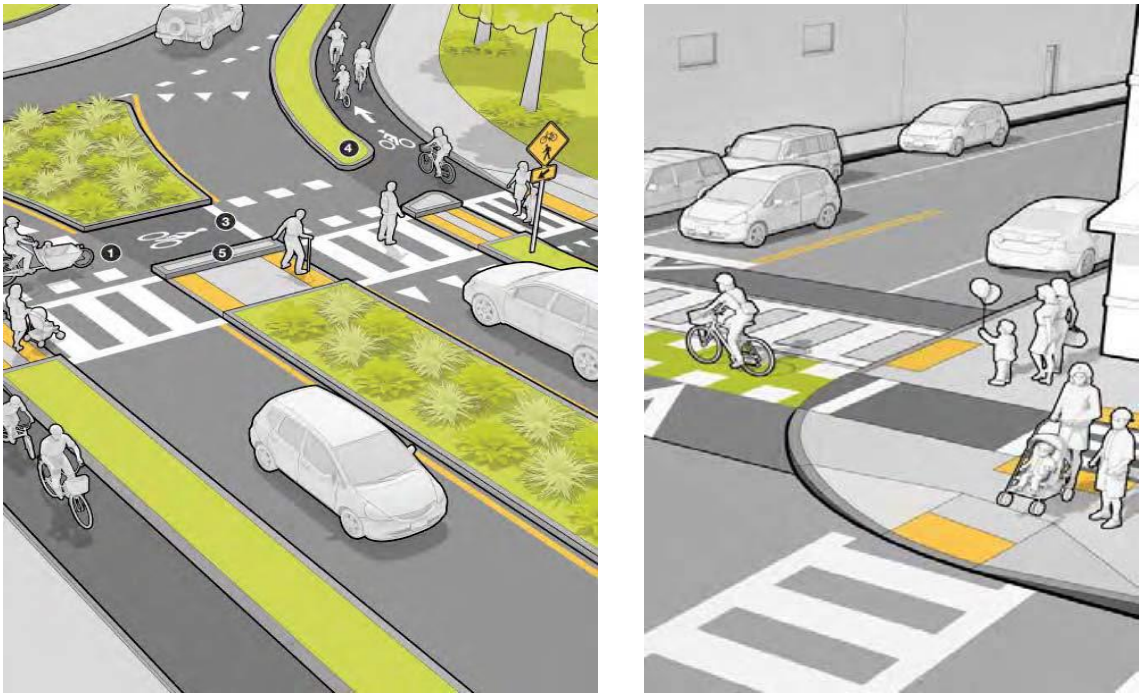


Figure 5.5-2 **DESIGN CONCEPTS AS PART OF TRAFFIC ENGINEERING MEASURES**[6]

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

These measures generally qualify as short-term measures for bringing in immediate relief from traffic problems. A combination of several measures can prove to be effective mean of problem solving. These measures are not very capital intensive and give instant results.

5.6.1 JUNCTION IMPROVEMENTS

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

- Closure of medians at certain intersections, while providing well designated mid-block crossings for pedestrians.
- Prohibition of free right turns
- Provision of adequate sight distance
- Providing adequate corner radii
- Providing sufficient turning radii
- Flaring approaches towards intersections
- Providing channelizers/division islands
- Providing pedestrian and cyclist crossing facilities such as zebra crossings, pelican signals, refuse islands etc.
- Bus stops near junctions to be re-located
- Providing signs/lane-markings/lighting

Typical junction improvement measures are shown in

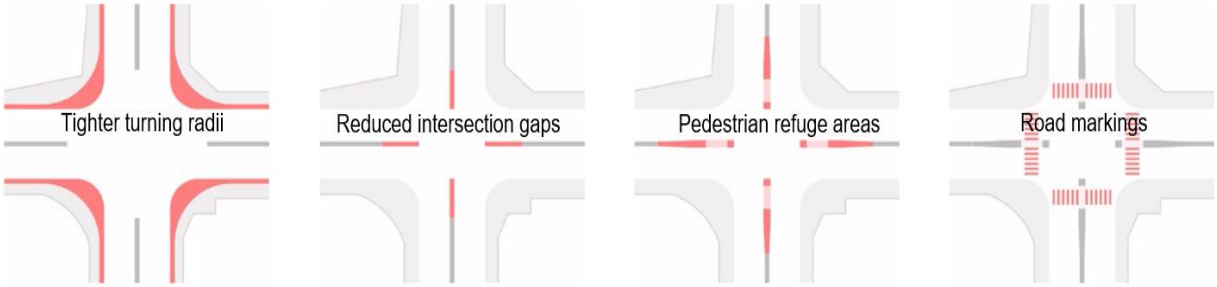


Figure 5.5-3 **TYPICAL JUNCTION IMPROVEMENT MEASURES**

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 5.6-1 and are shown in Figure 5.6-3.

Table 5.5-1 JUNCTIONS IDENTIFIED FOR GEOMETRIC CORRECTIONS

S.no.	Name of the Junction
1	Sapthagiri Circle
2	Clock Tower Junction
3	Departmental Bus Stop Junction
4	Galam Street Junction
5	Sri Kantam Circle
6	NTR Circle
7	Bellary-Chow Rasta Junction

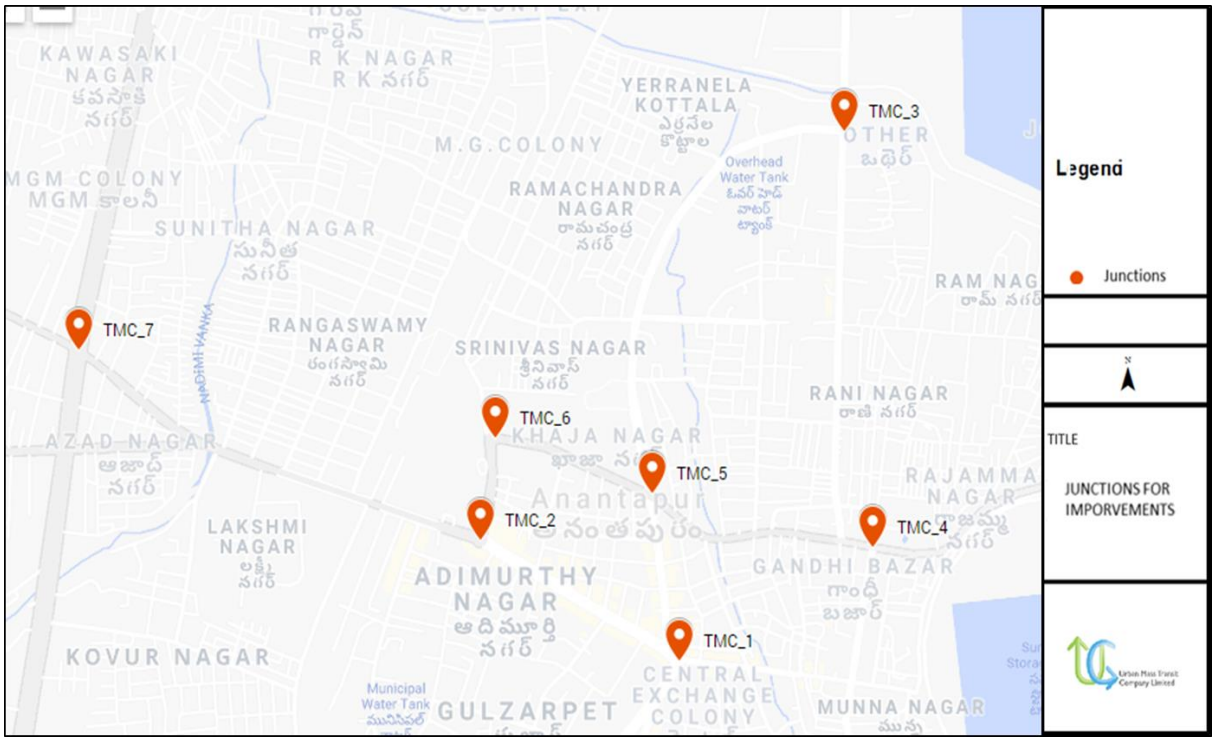


Figure 5.5-4 **JUNCTIONS FOR IMPROVEMENT**

Traffic signals are necessary for safe movement of traffic at a junction. IRC 93:1985 provides the guidelines on designs and installation of road traffic signals. The IRC 93 suggests 5 warrants for the installation of signals at any junction. Traffic control signals should not be installed, unless one or more of the signal warrants specified herein are met. Information should be obtained by means of traffic and engineering studies and compared with the requirements set forth in the warrants. If these requirements are not met, a traffic signal should not be put into operation.

The need for signals at surveyed junctions in the city was checked through Warrants given in IRC 93:1985. All the survey junctions qualified for signal installation. The following are the locations for which installation of signals is proposed. These junctions, either do not have a signal or have signals which do not function. List of junctions proposed for signalization are presented below,

1. Sapthagiri Circle
2. Clock Tower Junction
3. Sri Kantam Junction
4. Galam Street Junction

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

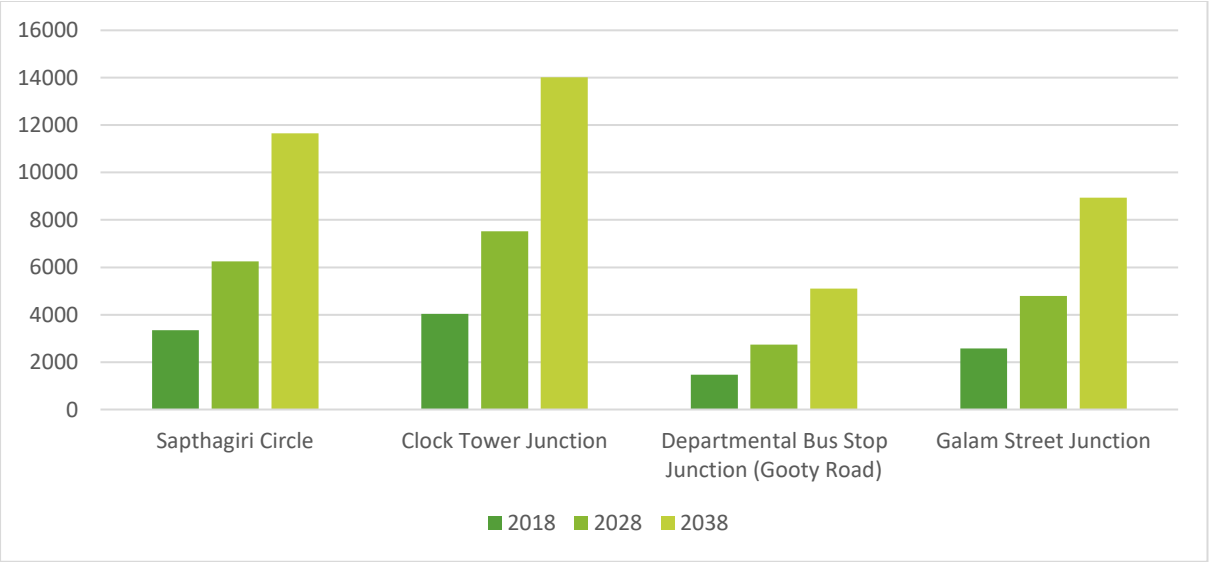


Figure 5.5-5 **ESTIMATED TRAFFIC AT JUNCTIONS**

Hence improvements to these junctions need to be considered for signalization/ roundabouts or grade separators. The type of junction has to be suited to the road type, the environment and capacity, in order to maintain good readability both of the road and of the junction, as well as a satisfactory level of safety. According to the above, for example, junctions or roundabouts should not be used on motorways, and signalized junctions need not to be used on rural roads, except in very special cases. The following shows guidelines for the selection of junction type according to traffic flows.

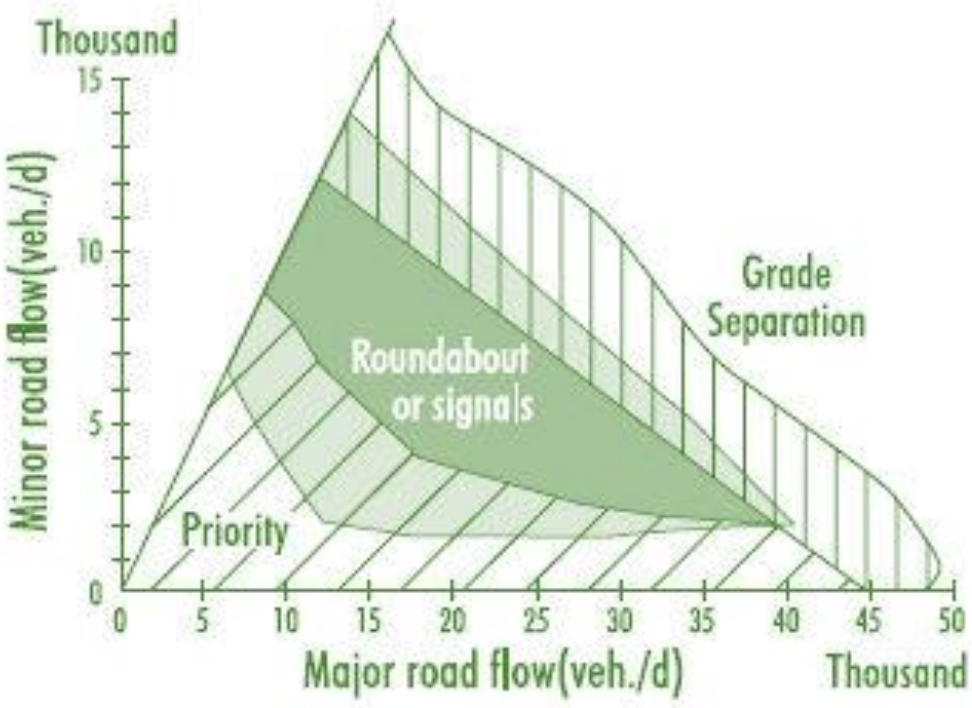


Figure 5.5-6 **JUNCTION TYPOLOGY BASED ON TRAFFIC FLOWS (IHT)**

However, 1 junction has been identified for grade separation which is the Clock Tower Junction.

Table 5.5-2 LIST OF JUNCTIONS WITH TYPE OF IMPROVEMENT

Code	Junction Name	2018	2028	2038
TMC_1	Sapthagiri Circle	Signal	Signal	Signal
TMC_2	Clock Tower Junction	Signal	GS	GS
TMC_3	Departmental Bus Stop Junction (Gooty Road)	Rotary	Signal	Signal
TMC_4	Galam Street Junction	Signal	Signal	Signal

It was observed that most of the locations have $PV^2/(2*10^8)$ values higher than 2, this indicates a considerable need to improve the pedestrian crossing facilities. Based on the PV^2 value and ROW constraints, pedestrian proposals were made at important junctions in Table 5.6-3.

Table 5.5-3 LIST OF JUNCTIONS WITH TYPE OF PEDESTRIAN CROSSING IMPROVEMENTS

CODE	LOCATION	PV Square/10^8 Value	Intervention
TMC_1	Sapthagiri Circle	2.9	Signalized Control
TMC_3	Clock Tower Junction	2.6	Signalized Control
TMC_4	Departmental Bus Stop Junction	0.45	Zebra Crossing
TMC_5	Galam Street Junction	1.8	Zebra Crossing

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

5.6.2 TRAFFIC MANAGEMENT PLANS

Following are the general Traffic management measures.

- Proper sign boards should be provided at important junctions, arterial/sub arterial roads, entry/exit points of market areas, cordon points, accident prone locations, school/college zones and other commercial areas.
- Zebra crossings, Lane Markings and Stop lines should be marked on all arterials and sub arterial roads.
- Pedestrian crossings should be provided at mid-blocks near school/college zones and major commercial areas. Pelican signals should be installed at such places. An exclusive pedestrian phase should be provided for safe pedestrian crossing with a cycle time no less than 15sec and designed as per IRC..
- Pedestrian refuge islands should be provided at wider junctions.
- Parking should be restricted at least 50-100m near to the junction on all the approach roads.
- Hawkers and Vendors should be restricted at least 50-100m near to the junction on all the approach roads and from using footpaths.
- Bus stop and Auto/Taxi stand has to be shifted 50-100m away from junctions
- Commercial vehicles (except Goods Auto) should not be allowed during peak periods inside the city which should be stopped at all Outer Cordons.
- Before implementation of Traffic Management Schemes, traffic awareness programmes shall be organized.

5.6.2.1 CORE AREA: GANDHI BAZAAR AREA

Gandhi Bazaar area is one of the oldest and is the core area of the city. It is the most important commercial centre and traffic attracting area with considerably high footfalls. The area consists of gold shops, retail textiles, electronics, etc. The major spines of the area are the Srikantam-Old Post Office Road, Galam Street and Gooty Road.

1.6.2.1.1 ISSUES IDENTIFICATION

- Like typical core areas, Main Bazaar Area also has narrow roads with right of way below 15m. Majority of these roads are having ROW of 7m while attracting intense volume of traffic especial two wheelers and auto rickshaws due to the commercial nature of the area.
- The higher traffic volumes coupled with chaotic parking generate pedestrian safety issues.
- The chaotic drop-off and pick-up along the Srikantam-Old Post Office Road and Galam Street hinder the traffic flow. This adds to the congestion in the area and requires immediate attention.
- The area sees the heavy pedestrian traffic yet no pedestrian facilities are provided. Pedestrian flow is often conflicted by the vehicular movement.
- On Street parking is observed predominantly along the Srikantam-Old Post Office Road and Galam Street. Owing to increasing obstructions in accessing the commercial establishments and hindering the pedestrian movement.

1.6.2.1.2 PROPOSED INTERVENTIONS AND IMPROVEMENTS

- Corresponding to Non-Motorised Transport and Intermediate Public Transport Strategy wherein the private modes entry to the certain stretches especially along the Galam Street are Proposed to be restricted during the peak hours that is 11am to 7pm.
- Off Street parking locations identified in the section 5.6.3. along the periphery of the old city shall facilitate the parking needs of this core area.
- On Street Parking along the major corridors especially Srikantam-Old Post Office Road and Galam Street needs to be prohibited during the restricted hours.
- E-Rickshaws are proposed to be provided internal connectivity during the restricted hours.
- Main transit streets shall be paved with paver blocks from property line (commercial frontage) to the carriage way.

- The carriage way can vary between 6.6m and 7m as the major movement shall be carried out by smaller vehicles such as e-rickshaws and cycles during restricted house and two-wheelers, e-rickshaws, cycles and cars during unrestricted hours.
- For safer crossing of pedestrians should be designed as a part of old city rejuvenation.
- Goods movement in the old city is majorly in form of LCVs, hand carts, cycle rickshaws carts. The movement into the old city shall be allowed between 9pm to 8am.

5.6.3 PARKING PROPOSALS

5.6.3.1 OFF-STREET PARKING RECOMMENDATIONS

Based on the survey analysis and on ground conditions the following are the identified off-street parking locations.

1 APSRTC Bus stand Parking Area

2 Railway Station Parking Area

3 Raja Ramana Parking Lot

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

List of off-street parking locations with number of proposed slots is given in Table 5.6-4.

Table 5.5-4 OFF-STREET PARKING- LOCATION WISE RECOMMENDATIONS

No	Location	Area (m^2)	ECS (Proposed)	TYPE
1	APSRTC Bus stand Parking Area	1750	70	Surface
2	Railway Station Parking Area	750	30	MLCP
3	Raja Ramana Parking Lot	1350	50	Surface

Source: UMTC Estimates

The off-street parking spaces are proposed at public spaces and along the periphery of the old city in order to facilitate parking facilities to support the old city traffic management proposal as discussed in Section 5.6.2.1.

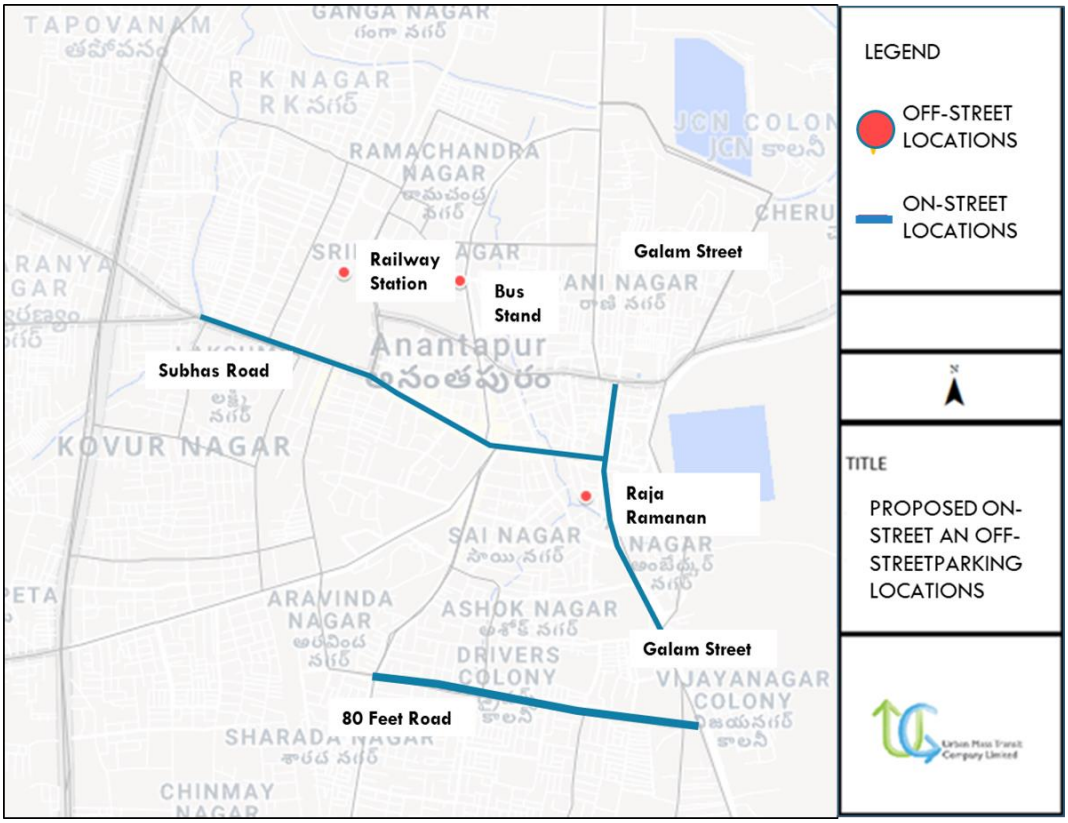


Figure 5.5-7 **PROPOSED OFF-STREET & ON-STREET PARKING LOCATIONS, ANANTAPUR**

5.6.3.2 ON-STREET PARKING RECOMMENDATIONS

For on-street parking, it is recommended to increase the capacity of existing facilities by using currently wasted areas (corners, edges, undeveloped land, etc.). Also, in the case of off-street parking being present in the vicinity, steps should be taken to ensure the effective usage of the off-street facility by imposing No-Parking zones around the facility. The off-street parking shall be considered while designing and reallocating the road spaces at following locations and the required is as shown in the Table 5.6-5.

Table 5.5-5 ON-STREET PARKING- LOCATION WISE RECOMMENDATIONS

No	Location	Length (m)	Type	Civil Works
1	Subash Road	1000	30 Degree Angular	Sign Boards, Thermoplastic Paints, QR Post
2	Galam Street	750	30 Degree Angular	Sign Boards, Thermoplastic Paints, QR Post
3	80 Feet Road	500	30 Degree Angular	Sign Boards, Thermoplastic Paints, QR Post

Source: UMTC Estimates

5.6.3.3 PROPOSED PAYMENT COLLECTION METHOD FOR PARKING:

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

1) Manage and price the most convenient parking spaces to favour priority users. Charge higher rates for longer durations and use shorter pricing periods at more convenient parking spaces such as on-street and near building entrances to increase turnover and favour higher-priority users. The increase in turnover does not only link with higher revenue but also with managing more demand with a smaller number of parking bays. This is an important initiative for cities like Anantapur where land prices are increasing rapidly, especially along the Bellary Road. The effective way of management is to charge performance-based prices, set to maintain 85-90% occupancy rates (i.e. parking index). At more convenient locations, prices should be higher, time increments smaller, and rates may increase over time (e.g., Rs. 10 for the first hour, Rs. 20 for the second hour and Rs. 50 for each subsequent hour) to encourage turnover. Case in which short term parking is predominant, the parking fees should be higher during peak periods and lower during off-peak periods. Less convenient locations can have lower rates and long-term discounts to shift demand from on-street / easy locations to less convenient off-street locations.
2) Implement parking pricing as part of an integrated parking management program that also includes improved user information on parking and transportation options, commuter trip reduction programs, improvements to alternative modes, and adequate, predictable and courteous enforcement.
3) Avoid excessive parking supply. Apply reduced and more flexible parking standards that reduce requirements if parking is efficiently managed.
4) Establish pricing policies that respond to changing conditions and demands. Optimal rates may vary from one location or time to another, and often need adjustment as supply and demand changes, for example, if nearby parking lots is closed or new businesses open. Establish performance indicators and identify additional management strategies that can be deployed as needed if problems develop.
5) Prices should be well publicized and predicable. Use signs, maps, brochures, websites and other resources to provide information to users.

6) Avoid discounts for long-term parking leases (i.e., cheap monthly rates). For example, set daily rates at least 6 times the hourly rates, and monthly rates at least 20 times daily rates. Even better, eliminate unlimited-use passes altogether. Instead, sell books of daily tickets, so commuters save money every day they avoid driving. Eliminate early-bird discounts.
7) Management programs should anticipate potential spill over problems, and respond with appropriate regulations and enforcement.
8) Parking fees should be coordinated throughout a district or region, so that comparable areas have comparable fees.
9) Dedicate some or all of the revenue from on-street parking to benefit local businesses and residents.
10) Unbundle parking from building rents, so occupants only pay for the number of parking spaces they want.
11) Tax parking spaces - Reform existing tax policies that favour free parking. For example, tax land devoted to parking at the same rate as land used for other development. Parking pricing implementation requires changing well-entrenched habits and institutional practices, so it is important to build community support. Opponents focus on parking pricing problems and costs, while overlooking benefits. It is important to identify all benefits and to illustrate savings and benefits to typical households. Clearly communicate the options a community face.

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

5.6.4 PAVEMENT MARKINGS AND SIGNAGES

Even though road signs and markings are provided on major road stretches of Anantapur, some of the sign boards are not visible and some are not maintained properly. It is recommended that proper signs be installed at all appropriate locations. Road signs are classified in three categories:

a) **Mandatory/Regulatory Signs:** To inform users about certain rules and regulations to improve safety and free flow of traffic. These include all signs such as STOP, GIVE WAY,

Speed Limits, No entry etc. The violation of rules and regulations conveyed by these signs is a legal offence (Figure 5.6-11).

Figure 5.5-8 **MANDATORY SIGNS**

b) **Cautionary/Warning Signs:** To caution the road users of certain hazardous condition either on or adjacent to the roadway. Some examples are Hairpin bend, Narrow Bridge etc. (Figure 5.6-12).

c) **Informatory Signs:** These signs are used to provide information and to guide road users along routes. The information could include name of places, sites, direction to the destinations etc. (Figure 5.6-13).

Traffic control devices such as Centre line, Traffic lane lines, Stop lines, Pedestrian crossings, Parking space Kerb marking for visibility, Obstruction marking etc. must be provided keeping in view all users of the road and especially for night time driving. All the traffic signs should be facilitated as per the guidelines provided in IRC: 67-2001.

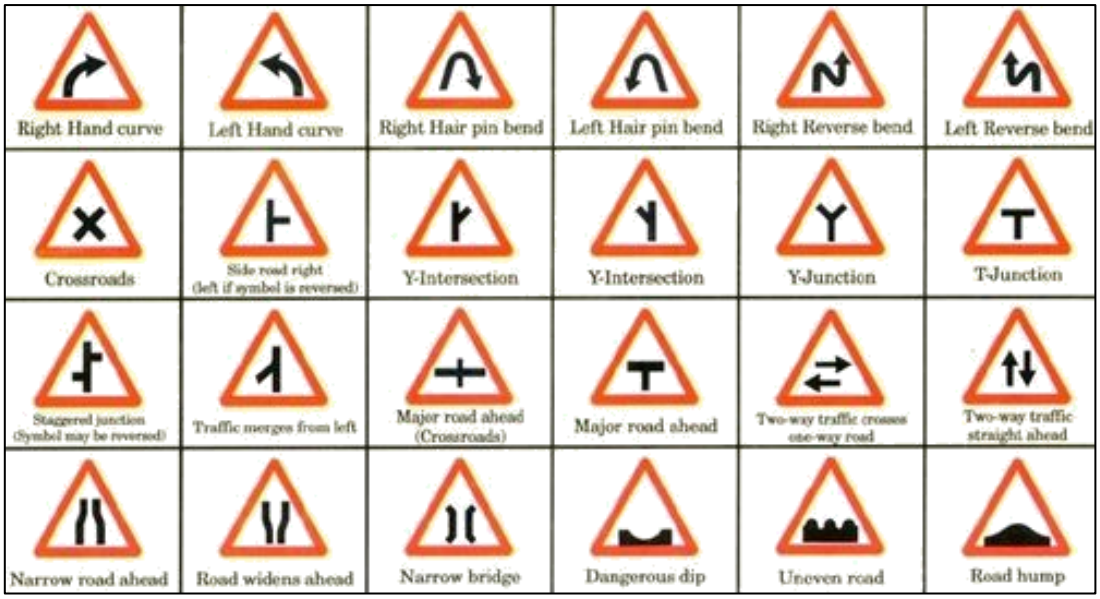


Figure 5.5-9 **CAUTIONARY OF WARNING SIGNS**

Figure 5.5-10 **INFORMATORY SIGNS**

5.7 TRAVEL DEMAND MANAGEMENT MEASURES

Travel demand management is an intervention (excluding provision of major infrastructure), to modify travel decisions so that more desirable transport, social, economic and/or environmental objectives can be achieved, and the adverse impact of travel can be reduced. A combination of TDM strategies and policies help reduce travel demand or redistribute this demand in space or in time. A demand management approach to transport has the potential to deliver better environmental outcomes, improved public health and stronger communities, and more prosperous and liveable 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
- Parking Restriction and Enforcement
- Congestion Charge
  - Impose congestion charge during peak hours on entry of private vehicles in core city area
- Cash-out measures, transit incentives, unbundling, curb side parking meters, price sensitivity, shared parking, parking regulation, remote parking and public transport facilities, improved enforcement and control

5.7.1.1 On-Street Parking- Demand Management

1. Many of the on-street parking locations show a parking index of less than 50%. AMC 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. AMC 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.

Parking signs and road marking

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

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

Types of parking control include:

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

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

5.8 TECHNOLOGICAL MEASURES

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

5.8.1 INTELLIGENT TRANSPORT SYSTEMS

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

a) **Advanced Traffic Management Systems (ATMS)** integrates various sub-systems (such as CCTV, vehicle detection, communications, variable message signs etc) into a coherent single interface that provides real information on traffic status.
b) **Advanced Traveller Information Systems (ATIS)** provides users of transportation systems both public and private mode users travel related information regarding routes, estimated travel times etc.
c) **Advanced Vehicle Control Systems (AVCS)** are tools and concepts that enhance the driver's control of the vehicle to make safe and more efficient.
d) **Commercial Vehicle Operations** for constant monitoring of heavy vehicles. It can be in the form of smart cards, weigh bridges etc.
e) **Advanced Public Transportation Systems** to enhance efficiency of public transit systems through information systems, signal priorities, GPRS etc

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

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

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

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

TYPICAL OPERATION OF ATCS

- An area sub-divided into zones or corridors
- Corridors operate on common background cycle

- Signal timings and Cycle lengths updated dynamically based on real-time demand
- Signals synchronized for green-wave
- Offset deviation corrected at plan transition

5.8.1.1 CASE STUDY: VEHICLE-ACTUATED WITRAC TECHNOLOGY IN PUNE

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

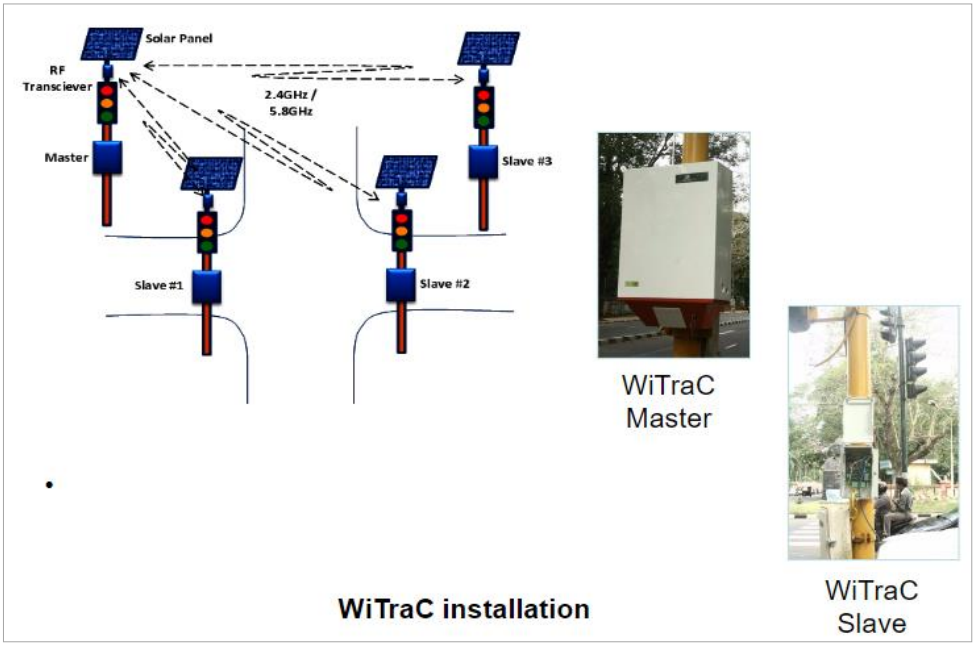


Figure 5.8-1 **WITRACC INSTALLATION**

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,II)	25
Ahmedabad	93

Figure 5.8-2 **ATCS PROJECT JUNCTIONS IN PUNE**

Impact Analysis of ATCS System in Pune

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

5.8.1.2 ATCS FOR ANANTAPUR

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

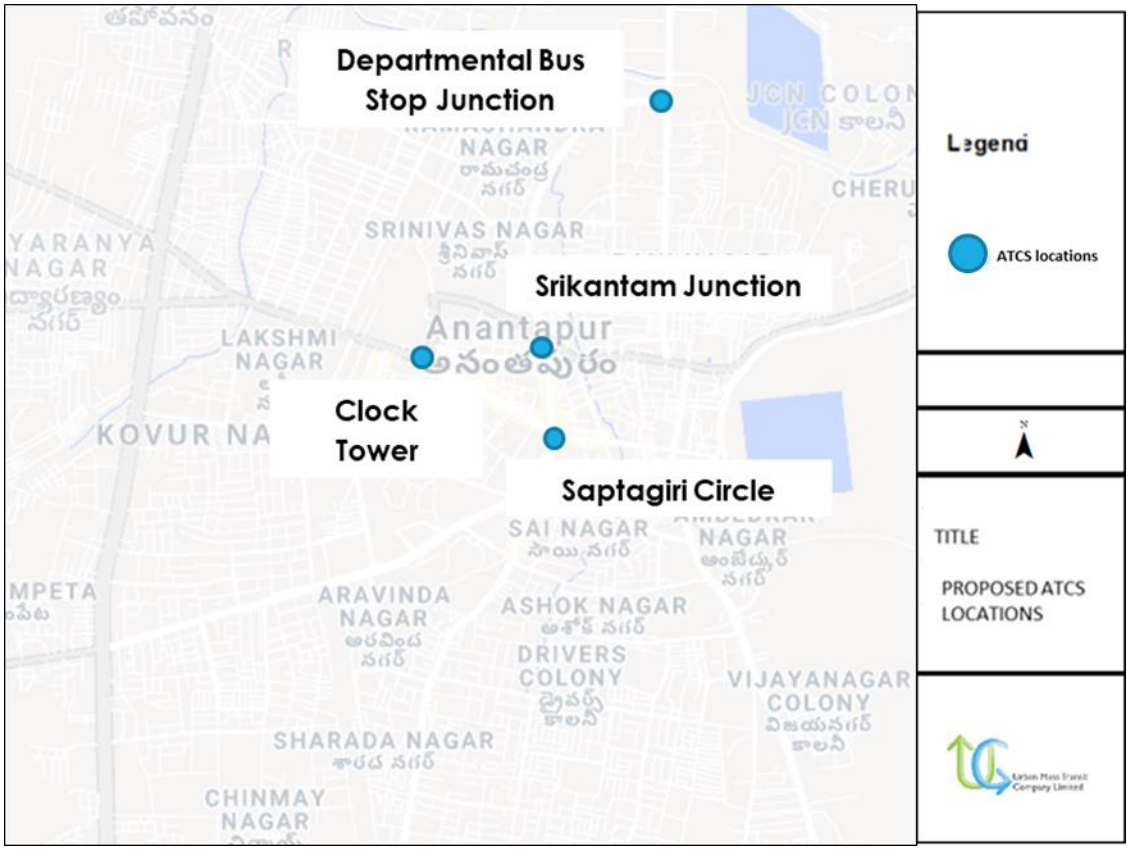


Figure 5.8-3 **PROPOSED LOCATIONS FOR ATCS**

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

5.8.1.3 PASSENGER INFORMATION SYSTEMS (PIS)

In the case of public transit, PIS refers to an information system, which provides real-time, dynamic information for passengers. This may include both predictions about arrival and departure times, and information about the nature and causes of disruptions. The system utilizes vehicle location data from AVL systems to disseminate information on the current location of the bus to passengers and predict arrival times at bus stops (Green City Streets n.d.). This is particularly useful on low-frequency routes and when buses deviate from scheduled times due to unforeseen circumstances[7].

