



सत्यमेव जयते

MINISTRY OF URBAN DEVELOPMENT
GOVERNMENT OF INDIA



VISAKHAPATNAM NMT CITY SPECIFIC PLAN



CONSULTANCY SERVICES FOR DEVELOPING GUIDANCE DOCUMENTS FOR TRANSIT ORIENTED DEVELOPMENT (TOD), NON-MOTORISED TRANSPORT (NMT) AND PUBLIC BICYCLE SHARING (PBS)



NON-MOTORISED TRANSPORT
VISAKHAPATNAM CITY SPECIFIC PLAN

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Images from Visakhapatnam city | source: iTrans



Prepared for Ministry of Urban Development, Government of India

By IBI Group

FOREWORD

Prior to the launch of the National Urban Renewal Mission (2005) and the National Urban Transport Policy (2006), investments in public transportation systems to meet the mobility needs of the current and future population were limited in Indian cities. Planning for essential city systems — environmental, land, mobility, economic and social — has largely been attempted in piecemeal manner. The need to induce a paradigm shift, putting people first in planning our regions, cities and neighbourhoods, implies providing for increased mobility choices from dependence on private vehicles to the availability of good public transportation and safe non-motorised transport.

Non-Motorised Transport (NMT) is a foundational mobility concept that prioritizes planning for walking and cycling over automobiles. This NMT City Specific Plan presents a compendium of strategies and recommendations for integrating accessibility with land use and infrastructure investment decisions in shaping NMT-friendly street designs. It follows the five-step planning process as prescribed in the NMT Guidance document for implementing non-motorised transport projects.

The document includes a comprehensive study on assessing the existing conditions in the context of preserving and encouraging the higher share of NMT usage, reviewing current institutional support, proposing development strategies and funding opportunities to facilitate implementation of prioritized non-motorised transport proposals. The plan also provides its stakeholders in Visakhapatnam on the city specific planning process for NMT and equip them with essential tools and resources necessary to integrate NMT planning within the city's existing public infrastructure implementation framework.

It is of utmost importance that the local agencies integrate the NMT recommendations presented in this document to mainstream non-motorised transport planning in Visakhapatnam. This will ensure that strategic investments in Visakhapatnam lead to reducing emissions, increasing safety and sustainable urban environment for India's emerging tier II city.

PREFACE

The Government of India (GoI) has initiated the Sustainable Urban Transport Project (SUTP) with the Ministry of Urban Development (MoUD) as the nodal agency and supported by the Global Environment Facility (GEF), World Bank and UNDP. SUTP consists of capacity building programmes and city demonstration projects, which aim to induce a major change in urban transport planning as currently undertaken in Indian cities. The primary objective of GEF-SUTP is to apply National Urban Transport Policy (2006) principles to achieve a paradigm shift in India's urban transport system for more favourable sustained developments and alternatives.

Under the guidance of MoUD, the project envisaged development of Guidance Documents for three sustainable development concepts: Transit Oriented Development (TOD), Non-Motorised Transport (NMT) and Public Bike Sharing (PBS) as essential steps towards achieving a comprehensive urban transport and land development planning process in the country. To further validate the findings and recommendations of the Guidance Documents, City Specific Plans (CSPs) for two selected demonstration cities each for the above mentioned concepts have been prepared. CSPs have also provided road map to the cities interested in applying these concepts. Lessons learned from these CSPs have helped contextualise the final Guidance Document(s) to Indian conditions.

The two NMT CSPs provide guidance for cities with: a) Hilly terrain to nurture a design sensitivity that respects the variations in topography and climate which could be replicated to cities with similar context; b) Integration of NMT with transit systems to improve the first and last mile connectivity. Ensuring that NMT infrastructure is in place as a support to existing or future public transit systems is crucial in developing compact communities and increasing transit ridership.

The Greater Visakhapatnam Municipal Corporation (GVMC) was one of the selected demonstration cities out of the total 13 applications received by SUTP. The city's Low Carbon Mobility Plan reported that more than 50% of the trips in the city are made by walk mode and about 3% trips are made by cycling. However, the infrastructure provision to support this large volume of pedestrians is inadequate in the city. Also, the accident data shows that NMT users suffer disproportionately from externalities of increasing motorization in the city. Further, Visakhapatnam has highly variable terrain and is currently experiencing signs of significant urban sprawl. Both these aspects cause an increase in trip lengths and give rise to higher dependency on motorised vehicles. NMT has the potential to address the challenges posed by rapid unhindered development and unplanned transport networks in Visakhapatnam. In addition, planning for NMT in the city would also offer last mile connectivity to the proposed BRTS and Metro rail.

ACKNOWLEDGEMENT

The successful completion of this project required extensive involvement from the nodal agency in Visakhapatnam - the Greater Visakhapatnam Municipal Corporation (GVMC) under guidance of Mr. Praveen Kumar (Commissioner, GVMC).

The consultant team would like to thank GVMC, specifically the staff that helped organize the meetings and guided the study process. In addition, IBI Group would also like to extend appreciation for supporting the initiative to:

1. Mr. K. Mahendra Pathrudu (Addl. DCP Traffic Police)
2. Mr. N Srinivas Rajamani, (City Project Coordinator, UNDP-Gol)
3. Mr. G Sudesh Kumar, (Regional Manager, APSRTC)
4. Faculty and staff from Geetam University and Andhra University

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EXECUTIVE SUMMARY

Introduction

The Ministry of Urban Development (MoUD), Government of India, under the Sustainable Urban Transport Project (SUTP), has appointed IBI Group in association with iTrans, to undertake the task of developing Guidance Documents and City Specific Plans for Transit Oriented Development (TOD), Non-Motorised Transportation (NMT), and Public Bicycle Sharing (PBS) for Indian cities. The Greater Visakhapatnam Municipal Corporation (GVMC) was the nodal agency for the project.

Visakhapatnam was selected as one of the demonstration cities for NMT Planning where the five-step planning process recommended in the Guidance Document was applied to test its validity. The presence, quality and connectivity of Visakhapatnam's NMT network varies significantly, and opportunities for improvements are evident throughout the city.

This Executive Summary highlights the research, analysis and stakeholder involvement activities that have been performed in the development of the NMT Plan; the resulting projects, programmes and policies that comprise the Plan; and the implementation strategy that will guide project and program activities.

The objective of this project was to develop a citywide plan for bicycle and pedestrian facilities and projects that addresses the mobility needs of different segments of the population – commuters, students, children, the disabled and the elderly. The Visakhapatnam NMT Plan focuses on how bicycle and pedestrian travel can become a more integrated and effective form of transportation to connect people to citywide destinations.



NMT FRAMEWORK

1 ASSESS



NMT FRAMEWORK

2 ENABLE



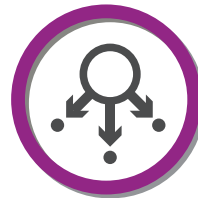
NMT FRAMEWORK

3 PLAN + DESIGN



NMT FRAMEWORK

4 INVEST



NMT FRAMEWORK

5 IMPLEMENT



Existing well designed Pedestrian Infrastructure along the Beach Road

NMT IN VIZAG TODAY



The baseline assessment carried out in Visakhapatnam shows that the city has **highly variable terrain** and is currently **experiencing signs of significant urban sprawl**. Both these aspects cause an **increase in trip lengths and give rise to higher dependency on motorised vehicles**. Key NMT related characteristics reported in the city's Low Carbon Mobility Plan include:

- More than 50% of the trips in the city are made by walk mode and about 3% trips are made by cycling.
- 71% of trips were within 3km in length, which explains the high proportion of walk trips in the city.
- NH-5, passing through the city, has significantly high accident rates.
- Only 77 km of roads out of the total 1,100 km of urban roads have footpaths present or under construction.

GVMC has adopted several initiatives to reduce transportation related pollution in the city, including the following NMT related interventions:

- A 3.5km stretch along the Beach Road, every day from 5:30 to 7:30 a.m. is dedicated as a vehicle-free zone since November 2011.
- Planned three Cycling Zones along Old Jail Road, R&B Road and Malkapuram
- Declared every Monday as 'vehicle-free day' for its employees restricting vehicles to enter GVMC premise. About 3,000 GVMC employees commute to work either by cycle or public transportation.
- Launched the concept of 'Cycling Clubs' along Beach Road

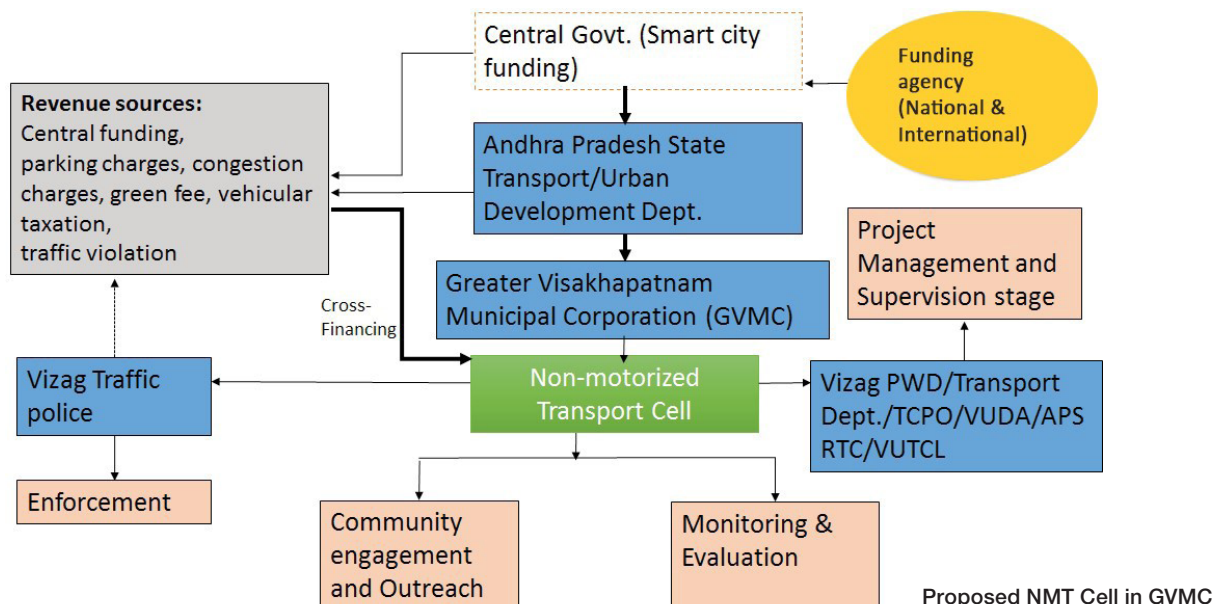


SUPPORT FOR NMT

Implementing the Visakhapatnam NMT Plan will require leadership from GVMC to support and encourage the "culture of walking and cycling" among the governmental agencies. It will require extensive collaboration amongst city departments, a commitment by city leadership and staff at all levels, and cooperation by other agencies and stakeholders.

Key Strategies:

- **Build leadership support and identify project champions:** GVMC, VUDA and Traffic Police will play a crucial role in plan implementation and identifying local champions.
- **Undertake Capacity Building:** Starting with adopting a citywide NMT Policy, the Plan recommends establishing a dedicated NMT cell within the GVMC to build local capacities to undertake NMT implementation and enforce identified measures.



DESIGN INTERVENTIONS



The 'Plan + Design' section presents a plan for Visakhapatnam at multiple scales. Primarily, it proposes development of an NMT network that allows for direct, coherent, safe, attractive and comfortable routes for all NMT users across most desire corridors. The following key ideas summarize the proposed NMT improvements in Visakhapatnam.

Key Strategies

1. Seamless NMT citywide network (walking infrastructure and cycling infrastructure)



2. Integrating land use and transport



3. Safe route to parks and schools programme



4. Public bicycle sharing



5. First and last mile connectivity to transit



6. Blueways recreational trail



7. Retrofitting existing streets



Signature Projects

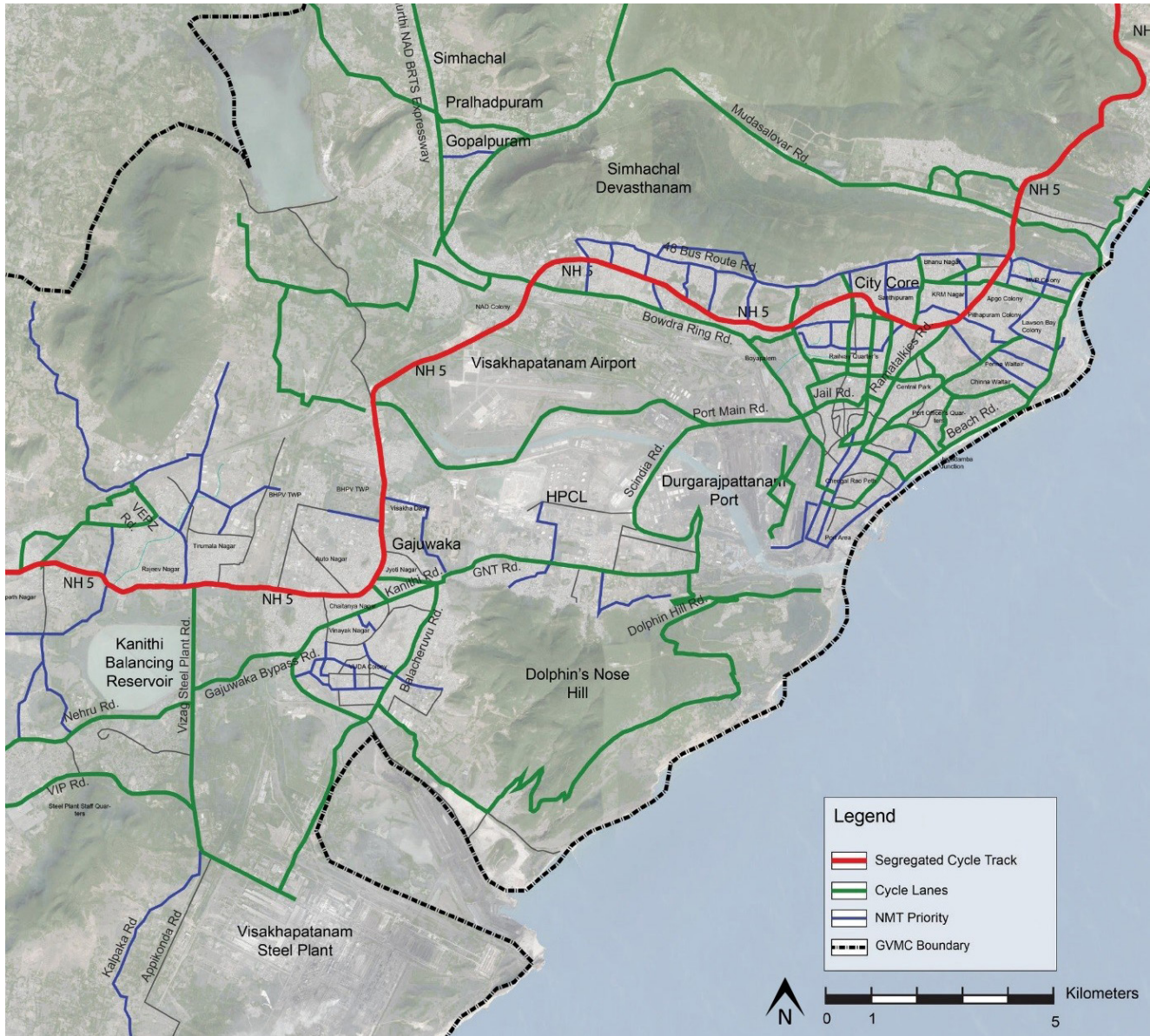
1. Cycling Highway along Beach Road



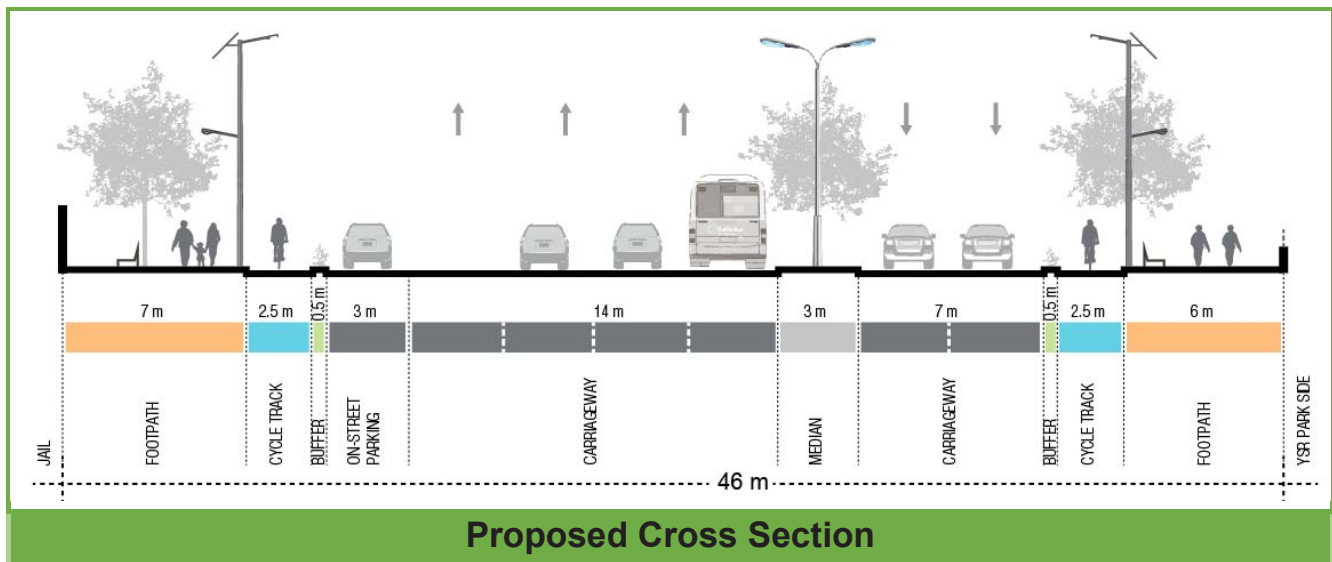
2. Accessibility design for influence areas of the proposed metro stations



DESIGN INTERVENTIONS



Proposed city-wide NMT network in GVMC area



INVEST



Provision and retrofitting various NMT infrastructure facilities as per **GVMC's report on Implementation of Cycle lanes, footpaths and Public Bicycle Schemes in Visakhapatnam City** would require around **Rs. 5.5 Crores** which is only for **11.6 Kms of length**. However, about **Rs. 4.5 Crores** would additionally be required for implementing the PBS scheme (a total investment of around Rs. 10 crores). Also, the city would require a much wider network otherwise the mode share for NMT will reduce exponentially.

The NMT Plan proposes that about 5% of the annual budget spent on transport needs be allocated to Non-Motorised Transport (NMT), including the following cost estimates:

S No.	Road name	Length in km	Estimated cost
1	Old Central Jail	1.2	1,03,85,424
2	Dwarakanagar to Gurudwara Jn.	1.3	64,98,198
3	Rednam Circle to Siripuram Circle (Dutt Island)	1.5	86,59,665
4	Siripuram Circle to GVMC	1.0	61,70,535
5	Siripuram Circle to Beach Road (via old CBI and Lawsons Bay Colony)	2.5	66,73,275
6	Siripuram Circle to Beach Road (via. Au out gate)	2.0	1,00,13,220
7	Tycoon Jn. to Mosque (VIP Road)	0.6	20,67,156
8	Seven Hills Jn. to Vizag Central Circle (via Jagadamba Jn.)	1.5	40,03,965
Total cost		11.6	5,44,71,438

Source: GVMC, 2012*

IMPLEMENT



One of the key tasks in implementing the Visakhapatnam NMT Plan will be to identify priorities based on available resources, political and public support and strategic opportunities to link with other existing programs. The following table describes the roles and responsibilities of various agencies in successfully implementing the recommendations contained in this plan.

Stakeholder	Potential Roles
Politicians	<ul style="list-style-type: none"> Build commitment and motivate the society. Enact regulatory changes, if necessary Ensure cooperation between various agencies
Visakhapatnam Urban Transport Company Ltd. (SPV for BRT)	<ul style="list-style-type: none"> Ensure integration of the system with bicycle Infrastructure like signage and signalling under PWD to support increased bicycle traffic volume. Provide space under PWD jurisdiction for walking and cycling infrastructure. Ensure implementation of all NMT facilities.
GVMC - Planning, Projects, Accounts, Finance departments	<ul style="list-style-type: none"> Provide space under GVMC jurisdiction for walking and cycling infrastructure. Ensure integration of the system with public facilities. Provide Advertisement permission for various locations along the NMT routes in the jurisdiction
VUDA	<ul style="list-style-type: none"> Provide space under VUDA for walking and cycling infrastructure.
APSRTC- Operations and Finance departments	<ul style="list-style-type: none"> Ensure integration of bus system with bicycling and walking infrastructure. Provide space for parking facilities for PBS at the bus stops. Ensure integration of public bicycle infrastructure with bus infrastructure under DTC. Promote the use of public bicycles to current bus users
Transport Department	<ul style="list-style-type: none"> Ensure integration of the system with walking and bicycle Infrastructure like signage and signalling to support increased pedestrians and bicycle traffic volume. Ensure check on growth of motorized vehicles. Ensure proper installation of advertisement according to the guidelines.
Auto-Rickshaw Drivers Union	<ul style="list-style-type: none"> Ensure integration of IPT with bicycling and walking facilities.
Traffic Police	<ul style="list-style-type: none"> Maintain a safe environment for walking and cycling Enforce the traffic rules for safety. Protect the city from theft and vandalism of the public facilities and infrastructure.

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ABBREVIATIONS

ABD	:	Area-based development
APIIC	:	Andhra Pradesh Industrial Infrastructure Corporation
APPCB	:	Andhra Pradesh Pollution Control Board
APSRTC	:	Andhra Pradesh State Road Transport Corporation
AU	:	Andhra University
BAU	:	Business as Usual
BC	:	British Columbia
BOQ	:	Bill of Quantities
BRT	:	Bus Rapid Transit
BRTS	:	Bus Rapid Transit System
CBI	:	Central Bureau of Investigation
CDP	:	City Development Plan
CEPT	:	Centre for Environmental Planning and Technology
CGG	:	Centre for Good Governance
CMP	:	Comprehensive Mobility Plan
CPTED	:	Crime Prevention through Environmental Design
DCR	:	Development Control Regulations
DPR	:	Detail Project Report
DTU	:	Technical University of Denmark
FAR	:	Floor Area Ratio
FIR	:	First Information Report
GHG	:	Greenhouse Gas
GITAM	:	Gandhi Institute of Technology and Management
GO	:	Government Order
GVMC	:	Greater Visakhapatnam Municipal Corporation
HPCL	:	Hindustan Petroleum Corporation Limited
ICT	:	Information & Communications Technology
IIM	:	Indian Institute of Management
IIT	:	Indian Institutes of Technology
IPT	:	Intermediate Public Transport
ITS	:	Intelligent Transportation System
IUT	:	Institute of Urban Transport
JN	:	Junction
LCMP	:	Low Carbon Mobility Plan
LOS	:	Level of Service

MV	:	Motorised Vehicle
NH	:	National Highway
NHAI	:	National Highway Authority of India
NMT	:	Non-motorised Transport
NMV	:	Non-motorised Vehicle
PBS	:	Public Bicycle Sharing
PM	:	Project Manager
PPP	:	Public Private Partnership
PPUDO	:	Passenger Pick-up and Drop-offs
PT	:	Public Transportation
PWD	:	Public Works Department
RTA	:	Regional Transport Agency
SCP	:	Smart City Proposal
SPV	:	Special Purpose Vehicle
SWOT	:	Strengths, Weaknesses, Opportunities, and Threats
TCPO	:	Town and Country Planning Organization
TOR	:	Terms of Reference
TRIPP	:	Transportation Research and Injury Prevention Programme
UNEP	:	United Nations Environmental Program
VMC	:	Visakhapatnam Municipal Corporation
VUDA	:	Visakhapatnam Urban Development Authority

CHAPTER I: INTRODUCTION

1. INTRODUCTION

The Ministry of Urban Development (MoUD), Government of India, is the primary agency responsible for development of cities by guiding and developing policies for urban development. MoUD, through its policies and programmes, such as the National Urban Transport Policy (NUTP 2006), continues to strengthen the capacities of urban local bodies and state governments to create conditions that will make Indian cities more liveable and sustainable for its citizens. One such initiative to further the goals of the NUTP 2006 is the Sustainable Urban Transport Project (SUTP). The World Bank and UNDP support SUTP under the Global Environment Facility (GEF) programme.

Under this GEF-SUTP programme, MoUD appointed IBI Group as the lead consultant for developing National-level Guidance documents and city specific plans for (i) Transit Oriented Development (TOD), (ii) Non-motorised Transport (NMT), and (iii) Public Bicycle Sharing System (PBS). The guidance document(s) present a “how-to” manual for each of these three sustainable transportation concepts in detail, by considering the lessons learned from worldwide experience and contextualizing the concepts to better suit India’s unique conditions.




To implement the findings and recommendations of the Guidance Documents, City Specific Plans for two cities were prepared for each of the above mentioned concepts. Lessons learned from these City Specific Plans were integrated in refining the Guidance Document(s) and ensuring that they are based on ground realities with a focus on implementation.



This report contains the Non-motorised Transport Plan for the city of Visakhapatnam (hereinafter referred as the ‘Visakhapatnam NMT Plan’) as one of the two City Specific Plans prepared to test the applicability of the NMT Guidance Document in cities. The Greater Visakhapatnam Municipal Corporation (GVMC) was one of the selected demonstration cities out of the total 13 applications received by SUTP. Visakhapatnam was selected as a demonstration city because of the following reasons:

- Presence of high NMT modal share (54% walk + 3% cycle)
- Successful demonstrations of NMT projects such as the construction of 5 km of dedicated cycling track and car-free beach access road.
- Commitment of city corporation staff to use NMT at least one day each week to set an example for its citizens
- Organizing increasingly common events like cyclothons by the stakeholders
- Potential to ensure last mile connectivity to the proposed BRTS and MRTS in the city.

1.1. Planning Process and Methodology

This Visakhapatnam NMT Plan follows the NMT Step-by-Step Planning Process recommended by MoUD's National Level NMT Guidance Document.

	Tasks	Outcomes	Reference	
 1 ASSESS <small>NMT FRAMEWORK</small>	'Assess' guides authorities for establishing baseline that needs to be carried out to understand the current status of the city.			
	1	Review City Characteristics and Transport Scenario	NMT Needs Assessment	Section 2.1, 2.4
	2	Conduct review of current institutional support, legislative and regulatory environment	NMT Readiness Assessment	Section 2.2, 2.3, 2.5, 2.6
	3	Map existing initiatives and their impact	Documentation of key learnings	Section 2.7
	4	Define scale and type of NMT Plan	Scale and Scope of NMT Plan	Section 2.8
	5	Identify funding opportunities for undertaking NMT studies	Funding Sources and Opportunities	
	6	Identify stakeholders and conduct and actors analysis	Actors analysis	Section 2.10
 2 ENABLE <small>NMT FRAMEWORK</small>	'Enable' provides the steps necessary to translate the policies into local actions and aims at building commitment and encouraging leadership to change culture and perceptions.			
	1	Establish leadership support and project champions	NMT Cell	Section 3.1
	2	Establish NMT Vision and time-bound targets	NMT Vision and Targets	Section 3.2
	3	Identify and address policy level barriers	Gaps, Consistencies and Recommendations	Section 3.1
	4	Define project requirements and delivery mechanism	NMT Plan Terms of Reference	Section 3.2, Appendix D
	5	Develop technical capacity	Augmentation of in-house technical skills	Section 3.3
 3 PLAN + DESIGN <small>NMT FRAMEWORK</small>	'Plan + Design' defines a flexible planning process that city may adapt based on the local context to undertake planning and implementation of NMT infrastructure at varying scales.			
	1	Map Existing Infrastructure and develop NMT Demand Estimates	Existing Conditions Inventory / NMT Demand Analysis	Section 2.3, 2.4
	2	Conduct Stakeholder Workshop / Meeting(s) to Revalidate Vision, Issues and Opportunities.	Stakeholder Inputs	Section 2.9
	3	Identify Gaps / Plan Expansion of NMT Network	NMT Network Plan with Street Hierarchy / Street Typologies	Section 4.1, 4.2
	4	Formulate context-specific NMT proposals	Master list of NMT proposals	Section 4.3
	5	Identify pilot projects and signature projects	Project Plans	Section 4.4
	6	Develop current and horizon year scenarios using traffic modelling tools	Scenario Models	
	7	Identify implementation and phasing strategy	Phasing Strategy and Preliminary Costing	

	Tasks	Outcomes	Reference	
 <p>'Invest' explores the possible financing options that city could use to ensure that funding for NMT is given equal priority as urban roads.</p>				
Invest	1	Prioritise NMT proposals for city budget allocations	Capital Improvement Program	Section 5.1
	2	Identify alternative financing sources	Alternative financing sources	Section 5.2
	3	Develop incentives for private stakeholders to invest in NMT infrastructure	Private stakeholder incentives/DCR modifications	Section 5.2
	4	Establish budget allocations for NMT up gradation and maintenance	Up gradation and Maintenance Plan	Section 5.1
 <p>'Implement' focuses on the various components of NMT implementation- from the organizational framework to community engagement, outreach, project management and monitoring and evaluation.</p>				
Implement	1	Define clear roles and responsibilities for NMT development and maintenance	Roles and responsibilities	Section 6.1
	2	Conduct advocacy and awareness campaigns	NMT events/ educational campaigns	Section 6.2
	3	Ensure high quality project delivery	Uniform tendering and contracting procedures	Section 6.3
	4	Conduct NMT sensitization workshops with enforcement officials	Sensitization/ training workshops	Section 6.4
	5	Develop monitoring and evaluation framework to measure success of NMT targets	Communications Strategy	Section 6.5

CHAPTER II: ASSESS

2. ASSESS

The baseline assessment for Vizag's NMT Plan's study area was conducted utilizing a combination of methods, including: review of secondary data, visual surveys, and meetings with various agencies involved in the city's urban and transportation development. The information gathered was reviewed from the perspective of how NMT-supportive are the city's policies, programmes and planning initiatives to date. Further, city processes currently underway were also evaluated to identify ongoing initiatives that could promote NMT environments and those that could pose potential threats to sustainable transportation choices. Table 2.1 lists the various data sources and NMT specific analysis conducted at the onset of the planning process of this project.

Table 2.1: Data source and NMT specific analysis

Data Source	NMT Specific Analysis
Master Plan (2007); City Development Plan (2012)	Base map, City profile, Demographic data, Land Use Data, Topography
Low Carbon Mobility Plan - 2014	Geographical information data – maps and shape files, network, Household survey and Traffic related data
GVMC budget and annual accounts	Analysis of city budgets Financial planning and investments
Slum data (City Development Plan - 2012)	Informal settlements in the city, Status of the informal settlements, Basic services assessment, Land encroached by slums
Road accident data (Low Carbon Mobility Plan - 2014)	Identify black spots, accident prone areas
Census data (City Development Plan – Greater Visakhapatnam, Census of India)	Population growth trends, densities and spatial distribution
Road inventory data (Low Carbon Mobility Plan - 2014)	Right-of-way availability, cross-sections, road hierarchy, network design
Pedestrian data – counts, characteristics (Low Carbon Mobility Plan - 2014)	NMT street hierarchy, quality of infrastructure, footpath widths, activity generators
Economic census data (City Development Plan - 2012)	Reviewing Legislative and regulatory environment
BRT corridor design data (Low Carbon Mobility Plan - 2014)	NMT infrastructure designing and network planning
Cost estimates - Schedule of rates – Government of Andhra Pradesh	Financial Planning, Costing of overall project

Source: *iTrans*

2.1. Visakhapatnam City Profile

The city of Visakhapatnam, commonly known as Vizag, is a port city on the southeast coast of Bay of Bengal, and the second largest urban agglomeration in the state of Andhra Pradesh. As per Census 2011, the city has a population of about 17.3 lakh. Known as the centre of the state's heavy industries, steel plants and oldest shipyard, Vizag also has the largest seaport of India. It has the only natural harbour of India and headquarters of the Eastern Naval Command of the Indian Navy.

The city continues to be a hub of economic activity in the region and hence its development is critical to the overall growth of the region. Its role as the region's economic engine has led to a steady increase in migration from the rural areas of the state. The 534 sq km of area under the jurisdiction of the Greater Visakhapatnam Municipal Corporation (GVMC) has been selected as the study area for the preparation of the NMT City Specific Plan primarily because it also coincides with the other project study areas like the Low Carbon Mobility Plan (LCMP, 2014) and as the priority area of intervention for the government's development policies. Figure 2.2 shows the GVMC area and its sub-areas, with the urban core city covering an area of 166 sq km.

A majority of people walk in Vizag (52% as per the LCMP 2014). If planned interventions to support NMT are not implemented soon, the increasing motorization and automobile oriented development may decline this percentage in years to come. The cycle mode share has also declined from 3% to 2% and only the captive cycle users, who travel longer than walk trips and can't afford any other mode of transport, are anticipated to use this mode (LCMP, 2014). Therefore, providing adequate NMT infrastructure needs to be an integral part of the development of the city to ensure that existing users don't shift to personal vehicles as the predominant mode of travel.



Figure 2.1: Aerial view of Vizag city showing Ramakrishna Beach area from the Port area

Source: https://en.wikipedia.org/wiki/Visakhapatnam#/media/File:Vizag_aerial_view.jpg

Due to the heavy industrial and ports related activities, Vizag is identified by the Central Pollution Control Board¹ as one of the critically polluted areas in the country, specifically the ambient air quality index. The growing trend of increased private car ownership is adding to these strained pollution levels in the urban core, as well as impacting the overall quality of life due to increased congestion and higher accident rates. Reducing GHG emissions by adopting sustainable transportation modes as a priority becomes crucial step in controlling the pollution levels, warranting a need for regular updates to the city's transportation plans. This NMT Plan is intended to build upon the city's transportation planning efforts ensuring that safe mobility alternatives are equitably made accessible to all citizens, while contributing in improving the city's overall environmental health.

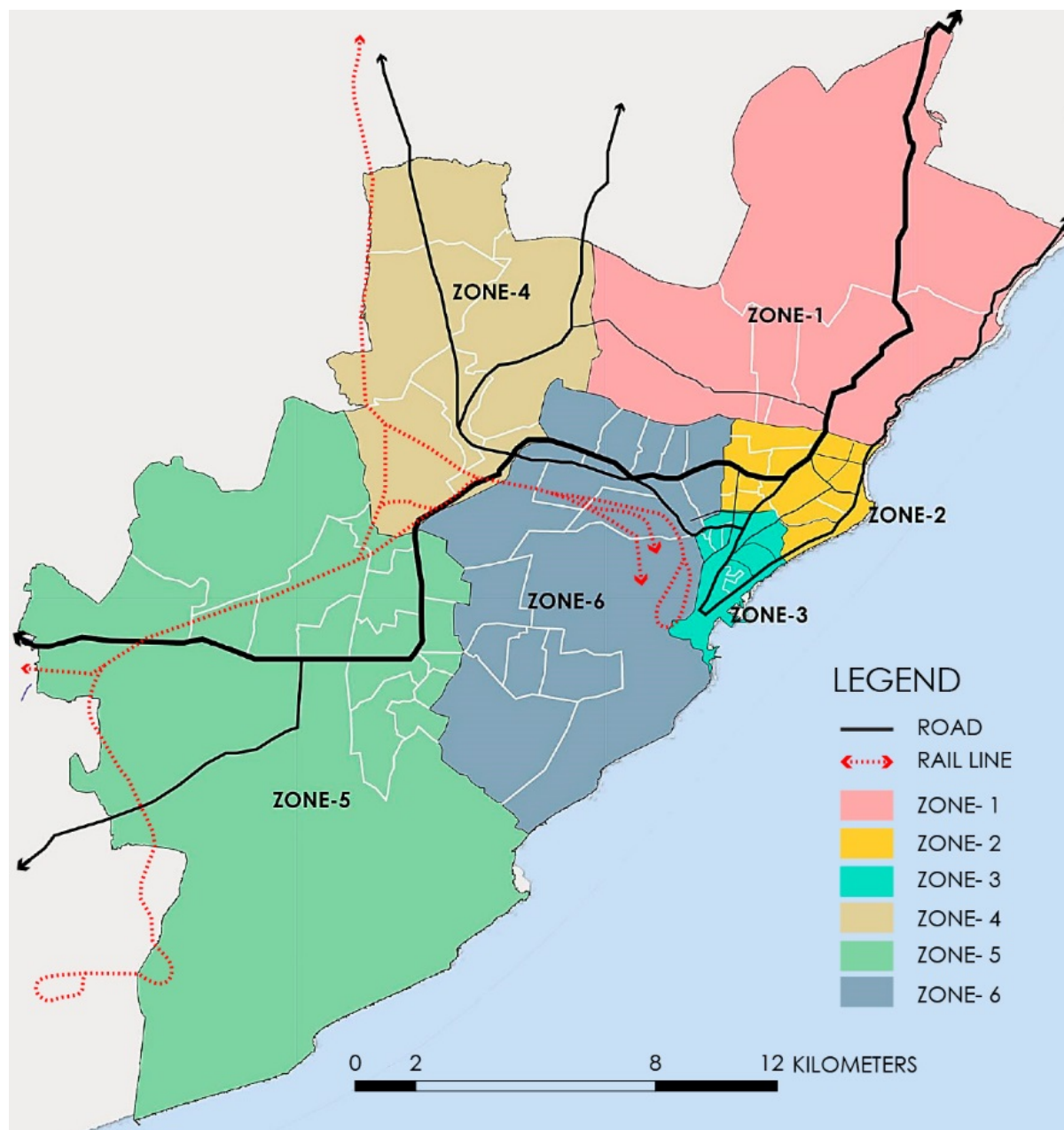


Figure 2.2: Administrative zones of Visakhapatnam

Source: Smart City Proposal, Vizag (<http://smartcities.gov.in/writereaddata/winningcity/VishakapatnamAnnexure.pdf>)

¹ Final Action Plan for Improvement of Environmental Parameters in Critically Polluted Areas “Visakhapatnam Cluster” Andhra Pradesh, A.P. Pollution Control Board, 2010.

