Coimbatore NMT Strategy

Non-Motorised Transport Network Planning Methodology

Submitted to GIZ – SMART SUT
by IBI Consultancy India Pvt Ltd
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NMT Network Planning Methodology

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ABBREVIATIONS

CCMC	:	Coimbatore Municipal Corporation
GIS	:	Geographic Information System
GIZ	:	Deutsche Gesellschaft fuer Internationale Zusammenarbeit
ITDP	:	Institute for Transport Development Policy
IRC	:	Indian Road Congress
MoUD	:	Ministry of Urban Development
NMSH	:	National Mission for Sustainable Habitat
NMT	:	Non-Motorised Transport
NUTP	:	National Urban Transport Policy
SMART -SUT	:	SIntegrated Sustainable Urban Transport Systems for Smart Cities technical
SSEF	:	Shakti Sustainable Energy Foundation
TRIPP	:	Transportation Research and Injury Prevention Programme
CROW	:	Netherlands Bicycle Design Standards

01 /
INTRODUCTION

Footpath and Cycle track in Pune
Source: IBI Group

1.1 Background

Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH is implementing the "Integrated Sustainable Urban Transport Systems for Smart Cities technical (SMART-SUT)" project with the Ministry of Housing and Urban Affairs as political partner. The objective of the SMART-SUT project is to improve the planning and implementation of sustainable urban transport in selected Indian cities. The implementation focuses on the pilot cities of Bhubaneswar, Coimbatore, and Kochi, which were selected by the German Government for special support on their way to becoming a Smart City.

Coimbatore is one of the three partner cities of the SMART-SUT Project. The Nodal Agency for project implementation is the Coimbatore City Municipal Corporation (CCMC).

The objectives of this assignment primarily include:

- Develop recommendations for the sustainable implementation of the proposed eco-mobility corridor and model roads projects in Coimbatore.
- Prepare an analytical and spatial baseline for Coimbatore that could be used as a base to prepare the city-wide NMT network.

This Report proposes a draft methodological framework for creating a Non-Motorised Transport (NMT) Network Plan for Coimbatore. It draws from the method suggested in the MoHUA NMT Guidance Document and also integrates the method adopted in German cities for defining a Bicycle Network.

Figure 1: Various NMT Users in Coimbatore
Source: IBI Group

1.2 Lessons from Germany -The Dresden Example

The paradigm shift in transport planning the world over has seen large number of cities invest in pedestrian and cycling infrastructure instead of road infrastructure for vehicles. Cities in the developed world are realising that the the move towards sustainable mobility is the most beneficial not only to federal budget, due to reduced reliance on fuel, but also beneficial to the health and well-being of citizens. From among the many cities in Germany that are making large scale plans and investing heavily in developing bicycle networks, the example of Dresden is presented here to demonstrate the network planning process.

Dresden is the capital of Germany's federal state of Saxony. With a population of over 5 lakhs, Dresden is the growing center of an urban agglomeration. In contrast to the generally decreasing population of Saxony's rural areas, it is estimated that Dresden will experience a population increase of 6.8 % by 2025. The existing Dresden transport infrastructure is adequate and in a state-of-good-repair, particularly the public transport system and the road network. It includes a 59 km sub-urban rail network, a 200 km tram network with 12 lines and a 200 km bus network with 28 bus routes. In 2008, 41 % of all passenger trips were done by private car, 21 % by public transport, 22 % by walking and 16 % by cycling. The strongest increase was recorded for cycling; a share of 10 % in 1998 surged to 16 % in 2008.

Many rudimentary plans were made before this time, along with a long process over the years of redesigning streets, however with mixed results. The steady interest in cycling encouraged the city to look at cycling at the network level. Preparation and adoption of a long-term cycling network plan was envisioned as an instrument to guide the growth and development of the city. The methodology followed for the planning and adoption of the Bicycle Network is described below.