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

[7] Source: Bus Karo 2.0

smart phones, create the potential to track buses in real time through mobile phone Apps, which is currently been adopted by BMTC in Bangalore for their city bus systems.

Figure 5.8-4 **PIS SYSTEMS RECOMMENDED FOR ANANTAPUR**

Figure 5.8-5 **PIS SYSTEMS AND APP AND WEBSITE APPLICATION OF BMTC**

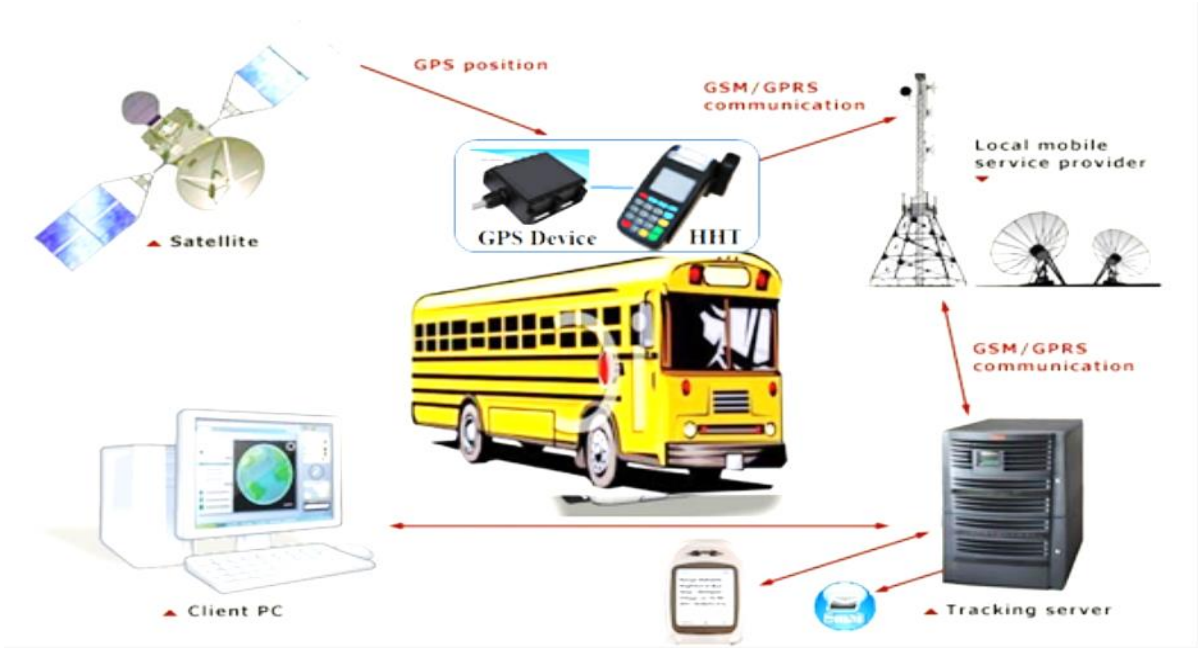


Figure 5.8-6 **PIS SYSTEMS**

In case of Anantapur, 121 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.

5.8.2 VECHICLE TECHNOLOGY

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

5.8.2.1 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 (NOx), sulfur oxides (SOx) 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.[8]
    - Due to lower carbon dioxide emissions, switching to CNG can help mitigate greenhouse gas emissions.[9] 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

[8] "Archived copy". Archived from the original on 2012-11-17. Wikipedia.
[9] "Gas South: Compressed Natural Gas". www.gas-south.com.

emissions over the entire fuel lifecycle will depend on the source of the natural gas and the fuel it is replacing.

Figure 5.8-7 **CNG VEHICLES IN INDIA**

In Case of Anantapur, CNG Buses can be considered. And is advised to make regulations and policies for Auto Rickshaws plying in city to adopt to CNG vehicles by 2022.

5.8.2.2 ELECTRIC BUSES AND AUTO RICKSHAWS:

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

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

Figure 5.8-8 **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 Anantapur. Thus, 80% Buses (97 Buses) are proposed to be Diesel (BS-IV) Buses and 20% Buses are proposed to be Electrical Bus (24 Buses).

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 during the restricted vehicle hours 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 6.2.2.

Urban Mass Transit Company Limited

Amaravati Metro Rail Corporation Limited

Chapter 6

PROJECT IMPACT ASSESSMENT

6 PROJECT IMPACT ASSESSMENT

6.1 PHASING AND PRIORTIZATION OF PROJECTS

"Prioritization" as an activity, identifies all individual projects that need to be executed in order to achieve the transportation goals of the city. This phase weaves the projects in one logical sequence, thus forming an "implementation program" which shall be discussed in the Chapter 7.

The implementation program outlines the following elements:

1) A sequence in which the projects should be undertaken. It should be noted that the "duration" of a project does not necessarily indicate its "priority". Some very long duration project may have to be started 5 years after the implementation of the LCMP commences whereas some short duration projects may have to be started immediately. Priorities of projects would be reflected in the suggested sequence.
2) Identification of all projects in two categories, as "Critical" and "Desirable." It should be noted that "Critical" does not necessarily mean "High priority", and vice versa. Also, as with priority, the duration of a project does not necessarily indicate its criticality. Some Critical projects may have to be logically started 10 or 15 years down the line, but are still critical for achieving the stated objectives of the LCMP. In other words, not implementing "Desirable" projects may have only a mild impact on achieving the transportation objectives, but not implementing "Critical" projects would severely compromise the essence of the vision and objectives of LCMP.

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

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 TRAMSPORT SYSTEM PROPOSALS

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

6.1.2 PROPOSAL 2: NON-MOTORISED TRANSPORT FACILITY IMPROVEMENT

Table 6.1-2 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
Shared 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 MANAGMENT PROPOSALS

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

6.1.4 PROPOSAL 4: PARKING MANAGEMENT PLAN

Table 6.1-5 PHASING AND PRIORITIZATION OF PARKING MANAGMENT PROPOSALS

Proposed Schemes	Category	Priority based on scoring	Phasing
On-street Parking	Desirable	Medium	Phase I
Offstreet Parking	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
Canal Bridge			
Clock Tower	Critical	High	Phase I
Government Hospital –Rudramapeta Road		Low	Phase III
Near Naik Nagar		Low	Phase III
New Links			
Ramachandra Nagar Road	Critical	Low	Phase III
Sunitha Nagar Road		Low	Phase III
Chinmay Nagar -Naik Nagar Road			
Road Widening			
NH-42	Desirable	Low	Phase III
NH-44 Rapthadu		Low	Phase III
SH-82		Medium	Phase II, III
SH-32		Medium	Phase II
Govt. Hospital Road		Medium	Phase II
Bellary Road-Ananthapur Road		Low	Phase III
Ramachandranagar Flyover		Medium	Phase II
Junctions for Geometry Improvement			
Sapthagiri Circle	Critical	High	Phase I
Clock Tower Junction		High	Phase I
Departmental Bus Stop Junction		High	Phase I
Galam Street Junction		High	Phase I
Sri Kantam Circle		High	Phase I
NTR Circle		High	Phase I
Bellary-Chow Rasta Junction		High	Phase I

All the proposals discussed so far can be broadly grouped under three categories:

- Short Term Improvements (Phase I): these are short term proposals that need to be reviewed and implemented within 5 years as per the requirement.

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

Accordingly, long term, medium term and short-term proposals for Anantapur 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
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 MEDIUM-TERM PROPOSALS

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

The projects identified in the earlier section are divided into three categories based on the urgency and duration of the implementation. Some of the long-term projects have potential to enter into Public Private Partnership (PPP); however, case to case project reports are required for validating the feasibility of each project.

6.2 IMPACT 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 PROPSED PROJECTS

Scenario	Private vehicle share (%)	IPT Share (%)	PT Share (%)	NMT Share (%)	Average Trip length (km)	Speed (in Kmph)	Average V/C
Base Year – 2018	51.7%	32.1%	4%	11.6%	3.6	27.2	0.92
Business as Usual – 2038	56%	40%	1%	3%	4.4	20.8	1.54
Sustainable Urban Transport – 2038	33%	26%	17%	24%	3.5	31.1	0.78

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 PROPSED PROJECTS

Project	ROW/Land Acquisition	Improve Mobility	Reduction in Travel Time
Improved Bus Systems	No	Yes	Yes
Intermodal Stations	Yes	Yes	Yes
Bus Terminals	Yes	Yes	NA
Freight Terminals	Yes	Yes	NA
Bus Shelters	Yes	Yes	Yes
ROBs/ New Roads/Flyovers/Bridges	Yes	Yes	Yes
Bypass/Ring Roads	Yes	Yes	Yes
Foot Path	No	Yes	NA
Cycle Tracks	Yes	Yes	Yes
Major Junction Improvements	No	Yes	Yes

6.2.2 ENVIRONMENTAL IMPACTS

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the LCMP. Screening is conducted by identifying the interaction of environmental components on the project activities for various projects. Screening conducted for the identified projects and respective impacts identified are presented in the Table 6.2-3.

Table 6.2-3 IMPACTS OF PROPSED 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

	Project	Sub Components	Impacts
			structures across major intersections.
3	Public Transport Planning	Terminals/Depots/ Transport Hubs/Bus Stops	• Acquisition of land for the facilities causes loss of livelihood, loss of shelter, severance of community & social ties. • Increase of noise and air pollution in the areas of terminals and depots. • Improvement in approaches to the terminals and depots causing impacts on adjacent land-uses and land acquisition. • Construction stage impacts include the increase in air and noise pollution. • Contamination of road runoff with stacked construction materials. • Improvement of traffic conditions during operation stage causing reduction in air and noise pollution. • Temporary interruption to traffic and increases of emissions from vehicles due to higher idling times • Temporary increase of noise levels due to idling and traffic snarls • Alternate traffic diversion routes increasing route length and consequently emissions • Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air / noise pollution.

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

1.6.2.2 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.

1.6.2.2.1 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 Anantapur, 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 PROPSED PROJECTS

Name of the Impact	Base Year (2018)	BAU Scenario (2038)	SUT Scenario (2038)
Local Emissions (Tonnes/day)	3.10	3.89	2.91
GHG Emissions (Tonnes/day)	67.86	74.7	62.1
Percent of public transport fleet in compliance with Indian emissions standards	0	0	80%

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

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Chapter 7

IMPLEMENTATION PLAN

7 IMPLEMENTATION PLAN

7.1 PROJECT COSTING

The projects identified in the earlier section are divided into three categories based on the phasing of projects for implementation. The long-term, medium-term and short-term projects have come as the output of transportation assessment carried out specifically to understand the future demand and system requirement. Some of these evolved projects have potential to enter into Public Private Partnership (PPP). It is important to highlight that the LCMP serves only to identify schemes and once these schemes are detailed for feasibility and engineering purpose, some of these costs may vary. The tentative block cost estimation is done in reference with the district scheduled rates for year 2018.

The projects proposed are to be implemented in three phases.

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

The overall short-term project cost is estimated to be 109.41 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 96.51 crores. The long-term projects will cost around 63.36 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	93.82	64.36	29.47	0.00
2	Improvement of Non-Motorised Transport Facilities	59.37	59.19	0.18	0.00
3	Improvement of Public Transport System	175.49	98.36	25.30	51.82
4	Improvement of Freight Transportation System	45.52	0.00	22.76	22.76
5	Intelligent Transportation System Facilities	24.18	7.93	8.13	8.13
6	Improvement of Parking Facilities	4.34	4.34	0.00	0.00
Overall LCMP Proposals		402.73	234.17	85.84	82.71

Sl.No	Projects	Unit	Total Quantity	Project Phasing Quantities			Unit Rate (in Crore)	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.	17.0	10.00	7.00	0.00	2.540	25.40	17.78	0.00	43.19
2	New Links	Km.	2.0	2.00	0.00	0.00	2.540	5.08	0.00	0.00	5.08
3	Canal/Rail Under/Over Bridges (4-Lanes)	No.	11.6	2.00	1.00	0.00	11.686	23.37	11.69	0.00	35.06
4	Junction Improvements	No.	1.50	7.00	0.00	0.00	1.500	10.50	0.00	0.00	24.00
	Total Proposal Cost							64.36	29.47	0.00	93.82
Improvement of Non-Motorised Transport Facilities											
1	Footpath	Km.	51.0	51.00	0.00	0.00	1.118	57.01	0.00	0.00	57.01
2	NMT Only Lanes	Km.	0.0	0.00	0.00	0.00	1.646	0.00	0.00	0.00	0.00
3	Foot Over Bridges	No.	1.0	1.00	0.00	0.00	0.813	0.81	0.00	0.00	0.81
4	Shared Cycle Tracks	Km.	35.0	25.00	10.00	0.00	0.018	0.44	0.18	0.00	0.62
5	Dedicated Cycle Tracks	Km.	26.0	26.00	0.00	0.00	0.036	0.92	0.00	0.00	0.92
	Total Proposal Cost							59.19	0.18	0.00	59.37
Improvement of Public Transport System											
1	Bus Fleet Augmentation-(Diesel Buses)	No.	162.0	97.00	32.00	33.00	0.610	59.14	19.51	20.12	98.77
2	Bus Fleet Augmentation-(Electric Buses)	No.	49.0	24.00	0.00	25.00	1.219	29.27	0.00	30.48	59.75
3	Bus Shelters	No.	150.0	100.00	50.00	0.00	0.091	9.15	4.57	0.00	13.72
4	Improvement of Existing Bus Terminals	No.	2.0	2.00	0.00	0.00	0.406	0.81	0.00	0.00	0.81
5	New Bus Terminal	No.	2.0	0.00	1.00	1.00	1.219	0.00	1.22	1.22	2.44
	Total Proposal Cost							98.36	25.30	51.82	175.5
Improvement of Freight Transportation System											
1	Proposed New Truck Terminals	Sq.m	56000.0	0.00	28000.0	28000.0	0.001	0.00	22.76	22.76	45.52
	Total Proposal Cost							0.00	22.76	22.76	45.52

Sl.No	Projects	Unit	Total Quantity	Project Phasing Quantities			Unit Rate (in Crore)	Phasing Rs (in Crores)			Total Cost (in Crores)
				2018-2022	2022-2032	2032-2038		2018-2022	2022-2032	2032-2038	
Intelligent Transportation System Facilities											
1	New Signal Installations	No.	2.0	2.00	0.00	0.00	0.406	0.81	0.00	0.00	0.81
2	Area Traffic Control System	Km.	5.0	5.00	0.00	0.00	0.610	3.05	0.00	0.00	3.05
3	ITS control Centre, PIS, Common Mobility Card, GPS, Mobile phone Applications and Surveillance Cameras)	Km.	50.0	10.00	20.00	20.00	0.406	4.06	8.13	8.13	20.32
	Total Proposal Cost							7.93	8.13	8.13	24.18
Improvement of Parking Facilities											
1	On street Parking	Km.	3.0	3.00	0.00	0.00	0.093	0.46	0.00	0.00	0.46
2	Off street Parking (Surface)	No.	2.0	2.00	0.00	0.00	0.086	0.26	0.00	0.00	0.26
3	Off street Parking (Multi-Level)	No.	1.0	1.00	0.00	0.00	3.618	3.62	0.00	0.00	3.62
	Total Proposal Cost							4.34	0.00	0.00	4.34
Overall Comprehensive Traffic and Transportation Plan Proposals											
	Total Project Cost							**234.17**	**85.84**	**82.71**	**402.73**

7.2 FINANCING OPTIONS

As per the Recommendations of Working Group on Urban Transport for 12th Five Year Plan, the financing of urban transport projects in the country has largely been confined to gross budgetary support from the government and the user charges. Due to heavy investment needs of urban transport and conflicting demands on the general exchequer, the investment in urban transport in past has not kept pace with the rapidly increasing requirement of the sector. The current level of user charges of limited urban transport facilities, do not make the system self-sustainable. At the same time, providing safe, comfortable, speedy and affordable public urban transport to all has to be a necessary goal of the governance. The key funding sources besides GBS and fare box can be dedicated levies, land monetization, recovery from non-user beneficiaries, debt and private investments. The paradigm of financing has to clearly move towards non-users pay principle and the polluters pay principle. There is a need for long-term sustainable dedicating financing mechanism to address fast worsening scenario in the field of urban transport. All the various components in which the investment would be required in the 12th Five Year Plan would need to be funded through a combination of funding from Govt. of India, State Govt./urban local body, development agencies, property development, loan from domestic and financial institutions as well as PPP. Thus, it is imperative to identify projects that are amenable to Government funding or PPP.

7.2.1 PUBLIC PRIVATE PARTNERSHIP (PPP)

Public-Private Partnerships is cooperation between a public authority and private companies, created to carry out a specific project. They can take on a number of forms, and can be a useful method of capturing property value gains generated by transport infrastructure In a PPP for a new transport infrastructure development project, the public authority creates a secure environment for the private sector to carry out the project, and the private partner offers its industry know-how, provides funding and shares in the project's risk. The objectives of the public and private sector partners appear to be quite different. The public sector aims to best serve the interests of taxpayers. The aim is not to use public money to obtain a return on capital investments. The private sector, on the other hand, aims to ensure a return on investment for its shareholders and to be as profitable as possible and yet these two contrasting goals can function perfectly well together in the framework of a PPP. The decision to undertake a public-private partnership and the choice of the most suitable form of partnership greatly depends on the context and the types of project to be developed are given below:

- The project context may influence the type of PPP to be implemented. The public partner must evaluate the total cost of the project, its importance in terms of public need, the time frame, the number of actors involved and the geographic area in question. Does providing this public service require a major

infrastructure? Will it require high levels of human and financial resources to provide this service? Before a decision can be made, it is necessary to fully understand the context of the proposed project.

- The cost of the project is of course a critical factor, which will weigh on the choice. Many PPP concern projects for underground systems, LRT and BRT requiring significant levels of financing which the local authorities would have difficulty assuming alone.
- A well-structured institutional framework and the local authority's experience in developing transport projects are also decisive factors. Urban transport is an industrial and commercial activity, which involves financial risk. Bringing in experienced partners is one way of compensating for a lack of certain skills in this field, though a good PPP should call upon other forms of expertise on the part of the public authority. This can sometimes facilitate obtaining a loan, in particular from international funding agencies.
- The tasks entrusted to the private sector (design, construction, development, operation, maintenance) will influence the type of contract.
- The sharing of responsibilities and risks will determine the degree of involvement of each partner and the type and clauses of the contract. There are many types of contracts but it is primarily the sharing of financial risk, which will determine the key characteristics. There are two categories of risk: commercial risk, related to trends in revenue, and industrial risk, related to the cost of construction and trends in operating and maintenance expenses. If both types of risk are covered by the public partner, then it would be a management contract in which the private partner is merely performing the work. The private partner must meet the specifications but will not be motivated to improve the service nor propose innovative techniques or management;
- If the project is not self-financing, i.e. if, at the end of the contract, the total revenues and gains do not balance out the total costs, the transit authority may be required to provide compensation, depending on the clauses of the contract.

7.2.2 GOVERNMENT SOURCES OF FUNDING

One of the particularities of the urban transport sector is that it depends on funding from several sources and involves various partners, public and private, individual and collective.

7.2.2.1 VIABILITY GAP FUNDING

In a recent initiative, the Government of India has established a special financing facility called "Viability Gap Funding" under the Department of Economic Affairs, Ministry of Finance, to provide support to PPP infrastructure projects that have at least 40% private equity committed to each such project. The Government of India has set certain criteria to avail this facility under formal legal guidelines, issued in August 2004, to support infrastructure under PPP framework. Viability Gap Funding can take various forms such as capital grants, subordinated loans, O&M support grants and interest subsidies. It will be provided in instalments, preferably in the form of annuities. However, the Ministry of Finance guidelines require that the total government support to such a project, including Viability Gap Funding and the financial support of other Ministries and agencies of the Government of India, must not exceed 20% of the total project cost as estimated in the preliminary project appraisal, or the actual project cost, whichever is lower. Projects in the following sectors implemented by the Private Sector are eligible for funding:

- Roads and bridges, railways, seaports, airports, inland waterways
- Power
- Urban transport, water supply, sewerage, solid waste management and other physical infrastructure in urban areas
- Infrastructure projects in Special Economic Zones
- International convention centers and other tourism infrastructure projects

7.2.2.2 AMRUT FUNDING

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

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

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

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

7.2.2.3 DEDICATED URBAN TRANSPORT FUND AT CITY LEVEL

For the projects, which are not admissible under AMRUT, or viability gap funding, the alternative sources of funding that a city could avail by setting up a dedicated urban transport fund at city level are given below:

A dedicated urban transport fund would need to be created at the city level through other sources, especially land monetization, betterment levy, land value tax, enhanced property tax or grant of development rights, advertisement, employment tax, congestion, a cess on the sales tax, parking charges reflecting a true value of the land, traffic challans etc.

Pimpri-Chinchwad Municipal Corporation has already set up a dedicated urban transport fund through land monetization and advertisement rights. Similarly, Karnataka has set up a dedicated urban transport fund through MRTS cess on petrol and diesel sold in Bangalore, which is being used to fund the metro rail projects. The various sources of funding that can be used to set up the urban transport fund is given below:

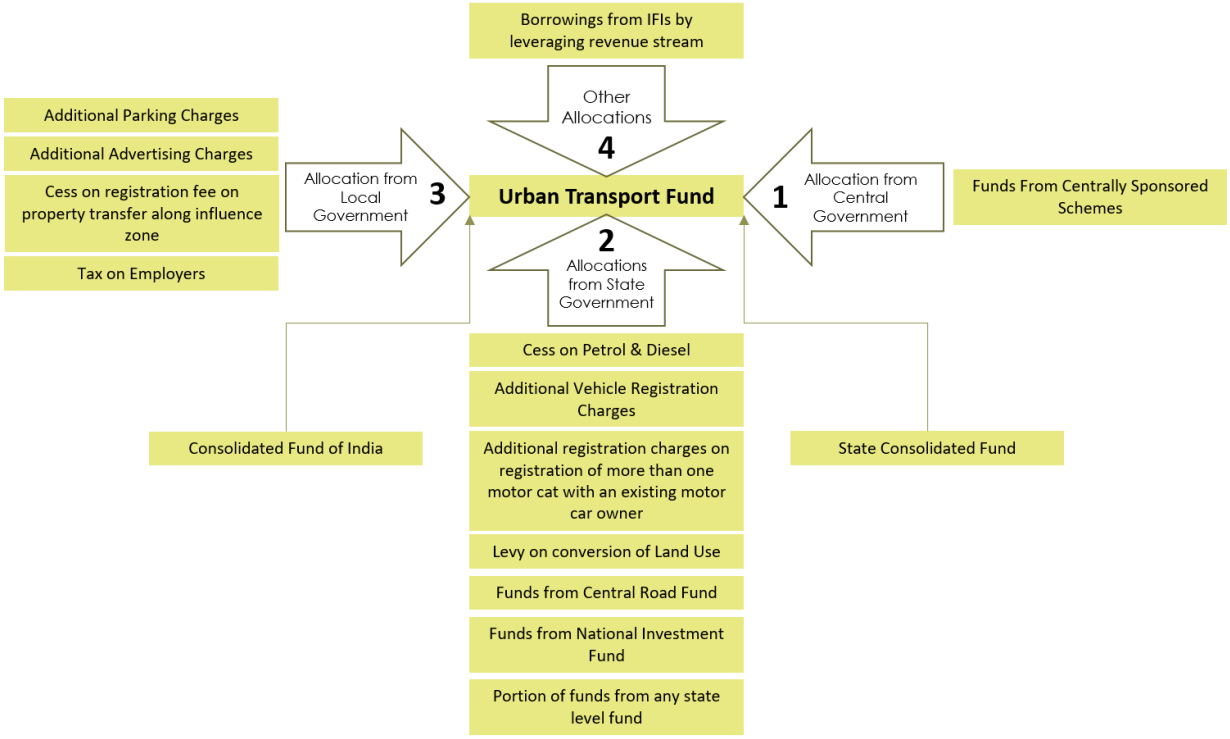

Figure 7.2-1 **SOURCES OF FUNDS FOR URBAN TRANSPORT FUND**

7.2.2.3.1 *ANTICIPATED PURCHASE OF LAND*

This method involves public authorities buying land before announcing that an infrastructure will be built or where the route will run. In this way, the purchase can be made at market price without the infrastructure. The strategy then consists in:

- Directly selling the land to private developers including the estimated added value in the sale price, such as was done in Aguas Claras on the periphery of Brasilia, or in Copenhagen;
- Developing the area as part of an urban renewal project and then selling it at market price, as was done in Copenhagen or in Japan, where rail companies were the first to use this method to finance their operations

A city can also levy additional stamp duty (5%) on registration of property.

7.2.2.3.2 *BETTERMENT TAX*

A betterment tax is not the same as a property tax, because the increase in value of property is not due to the action of the owner (such as would be the case with renovations and improvements) but from a community action, thus justifying the public authorities to impose such a tax. However, it is not easy to implement, which no doubt explains why this financing mechanism is still underused.

This tax must be levied on all areas that benefit from the new transport infrastructure. The land is valued each year based on an optimal use of each site, without considering the existing facilities. A tax based on the value of the land is then levied in order to generate funds for the public sector. Thus, if the value of the land increases, the tax collected also increases. This means that a vacant plot of land in the city centre which has been earmarked for building a residential and commercial complex will pay the same tax as an identical site which has already been developed in a similar manner. Unlike construction taxes, no tax reduction is available to landowners who leave the site empty. Likewise, taxes are not increased if the site is built upon. Landowners will therefore to seek to capitalize on the use of their land.

7.2.2.3.3 *LAND VALUE TAX*

Once an area is well connected by public transport and is accessible to the commercial area and also the liveability of the area increases it is possible that the price of the land will increase. Such increase in price can be source revenue for the municipality. Similar to parking, the obtained revenue needs to be utilized for improvement of the area and other areas in the vicinity. A substantial amount of revenue could be generated through cess on turnover, particularly in cities, based on industry, trade and commerce activities. Such cess has already been levied for Bangalore MRTS project. Bangalore has also levied luxury tax and professional tax towards the metro fund.

7.2.2.3.4 *ADVERTISING*

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

Paris, France has used the advertising money in developing a public bike scheme, which is now a well renowned model. Similarly, Transport for London (TfL) has made a deal with the advertising specialist, Clear Channel, for the regular maintenance and design of the street furniture in return for the advertising space on bus shelters.

One important aspect that needs to be considered is that the advertising money needs to be utilized for improving the transport system rather than spending it on building more roads. In the similar way, the advertising should not be overdone to avoid visual pollution. Further, ideally advertising revenue should not be a reason for building of pedestrian overpasses as the greater good for the society from these overpasses is minimal.

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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 Anantapur.

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

In view of bringing the institutional setup in a proper structure, it is important to understand the issues with the present Institutional set up, listed below.

- No clear segregation between the planning and implementing bodies
- Lack of coordination amongst all the departments in the urban transport sector
- All departments related to urban transport do not function in coherence.

Road projects are implemented in isolation with other projects which should otherwise be an integral part of road development like footpath, cycle tracks, pedestrian facilities etc. No control over mushrooming IPT modes in the city, which lead to issues of congestion along with contesting with the buses for passengers. Operation issues in public transport due to poor route and service planning. No dedicated organization that is in charge of long-term urban transport planning for the city.

With a view to coordinate all urban transport activities in the city, it is recommended that a UMTA be set up at the city level that acts as a planning and decision-making body for all matters related to urban transport in the city.

It is recommended that the city level UMTA be set up on an executive order for the ease of formation however, it must be given a legal backing so that it's functioning falls under an act and commands greater authority.

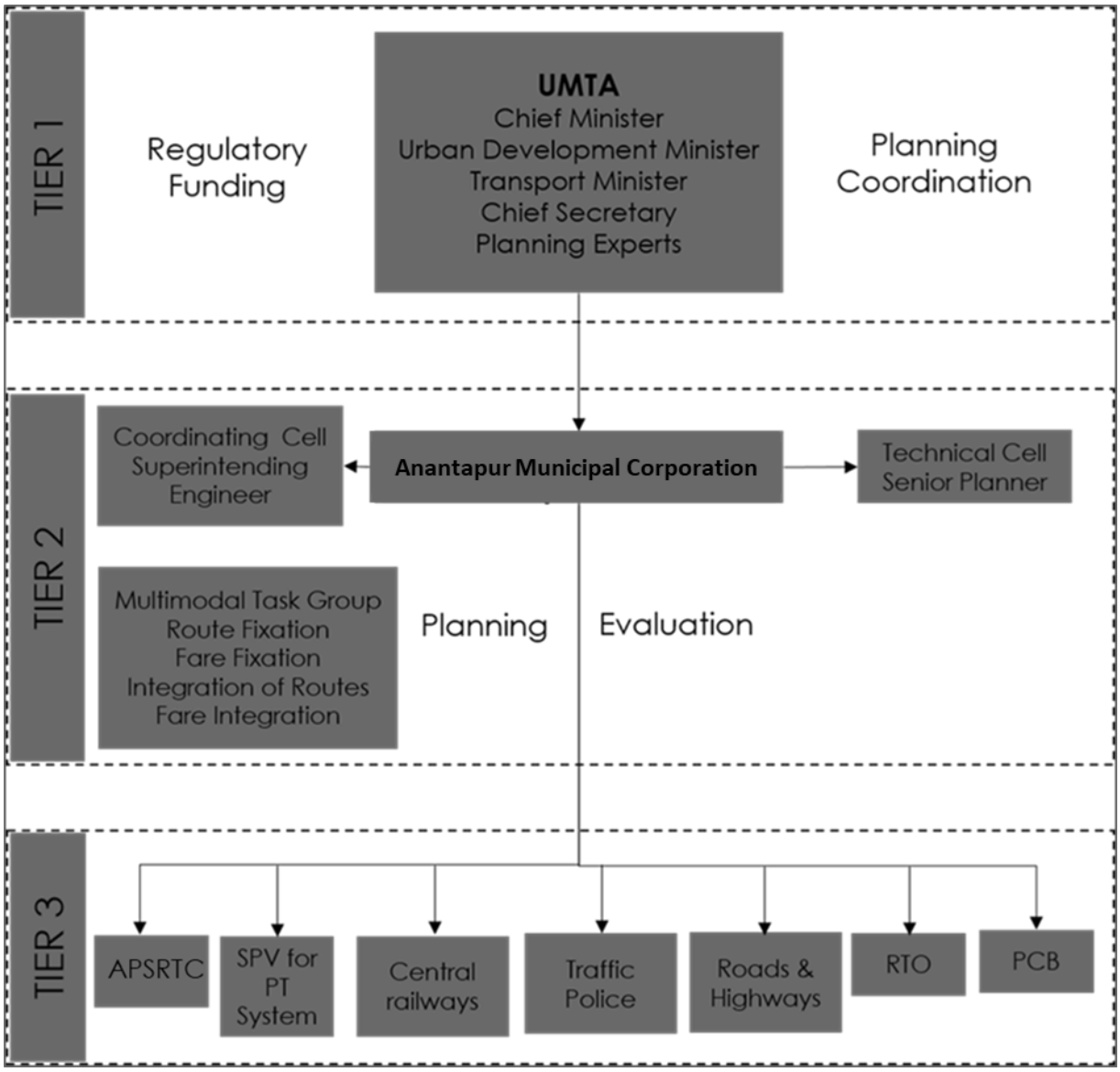

Figure 8.1-1 **RECOMMENDED STRUCUTRE FOR UMTA SETUP**

1.7 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;

1.8 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

1.9 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.