2.1.1. Demographics

From 1858, when its 'Municipal Association' was formed, to date, the city has developed into a significant economic, educational, health and tourism hub for the people of north-eastern Andhra Pradesh and adjoining states of Odisha and Chhattisgarh. The city is well connected nationally and internally by National Highway (NH-5), which also functions as one of the major freight corridors in the region. Additionally, a strong presence of the railways, airport and the sea port attracts a large floating population to access the employment and educational activity centres offered by the city.

Greater Visakhapatnam Municipal Corporation (GVMC) was formed in 2005 by merging the erstwhile Visakhapatnam Municipal Corporation (VMC), Gajuwaka Municipality and 32 other villages. Table 2.2 illustrates the population growth trends since 2001 and projection estimates for 2021. GVMC is estimated to reach a population of 20 lakh by 2021 with a growth rate of about 50% witnessed in the city between 2001 and 2006 mainly due to the merger of surrounding areas with the city.

Table 2.2: Population trends of Visakhapatnam

Component	Area (sq. km)		Total Population (in lakh)			
	2001	2006	2001	2006	2011	2021 (Projected)
GVMC	111	540	9.69	14.5	16.61	20.99
VUDA	1701	1701	22.02	26.21	30.58	34.99

Source: United Nations, Department of Economic and Social Affairs, Population Division. (2011). On-line data: Urban agglomerations. http://esa.un.org/unup/unup/index_panel2.html

With a population of 17.3 lakh (Census 2011) and a total area of 530 sq km, the average population density of the city is around 3,300 persons per sq km. However, since the effective built up area is only around 166 sq km, the urban population density in the city is around 10,400 persons per sq km. Within the built-up core area, approximately 50 sq km of the core city area holds up to 50% of the city population, resulting in a very high population density of 27,000 persons per sq km (refer Figure 2.3). Some wards in the core city even have a density of 60,000 persons per sq km. Higher population densities often equate to compact developments with visible and latent demand for pedestrian travel. These areas often contain land uses that are both travel generators (residential) and travel attractors (retail, employment, schools) and located in close proximity to each other. However, often due to lack of proper NMT infrastructure people are forced to shift to personal vehicles for daily trips such as driving children to schools, or using two-wheelers for shorter trips. GVMC in its planning efforts, including the Master Plan Update and DCRs, need to ensure that complementary land uses are retained and supported with a fine grain street network to better connect the existing land uses in compact areas.

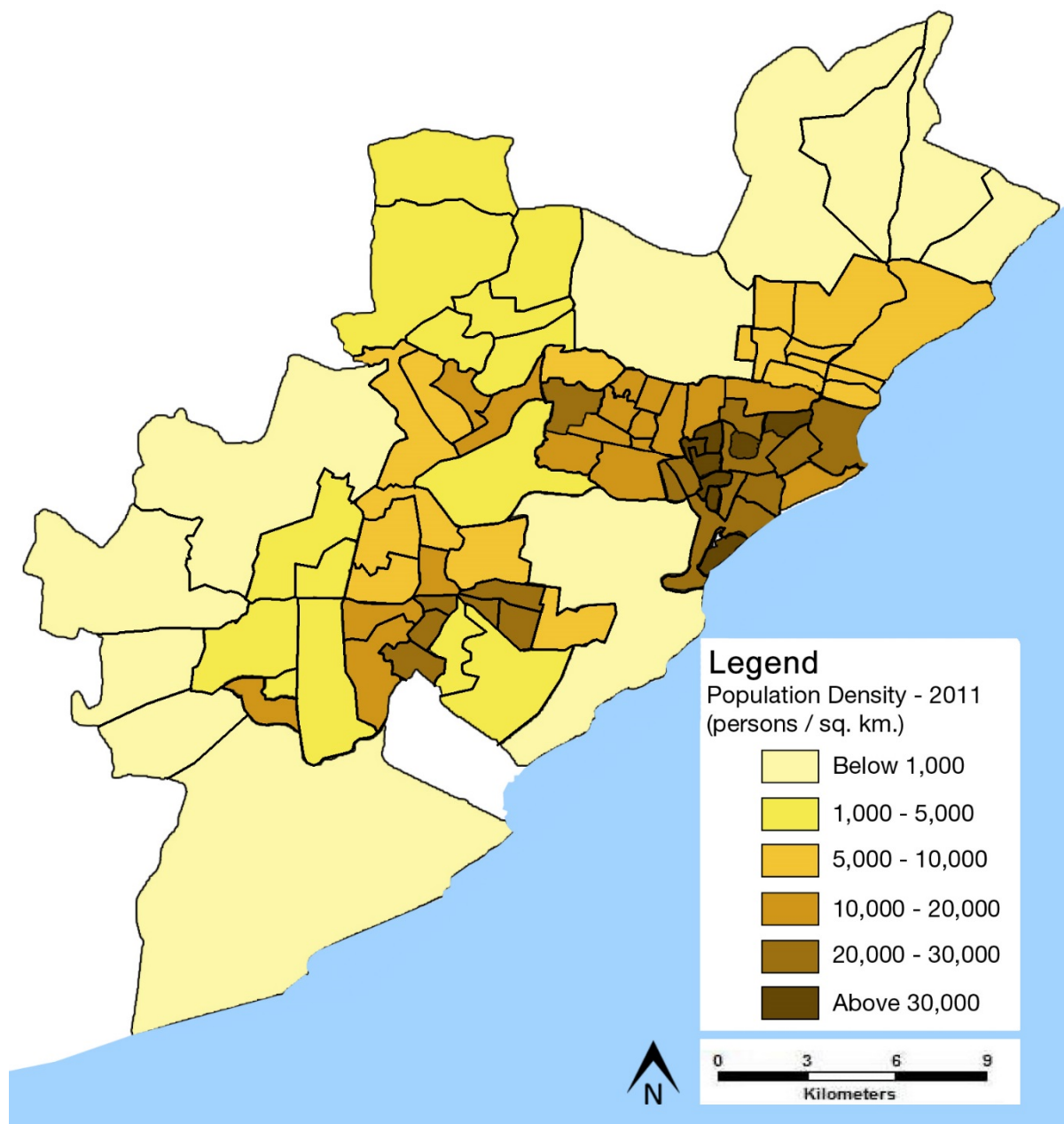


Figure 2.3: Existing population density (2011)

Source: LCMP 2014, Promoting Low Carbon Transport in India, UNEP DTU Partnership, Technical University of Denmark

2.1.2. Land Use

The city's urban area boundary encompasses a total land area of 166 sq km, industries occupy nearly 57% of the city area, forming the predominant land use type. Residential uses (23%) are the next dominant land use, followed by transportation related uses (16%- 10% roads and 6% transit facilities), and commercial and public spaces occupying a mere 2% of the total land area. Table 2.3 shows the 2011 land use distribution in the city. This disproportionate land use distribution combined with unbalanced spatial development pattern, illustrated in Figure 2.4 is a concern for promoting sustainable transportation modes in the city. For example, majority of the commercial areas are concentrated in the core city area thereby inducing long distance trips to connect the employment and residential activities located in the outskirts of the city. There is a need to encourage mixed land use in the central core and increase the commercial areas in all outgrowths of the city, while investing in public transportation and non-motorised transportation to curtail urban sprawl and promote compact, walkable neighbourhoods.

Table 2.3: Land use distribution in Visakhapatnam urban core

Land use type	Built up area (in sq km)	% Area occupied
Industrial	95	57%
Residential	38	23%
Commercial	2	1%
Public Facilities	1	1%
Roads	17	10%
Railways+ Airport+ Bus Terminals	11	6%
Other	2	1%
Total	166	100%

Source: VUDA, April, 2007, Revised Master Plan for Visakhapatnam Metropolitan Region – 2021

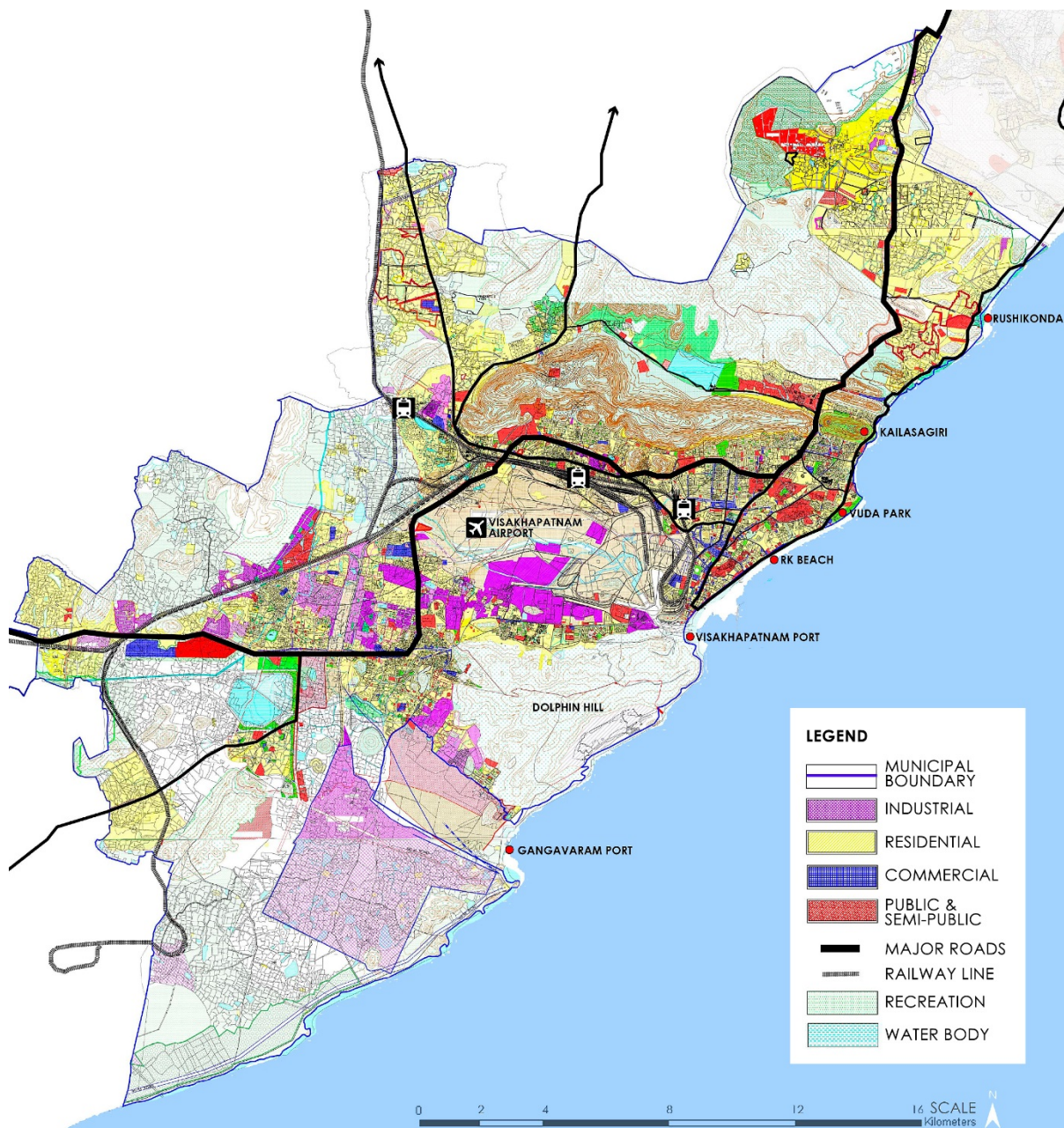


Figure 2.4: Existing Land Use pattern as per the Master Plan

Source: Smart City Proposal, Vizag (<http://smartcities.gov.in/writereaddata/winningcity/VishakapatnamAnnexure.pdf>)

2.1.3. Topography

Vizag's topography is described as a spoon-shaped basin surrounded by hill ranges on three sides and sea on the other side. The physiographic character of Visakhapatnam exhibits distinctly four broad natural features: 1) The two hill ranges forming northern (Kailasa Range) and Southern (Yarada Range) borders; 2) The highlands extending along the shore; 3) Extensive tidal swamp on the west; and 4) Bay of Bengal on the eastern side. The Kailasa Hill range stretches from Simhachalam to MVP Colony on the north flank of the city. The city, which appears like a small basin, is surrounded by the Yarada Hill popularly known as Dolphin's Nose on the southern side and the Kailasgiri Hill on the northern side.

This diversity in topographical conditions creates both challenges and opportunities for promoting non-motorised transportation modes in the larger region. As shown in Figure 2.5, majority of the city's urban core area, near the beach road, is relatively flat and could support NMT infrastructure facilities without compromising on pedestrian connectivity. However, outside the core area undulating topographical conditions with steep slopes may need innovative design solutions as it relates to promoting cycling, e-rickshaws and appropriately designed footpaths.

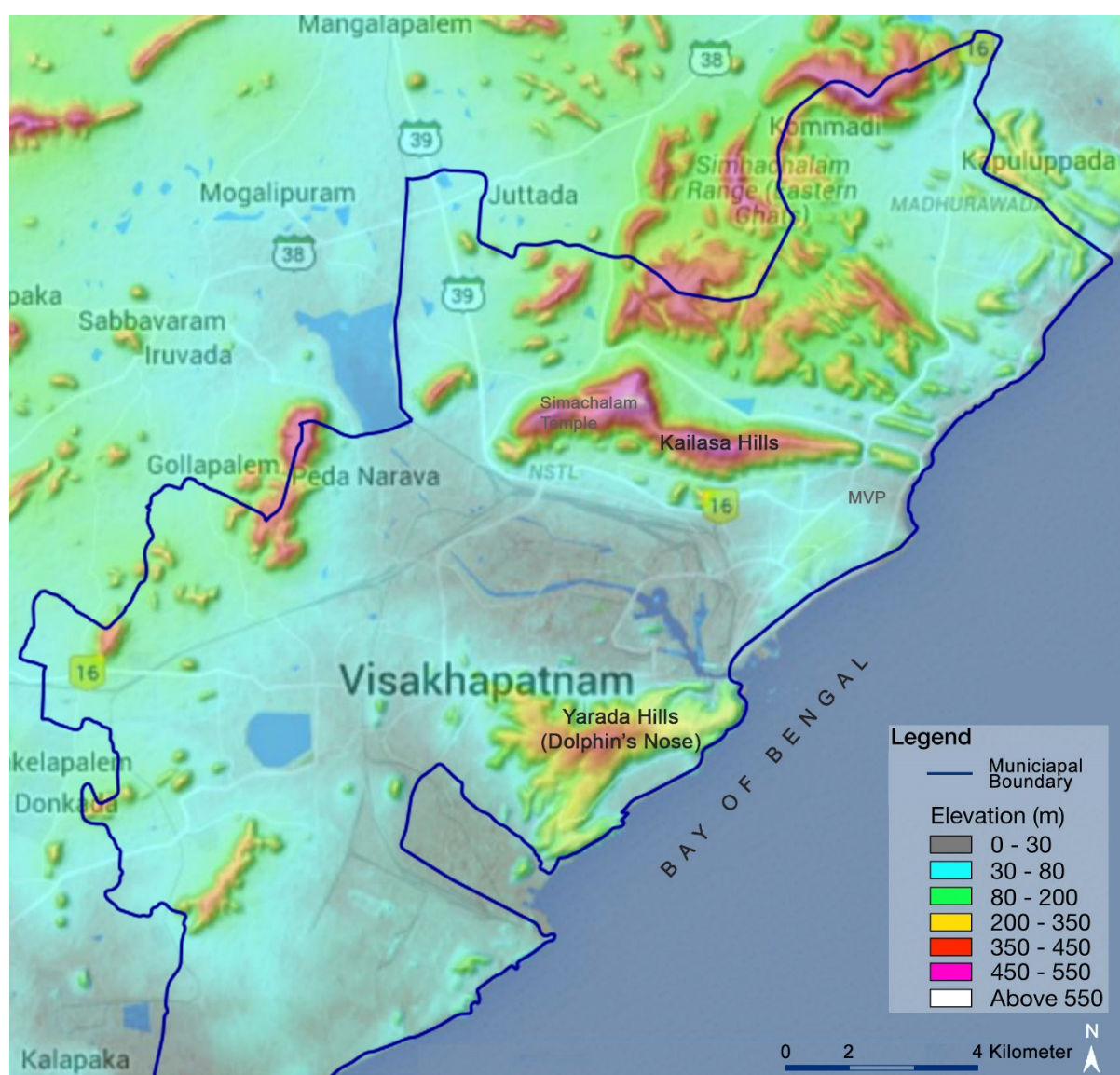


Figure 2.5: Topographical map of Visakhapatnam

Source: <http://en-ca.topographic-map.com/places/Visakhapatnam-1300168/>

2.2. Planning and Policy Context

2.2.1. Master Plan 2021 (2007)

A Master Plan of the city is a statutory document for guiding and regulating urban development. It defines the future area for urbanisation, and addresses planning issues for various sectors. It contains development measures such as road network (arterials, collectors, and distributors etc.), parking facilities and public transport systems.

The Greater Visakhapatnam Master Plan does not discuss non-motorised transport in great detail. Under the section on “safety and convenience”, it briefly discusses that pedestrianisation is not being given sufficient consideration in the planning and designing of residential, commercial and other areas. It also mentions at the issues identification stage that a pedestrian network should provide accessibility to bus stops, shopping centres and schools etc. and it should link major work places and commercial centres. But, under the investment plan and phasing of projects, no allocation of funds towards non-motorised transport is incorporated.

2.2.2. City Development Plan, 2012

The Visakhapatnam City Development Plan (CDP), prepared under the JnNURM programme, is a broad framework document that identifies urban infrastructure requirements in various sectors, including transportation and utilities. However, the city’s CDP does not adopt a scientific approach to assess transportation needs of the city and do not include a clear strategy for long-term urban transport development. The CDP provided valuable information regarding the existing and future development of the urban area, which are essential while planning for the horizon year. However, in the CDP of Visakhapatnam, under the section of ‘Transit and Transportation Plan’, there were no specific recommendations related to NMT infrastructure. Few references in the City Development Plan to NMT infrastructure, include:

- *“Disincentivising the private transport during peak hours:*
- Disincentivising the use of private vehicles during peak hours and in the CBDs is one of the key strategies to address the problems of traffic congestions and delayed journeys and improve the public transport as well. Congestion pricing during peak hours, differential parking fee, pedestrianisation, and surcharge on vehicles belonging to other cities/ regions, etc. are some of the strategic disincentives.”
- The other aspect mentioned is related to the vision for increasing the share of Sidewalks length to total road length from 3% to 90% of the requirement.
- Under the stakeholder discussions, the working group on transportation recommended that “all the arterial roads within the city should be widened to a minimum of 100 feet with safe pedestrian walkways.”

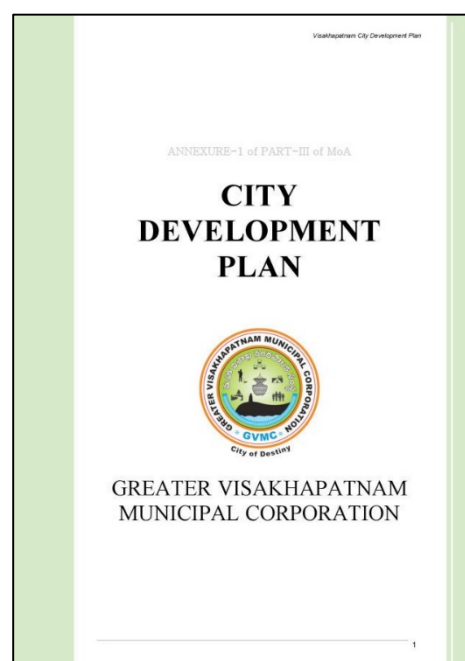


Figure 2.6: CDP of Visakhapatnam

2.2.3. Low Carbon Comprehensive Mobility Plan (LCMP), 2014

The LCMP for Visakhapatnam essentially serves as the city's Comprehensive Mobility Plan (CMP) document, but with an additional emphasis on understanding the impact on carbon emissions through transportation and land use decisions. The Vizag LCMP identifies a long-term vision for desirable accessibility and mobility pattern for people and goods in the city to provide, safe, secure, efficient, reliable, seamless connectivity that supports and enhances economic, social and environmental sustainability. Along with identifying a range of land use and transport issues, the document also involves modelling CO2 emissions and air pollutants and impact analysis of scenarios on measurable indicators. The LCMP was one of the first attempts in the city to include sustainable transportation alternatives as a means to address the issues of congestion, urban sprawl and road safety.

LCMP's Business as Usual (BAU) scenario analysis for 2030 reinforces the need to urgently change the status quo. The BAU scenario highlights the following trends that will need to be taken into consideration while formulating recommendations in this Plan:

- **Household incomes** in Vizag will increase, thereby increasing vehicle ownership and change in trip making patterns. VUDA Master Plan proposed concentration of commercial development in the core city will increase trip lengths and hence induce mode shifts.
- **Mode share of walk** will reduce from 52% currently to 36% and cars and two-wheelers would increase from 17% to 33%. Number of bus trips would reduce by half and auto-rickshaw trips would double.
- The above mode-shifts will cause an addition of 15 lakh vehicles to ply on roads, which results in severe congestion on many corridors. Even the RoWs envisaged by the VUDA Master Plan would not be able to cater to this demand.
- The per-capita CO2 emissions would increase by 40% which is against the targets stipulated in the national climate change policies.
- The traffic fatalities will increase up to 1,100 per year and will be one of the highest in the country.

Some of the key recommendations contained in the LCMP that specifically addressed NMT issues, include:

- 430 km of arterial and sub-arterial roads in the city proposed to be upgraded with safe and adequate footpaths and crossings. Of which, 41 km of priority corridors are identified for intersection and sidewalk improvements, as per the 'Urban Roads Code' released by the Ministry of Urban Development.
- On arterial roads with right-of-ways (RoW) exceeding 30m, segregated cycle tracks are proposed to separate cyclists from high-speed motorised traffic.
- On roads with lesser RoW widths, traffic-calming measures need to be undertaken so that the traffic speed is not too high compared to the speed of the cyclists, thereby increasing their safety.
- Immediate priority cycle tracks are already covered as part of the priority BRT corridors listed above, and separate investments are not needed along these corridors.
- Two Public Bicycle Sharing (PBS) pilot schemes are proposed as a means of promoting cycling in the city.

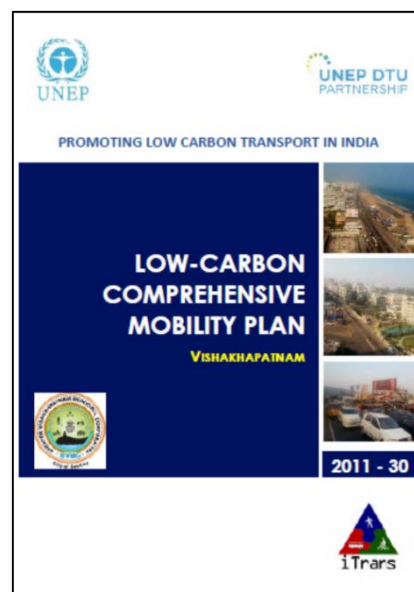


Figure 2.7: LCMP for Visakhapatnam

2.2.4. Visakhapatnam Smart City Proposal, 2016

The Smart City Proposal (SCP), prepared by GVMC as part of MoUD’s Smart Cities Challenge identified mobility as a significant component of the city’s Area-based development (ABD) (refer Figure 2.8). During the stakeholder workshop, recommendations proposed by this NMT Plan and the SCP were shared with the consultants and incorporated in both documents. Key recommendations related to urban mobility proposed in the city’s proposal included:

- Provide walking and bicycling lanes in ABD;
- Introducing handicap accessible walkways;
- Multi-use multi-level car parks with ground floor retail, bicycle parking and e-rickshaw parking to complete last mile connectivity;
- Two lanes of the beach road for a 4 km stretch are apportioned to accommodate walking and bicycling;
- Dedicated hawker zone in ABD have been proposed to avoid situations of haphazard commercial activity that results into congestion and un-healthy conditions of the NMT areas;
- Proposed and existing bus stops will be fitted with ICT enabled information systems along with charging points for electric bicycles and e-rickshaws;
- Reduction in vehicular speeds to 30km/hr along with accommodating walking and bicycling lanes including bicycle share program in ABD (in phases);
- Increased use of electric bicycles for ease of managing steep gradients due to topography;
- Introduction of women driven e-rickshaws (She-Rickshaws) have been proposed to be operated as an area-wide strategy along with installation of air pollution monitoring devices and smart signalling and traffic surveillance in order to reduce diesel related emissions;
- Beach beautification project (involves universal access design elements, barrier free design); and
- Appropriating two lanes from the Beach Road towards public space in a phased manner. The addition of public space along Beach Road will then be dedicated towards a pedestrian promenade and dedicated cycling lanes.



Figure 2.8: Mobility proposals for ‘Area Based Development’ of Vizag Smart City Proposal

Source: <http://smartcities.gov.in/writereaddata/winningcity/VishakapatnamAnnexure.pdf>

2.3. Legislative and Regulatory Environment

2.3.1. Development Control Regulations (DCR), Visakhapatnam Master Plan, 2007

DCRs are regulatory mechanisms through which entire process of urban development is regulated to achieve the objective of promoting overall benefit of the society and promoting public health and safety. It includes guiding the development and use of land, curbing misuse of land, promoting rational and orderly development of built environment. Typically, DCRs include building regulations related to height, density, parking, access, and other aspects of controlling the urban form, specifically the private realm. Progressive cities such as Ahmedabad, Delhi, Naya Raipur have recently begun incorporating NMT infrastructure design as part of their DCRs. Vizag's DCR, a part of its 2007 Master Plan document, has a minor reference to planning of residential areas regarding traffic safety requirements, stipulating that no footpath shall be less than 1.8m in width.

2.3.2. Andhra Pradesh Motor Vehicle Rules, 1989

Vizag has seen a multi-fold increase in vehicle ownership due to improvement of economic status of people coupled with easy availability of credit. This however, was not accompanied by commensurate public expenditure in creation of supporting infrastructure like policies, organization of roads or public transit. This has resulted in extremely congested situation of traffic on city roads further stressed by the lack of a connected non-motorised transport network. Similar to other state Motor Vehicle rules, the existing Andhra Pradesh rules also include regulations applicable only for motorised vehicles such as drivers licence, authority involved, registration certificate, vehicle permits, fines, and other such automobile related rules.

Observations

The existing regulatory environment is not very supportive of NMT-friendly design improvements. Policy-level interventions such as developing Street Design Guidelines, incorporating recommendations of the Urban Road Codes into statutory documents such as the Master Plan Update and the DCRs are critical. Changes at the state level to the Motor Vehicle Rules to incorporate regulations related to discouraging private car ownership and better design of public transportation systems, indirectly supporting NMT improvements are needed.

2.4. Transportation Infrastructure

The transportation baseline of the city was developed primarily by analysing the secondary data collected from the recent planning initiatives undertaken by the city, most notably the Low-Carbon Comprehensive Mobility Plan prepared by United Nations Environmental Program (UNEP) in 2014. The following section provides a brief summary of the city's current state of NMT infrastructure as observed through visual surveys and review of previous planning efforts.

2.4.1. Roads and Footpaths

The main objective of the road inventory survey is to evaluate the existing street infrastructure available for various modes. While the municipal agencies are expected to maintain the database on their existing infrastructure, no such data exists with the GVMC. Therefore, a sample of the total road network surveyed as part of the LCMP 2014 was used as a starting point and further validated by field visits during the preparation of this NMT Plan. Figure 2.10 shows the city's road transportation network.

Only 77km of roads out of the total 1,100km of urban roads have footpaths constructed or being constructed along them. During field surveys, it was observed that even the constructed footpaths are not continuous and often disrupted with encroachments such as parked vehicles, crossings and entry to properties along the road, blocking free movement of the pedestrians. From a design perspective, several locations were observed to have high kerb heights, gaps between paver blocks and inappropriately located electric poles, street lights or trees acting as obstacles in pedestrian movement. In other instances, concrete blocks covering the sewage lines were used as footpaths (refer Figure 2.9) that could technically not be considered as designed to achieve the goal of safe pedestrian access and mobility.



Figure 2.9: Drain covers on the left are unusable and unsafe as footpaths at Bowdra Ring Road near Balabharati Nagar
 Source: <http://www.panoramio.com/photo/101174050>

Out of the 77 km of footpaths existing or being constructed in the city, 40 km are part of the two BRT corridors in the city which are currently under construction. While this is a much needed improvement, none of these footpaths were observed to be designed with barrier-free design elements. Table 2.4 provides a summary of footpath infrastructure in the city, specifically as it relates to the length of streets with constructed footpath widths.

Table 2.4: Length and width of available footpaths in Visakhapatnam

Width of Footpath (in m)	Length (km)
1.5	67
2.0	6
3.0	4
Total	77

Source: Road inventory survey, LCMP 2014

Most of the footpaths built in the city were constructed as per the earlier Government Order (GO) issued by the state government to maintain a width of 1.5m. The more recent footpaths, totalling 6 km in length, built along the inner ring of the city have a width of 2m, which is insignificant when viewed as a proportion of the total road network in the city. The 3m wide footpaths built along the Beach Road is concentrated only along the 4km stretch and not replicated in other parts of the city.



Figure 2.10: Road network hierarchy

Source: iTrans

Table 2.5: Quality of footpath infrastructure

Quality of footpath	Proportion of footpaths
No encroachments	30%
Discontinuous	50%
Mostly un-usable	20%
Total	100%

Source: Road Inventory Survey by iTrans, and LCMP 2014

It is observed that 50% of the footpaths in the city are discontinuous, due to various reasons like presence of electric poles and trees on the footpath, entry to properties along the road, break in footpaths at crossings and on-street parking. 20% of the footpaths are mostly encroached by parking and shopkeepers along the road extending their shops to the footpaths. Only 30% of the footpaths are without any encroachments. However, even these footpaths are not completely pedestrian friendly because they are mostly concrete blocks placed as a cover to the sewer lines below and not designed with pedestrian comfort and safety in mind (refer Table 2.5).

During field visits and visual surveys, it was noted that majority of the arterial roads in the city had adequate street lighting for the carriageway, but did not provide separate lighting for the footpaths. However, some arterial roads have shops adjacent to the road, thereby providing adequate lighting for people to walk. 20 km of the total 37 km of footpaths have shop fronts that are also perceived to be more secure by the pedestrians. The LCMP included a household survey to determine the perception of pedestrian safety in the city, the results of which are presented in Table 2.6. It is observed that nearly 80% of the survey sample considered the existing roads to be adequately secure for walking. However, this is contradictory to the data collected and indicates the important role of awareness building and educating citizens in the benefits of improved road design including sharing of best practices with users to help them make informed choices.

Table 2.6: Pedestrian safety perception survey

User groups	Opinion		
	Good	OK	Bad
Females	2%	83%	15%
Males	5%	76%	19%
Overall	4%	79%	17%

Source: Household Survey Data, iTrans, LCMP 2014

2.4.2. Public Transportation (PT) and Intermediate Public Transport (IPT)

City Bus

The city bus service in Vizag has a total of 670 public buses plying on 157 dedicated routes covering almost 5 lakh trips per day. However, supporting infrastructure such as bus shelters, waiting areas at the bus stops are inadequate forcing people to stand on the carriageway often leading to safety concerns and general discomfort as transit users. In the second round of JnNURM funding, the city has sanctioned an additional 160 buses with 2 low-floor AC buses to improve the overall peak frequency to 15min. This proposed fleet expansion could encourage a shift from private vehicle to public transportation modes provided the system design also integrates the issues of transit stop designs and better first and last mile connectivity to and from transit corridors in the city.

The city has also an operational BRT system in place, approved under JnNURM. It includes two corridors- Phase One - the Pendurthi Transit Corridor and the Simhachalam Transit Corridor, with route lengths of 20km and 18.50km respectively. Further to expand the network of public transport, Vizag has planned Metro Rail along three corridors covering a total length of 45km. (refer Figure 2.11)

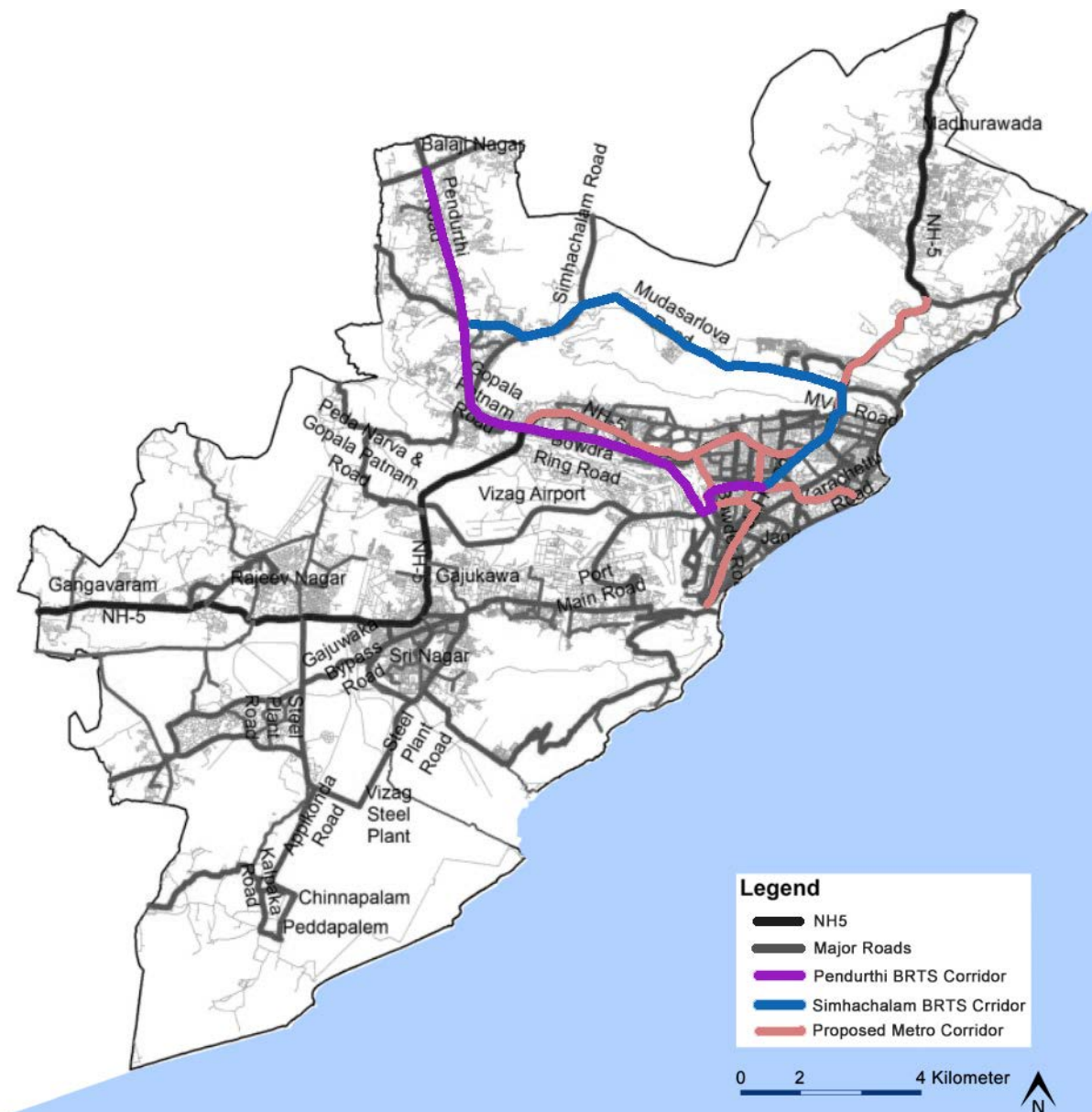


Figure 2.11: Operational BRTS corridors

Source: Adapted from LCMP 2014

IPT

The Intermediate Public Transport (IPT) system in the city is dominated by auto rickshaws. Operating on fixed routes as a shared service in some areas, it helps to fill in the gap for public transportation. The total number of organised auto-rickshaws registered in the city is around 25,000 which is nearly 5% of the total registered vehicles. With a significant share in the city's travel pattern, the IPT system lacks organised infrastructure facilities such as parking lots, waiting areas and marked stops. As a result, they end up encroaching pedestrian and cyclist space, ultimately impacting movement for all NMT modes. Following are the major corridors identified in the city that carries high share of shared-auto rickshaw which would require special attention to ensure safe NMT movements:

- Maddilapalem to NAD
- Maddilapalem to Madhavadara
- RTC Complex to Waltair
- RTC Complex to Gajuwaka
- RTC Complex to Sindia
- RTC Complex to Pendurti
- Jagadamba to Waltair
- Jagadamba to Arilova
- Gajuwaka to Aganampudi
- Gajuwaka to NAD
- Pendurti to Maddilapalem



Figure 2.12: Inadequate bus stop facilities

Source: LCMP 2014

2.5. Needs Assessment

The modal split in 2013 for various trips is shown in Table 2.7. As evident from the data, 55% of the total trips are made by non-motorised modes, mainly walking and cycling. While cars cater only to 2% of the total trips made in the city, combined with 2-wheelers it accounts for 17% of the trips completed. Public transport (city bus) is the dominant mode of transport followed by auto-rickshaws at 9%.