1.10 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 12-1: DETAILS OF IMPLEMENTING AGENCIES

Sl.No	Projects	Agencies Responsible	Implementation Operation	
			Construction	Operation/Maintain
Improvement of Road Network				
1	Upgradation of Existing Roads	PWD/NHAI/AMC	PWD/ NHAI / Private	PWD / NHAI / Private
2	New Links	PWD/NHAI/AMC	PWD/ NHAI / Private	PWD / NHAI / Private
4	Canal Bridges	PWD/NHAI/AMC	PWD/ NHAI / Private/AMC	PWD / NHAI / Private/AMC
5	Rail Over Bridges (4-Lanes)	PWD/NHAI/AMC	PWD/ NHAI / Private/AMC	PWD / NHAI / Private/AMC
6	Junction Improvements	PWD / AMC / State Govt. / NHAI	State Govt. / AMC	PWD / NHAIs
Improvement of Non-Motorised Transport Facilities				
1	Footpath	AMC / PWD	PWD / AMC/ Traffic Police	AMC / PWD/ Traffic Poilice
2	NMT Only Lanes	AMC / PWD	PWD / AMC	AMC / PWD
5	Shared Cycle Tracks	AMC / PWD	PWD / AMC	AMC / PWD
6	Dedicated Cycle Tracks	AMC / PWD	PWD / AMC	AMC / PWD
Improvement of Public Transport System				
1	Bus Fleet Augmentation-(Diesel & CNG Buses)	APSRTC	State Govt.	APSRTC
3	Bus Shelters	APSRTC/AMC	APSRTC/AMC/PPP	APSRTC/AMC/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 /AMC/traffic police	GoI / State Govt. / AMC	Public Education and awareness program

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

Urban Mass Transit Company Limited

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Chapter 9

STAKEHOLDERS WORKSHOP

9 STAKEHOLDERS WORKSHOP

The Stakeholder workshop on Low Carbon Mobility Plan for Anantapur was held on 11th 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 Anantapur 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 Anantapur. 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 C);

Mr. N.P.Ramakrishna Reddy	Managing Director, AMRC
Mr. V. Ramudu	Director, Town and Country Planning
Mr. S. Vinay Prasad	Town Planning Officer (TPO)
Mr. B. Balachandra	Depot Manager, APSRTC
Mr. V. Krishna Kishore	DCP
Mr. Dr. V Sundar	Dy. Traffic Commissioner, RTA
Mr. S. Rama Krishna	Sr. Vice President, UMTC
Mr. Ankush Malhotra	Vice President, UMTC
Mr. J. Siva Niranjan	Manager, UMTC
Mrs. Harshita Sarma	Asst. Manager, UMTC
Mr. Rakesh Jinka	Project Officer, UMTC
Ms. Sri Navya Annem	Sr. Officer, UMTC

Figure 9.1-1 STAKEHOLDERS WORKSHOP

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

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:

- A Mr. S. Vinay Prasad, Town Planning Officer (TPO) has highlighted the bottle neck created at Railway Station Junction as it opens into 40feet Road. He expressed the need for better connecting routes to Kalyanadurgam, Bengaluru, Bathalapalli Junction, Tadipatri. UMTC team explained that the same were already incorporated in the CMP. Further, Town Planning Officer (TPO) specified that larger freight movement is observed along the Tadipatri Road thereby suggested to review the possibility of Freight terminal along Tadipatri Road. He appreciated the strategy to terminate the regional bus services outside the city and suggested to consider locations along Bukkaraya Samudram, Rapthadu, Gangasamudram along with the proposed terminals. In addition, he advised to review the hydrated Pandameru Rain Water area for proposing Public Transport Terminals. UMTC team agreed to review the suggestion and incorporate it in the CMP. It was also suggested to extent the proposed bus routes to the sub-urban centres which envisaged for future developments. UMTC team agreed to review the suggestion and consider it for the Horizon year and explained that a detailed DPR should be carryout for detailed operation of routes.

- Mr. Dr. V Sundar, Dy. Traffic Commissioner, RTA and Mr. B. Balachandra, Depot Manager, APSRTC have suggested to review the termination of buses entering the city near Railway Station and to divert Bengaluru routes from collectorate area towards Ratpadu decongest the core area. UMTC team explained that with the development of new terminals to terminate the regional services entering the city shall address the issue and the suggestion shall be reviewed along with the proposed strategies.

- Mr. Dr. V Sundar, Dy. Traffic Commissioner has suggested to consider satellite developments around SKU and Rapthadu while planning routes. The following corridors were recommended to be reviewed as a part of City Bus Systems,
  - SKU to Collectorate Office Road
  - SKU to Maruti Nagar
  - SKU to RTC
- UMTC team explained that the proposed routes cover the above-mentioned locations and the suggested corridors shall be reviewed and advised for the preparation of a Detailed Project Report for the same.

On receiving the following observations from the stakeholders, the proposals were reviewed based on the suggestion and the final proposals have been updated as discussed in the Chapter 5 and Chapter 7 of this Report.

Urban Mass Transit Company Limited

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ANNEXURE

ANNEXURE A -TRAFFIC ANALYSIS ZONES

WARD NO.	LOCALITIES
1	M.G. Colony, Yerranela kottalu, Revenue Colony, Shirid inagar
2	Nirmalanand nagar, HLC canal, Band Hats, Bindela colony, Vinayaka nagar, Arveti nagar, Bhagya nagar
3	Venugopal nagar, Tarakapuram kottalu, Tarakapuram
4	Ramachandra nagar, Revenue colony, Shiridi nagar
5	Srinivasa nagar, Khaja nagar, Chapalagunta colony, RTC Busstand road, RF road
6	Neeruganti veedhi , Venugopal nagar
7	Neeruganti veedhi
8	Rani nagar, Vinayaka nagar
9	Ferro nagar, Bhavaninagar Srikrishna devaraya nagar, vinayaka nagar
10	Rajamma colony, Ambarapu veedhi, Gadangi veedhi, Tadipatri road, Gooty road
11	Ambarapu veedhi, Amudala street, Gandhi Bazar
12	Thilak road, Kuruba veedhi, bramhana veedhi
13	Uma nagar, Roshan Nagar, Ramaswamy Temple area, Thilak road, Gooty road, Neeruganti veedhi
14	Subash road, Rajaji Veedhi, Uma nagar
15	Kamala nagar, Raju road, RF road, Subash road
16	Kamalanagar, Municipal colony, Srinivasa nagar, Venkata Reddy colony, DCMS road, RF road, Subash road
17	Gulzarpet, Adimurthy nagar, Subash road
18	Gulzarpet, Patel road, Sing street, Umapthi road, court road, malleswari road, Subash road
19	Prakash road, Rahamath nagar, Baba nagar, Govt Hospital road
20	Obuladeva nagar, Sai nagar, Subash road, Rajini bar street
21	Sai nagar, Ammavari Cheruvu kottalu
22	Boya street, Sangamesh nagar, Surya nagar road
23	Vegetable street, memin street, Asar street, Ambedkar nagar, munna nagar
24	Collector office road, Sangamesh nagar, Maruvakomma colony, buddappa nagar colony, Drivers colony
25	Ashok nagar , Drivers colony
26	Ammavari cheruvu kottalu, Sai nagar

WARD NO.	LOCALITIES
27	Harihara nagar, Ashok nagar, Jesus nagar, Vidyut nagar
28	Venkateswar nagar, Novodaya colony, Housing Board colony
29	Vincent ferror colony, Vijayanagar colony, Engineering college road, R.D.T area, Sarada nagar
30	Bangalore road, JNTU college road, Tarakanath colony , Sarada nagar, SBI colony, Navodaya colony
31	Housing board colony, Hamali colony
32	Vidyut nagar, obuladeva nagar, Adarsh nagar, new Vidyut colony,F.C.I. colony, Shivaji nagar, prasannaya palli road
33	Govt Hospital road,obuladeva nagar, Aravind nagar, Krupananda nagar
34	Prasannayapalli road, Krupananda nagar, Srikrishna devaraya nagar, Naik nagar
35	Ramnagar, Maruthi nagar, Railway trac , Mangalavari colony
36	Mangalavari colony, Venkata rao nagar, Adarsh colony, Srinagar colony, Andhra Bank colony, 80 feet Ayyappa swamy temple road
37	Ramnagar main road, Ram nagar, Railway track line
38	Kovur nagar, Mahammad nagar
39	Lakshmi nagar, Kovur nagar, PTC compound
40	Ballary road, Kld road, N.H. 7,Satyadeva nagar, Vadde colony, Azad nagar, Parvathama colony
41	NH7, George pet, Ballary road, Hanuman road, Yuvajana colony, Kylasam road
42	Indira nagar, LB nagar, Hyderavali colony, Kylasam road, 6throad, Ballary road, NH7
43	5th road, Georgpet, Yerukalavari colony
44	5th road, 1st road, Georgpet
45	Georgpet, 1st road, 5th road, Railway track.
46	Nehrupoormen colony, 5th road, Somanath nagar road
47	Nehrupoormen colony, Somanath nagar , Sunitha nagar part
48	Rajak nagar, KK nagar, Santhi nagar, Somanath nagar road
49	2nd road, Indira Gandhi kottalu, Ganga nagar, RK nagar, Thirumala nagar
50	1st road, HLC colony, Dwaraka nagar, Sunitha nagar part, pedda mutyalamma colony , 2nd road

ANNEXURE B -PRIMARY SURVEY FORMATS

10.1 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. 50 km in Anantapur.

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

10.1.1 CARRIAGE WAY

65% of the surveyed network has carriage way below 12m. Majority of the roads are 2 laned and 4 lanes constituting 85% share of total length. Remaining are Single Lane, Intermediate Lane (IL) and 6 lane with divided/undivided roads.

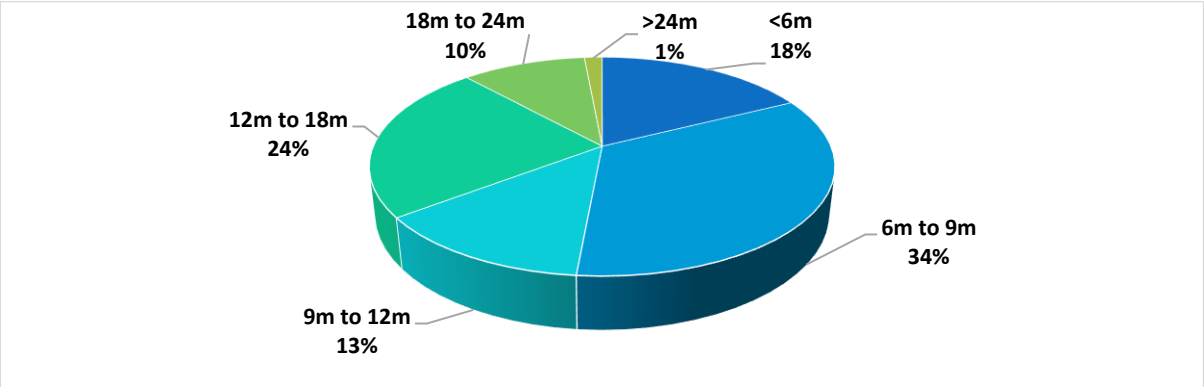


Figure 10.1.1 DISTRIBUTION OF EXISTING ROAD NETWORK CLASSIFICATION BASED ON CARRIAGE WAY

From the network inventory analysis, it is observed that, a larger share which is about 95% of the surveyed network has well paved road surface, of which 60% if flexible in nature and 34% of the survey network has rigid surface. The surveyed network is largely two-way in nature allowing movement on either direction. The important links with one-way movements are observed along Rapthadu police ststion to MEO office.

45% of the survey network is divided while the remaining 55% is undivided. It is observed that the divided lanes are observed on the arterial roads and few sub arterial roads which are Subash road, RTC bus stand road, Tadipatri road, Government hospital road, Rudrampet by pass road, Gooty road and so on, 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 54% of the survey network is 2 laned in nature (Figured 10.1.3 and 10.1.4).

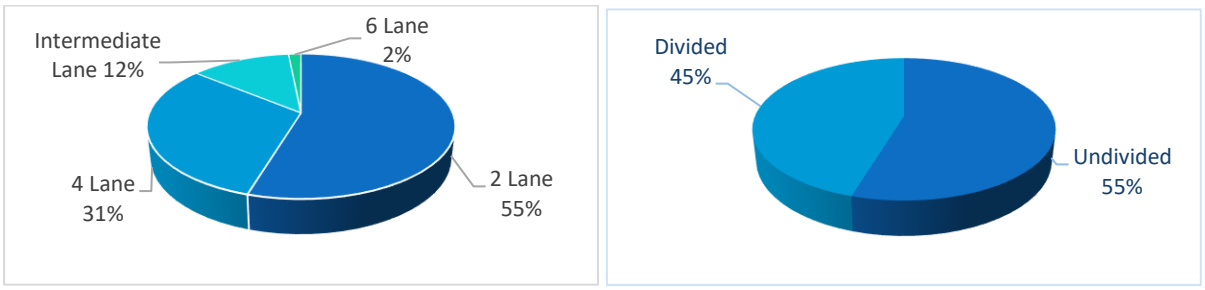


Figure 10.1.2 CLASSIFICATION BASED ON NUMBER OF LANES AND LANE TYPOLOGY

It is observed that only 25% of the surveyed network has shoulder space available to cater the needs of the future traffic in which about 75% are having total shoulder width less than 3m. 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 3m to 6m wide space available to improve the urban fabric of the streets and the movements.

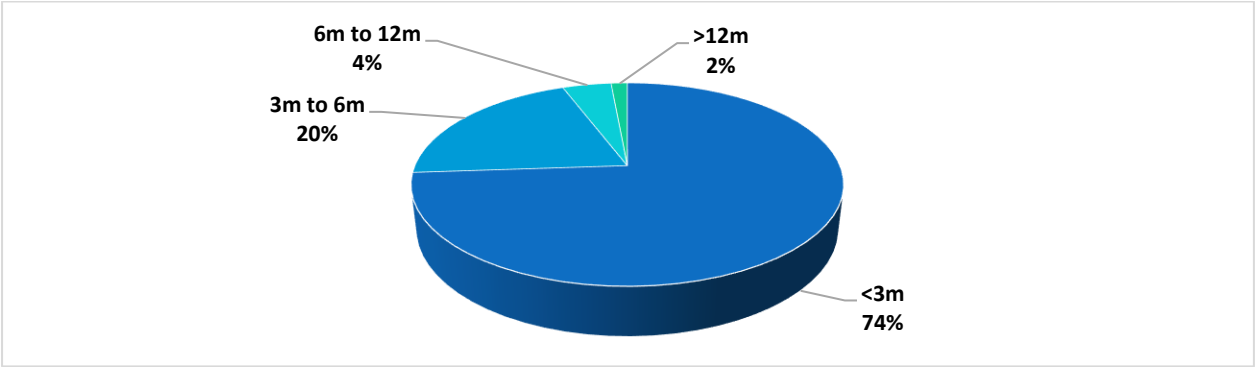


Figure 10.1.3 DISTRIBUTION OF EXISTING ROAD NETWORK CLASSIFICATION BASED ON SHOULDER WIDTH

10.1.2 PEDESTRIAN FACILITIES

From the surveyed Road Network Inventory Analysis, it is observed that only 7.8% of the network has facilities (footpath) to support safe pedestrian movement. While in the remaining 92% of the network about 87% have unpaved footpath for pedestrians.

10.1.3 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.

10.1.4 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 Subash road, Galam Street and 80 feet road.

10.1.5 INTERSECTIONS

The Major Intersections within the Anantapur Study area are Clock Tower Junction, Saptagiri Circle, Tower Clock Junction, Mirchi Junction, Sree Kandam Circle, Old Town Junction, Saptagiri Circle, Ambetkar Circle, Cresent Circle, Vidhyuth Nagar Cicle, Sangameshwara Circle, Thomas Manro Circle, Chandra Hospital Circle and so on. It is observed that there are about 15 notable junctions of which 5 are signalized junctions while the rest are unsignalized.

Key Inferences:

1. The network structure in the city is largely linear with few radials connecting the sub-urban places around the city.
2. About 64% of the survey network has carriage way below 12m.
3. Only 7.8% of the surveyed network is facilitated with pedestrian infrastructure.
4. The city has no designated infrastructure facilities for non-motorised vehicles.

10.2 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.

Road Stretches: Road length of approx. 50 km in Anantapur similar to the road network inventory was surveyed.

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

10.2.1 TRAVEL SPEED

The average speed within the city is observed to 27.18kmph. The average speed along observed along the National Highway, Bangalore-Hyderabad Highway passing out of the city is 37 kmph. The speed of other important roads within the city range between 20kmph to 30kmph.

Table 10.2-1 JOURNEY AND RUNNING SPEEDS ACROSS VARIOUS ROADS IN THE STUDY AREA

S.No.	Name of the road	Journey Speed	Running Speed
1	**Arterial Roads**	36.89	38.7
2	**Sub-Arterial Collector Roads**	**27.18**	**36.30**
3	**Local Roads**	**22.02**	**29.54**

10.1.1 DELAYS IN TRAVEL

The delays observed in the travel speed along the survey network is largely due to traffic movement hindrances and signal delaysl. 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/Bridge Construction). The Figure shows the share of cause of delays along the surveyed network.

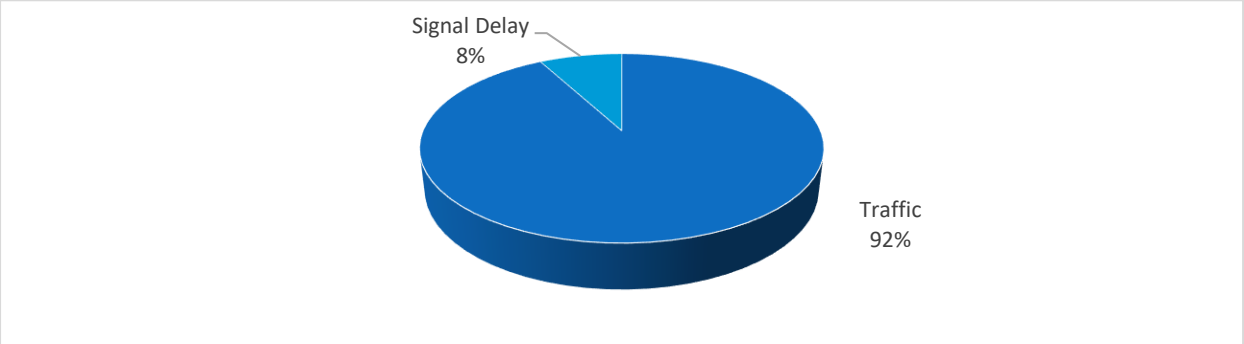


Figure 10.2.1 DISTRIBUTION OF CAUSES OF DELAY ALONG THE NETWORK

Key Inferences:

1. The average journey speed along the network is observed to 27.18kmph.
2. The average speed along the arterial roads is observed to be over 35 kmph, while along the sub-arterial roads ranges between 20kmph to 30kmph.
3. The speed along the collector and local roads varies between 20kmph to 25kmph.
4. The delays in travel speeds are caused largely due to police control at road intersections.

10.3 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.

Location: Six outer cordon points were identified to capture the external and internal interactions with Anantapur (Figure 10.3.1 and Table 10.3.1).

Table 10.3-1 OUTER CORDON LOCATIONS

CODE	LOCATION
OC_1	Near Shivalayam, Tirupati- Anantapur Highway
OC_2	Near Petrol Bunk, Srinagar Kanayakumari Highway
OC_3	Near Chandra Prabha Swimming Pool, Kalyandurgam Road
OC_4	Near Akkammagarlu Temple, Bellary-Anantapur Road
OC_5	Banglore hyderabad Highway, Vignesh Nusery
OC_6	Matka Garden, Aanathapur Tadipatri Highway

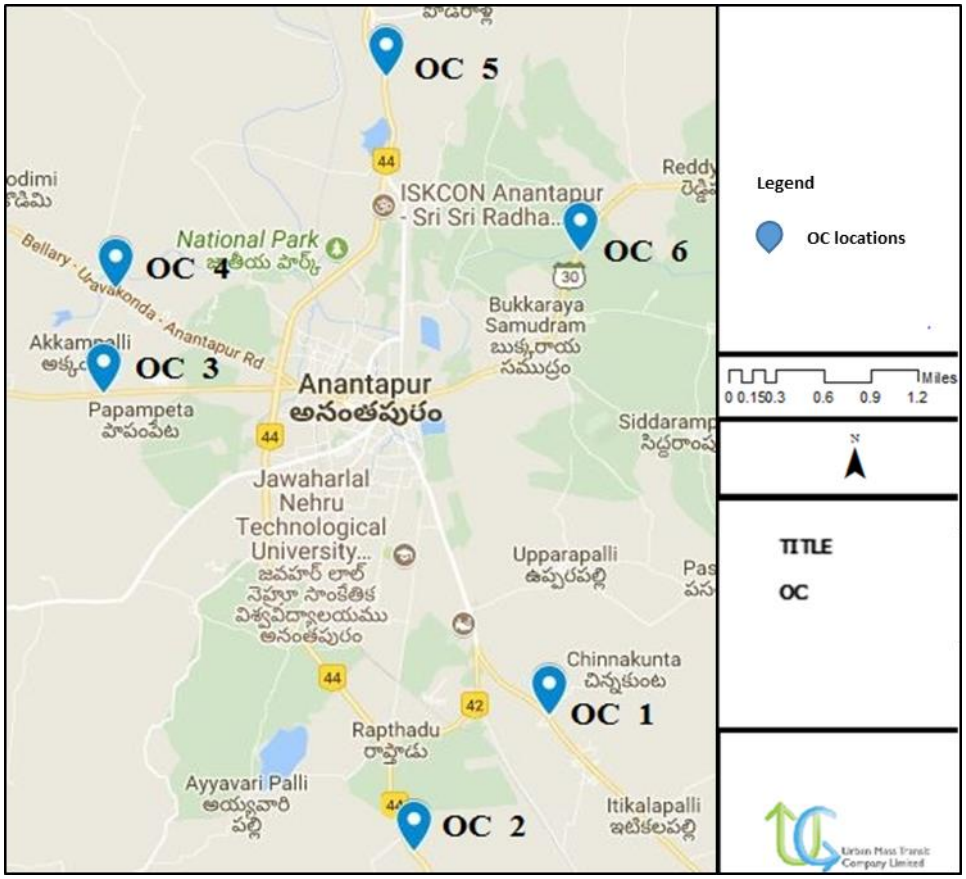


Figure 10.3.1 OUTER CORDON LOCATIONS

Analysis:

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

PASSENGER VEHICLES:

It was observed that majority of the trips were work and religious/recreational based trips, accounting to 34% and 20% of the trips (Figure 10.3.3) respectively.

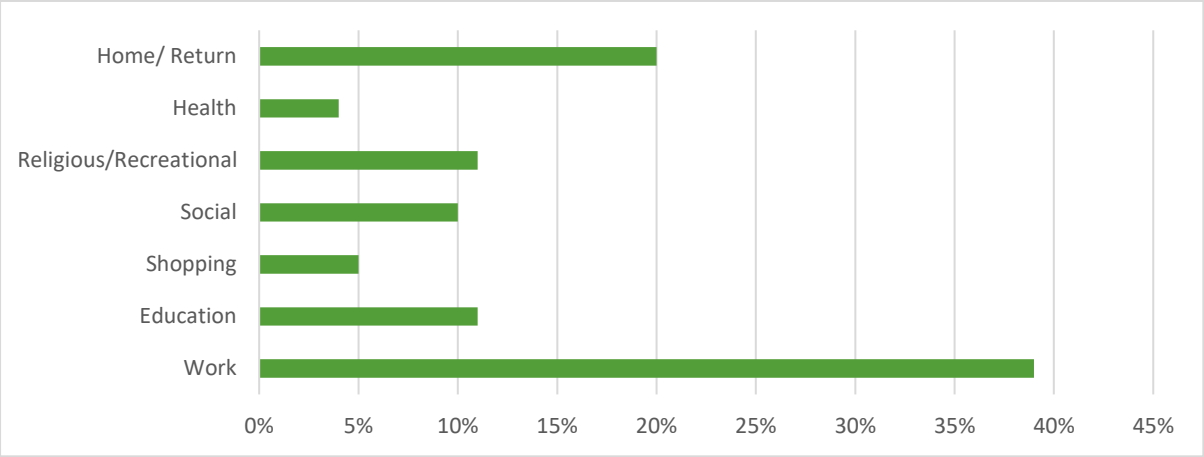


Figure 10.3.2 TRIP PURPOSE FOR PASSENGER VEHICLES AT OUTER CORDON LOCATIONS

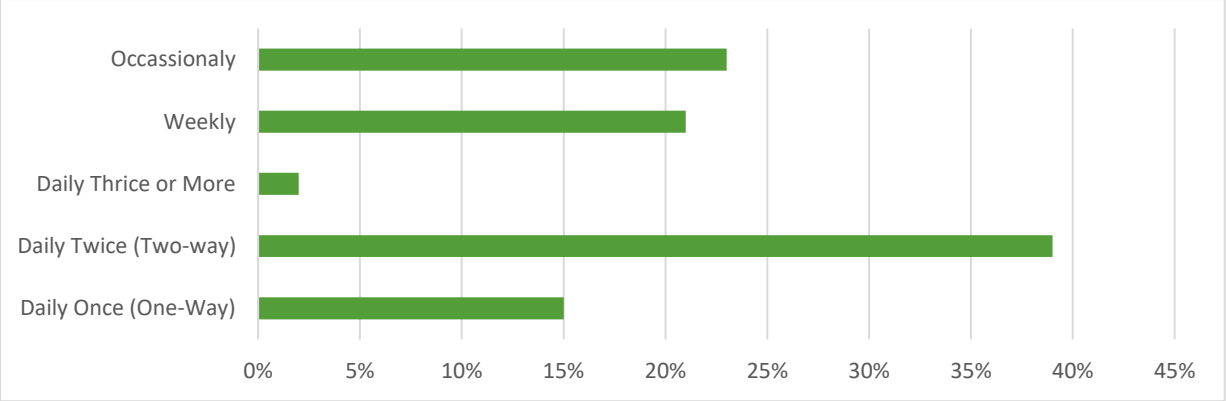


Figure 10.3.3 TRIP FREQUENCIES FOR PASSENGER VEHICLES AT OUTER CORDON LOCATIONS

The average travel distances captured for the passenger vehicles at the outer cordon locations are as shown in Figure 10.3.5.

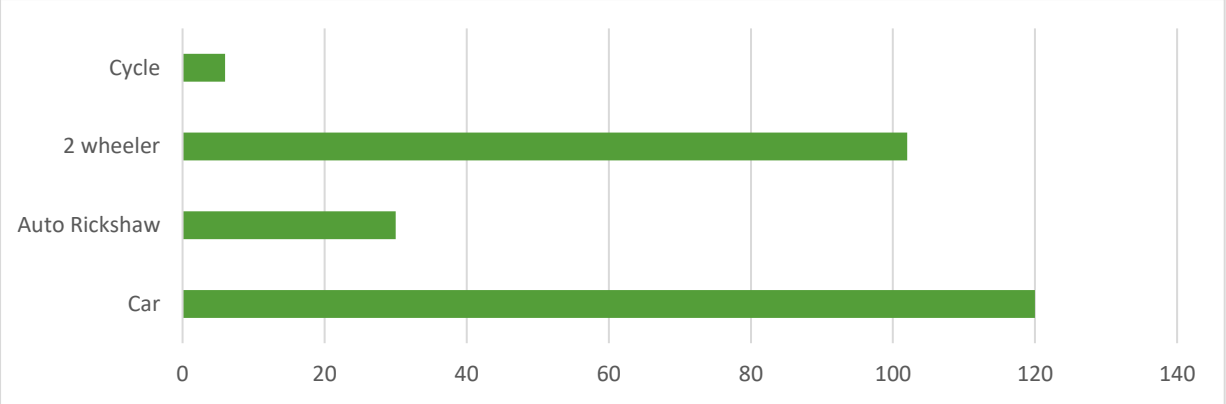


Figure 10.3.4 AVERAGE TRAVEL DISTANCES AT OUTER CORDON LOCATIONS

10.4 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.

Location: The survey was conducted at five outer cordon points as shown in Figure 10.3.1 and Table 10.3.1.

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 10.4-1 represents the daily traffic volume at outer cordon.

Table 10.4-1 DAILY VOLUME AT OUTER CORDON LOCATIONS

Location ID	Towards Anantapur		Away From Anantapur		Total		% Incoming PCU	% Out going PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
OC 01	4,882	5,534	6,143	7,168	11,025	12,702	43.6%	56.4%
OC 02	9,554	10,292	11,085	13,823	20,639	24,116	42.7%	57.3%
OC 03	5,878	6,585	6,777	7,769	12,655	14,354	45.9%	54.1%
OC 04	11,135	14,172	9,633	14,784	20,768	28,956	48.9%	51.1%
OC 05	8,829	10,748	8,476	10,744	17,305	21,492	50.0%	50.0%
OC 06	8,894	11,282	8,476	10,744	17,370	22,026	51.2%	48.8%

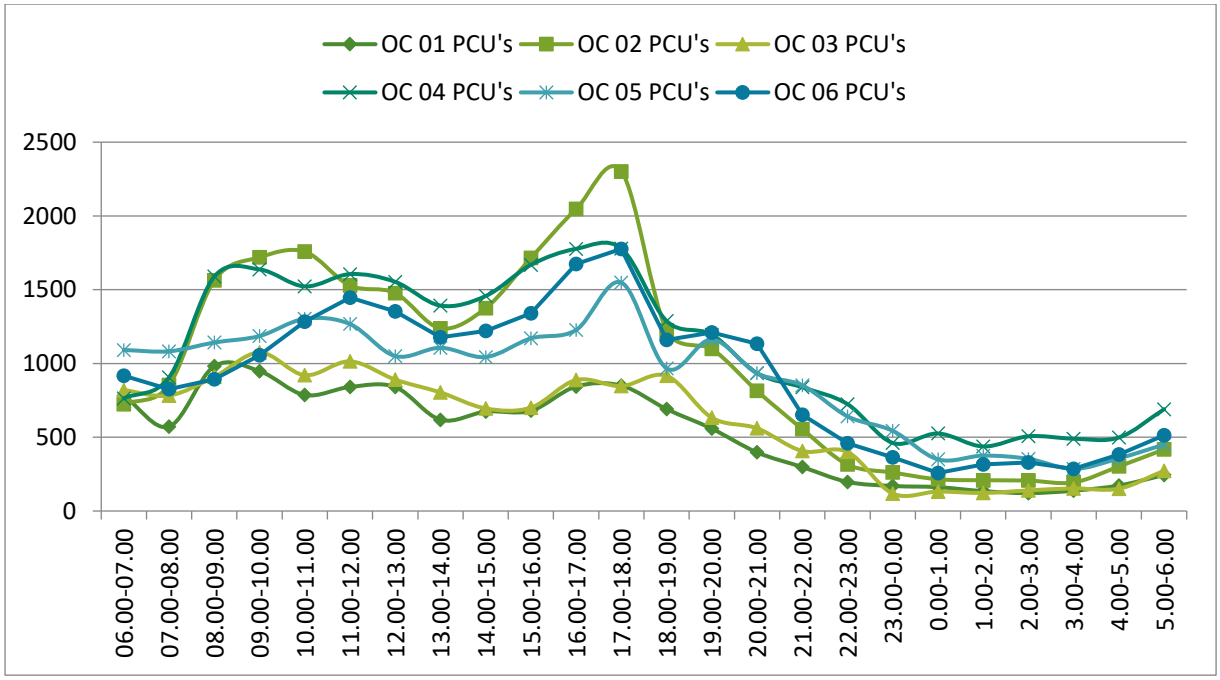


Figure 10.4.1 HOURLY VARIATIONS OF PCUS AT OUTER CORDON LOCATIONS

Table 10.4-2 PEAK HOUR VOLUMES AT OUTER CORDON LOCATIONS

Location ID	Peak Hour	Towards Anantapur		Away From Anantapur		Total	
		Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
OC 01	**08.30-09.30**	500	533	517	578	1,017	1,111
OC 02	**16.30-17.30**	736	792	1,255	1,950	1,991	2,743
OC 03	**09.00-10.00**	541	568	521	507	1,062	1,075
OC 04	**17.00-18.00**	782	903	794	876	1,576	1,779
OC 05	**17.00-18.00**	598	710	685	839	1,283	1,549
OC 06	**16.30-17.30**	817	1,228	678	774	1,495	2,001

Table 10.4-3 PEAK HOUR VOLUME SHARES AT OUTER CORDON LOCATIONS

ID	Location	Peak Hour PCUs	Daily PCUs	Share

OC 01	Near Akkammagarlu Temple	1,111	12,702	8.7%
OC 02	Near B K Samudram	2,743	24,116	11.4%
OC 03	Near Chandraprabha Swimming pool	1,075	14,354	7.5%
OC 04	Near Pamurai	1,779	28,956	6.1%
OC 05	Near Rapthadu	1,549	21,492	7.2%
OC 06	Near S K University	2,001	22,026	9.1%

It is observed that two-wheelers constitute the highest accounting to about 46.3% of the modal share at outer cordon locations preceding Goods (21.0%) and Car/Jeep/Van (15.8%) shares. The modal share for the same are as shown in Figure 10.4.2 and Table 10.4-3.