Table 2.7: Mode shares in Visakhapatnam, 2013

Mode	Total
Walk	52%
Car	2%
2-Wheeler	15%
Bus	18%
Auto Rickshaw	9%
Cycle	3%
Others	1%
Total	100%

Source: LCMP 2014



Figure 2.13: Transport system users near Sanghvi Jewellery Mall on Rama Talkies Road

Source: iTrans

2.5.1. Profile of NMT Users

The NMT user profile prepared as part of LCMP 2014 reiterated the established correlation between income levels and mode choices. This depicts that walking and cycling are primarily the modes of lower income groups in Vizag. Further, the walk mode share reduces with increases in household income, while the 2-wheeler mode share increases. 2-wheelers are the most preferred mode for work trips, while education trips are mostly made by bus and auto-rickshaw. Cycle usage is higher in work trips than in education trips indicating that cycle users are captive to that mode and other modes including public transit and IPT remain unaffordable (refer Figure 2.14).

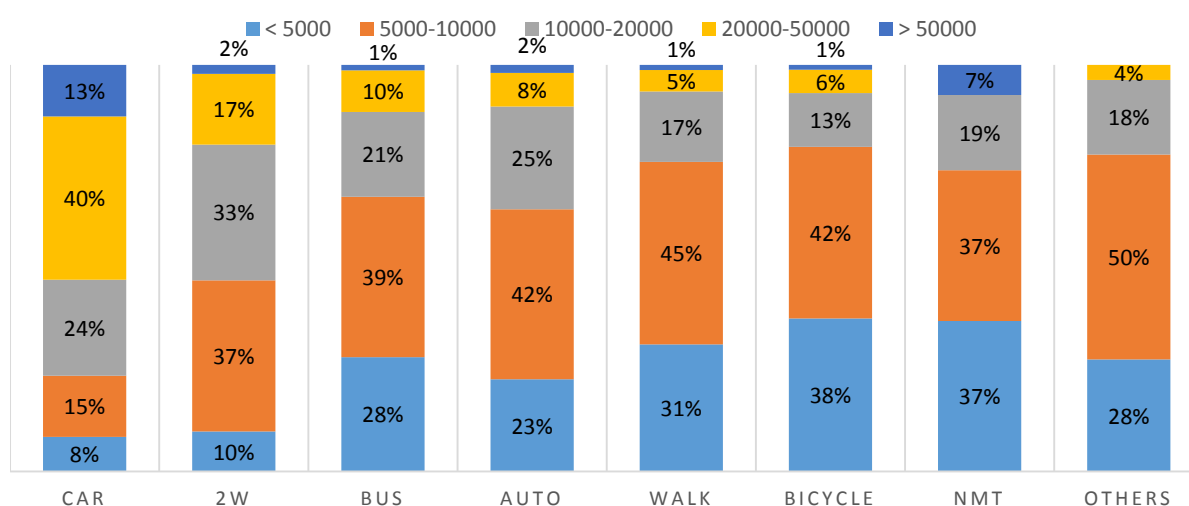


Figure 2.14: Mode vs monthly income distribution in Vizag

Source: LCMP 2014 based on 2013 data

From a gender perspective, nearly 70% of the trips made by women are by walking, followed by bus and auto-rickshaw, which combined caters to about 23% of their trips (refer Table 2.8). Two-wheelers are the predominant mode for men in the city to complete their trips.

Table 2.8: Gender wise mode share in Visakhapatnam, 2013

Mode	Total	Male	Female
Walk	52%	37%	69%
Car	2%	2%	1%
2 Wheeler	15%	22%	6%
Bus	18%	22%	14%
Auto Rickshaw	9%	10%	9%
Cycle	3%	5%	1%
Others	1%	1%	0%
Total	100%	100%	100%

Source: LCMP 2014

The LCMP data presents valuable information that could be used to create context sensitive NMT solutions and projects that target the diverse NMT users in the city, including, but not limited to:

- **Slum Redevelopment Projects:** Considering the high correlation between low-income users and NMT as primary mode of travel, special emphasis on mandating higher standards for pedestrian and cycling infrastructure in all slum redevelopment projects should be considered. Further, GVMC may consider instituting pilot projects for cycle tracks in low-income neighbourhoods to control the shift of existing NMT users to 2-wheelers.
- **Women’s Safety:** With a significant percentage of women reporting walking or using PT and IPT modes for their daily trips, safe access to transit stops should be prioritised as part of future design, including the BRTS corridor design that the city is planning on undertaking. Design

considerations for women’s safety includes components from the inception stage such as operational measures including hiring women employees in transit agencies to gender sensitivity training. Physical design and enforcement measures may include street lighting standards and emergency help boxes at bus stops to CCTV cameras and “eyes on the street” for enforcement.

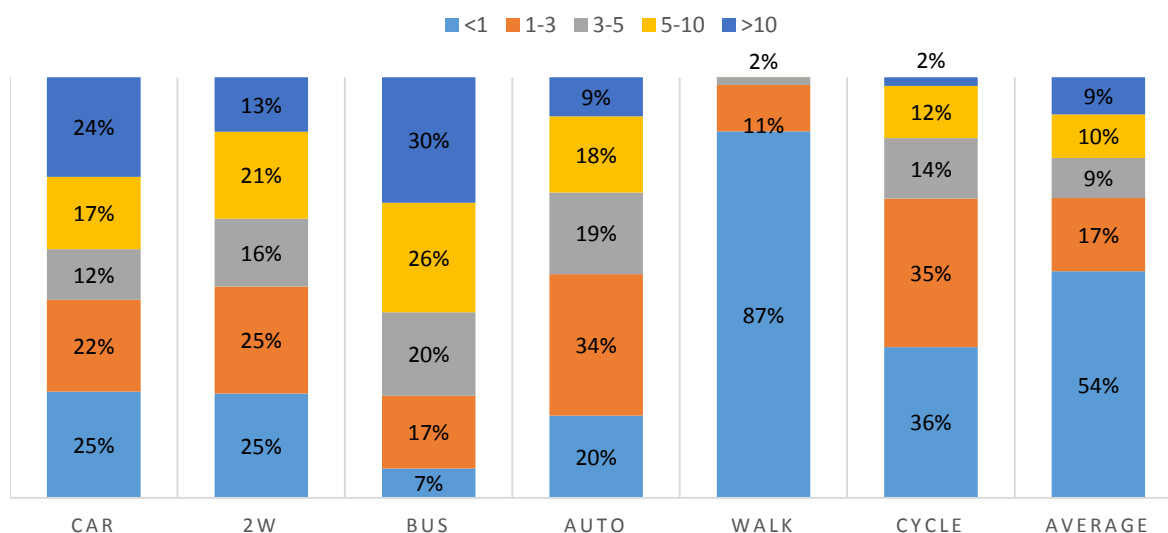


Figure 2.15: Mode vs trip lengths in km

Source: LCMP 2014

While comparing mode share and trip length of the users, 71% of trips were within 3km in length, which explains the high proportion of walk trips in the city. The average trip length in the city is observed to be 4.1km. The LCMP also reported that cycle users travel for 10km on an average (refer Figure 2.15). Also 25% of car and 2-wheeler trips and 20% of the auto-rickshaw trips are less than 1 km in distance. These are potential walking trips which may be influenced by provision of better pedestrian infrastructure in the city. Similarly, 22% of car trips and 25% of 2-wheeler trips are within 1-3km range in the city are potential cycling trips where the terrain allows.

Potential design implications related to the modal share with respect to trip lengths indicates a clear need to develop strategies that ensure short trips remain non-motorised. Preliminary solutions may include:

- **Public Bicycle Sharing (PBS):** The average trip length of 4 km is ideal for promoting a PBS system in the city and offering alternative non-motorised choices. GVMC’s Smart City Proposal identifies a pilot area for PBS in its selected area based development; however similar PBS schemes could be expanded into other parts of the city with high percentage of auto-rickshaw trips as a starting point.
- **E-rickshaws:** Considering the undulating terrain of the city but a high percentage of IPT modes used for shorter trips, GVMC could consider starting an e-rickshaw service in selected areas of the city.

2.5.2. Accidents, Safety, and Security

Table 2.10 and the mapping in Figure 2.18, provides an overview of the total number of accidents that took place along the various segments of NH-5 from year 2007-2011. According to accident data obtained from GITAM University in Vizag, NH-5 has reported significantly high accident rates and requires urgent attention from the agencies involved.

These agencies include:

GVMC- to provide improved infrastructure;

Traffic Police- better enforcement of traffic speeds and helmet law; and

National Highway Authority of India (NHAI) - to regulate speed limit along the 70 km stretch of NH-5 that passes through the city and is currently functioning as a major arterial road.

It is reported that of the 74 high crash locations in Vizag, 40 locations are on the NH-5 stretch passing through the city (highlighted with yellow in Figure 2.19).

Figure 2.20 presents the victim and impacting vehicles based on FIR data collected from the Traffic Police. It is clear that pedestrians are the most vulnerable road users and are exposed to the maximum risk, followed by two-wheelers. Providing safe walkways and crossing facilities, street lighting for pedestrians and better enforcement of helmet usage in the city are the two immediate measures that need to be implemented in the city. Table 2.9 shows the risk exposed to and risk imposed by each mode where, it is observed that 2-wheelers have the highest risk of fatality followed by cycles.

Pedestrians, even though have lesser risk per user, form 43% of the total fatalities. Such high pedestrian fatalities and risk to the cyclists shows the high speed differential that exists in the city between motorised and non-motorised modes thereby causing so many deaths. The need for better helmet law enforcement and better traffic calming in the city are some of the solutions that can be derived from the traffic fatality data.

Table 2.9: Risk exposed to and risk imposed by each mode

Mode	Fatal accidents (per 1000 users of the mode)	Number of accidents caused by the mode on other road users (per 1000 of respective mode user)
Car	5	28
2-Wheeler	7	3
Bus	0	2
Auto	3	3
Walk	2	0
Cycle	5	0
Truck	2	45

Source: LCMP, 2014

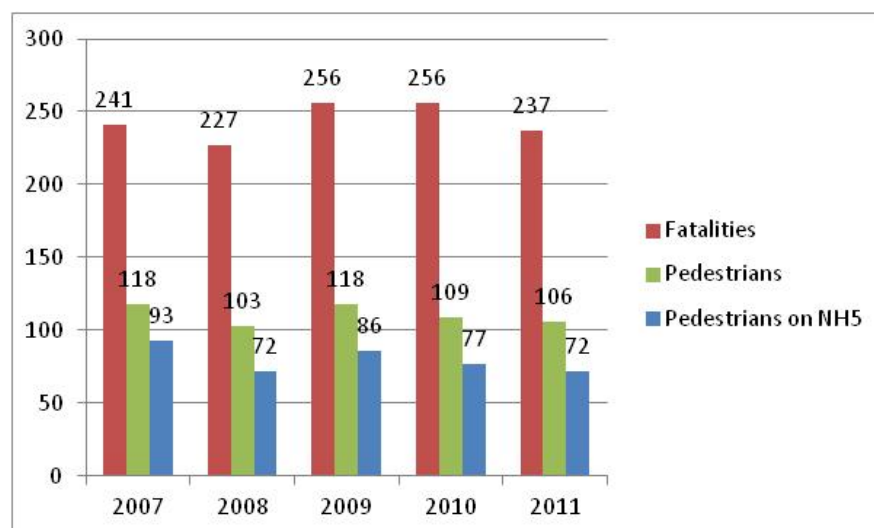


Figure 2.16: Overall traffic fatalities (2007-2011)

Source: Mukund Dangeti, Ph.D., Department of Civil Engineering, GITAM University, Visakhapatnam

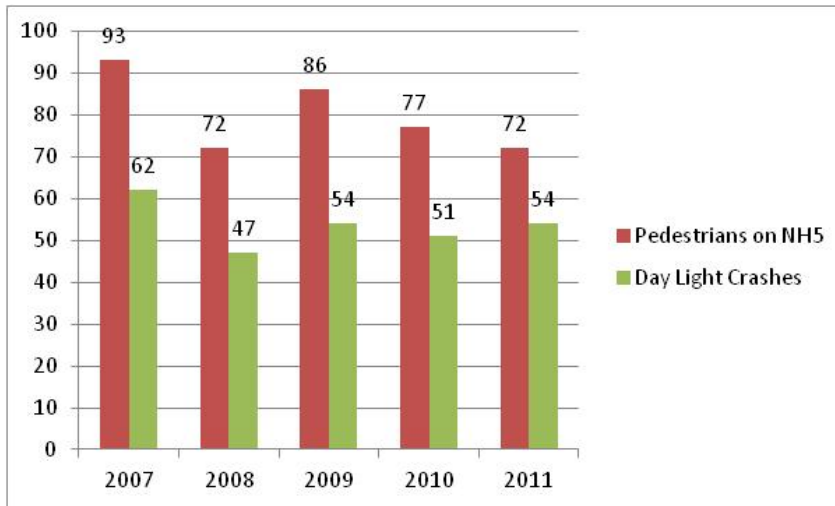


Figure 2.17: Daytime fatalities (2007-2011)

Source: Mukund Dangeti, Ph.D., Department of Civil Engineering, GITAM University, Visakhapatnam

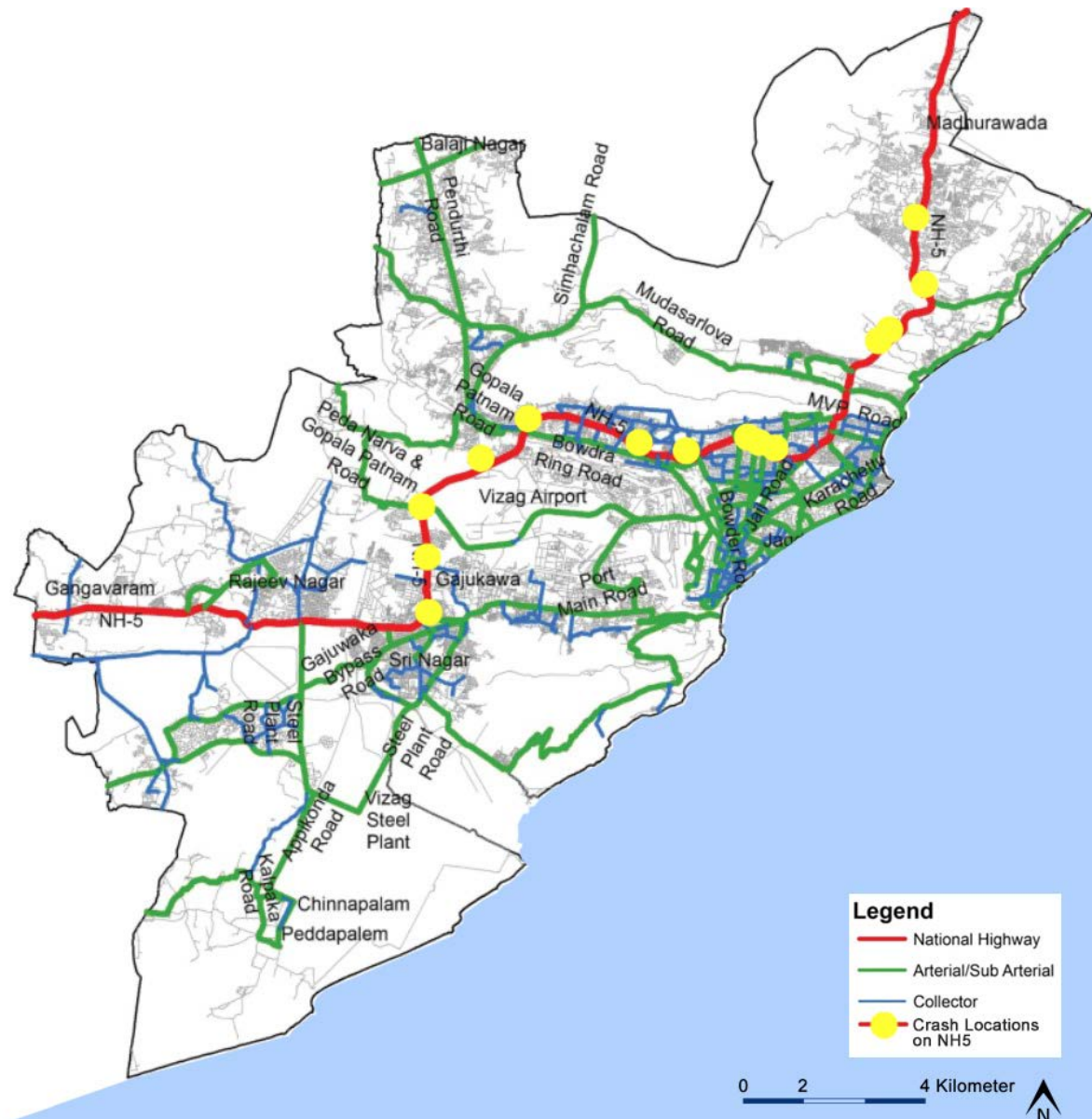


Figure 2.18: Accidents on NH-5 during 2007-2011

Source: Mukund Dangeti, Ph.D., Department of Civil Engineering, GITAM University, Visakhapatnam

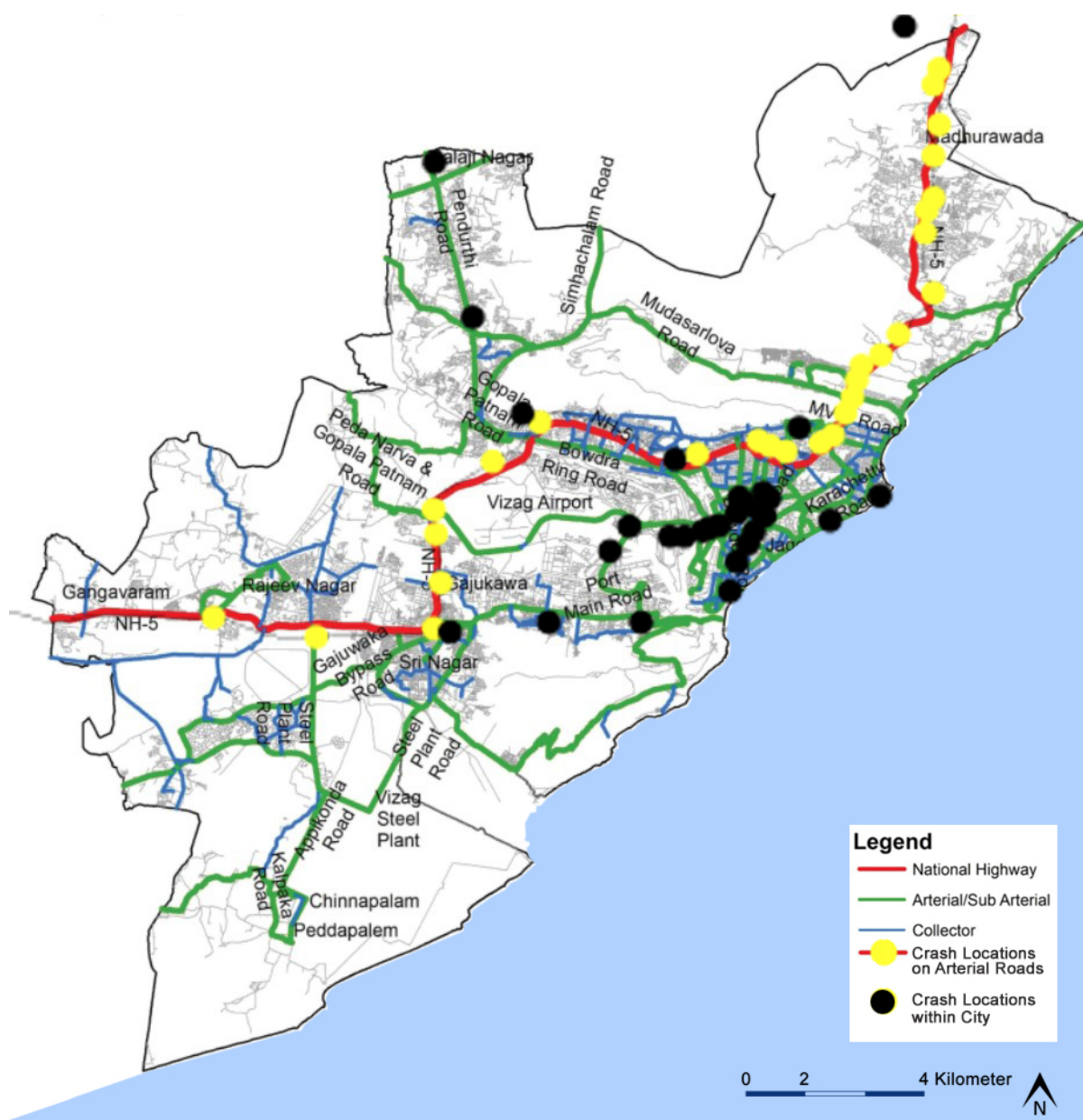


Figure 2.19: High crash locations in Vizag

Source: Mukund Dangeti, Ph.D., Department of Civil Engineering, GITAM University, Visakhapatnam

Table 2.10: Segment wise accident data along NH5 (2007-2011)

Segment	Number of Accidents (2007-11)
P.M Palem to Yendada	75
Yendada to Dairyfarm	13
Dairyfarm to Hanumanthavaka	13
Hanumanthavaka to Isukathota	18
Isukathota to Maddilapalem	11
Maddilapalem to Mahindra-Satyam	9
Mahindra-Satyam to Gurudwar	13
Gurudwar to 4th Town	20
4th Town to Akkayapalem	10
Akkayapalem to Tatichetlapalem	31

Segment	Number of Accidents (2007-11)
Tatichetlapalem to Kancherapalem-Urvasi	57
Kancherapalem-Urvasi to NAD	53
NAD to Airport	33
Airport to Sheelanagar	46
Sheelanagar to Mindhi	63
Mindhi to Gajuwaka	35

Source: Mukund Dangeti, Ph.D., Department of Civil Engineering, GITAM University, Visakhapatnam

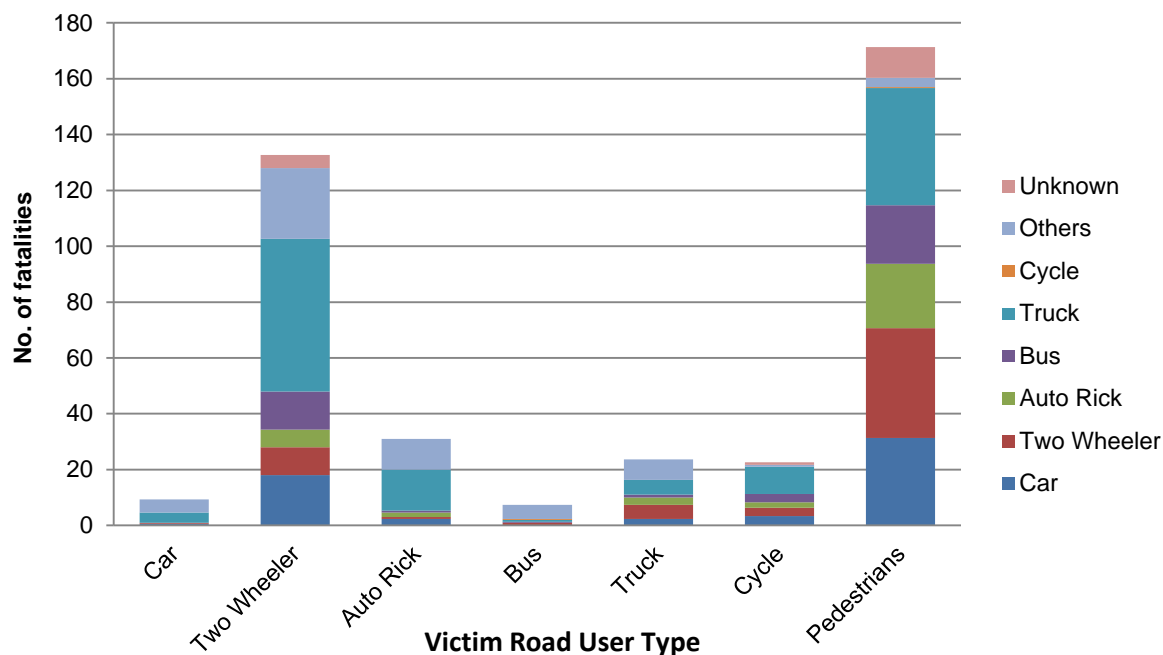


Figure 2.20: Traffic fatality- victim and impacting vehicle types

Source: FIR Data from Visakhapatnam Traffic Police, IIT Delhi, 2012

GVMC area has a total of 70 km of National Highway (NH)-5 which passes through the city. The speed limit on this road varies from 80km/hr to 100km/hr at different locations within the city causing heavy risk to the pedestrians, city bus and auto-rickshaw users who need to cross these roads. These roads also lack basic amenities like footpaths and bus shelters along them forcing the users to share road space with high-speed motorised traffic, thereby inducing significant risk (Figure 2.20).

The traffic police have embarked on a few initiatives such as placing temporary physical barricades at various locations for traffic calming and creating zebra crossings for the pedestrians. However, permanent measures like raised crossings and speed humps along the road are absent. This is because the road is under the jurisdiction of the National Highway Authority of India (NHAI) which doesn't permit the creation of such infrastructure. GVMC and the State of Andhra Pradesh should continue working with NHAI to create pedestrian infrastructure in existing and future designs as a high priority.

2.5.3. Additional Challenges and Opportunities

In addition to the challenges and opportunities discussed above based on the LCMP data, the following section describes additional issues observed and preliminary opportunities to address these challenges. These include:

1) Variable Terrain

Vizag has a highly variable terrain, especially outside the core city area, including hill ranges, uplands, undulating plains, low lying areas and marshy swamps as seen in Figure 2.21. These geographical constraints pose special problems for planning and implementing walking and cycling infrastructure because of the slopes and the constrained spaces. The challenges faced are also in terms of providing universal accessibility to elderly and differently-abled people.

Due to its undulating terrain, new settlements are scattered in patches separated by small hillocks leading to urban sprawl and increased trip lengths between the city centre and industrial areas on the fringes of the city. This has increased dependence on motor vehicles and is a major barrier for non-motorised transportation to be prioritised as the primary mode of commuting in the city. Design considerations related to hilly terrains including proper drainage gradients, appropriate slopes for sidewalks and cycle tracks, and greater use of electric bicycles and e-rickshaws are some of the solutions that GVMC should consider as part of its NMT improvement projects.

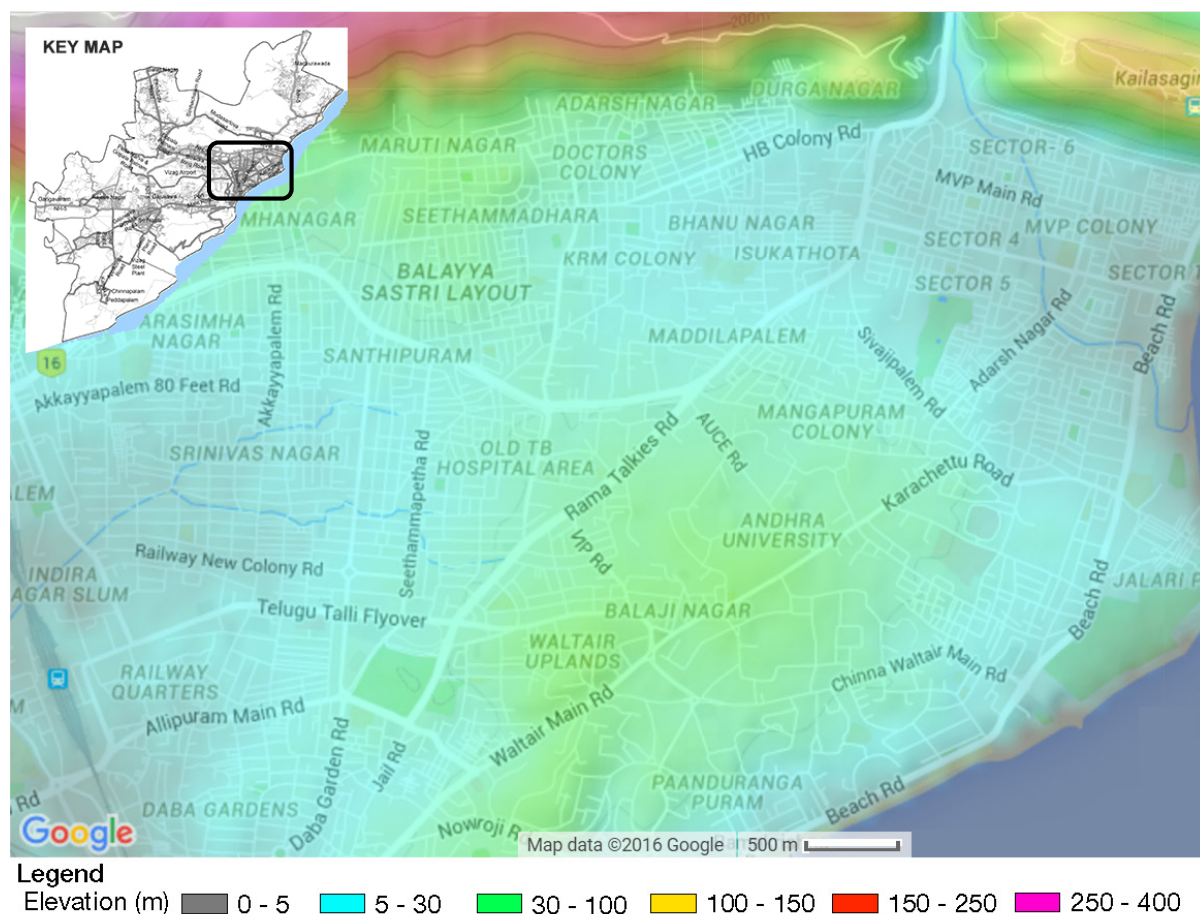


Figure 2.21: Topographical profile of city centre, Vizag
 Source: <http://en-ca.topographic-map.com/places/Visakhapatnam-1300168/>

2) Parking Conflicts and Encroachment

Illegal and unenforced on-street parking is another challenge faced by the pedestrians and cyclists on the constrained road spaces in the city. The needs of the pedestrians and cyclists compete with conflicting demands like hawkers, parked cars or motorcycles, and infrastructure utilities. With the lack of dedicated facility planned for NMT and increasing encroachments, the pedestrians and cyclists are forced to walk on vehicular right-of-ways, resulting in greater conflicts between pedestrians and motorists. Apart from the parking for passenger vehicles, there is a need to plan dedicated spaces for goods vehicles parking which is currently missing.

With the increasing demand for parking as a consequence of increasing dependency on motorised vehicles (both cars and 2-wheelers), there is a need to plan a parking policy. The parking policy should recognise land as a public good and charge the area provided for parking in such a way that the true value of the land is reflected in the parking price. Creating separate parking price slabs based on activities and locations such as commercial and residential areas, core city and outskirts etc. would also help in decongesting the roads.

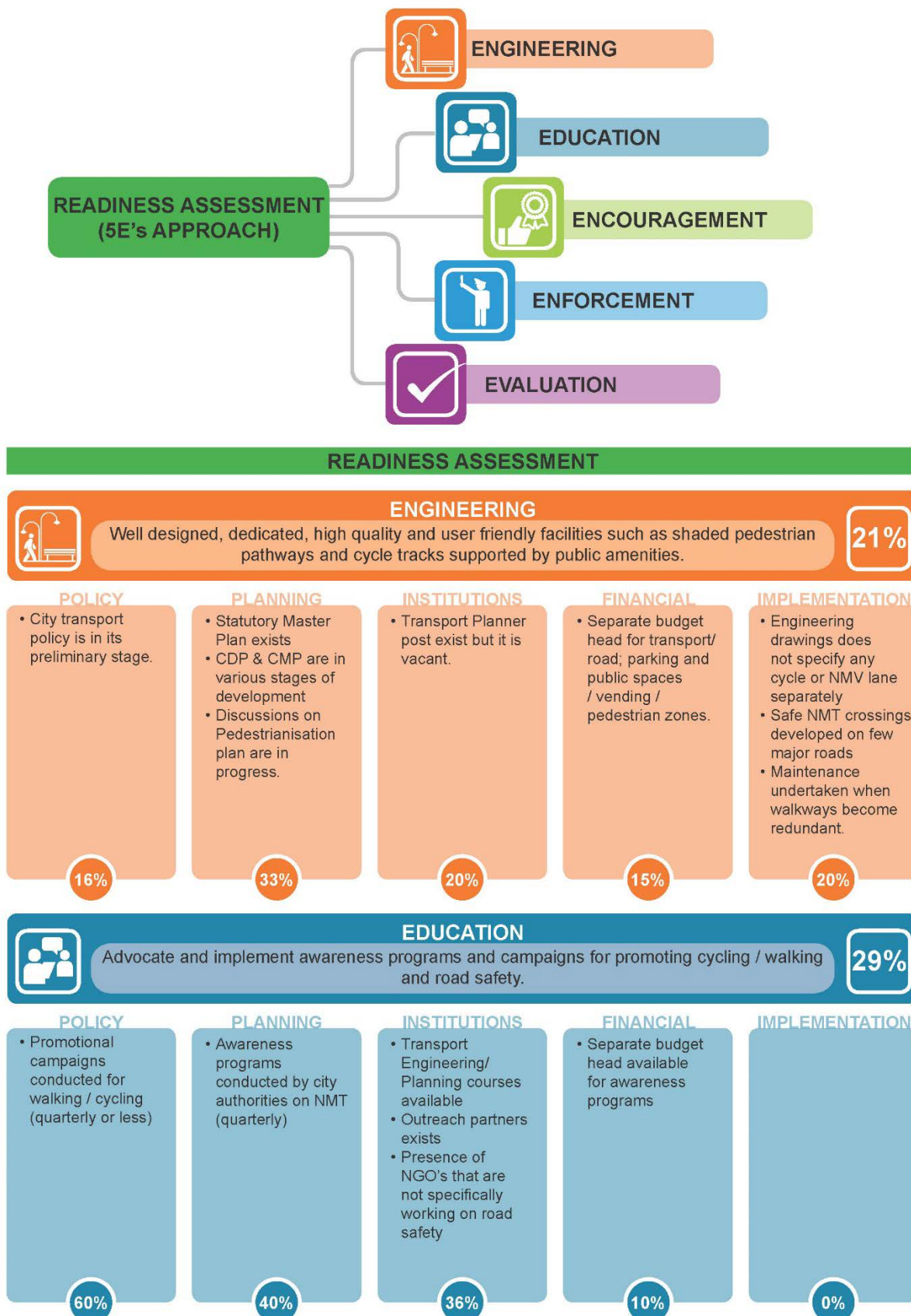


Figure 2.22: On-street parking in conflict with pedestrians beneath Telugu Talli Flyover

Source: LCMP 2014

2.6. Readiness Assessment

Based on the Readiness Assessment as provided in the Ecomobility Readiness Assessment Report by ICLEI, the city of Visakhapatnam was evaluated on the 5Es as defined below (Figure 2.23).



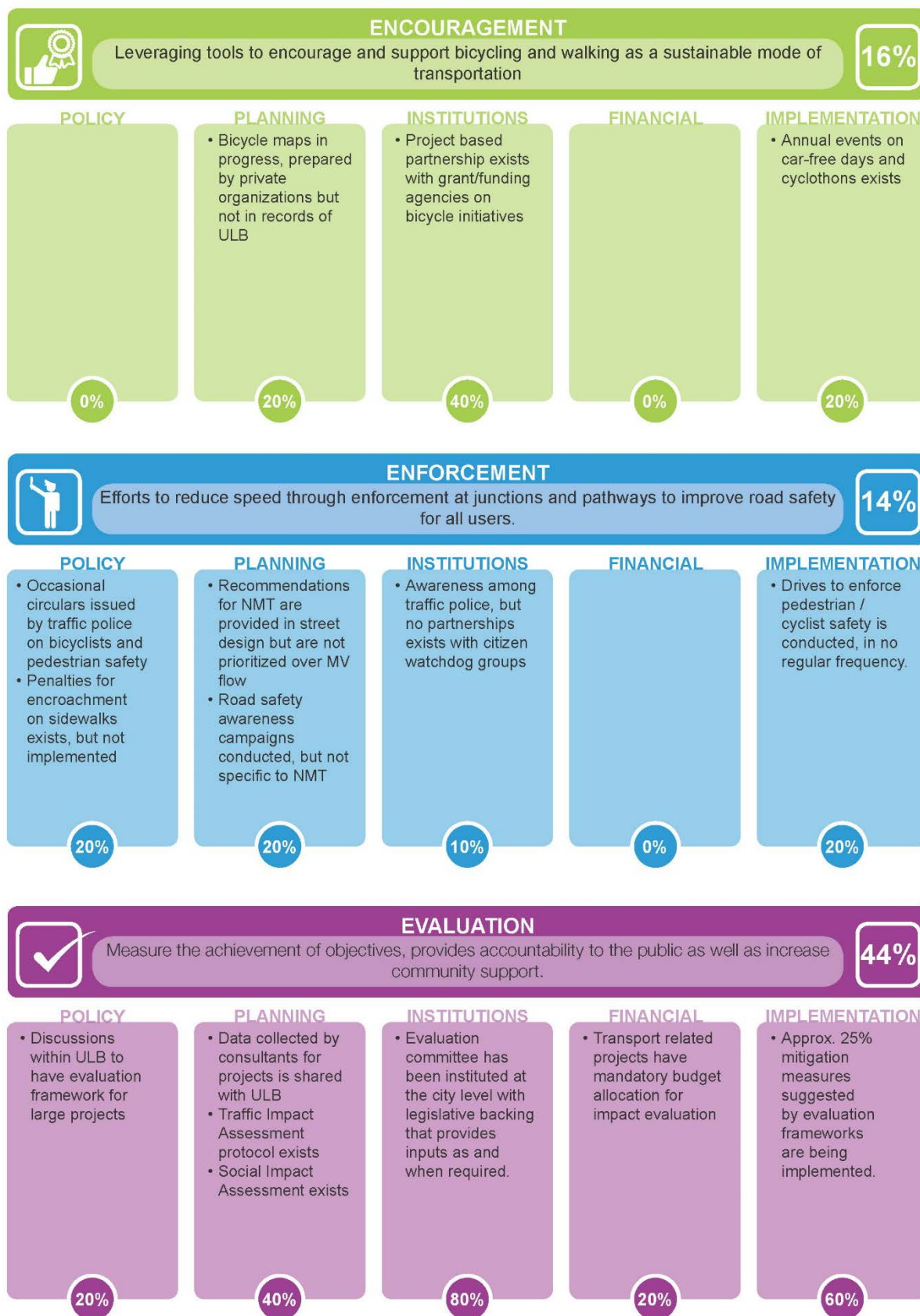


Figure 2.23: 5E Readiness Assessment

Source: Adapted from Ecomobility Readiness Assessment Report by ICLEI, 2013

After assessing the city based on 5Es, Vizag lacks engineering, encouragement, and enforcement in NMT, however, the city has a strong position in education because of the regular campaigns (conducted since November 2011 by GVMC) to promote sustainable transport such as walking and cycling. The result of the assessment is presented below in Figure 2.24.

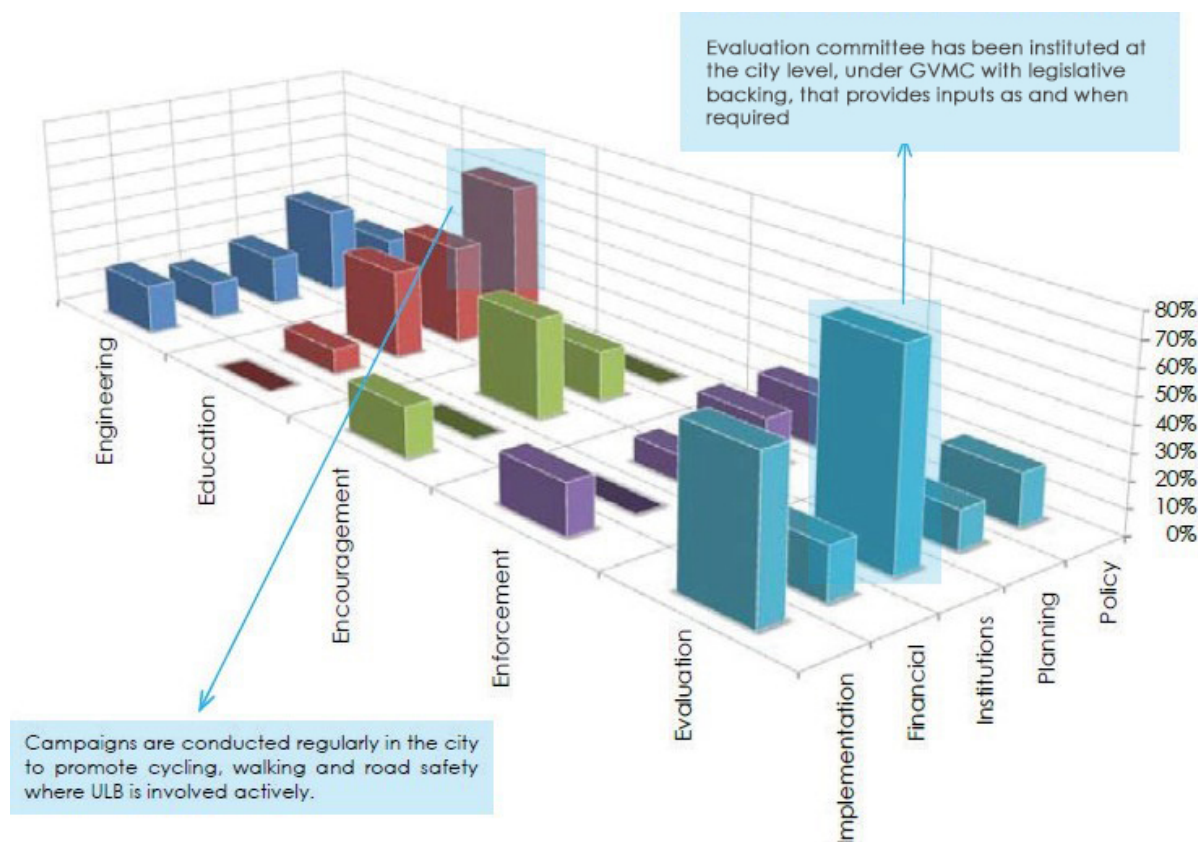


Figure 2.24: Visakhapatnam Readiness Assessment performance graph

Source: iTrans

2.7. Existing Initiatives

GVMC has adopted several initiatives to reduce transportation related pollution in the city, including the following NMT related interventions:

- A 3.5km stretch along the Beach Road, every day from 5:30 to 7:30 a.m. is dedicated as a vehicle-free zone since November 2011. (Figure 2.25).
- Planned three Cycling Zones along Old Jail Road, R&B Road and Malkapuram (Figure 2.26).
- GVMC has declared every Monday as ‘vehicle-free day’ for its employees restricting vehicles to enter the premise. About 3,000 GVMC employees including the higher authorities, commute to work either by cycle or public transportation.
- GVMC has launched the concept of ‘Cycling Clubs’ in the city. These clubs lend cycles on rent to the interested citizens at minimal deposits. It is initiated at Beach Road & is proposed in other similar locations (refer Figure 2.27).



Figure 2.25: Vehicle Free Zone on Beach Road

Source: iTrans



Figure 2.26: School children with Commissioner, GVMC in Bi-Cycling in South Jail Road

Source: iTrans



Figure 2.27: Bicycles for rent at GVMC Cycling Club

Source: iTrans

Inspired from the initiatives from GVMC, several other government and private organizations in the city have started supporting cycling. Some of these are listed below:

- Andhra University has proposed Saturday's as cycling day in their campus since March 2012.
- Similarly, GITAM University has adopted Monday's as a cycling day.

With the message going deeper into the citizen's mind, many student organizations, press & electronic media and voluntary organizations have started following cycling in the city. The sale of cycles had increased manifold in 2012 and about 15,000 cycles were sold in the 4 months as compared to sales of few hundred in normal course. The demand from citizens for creation of Cycling Zones in all areas in the city is increasing exponentially because of such initiatives taken up by the GVMC over the last few years.



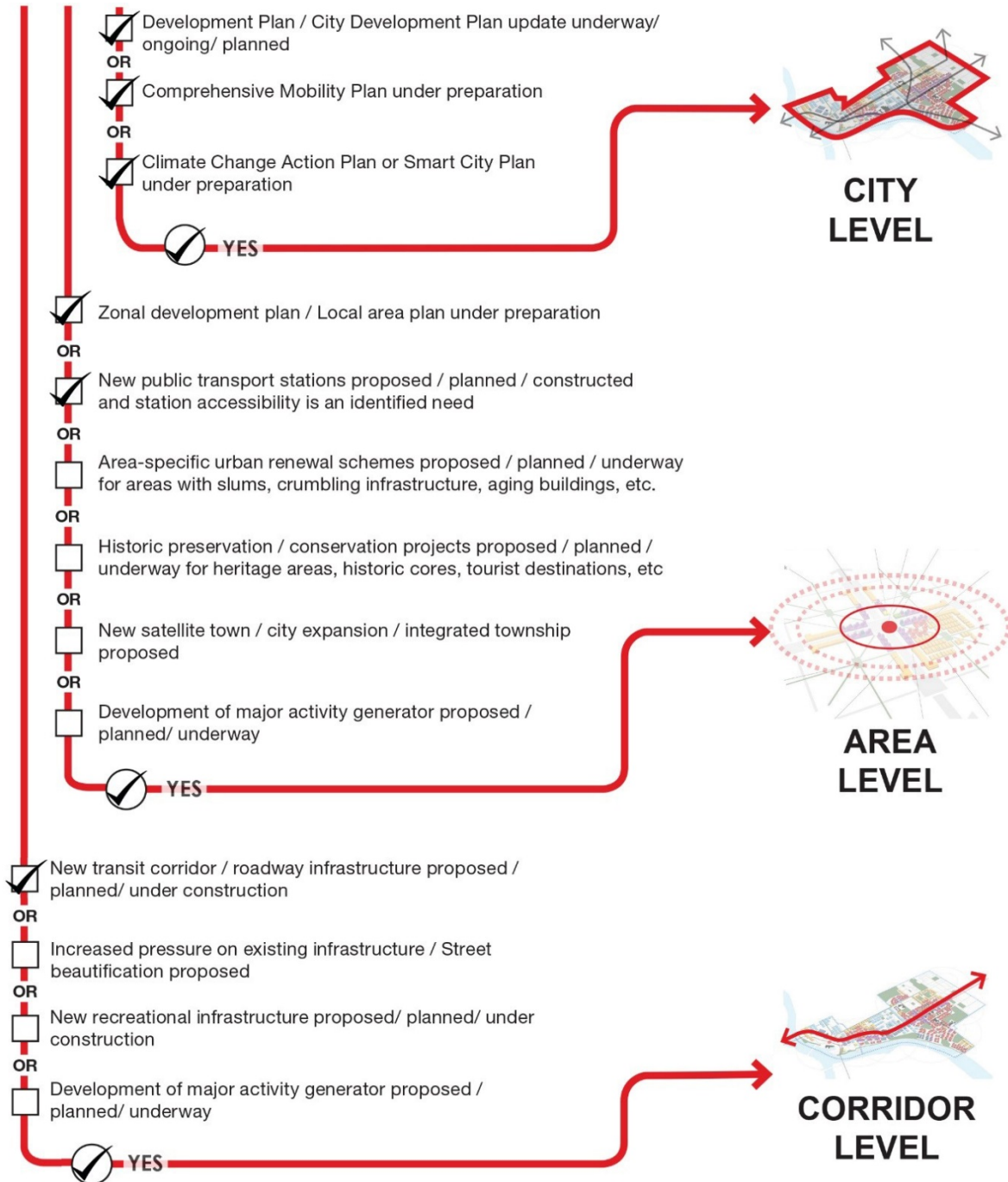
Figure 2.28: Cycling along Beach Road

Source: iTrans

2.8. Determining the Scale of NMT Plan

This NMT Plan is developed at the city-wide scale, taking advantage of the work being undertaken for the Mobility Plan. The following tool kit was used to determine the scale of the NMT plan in Vizag.

Where does your city stand on the following?



2.9. Study Area Delineation

The Greater Visakhapatnam Municipal Corporation (GVMC) area of 534 sq km represents the urban agglomeration area of the city and is considered as the study area of the NMT Master plan. The city has large pockets of land covered by hills, forests, the port and industries. Excluding these areas, the urban built up area of the city is concentrated in 166 sq km spread across the 534 sq km of the total city area. Figure 2.29 shows the planning area i.e. GVMC boundary, wards and its road network.



Figure 2.29: Study area for Vizag NMT plan

Source: Adapted from LCMP 2014

2.10. NMT Stakeholders Mapping

The different stakeholders of the project include the following agencies:

- Elected representatives
- GVMC—Planning, Projects, Accounts, Finance departments
- Traffic Police
- APSRTC-Operations and Finance departments
- VUDA
- Visakhapatnam Urban Transport Company Ltd. (SPV for BRT)
- NHAI
- Academic Institutions like Andhra University, GITAM University
- HPCL
- RTA
- APPCB
- Auto-Rickshaw Drivers Union
- Journalists and NGOs
- Chamber of Commerce
- APIIC

Roles and responsibilities for policy planning, engineering design, construction administration, operations and performance monitoring are distributed at various governmental levels. Within each level, the functions are further distributed among many agencies, with each agency carrying out a specific task and sometimes more than one agency carrying out the same task. The following Table 2.11 describes the responsibilities of various departments for non-motorised transport.

Table 2.11: Stakeholder mapping for agencies in Vizag

Mode	Hierarchy	Planning and Policy	Infrastructure	Operations	Monitoring and Evaluation
Non-Motorised Transport	Centre		NHAI		
	State	VUDA		Traffic Police	
	City	GVMC	GVMC	Private Operators/ GVMC	GVMC

Source: *iTrans*

CHAPTER III: ENABLE

3. ENABLE

Building an enabling environment to ensure support for NMT at the decision making level (political and executive), planning level and the implementation is critical to ensure that Visakhapatnam transforms into a pedestrian and cycling supportive city. The Enable framework aims at building commitment and encouraging leadership to change culture and perceptions, integrating NMT with urban planning and decision making processes and budgets, and building capacities to enable effective implementation.

3.1. Strategies to Build Leadership Support and Project Champions

The success of any project is highly dependent on the acceptance from the state or city authorities. Therefore, it is very important to create an institutional commitment that endures across changes in political leadership or bureaucracy and administration in Vizag. The first step is to create high level political commitment to boost NMT shares. However, a very positive start for city is that several GVMC officials are supportive of cycling and walking. The city has initiated new strategies and NMT projects such as construction of cycle tracks in the city, evaluation of PBS system and no-vehicle zones.

Apart from this, other city agencies such as VUDA and Traffic Police in Vizag also play an important role in supporting walking and cycling in Vizag. It is important for GVMC to formulate a collaborative vision with all governmental and non-governmental agencies and citizen groups to ensure ownership for maintenance and upkeep of NMT investments. The vision will help in maintaining a long term commitment to ensure continuity in NMT planning process beyond the office term of elected or appointed officials.



Figure 3.1: -GVMC Commissioner with H.W. Mayor and Hon'ble MLA's at cycling event

Source: *iTrans*

To help achieve a sustainable operations program, the following actions are suggested:

- Collaborate with well-defined roles and responsibilities, frequency of tasks, quality standards, and estimated unit costs and/ or staffing requirements. This should be translated into an annual budget that anticipates development of the system in five-year increments.
- Identify a cost-effective and diverse funding sources to finance construction, operation and maintenance of NMT improvements.
- Develop a goal-oriented and action-based citywide NMT policy to give legal/ statutory support to the larger vision of adopting sustainable transportation initiatives.
- Designate an individual or committee to serve as the city’s liaison advocating sustainable transportation interventions in all urban development projects.
- Identify a lead person, NMT Coordinator, with appropriate development and management skills to coordinate the ongoing system-level improvements for NMT investments. This “NMT Coordinator” should partner with the appropriate departments and/ or organizations as appropriate to carry out the various operations, management, and programming functions.

The Figure 3.2 illustrates how the NMT cell can be institutionally located in Vizag.

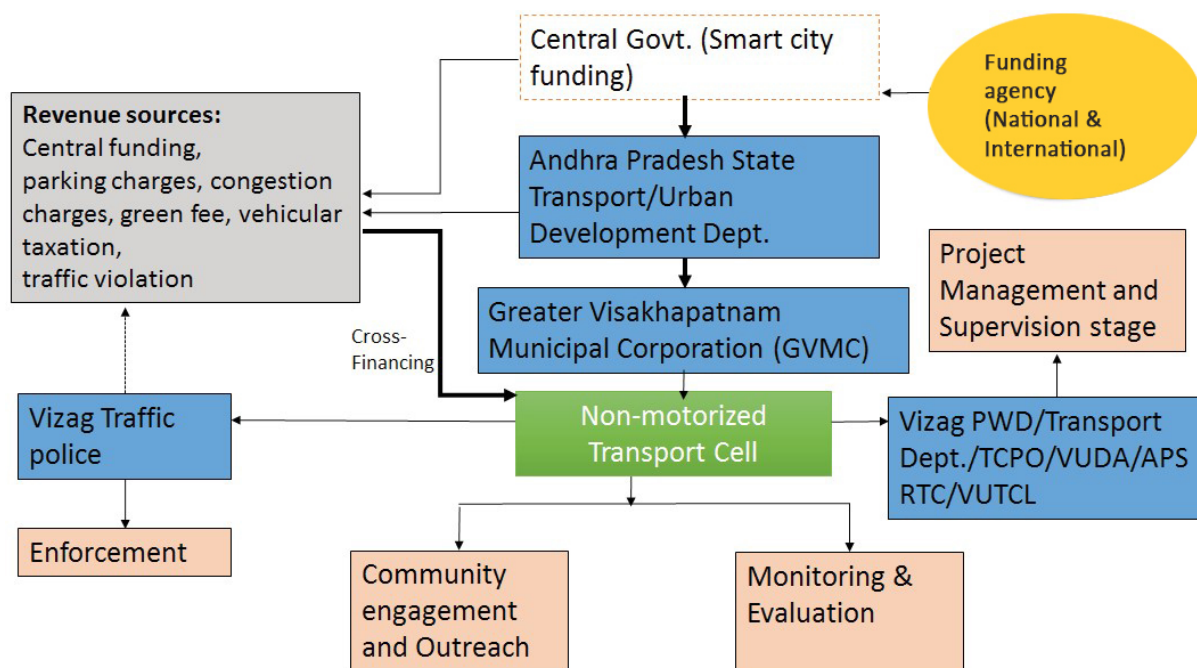


Figure 3.2: Proposed NMT cell for Vizag

Source: iTrans

3.2. Objectives for Vizag's NMT Plan

Improvement in the NMT conditions of Vizag will need planning and design effort at the network level filtered down to minute details that would make walking and cycling a comfortable and safe experience.

The following objectives were established during the stakeholder visioning sessions in the city as part of the planning process:

- **Integrate land use and transit:** Encourage mixed use planning in all new development areas accompanied by high density development along major transit corridors.
- **Build/ retrofit roads with walking infrastructure:** All 430 km of arterial and sub-arterial roads should be upgraded with walking infrastructure built as per 'Urban Road Design Guidelines' released by the Ministry of Urban Development. In the long-term all roads, including the collector and access roads should be made pedestrian-friendly.
- **Build/ retrofit roads with cycling infrastructure:** In keeping with the VUDA Master Plan, all roads with a proposed RoW of 30m or higher, should have the provision of segregated cycle tracks. Beach Road should be equipped with a cycling track and bicycle parking facilities.
- **Build a PBS network:** In keeping with the NMT master plan, a PBS network having a 3km radius coverage around the main public transit lines (the proposed Metro and BRT) and feeder lines should be built.
- **Prioritise first and last mile needs of Transit:** NMT infrastructure upgrades must be given priority in the transit influence zones accompanied by multiple transit opportunities for efficient last mile connectivity.



Figure 3.3: Visioning session during NMT Plan preparation, held on 20th February, 2015

Source: iTrans

3.3. Undertake Capacity Building

The lack of capacity to understand the needs of NMT users and implications on policy, planning and design is one of the most challenging factors hindering successful realization of sustainable transportation in urban areas. The following issues, when addressed collectively in a comprehensive manner, can strengthen and build the institutional and citizen capacities and help enable a NMT-supportive environment in Vizag:

Policy Development

A sound NMT policy grounded in Visakhapatnam's unique challenges will help set the foundation for developing a supportive institutional and legislative environment. GVMC should as part of its Smart City Proposal implementation undertake formulation of an NMT Policy with technical assistance from the State, international development agencies and mobility consultants retained as part of its implementation plan.

Funding Strategy

Vizag, similar to other smaller municipalities, have limited financial resources available for non-traditional projects such as NMT investments and there is no clear approach to allocate funds. It is recommended that clear budgetary allocation for NMT is mandated in annual budgets of GVMC, Traffic Police and other transportation authorities. This budgetary allocation should be developed through an understanding of detailed planning, construction, maintenance and operations needs required for effective delivery of NMT interventions.

NMT Planning Expertise

The current NMT expertise in government agencies is limited not only in India but globally. Transport decision-makers, planners and designers are trained exclusively in planning and designing for motorised traffic. In Vizag, GVMC's staff is no different with traffic engineers who are not aware of the nuances of NMT planning and in consultancies for road designs or policy formulation rarely require NMT experts. It is recommended that the city consider instituting an NMT cell staffed with planners and designers who have experience of working on NMT projects.

Mobilizing and Supporting Local Interest Groups

Local interest and advocacy groups can play an important role in the promotion of NMT. Strengthening their position can influence the quality of transport policy, the plans and designs and implementation. This would require reaching out to citizens groups which are strong in the city and building their capacity to take up the NMT agenda as a rights-based discourse at the grassroots level.

Benchmarking and Guidelines

Creating a stakeholder-driven Vizag Street Design Guidelines manual with appropriate benchmarking and performance measures to gauge the success of the city's NMT implementation efforts will help provide the necessary tools to the government planning, engineering and enforcement staff to help leaders make informed decisions. These guidelines should be flexible enough to adapt to contextual variations and enable predictability in implementation. However, awareness regarding the guidelines and discussions on how to refer to them and adapt them needs to be carried out continuously with the different governmental agencies and private sector developers.

CHAPTER IV: PLAN + DESIGN

4. PLAN + DESIGN

4.1. Principles of NMT Network Planning

The following principles (Figure 4.1) recommended in the National-level NMT Guidance Document were used as a reference for developing the Vizag NMT Plan. Building upon the findings of the Assess and Enable steps, the NMT Plan identifies a series of policy-level interventions, projects and programmes to define a course of action for upgrading the city’s NMT infrastructure and facilities.

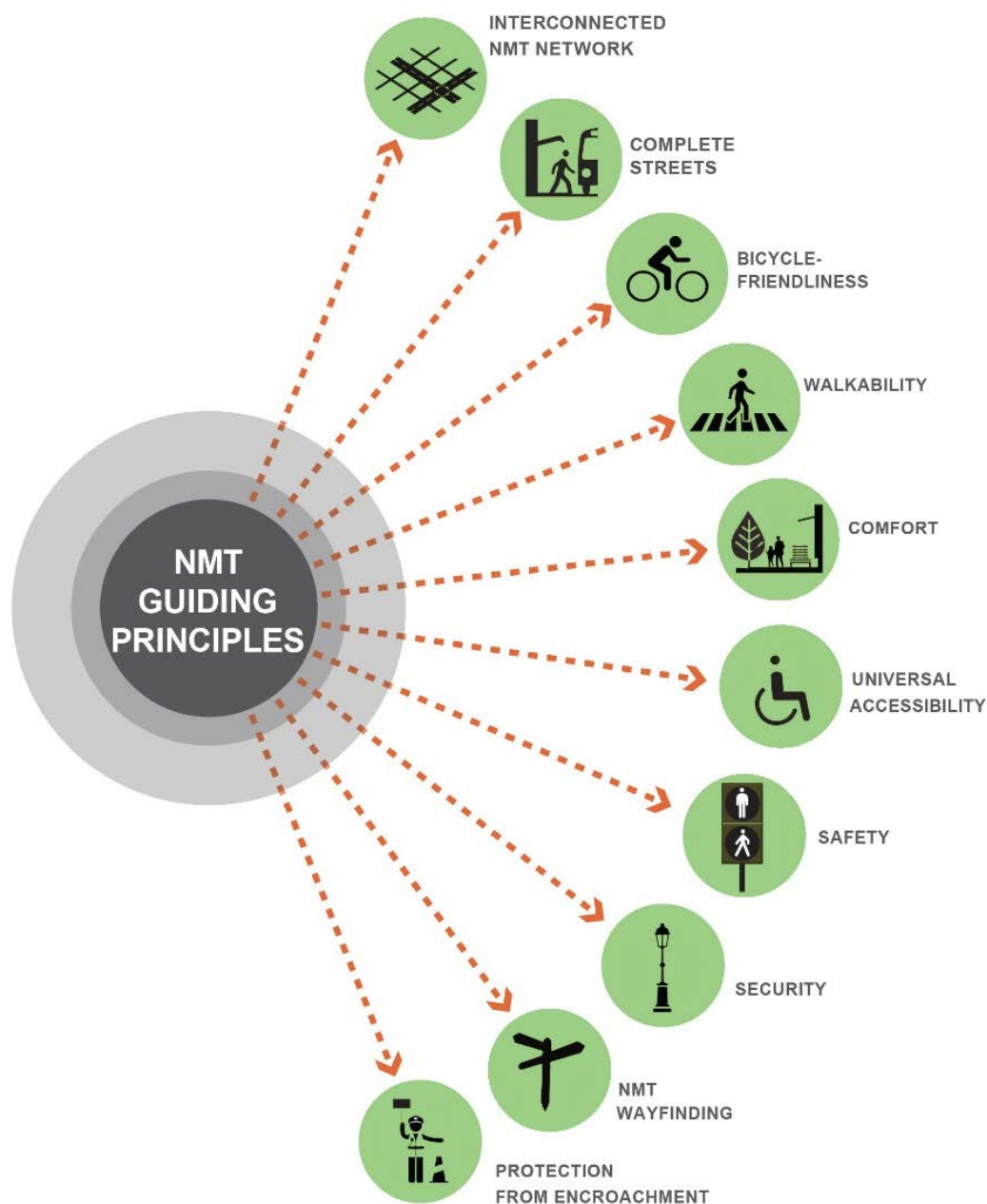
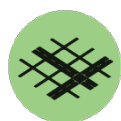


Figure 4.1: NMT Guiding Principles

Source: IBI Group

Table 4.1: NMT Guiding Principles

1. Interconnected NMT Network



An interconnected NMT network reduces congestion, encourages use of NMT modes and reduces walking distances between places as well as travel times.

2. Complete Streets



Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities.

3. Bicycle – Friendliness



Bicycles are efficient ways to expand accessibility without relying on automobiles or bus service. Bicycle lanes, bicycle routes, and secure bicycle parking make the bicycle an easy option.

4. Walkability



A qualitative measure of the cities that inspires walking trips. Often used in conjunction with liveability, walkability is a defined more by the quality of the place than by any transport-related metric.

4. Comfort



An attractive streetscape and public realm with design elements, coordinated to provide shade, weather protection, pedestrian amenities and visual interest improves the desirability of walking and shortens the perception of distance.

6. Universal Accessibility



Universal Accessibility simplifies navigation and reduces physical effort to an extent that a physically handicapped person should be able to navigate the pedestrian facilities without external assistance. It is a design approach that is meant to improve the usability and appeal of places by all types of users.

7. Safety



Developing the pedestrian environment to maximise safety will reduce the risk of accidents and enhance pedestrian experience in urban areas.

8. Security



Ensuring security of vulnerable groups such as women and children in the public realm will increase attractiveness of NMT. Crime Prevention through Environmental Design (CPTED) is an approach intended to discourage criminal behaviour through urban design principles.

9. NMT Wayfinding



Wayfinding is an essential feature to assist the users in navigation and improve sense of place. Develop wayfinding and signage, with focus on NMT users, to support the legibility and permeability of the cities.

10. Protection from Encroachment



Protection from encroachment ensures continuity and predictability in NMT use. It allows uninterrupted non-motorised mobility and brings in a sense of order.

Source: IBI Group

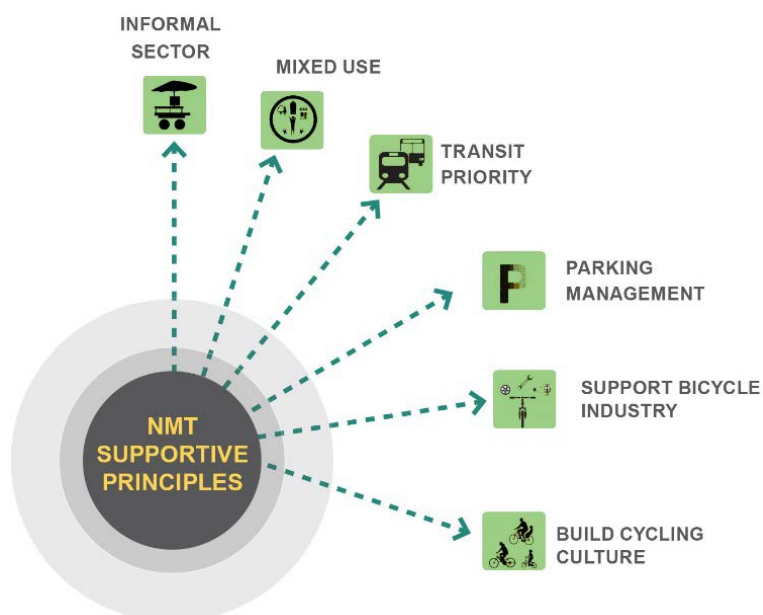


Figure 4.2 NMT Supportive Principles

Source: IBI Group

Table 4.2: NMT Supportive Principles

1. Informal Sector



To achieve the goal of inclusive mobility, integrate the informal sector such as street vendors and settlements in planning and design of NMT infrastructure within the cities.

2. Mixed Use



A mix of diverse and complimentary land uses in a compact pattern allows residents and workers to walk to work or to shop rather than driving for all daily needs.

3. Transit Priority



Transit priority planning encourages non-motorised modes for first and last mile connectivity promoting a shift towards increased NMT usage.

4. Parking Management



Utilise parking management strategies as a travel demand management tool to discourage personal vehicle usage, reduce parking demand, and promote sustainable mobility opportunities to build people-oriented neighbourhoods.

5. Support Bicycle Industry



To reverse the declining trends in the bicycle industry, initiate key tax incentives and investment in research and development.

6. Build Cycling Culture



Promote healthy lifestyle and sustainable living principles by encouraging recreational cycling and conducting events like Raahgiri and Cyclothons. This will help elevate the perception of cycling, and promote a cycling culture in cities.

Source: IBI Group

Table 4.3: NMT proposals and applied planning principles

Key Strategies

1. Seamless NMT citywide network (walking infrastructure and cycling infrastructure)



2. Integrating land use and transport



3. Safe route to parks and schools programme



4. Public bicycle sharing



5. First and last mile connectivity to transit



6. Blueways recreational trail



7. Retrofitting existing streets



Signature Projects

1. Cycling Highway along Beach Road



2. Accessibility design for influence areas of the proposed metro stations



Source: IBI Group

4.2. Vizag NMT Plan

The Vizag NMT Plan is intended to serve as a roadmap and guiding document for GVMC to adopt in order to achieve its goal of improving the overall quality for its citizens. The strategies and proposals presented in this Plan are based on the study of all existing NMT routes in the city with current peak and off-peak demand and also the location of facilities associated with walking and cycling.

Figure 4.3 presents the existing road hierarchy for the city based on right-of-way widths (RoWs) and their potential to provide a seamless network of interconnected streets with NMT infrastructure.



Figure 4.3: Road hierarchy in Vizag

Source: LCMP 2014

The varying road widths, with different functions need to be redesigned in a manner that aims to achieve equitable distribution of road space for all modes of travel with the highest priority given to pedestrians, followed by cyclists and public transit. In Vizag, as discussed earlier, more than 50% of the users walk to their destinations and it is essential to build well connected and attractive NMT infrastructure. Providing footpaths and cycle tracks on both sides of roads is desirable with special focus on areas such as schools, bus stops, commercial streets and main activity zones.

Table 4.4 and Table 4.5 present the proposed minimum design widths for footpaths and cycle tracks for Vizag, adapted from the Urban Roads Codes, 2012. Typical design standards and details according to the Urban Road Codes, 2012 are incorporated in 0 for reference.

Table 4.4: Width of footpath as per capacity

Effective capacity as per LOS – ‘C’ in persons/min counted over 15 min	Effective width of footpath (m)
23-50	1.5
58-83	2.5
81-116	3.5
115-165	5.0

Source: Urban Road Codes, 2012

Table 4.5: Width and other design parameters of cycle tracks

	Arterial Roads	Sub Arterial Roads	Distributary Roads	Access Roads
Non-motorised vehicle	Segregated cycle track	Segregated cycle track	Cycle lane	Mixed traffic
location	Between carriageway or street parking and footpath on either edge of the carriageway	Between carriageway or street parking and footpath on either edge of the carriageway	On the edge of the carriageway, adjacent to the footpath or parking.	
Horizontal curve	30m or more	30m or more	30m or more	As per the alignment of the road
Gradient	1:12 – 1:20	1:12 – 1:20	1:12 – 1:20	1:12 – 1:20
Lane width	2.2 to 5.0m	2.2 to 5.0m	1.5 to 2.5m	Mixed with motorised vehicular traffic
Minimum width	2.5 for a two lane cycle track and 1.9m for a common cycle track and footpath	2.0 for a two lane cycle track and 1.7m for a common cycle track and footpath	1.5m	1m (painted)

Source: Urban Road Codes, 2012

4.3. Key Strategies

1) CREATE A SEAMLESS CITYWIDE NMT NETWORK

Various NMT improvements identified at different scales- street, corridor or area level- lead to an overall improvement in the NMT attractiveness of the city. However, preparing a citywide network plan before detailed level planning should be undertaken in order to understand the larger picture on how transportation corridors in Vizag are helping connect different areas of the city. At the network plan scale presented in the following sections, proposals including street hierarchy and links for segregated cycle tracks and pedestrian footpaths on arterial roads are envisaged. Where feasible, the NMT Plan identifies opportunities such as developing recreational trails along the city’s underutilised drains and waterways.