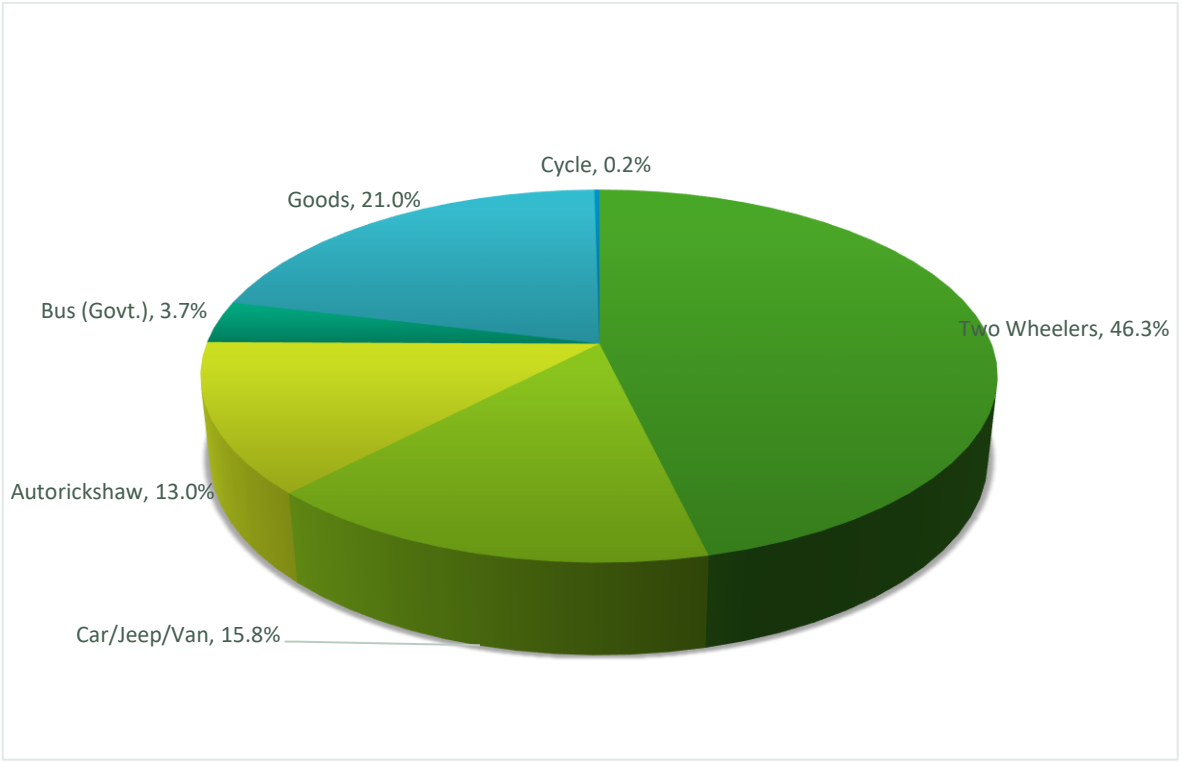


Figure 10.4.2. OVERALL DAILY TRAFFIC COMPOSITION AT OUTER CORDON LOCATIONS

Table 10.4-4 LOCATIONWISE CLASSIFICATION OF DAILY TRAFFIC

MODE	OC_1	OC_2	OC_3	OC_4	OC_5	OC_6
Two Wheelers	51.5%	53.4%	54.3%	44.3%	39.7%	39.9%
Car/Jeep/Van	15.5%	12.9%	9.9%	16.2%	24.4%	20.7%

Auto Rickshaw	13.4%	16.3%	17.8%	10.1%	5.6%	10.3%
Bus (Govt.)	3.3%	2.9%	3.3%	3.8%	3.0%	4.1%
Goods	15.5%	13.9%	14.1%	25.2%	26.9%	24.4%
Cycle	0.5%	0.4%	0.4%	0.0%	0.1%	0.2%

Key Inferences:

1 The outer cordon location OC-4 has highest traffic volume due to along the Ballary Road.

2 Two-wheelers contribute to the highest modal share (46.3%) at the survey outer cordon locations.

3 Highest volume at peak is observed along the B K Samudram

10.5 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.

Location: The survey was conducted at four screen lines points along the two north-south and east-west screen lines as shown in Figure 10.5.1 and Table 10.5.1.

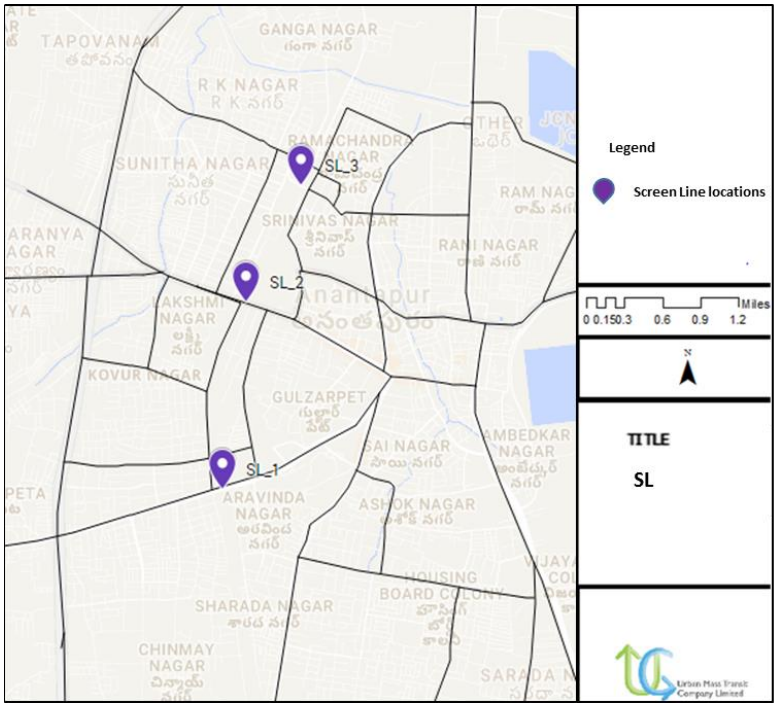


Figure 10.5.1 SCREEN LINE LOCATIONS

Table 10.5-1 SCREEN LINE LOCATIONS

CODE	LOCATIONS
SL_1	Government Hospital Road, Near RTC Bus Stop
SL_2	Bellary Urvakonda Anantapur Road, Near PTC Ground
SL_3	Flyover, Near Railway Station

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 10.5-2 represents the daily traffic volume at Screen Lines.

Table 10.5-2 DAILY VOLUME AT SCREEN LINE LOCATIONS

Location ID	East Bound		West Bound		Total		% Incoming PCU	% Out going PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
SL_1	10,504	8,807	10,865	9,613	21,369	18,420	48%	52%
SL_3	12,937	11,696	13,916	12,084	26,853	23,780	49%	51%
Location ID	North Bound		South Bound		Total		% Incoming PCU	% Out going PCU
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs		
SL_2	21,469	21,829	23,945	24,581	45,415	46,410	47%	53%

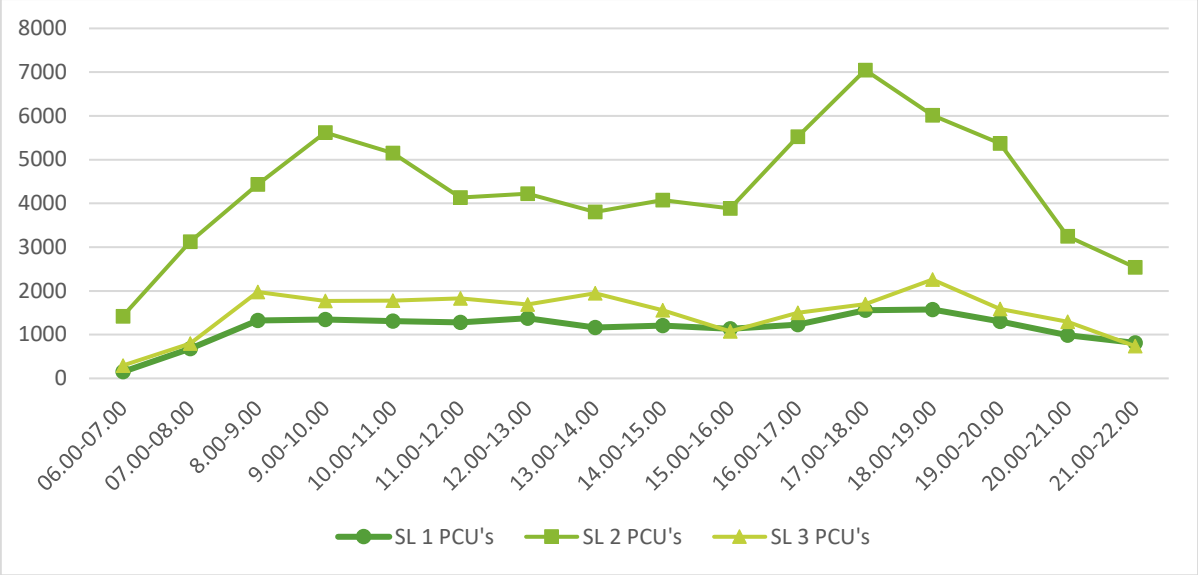


Figure 10.5.2 HOURLY VARIATIONS OF PCUS AT SCREEN LINE LOCATIONS

Table 10.5-3 PEAK HOUR VARIATIONS AT SCREEN LINE LOCATIONS

Location ID	Morning Peak Hour	Total PCUs	Evening Peak Hour	Total PCUs
SL_1	08.15-09.15	1424	17.15-18.15	1618
SL_2	09.15-10.15	3586	17.00-18.00	3802
SL_3	08.15-09.15	2023	18.00-19.00	2259

Table 10.5-4 PEAK HOUR SHARE AT SCREEN LINE LOCATIONS

ID	Location	Peak Hour PCU	Daily PCU	Share
SL_1	Level Crossing Near Ram Nagar gate	1618	18,420	8.8%
SL_2	ROB Near Clock tower	3802	46,410	8%
SL_3	Sypulla bridge near railway station	2259	23,780	9.5%

It is observed that two wheelers constitute the highest accounting to about 65.4% of the modal share at screen line locations, followed by Auto Rickshaws with 25.3%. The modal share for the same are as shown in Figure 10.5.3 and Table 10.5-3.

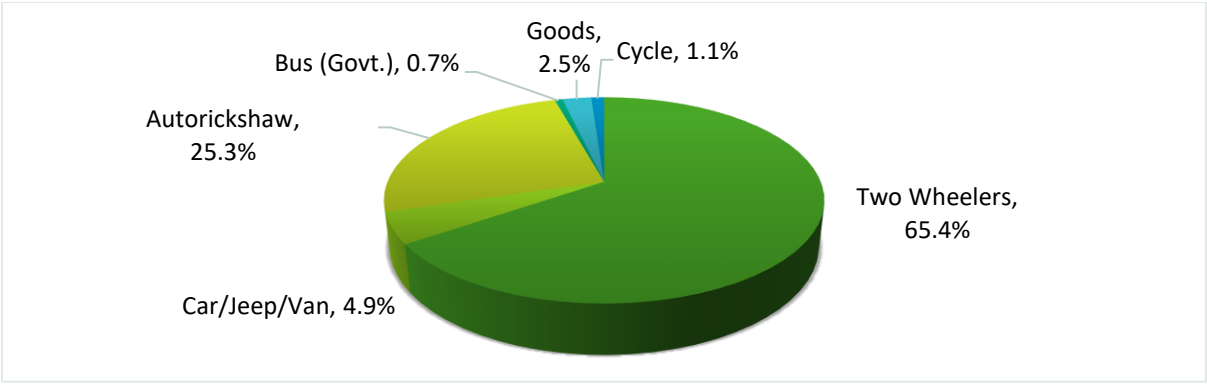


Figure 10.5.3 OVERALL DAILY TRAFFIC COMPOSITION AT SCREEN LINE LOCATIONS

Table 10.5-5 LOCATIONWISE CLASSIFICATION OF DAILY TRAFFIC

MODE	SL 01	SL 02	SL 03
Two Wheelers	74.6%	59.3%	73.4%
Car/Jeep/Van	2.1%	6.2%	4.1%
Autorickshaw	16.9%	30.5%	18.7%
Bus (Govt.)	0.2%	1.0%	0.3%
Goods	1.7%	2.5%	3.0%
Cycle	4.3%	0.4%	0.4%

KeyInferences:

1 The screen line location SL-2, Bellary Urvakonda Anantapur Road, Near PTC Ground has the highest volume due to its location oh the highway connecting to ballary-Bangalore.

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

10.6 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.

Location: The survey was conducted at six screen line points as shown in Figure 10.5.1 and Table 10.5.1.

Analysis: From the table it is observed that bus occupancy varies from 29 to 48 and averages out at 40. Average occupancy for cars and two wheelers is found to be 3.5 and 1.5 respectively. The Auto Rickshaw has an average occupancy of 3.9.

Table 10.6-1 OCCUPANCY AT SCREEN LINE LOCATIONS

CODE	Direction	Two Wheeler	Car	Auto Rickshaw	Bus	Cycle	Cycle Rickshaw
SL_1	Fish Market to Govt. Hospital	1.5	3.4	3.2	32.0	1.0	1.0
	Govt. Hospital to Fish Market	1.5	3.3	3.3	27.0	1.0	1.6
SL_2	Stadium to Clock Tower	1.3	3.7	4.5	28.9	1.0	1.0
	Clock Tower to Stadium	1.6	4.0	3.9	28.8	1.0	1.1
SL_3	Flyover to life line Hospitals	1.5	3.5	4.5	46.4	1.0	1.4
	Life Line Hospital to Flyover	1.6	4.0	4.4	47.1	1.0	1.3
Overall		**1.5**	**3.7**	**4.0**	**35.0**	**1.0**	**1.2**

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 2.6, while the average occupancy of shared auto rickshaw (7seater) is observed to be 5.7.

10.7 TURNING MOVEMENT COUNTS AT INTERSECTIONS

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

Conduct: Video traffic counts were carried out on a typical working day for a duration of 16 hours at all locations listed below. At each identified intersection, for all arms both directional counts will be carried out by vehicle type. I.e. cars, jeeps, vans, buses, trucks, MAVs, LCV's tractors, motorized two wheelers and slow-moving vehicles as shown in the survey format in Annexure A.

Locations: Four critical intersections were identified as shown in Figure 10.7.1 and Table 10.7.1.

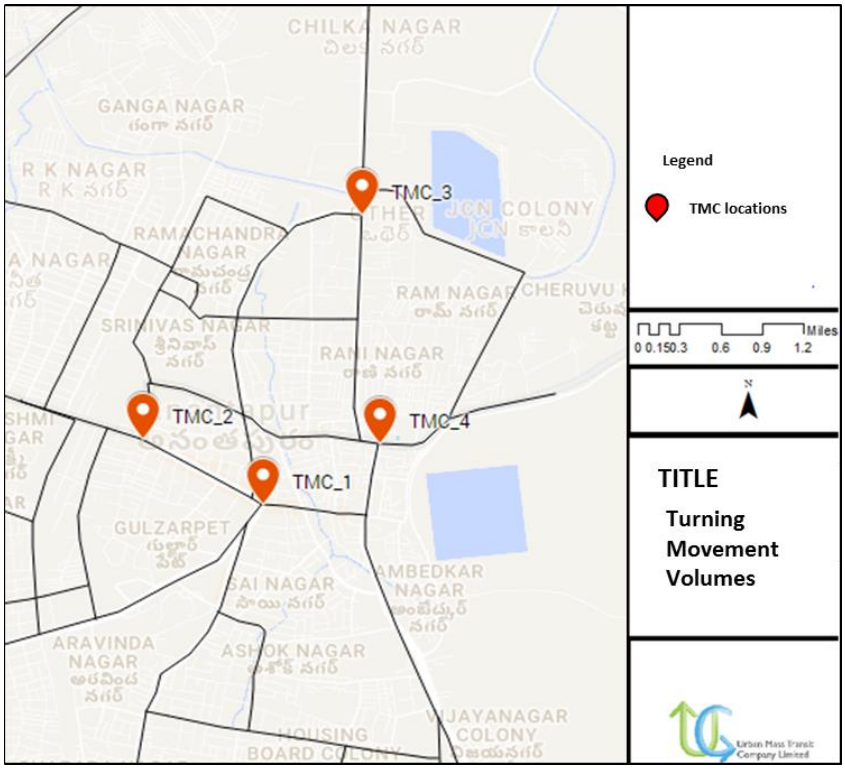


Figure 10.7.1 TMC LOCATIONS

Table 10.7-1 TMC LOCATIONS

CODE	LOCATION
TMC_1	Sapthagiri Circle
TMC_2	Clock Tower Junctipn
TMC_3	Dparmental Bus Stop Junction
TMC_4	Galam Street Junction

Analysis: The quantum and temporal variation of total daily traffic, intensity and composition of vehicles and passenger trips moving in the study area are presented in the following sections. Table 10.7-2 represents the daily traffic volume at the surveyed intersections.

Table 10.7-2 DAILY TRAFFIC VOLUME AT INTERSECTIONS

Code	Location	Total Vehicles	Total PCUs
TMC_1	Sapthagiri circle	39098	40093
TMC_2	clock tower junction	42556	44737
TMC_3	Mirchi godown circle	11087	12911
TMC_4	galam street junction	13830	16540

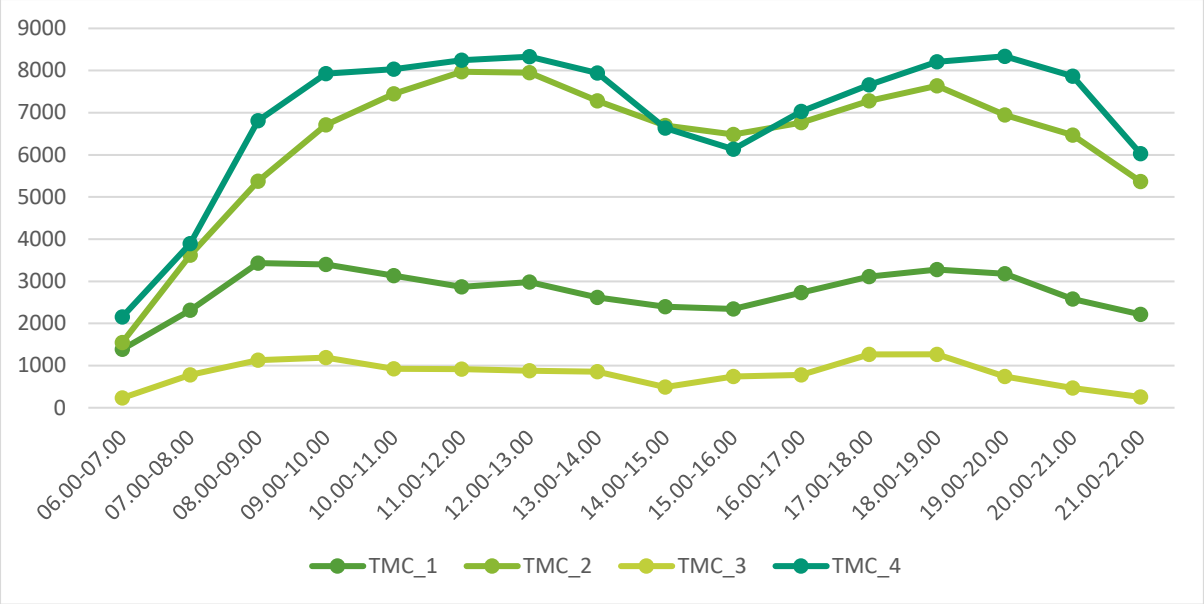


Figure 10.7.2 HOURLY VATIATIONS OF DAILY TRAFFIC VOLUMES

Table 10.7-3PEAK HOUR TRAFFIC VOLUMES

Location ID	Location	Peak Hour	Morning Peak		Peak Hour	Evening Peak		Daily Total PCUs
			PCUs	PH%		PCUs	PH%	
TMC_1	Sapthagiri circle	**09.45-10.45**	**3361**	**8%**	**17.45-18.45**	**3351**	**8%**	40093
TMC_2	clock tower junction	**10.15-11.15**	**3949**	**9%**	**18.00-19.00**	**4030**	**9%**	44737
TMC_3	Mirchi godown circle	**08.45-09.45**	**1232**	**10%**	**17.30-18.30**	**1469**	**11%**	12911
TMC_4	galam street junction	**10.00-11.00**	**2919**	**9%**	**17.30-18.30**	**2570**	**8%**	16540

It is observed that two wheelers constitute the highest accounting to about 61.9% of the modal share at survey intersections, followed by auto rickshaws with 25.0%. The modal share for the same are as shown in Figure 10.7.2 and Table 10.7-3.

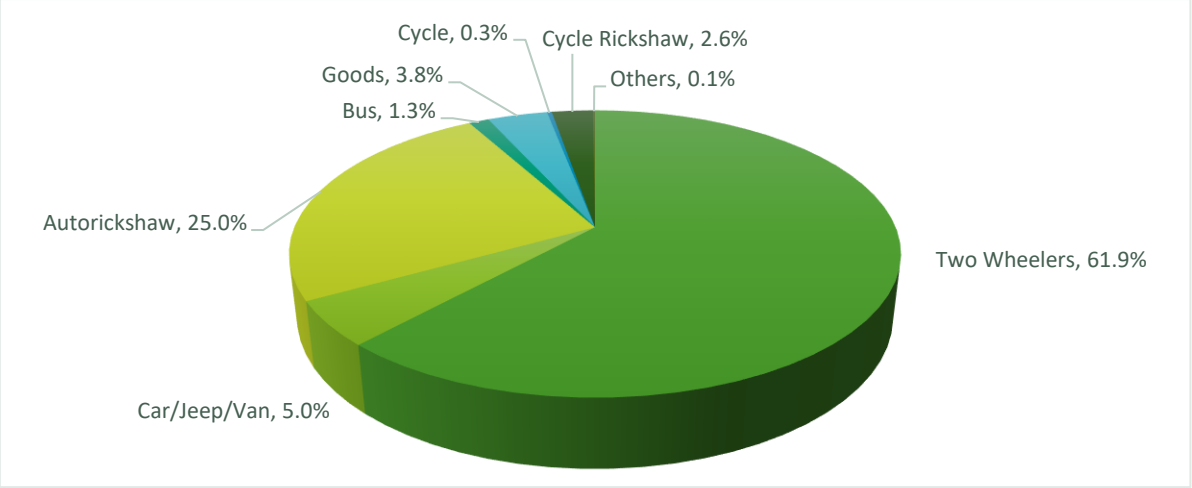


Figure 10.7.3 TRAFFIC COMPOSTION AT TMC LOCATIONS

Table 10.7-4 LOCATION WISE TRAFFIC COMPOSITION FOR INTERSECTIONS

MODE	TMC_1	TMC_2	TMC_3	TMC_4
Two Wheelers	66%	63%	53%	49%
Car	4%	6%	5%	5%
Auto rickshaw	23%	22%	32%	34%
Bus	1%	1%	2%	1%
Goods	2%	4%	7%	7%
Cycle	1%	10%	1%	1%
Cycle rickshaw	3%	3%	1%	3%

Key Inferences:

1. Highest traffic volume is observed at Sapthagiri Circle and Clock Tower Circle.
2. Two wheelers contribute to the higher share of traffic composition in the city, followed by auto rickshaws.
3. Highest share of two wheelers are observed at Sapthagiri circle, the highest share of auto rickshaws are observed at Galam street and clock tower junction has highest share of cars.

10.8 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.

Locations: The surveys were conducted at all the two public transit terminals present in in Anantapur.

Table 10.8-1 TERMINAL SURVEY AND COUNTS LOCATIONS

CODE	LOCATION
TC_1	Anantapur Railway Station
TC_2	Anantapur Bus Station

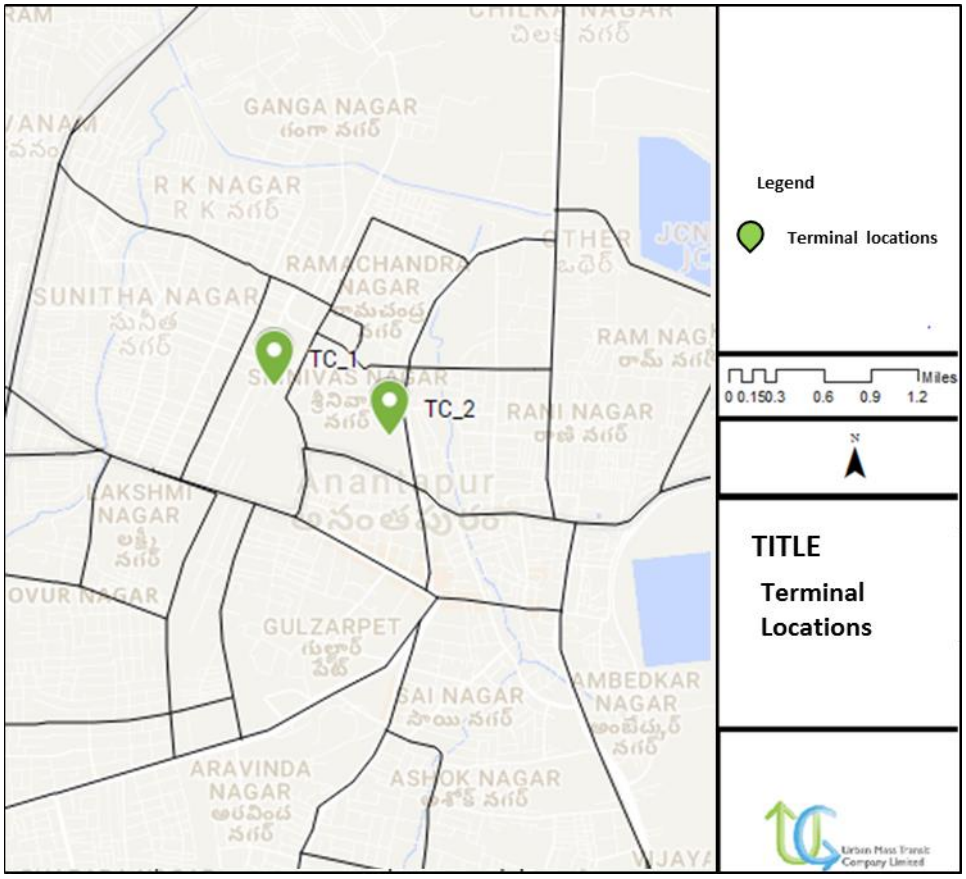


Figure 10.8.1 TERMINAL SURVEY LOCATIONS

Analysis: The terminal passenger surveys indicate that Anantapur RTC Bus Stand has the highest share of passenger volume accounting up to 44%, followed by Anantapur Railway Station. The in and out

flow volumes are shown in Table 10.8-2. The hourly variations at these terminals are as shown in Figure 10.8.2.

Table 10.8-2 TERMINAL PASSESNGER VOLUMES

S. No.	Code	Name of the Terminal	Buses			Passengers			Occupancy	% Share of Overall Passengers
			In	Out	Both	In	Out	Both	Both	
Bus Station										
1	TC_1	RTC BUS STATION	797	777	797	13602	11539	25141	31.5	82%
Railway Station										
2	TC_2	Anantapur Railway Station				2982	2410	5392		18%
Grand Total						16584	13949	30533		100%

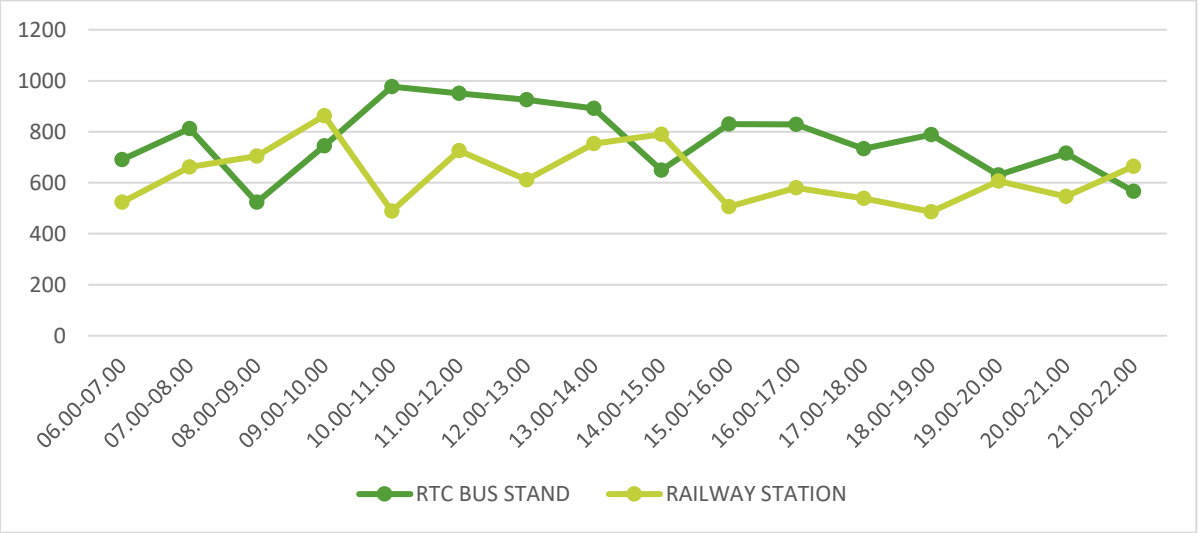


Figure 10.8.2 HOURLY VARIATIONS OF PASSENGERS AT TERMINAL LOCATIONS

It is observe d that the peak period the Bus based transit is between 11am to 2pm, and evening 6pm to 7pm for the rail based transit. The peak hour volumes are shown in Table 10.8-3.

Table 10.8-3 PEAK HOUR PASSENGER VOLUMES AT TERMINAL LOCATIONS

Code	Name of the Terminal	Peak Hour	Passengers			% Share in Total Volumes		
			In	Out	Both	In	Out	Both
Bus Station								
TC_1	RTC BUS STATION	12.45-13.45	851	859	2303	6%	7%	9%
Railway Station								
TC_3	RAILWAY STATION	06.00-07.00	371	550	729	12%	23%	14%

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

It is observed that majority of the trips are work based trips accounting to 40% of the total trips, which is observed to be justified by tip frequency distribution wherein 45% of the trips are made on daily basis (Table 10.8-4 and Table 10.8-5).

Table 10.8-4 DISTRIBUTION OF TERMINAL PASSENGER TRIPS BASED ON PURPOSE

PURPOSE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Work	38%	34%	41%
Education	17%	16%	17%
Shopping	3%	4%	2%
Social	20%	19%	20%
Religious/Recreation	6%	5%	7%
Health	1%	1%	1%
Home(Return)	13%	15%	10%
Others	4%	6%	2%

Table 10.8-5 DISTRIBUTION OF TERMINAL PASSENGER TRIPS BASED ON FREQUENCY

FREQUENCY	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
Daily once(one-way)	23%	27%	36%
Daily twice(up & down)	21%	13%	9%
Daily thrice or more	1%	2%	1%
Weekly	29%	32%	24%
Occasionally	26%	26%	30%

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 10.8-6 and Figure 10.8-6.

Table 10.8-6 MODE WISE DISPERASL OF TERMINAL PASSENGERS

DISPERSAL MODE	TOTAL	BUS PASSENGERS	RAIL PASSENGERS
2-wheeler	38%	30%	6%
Car/Jeep/Van	2%	1%	1%
Auto Rickshaw	40%	21%	21%
Bus	16%	10%	4%
Cycle	3%	3%	1%
Walk	1%	1%	1%

10.9 BOARDING AND ALIGHTING 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 4 bus stop locations as shown in Table 10.9.1 and Figure 10.9.1

Table 10.9-1 BOARDING AND ALIGHTING SURVEY LOCATIONS

CODE	LOCATIONS
BS_1	Collector Office Bus Stop
BS_2	Neelam Theater Bus Stop
BS_3	PTC Bus Stop
BS_4	Balaji Bus Stop

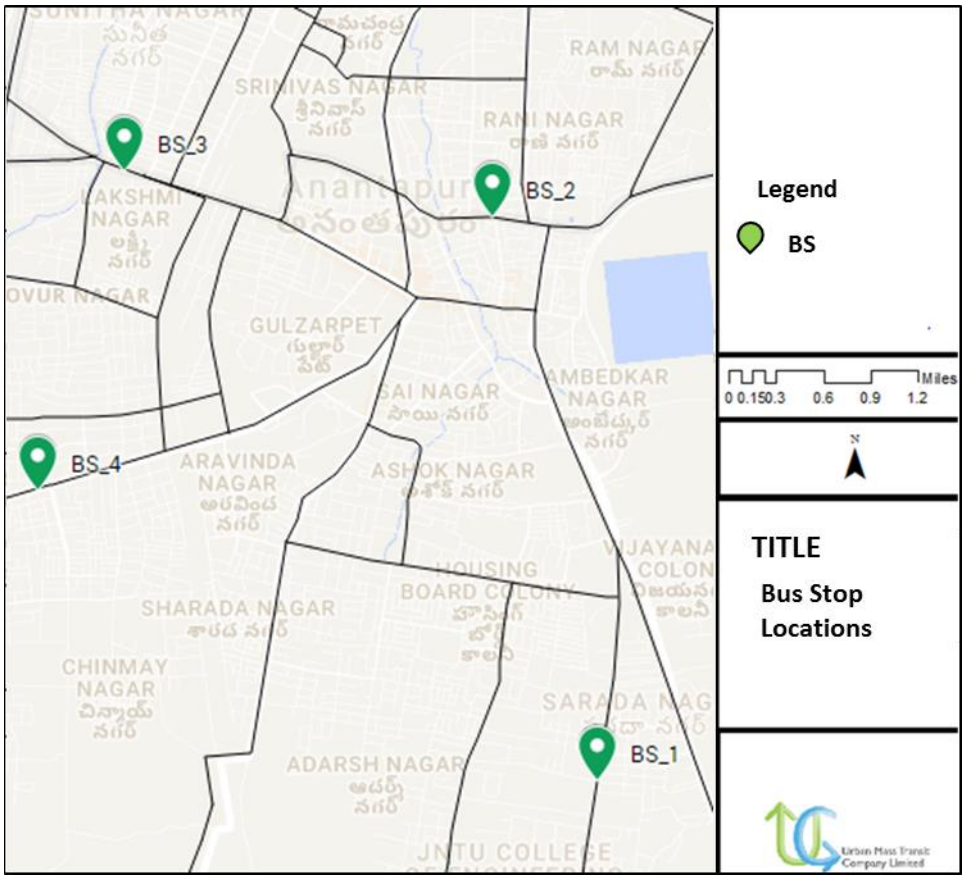


Figure 10.9.1 BOARDING AND ALIGHTING SURVEY LOCATIONS

Analysis: The results boarding and alighting survey indicates that Collector Office Stop has the highest number of passengers boarding and alighting amongst all the surveyed locations. The following Table 10.9.2 represents the location wise boarding and alighting at surveyed locations.

Table 10.9-2 BOARDINGS AND ALIGHTINGS AT SURVEYED LOCATIONS

CODE	LOCATIONS	PB	PA	Total PB+PA	Average Dwell Time (min)
BS_1	Collector Office Bus Stop	845	637	1482	1.1
BS_2	Neelam Theater Bus Stop	572	453	1025	1.2
BS_3	PTC Bus Stop	592	527	1119	1
BS_4	Balaji Bus Stop	425	402	827	1
Total		**2434**	**2019**	**4453**	**1.1**

Table 10.9-3 MODE WISE BOARDINGS AND ALIGHTINGS

Mode	PB	PA	Total PB+PA	PB	PA	Dwell Time (min)	Sitting	Stan -ding
Intercity Bus	1460	1211	2672	55%	45%	1.05	28	0
Charted Bus	584	485	1069	54%	46%	1.1	37	0
Mini/Midi Bus	389	323	712	51%	49%	1	38	0
All Modes	2434	2019	4453	55%	45%	1.05	34	0

The major mode of public transport in the city is through sub-urban bus services and auto-rickshaws. The sub-urban services account to 60% of all the bus-based transit modes. The Table 10.9.3 represents the mode wise boarding and alighting details at surveyed locations.

Key Inferences:

1. Collector Office bus stop is observed to have higher footfalls with respect to the boarding and alighting due to its proximity to government institutions and JNT University.
2. Intercity or the sub-urban bus services are providing the inter-city and intra city services in Anantapur.

10.10 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.

Locations: The survey was conducted at workplaces, through roadside interviews at above identified 4 TMC locations (Figure 10.9.1 and Table 10.9.1).

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.

It is observed that 26.48% of the users are willing to use a new and improved public transport facilities with a waiting time of 4 minutes and below and reduction in travel time and cost over 25% of their existing modes. The Table 10.10.1 details out the results of users' preferences.

Table 10.10-1 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	26%	16%	26%	29.5%	26.5%	31%	29%	31%	26.8%
2	Probably Existing	22.5%	34%	34.5%	32.5%	36.0%	30.5 %	28.5%	32.5%	31.3%
3	Can't Say	28.5%	27%	15.0%	21%	11.5%	16.5 %	14.5%	12.5%	18.3%
4	Probably Improved PT System	21.5%	10%	11.5%	5.0%	12.0%	10.5 %	12%	11.5%	11.7%
5	Definitely Improved PT System	1.50%	13%	13%	12%	14.0%	11.5 %	16%	12.5%	11.6%
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%

Key Inferences:

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

10.11 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.

Location: The survey is conducted at across the 4 TMC locations (Figure 10.9.1 and Table 10.9.1.) which were observed to be the major IPT catchments nodes in Anantapur.

Analysis: It is observed that majority of the IPT trips were work based trips followed by educational trips (Figure 10.11.1). The average distances commuted by the surveyed passenger's trip purposes are as shown in 10.11.2. It is observed that, for the surveyed passengers the average distance of work trips is about 3.8km and over 3.5km for educational and about 2.8 km for the remaining trips.

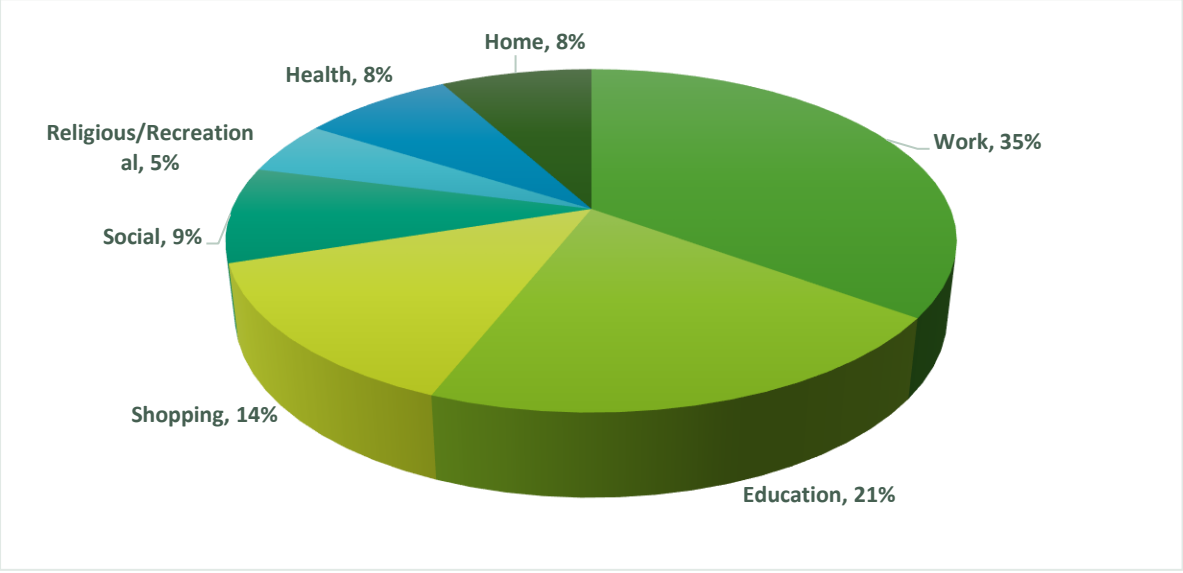


Figure 10.11.1 DISTRIBUTION IPT COMMUTER TRIPS BASED ON TRIP PURPOSE[10]

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

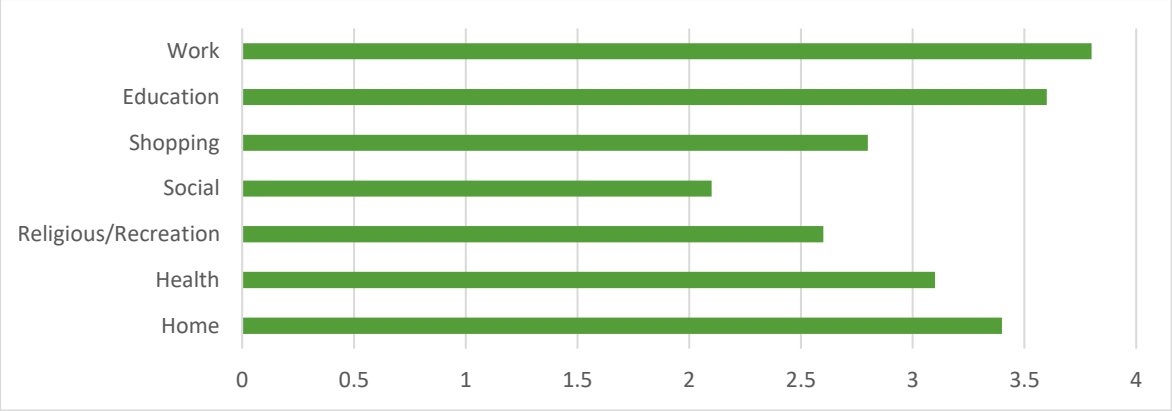


Figure 10.11.2 TRIP PURPOSE BASED AVERAGE TRIP DISTANCES [2]

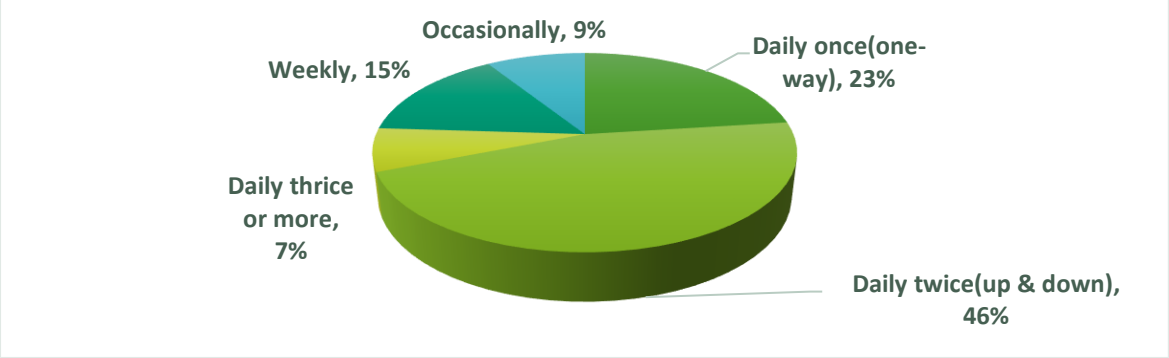


Figure 10.11.3 DISTRIBUTION IPT COMMUTER TRIPS BASED ON TRIP FREQURNCEY[11]

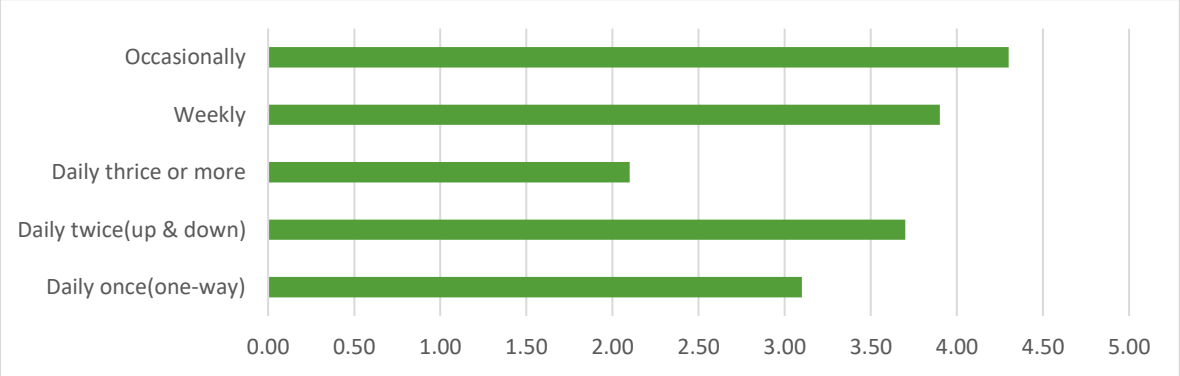


Figure 10.11.4 TRIP FREQUENCY BASED AVERAGE TRIP DISTANCES [3]

About 76% of the surveyed IPT passenger trips were observed to be daily trips followed by weekly trips accounting to 15% of the total trips (Figure 10.11.3). The average trip distance of daily trips is about 3km while the occasional users is about 4.3km. Thus, the work based daily trips are made within a distance of 5kms. The Figure 10.11.4 shows average trip lengths of survey passengers' base on the trip frequency.

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

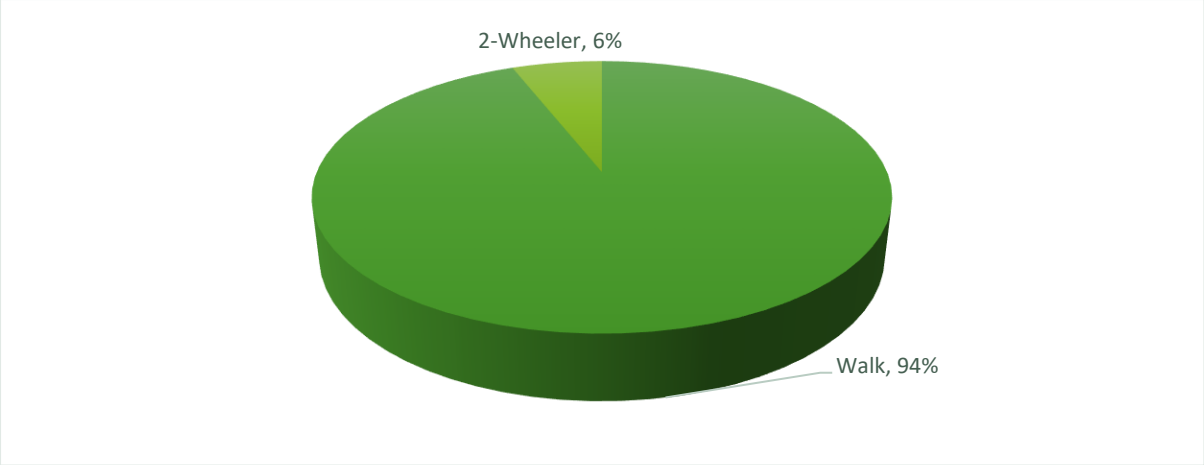


Figure 10.11.5 MODE WISE DISTRIBUTION OF ACCESS AND EGRESS TRIPS

In case of Anantapur, 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 10.11.5. The trip characteristics of surveyed IPT passengers are as shown in Table 10.11-.1.

Table 10.11-1 IPT COMMUTER ACCESS AND EGRESS TRIPS TRAVEL CHARACTERISTICES

ACCESS/ EGRESS MODE	AVERAGE TIME TIME (MIN)	AVERAGE TRAVEL COST (RS)
2-Wheeler	3.6	10
Walk	6	0

Key Inferences:

1 35% 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 4km 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 5 minutes.

5 The average distances of last mile walk trips of IPT commuters is about 0.85km.

10.12 PEDESTRIAN COUNT SURVEYS

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

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

Locations : The following 4 locations were identified for the same (Table 10.9-1 and Figure 10.9.1).

Analysis: It is observed that Sapthagiri circle, Galam Street and Clock tower has the highest volume of footfall due to its strategic location connecting the various commercial activities. The pedestrian daily volumes and peak hour volumes are as shown in Table 10.12-2 and the hourly variations in daily volumes is shown in figure 10.12.1.

Table 10.12-1 PEDESTRIAN VOLUMES

CODE	LOCATION	Daily Volume	Peak Hour	Peak Hour Volume
TMC_1	Sapthagiri circle	27844	12.15-13.15	2402
TMC_2	clock tower junction	27313	10.15-11.15	1570
TMC_3	Mirchi godown circle	1572	08.45-09.45	135
TMC_4	galam street junction	27692	09.15-10.15	2055

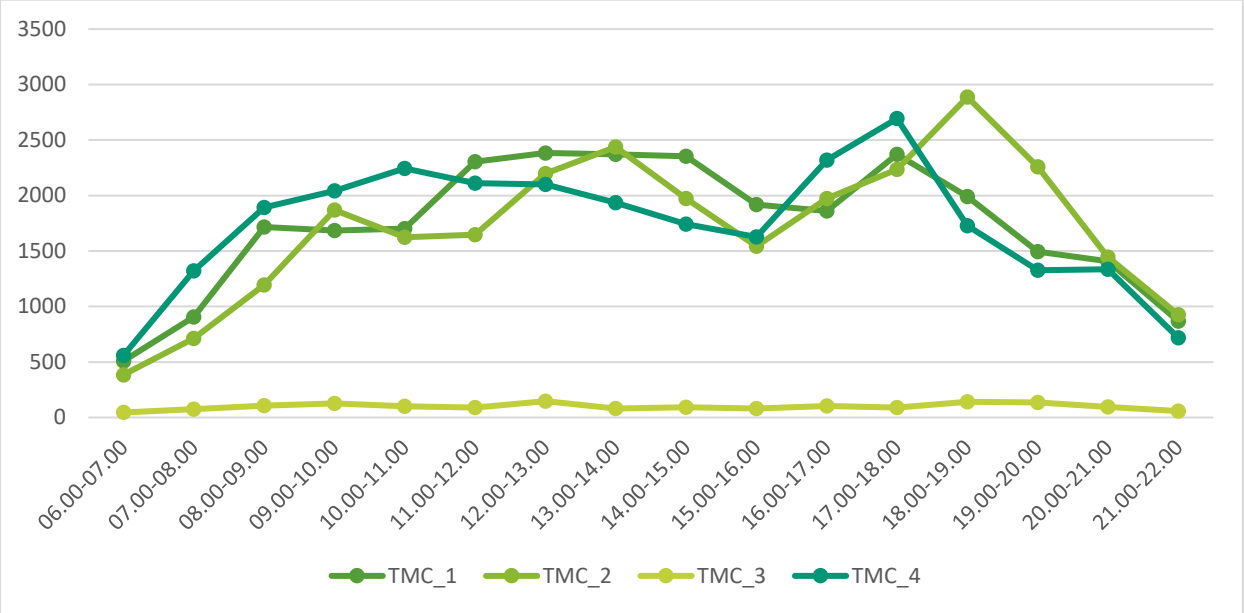


Figure 10.12.1 HOURLY VARIATIONS IN PEDESTRAIN VOLUMES

The degree of conflict between the pedestrians and vehicles is analysis and it observed that clock tower circle requires design-based interventions in terms of crossing facilities. The Table 10.12-3 exhibits the values for the PV square analysis.

Table 10.12-2 PV SQUARE ANALYSIS VALUES

CODE	LOCATION	PV Square/10^8 Value
TMC_1	Sapthagiri circle	2.88
TMC_2	Clock Tower Junction	4.87
TMC_3	Mirchi Godown circle	0.04
TMC_4	Galam Street Junction	0.63

Key Inferences:

1. Sapthagiri Circle is observed to have highest footfall amongst all the surveyed locations.
2. Clock Tower Circle require design-based interventions in terms of crossing facilities to minimise the degree of pedestrian conflicts.

10.13 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.

Locations : The survey was conducted in the following two location as shown in Figure 10.13.1 and Table 10.13-1.

Table 10.13-1 GOODS OPERATOR SURVEY LOCATIONS

CODE	LOCATION
GO_1	Industrial Estate
GO_2	Gooty Road

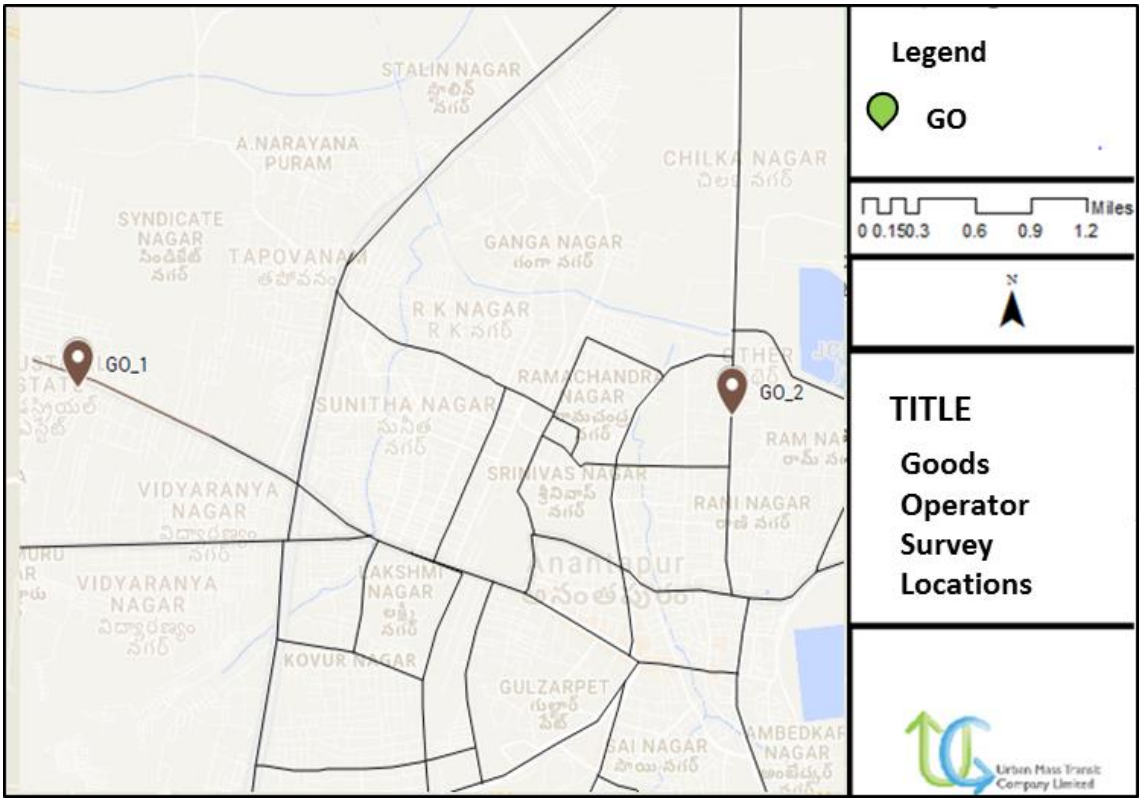


Figure 10.13.1 GOODS OPERATOR SURVEY LOCATIONS

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 10.13.2.

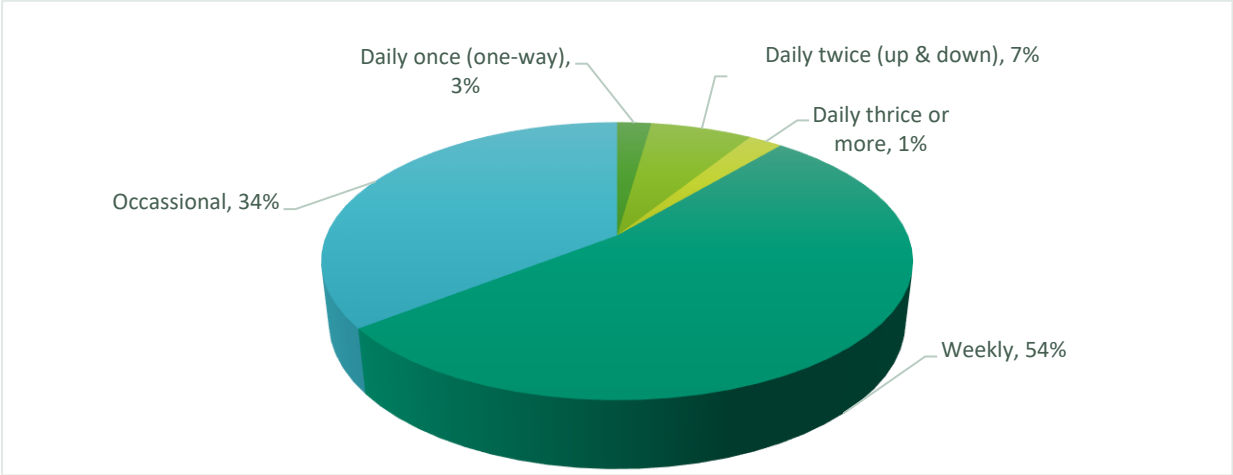


Figure 10.13.2 TRIP FREQUENCIES OF GOODS VEHICLES

The list of major routes used by goods operators are shown in Table 10.13-2.

Table 10.13-2 FREQUENT ROUTES OPERATED FOR GOODS VEHICLES IN THE CITY

S.NO.	GOODS VEHICLE ROUTES
1	Bangalore -Anantapur
2	Anantapur-Hyderabad
3	Anantapur- Anantapur
4	Anantapur - Vijayawada
5	Anantapur - Guntur
6	Anantapur - Nellore
7	Anantapur - Ballary

The survey indicates that 35% of the goods operates do not own designated parking areas. It was observed 52% of the operators own vehicle parking area below 500sqft, while 31% of the operators own vehicle parking area over 2000sqft. The nature of parking facilities employed by 52% of the surveyed operators is on-street parking. The nature and share of commodity type are as shown in Table 10.13-3.

Key Inferences:

1. The majority of the trip are observed are weekly trips made within the city and to the nearby towns.
2. 58% of the operation are engaged in off-street parking of vehicles adjoin their plots.
3. Chemicals and Fertilizers contribute to the highest share (27%) in commodity type, followed by others.

10.14 HOUSEHOLD SURVEY

10.14.1 SOCIO-ECONOMIC CHARACTERISTICS

10.14.1.1 DEMOGRAPHIC DISTRIBUTION

The age wise distribution of population based on the house hold data is as shown in Table 10.14-1. It observed that, Anantapur has a good share of younger population aged below 35 constituting about 69%. The working age group contribute to about more than 67% of the total population. The age-sex pyramid is as shown in Figure 10.14.1. The share of females is higher in age groups between 25 years to 34 years. The sex ratio derived from the house hold survey is 989. It is observed that ratio between the male and females across all the age groups is not well distributed.

Table 10.14-1 AGE WISE DISTRIBUTION OF POPULATION

Code	Age	All	Male	Female
1	0-5	4.68%	5.24%	4.01%
2	5-17	21.84%	23.82%	19.63%
3	18-24	10.92%	8.82%	13.30%
4	25-34	31.51%	29.05%	34.38%
5	35-44	14.32%	15.06%	13.54%
6	45-58	11.60%	11.98%	11.22%
7	59-64	3.17%	3.87%	2.40%
8	65-74	1.62%	1.72%	1.28%
9	>75	0.34%	0.43%	0.24%

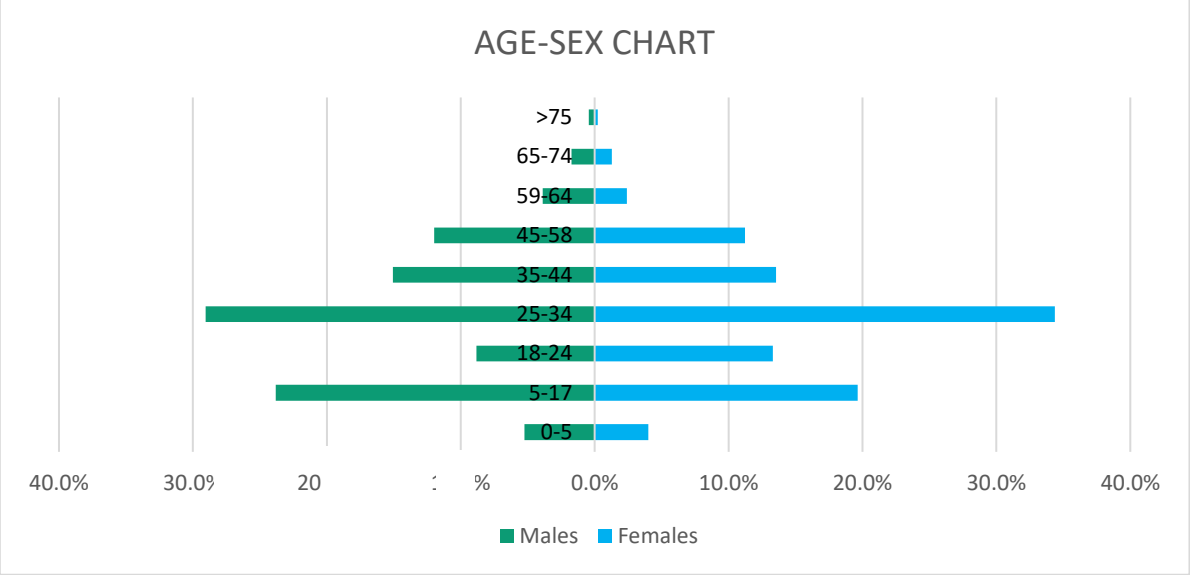


Figure 10.14.1 AGE-SEX PYRAMID

3.15.1.2 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 10.14.2. Similarly, the distribution based on occupational status and employment sector are shown below in Figures 10.14.3 and 10.14.4. It is observed that 17.5% of the population are students, 70% are employed in various sectors as shown in Figure 10.14.3 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 service sector and real estate sector with 26% and 27% respectively followed by whole sale and retail trade with a share of 16%. The manufacturing sector contributes to 3% while informal sector contributes about 0.6% and agricultural sector about 1.8%. 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 1.

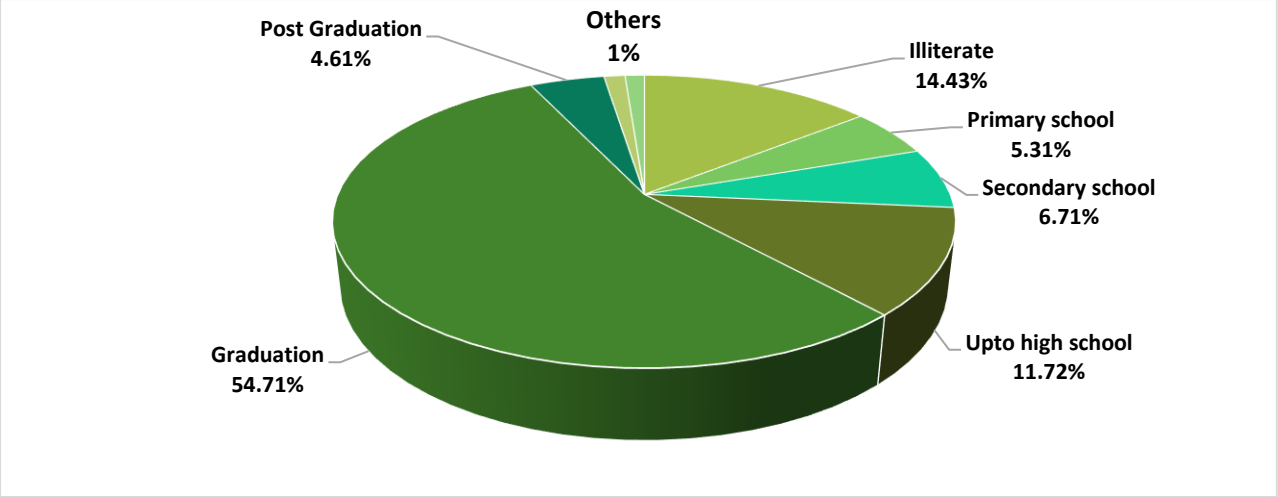


Figure 10.14.2 DISTRIBUTION BASED ON EDUCATIONAL QUALIFICATION

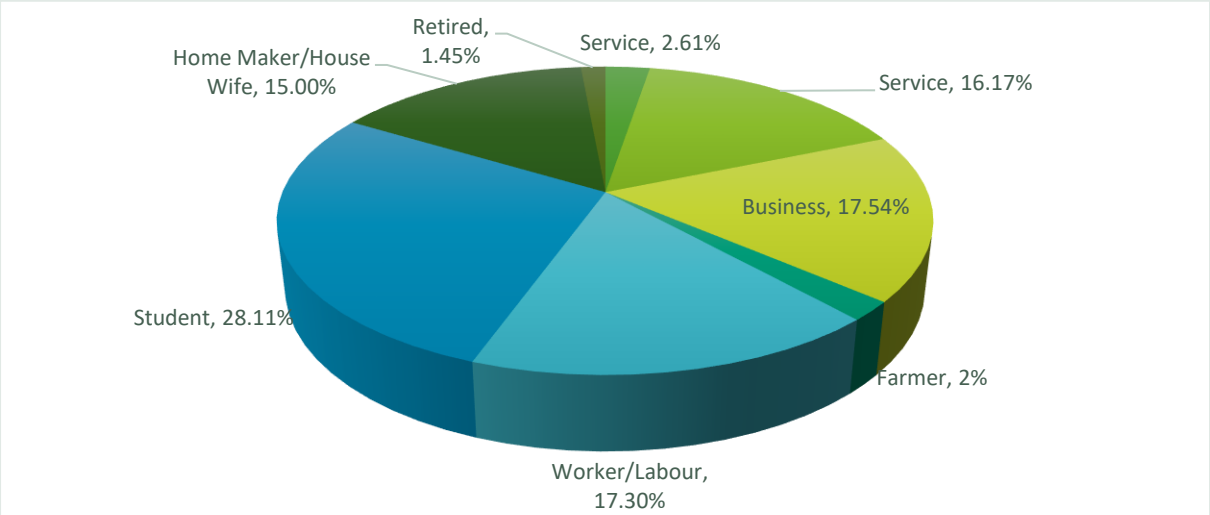


Figure 10.14.3 DISTRIBUTION BASED ON OCCUPATIONAL STATUS

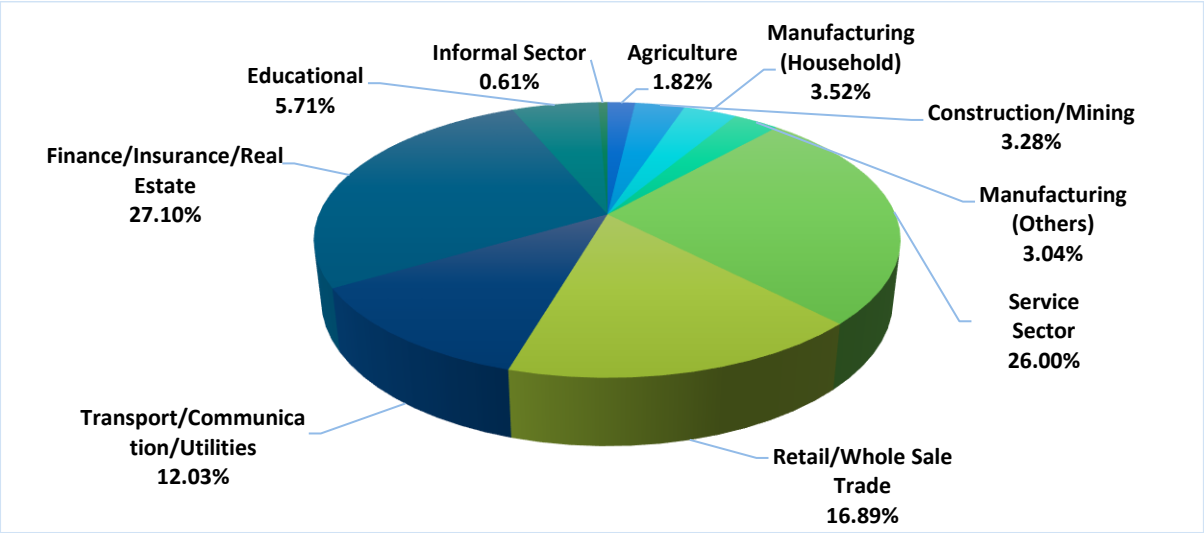


Figure 10.14.4 DISTRIBUTION BASED ON EMPLOYMENT SECTOR

The average monthly income as per the Household survey in Anantapur is about INR 9,837. The distribution of households based on monthly income is as show in Table 10.14.2. About 67% of households have monthly income between INR 10,000 to INR 15,000 and 7% 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. 1.2). The distribution is as shown in figure 10.14.5.

Table 10.14-2 DISTRIBUTION BASED ON AVERAGE MONTHLY INCOME

Code	Category	Monthly HH Income	% Distribution	Avg. Monthly HH Income (INR)
1	EWS	<5000	11%	2401
2	LIG	5001-10000	15%	6603
3	MIG	10001-15000	67%	10813
4	HIG	>15000	7%	19458
Total			100%	**9837**

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 10.14-3 PARKING AVAILABILITY WITHINTHE PROPERTY PREMISES

Code	Parking Availability	% Dist.
1	**Yes**	**77.36%**
2	**No**	**22.64%**
Total		**100%**

Table 10.14-4 DISTANCE BASED DISTRIBUTION OF HOUSEHOLDS TO DAILY NEEDS

Code	Distance to Daily needs	To Shop	Educational Needs	Medical Needs
		% Dist	% Dist	% Dist
1	<250	41%	4%	9%
2	251 to 500	30%	42%	34%
3	501 to 750	13%	4%	49%
4	751 to 1000	7%	34%	2%
5	1001 to 1500	2%	6%	1%
6	>1500	8%	10%	5%
	Total	**100%**	**100%**	**100%**

It is observed that more than 71% of the households travel below 500m to access their daily household errands. 84% of the household travel up to 1km for their educational needs and the medical needs

are majorly accessed over a distance of 500m. Thus, it id 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 10.14.2.

10.14.2 TRAVEL CHARACTERISTICS

Based on the travel dairy information collected as a part of the household survey, the Per Capita Trip Rate (PCTR) for Anantapur was observed to be 1.1 including the walk trips and 0.90 excluding the walk trips. The PCTR for motorised trips is about 0.95. The distribution of trips based on the major mode of travel is as shown in Figure 10.14.7. The major modes of travel in Anantapur are observed to be auto rickshaw and two wheelers with a model share of 18% and 55% respectively. The share of bus based public transport accounts to 7.66%. The Non-Motorised Transport comprises about 10.41% including 10% of walk trips. Thus, the clearly indicating that auto rickshaw is a dominating mode over public buses.