Figure 4.4 illustrates the proposed non-motorised network design in Vizag classified into three main categories: 1) Segregated cycle tracks; 2) Cycle lanes; and 3) NMT Priority streets.

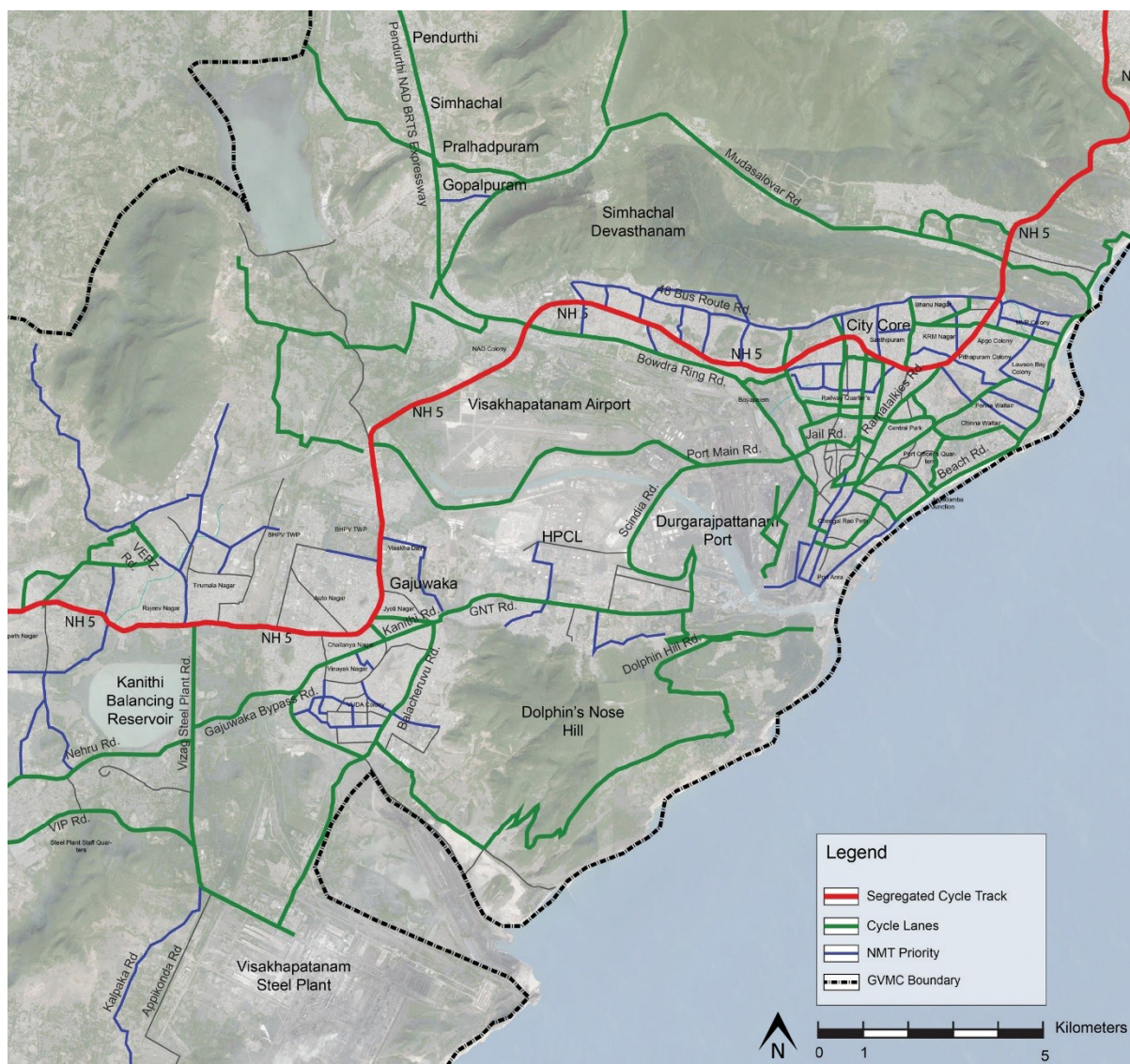


Figure 4.4: Proposed NMT network in Vizag

Source: iTrans

The NMT Plan refers to the information collected by the LCMP and aligns with the proposals made therein:

Walking Infrastructure

Currently, only 78 km out of the 430 km of arterial and sub-arterial roads in the city have footpaths. The NMT Plan proposes that GVMC create a phase strategy to cover the entire 430 km stretch over the course of time. In the long-term all roads, including the collector and access roads need to be transformed into pedestrian friendly streets. Few priority corridors to be taken up immediately are identified and are shown in Figure 4.5. Some of the corridors are planned to be taken up under Public Private Partnership (PPP) mode to overcome the current lack of funds to spend on walking infrastructure.

As shown in Figure 4.5 priority sidewalks are proposed to be built on NH5 and to the south of the NH5 along Waltair Station Approach Road, Raja Ram Mohan Roy Road, American Hospital Road and KGH Down Road.

Sidewalks along MVP Double Road, Seethammandara Road, Akkayapalem Road, Railway New Colony Road, Rama Talkies Road, VIP Road, Daba Garden Road, Waltair Main Road, Chinna Waltair Main Road are proposed to be built through public private partnership initiatives.

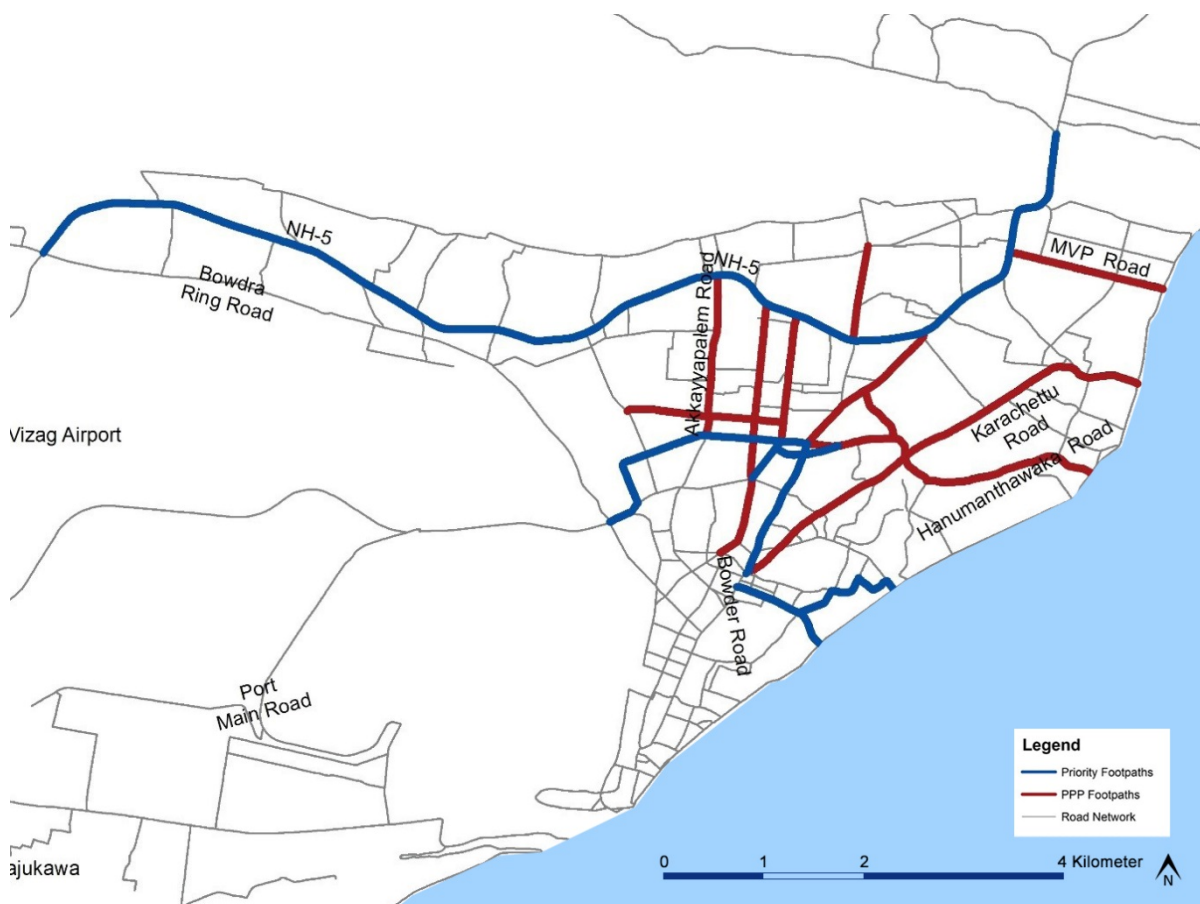


Figure 4.5: Map showing proposed walking infrastructure

Source: LCMP, 2014

Cycling infrastructure

One of the major reasons for low cycle usage in the existing scenario is the lack of safety on roads for the cyclists and also lack of parking for cycles in the city. On the arterial roads with RoW more than 30m, segregated cycle tracks are needed to separate the cyclists from high speed motorised traffic. On roads with lesser RoW, traffic calming measures need to be taken up so that the traffic speed is not too high compared to the speed of the cyclists, thereby increasing their safety. All roads with a proposed RoW of 30m or higher, as per the VUDA Master Plan, are identified for the provision of segregated cycle tracks. Figure 4.6 highlights the network of cycling tracks proposed in Vizag along the roads wider than 30m these include NH5, Beach Road, Bowdra Ring Road, GNT Road, Sheela Nagar Port Road, Mudasarlova Road and Vizag Steel Plant Road.

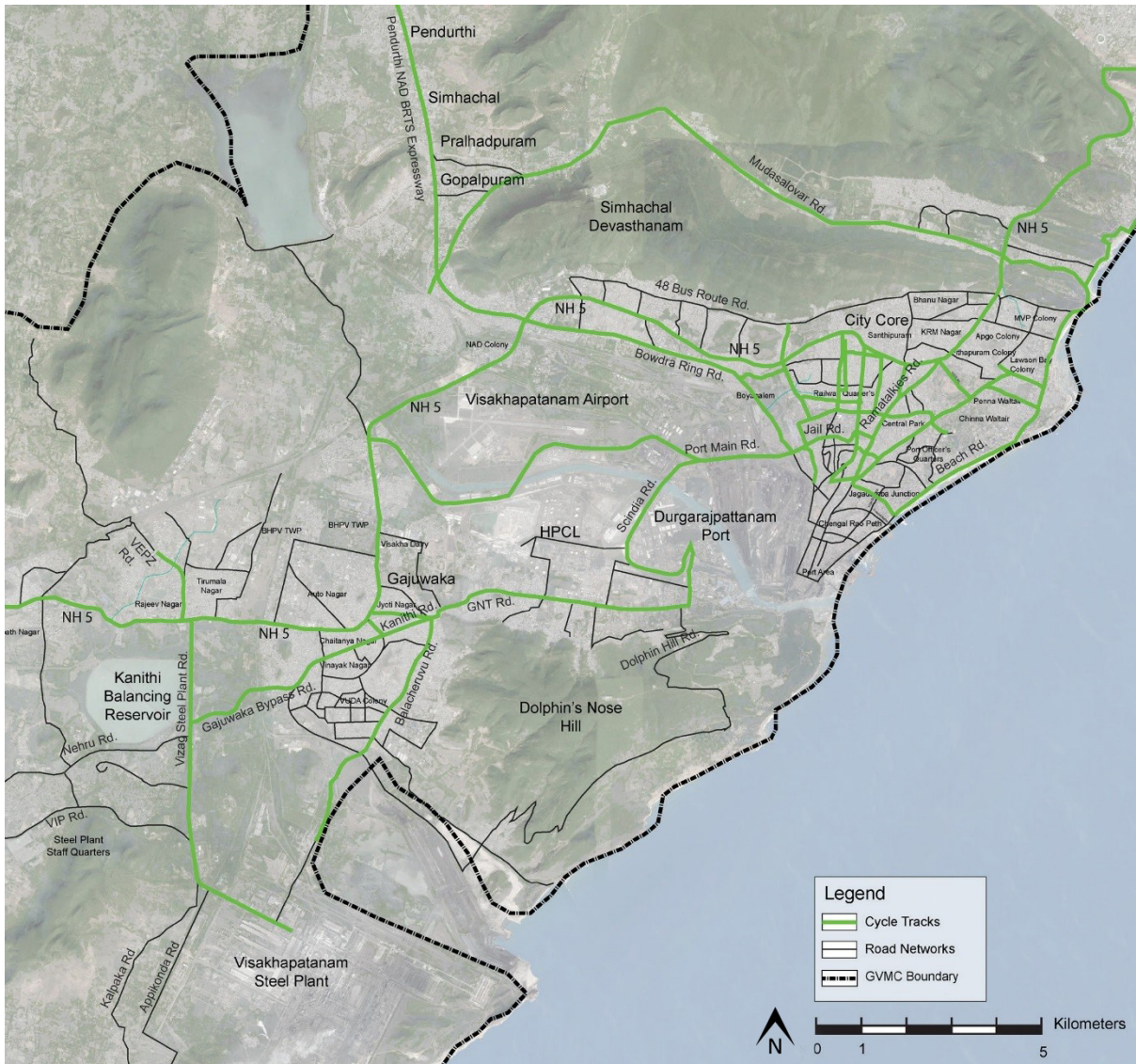


Figure 4.6: Proposed segregated cycle tracks on roads having RoW more than 30m

Source: LCMP 2014

2) INTEGRATING LAND USE AND TRANSPORT

Mixed-use developments, integration of affordable housing near transit, and compact urban cores are some of the strategies used to better integrate land use and transport planning. The intent of this increased integration is to create walkable communities where people can access their daily needs and work trips within a 5 to 10-minute walk. Segregated land uses, as currently found in Vizag, will lead to more travel or trips per day which will in return stretch the GVMCs resources to provide infrastructure and access to required amenities. Also, trip lengths would increase in the city since people in the outgrowths would still need to travel to the core city for their work, shopping and other activities. Longer trips encourage the usage of motorised modes of transport and hence the carbon footprint of the city.



Figure 4.7: Commercial land use along Rama Talkies Road in Vizag

Source: *iTrans*

In Visakhapatnam, an alternative plan is proposed by the LCMP, 2014 where a pattern of city growth is envisaged in such a way that the commercial activity in the city is spread across the entire city i.e. even the suburbs. Since the core city already has a high density of population, this would also ensure in people moving to the new development. According to the LCMP, 2014, it is proposed to increase three new developments of the city i.e. Madhurawada, Pendurti and Gajuwaka (refer Figure 4.8). Encouraging more commercial development in these areas than proposed in the VUDA Master Plan, and also encouraging mixed land use provisions will ensure areas with more balanced distribution of residential and employment centres are created across the city.



Figure 4.8: Proposed growth centres in Vizag

Source: LCMP, 2014

3) SAFE ROUTE TO PARKS AND SCHOOLS PROGRAMME

The Vizag NMT Plan recommends that GVMC institutes a “Safe Route to Parks and Schools” programme in order to ensure that all school zones are safely accessible by walk. Traffic calming measures along the frequently travelled streets, within a 500m walking radius from activity areas used by children, should be installed at recommended intervals with appropriate enforcement. Figure 4.9 identifies the social, institutional and recreational zones in the cities, earmarking them for priority intervention of the proposed “Safe Route to Schools” programme.



Figure 4.9: 500 meter buffer to educational, institutional and recreational facilities in the city

Source: iTrans

4) PUBLIC BICYCLE SHARING (PBS)

PBS is a public transportation system based on cycles, which are generally stored in a closely spaced network of stations. With a smart card or any other form of identification, a user can check out a bicycle from a station and return it to any other station. The central concept of this system is to provide affordable access to cycles for short- distance trips in an urban area as an alternative to motorised public transportation or private vehicles.

Unlike traditional bicycle rental systems found in several Indian cities, PBS is a more flexible system which allows its user to rent a cycle from a station and return it to any other depending on the user’s comfort. It hence allows its users the freedom to make one way trips. While traditional systems had users renting cycles for an hour to several days, PBS encourages its users to rent cycles for a shorter time period which range from a few minutes to a few hours. Users are economically incentivised to return cycles at the earliest by making usage free for the first thirty minutes or so. Moreover, while traditional systems use cycles which are commercially available, PBS make use of cycles which are specially designed for the system and hence unique.

The Vizag NMT Plan proposes a PBS system covering a 3km radius around the main public transit lines (proposed Metro and BRT) and feeder lines. As seen in the Figure 4.10, this coverage area (blue) covers almost the entire city by cycle share. However, at one of the end line locations (light peach colour) it is proposed that due to longer cycling distances from public transit and hilly terrain, geared bicycles or electric bicycles can be deployed in the PBS system.

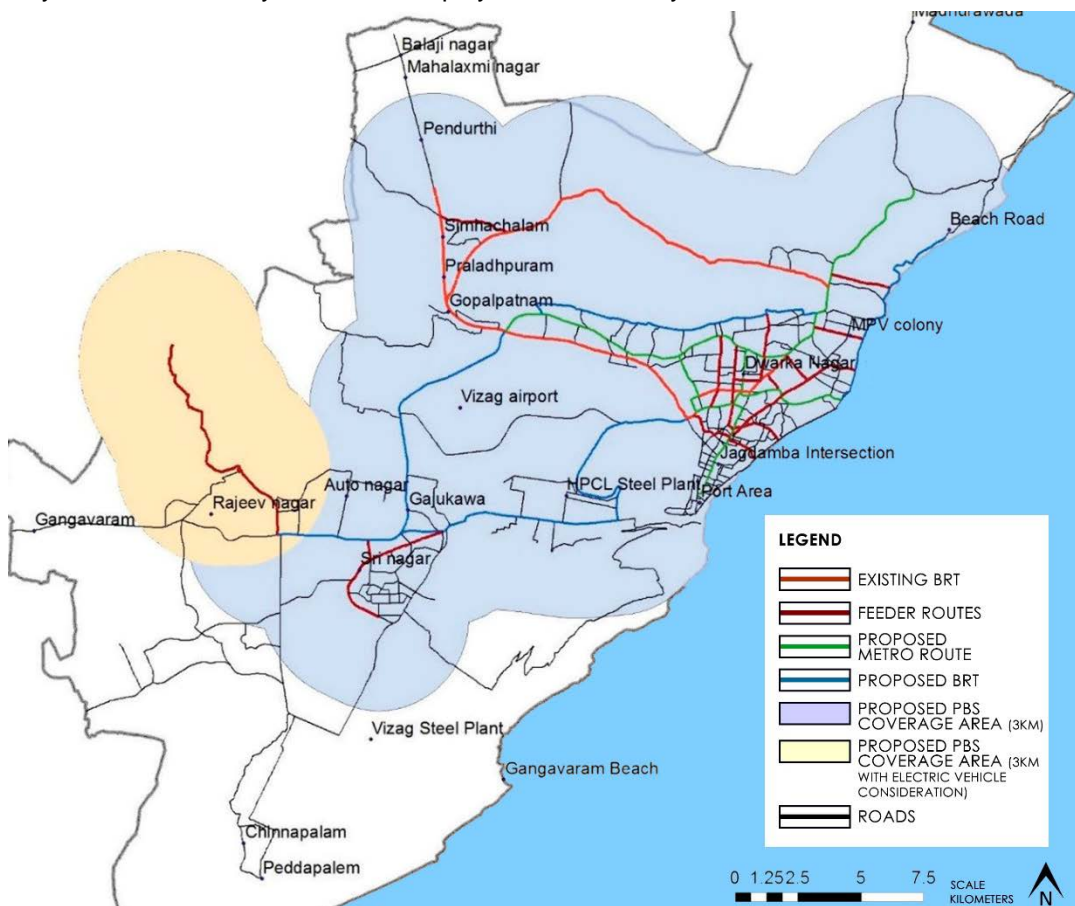


Figure 4.10: Proposed PBS coverage area (3 Km)
 Source: iTrans

Two networks have been identified as part of LCMP, 2014 which can act as a pilot for the implementation of PBS in the city and are shown in Figure 4.11 and Figure 4.12.

Within the core city area, the PBS stations have been planned along Telego Talli Road, CBM Compound Road, RTC Complex Road, Waltair Main Road, Beach Road, Town Main Road and Raja Rammohun Roy Road.

Cycle lanes to promote PBS has also been planned in the Gajuwaka area along NH5 going towards the Durvada Railway Station and Kanithi Road.



Figure 4.11: Network of cycle lanes to promote PBS in the core city area

Source: LCMP, 2014



Figure 4.12: Network of cycle lanes to promote PBS in Gajuwaka Area

Source: LCMP, 2014

5) FIRST AND LAST MILE CONNECTIVITY TO TRANSIT

Integrating pedestrian and bicycling infrastructure with mass transit facilities, including buses and community shuttle services will help provide a safer NMT environment while also increasing transit ridership. In order to strengthen first and last mile connections, a number of design components are identified including:

- Well-designed footpaths with safe pedestrian crossings in the influence areas of bus stops and metro stations as a critical intervention required for improving the access experience of the transit commuters.
- Network of bicycle lanes connecting the transit station and major destinations are identified along with dedicated spaces for bicycle parking near the station to promote multi-modal integration.
- Pedestrian safety measures such as refuge islands, table top crossings, push buttons to be incorporated at intersections and mid-block crossings.
- Create clear, direct, and short transfers between different transit modes by minimizing walking distances and removing physical and perceived barriers within transit stations.
- Provide clearly marked and protected access for pedestrians and cyclists at station areas to minimize conflicts, particularly at passenger pick-up and drop-offs (PPUDO), bus facilities, IPT stops and parking access points
- Prioritise accessible bicycle sharing schemes to encourage public transit users in particular and public in general to use cycle as a mode to perform their first and last mile journey as well as to make regular short trips without using private vehicles.
- Incorporate cycle rickshaw parking and three wheeler parking bays of 1.5m width near junctions.
- All pedestrian facilities should be barrier free for universal access by all persons with reduced mobility including those with hearing and visual impairments.
- 30 km of NMT priority area has been identified along the BRT corridors in such a way that they integrate the various mass transit corridors (refer Figure 4.13).

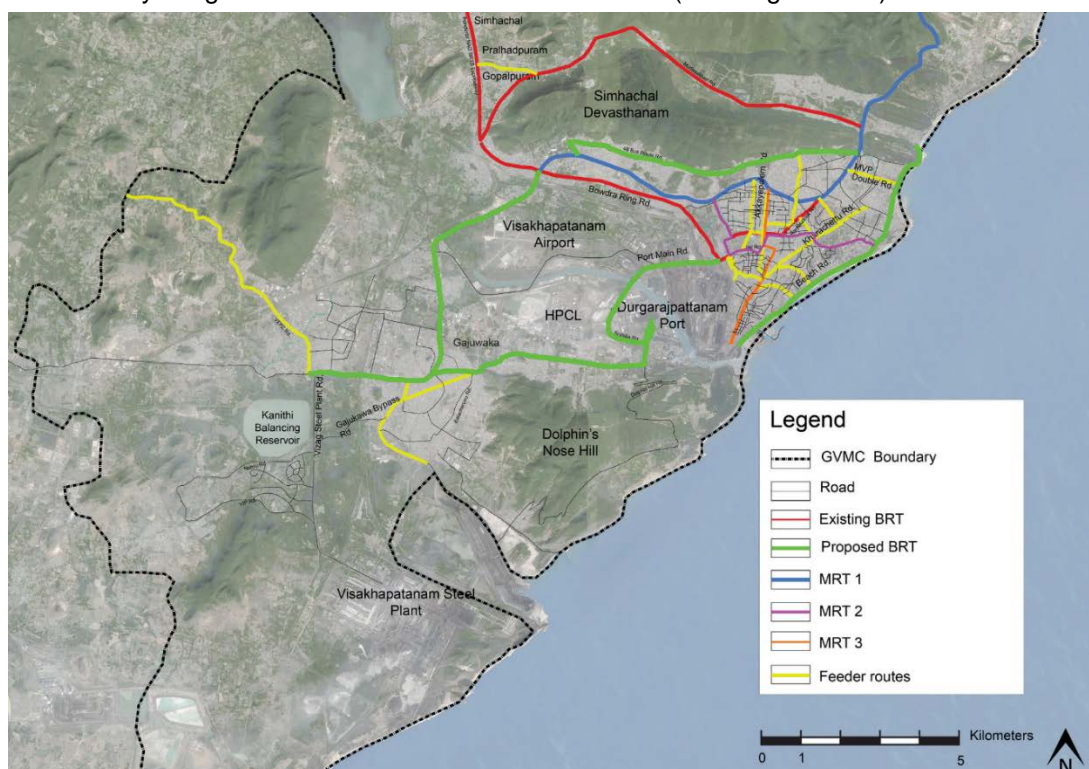


Figure 4.13: Last mile connectivity to existing and proposed BRT network
Source: *iTrans*

6) BLUEWAYS RECREATIONAL TRAIL

In 1929, Vizag city covered an area of 15 sq km having around 30 km length of storm water drains of 30m to 60m width and 300 acres of lakes and tanks, accounting for 14% of “blue green spaces”. By extrapolating this data to the current year, the NMT Plan assumes that Vizag city with its present extent of 544 sq km of area possesses around 1,000 km of storm water drains. This means the city has the potential of creating an extensive network of safe, comfortable and vehicle-free recreational trails connecting the entire city and open spaces providing a public amenity that also serves the dual purpose of acting as the greenbelt of the city.

The NMT Plan envisions using the Blueways Recreational Trail to connect walkable localities while reducing congestion, air pollution, resource depletion and enhancing the overall quality of life. It will also promote ecological restoration of the city’s natural resources by protecting open spaces, reducing urban heat effects, and recharging ground water. (refer Figure 4.14 to Figure 4.17). The trail has the potential to bring recreational open spaces close to most of the households, increase the potential for interactions among citizens and provide alternative safer routes for people to access activity centres in the city.

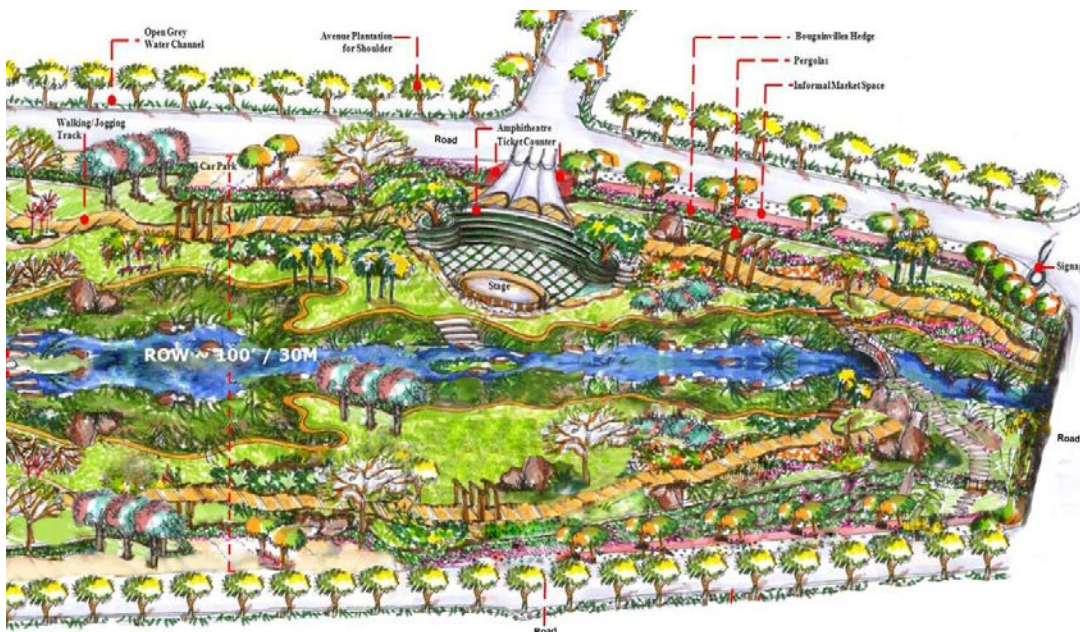


Figure 4.14: Design for development of water channels in the front yard

Source: Shilpa Architects



Figure 4.15: Cross section of the designed space around the water channels

Source: Shilpa Architects



Figure 4.16: View of a water channel development

Source: Shilpa Architects

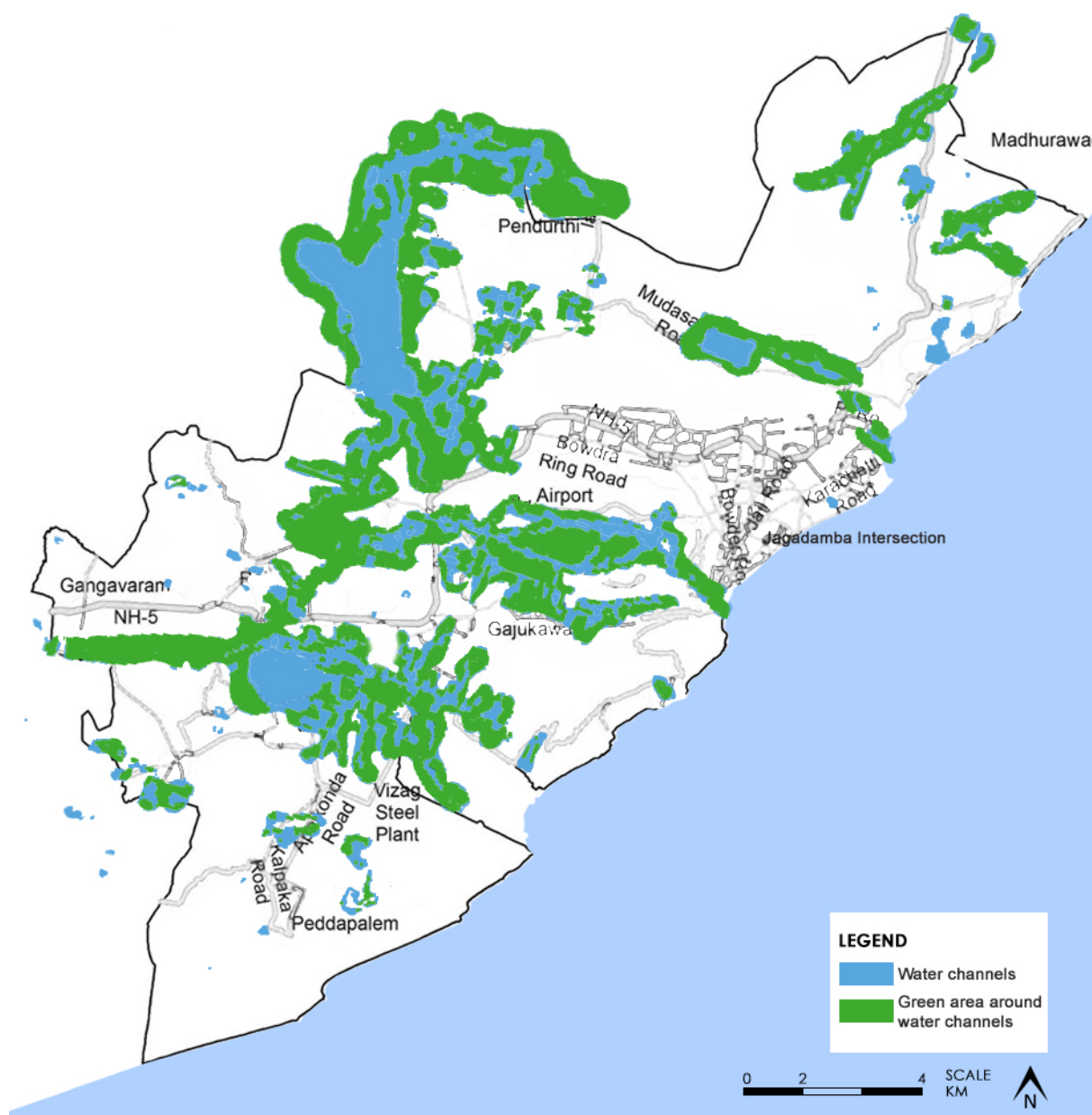


Figure 4.17: Plan for developing the water channels in Vizag

Source: Adapted from map prepared by Shilpa Architects

4.4. Identifying Signature Projects

Visakhapatnam envisions to be an **“eco-friendly city ensuring a comfortable, lively and vibrant character with visually pleasing cityscape equipped with state of the art physical, social and economic infrastructure”**. In alignment with the city’s vision and drawing lessons learned from the baseline assessment of city’s transportation system, the NMT plan for Visakhapatnam envisages; “A livable city where children can bicycle to school, women feel secure walking in public spaces, roads are accident and pollution free, and every citizen has choices in how they want to move in the city.”

To convert the vision into a favourable environment for effective implementation, two signature projects have been identified to demonstrate successful implementation in low budget and short duration of time.

1. **Cycling Highway along Beach Road**

The Beach Road has an existing high visibility of pedestrians with the presence of wide promenade which is a well utilised and organised public space in the city. A signature project with 1.5 m wide cycle tracks along the Beach Road is proposed with cross-over facilities at all intersections along with bicycle parking and PBS stands. Bicycle parking places at all the nodes where the perpendicular roads intersect with the Beach Road is recommended. The proposal will help in encouraging a structured approach to promote cycling as a recreational activity. It will also help in understanding the impact of NMT improvements and act as a catalyst for expansion of the NMT network in the city.

As a first step, temporary changes such as painted cycles tracks and allocating areas for bicycle parking should be used to experiment with ideas before permanent changes are made. Followed by traffic signal improvements, wayfinding and signage interventions and aligning it with other system based interventions such as public bicycle sharing, bicycle rental should be pursued.

2. **Accessibility design for influence areas of the proposed metro stations**

Visakhapatnam is still in process of identifying the corridors and station locations for the proposed metro and it is important to integrate principle of NMT from the beginning to transform the area surrounding the transit station from an auto-oriented corridor into a series of pedestrian-oriented nodes. During the DPR preparation for the metro corridor, it is recommended that mandatory accessibility improvements within 10-minute walking distance from all transit stations should be planned. This will not only ensure better ridership but demonstrate the principles of multimodal integration and accessibility planning.

Some part of feeder networks leading to the tentative locations of the metro stations have been integrated with the NMT plan, however, consultants can be appointed to carry out accessibility planning around metro stations. A sample TOR for planning accessibility around the metro stations (adapted from a similar exercise) is appended in 0).

4.5. Retrofitting the Streets

Retrofitting streets to integrate NMT facilities requires conducting a detailed street audit to minimize disturbing the existing infrastructure and utilities while making adjustments to the existing right of way to equitably allocate space for walking and cycling, where possible. Figure 4.18 shows a sample retrofitted pedestrian stretch on the Beach Road.

As part of the planning process, 8 stretches listed in Table 4.6 were identified for improvements. However, the current engineering design allocates most of the RoW to motorised carriageway leaving pedestrians and cyclists with 1.5m shoulders on both sides. The following prioritised streets are proposed for retrofitting by introducing the concept of ‘road diets’ to achieve equitable allocation of space for all modes, especially pedestrians and cyclists. A typical road diet technique is to reduce the number of lanes on a roadway cross-section. Figure 4.19 to Figure 4.27 illustrates the existing and proposed cross-sections for the priority streets identified.

Table 4.6: Proposed cycle tracks in Vizag

S No.	Proposed cycle cracks	Length (km)	Reduced carriageway on both sides (m)		Increased NMT on both sides (m)
1	Old Central Jail	1.20	22.0 to 14	11.0 to 7.0	13.0 to 25.0
2	Dwarakanagar to Gurudwara Jn.	1.30	8.8 to 7.0	8.8 to 7.0	6.4 to 10.0
3	Rednam Circle to Siripuram Circle (Dutt Island)	1.50	9.2 to 7.0	10.25 to 7.0	7.55 to 13.0
4	Siripuram Circle to GVMC	1.00	10.6 to 7.0	10.6 to 7.0	7.8 to 15.0
5	Siripuram Circle to Beach Road (via Old CBI and Lawsons Bay Colony)	2.50	8.0 to 7.0	10.5 to 7.0	3.5 to 8.0
6	Siripuram Circle to Beach Road (via AU Out Gate)	2.00	9.3 to 7.0	9.3 to 7.0	5.4 to 10.0
7	Tycoon Jn to Mosque (VIP Road)	0.60	9.3 to 7.0	9 to 7.0	5.7 to 10.0
8	Seven Hills Jn to Vizag Central Circle (via Jagadamba Jn)	1.50	14.5 to 10.0		3.0 to 7.5
TOTAL LENGTH		11.60			
Note: 2.0 m of cycle track has been proposed on the both sides of the road in the above sections.					