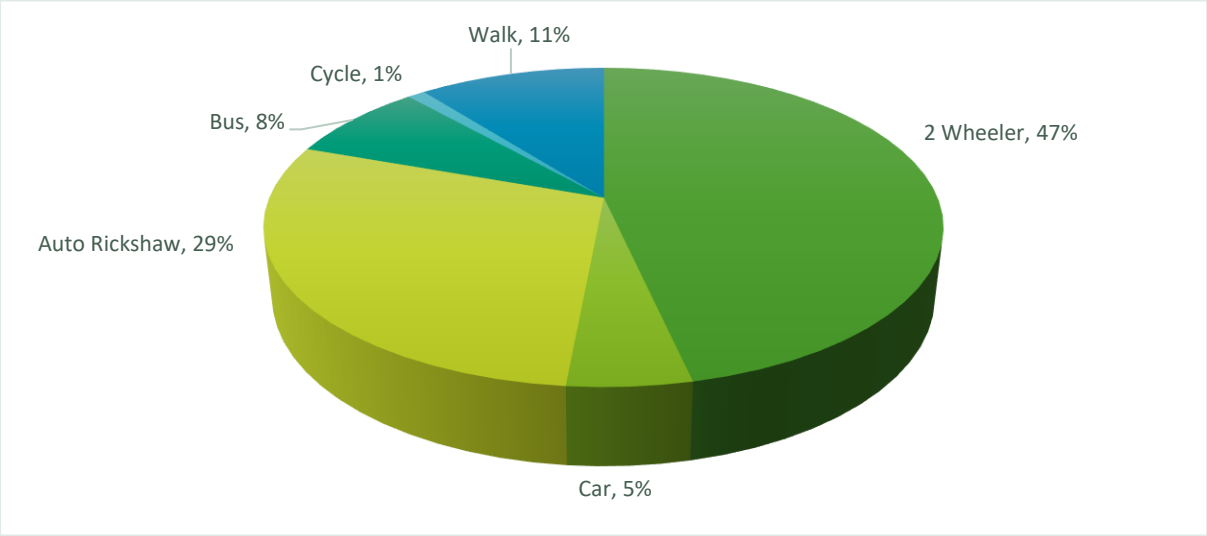


Figure 10.14.5 MODE SHARE

Table 10.14-5 AVERAGE TIME

Code	Mode	Avg. WT (Mins)
1	Public Bus	5.1
2	Auto Rickshaw	3.0
Total		**4.1**

The average waiting time to access the public transport services in 3.0 minutes. The longest waiting time is observed for buses with a wait time of 5.1 minutes. The average wait times of all the public transport modes are shown in Table 10.14-5. The average trip length in the Anantapur is observed to be 3.6km including the walk trips and 3.61km excluding the walk trips. The mode wise trip length are as shown in Figure 10.14.8. The mode wise and distance based classification of trips are shown in Figure 10.14-9.

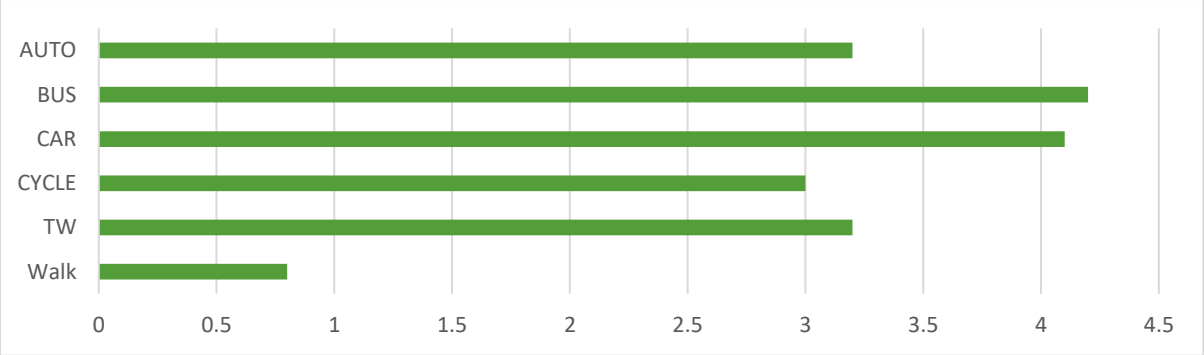


Figure 10.14.6 MODE WISE TRIP LENGTHS

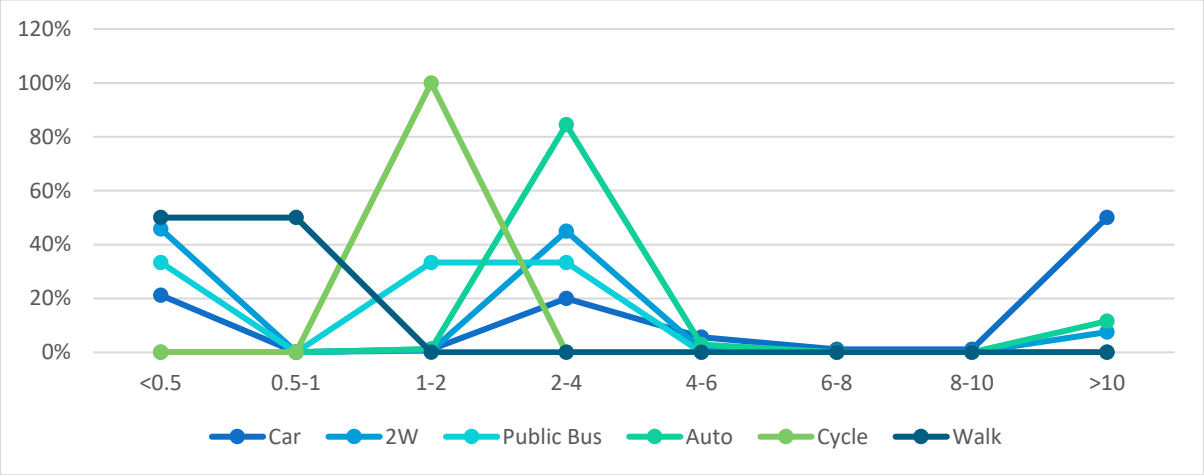


Figure 10.14.7 MODE-WISE AND DISTANCE BASED DISTRIBUTION OF TRIPS

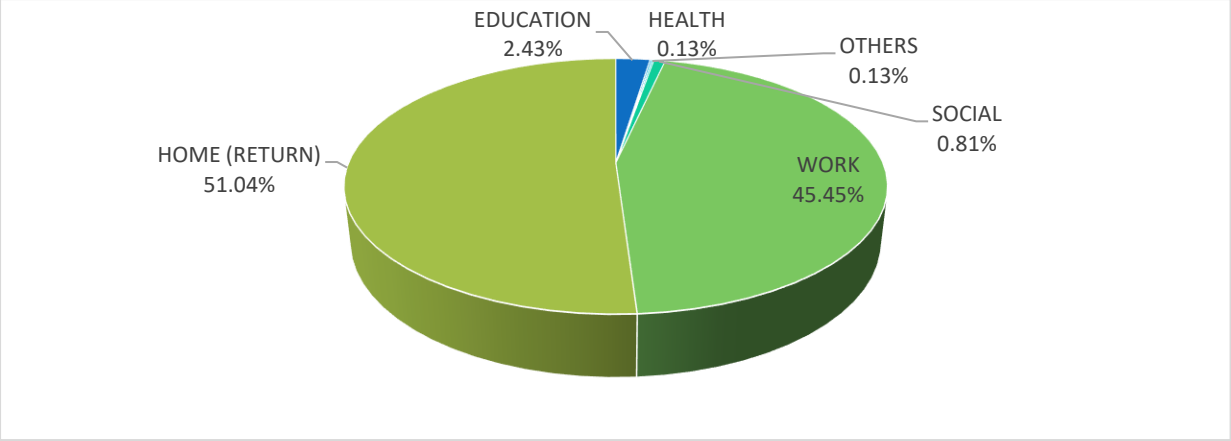


Figure 10.14.8 DISTRIBUTION OF TRIPS BASED ON TRIP PURPOSE

The purpose wise distribution of trips are as shown in Figure 10.14.10. It is observed that major share of trips are work based and education trips accounting to 45.45% and 2.43% respectively. A similar share is observed in the home (return) trips. The Average Trip Length (ATL) for work trips is observed to be 3.64 and 2.58 for educational trips. The Distribution of trips and ATL based on trip purpose are as shown in Figure 10.14.12 and Figure 10.14.11 respectively.

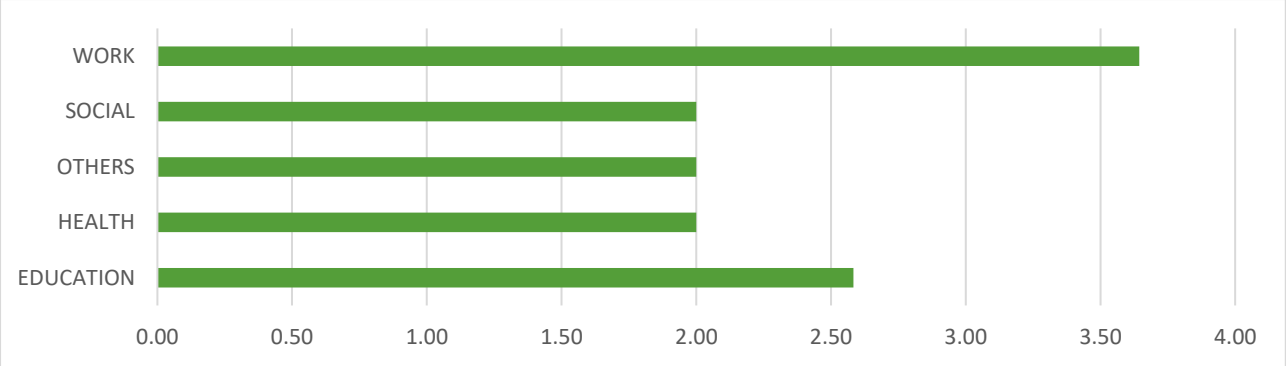


Figure 10.14.9 AVERAGE TRIP LENGHTS BASED ON TRIP PURPOSE

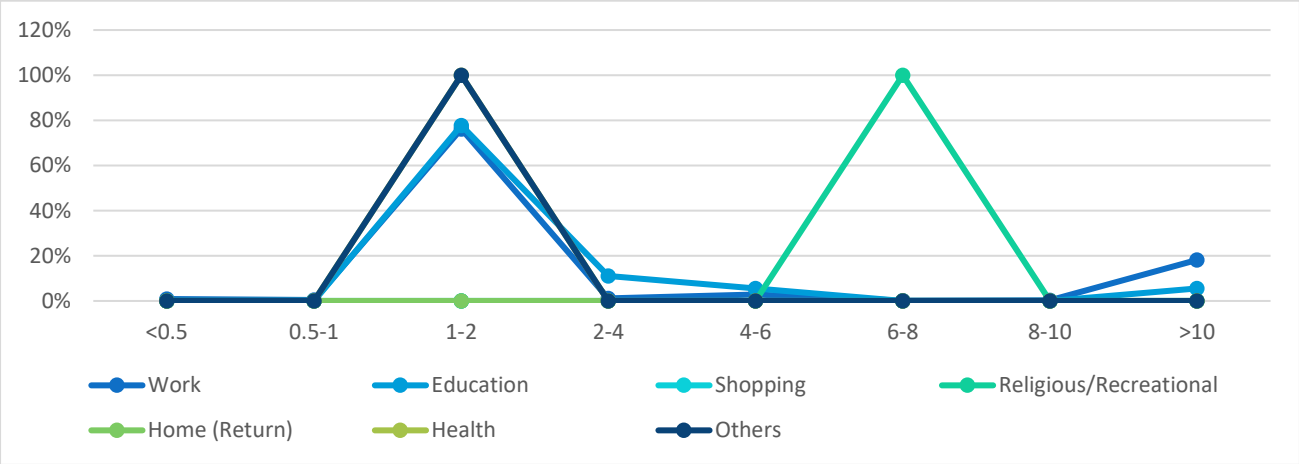


Figure 10.14.10 DISTRIBUTION OF TRIPS PF TRIPS BASED ON TRIP LENGTHS AND TRIP PURPOSE

The distribution of trips based on trip purpose are as shown in Figure 10.14.13. It is observed that a major share of trips are made on daily basis which are over 85%. The average trip length of daily trips is 3.63. The ATL based on trip Frequency is as shown in Figure 10.14.14.

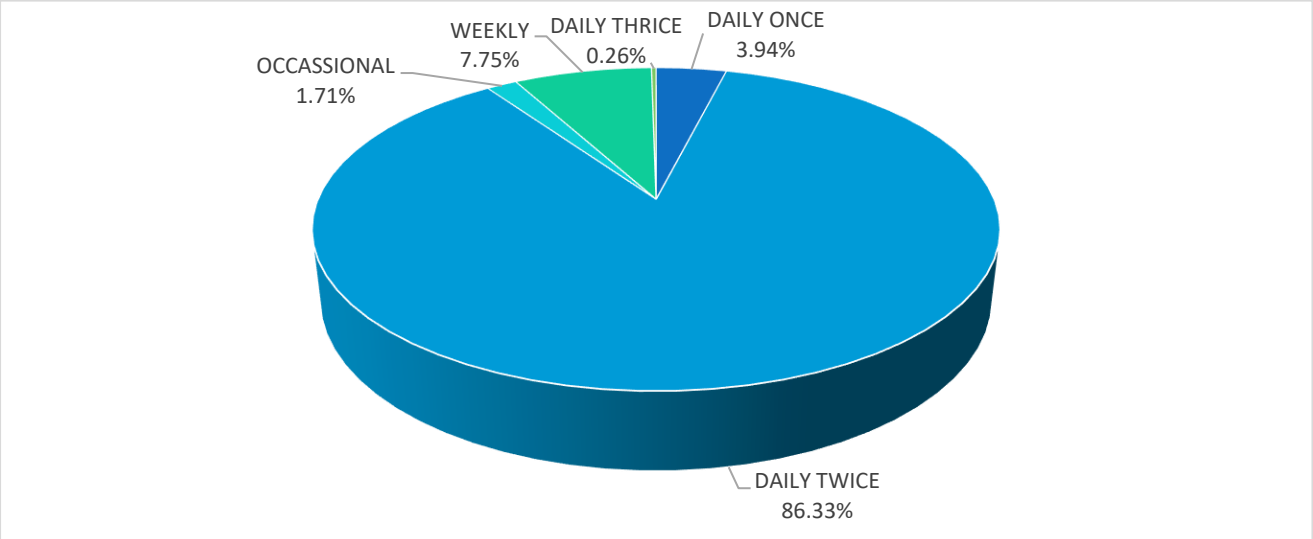


Figure 10.14.11 DISTRIBUTION OF TRIPS BASED ON TRIP FREQUENCY

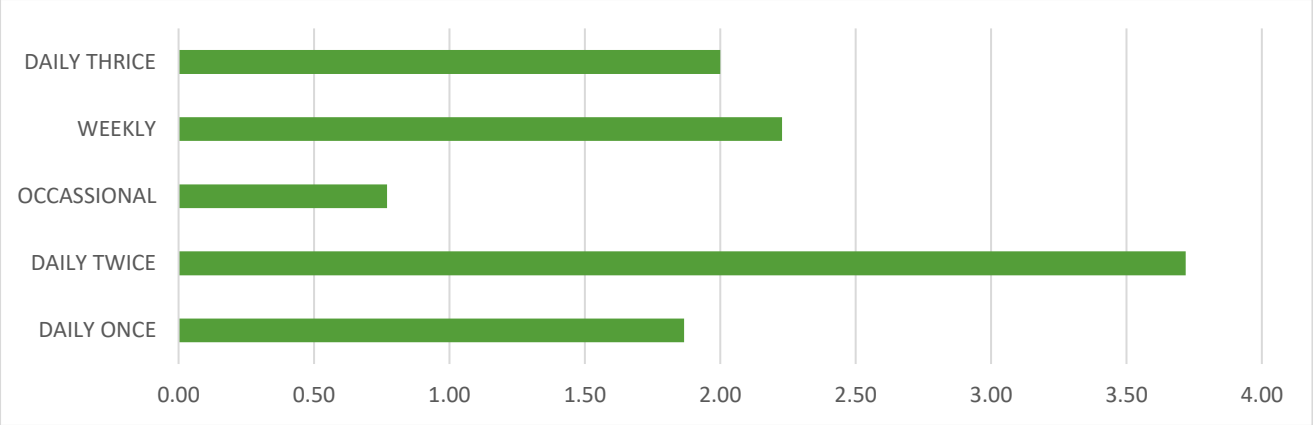


Figure 10.14.12 AVERAGE TRIP LENGHTS BASED ON TRIP FREQUENCY

10.14.3 HOUSEHOLD ACCESSIBILITY AND OPINION

The accessibility of households to Public Transit (PT) or Intermediate Public Transport (IPT) stops is as assessed in terms of distance and time. The average distance travelled by the house hold to access the near PT or IPT stop is 1.11km 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 10.14-6 and 10.14.15.

Table 10.14-6 ACCESSIBILITY TO PT OR IPT STOPS

Code	Mode	Nearest Stop (km)	Time taken to reach (min)
1	Public Bus	1.34	4.96
2	Shared Auto	0.87	3.06
	Total	**1.11**	**4.01**

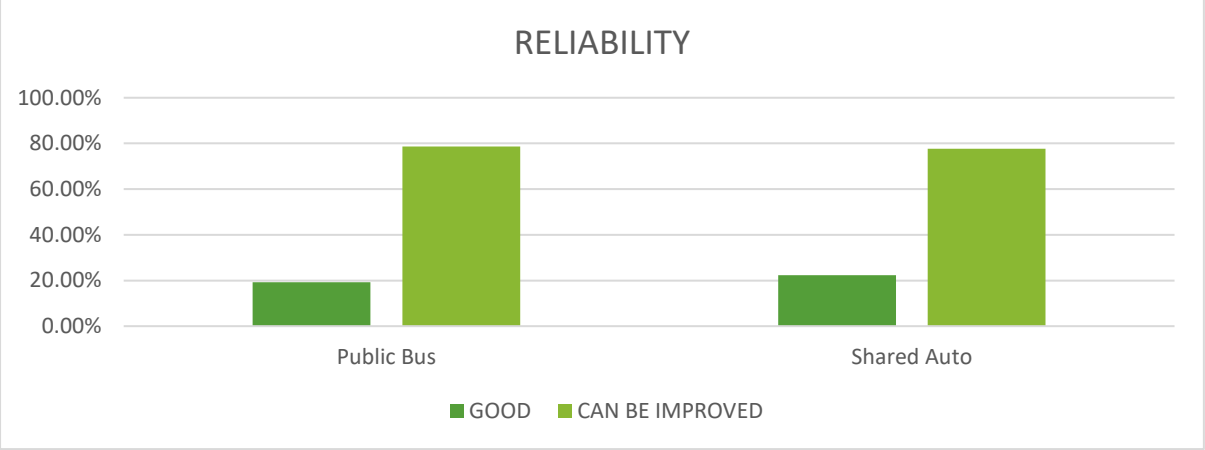


Figure 10.14.13 USERS OPINION ON RELIABILITY OF PT AND IPT MODES

Figure 10.14.14 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 that need to be improved in all 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 buses are perceived to be affordable compared to the auto rickshaw.

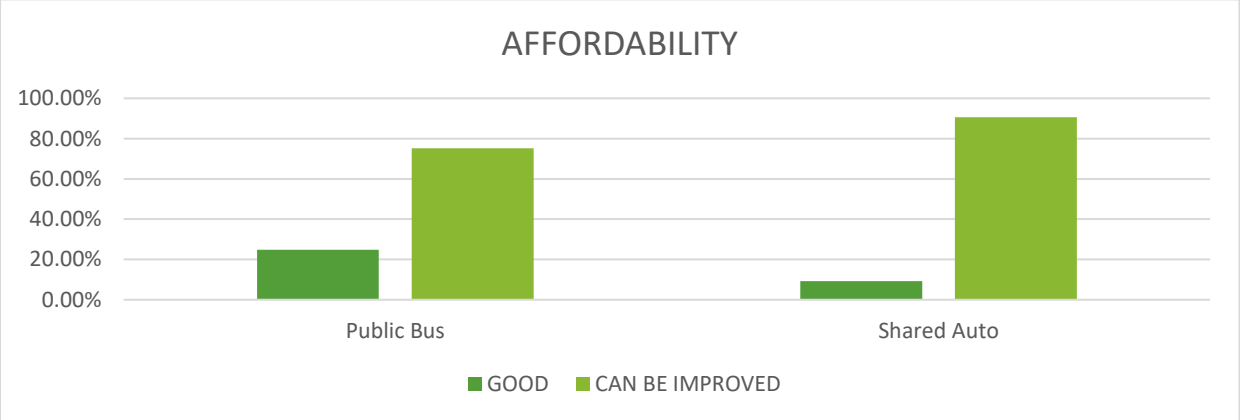


Figure 10.14.15 USERS OPINION ON AFFORDABILITY OF IPT MODES

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.

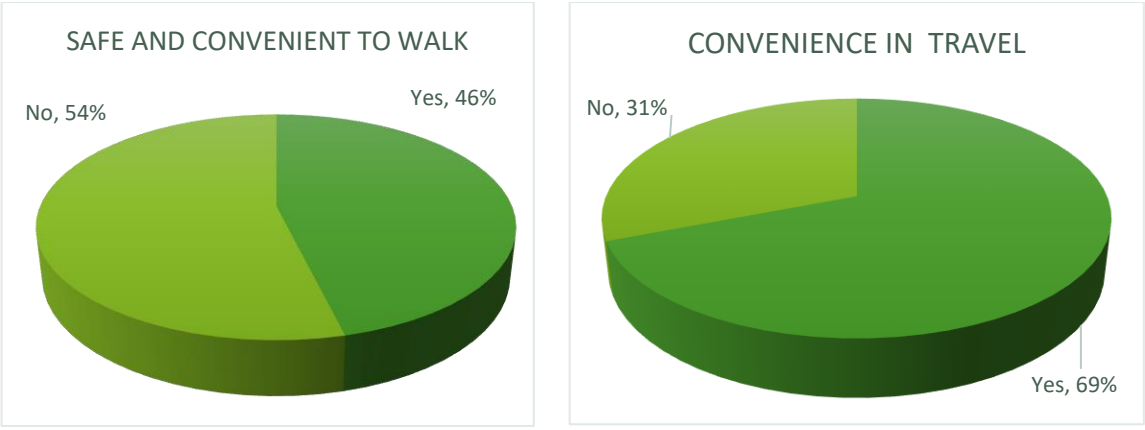


Figure 10.14.16 PERCEPTION OF TRAVEL CONDITIONS IN THE CITY

Key Inferences:

1. The sex ratio derived from the house hold survey is 989.
2. The average monthly income as per the Household survey in Anantapur is about INR 9,837 with the average number of earning members per house hold being 1 (Approx. 1.2).
3. The Per Capita Trip Rate (PCTR) for Anantapur was observed to be 1.01 including the walk trips and 0.9 excluding the walk trips. The PCTR for motorised trips is about 0.95.
4. The major modes of travel in Anantapur are observed to be auto rickshaw and two wheelers with a model share of 18% and 55% respectively.
5. The Non-Motorised Transport comprises about 11% including 10% of walk trips.
6. The average trip length in the Anantapur is observed to be 3.6km including the walk trips and 3.61km excluding the walk trips.
7. The work and education based trips account to 45.45% and 2.43% of the total trips respectively.
8. The Average Trip Length (ATL) for work trips is observed to be 3.64 and 2.58 for educational trips.
9. The average trip length on daily trips is 3.63km.
10. The average distance travelled by the house hold to access the near PT or IPT stop is 1.61km 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 buses are perceived to be affordable compared to the auto rickshaw.

13. The other major concerns with respect to travel within the city are the bus based public transit connectivity, safety of pedestrians.

10.15 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 3 on street Parking locations as shown in Table 10.15-1.

Table 10.15-1 ON STREET PARKING LOCATIONS

CODE	LOCATIONS
ONSP_1	Subash Road
ONSP_2	Galam Street
ONSP_3	80 Feet Road

Analysis: It is observed peak across all the surveyed locations is observed to be between 4pm to 6pm. The location with highest accumulation of parking is observed to be Location 3 near 80 Feet Road followed by Subash Road area. The peak hour accumulation is observed to be 10% to 18% of the daily accumulation. The parking durations is observed to vary between 10mins to 15min. The longest parking duration at peak hour is observed at Galam Street due to the concentration of commercial and recreational activities. The details of the parking survey analysis is as shown in Table 10.15-2.

Table 10.15-2 ON STREET PARKING ANALYSIS

PARKING ANALYSIS	Location 1	Location 2	Location 3
	ECS	ECS	ECS
Parking Accumulation (Daily)	423.1	417.4	523.6
Parking Accumulation (Peak)	42.7	37.5	52.4
Peak Period	16.30-17.30	11.15-12.15	16.00-17.00
PH%	10%	9%	10%

10.16 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 conductd 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.

Locations: The survey is conducted at the 3 off street Parking locations as shown in Table 10.16-1.

Table 10.16-1 OFF-STREET PARKING LOCATIONS

CODE	LOCATIONS
OFSP-1	Railway Station Parking Area
OFSP-2	Bus Station Parking Area
OFSP-3	Raja Ramana Parking Lot

Analysis: The location with highest accumulation of parking is observed at Railway Station followed by APSRTC Bus Stand. The peak hour accumulation is observed to be 1% to 4% of the daily accumulation. The longest parking duration at peak hour is observed at Railway Station. The details of the parking survey analysis is as shown in Table 10.16-2.

Table 10.16-2 OFF STREET PARKING ANALYSIS

PARKING ANALYSIS	Location 1	Location 2	Location 3
	ECS	ECS	ECS
Parking Accumulation (Daily)	930	562	312
Parking Accumulation (Peak)	83.7	44.9	15.6
Peak Period	16.00-17.00	16.00-17.00	16.30-17.30
PH%	9%	8%	6%

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.

10.17 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.

Locations: The following six bus stop locations were identified as shown in Table 10.9-1 and Figure 10.9.1.

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

- Having to travel long distances
- Lack of public transport connectivity
- Lack of clean and hygenic public transport vehicles
- Difficult driving conditions/Haphazard traffic

Due to the lack of city based public bus services, passengers especially aged below 20years (who are the dependent users) percive difficulty in accessing various places with in the city. The detailed analysis of the passenger perception with regard to travel experience concerns are shown in Figure 10.17.1.

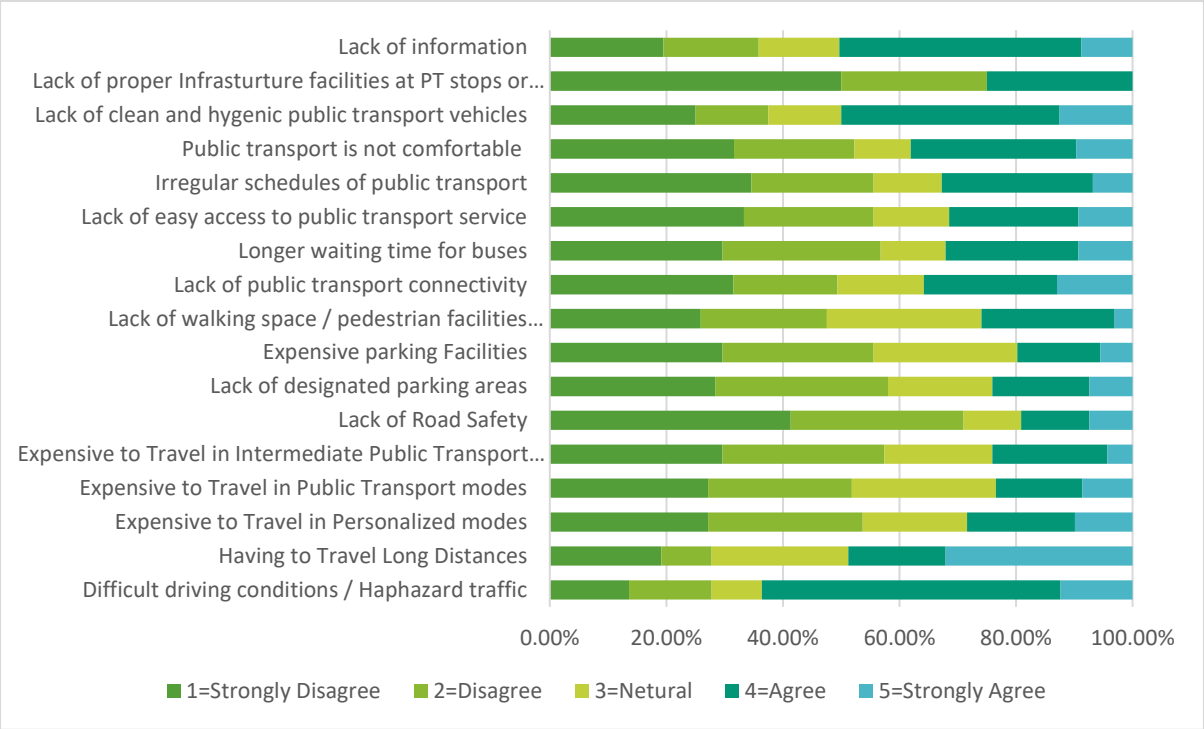


Figure 10.17.1 PERCEPTION OF PASSENGER TRAVEL CONCERNS

Similarly, the passenger's opinion in regard to the reasons for above experienced issues was assessed as shown in the Figure 10.17.2. The major reasons for the concerns in regard to the travel are,

- Lack of traffic sense

- Lack of road space/ less width of roads
- Lack of proper road network connectivity

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.

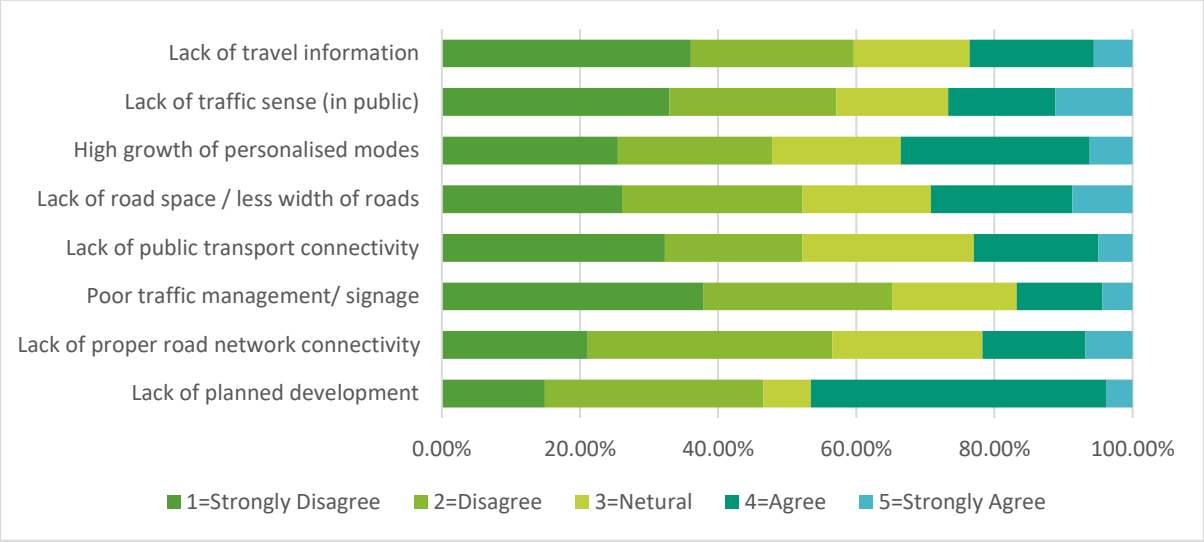


Figure 10.17.2 REASONS FOR TRAVEL CONCERNS AS PERCIEVD BY THE PASSENGERS

The passengers' perception in regard to improvement measures for enhancing the travel experience is as shown in Figure 10.17.3. The measures which are perceived of high importance by the users are as follows,

- Improve public transport service
- Improve public transport facilities
- Improve/provide more public parking

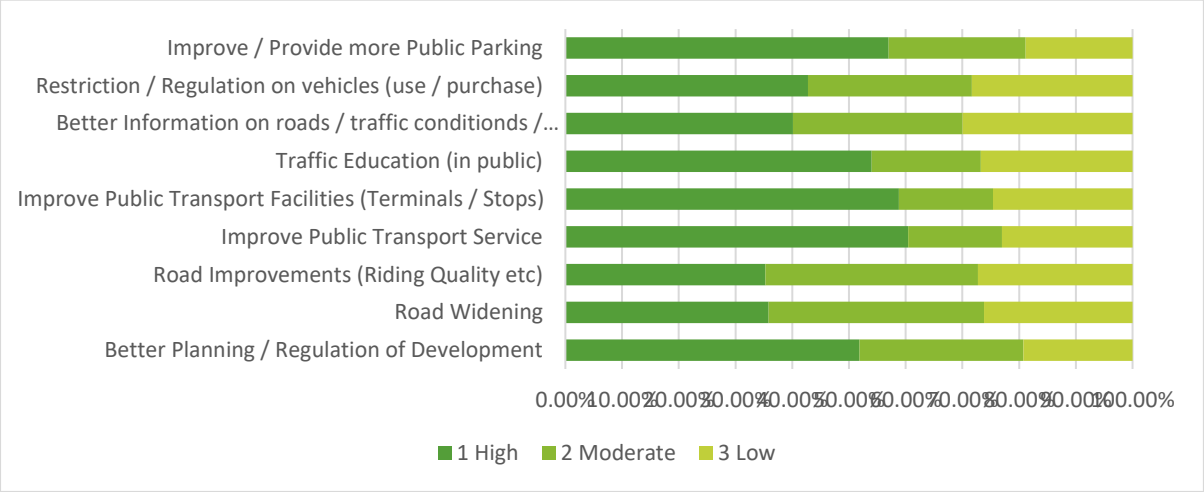


Figure 10.17.3 PASSENGER PERCEPTION IN REGARD TO IMPROVEMENTS

The passenger opinion on ways to promoted transport and traffic fund is as shown in Figure 10.17.4.