Source: iTrans



Figure 4.18: Existing retrofit of Beach Road in Vizag

Source: iTrans



Figure 4.19: Proposed cycle tracks
 Source: Adapted from GVMC, 2012

RIGHT OF WAY: 46M

OLD CENTRAL JAIL ROAD (GOVT. DEGREE COLLEGE SIDE ROAD)

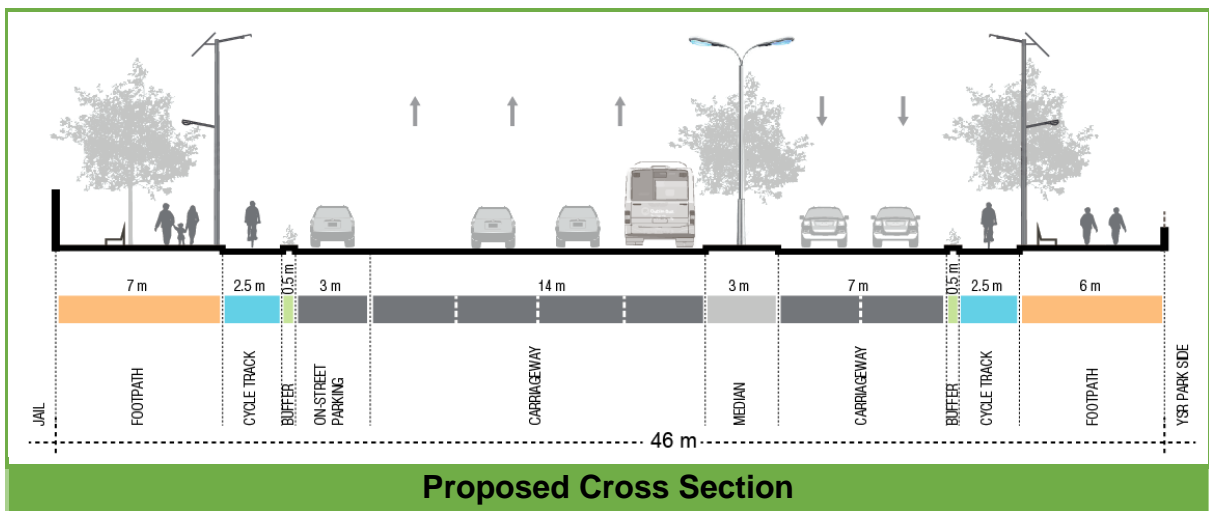
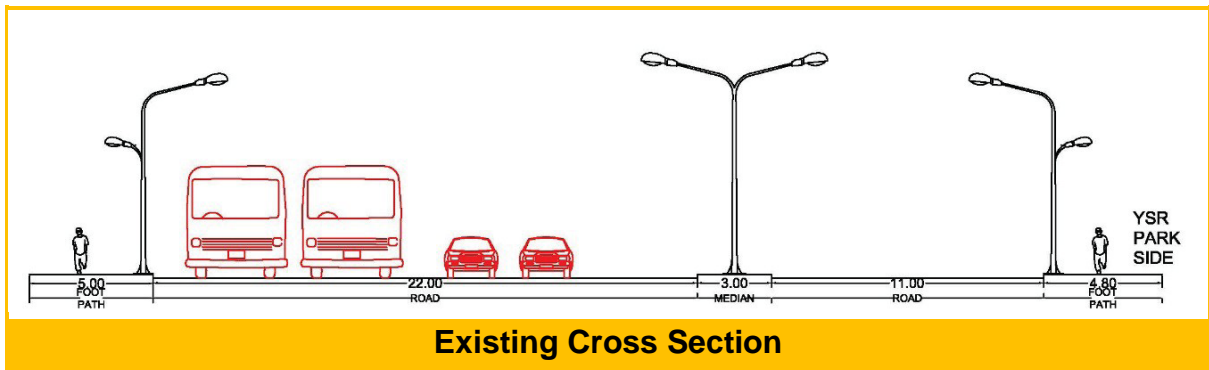


Figure 4.20: Existing and proposed cross section of Old Central Jail Road

RIGHT OF WAY: 29M

SIRIPURAM JN. TO GVMC

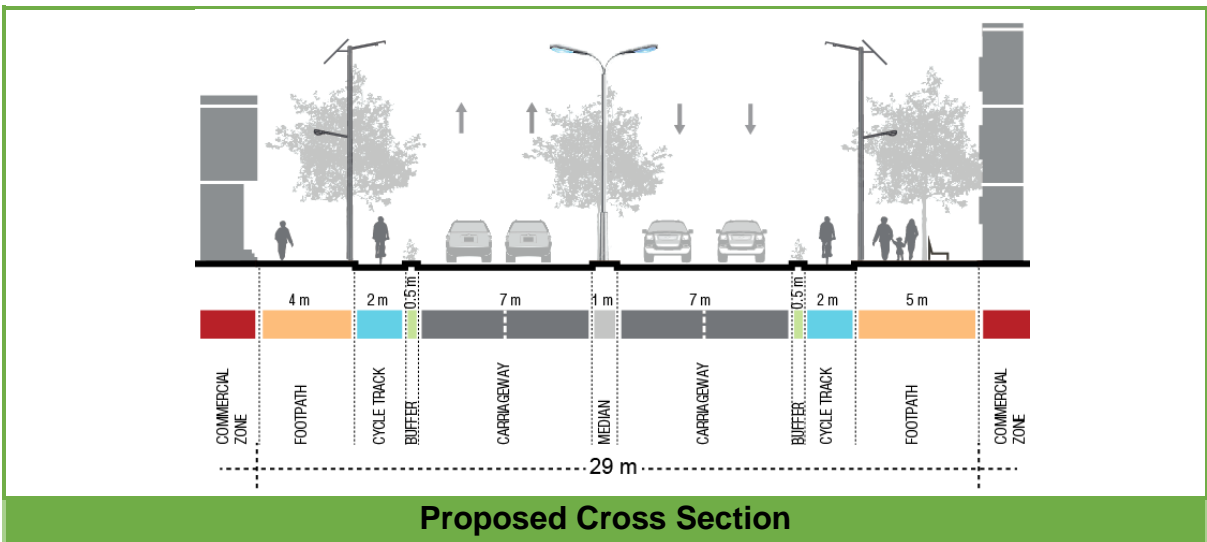
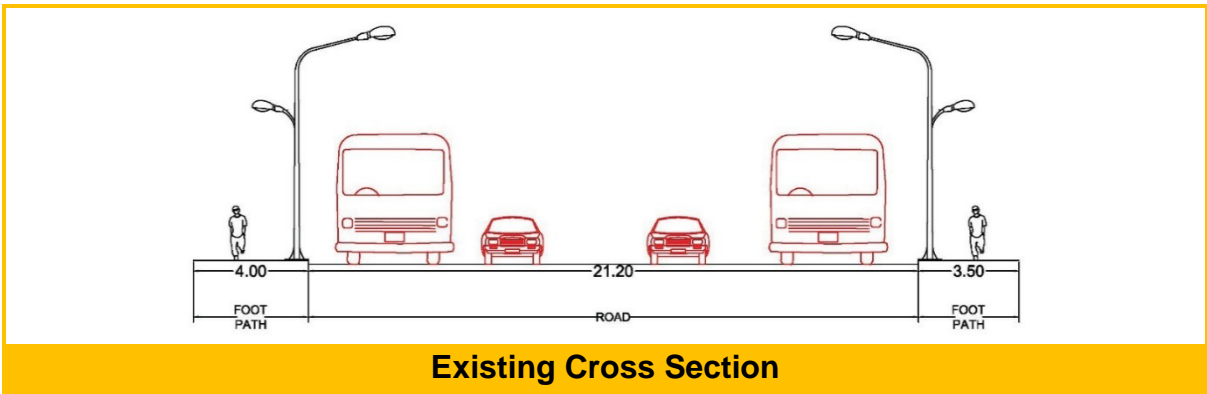


Figure 4.21: Existing and proposed cross section of stretch from Siripuram Jn. to GVMC

RIGHT OF WAY: 27M

REDNAM CIRCLE TO SIRIPURAM JN.

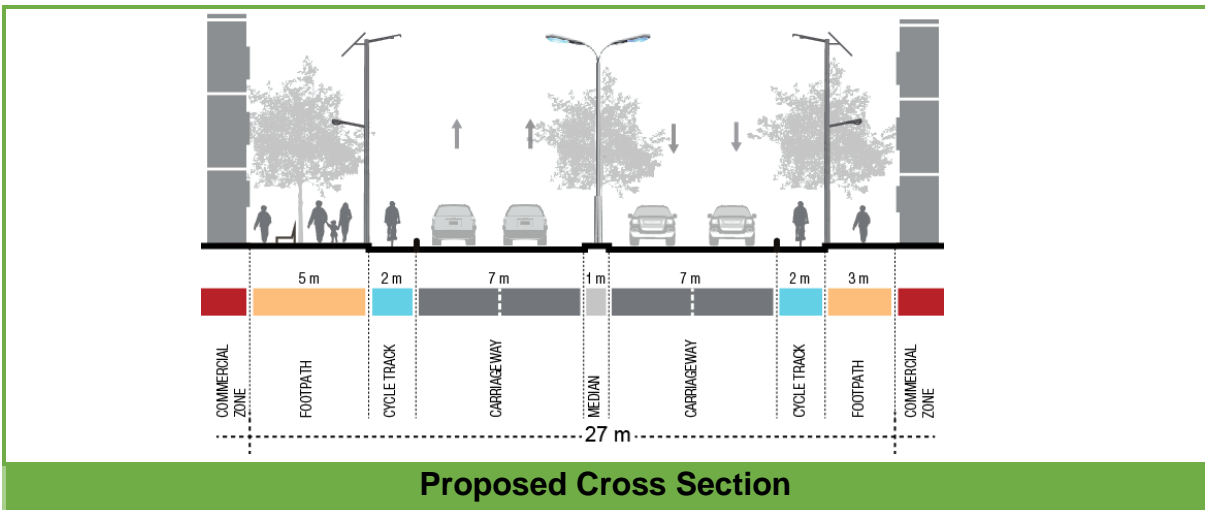
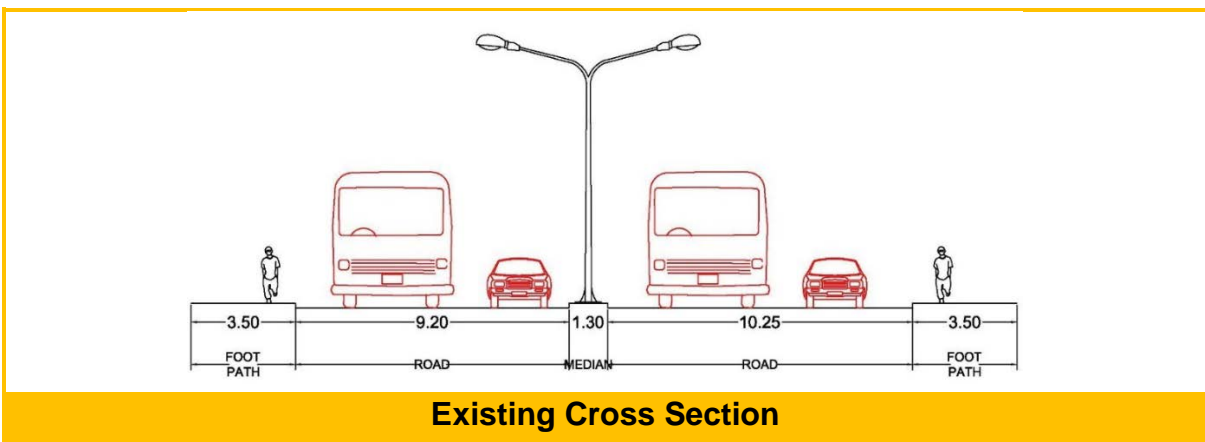


Figure 4.22: Existing and proposed cross section of stretch from Rednam Circle to Siripuram Jn.

RIGHT OF WAY: 24M

DWARKA NAGAR TO GURUDWARA JN.

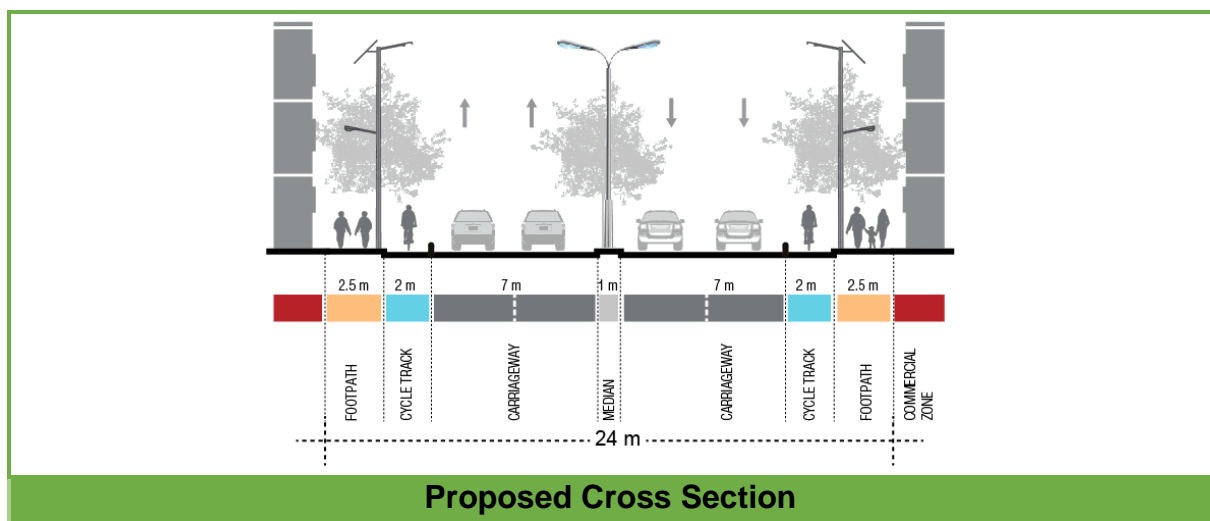
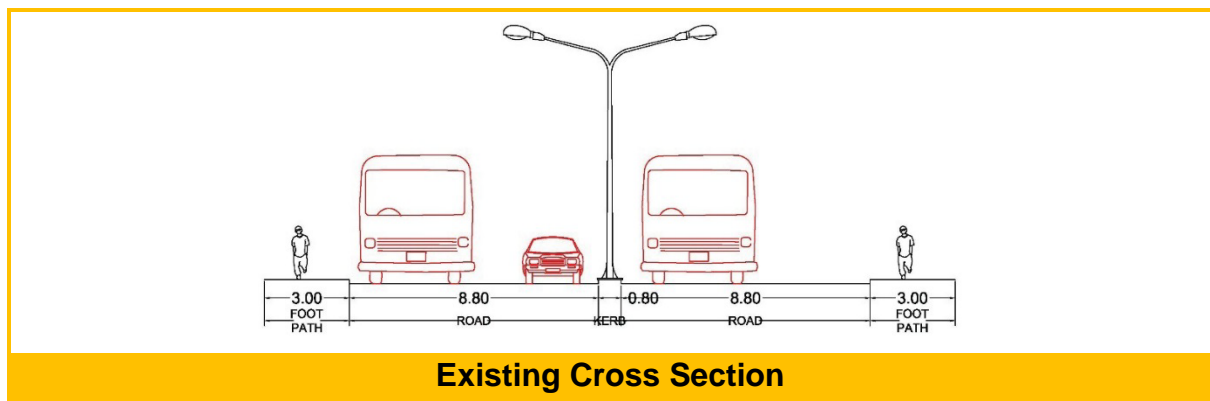


Figure 4.23: Existing and proposed cross section of stretch from Dwarka Nagar to Gurudwara Jn.

RIGHT OF WAY: 24M

TYCOON JN. TO MOSQUE (VIP ROAD)

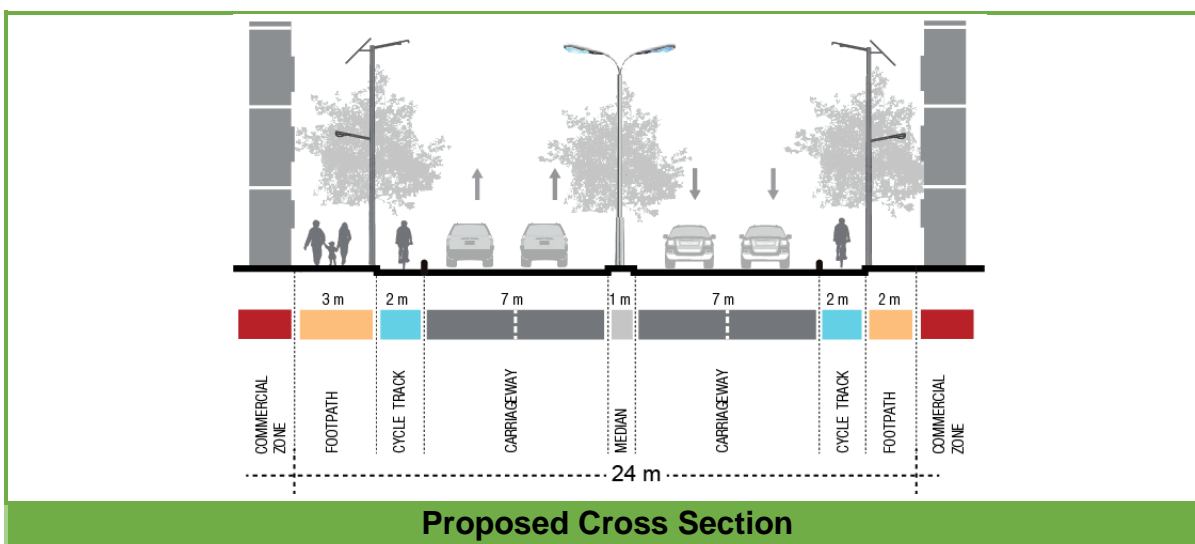
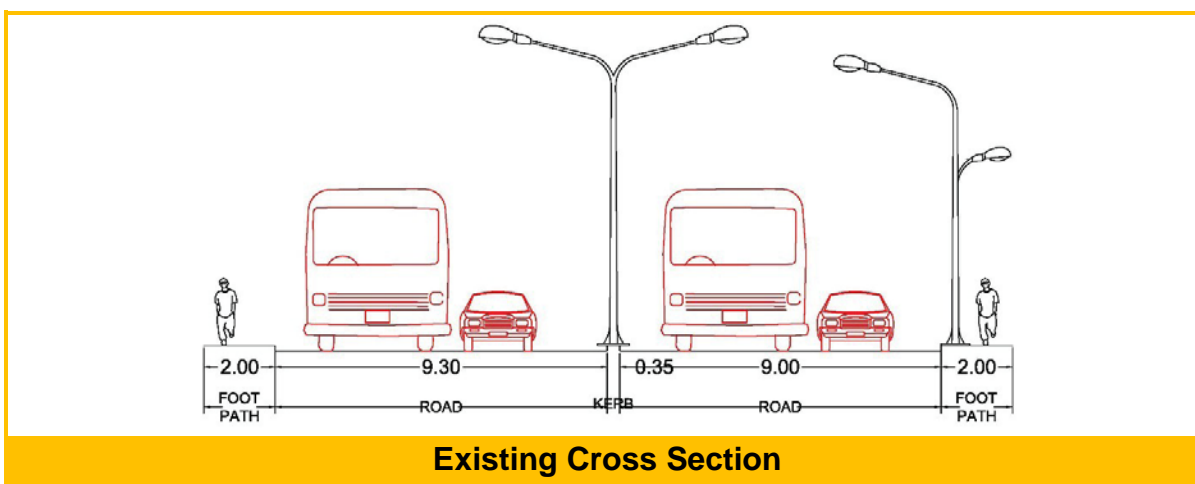


Figure 4.24: Existing and proposed cross section of stretch from Tycoon Jn. to Mosque (VIP Road)

RIGHT OF WAY: 24M

SIRIPURAM JN. TO BEACH ROAD (VIA AU GATE)

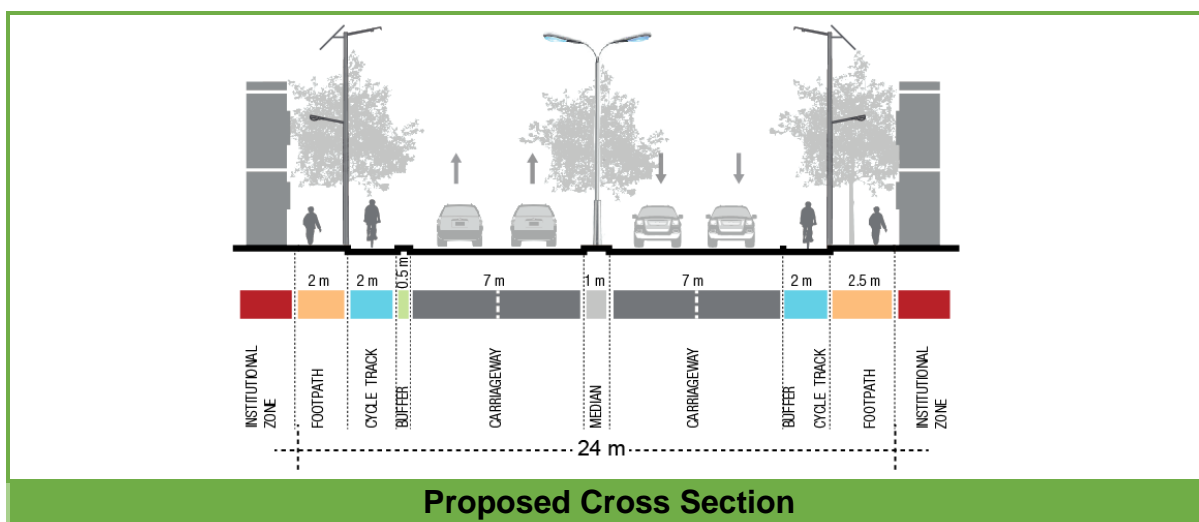
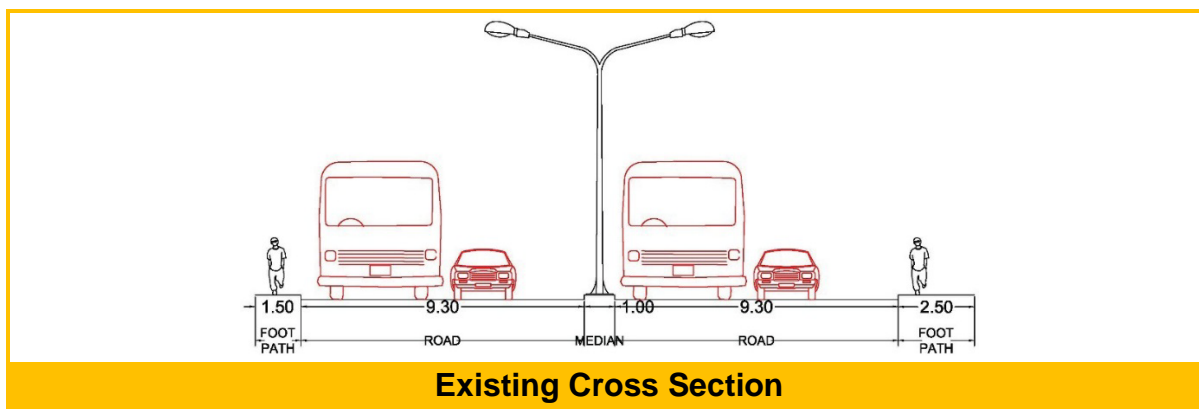


Figure 4.25: Existing and proposed cross section of stretch from Siripuram Jn. to Beach Road (via AU Gate)

RIGHT OF WAY: 22M

SIRIPURAM JN. TO BEACH ROAD (VIA OLD CBI)

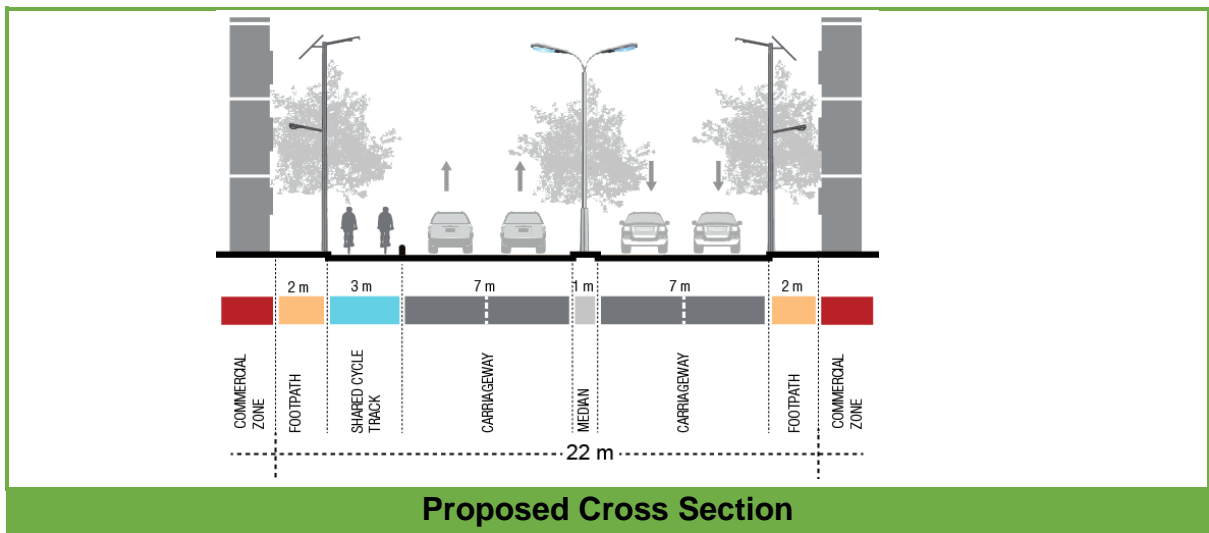
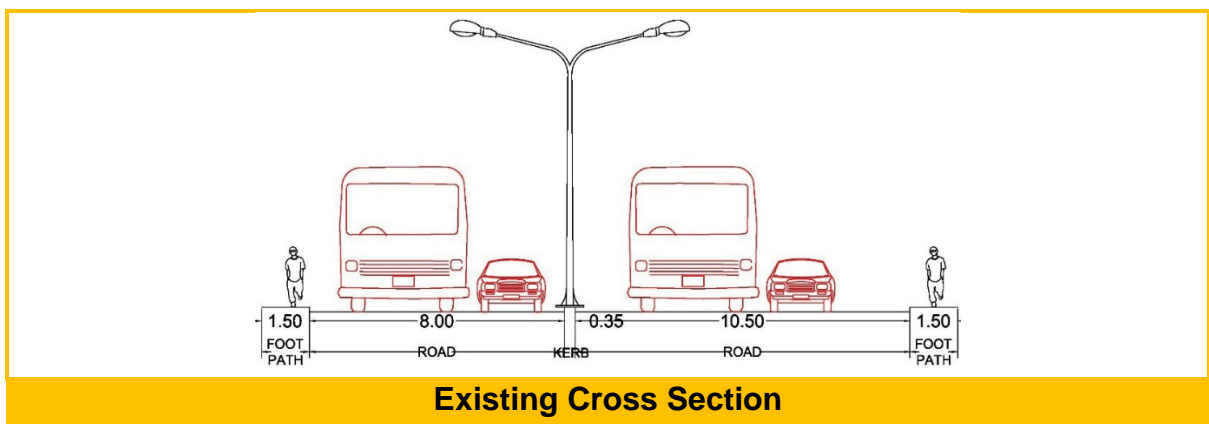


Figure 4.26: Existing and proposed cross section of stretch from Siripuram Jn. to Beach Road (via Old CBI)

RIGHT OF WAY: 17.5M

SEVEN HILLS JN. TO VIZAG CENTRAL (VIA JAGADAMBA)

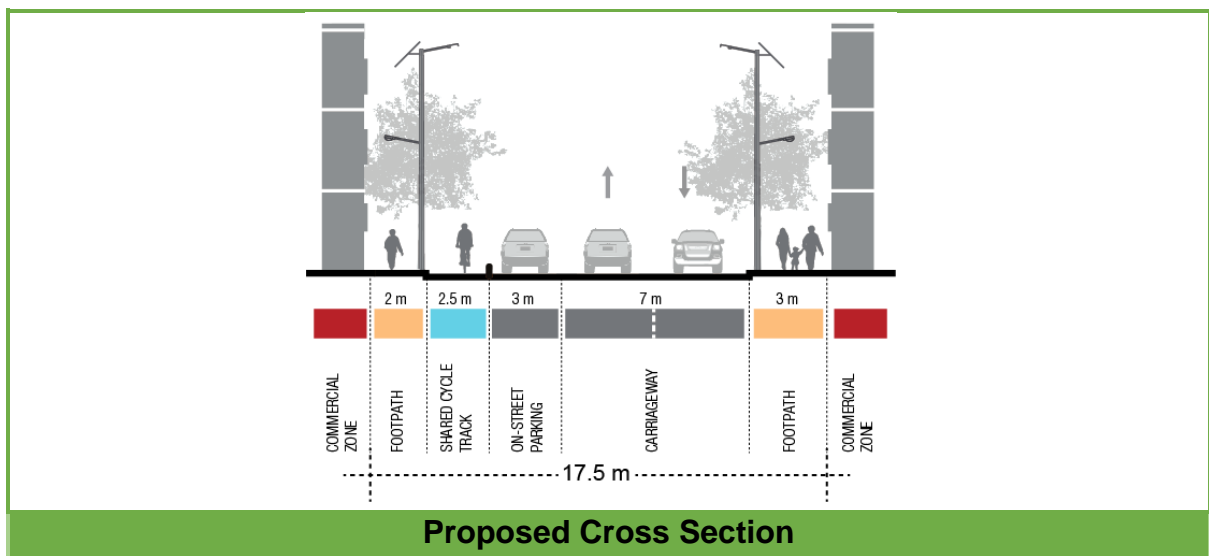
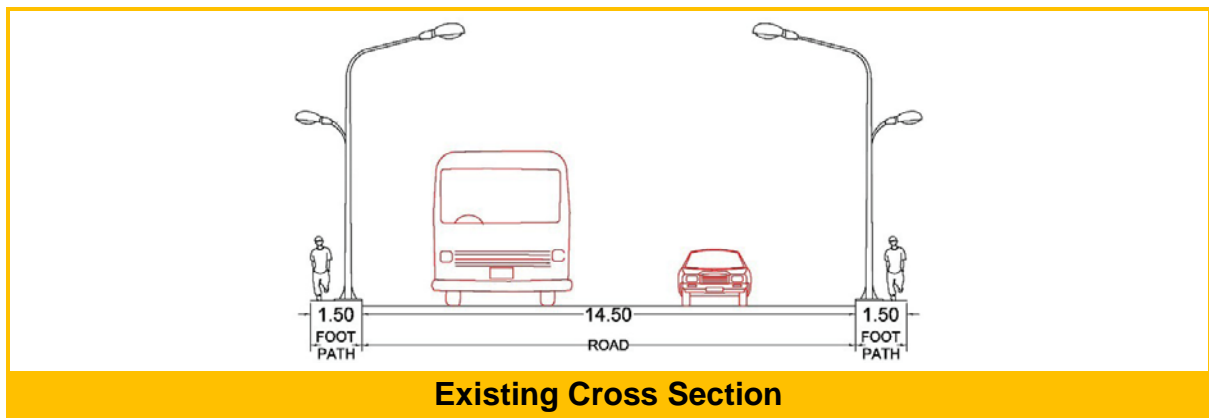


Figure 4.27: Existing and proposed cross section of stretch from Seven Hills Jn. to Vijag Central (via Jagadamba)

4.5.1. Additional Design Considerations

The following section presents additional design considerations for GVMC to use as a reference during detailed engineering phases. Key design elements to ensure NMT-friendly streets may include the following at a minimum:

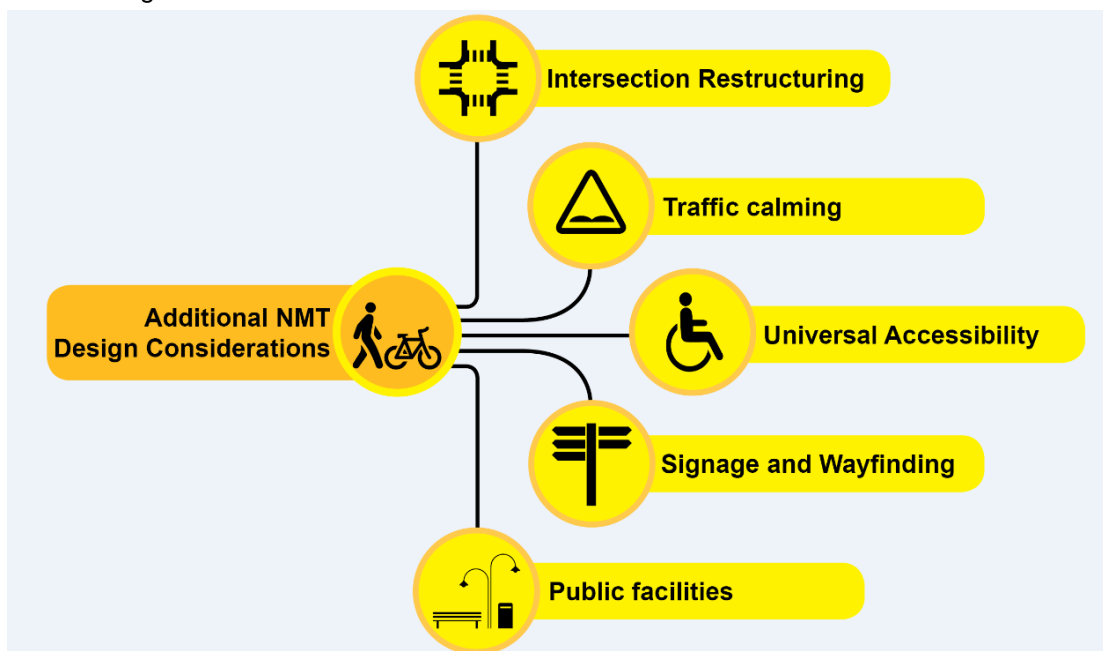


Figure 4.28: Additional components to consider for NMT designs

Source: IBI Group



Figure 4.29: Unsafe pedestrian crossings (Siripuram Jn. Road)

Source: iTrans



Figure 4.30: Haphazard and ill maintained footpath areas (Seven hill Jn. Road)

Source: iTrans



Figure 4.31: Unorganised intersections plague the current conditions of NMT design in Vizag.

Source: iTrans

4.5.2. Intersection Restructuring

Redesigning intersections typically involves employing one or more of the following approaches in combination to reduce pedestrian, cyclist and vehicular conflicts. These include:

01. Speed restrictions: needs to be determined based on available land, sight distance available and presence of the traffic and pedestrian volumes.

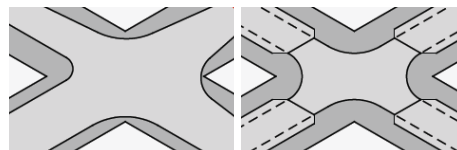


Figure 4.32: Consistent travel lane widths with bulb outs at intersection are safer for NMV users

Source: IBI Group

02. Signalization: At signalised intersections, expected delays for cyclists are considerably longer than other junction solutions. Therefore, in case of a signalised intersection, a flexible approach using single or combination of crossing methods should be adopted. Key considerations from a need to prioritise cyclists are as follows:

Segregated cycle tracks at or near intersections ensures safety and directness for cyclists. Cycle tracks extending up to the stop line on the near side of the junction ensure reduced delays, higher safety and protection from traffic path for bicyclists.