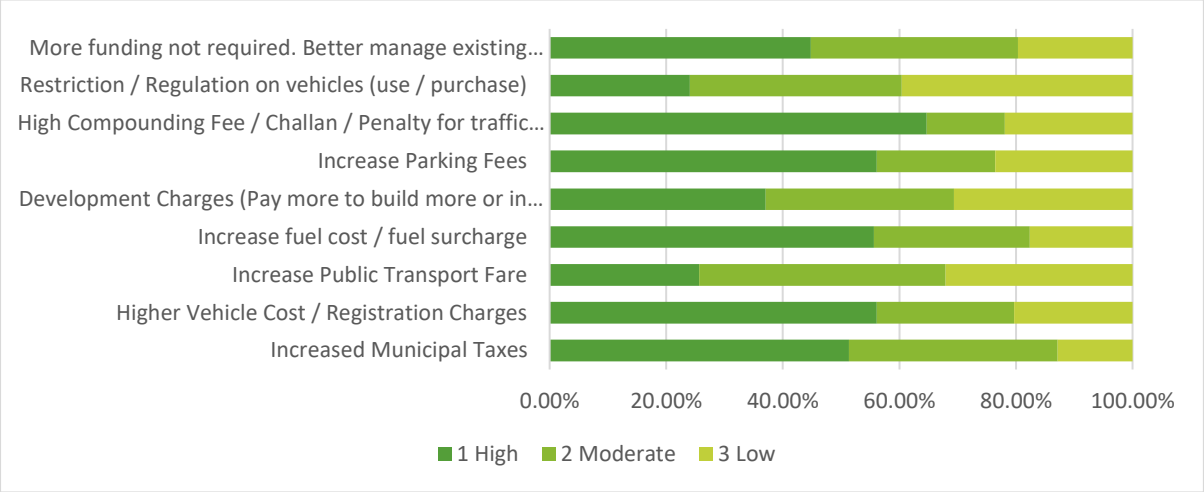


Figure 10.17.4 PASSENGERS OPINION ON WAYS TO PROMOTE TRAFFIC AND TRANSPORT FUND

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

- High compounding fee/Challan/Penalty for traffic violations
- Higher vehicle cost/Registration charges
- Increase parking fees

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 10.17.5. It was observed that 79.63% of the users perceive it Reasonably Good, while 8.64% of the users perceive it somewhat congested but well managed.

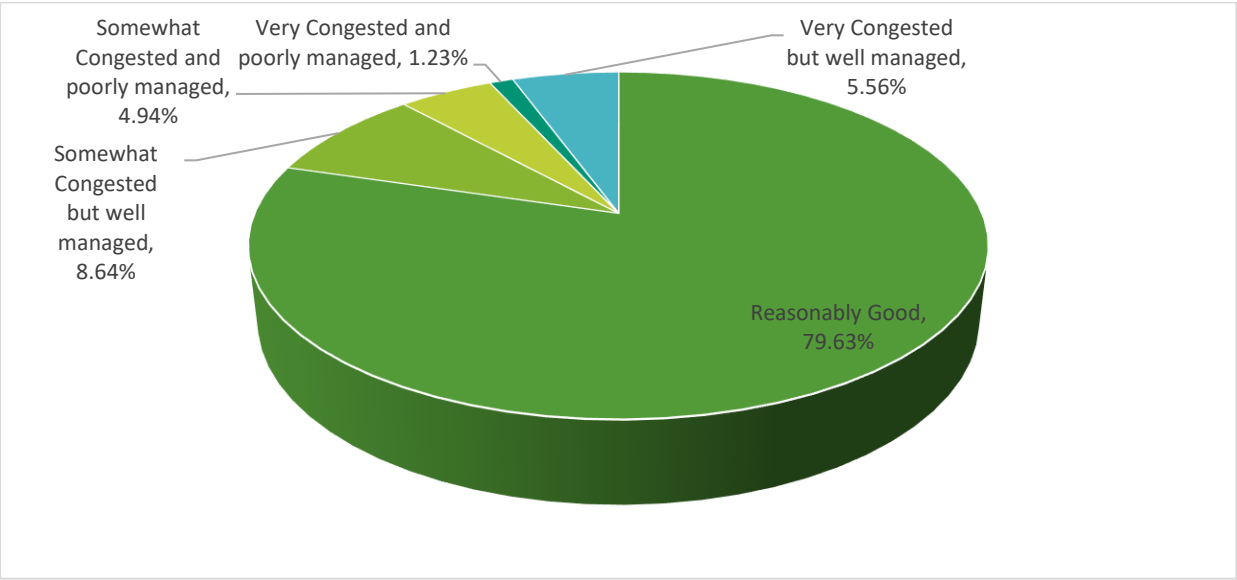


Figure 10.17.5 OVERALL EXPERIENCE OF ROAD TRAFFIC CONDITIONS

It is observed that the passengers are willing to pay for the improved services if the time savings are over 25 minutes. The willingness to pay with respect to the time saving are as shown in Figure 10.17.6.

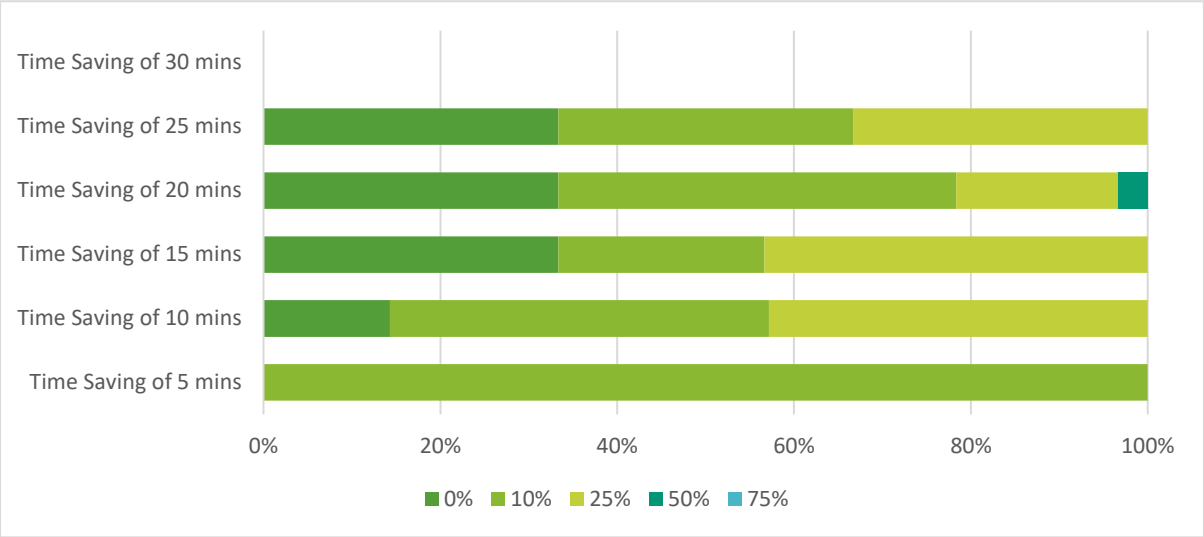
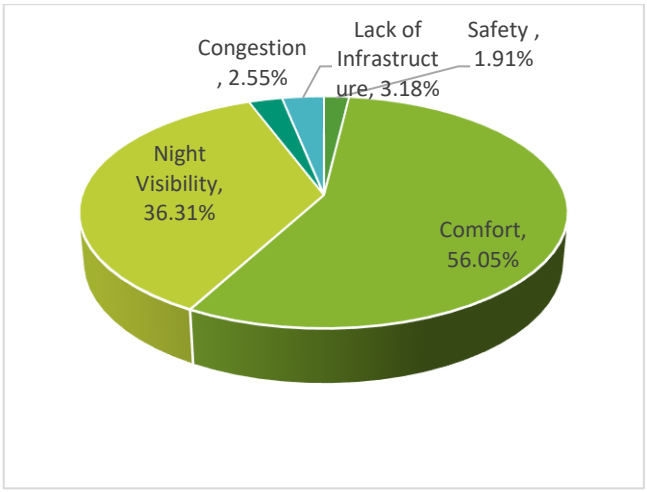


Figure 10.17.6 WILLINGNESS TO PAY WITH RESPECT TO TIME SAVINGS

The major concern of the Non-Motorised Transport users is observed to the Comfort followed by Lack of Infrastructure (Refer 10.17.7). 78% of the users desired improved footpaths and cycle tracks to enhance the quality of Non-Motorised Transport travel experience (Refer 10.7.8).



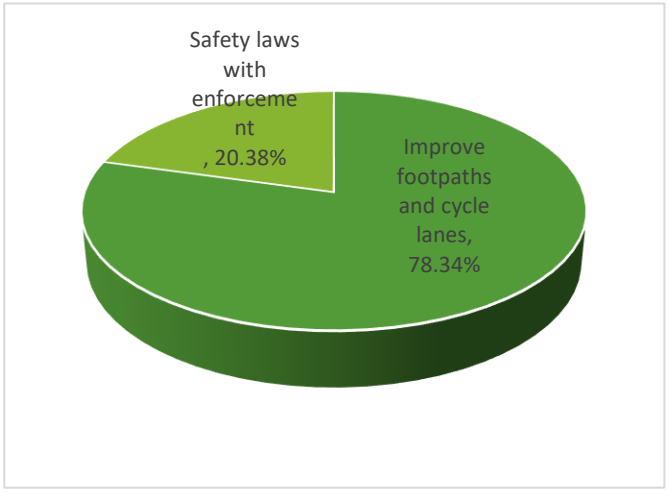
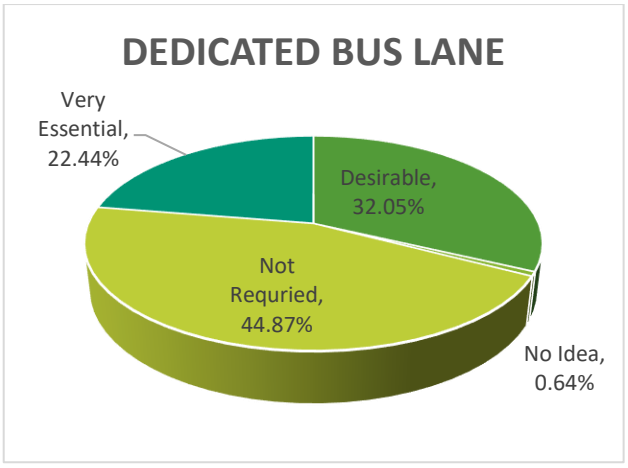


Figure 10.17.7 NMT USER CONCERS (LEFT)

Figure 10.17.8 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 10.17.9. 32% of the passengers perceive the need for dedicated bus lanes and about 4% of the users perceive the need for dedicated bicycle lanes.



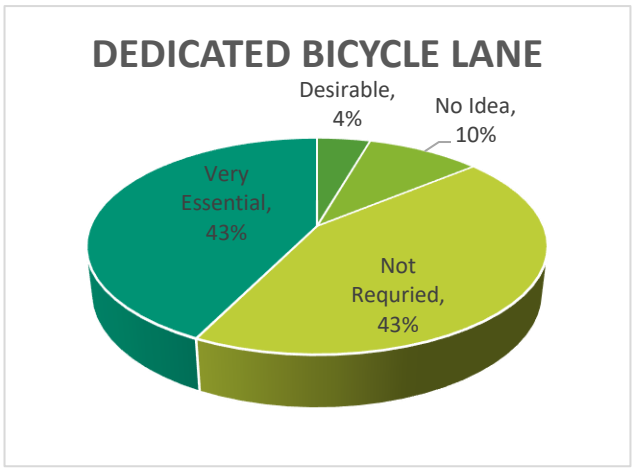


Figure 10.17.9 PERCEPTIONS REGARDING THE NEED FOR DEDICATED BUS AND BICYCLE LANES

Key Inferences:

1. The survey analysis indicates the need for improved traffic and travel management along with strategies to refrain increasing the usage of private modes over the public transit modes.
2. The majority of the responders are inclined towards indirect funding such as vehicle costs and registration charges, high compounding fee or high penalty for the traffic violators to promote travel and traffic fund.
3. 79.63% of the users perceive the overall experience of road traffic conditions reasonably good, while 8.64% of the users perceive it somewhat congested.
4. 78.34% of the users desired improved footpaths and cycle tracks to enhance the quality of Non-Motorised Transport travel experience

ANNEXURE C- STAKEHOLDERS WORKSHOP

Dt. 11.12.2018.

Attendance Sheet

Preparation of Low Carbon Comprehensive Mobility Plan – Anantapur

Sl.No.	Name	Designation	Phone No.	Email Id	Signature
1	S. Vinay Prasad	T.P.O.	9849607686	townplanningatp@gmail.com	
2	B. Balakrishna	Deputy Manager (Ops)	9959225813	dmatp@apsrtc.ap.gov.in	
3	Dr. V Sundar	DTC	9948661786	[illegible]	
4	S. Ramakrishna	SVP, UMTC	9000265056	sramakrishna@ilfsindia.com	
5	ANKUSH MALHOTRA	VP, UMTC			
6	T. Siva Niranjan	Manager, UMTC	7989437651	SIVA.NIRANJAN@UMTC.IN	
7	M. Harshita Sarma	Asst. Manager	9573810022	harshita.sarma@umtc.in	
8	Sri Navya Annem	Sr. Officer, UMTC	9246776642	srinavya.annem@umtc.in	
9	Rakesh Jinka M	Asst. Manager, UMTC	9632794757	rakesh.jinka@umtc.in	
10					
11					
12					
13					
14					
15					

ANNEXURE D- STAKEHOLDERS PRESENTATION

WELCOME

Presentation on

COMPREHENSIVE (LOW CARBON) MOBILITY PLAN

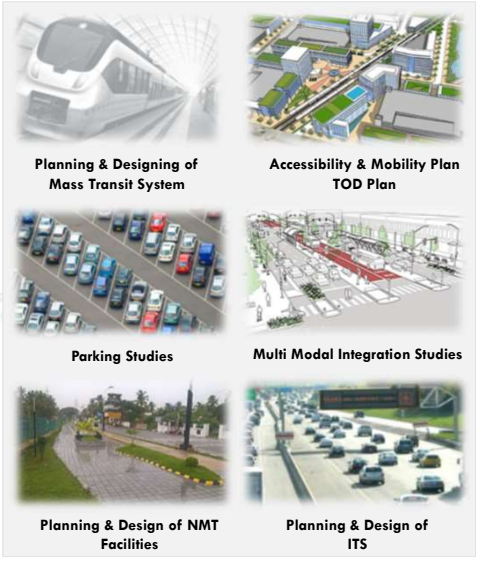
for

ANANTAPUR

DECEMBER 2018

About UMTC

1. Ministry of Housing and Urban Affairs, Government of India
2. Government of Andhra Pradesh*
3. Andhra Pradesh Road Transport Corporation*
4. IIDC Fund



* *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

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UMTC EXPERIENCE – METRO + BRTS

Experience with Metro Rail Organizations

- Amaravati Metro Rail Corporation Limited
- Delhi-Gurgaon-Rewari-Alwar Regional Rapid Transit System
- Rapid Metro Gurgaon
- Noida Metro Rail Corporation Limited
- MAHA Metro (Maharashtra Metro Rail Corporation Limited)
- Delhi Metro
- Kochi Metro Rail Limited
- Hyderabad Metro Rail Limited
- Lucknow Metro Rail Corporation
- Mumbai Metro Rail corporation Limited

Experience in Bus Rapid Transit System

- 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)

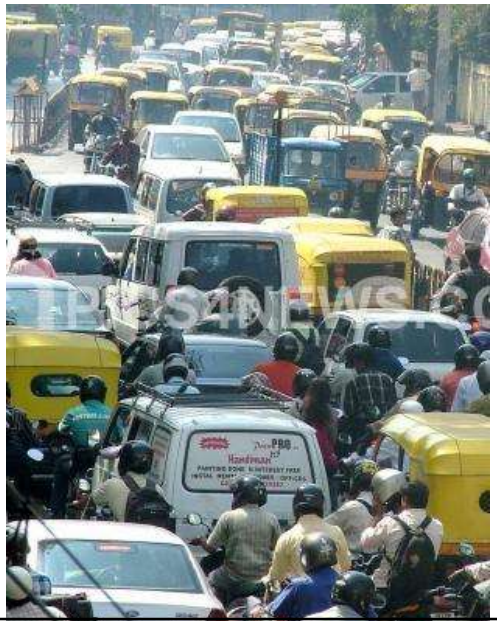
Assisted MouD in Appraisal of about 486 kms of Metro Corridors

NEED FOR THE STUDY

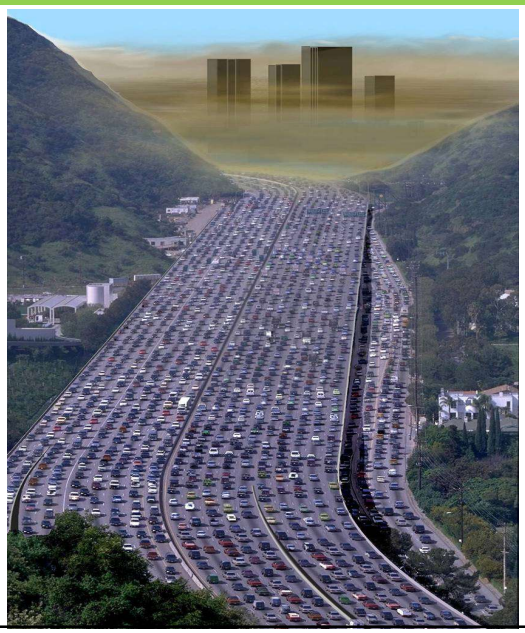
- **Growth of Private Vehicles**
- **Growth of unorganised Intermediate Public transport**
- **Lack of Public Transport Systems**
- **Increasing rate of road accidents concerning the pedestrians**
- **Decreasing mode shares of sustainable transport**

To meet the objectives of Smart City (Smart Mobility)

CITIES IN INDIA ARE GETTING CHOKED

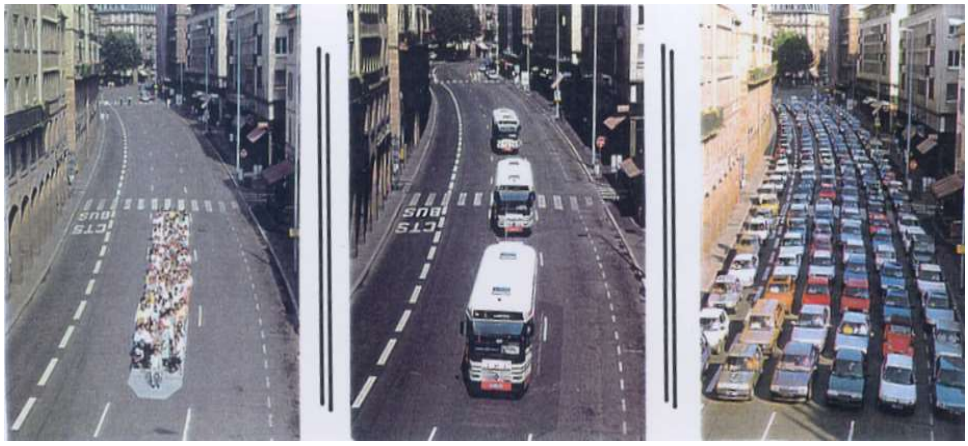


Impact of endless road widening



Thrust of the National Urban Transport Policy

Focus on moving people, not vehicles



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

What It Covers	What It Doesn't Cover
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	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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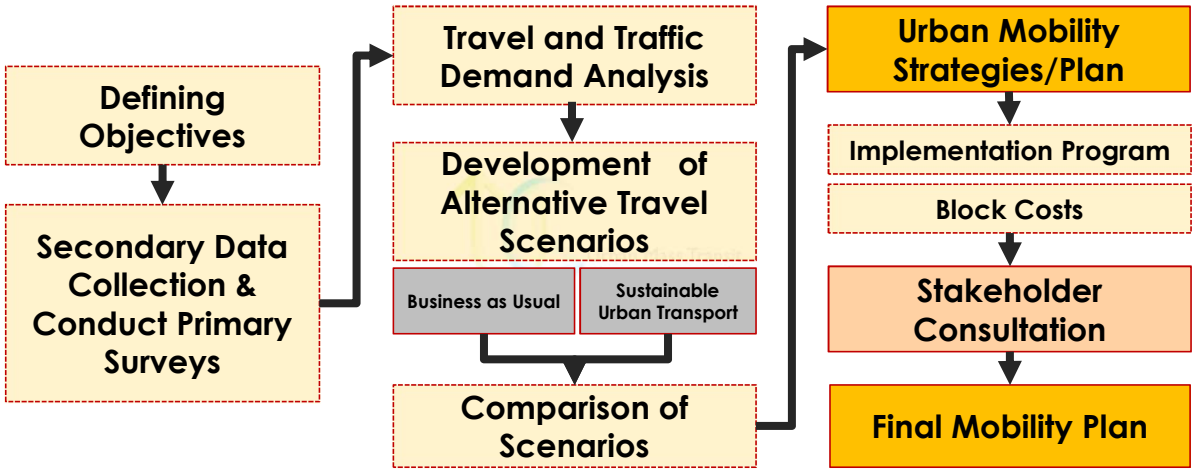
METHODOLOGY



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

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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PRIMARY SURVEYS CONDUCTED
(As per MoHUA, GOI Guidelines)

S. NO.	SURVEYS	EXPECTED OUTCOMES
1	Classified Traffic Volume Counts at Outer Cordon Location, Screen Line Locations & Turning Movement Counts at Intersections	Traffic flow characteristics in terms of modal composition, peak hour traffic at each survey location (OC, SC & Intersections)
2	Origin – Destination Surveys along with Mode Wise Occupancy Surveys	Information on Travel Patterns of Vehicles at the Outer Cordon & Screen Line Locations in terms of the Desire Line Pattern for the base year.
3	Road Network Inventory Surveys	Network characteristics such as, RoW, carriageway width, Footpaths, Surface Quality, etc which would be used in the Travel Demand Model
4	Speed and Delay Surveys	Congestion levels in the city and to validate the journey speeds predicted by the transport model

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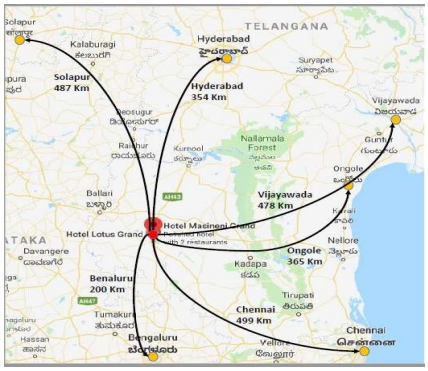
PRIMARY SURVEYS CONDUCTED
(As per MoHUA, GOI Guidelines)

S. NO.	SURVEYS	EXPECTED OUTCOMES
5	Bus Passenger Boarding & Alighting Surveys	Assess the passengers using Buses for their travel patterns and sectional loads to be used for service planning.
6	Bus & Rail Terminal Counts	Time, No. of Passengers entering & existing the terminal.
7	Bus & Rail Terminal Origin & Destination Surveys	Assess the travel patterns of passengers entering & exiting the Bus Terminals & Rail terminals.
8	Vehicle Operator Surveys –Auto Rickshaws & Goods Vehicles	To capture the needs of the IPT operators and the details of the IPT trips operated within the City To establish the commercial vehicle quantum and OD patterns within the city

PRIMARY SURVEYS CONDUCTED
(As per MoHUA, GOI Guidelines)

S. NO.	SURVEYS	EXPECTED OUTCOMES
9	Household Interviews	Information on the demographic and socio-economic data at the household and individual levels, and behavioural data that defines the travel pattern on a daily basis
10	Stated Preference & Opinion Survey	Assess Passengers Willingness to Shift and Willingness to Pay for the improved public transport system.
11	NMT Surveys	Pedestrian Count Survey to identify critical locations for pedestrian/NMT Movements NMT Opinion Survey to identify the needs & trip characteristics of the NMT Users
12	Parking Surveys (On Street & Off Street)	To assess the demand for parking characteristics of the parked vehicles, present parking supply etc within the city.

CITY PROFILE



Ananthapur town is the Headquarters of the district

Emerged as an crucial **important City in Rayalaseema Region**

POPULATION **2.68 LAKH (2011)** **2.96 LAKH (2018)**

34% **WORKING POPULATION (1.01lakhs)**

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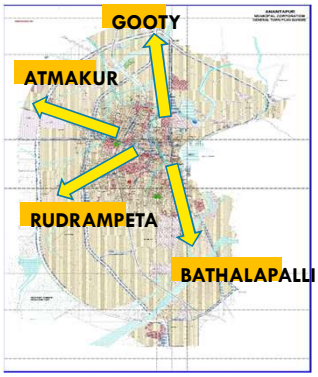
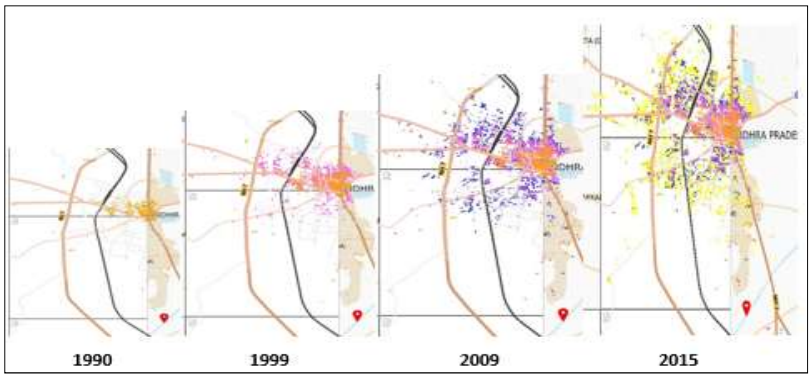
CITY PROFILE

LANDUSE



GROWTH PATTERN



Population		Area		Population Density		
2.6 LAKH Municipal Limits	**2.9 LAKH** Urban Agglomeration	**16.4Sqkm** Municipal Limits	**56.9Sqkm** Urban Agglomeration	**164 PPH** Municipal Limits	**51PPH** Urban Agglomeration	**10.9%** Area Under Transportation

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CITY PROFILE

No City Bus Services Operated Either By RTC Or Private Agencies	**7,200** Auto Rickshaws (Registered Vehicles-2017)	**6%** CAGR – Registered Vehicles	**3.9** Fatality Rate-2017 (per annum) (per 1 Lakh Population)

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TRAVEL AND TRAFFIC CHARACTERISTICS

1.1 Per Capita Trip Rate Including walk trips	**3.6Km** Average Trip Length Including walk trips	**0.92** Average Volume / Capacity Ratio
0.9 Per Capita Trip Rate Excluding walk trips	**3.61Km** Average Trip Length Excluding walk trips	**27.2 kmph** Average Network Speed

	+				
MODE SHARE	36.1%	46.7%	5.0%	10.6%	1.0%
TRIPS (in lakhs)	1,20,841	1,51,867	16,330	34,293	3,266

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CITY PROFILE

Lack of City based Public Transport

↓

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

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

Congestion along **Major Roads**

Safety Concerns amongst Pedestrians and cyclists

Increasing levels of **Air Pollution**

Increasing Vehicles
Increasing Safety Concern

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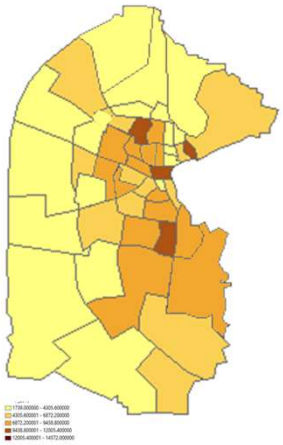
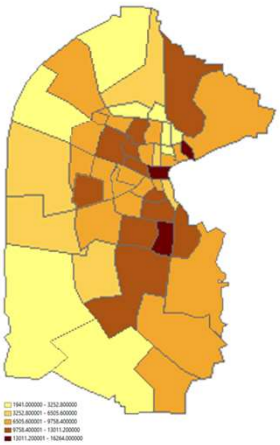
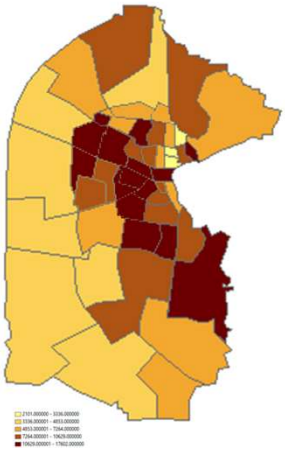
POPULATION PROJECTIONS



Population 2018
2.96 lakhs



Population 2028
3.31 lakhs



Population 2038
3.58 lakhs

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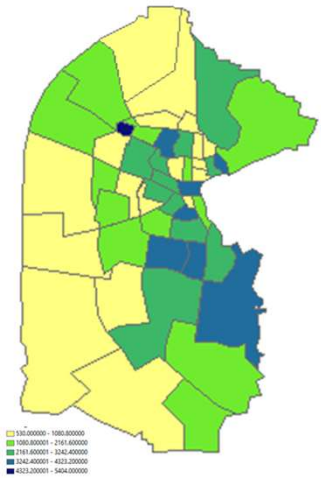
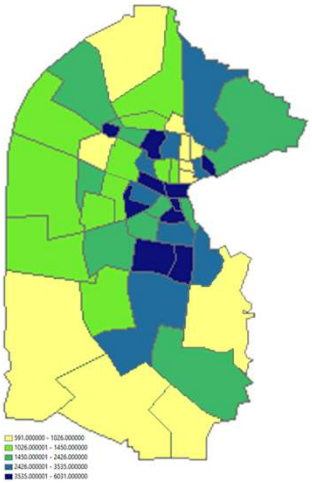
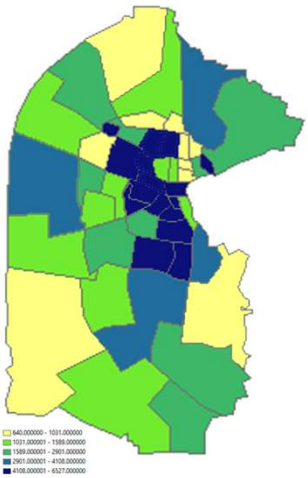
EMPLOYMENT PROJECTIONS



Worker Population 2018
1.01 lakhs



Worker Population 2028
1.13 lakhs



Worker Population 2038
1.22 lakhs

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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

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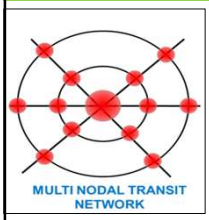
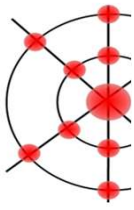
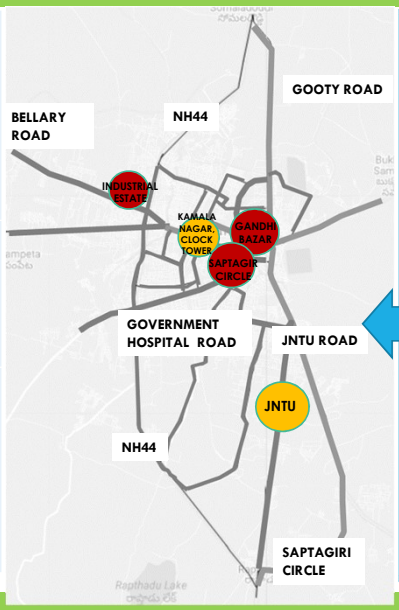
LANDUSE AND TRANSPORT STRATEGY

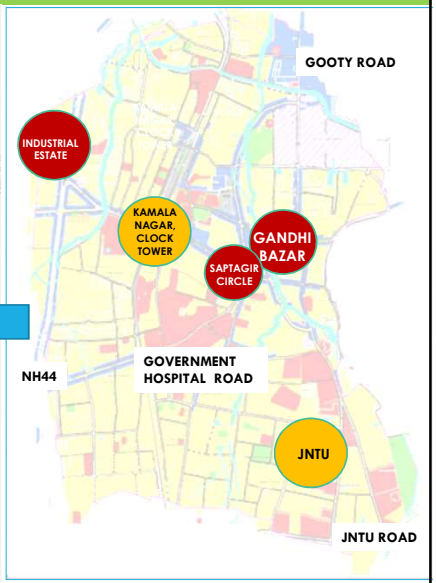


Core Area	GANDHI BAZAR, SAPTAGIRI CIRCLE
Immediate Proximity (Along Inner Bypass)	KAMALANAGAR-CLOCK TOWER, JNTU ROAD, GOVERNMENT HOSPITAL AREA
Medium Proximity (Along Outer Bypass Road)	INDUSTRIAL ESTATE



SEMI- RADIAL-Multi Nodal Transit Network for Ananthapur





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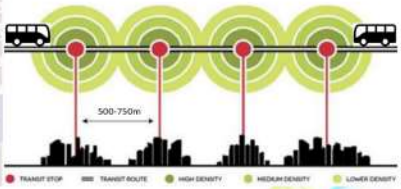
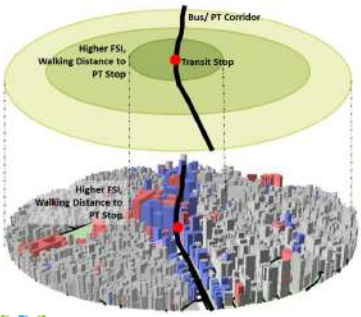
TRANSIT ORIENTED DEVELOPMENT





- 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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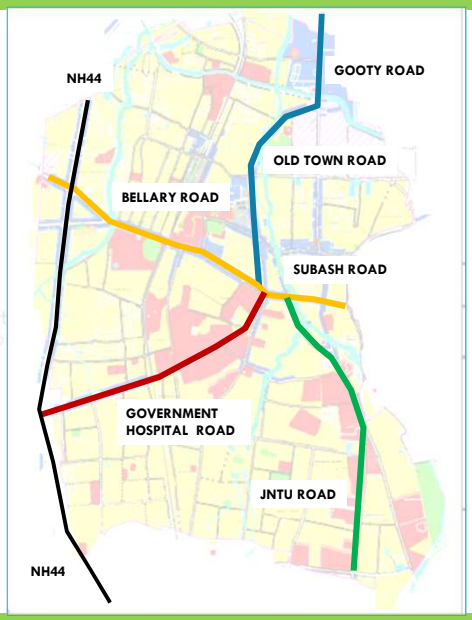
TRANSIT ORIENTED DEVELOPMENT

Corridors identified for densification are;

1. SUBASH ROAD-BELLARY ROAD
2. GOVERNMENT HOSPITAL ROAD
3. JNTU ROAD
4. GOOTY ROAD-OLD TOWN ROAD
5. NH 44



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Strategy 2

ROAD NETWORK IMPROVEMENT STRATEGY

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

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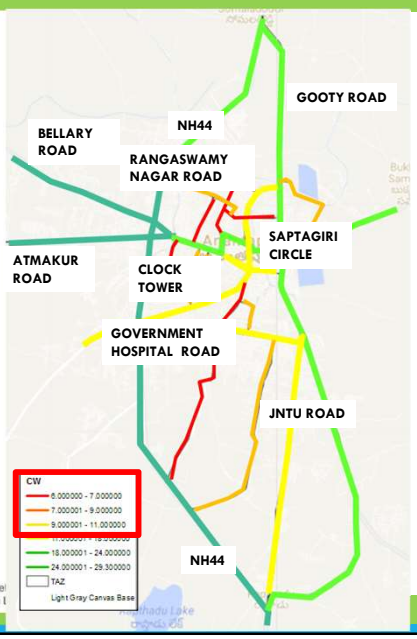
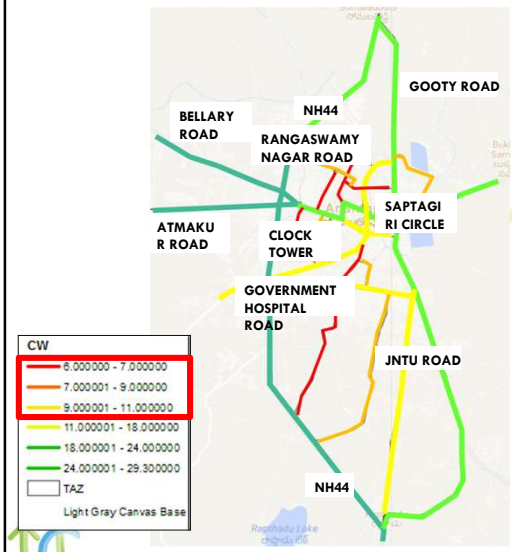
EXISTING ROAD NETWORK SCENARIO

54% Network Carriageway below 12m

ROW	SHARE %	LENGTH (KM)
BELOW 9M	38%	38
9M TO 12M	16%	16
12M TO 18M	21%	21
18M TO 24M	18%	18
ABOVE 24M	7%	7



EXISTING ROAD NETWORK SCENARIO



Network Hierarchy Jumps

Bottle Necks

SAPTAGIRI CIRCLE
CLOCK TOWER

Average V/C Ratio

2018	2038
0.92	1.58

Average Network Speed

2018	2038
27.2 km/hr	25.8 Km/hr

V/C Ratio

Road Name	2018	2038 (BAU)
SH-32	1.04	1.77
Govt. Hospital Road	0.94	1.61
Bellary Road-Ananthapur Road	2.22	3.79
Ramachandranagar Flyover	1.32	2.25

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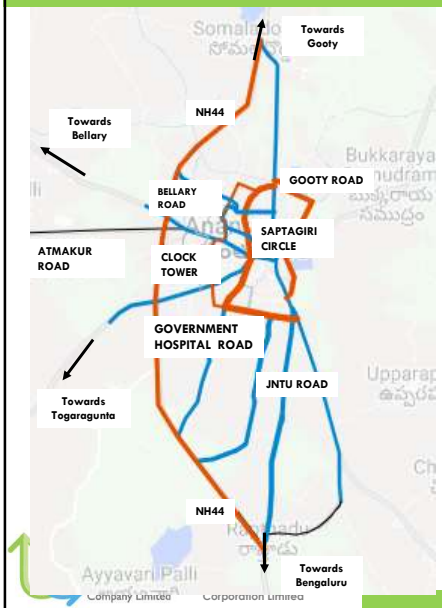
PROPOSED ROAD NETWORK STRATEGY



SEMI RING RADIAL

Radial Roads

1. Bellary Road
2. JNTU Road
3. Gooty Road
4. Government Hospital Road

Ring Roads

1. Inner Bypass Road
   1. Raju Road
   2. Sai Nagar Road
   3. 60 FEET Road
   4. Old Town Road
2. Outer Bypass Road

NAME OF THE ROAD	LENGTH (KM)	BASE (2018)	SUT (2038)
NH-42	2.1	2	4
NH-44 Rapthadu	3	4	6
SH-82	3.9	2	4
SH-32	4	2	4
Govt. Hospital Road	2.7	2	4
Bellary Road-Ananthapur Road	0.6	2	4
Ramachandranagar Flyover	0.7	2	4

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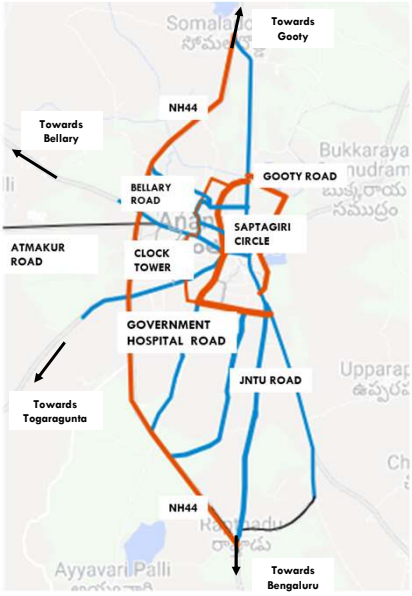
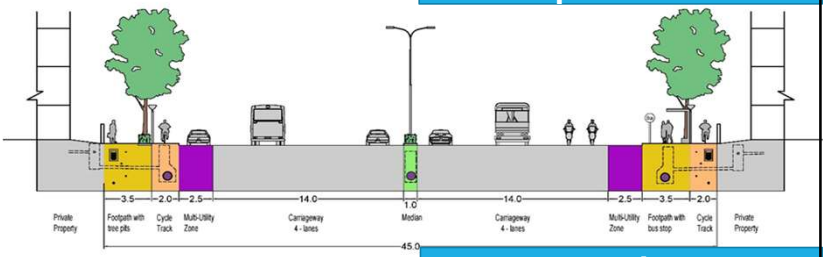
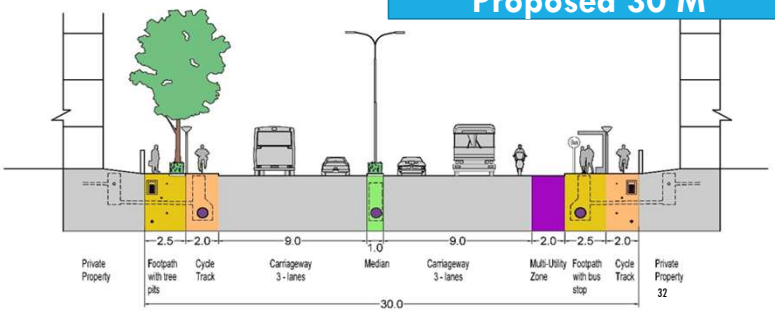
PROPOSED ROAD NETWORK STRATEGY



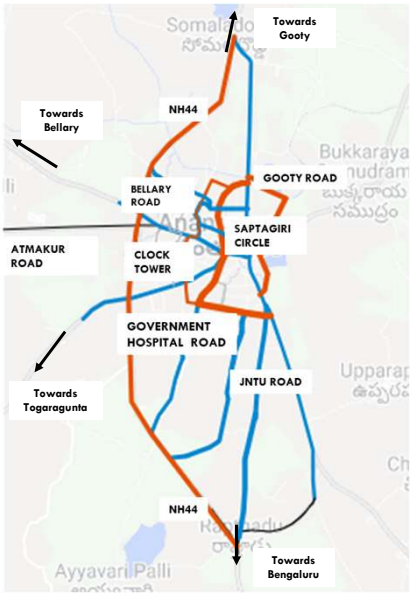
Proposed 45 M



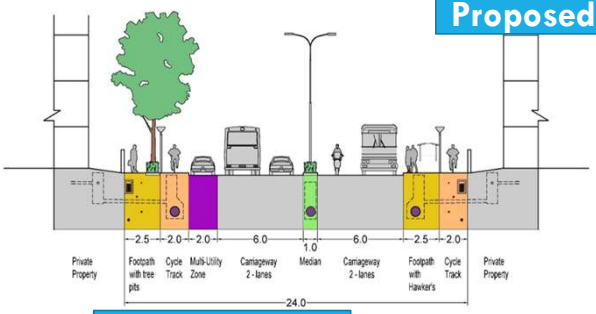
Proposed 30 M



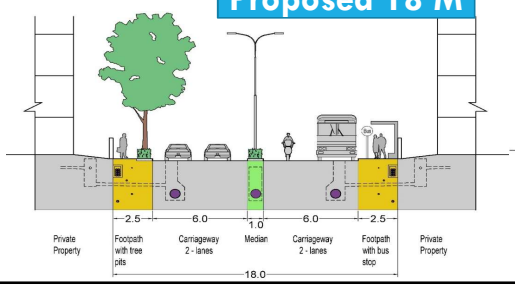
PROPOSED ROAD NETWORK STRATEGY



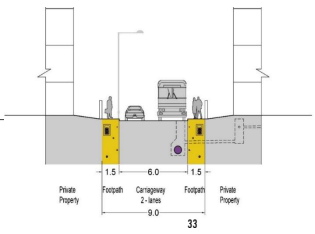
Proposed 24 M



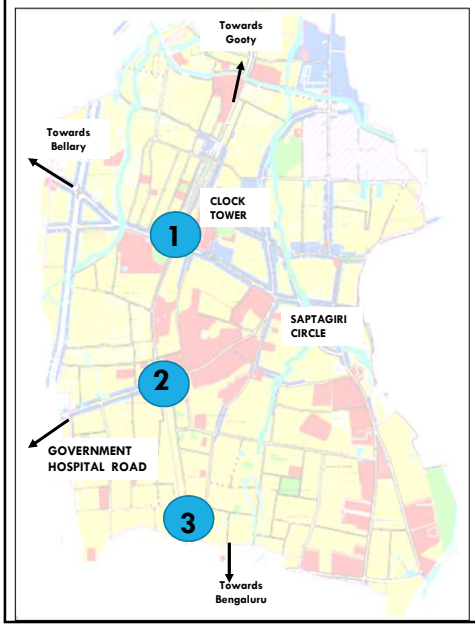
Proposed 18 M



Proposed 09 M



PROPOSED ROAD NETWORK STRATEGY



Road Infrastructure

Rail Over Bridges (ROB)/Rail Under Bridge (RUB) – 3

1. **ROB Widening near Clock Tower (2 lane to 4 lane)**
2. **Near Government Hospital –Rudramapeta Road**
3. **Near Naik Nagar**

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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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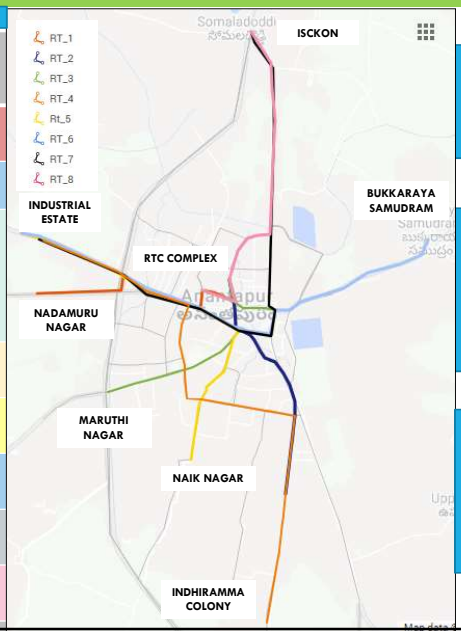
PROPOSED CITY BUS NETWORK

S. No.	Name	BASE YEAR Route Length (km)	Proposed Peak Hour Headway (min)	Proposed Fleet
1	RTC Bus Stand to Nadamurunagar	4.2	15	5
2	RTC Bus Stand to JNTU	4.0	15	5
3	RTC Bus Stand to Maruthinagar	5	15	5
4	Indhiramma Colony to Industrial Estate	10.6	15	5
5	Naiknagar to Industrial Estate	6.7	15	5
6	Industrial Estate to Bukkaraya Samudram	8.9	15	5
7	Industrial Estate to Iscon Temple	8.9	15	5
8	RTC Bus Stand to Iskon Temple	4.1	15	5



8 Routes

40 Buses (2019)

121 Buses (2038)

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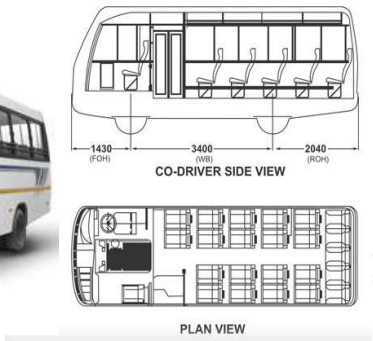
VEHICLE TYPE- MINI BUSES



Characteristics	Mini Bus
Seating Capacity	15 to 25
Turning Radius (m)	13
Overall Length (mm)	~ 7000
Overall Width (mm)	~ 2000
Life Cycle	12 Years or 10,00,000 kms

The smallest vehicle in the bus category vehicles,
with a passenger capacity (seating + standing) ranging between 15 to 25 passengers.
These vehicles are extensively used on Roads With Smaller ROW.

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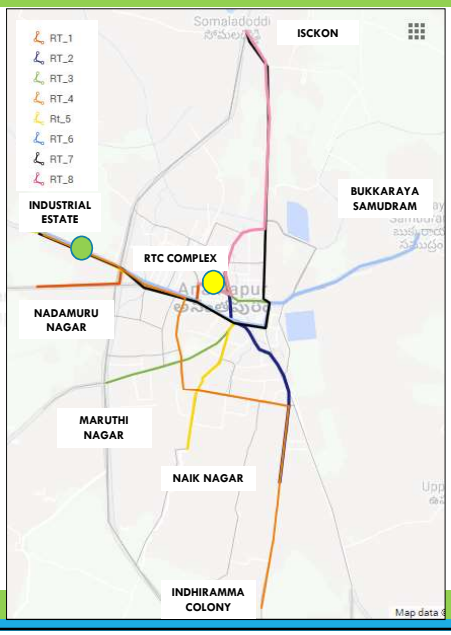
PUBLIC TRANSPORT TERMINALS

Existing Bus Terminal

1. Anatapur Bus Stand

Proposed Bus Terminal

1. Industrial Estate



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INTERMEDIATE PUBLIC TRANSPORT

ANY VEHICLE LESS THAN 8 SEATER IS CONSIDERED TO BE INTERMEDIATE PUBLIC TRANSPORT

Intermediate Public Transport - ANANTAPUR

↓

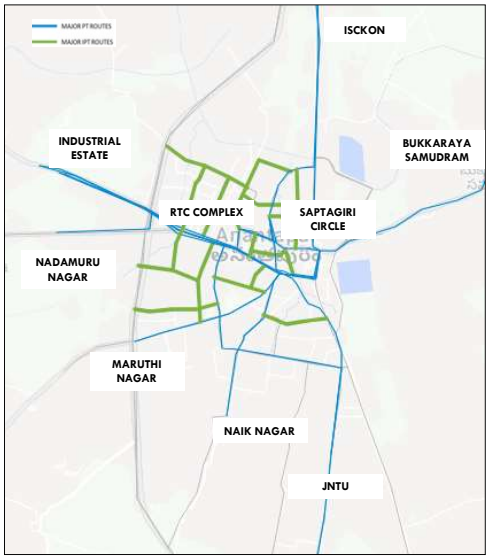
Auto-Rickshaw

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

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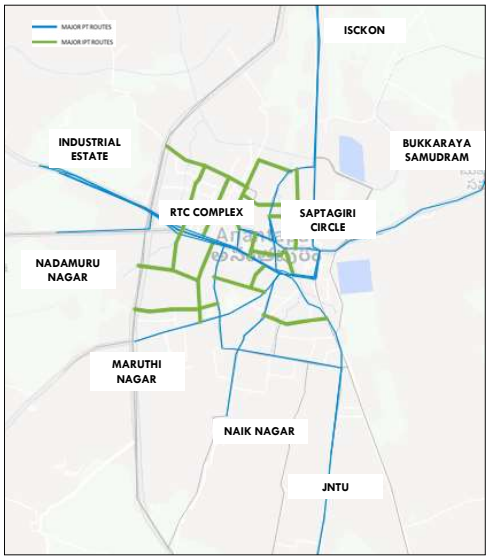
INTERMEDIATE PUBLIC TRANSPORT

PROPOSED PHASE-WISE CONVERSION TO E-RICKSHAWS

Year	E- Rickshaws	
	No.	Share
2023	1435	20%
2028	2870	40%
2038	2870	40%



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

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INTERMEDIATE PUBLIC TRANSPORT

Characteristics	E-RICKSHAW
Seating Capacity	4-6 Seater
Maximum Speed	25kmph (as per MV Act 2015)
Moto Output Power	850 Watt
Duration for Fully Charged Batteries	8 Hours
Mileage with 100% charge	80km
Mileage with 80% charge	60km
Vehicle Life Cycle	7-8 Years
Battery Life	5 Years
Overall Efficiency	80%

The smallest vehicles providing intermediate public transport facilities and last mile connectivity, with a passenger capacity (seating) ranging between 4 to 6 passengers. These vehicles are extensively used as alternative sustainable modes.

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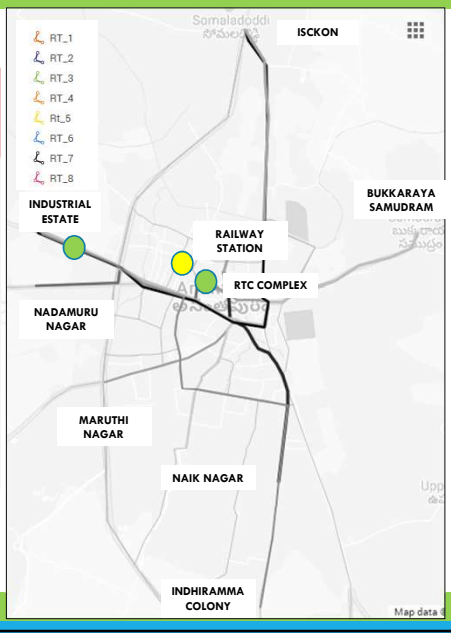
MULTI MODAL INTEGRATION NODES

S.NO.	LOCATION	TYPE	INTEGRATION
1	RTC Bus Stand	Major	Bus, IPT, NMT
2	Anathapur Railway Station	Major	Train, Bus, IPT, NMT
3	New Bus Terminnal	Major	Bus, IPT, NMT



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PROMOTING PUBLIC TRANSPORT OUTREACH

- Create a network of allies and provide platforms for them to actively participate as disseminators of project benefits.
- Use proactive and creative communication media to promote key messages. Communication media can be print, broadcasts, short films, event marketing etc.
- Programmes can be conducted in schools and colleges advocating the need for public transport. Events like Car Free Day, Cycle Day can also be promoted.

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Strategy 4

NON-MOTORISED TRANSPORT STRATEGY

- Development of Footpath
- Development of Bicycle Friendly Streets

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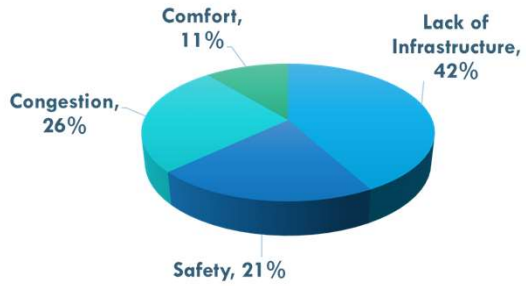
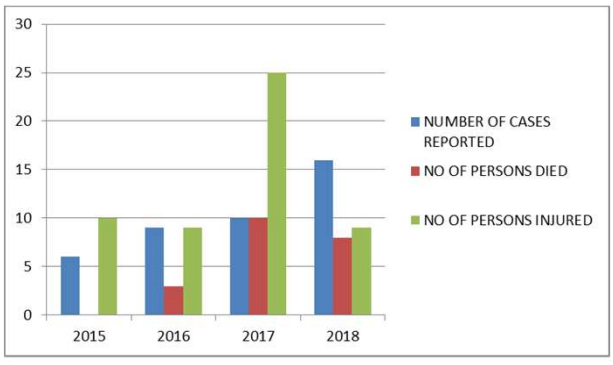
NON MOTORIZED TRANSPORT SCENARIO

9% network has facilities (footpath) to support safe pedestrian movement





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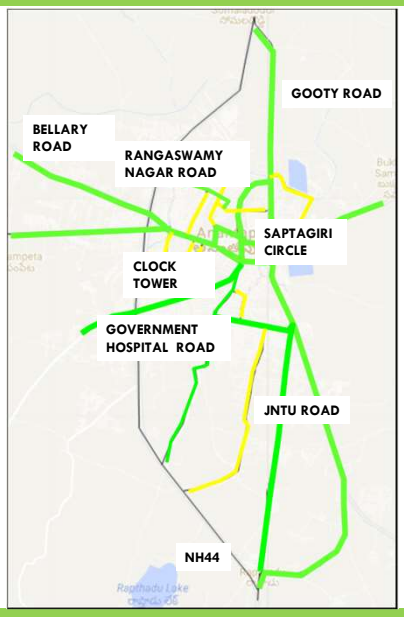
NON MOTORIZED TRANSPORT SCENARIO

GOVERNMENT HOSPITAL ROAD
JUNTU ROAD
PRASANNAYAPALLI ROAD
CLOCK TOWER ROAD
RANGASWAMY NAGAR ROAD
COURT ROAD
PTC ROAD
CSR HOSPITAL ROAD
OLD TOWN ROAD
RAILWAY STATION
PRASANNAYANAPALLI ROAD



51 Kms
For Footpath Development
2 m
Minimum Clear Walking Space

25 Kms
Dedicated Cycle Tracks

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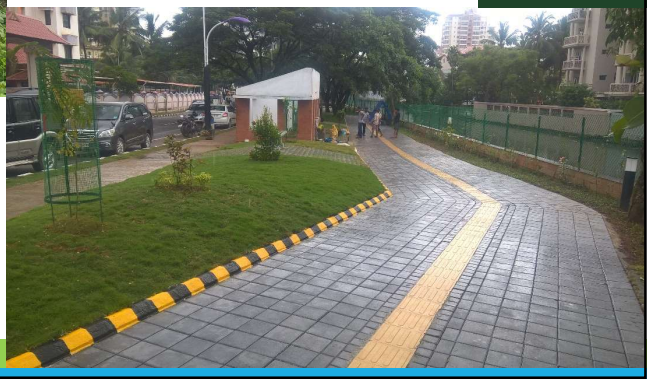
TRANSFORMATION OF SHIHAB THANGAL ROAD

Before

After



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Strategy 5

TRAFFIC ENGINEERING AND MANAGMENT

- Junction Improvements
- Traffic Management Plans
- Parking Proposals

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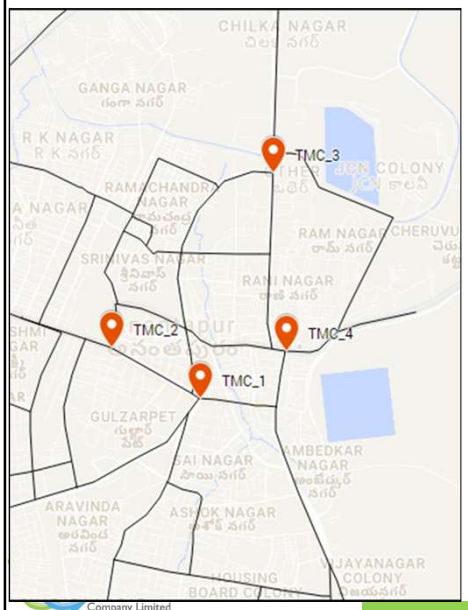
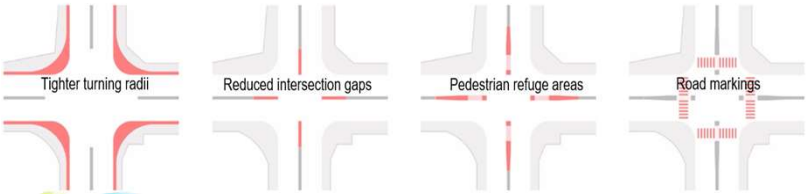
JUNCTION IMPROVEMENT PLANS





4 Junction for Immediate improvements

S.no.	Name of the Junction
1	Sapthagiri Circle
2	Clock Tower Junctipn
3	Dparmental Bus Stop Junction
4	Galam Street Junction

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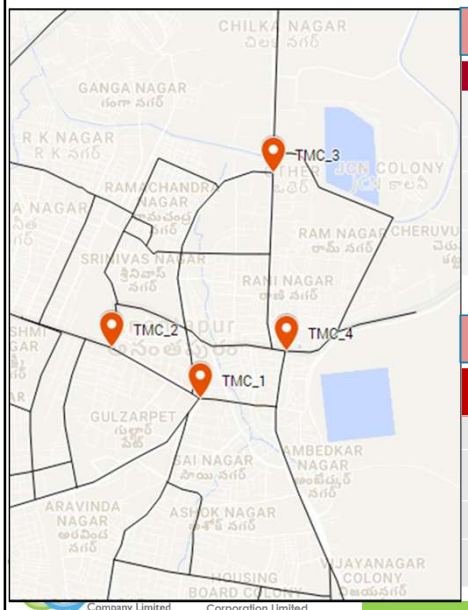
JUNCTION IMPROVEMENT PLANS



GEOMETRIC IMPROVEMENT

	Junction Type	2018	2028	2038
1	Sapthagiri Circle	Signal	Signal	Signal
2	Clock Tower Junction	Signal	GS	GS
3	Departmental Bus Stop Junction (Gooty Road)	Rotary	Signal	Signal
4	Galam Street Junction	Signal	Signal	Signal

PEDESTRIAN IMPROVEMENT FACILITES

	Junction Type	PV Square Value (10^8)	Crossing Facilities
1	Sapthagiri Circle	2.9	Signalized Control
2	Clock Tower Junction	2.6	Signalized Control
3	Departmental Bus Stop Junction	0.45	Zebra Crossing
4	Galam Street Junction	1.8	Zebra Crossing

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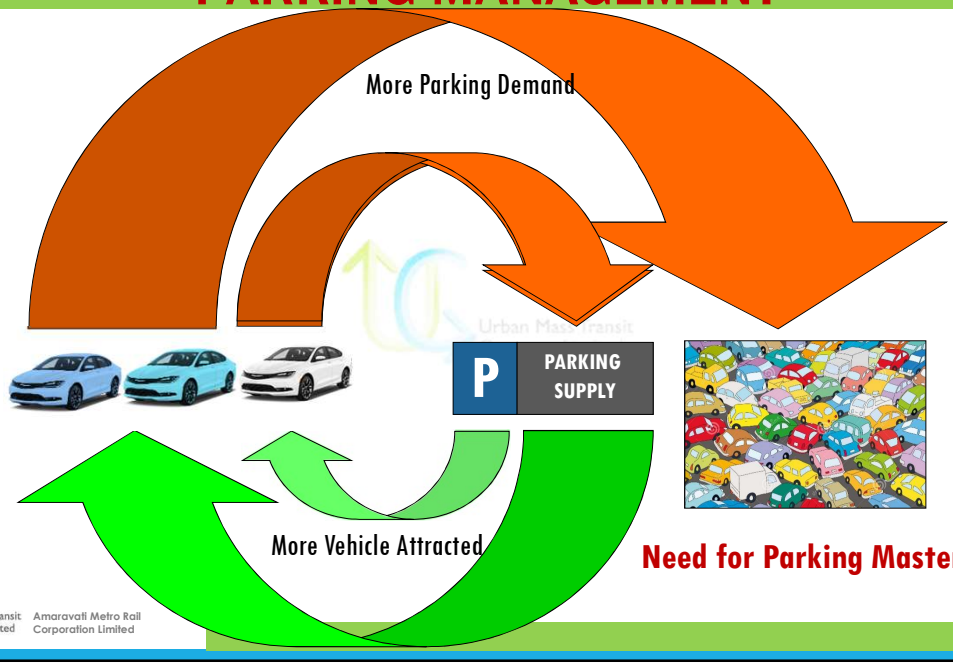
PARKING MANAGEMENT

Source: ITDP-Presentation Vibrant Gujarat



Need for Parking Master Plan

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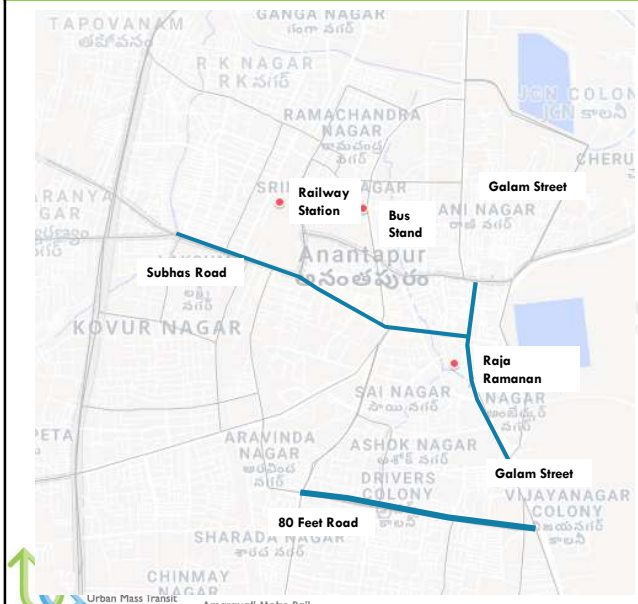
PARKING PROPOSALS



OFF STREET PARKING

No	Location	Area (m^2)	ECS (Proposed)	TYPE
1	Railway Station Parking Area	1750	70	Surface
2	Bus Station Parking Area	750	30	MLCP
3	Raja Ramana Parking Lot	1350	50	Surface

ON STREET PARKING

No	Location	Length (m)	Type
1	Subash Road	1000	30 Degree Angular
2	Galam Street	750	30 Degree Angular
3	80 Feet Road	500	30 Degree Angular

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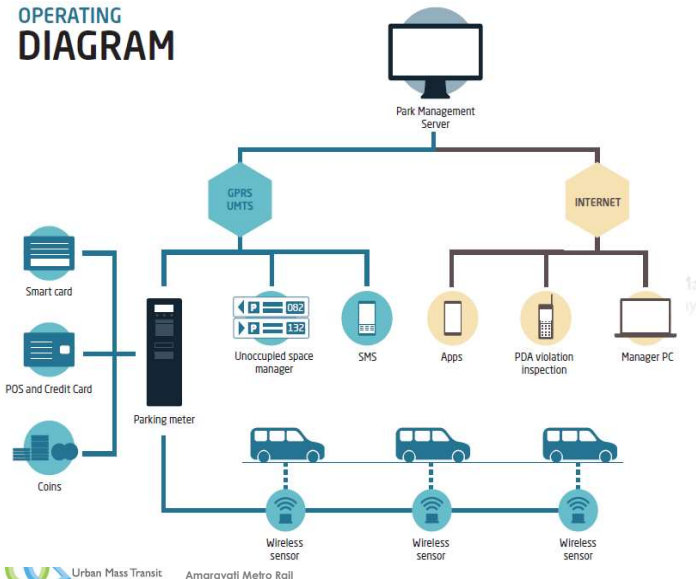
ON-STREET PARKING MANAGEMENT



Parking Meter

In-road Parking Sensor

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ON-STREET PARKING MANAGEMENT

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INTELLIGENT TRANSPORT SYSTEMS

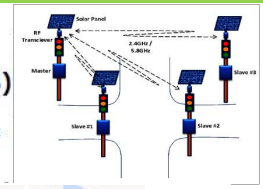
1 Advanced Traveller Information Systems (ATIS)

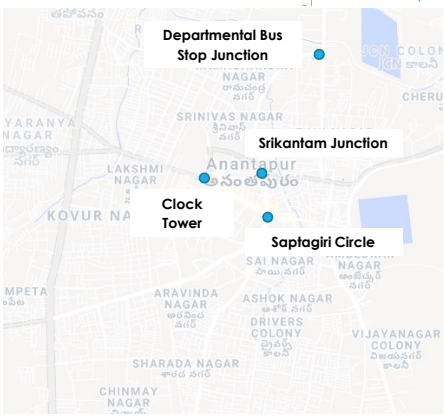
Provides users of transportation systems travel related information regarding routes, estimated travel times etc.

APSRTC BUS TERMINAL, OLD BUS STAND AND ALL BUS STOPS

2 Vehicle-Actuated Control Systems (VACS)

Signals controlled by traffic demand, obtained from detectors





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VEHICLE TECHNOLOGIES

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

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

Strategy 6

FREIGHT MANAGMENT

- Freight Terminals

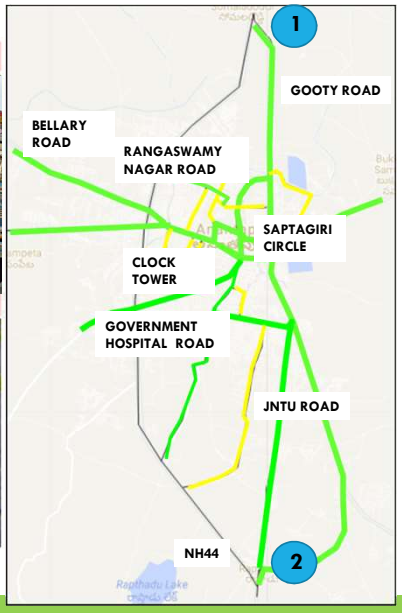
FREIGHT STRATEGY

Proposed Truck Terminals

1. Gooty Road
2. Rapthadu

Existing Goods Parking along the Highway

Envisioned Truck Terminal Facilities



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IMPACT ASSESSMENT

IMPACT ON TRAVEL CHARACTERISTICES		Public Transport	Intermediate Public Transport	Private Modes	Non-Motorised Modes	Average Network Speed	Average V/C Ratio
Base Year (2018)		4%	32.1%	51.7%	11.6%	27.2 kmph	0.92
Business as Usual Scenario (2038)	Similar growth patterns with ongoing projects	1%	40%	56%	3%	20.8 kmph	1.54
Sustainable Urban Transport Scenario (2038)	Sustainable Improvements in PT, NMT, Freight and Network	17%	26%	33%	24%	31.1 kmph	0.78

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PROJECT PRIORITIZATION

PHASE-1	PHASE-2	PHASE-3
SHORT TERM PROJECTS (2018-2023)	MEDIUM TERM PROJECTS (2023-2032)	LONG TERM PROJECTS (2032-2038)
Junction Improvements	Upgradation of Existing Roads	Development of New Links
Footpath	Flyover	Rail Over Bridges
Bicycles Stands	Shared Cycle Tracks	
Bus Shelters	Dedicated Cycle Tracks	
Improvement of Existing Bus Terminals	New Bus Terminal	
Parking Management Plan	Improved Bus System	
Improved Bus System	Proposed Truck Terminals	
	Off-Street Multi-Level Parking	
	ITS Systems	

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TOTAL PROJECT COST (As per 2018 prices)

Sl.No	Projects	Total Cost (Rs in Crores)	Phasing (Rs in Crores)		
			2018-2022	2022-2032	2032-2038
1	Improvement of Road Network	93.82	64.36	29.47	0.00
2	Improvement of Non-Motorised Transport Facilities	59.37	59.19	0.18	0.00
3	Improvement of Public Transport System	175.49	98.36	25.30	51.82
4	Improvement of Freight Transportation System	45.52	0.00	22.76	22.76
5	Intelligent Transportation System Facilities	24.18	7.93	8.13	8.13
6	Improvement of Parking Facilities	4.34	4.34	0.00	0.00
Overall LCMP Proposals		402.73	234.17	85.84	82.71

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COMMENTS AND SUGGESTIONS

COMMENTS AND SUGGESTIONS FROM MEMBERS/ STAKEHOLDERS…

Thank You

Urban Mass Transit Company Limited

Urban Mass Transit Company Limited

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AMARAVATI METRO RAIL CORPORATION LIMITED

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Gummadi Rao Street, Labbipet, Vijayawada

Urban Mass Transit Company Limited

Urban Mass Transit Company Limited

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