Figure 4.33: Segregated through cycle lanes at intersection

Source: IBI Group

Bicycle Boxes or Stacking Spaces are required for waiting cyclists on the near side of junctions. Bicycle holding area or boxes and signal phase design are interrelated to the flow of bicyclists and motorised vehicles that needs to be evaluated together. NMVs accessing bicycle boxes or stacking space should be provided with a clear, defined and barrier free path. At locations, where the bicycle track does not open directly onto the cycle box, a surface coloured and pavement marked bicycle lane (with cycle symbols) should be provided as a direct connection between the two.



Figure 4.34: Paint marking of bicycle box at intersection, Vancouver BC

Source: nacto.org

Signal timing and planning for cyclists is also as important as physical improvements. Designers should ensure inclusion of specific NMV considerations in the signal design as it relates to timing; however, a separate signal phase is not required.

03. Roundabouts: Safety of cyclists and pedestrians at roundabout is mainly ensured by its geometric design that helps in regulating the vehicular speeds, adequate segregation and visibility for the slow moving users. However, it is important to understand that roundabouts have capacity limitations and need to be upgraded with traffic signalisation as required. The general design principles related to intersection design are followed from the Urban Code of Practice -2 (IUT, 2012) and typical designs applicable for Visakhapatnam are given in the 0.

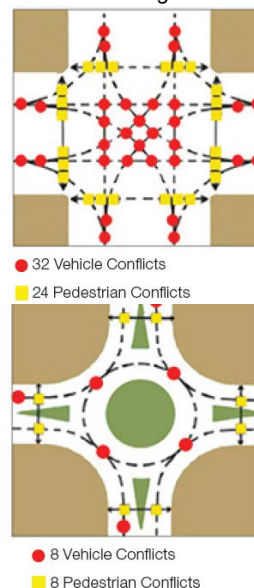


Figure 4.35: Reduced number of vehicle and pedestrian conflicts by design of roundabout,

Source: www.rgc-roundabout.com

4.5.3. Traffic Calming

Traffic calming measures are one of the most important design measures to enhance safety of NMT by reducing vehicular speed. The purpose of traffic calming is to modify driver behaviour, control vehicle speeds and (in some circumstances) reduce the volume of traffic. This reduces danger from traffic and can enable users, including children, to reclaim the streets as social places where walking and cycling can be safer. Some of the traffic calming techniques include: road humps, speed tables, chicanes, edge islands and rumble strips.

Road humps: are one of the most effective traffic calming devices and can be used on virtually all roads with posted speed limits of up to 50 km/hr. Speed humps most successful for Indian streets are trapezoidal and table tops. However they require much more supervision during construction. Trapezoidal humps have a flat top and are generally a minimum of 2.5m wide.

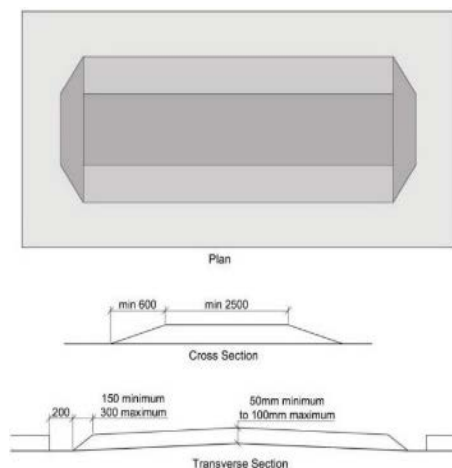


Figure 4.36: Trapezoidal hump/ table top crossing

Source: *Urban Road Codes, 2013, Volume 5*

4.5.4. Universal Access and Inclusion

The concept of universal access refers to the design of places and objects in a way that they are aesthetic and usable to people of all ages, abilities and socio-economic status. The purpose of universal design for NMT movement is to simplify navigation and reduce physical effort to an extent that a physically handicapped person should be able to navigate the pedestrian facilities without external assistance. The concept of universal design, however, goes beyond the conventional understanding of similar concepts such as barrier-free design and accessibility, as it seeks to blend aesthetics as a core design consideration. The key provisions included in universal design are:

Design features:

- A:** Ramps on to sidewalks for easy movement of wheelchairs
- B:** Bridges and tunnels with ramps at appropriate slopes or elevators
- C:** Textured sidewalks to direct visually impaired
- D:** Audible signals in at-level crossings.

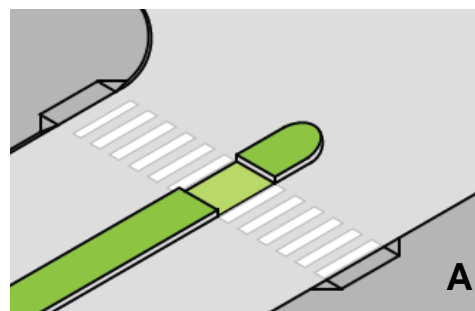


Figure 4.37: Design features of universal accessibility

Source: *IBI Group*

4.5.5. Wayfinding and Signage

All NMT users need to be informed about their location and help in finding their route to their destination. The information can be provided to users in form of signage, route maps, mobile phone applications, Intelligent Transport Solutions (ITS) etc. The signage classification as per Non-motorised Transport Planning and Design Guideline, 2014 is as follows:

Table 4.7: Proposed NMT signage for Vizag

REGULATORY					
Prohibited Parking in Non-Motorised Lanes: Used to prohibit parking on the segregated cycle lane.	Cycle Prohibited Note - to prohibit cyclists from using elevated roads like flyovers and they should remain at grade for movement.	Compulsory cycle track/ cycles only	Compulsory Route For Cyclists & Pedestrians	Segregated Cycle & Pedestrian Route	Compulsory Route for Cycles & Buses
WARNING					
Cycle Crossing	Cycle Route Ahead	Prohibited Parking in Non-Motorised Lanes: Used to prohibit parking on the segregated cycle lane.		Common Lane for Cyclists and MV: To warn motorists of the cycle users, wherever the cycle track is painted and not segregated	
INFORMATORY					
NMV Parking: Located at cycle parking areas.	NMV Track: Indicating segregated cycle track	Common Cycle Track and Footpath: Used at locations where pedestrians and cyclists share the road	Differently-abled Environment: Indicated at locations which have wheelchair access and are accessible by the differently-abled.	Ramps: Used to indicate locations of ramps at the subways and/ or foot-over bridges, which are accessible by the differently-abled.	

Source: Planning and Design Guideline for Cycle Infrastructure by TRIPP & Shakti Foundation

Signage for Wayfinding of Pedestrians and Cyclists are essential for creating a people friendly city. Signage provides help to pedestrians to navigate the city with ease and safety, and have the following functions:

- Orientation – Way finding (Street Signs)
- Availability of Public Transit nearby (Transit Signs)
- Guiding Street Flow (Traffic Signs)
- Announcing about City' specific features or attractions (Information Signs)
- Signs should reinforce the overall character of the specific district and be consistent throughout the City.
- Posts and pole should be arranged to minimize the number and avoid clutter.

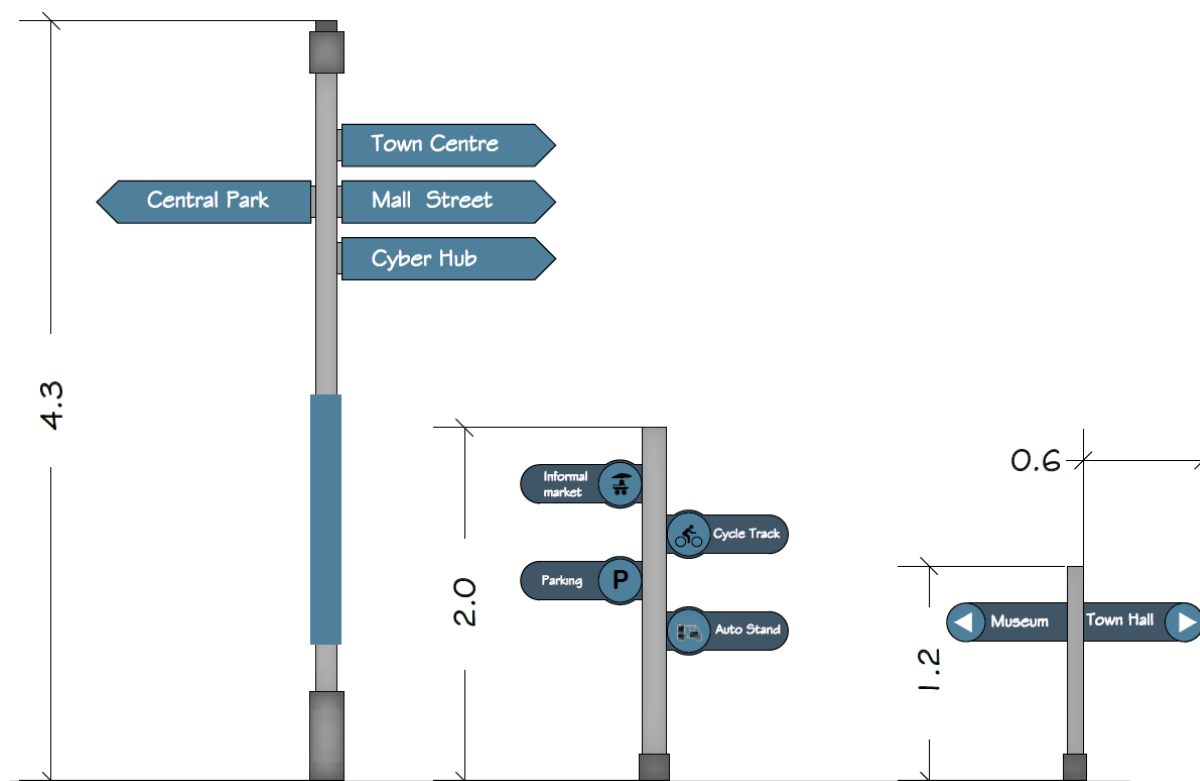


Figure 4.38: Sample wayfinding signage for pedestrians and cyclists

Source: IBI Group

4.5.6. Public Facilities

Public facilities on streets are conveniences, amenities or benefits offered to the public for their use and/or enjoyment. Lack of appropriate public amenities or its poor location occupies space rather than serving a useful purpose. Maintenance of public amenities such as broken benches, haphazard vending zones or lack of public toilets are the other aspects that needs to be addressed. Apart from an apt design, amenities should be accompanied by a maintenance plan involving local partners. As the design of attractive and comfortable NMT realm increases the preference towards its usage, some of the components to achieve these are discussed in the following section.

1. Public Toilets

Provide public toilets at a distance of every 500 – 800 m (5-8 minute walk) from each other or for every alternate bus stop and from any other destination. They should be provided as a combination of general toilets and accessible toilets to cater to the needs of senior citizens, families with young children and the disabled.



Figure 4.39: Public toilets in Delhi

Source: IBI Group

2. Street furniture

Furniture should be located in shaded areas, where they are likely to be used such as commercial hubs, market areas, crossroads, bus stops, railway stations, and public buildings. Placement of furniture must not obstruct the through movement of NMV users. Ideal locations for furniture include, bulbouts in parking lanes, street vending islands in shared streets, and within the landscape strip.



Figure 4.40: Design of street furniture

Source: IBI Group

3. Vending areas

Integrating vending spaces along pedestrian paths needs to be done in such a way that it does not reduce the effective widths of the pedestrian paths. GVMC is in the process of rationalizing the vending spaces in the city. This needs to be integrated with the design of footpaths and cycle tracks.



Figure 4.41: Organized street vending zone

Source: IBI Group

4. Bicycle Stands / PBS stations

Some of the strategies that can integrate walking and cycling with public transport are by providing secure and safe parking at the transit stations. Promoting and providing Bicycle hubs, cafes, repair stations, shower & changing rooms as part of public bicycle sharing schemes / rental schemes influence the choice of travel towards supporting NMT usage.



Figure 4.42: Bicycle sharing stand, Bangalore

Source: www.cyclesharing.in

CHAPTER V: INVEST

5. INVEST

5.1. Prioritizing NMT in City Budget Allocations

The annual budget and accounts data of GVMC for the past five years were reviewed to analyse the investment trends for various modes. Since 2008, all municipalities in Andhra Pradesh, including GVMC, has been following the Centre for Good Governance (CGG) manual for accounting. This segregates the money spent on transport infrastructure further into subheads like road maintenance, footpaths, road building, footpaths, bus stops and street furniture. However, the share of expenditure varies significantly for different sub-heads. Table 5.1 presents the highlights of the budget under various sub-heads.

Table 5.1: Item-wise transport infrastructure investments

Infrastructure	Year wise expenditure (in Rs. Crores)		
	2008-2009	2009-2010	2010-2011
Road Building	49.10	22.21	23.13
Road Maintenance works	4.77	6.02	11.10
Street Furniture	9.22	7.25	9.04
Footpaths	0.41	0.28	0.42
Bus Stops	0.01	0.01	0.01
Total Expenditure	63.51	35.77	43.70

Source: LCMP, 2014

It is observed while significant investments were dedicated to transport infrastructure between 2008 and 2011, the amount of money spent on various areas is a matter of concern. The maximum amount of money is spent on road building activities but the amount spent on footpaths is only a fraction of the total budget and no money is spent on bus stop infrastructure. Even the road inventory surveys reveal that the existing infrastructure assists only private modes of transport like cars and 2-wheelers, which caters to only 17% of the total trips in the city. This indicates an urgent need to realign the spending patterns in the city towards the actual mode-wise users.

According to the LCMP 2014 if nothing is done in the near future, the following are the key observations for the Business as usual (BAU) scenario analysis for 2030:

- **Household incomes** in Vizag will increase, thereby increasing vehicle ownership and change in trip making patterns. Master Plan proposed concentration of commercial development in the core city will increase trip lengths and hence induce mode shifts.
- **Mode share of walk** will reduce from 52% currently to 36% and cars and two-wheelers would increase from 17% to 33%. Number of bus trips would reduce by half and auto-rickshaw trips would double.
- The above mode-shifts will cause the addition of 15 lakh vehicles on to the road, which results in severe congestion on many corridors. Even the RoWs envisaged by the Master Plan would not be able to cater to this demand.
- The per-capita CO₂ emissions would increase by 40% which is against the targets stipulated in the national climate change policies.
- The traffic fatalities will increase up to 1,100 per year and will be one of the highest in the country.

The BAU scenario is not even an option for the city and various sustainable and low-carbon measures need to be put in place to avoid this scenario. Redistribution of funds equitably for public transit, NMT infrastructure, and roadways is a first step in constructing urgently needed NMT infrastructure to avoid the negative consequences predicted by the BAU scenario.

According to GVMC's report on 'Implementation of Cycle Lanes, Footpaths and Public Bicycle Schemes in Visakhapatnam City', provision and retrofitting various NMT infrastructure facilities would require around Rs. 5.5 crores for 11.6 Km of length (refer Table 5.2). Additionally, about Rs. 10 crores is also proposed for implementing the PBS scheme which makes the total investment around Rs. 15.5 crores.

Table 5.2: Link wise cost estimate in NMT and PBS project

S No.	Road name	Length in km	Estimated cost
1	Old Central Jail	1.2	1,03,85,424
2	Dwarakanagar to Gurudwara Jn.	1.3	64,98,198
3	Rednam Circle to Siripuram Circle (Dutt Island)	1.5	86,59,665
4	Siripuram Circle to GVMC	1.0	61,70,535
5	Siripuram Circle to Beach Road (via old CBI and Lawsons Bay Colony)	2.5	66,73,275
6	Siripuram Circle to Beach Road (via. Au out gate)	2.0	1,00,13,220
7	Tycoon Jn. to Mosque (VIP Road)	0.6	20,67,156
8	Seven Hills Jn. to Vizag Central Circle (via Jagadamba Jn.)	1.5	40,03,965
Total cost		11.6	5,44,71,438

Source: GVMC, 2012*

Table 5.3: Cost estimates as per the NMT PBS project report by GVMC

Project /Component	Cost (Rs in Crores)	% of Cost
NMT	5.44	53%
Public Bicycle Scheme	4.55	44%
Consultant Fees	0.25	2%
Total	10.24	100%

Source: GVMC, 2012²

As per the LCMP, 2014 estimates, nearly 30 km of proposed walking and cycling network are required at a total cost of Rs. 420 crores (Table 5.4).

Table 5.4: Cost estimate as per LCMP project

S. No.	Name of Project	Unit	Unit Cost (Rs. Crores)	Project Cost (Rs. Crores)
1	BRTS corridor with NMT infrastructure	68 km	15	1,020
2	NMT infrastructure routes	30 km	4	120
3	Public Bicycle Sharing	5000 bicycles	0.06	300
Total Cost				1,440

Source: LCMP, 2014

However, the city would require a much wider network to ensure that the mode share for NMT is maintained at its current levels. In consultation with the city officials, it was decided that for the initial year a dedicated 5% of the annual budget spent on transport needs will be allocated to Non-motorised Transport (NMT) which would gradually be increased over the years. The fund should be dedicated to include projects on pedestrian walkways, crossing facilities, cycle tracks, cycle parking, bus stops and other street infrastructure like street lighting, landscaping etc.

² GVMC, 2012: Greater Vizag Municipal Corporation, march (2012), Implementation of Cycle lanes, Foot paths and Public Bicycle Schemes in Visakhapatnam City

5.2. Alternative Financing Options

Within government and private investment processes, there is a need to create unconventional financing sources to finance NMT projects. Some examples of these sources include:

- **State transport duties revenue reallocation** – Andhra Pradesh Government should earmark a fixed portion of revenue collected from imposing various transport charges such as MV licencing, octroi, and other similar charges for NMT infrastructure provision in municipalities.
- GVMC can allocate **municipal budget** for Non-motorised infrastructure implementation and phase the network according to the funds available.
- **Advertisement revenue** – government should formulate a committee for integration of advertisement revenue, from different sources like bus shelters, buses, road space etc., for funding parts of NMT infrastructure like guarded bicycle parking system, PBS system etc.
- **NMT fund** – state government should establish the NMT fund to promote the implementation of NMT projects and assist municipalities in funding NMT related road infrastructure improvement.
- **Financial aid from international development agencies** - several international development agencies such as **KfW Development Bank, World Bank, Asian Development Bank** are showing keen interest in providing assistance for mobility issues in India. KfW in particular has expressed interest in offering a soft-loan for public transit and NMT upgradation in Vizag.
- **Smart City funds**-As part of Vizag's Smart City proposal, a significant portion of the financial committed is identified to be dedicated to implement urban mobility solutions.
- **Visakhapatnam Transportation Fund** can be proposed for Vizag which could become the financing tool to fund various non-motorised projects.

In the case of Visakhapatnam, it is proposed to bundle the following NMT projects with the Metro project:

- Developing 30km feeder route network with provisions for walk, cycle, auto-rickshaws, buses and other street amenities and,
- Implementing a Public Bicycle Sharing Scheme (PBS) with 5,000 cycles across the city
- Heritage and tourist area plans- walking and cycling infrastructure has a symbiotic relationship with heritage and tourist areas as a lot of domestic and foreign visitors walk and cycle in these areas. Also there is focus on public spaces and green areas which makes it perfect for walking and cycling.
- Other initiatives like decongesting cities, making green cities, making smart cities etc., easily incorporate NMT projects in their agenda.



Figure 5.1: Proposed metro rail corridors in Vizag
 Source: GVMC

Green Financing options can be created from the city by taxing use of private vehicles under the “polluter pays” principle. These can be in the form of:

- **Private vehicle taxation** – government should levy tax on private motorised vehicles on annual basis for usage of the road like it is practiced in case of buses.
- **State transport duties revenue reallocation** – state government should earmark a fixed portion (for NMT infrastructure provision) of revenue collected from imposing various transport duties like MV licencing, octroi etc. (this is also mentioned in section 6.3)
- **Parking fee increase** – free parking in any part of city should be abolished and wherever parking’s are provided parking charges should represent the actual market value of the land, eg. Rs. 400 per hour in commercial areas in Delhi.
- **Maximum parking norms** – GVMC should abolish the current minimum parking norms in building bye laws or development control roles and it should implement the maximum parking norms. In addition, there should be high amount penalties for violation.

Additionally, **climate financing** options available internationally can be tapped to generate financing for NMT projects as they fit into the mitigation and adaptation proposals to reduce GHG emissions. These can be availed from a variety of funding institutions and under the Nationally Appropriate Mitigation Action (NAMA) plans that the country supports. These can be more easily availed if bundled with other green transport projects such as public transit.

CHAPTER VI: IMPLEMENT

6. IMPLEMENT

6.1. Organizational Framework Roles & Responsibilities

The implementation of NMT facilities will involve a variety of stakeholders. Planning and implementation works for transportation infrastructure improvements and construction in the city of Visakhapatnam is currently being undertaken by the Greater Visakhapatnam Municipal Corporation (GVMC). However, all authorities and agencies should be involved in the planning, designing and implementation process in order to achieve smooth and complete implementation.

The non-motorised transportation system includes an array of varied components from paved shared-use paths to soft surface trails, road shoulders, sidewalks and streets. Ideally, these should be integrated and operated as seamlessly as possible, offering citizens and visitors a first class system. Because there are multiple agencies with different but complementary missions, coordination and cost-effective management and function is essential. Table 6.1 covers the key stakeholders involved and their respective roles and responsibilities in providing adequate NMT infrastructure.

Table 6.1: Roles and responsibilities of various stakeholders

Stakeholder	Potential Roles
Politicians	<ul style="list-style-type: none"> Build commitment and motivate the society. Enact regulatory changes, if necessary. Ensure cooperation between various agencies.
Visakhapatnam Urban Transport Company Ltd. (SPV for BRT)	<ul style="list-style-type: none"> Ensure integration of the system with bicycle infrastructure like signage and signalling under PWD to support increased bicycle traffic volume. Provide space under PWD jurisdiction for walking and cycling infrastructure. Ensure implementation of all NMT facilities.
GVMC - Planning, Projects, Accounts, Finance Departments	<ul style="list-style-type: none"> Provide space under GVMC jurisdiction for walking and cycling infrastructure. Ensure integration of the system with public facilities. Provide Advertisement permission for various locations along the NMT routes in the jurisdiction.
VUDA	<ul style="list-style-type: none"> Provide space under VUDA for walking and cycling infrastructure.
APSRTC- Operations and Finance Departments	<ul style="list-style-type: none"> Ensure integration of bus system with bicycling and walking infrastructure. Provide space for parking facilities for PBS at the bus stops. Ensure integration of public bicycle infrastructure with bus infrastructure. Promote the use of public bicycles to current bus users.
Transport Department	<ul style="list-style-type: none"> Ensure integration of the system with walking and bicycle Infrastructure like signage and signalling to support increased pedestrians and bicycle traffic volume. Ensure check on growth of motorised vehicles. Ensure proper installation of advertisement according to the guidelines.
Auto-Rickshaw Drivers Union	<ul style="list-style-type: none"> Ensure integration of IPT with bicycling and walking facilities.
Traffic Police	<ul style="list-style-type: none"> Maintain a safe environment for walking and cycling. Enforce the traffic rules for safety. Protect the city from theft and vandalism of the public facilities and infrastructure.

Source: iTrans

6.2. Community Engagement and Outreach

Citizens as important stakeholders, when brought together, will help in streamlining initiatives or campaigns by continuous engagement throughout the planning process. Sustainable transport concepts initially are generally very counterintuitive to people's dominant behaviours and educate them about the basic facets is crucial to achieve success. Informing the community about the plan update and seeking their experiences in walking and cycling in Vizag can be accomplished in following ways:

- Posting information on the GVMC website, running display ads in the newspaper and public buildings, being interviewed on local radio shows and running public service announcements on the radio before public meetings.
- Hosting public meetings in different locations throughout the community to explain the project, answer questions and encourage people to draw routes they use, wish to use, and desire to be improved as they walk, bicycle or use other non-motorised transportation to get around their neighbourhoods and the community.
- Contacting and/ or meeting with agencies or stakeholder groups such as the RWAs, Bicycle Club, TCPO, GVMC etc.
- Developing a project questionnaire to solicit written, mapped and emailed comments and ideas on walking and bicycling destinations, missing links, safety concerns and other obstacles along the routes.



Figure 6.1: Community mapping exercise during stakeholder workshop

Source: *iTrans*

6.2.1. Changing Culture & Perception

There is a need to change the image of walking and cycling towards more lifestyle oriented modes rather than “poor man’s” mode. This can be done by various awareness programs and campaigns such as promoting walk to work, cycle rallies etc. The Raahagiri Initiative, now operational in various cities around the country such as Delhi, Gurgaon, Bhubaneswar and Hyderabad, is an interesting collaborative campaign of citizen groups and city agencies including the Municipal Corporation and Traffic Police to raise about the importance of reclaiming space for walking and cycling in the city. Vizag can also conduct various awareness program and campaigns on Non-motorised Transport such as cycle rallies and walk/ cycle to work etc.

Planning for cycle and pedestrian paths, bus lanes and stops, integrating with metro station access, on-street parking and para transit stands, and street vendors, all require to be integrated in the planning process to ensure that the NMT infrastructure functions as planned.

To ensure integration of NMT planning with land-use in new areas it is essential to include some of the design parameters in the building control guidelines of Vizag. Moreover, it is also critical include NMT facilities and requirements in the master plan as a specific chapter.



Figure 6.2: Supervision at the site
Source: iTrans



Figure 6.3: Managing and including all utilities while construction
Source: iTrans

6.3. Project Management and Supervision

Planners/ designers should produce a set of key guidelines as instructions for the agency/ team implementing and executing the design. Transfer of a well-conceived NMT infrastructure plan on site, demands good communication between design agency, project managers and the contractors in order to explain instruction on use and interpretation of drawings. All drawings should be well referenced with the detail drawings including signage and marking designs. They can also be made to suit the various contractors employed like civil, electrical, drainage, etc.

- **Preparation of Construction/ Working Drawings:** All alignments and design details should be done based on the total station system and not moved, since each point on the drawings on refers to a location on site as per the co-ordinate system of the drawing.
- **Project Manager and Quality Surveyor:** Apart from assisting the employer in quality control and billing, the role of project manager (PM) is to ensure that there are no discrepancies during the process of transfer of drawings to site. PM ensures two way communications between designer and the contractor.
- **Site Layout and Inspection:** Accurate site layout of digital working drawings of an NMV facility is critical to accurately replicate design features essential for ensuring usability and safety.
- **Site Inspection Procedures:** At all stages of construction, there should be no compromise on safety of the road users as well as the workers on site. There should be periodic inspections to maintain the quality of the project execution.



Figure 6.4: No Vehicle Zone enforced by barricading in Vizag
Source: iTrans

6.4. Enforcement

Enforcement is needed against violations of motorised vehicles encroaching sidewalks and cycle tracks space including illegal parking, over speeding, traffic signal violations, and other similar violations. In Visakhapatnam, at the Beach Road, a 3.50km stretch has been declared as Vehicle Free Zone since 1st November, 2011 from 5:30 a.m. to 7:30 a.m. Only pedestrian and cyclists were allowed in this space. Traffic police officials have played a very important role in enforcing the car free zone along this stretch. Similar enforcing strategies need to be replicated in other areas of the city to promote and safeguard NMT facilities. Some of enforcement strategies that GVMC and Traffic Police could adopt, include:

- Stationing of trained policemen or marshals at each entry to cycle lane/ track (far or after side of the junction), to direct unauthorised motor vehicles outside the infrastructure.
- Policing and citations at junctions, towards the end of cycle paths.
- Improvement of the enforcement of speed limits and other safety related measures that have a direct effect on accident rates.
- Recording of violations for secondary fines and citations using video cameras should be conducted in addition to manual enforcement.

6.5. Monitoring and Evaluation

After the NMT infrastructure in the city is laid down, there is a need to monitor the facilities at regular intervals. Monitoring and evaluation would include conducting user satisfaction surveys, forming performance indicators and benchmarks, gathering user's information and identifying issues indicator wise by comparing with bench marks. Some indicators should be evaluated every month and some half yearly or annually.

Appointing an expert team (from the government system or third-party consultants) for the monitoring and evaluation (M&E) of overall NMT policy performance and to ensure its effective implementation can be useful for the project. The strategies to be followed by the M&E team should include the following, at a minimum:

- Focus on direct outcomes of the projects that have been carried out. In that case it is important to pay attention to the development of knowledge, arguments and instruments.
- Focus on the internalization of the results of the projects in policy and plans of the target groups.
- Assess the impacts achieved by the project as per pre-developed quantitative verifiable indicators.

A post -project audit format can be developed by the city to monitor that the project is beneficial in the short and long terms and the targeted beneficiaries. The key objectives that evaluation of a NMT route/ network is to assess and reason the following:

- If the network/ infrastructure has succeeded in sustaining existing and or attracting additional use along the route.
- If the type of infrastructure developed is appropriate to the environment, road or context in which it has been used.
- If the infrastructure developed manages to attract/ serve existing users already on the road network.
- If the infrastructure succeeded in improving safety of bicyclists along the route by design.

Appendices

Appendix A: Cross Section Designs

Various typical cross-sections based on the road functionalities as given in Non-motorised Planning and Design Guidelines, 2012.

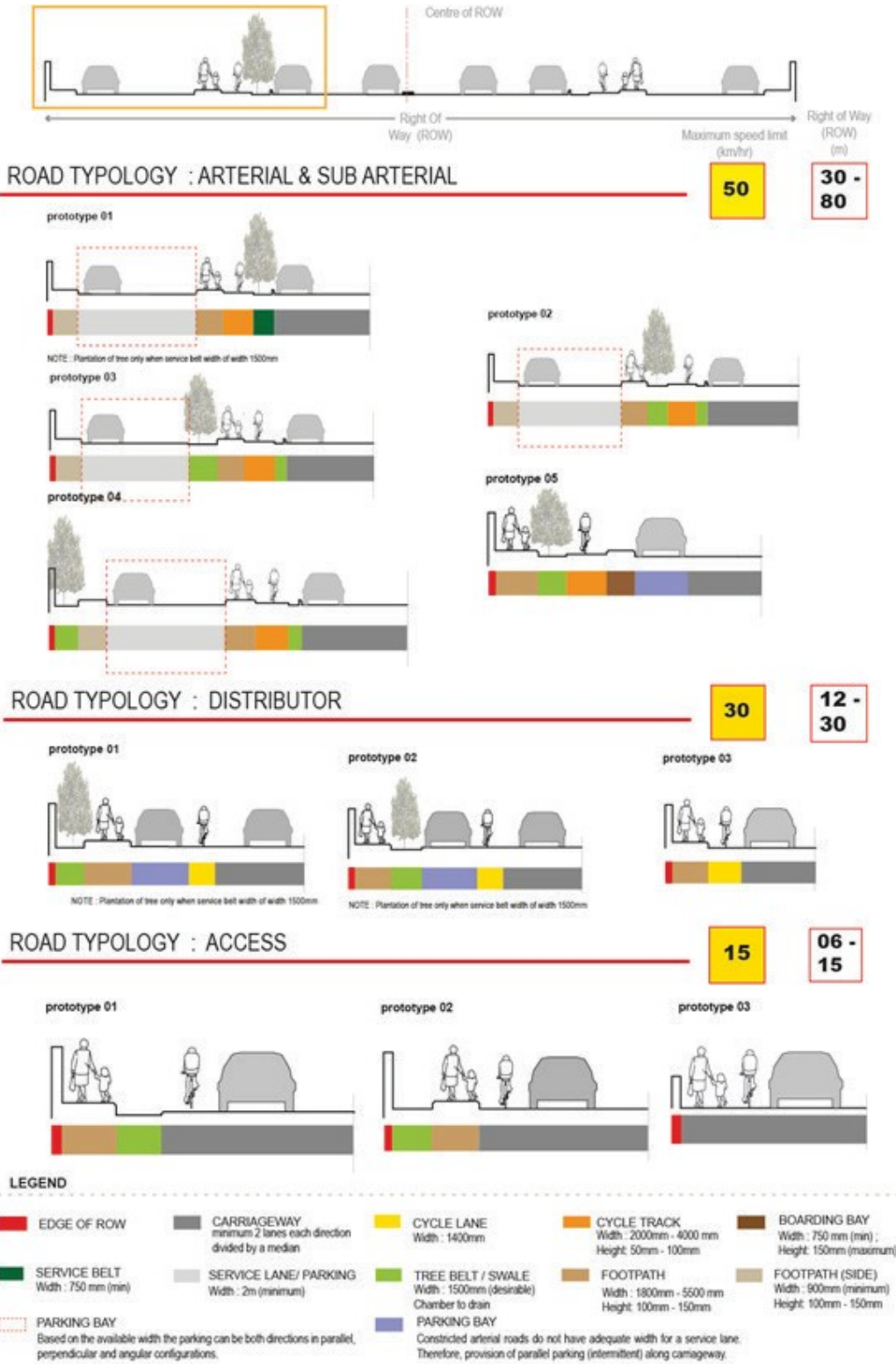


Figure 6.5: Cross section design – prototype for various roads as per the NMT planning and design guidelines
Source: Non-motorised Planning and Design Guidelines, 2012.

Various typical cross-sections based on the road functionalities as given in Urban Road Codes (part 1 cross sections), 2012

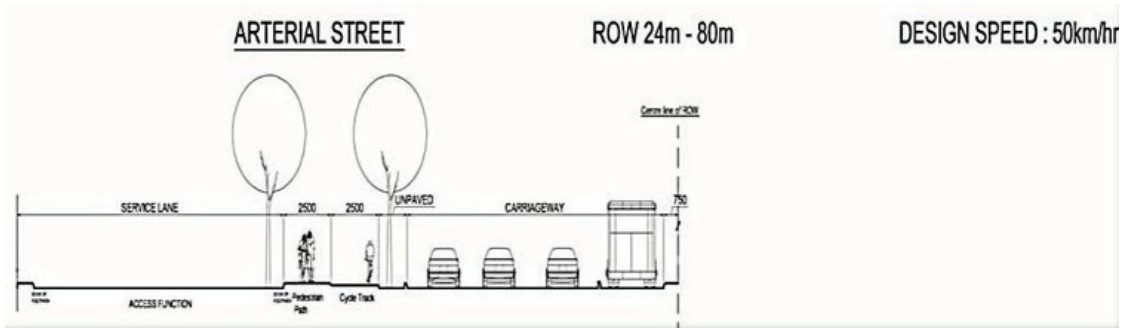


Figure 6.6: Cross Section Arterial Road

Source: Urban Road Codes (part 1 cross sections), 2012

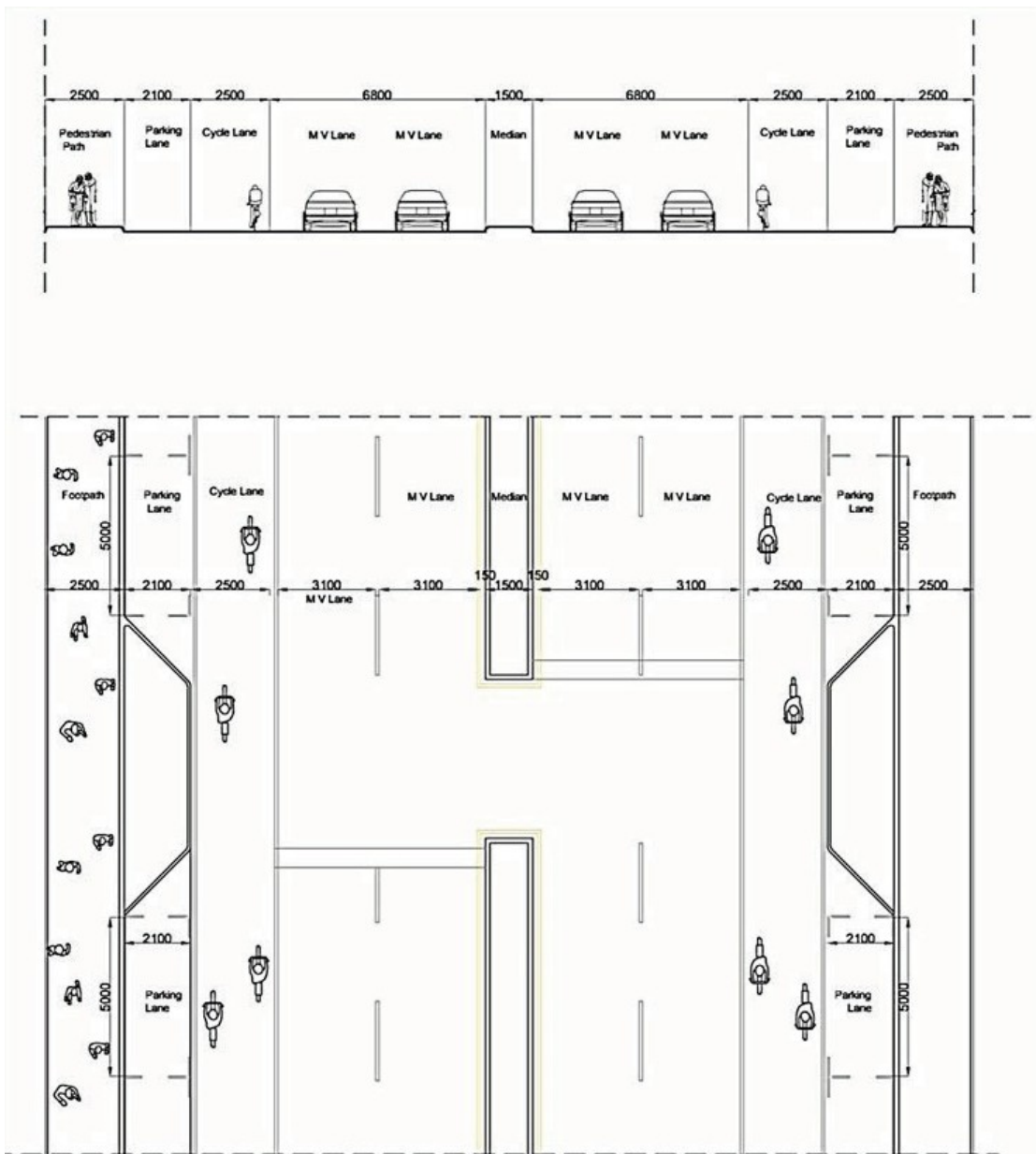


Figure 6.7: Plan and Section –Distributary Road with parking lane (design speed 30km/hr.)

Source: Urban Road Codes (part 1 cross sections), 2012

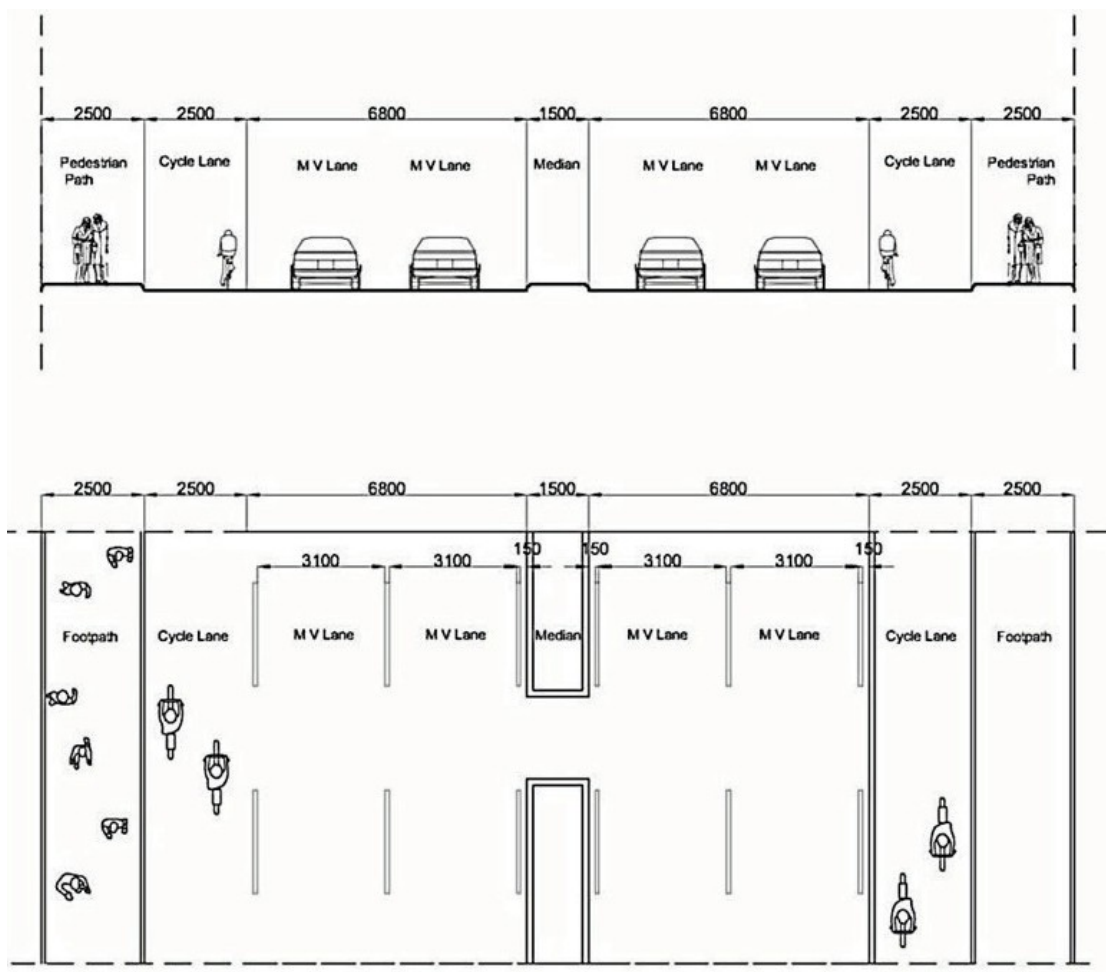


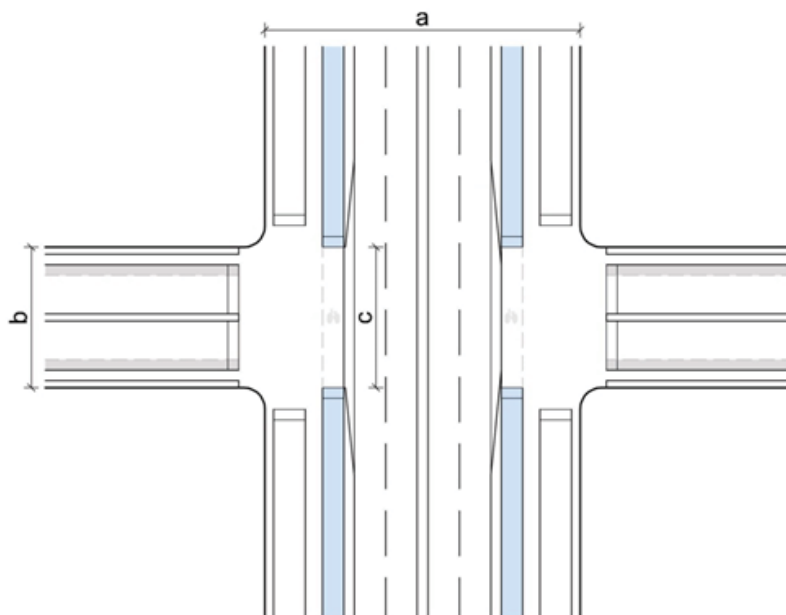
Figure 6.8: Cross section –access road plan and section - distributory road without parking areas (RoW 12 -30m, Design speed 30km/hr)

Source: Urban Road Codes (part 1 cross sections), 2012

Appendix B: Intersection Design

Various typical intersections based on the road functionalities as given in Urban Road Codes (part 2 intersection), 2012

Junction Type : Arterial to Distributory
(T- Junction on distributory roads)

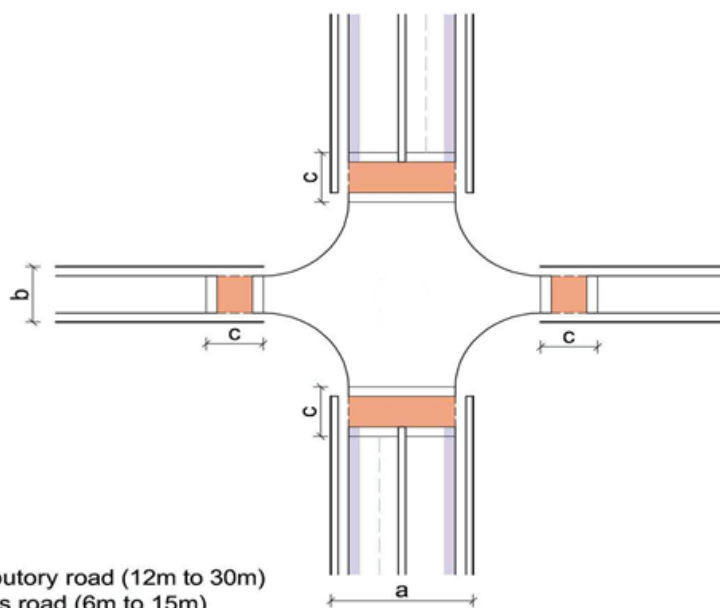


- a : arterial road (24m to 60m)
- b : distributory road (12m to 30m)
- c : raised crossing ramp (minimum 6m wide)

Figure 6.9: Arterial to access – raised crossing on access roads

Source: Urban Road Codes (part 1 cross sections), 2012

Junction Type : Distributory to Access
(Non - Signalised Junction)

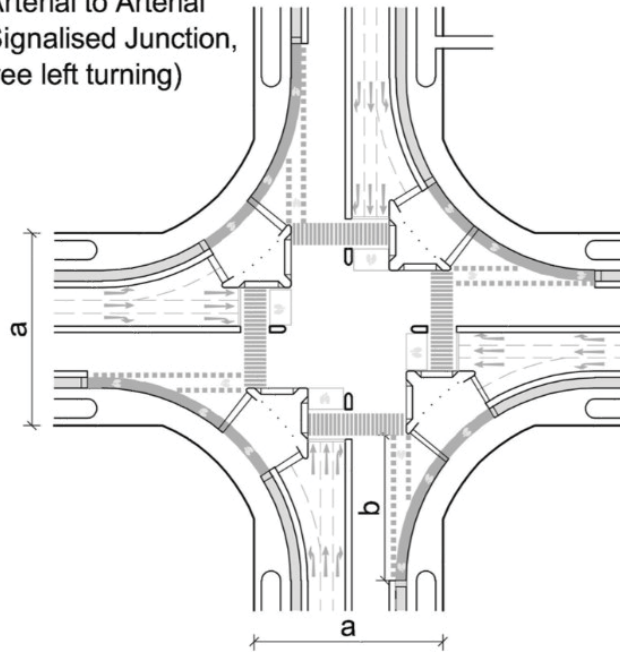


- a : distributory road (12m to 30m)
- b : access road (6m to 15m)
- c : raised crossing on every arm after turning

Figure 6.10: Non-signalised junction - distributor to access – raised crossings

Source: Urban Road Codes (part 1 cross sections), 2012

Junction Type : Arterial to Arterial
(Signalised Junction,
free left turning)



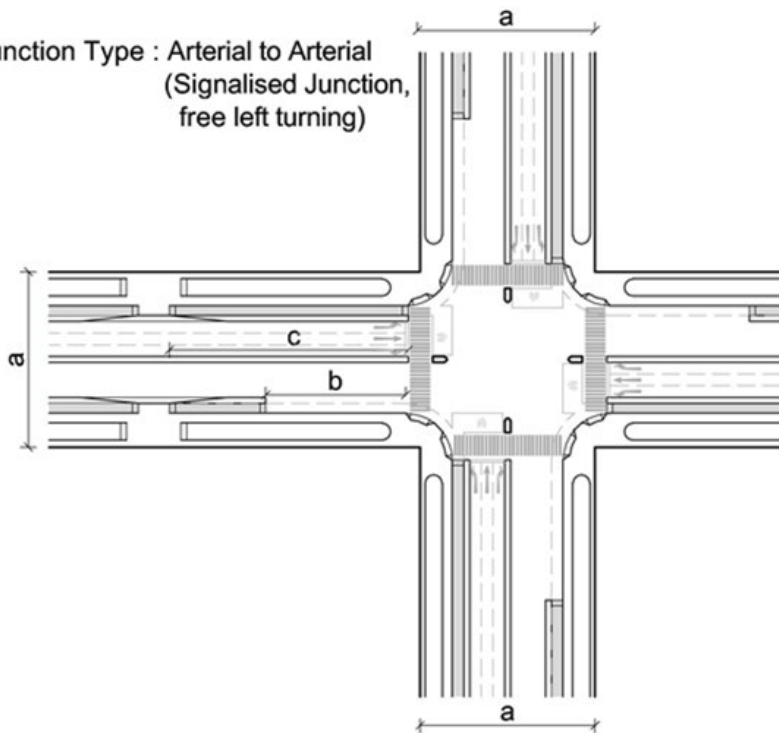
a : arterial road (24m to 60m)

b : length of cycle lane leading upto cycle track (minimum 30m)

Figure 6.11: Arterial to arterial –signalised intersection (with pedestrians and cyclist facility)

Source: Urban Road Codes (part 1 cross sections), 2012

Junction Type : Arterial to Arterial
(Signalised Junction,
free left turning)



a : arterial road (24m to 60m)

b : offset for cycle track start from junction (minimum 30m)

c : distance for entry/exit on side roads from junction (minimum 60m)

Figure 6.12: Signalised intersection - arterial to distributor – with slip lanes

Source: Urban Road Codes (part 1 cross sections), 2012

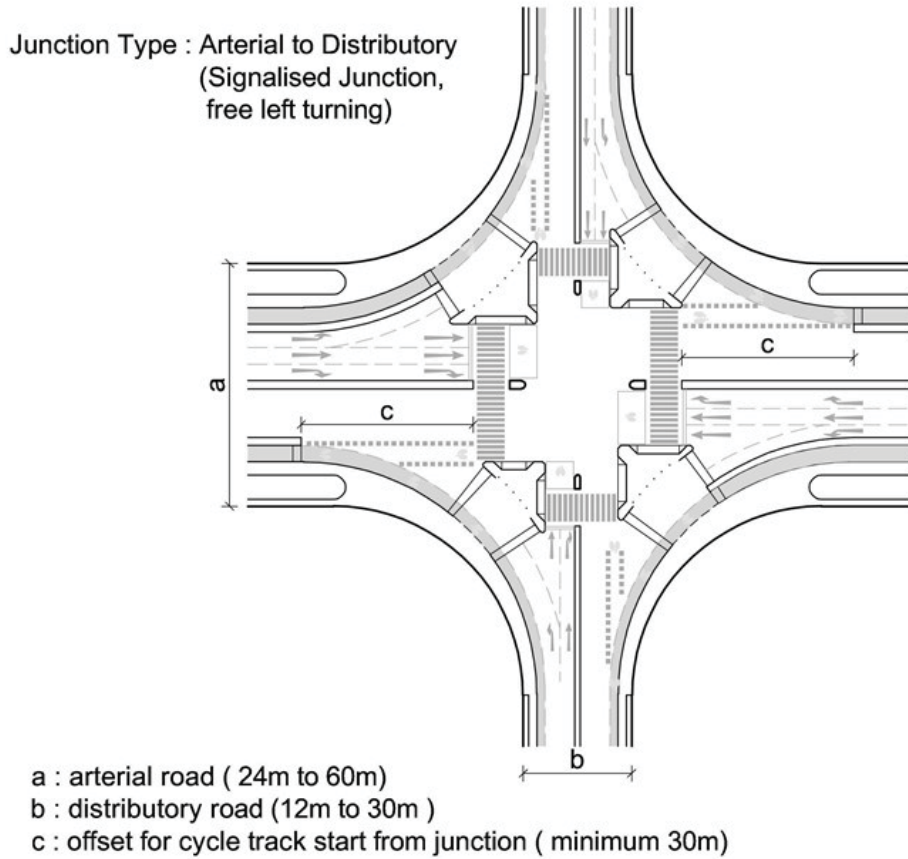


Figure 6.13: Signalised intersection - arterial to distributor (free left turning)

Source: *Urban Road Codes (part 1 cross sections), 2012*

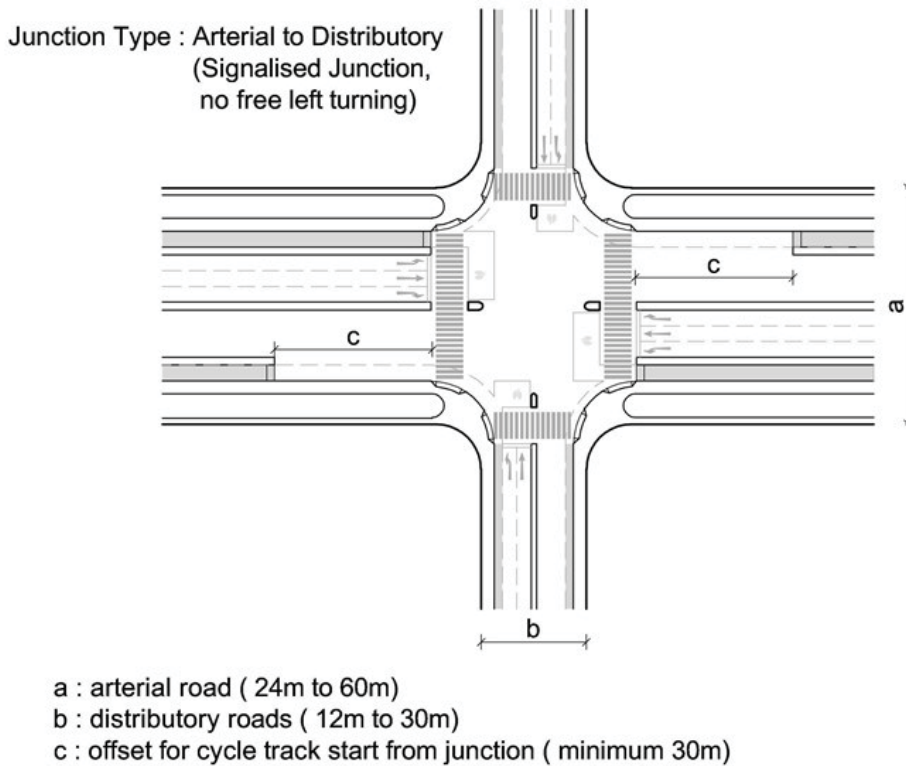


Figure 6.14: Signalised intersection - arterial to distributor (no free left turning)

Source: *Urban Road Codes (part 1 cross sections), 2012*

Junction Type : Distributory to Distributory
(Signalised Junction, no free left turning)

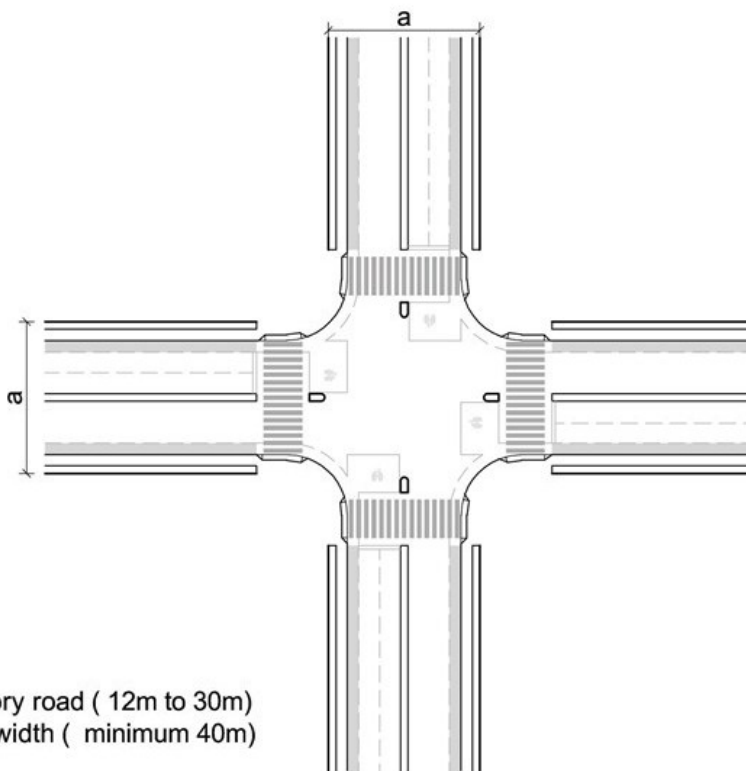


Figure 6.15: Signalised junction - distributor to distributor
Source: *Urban Road Codes (part 1 cross sections), 2012*

Appendix C: NMT Audit Form

NMT AUDIT FORM - ARTERIAL / SUB ARTERIAL STREETS

INSTRUCTIONS

- 1 In SEC A, tick mark or fill the form
- 2 In SEC B, for mid block fill points 1-25. For intersections fill points 1-30
- 3 For an arterial road and max speed limit 50 km/h, a segregated cycle track is compulsory on both sides

A	Audit Area	Existing Infrastructure <input type="checkbox"/>	Planned Infrastructure <input type="checkbox"/>																																
2	Road Type	Arterial/Sub Arterial <input type="checkbox"/>	Collector <input type="checkbox"/> Local <input type="checkbox"/>																																
3	Right Of Way (RoW)	<input type="text"/> m																																	
4	Length of Audit Area	<input type="text"/> m																																	
5	Posted Speed Limit	<input type="text"/> km/h																																	
6	Amenities (hawker spaces, etc.)																																		
	<input type="text"/>	Pedestrians provided some good amenities and feel safe																																	
	<input type="text"/>	Limited number of provisions for pedestrians and slightly uncomfortable at late nights																																	
	<input type="text"/>	No amenities and Unsafe																																	
7	SPEED MEASURES	Maximum Speed Observed for Motorised modes	<input type="text"/> km/h																																
8	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Volume Measures</th> <th style="width: 20%;">Cycle</th> <th style="width: 20%;">Hand Drawn Rickshaws</th> <th style="width: 30%;">Pedestrian</th> </tr> </thead> <tbody> <tr> <td>0-10min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>10-20min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>20-30 min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>30 - 40 min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>40 - 50 min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>50 - 60 min</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Average Volume</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Volume Measures	Cycle	Hand Drawn Rickshaws	Pedestrian	0-10min				10-20min				20-30 min				30 - 40 min				40 - 50 min				50 - 60 min				Average Volume			
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B	Arterial / Sub Arterial	Present / Yes (1 pt)	Good	Fair	Poor	(AxB)
		Absent / No (0 pt)	(1 pt)	(0.5 pt)	(0.2 pt)	
1	Width of cycle track		>=2.5m - 5.0m	<2.5m - >=2.2m	< 1.8m	
2	Height of cycle track		+50mm - +100mm	0-50mm / '100-150mm	150 above or <0mm	
3	Location of cycle track		along the carriageway	Footpath separates cycle track from carriageway	Between property wall and service lane / combined with footpath/ any other location	
4	Distance from carriageway		>=0.75m upto <=1.2m	>0.3m upto <=0.75m / >1.2m - =3.0m	<=0.3m or >3.0m	
5	Type of segregation/ buffer zone		green belt / utility belt	green belt only	kerb only / any vertical surface higher than 180mm / railing	
6	Pavement surface		concrete/asphalt	interlocking tiles / smooth tiles / stone	unpaved / non-metal surface	
7	Turning radius		Mostly Smooth (30m or more)	Partly Smooth (10m-30m)	Rough (0-10m)	
8	Barrier free (LHS/RHS)		No obstructions	Some obstructions	Mostly obstructed	
9	Slopes		Comfortable (Does not require extra effort to cycle)	Moderate (Require more extra effort to cycle)	Steep (Cannot be cycled)	
10	Lighting levels		Good lightning (tracks with avg. lighting level of 40lux)	Partial (tracks with avg. lighting level of 40 to 22lux)	Poor (tracks with avg. lighting level of <22lux)	
11	Traffic Calming at Minor Junctions (Speed breakers, raised crossing, rumble strips, etc.)		Present at all T-junctions	Present at most T- Junctions	Absent at most T- Junctions	
12	Cycle specific Marking		Frequent and Visible	Sometimes	Rarely or hardly visible	
13	Cycle specific Signage		Frequent and Visible	Sometimes	Rarely or hardly visible	
14	Shade		Complete	Mostly shaded	Lack of shade	
15	Land use along the footpath		Commercial (Retail) on both sides / Commercial (Retail) on one side and Residential or Commercial (Office) on the other side	Commercial (Retail) on one side and Vacant or Institutional land on the other / Both directions having Residential or Commercial (Offices)	Both sides vacant plot / Residential or Commercial Office on one side and Vacant/institutional land on other	
16	Parking facility for cycles		Within 250m of the station / bicycle are allowed in the	Provided between 250 - 500 m of the station	Informal parking available within 500 m	

			transit		of the station	
17	Parking cost for cyclists		Free	Less than MV parking fee	Same as motor vehicle parking fees	
18	Effective width of footpath		with No obstructions	with some obstructions	mostly obstructed	
19	Height of footpath		75mm above cycle track	50mm above cycle track	>75mm above cycle track	
20	Provision of footpath along segment		Along full length of the segment	More than 80% of the length of the segment	Less than 80% of the length of the segment	
21	Provision of service lane along segment		Along full length of the segment and not opening onto the intersection	More than 80% of the length of the segment	Less than 80% of the length of the segment	
22	Provision of on street parking along segment		None	Less than 80% of the length of the segment	More than 80% of the length of the segment	
23	Availability of at grade crossings		Avg. spacing between controlled crossings is < 500m	Avg. spacing between controlled crossings is between 500 m – 700 m	Avg. distance of controlled crossings is >700 m	
24	Type of additional crossings		Level/ at grade crossing	Foot over bridges with elevators or half subways which are well lit.	Foot over bridges without elevators or completely covered subways without proper lighting	
25	Time taken to cross road		Staged with refuge island	Staged without refuge island	High Waiting Time	
INTERSECTION						
26	Tapering of cycle track at intersections (reducing width for cyclists to increase turning radius for MV's and it is not good for cyclist)		No reduction in width at any intersection	Reduction in width at some intersections	Cycle track merged with turning vehicles at most intersections	
27	Markings showing the continuity of cycle tracks at intersection		Frequent and Visible	Sometimes	Rarely or hardly visible	
28	Ramps to get off / on at intersections		Frequent and Visible	Sometimes	Rarely or hardly visible	
29	Provision of lighting at crossing		Lit and enhanced visibility for motorised vehicles / Safe	Uncomfortable for crossing/ poorly lit	Unsafe and poorly lit	
30	Cycle track termination upto stop line (any other should be considered absent)		cycle track terminates at stop line leading to cycle box marking			

Appendix D: TOR for Station Accessibility Consultants

Scope of work

The scope of work includes the following tasks that are further detailed out in later sections of this document.

- Task 1 Confirm Scope, Approach and Methodology
- Task 2 Collect Data, Undertake Documentation and Analyze Urban Form & Transport Environment
- Task 3 Prepare Proposals
- Task 4 Prepare Implementation Programme
- Task 5 Detailing of Phase I Proposals
- Task 6 Stakeholder Participation Workshops at key stages of plan making
- Task 7 Final Proposals after incorporating recommendations

Task 1: Confirm Scope and Methodology

The consultant is expected to arrive at an approach and methodology for the tasks outlined below.

Task 1.1: Delineate Study Area

The study area will not be less than 750m around each metro station. It will follow road or property lines. If major economic / social generators and environmental features are adjoining it and are likely to have an impact on metro station access, then these should be included within the study area boundary.

The study area will be broken into a core and buffer area. The core area is 150m around the metro station and will be most affected by movement of people, vehicles and activity. The buffer area is the larger feeder area to the metro station and is generally delineated based on a 10-15 minute walking distance i.e. 500-750m. The consultant will define the study area, core and buffer area boundaries based on the above guidelines. An accurate CAD base map of the study area will then be prepared with satellite images, city survey sheets and cross checked with site visits.

Task 1.2: Outline Approach and Detailed Methodology

The consultant will outline the approach and detailed methodology; a reconnaissance visit and photo-documentation of the study area; review of existing and proposed Master Plan documents; LCMP, 2014 and preliminary consultation and meetings with key stakeholders such as GVMC, VUDA, Traffic Police, APSRTC, Vizag Metro Corporation, Commercial businesses and street vendors. The approach will present the major issues, opportunities and concerns observed and outline broad strategies to guide the rest of the study.

Task 2: Collect Data, Undertake Documentation and Analyse Urban Form & Transport Environment

Task 2.1: Prepare Study Area Profile

Prepare a profile of the study area from available documents and compare with the city level statistics. The parameters include location in the city, history and evolution of the area, population and demographic data(education, gender, age groups) and socio-economic data (household size, percentage and type of employment, income etc).

Task 2.2: Collect Data, Undertake Documentation of the Study Area

The consultant is expected to document the land use, urban form, mobility network and street environment that determines / affects non-motorised travel within the study area. These include but are not limited to:

1) Land Use, Urban form and Activity

The consultant will document existing land use and the economic, social or cultural generators, floor area ratio (FAR), land ownership, building height, building use, building typology, building edge, ground coverage, development status (whether vacant, redeveloped, demolished, under construction, densified), infrastructure (water supply, electricity, storm and sewer), public open spaces, natural features and environment, plot access and physical contours of the area. These will be documented with maps, plans, sections and 3D views.

2) Mobility Networks

The consultant will document an “accessibility chain” i.e. the path taken by a person to complete a trip e.g. from home to the public transit station and back through different modes or combination of modes i.e. walking, bicycling, intermediate public transport, public transport and private motor vehicles. This will be supported by the following documentation.

- **Road networks and safety:** Identify existing and proposed regional, city, neighbourhood and local linkages and collect data relevant to pedestrian safety. For example data on accident rates / prone areas / blind spots, existing and proposed vehicular speeds etc.
- **Non-motorised transport networks:** Document existing and proposed non- motorised transport infrastructure, routes, networks, pedestrian or bicycle paths, high pedestrian volume areas, priority zones, availability of parking etc. Further the existing street and public realm activity, nodes, cultural practices, rituals and festivals celebrated in streets / public spaces will be documented through plans, sections, 3D views and substantiated with sketches/photographs.
- **Public transport:** Document existing situation and proposed mass transit and feeder networks, bus routes, shelters and major bus stops.
- **Intermediate public transport:** Identify existing and proposed IPT infrastructure e.g. IPT stands, number of autos / taxis parked, laybys etc.

These will be documented with maps, plans, street sections and other appropriate graphical /text methods.

3) Street Environment

The consultant will document the existing non-motorised infrastructure and environment. A physical survey of the streets in the study area will be undertaken to document existing right of way, carriageway, lane widths, pavement widths and heights, signage, trees, garbage bins, seating, street lights, electric and telephone junction boxes, IPT stands, crossings, medians, manholes and vendors, amenities like public toilets, PCO booths, shrines etc. These will be represented spatially through plans and sections for different types and widths of streets.

Task 2.3: Conduct Vehicular, Pedestrian and Non-motorised vehicles (NMV) Counts

Vehicular and pedestrian counts will be undertaken at major intersections to understand peak hour traffic and movement. They will be done from 06:00 to 22:00 with 15 minute intervals. Proposed survey locations should be identified during Task 1 and be listed in the Inception Report.

Task 2.4: Conduct Surveys / Interviews

The following surveys / interviews will be conducted:

- **Pedestrian origin-destination surveys:** These should include residents and visitors. The ratio of the total number of surveys to that of the total population in the study area should be 1:50 (2% of the resident population). The surveys should establish their profile, capture their overall origin and destination, trip distance, trip time, mode and stages of travel; number of walking trips undertaken in a day, average walking trip lengths and time, purpose of walking trips and perception of walking. The surveys should be distributed at entrances and exits of the metro station and along corridors with high pedestrian volumes.
- **Interviews with key stakeholders / organizations:** These include key stakeholders interviewed in Task 1, groups most likely to be affected by metro station, people with disabilities etc.

The proposed number and type of surveys / interviews should be identified during Task 1 and be listed in the Inception Report.

Task 2.5: Analyse the Data Collected and Documentation Undertaken

The consultant shall analyse the existing data and documentation to evaluate accessibility through the following but not limited to:

- **Non-motorised facilities and infrastructure:** The gap between the demand and supply of NMT infrastructure will be evaluated through a level of service analysis for existing condition (2012) and the future (2015 and 2021). In addition other aspects of NMT facilities such as NMV parking etc. will also be evaluated.
- **Pedestrian and bicycle convenience, safety and comfort:** Evaluate and rate the ease of walking and bicycling; safety at crossings, intersections; exposure to vehicles and vehicular speeds; quality of pedestrian routes, distances travelled by pedestrians / bicyclists etc.
- **Sense of place:** Evaluate which areas / places / elements have created an image with the residents / visitors, whether the area facilitates way finding etc.
- **Mobility Management:** Analyse traffic control measures, demand for parking, safety issues for non-motorised transport users
- **Public and Intermediate Public Transport Infrastructure:** Evaluate the ease of seamless intermodal transfers between walking, bicycling, intermediate public transport, metro and bus systems.

These will be represented spatially through maps, sketches, plans and sketches. A SWOT will be created to understand the opportunities and threats affecting access and their key causes.

Task 3: Prepare Proposals

Task 3.1: Prepare Master List of Proposals

Based on Tasks 1 & 2 and learning from global best practices, a Master List of Proposals will be prepared. It will identify improvements in

- **Non-motorised facilities and infrastructure:** These include but are not restricted to street network and intersection improvements, creating segregated or mixed lanes, NMV parking facilities etc.
- **Pedestrian and bicycle convenience, safety and comfort:** These should improve safety, convenience and comfort for NMT users and include but not be limited to traffic calming measures, location of pedestrian crossings, creating pedestrian priority areas, cul- de-sacs, new pedestrian linkages, improve shade, creation of public open spaces etc.
- **Mobility Management:** The measures for mobility management should be developed with implications for regulation and enforcement. The topics to be covered in this plan include but are not limited to traffic control measures, parking plan, demand management measures and traffic safety plan.
- **Public Transport Improvements:** These are broad proposals to improve public transport such as, but not limited to; location of bus stops, improvement in bus stop infrastructure / waiting area, suggested realignment of feeder bus routes to support the metro, potential bus priority lanes, improvements to existing metro feeder bus systems, terminals for inter-modal connectivity etc. These shall be derived from surveys, data and engagement with APSRTC / and other relevant agencies.
- **Intermediate Public Transport Improvements:** These are broad proposals to improve para transit services such that they serve as an efficient feeder service to the metro. These include but are not limited to location of IPT stands, share auto measures etc.

The Master List of Proposals will be represented spatially through maps, sketches, plans, sketches and will include block cost estimates for each proposal.

Task 4: Prepare Implementation Programme

Task 4.1: Implementation of Proposals

The consultant shall devise an innovative program to implement the proposed measures. Sustainable financing options and inclusion of resident or community based organizations should be explored. A brief summary of project information is required, including project title, location, estimated cost etc. Proposed projects should be evaluated and prioritised against clear criteria and classified into Phase I, II and III. Specifically, the following tasks should be conducted.

- Preparation of Project List
- Selection of Priority Measures
- Prioritization Methodology
- Identification of Roles of Implementation Agencies
- Identification of Possible Financing Options

Task 5: Detail Phase I Proposals

A total station survey of area delineated for Phase I proposals will be undertaken and detailed proposals shall be given out as per Urban Road Codes and NMT Guidance Document (MoUD 2015) and detailed cost of the proposals, BOQ and good for construction drawings for implementation are to be given. The proposals will be represented through a series of images / sketches and detailed drawings showing the conditions before and situation after.

Task 6: Stakeholder Participation Workshops

The consultant shall assist the GVMC in conducting stakeholder participation workshops. Two such workshops would be conducted as detailed below;

One workshop at the end of Stage 2

One workshop at the end of Stage 3

The cost for conducting the stakeholder participation workshops will be borne by GVMC and materials such as but not limited to; maps, graphics and presentation boards etc. illustrating the proposals presented in the workshops shall be provided for by the consultant

Task 7: Final Project Report

The consultant shall incorporate the recommendations of the evaluation committee and submit a finalised report.

References

- VUDA, April, 2007, Revised Master Plan for Visakhapatnam Metropolitan Region- 2021
- UNEP, IIT (Delhi), IIM (Ahmedabad), & CEPT University, (2015), Low Carbon Mobility Plan, Visakhapatnam
- MoUD, (2012), Urban Road Codes (Section 1: Cross Section)
- TRIPP, IIT, Delhi, (2014), NMT planning and Design Guidelines
- World Bank & MoUD, (2015), NMT Guidance Document.
- <http://fundingconnection.co.za/funding-agencies-in-south-africa/kfw-german-development-bank/> viewed on 18-03-2015
- Greater Vizag Municipal Corporation, March (2012), Implementation of Cycle lanes, Foot paths and Public Bicycle Schemes in Visakhapatnam City
- Planning and Design Guideline for Cycle Infrastructure by TRIPP & Shakti Foundation (http://tripp.iitd.ernet.in/publications/other_pub/Planning%20and%20Design%20Guideline%20for%20Cycle%20Infrastructure.pdf)