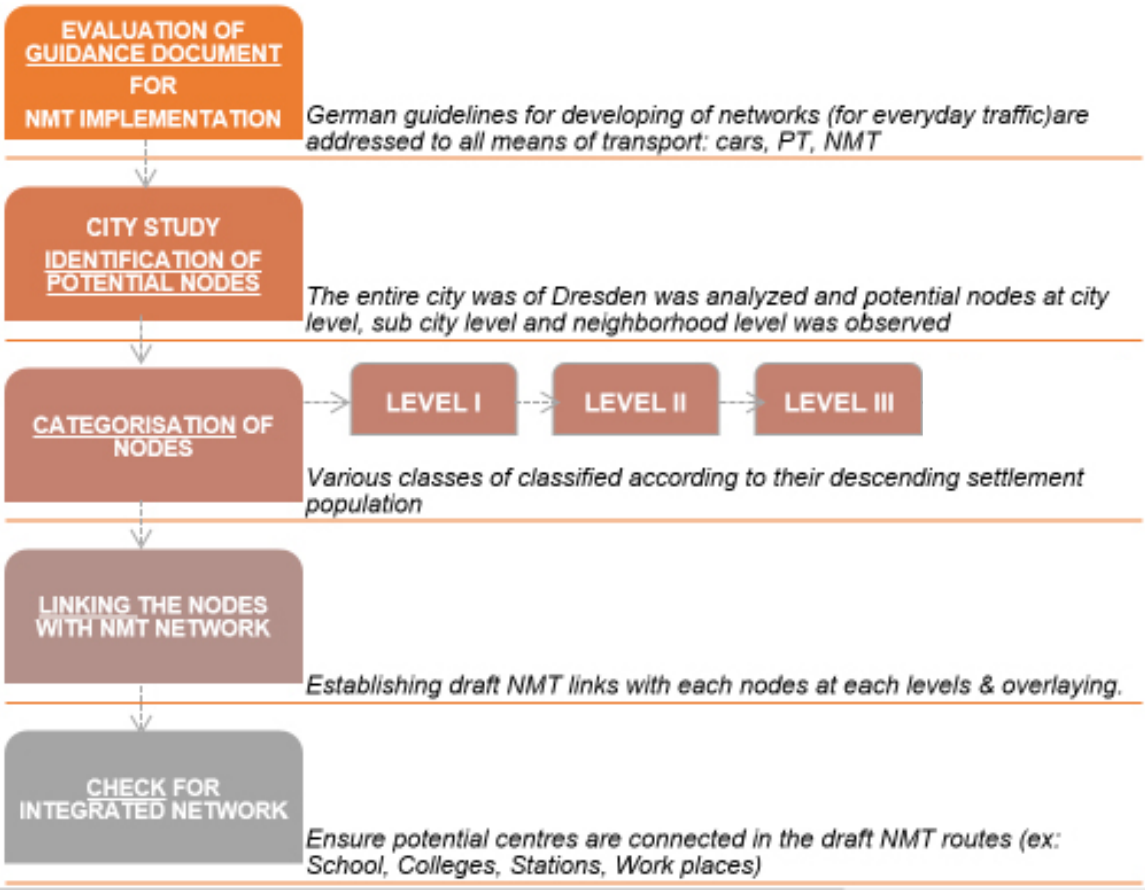


Figure 2: Illustration of steps adopted by the city for preparation of its NMT street network
Source: Mr. Michael Haase

The basic objective for bicycle network planning is to ensure that cyclists are provided seamless connections to all their daily needs. This should ideally promote cycling as a viable alternative to other more polluting modes of transport.

The first step then for the bicyle network planning was to identify the potential origin and destination nodes across the city and then identify the best routes to complete these connections by cycle.

Step 1: Identify the Level 1 Nodes

The first step in the planning exercise was to identify the large city centers in and around Dresden.

Step 2: Connect Bee Lines between Nodes

The second step was to draw straight lines between all the nodes to demonstrate the desired travel connections.

Step 3: Identify Cycling Routes corresponding to Bee Lines

The third step was to identify most appropriate combination of streets and intersections for creation of a cycling route to correspond to each bee line.

Step 4: Identify Level 2 and 3 Cycling Routes

Similarly Level 2 and 3 Nodes were identified based on their importance. Beel lines were drawn between all nodes, and a three-tiered bicycle network was prepared using the existing street network as the base.

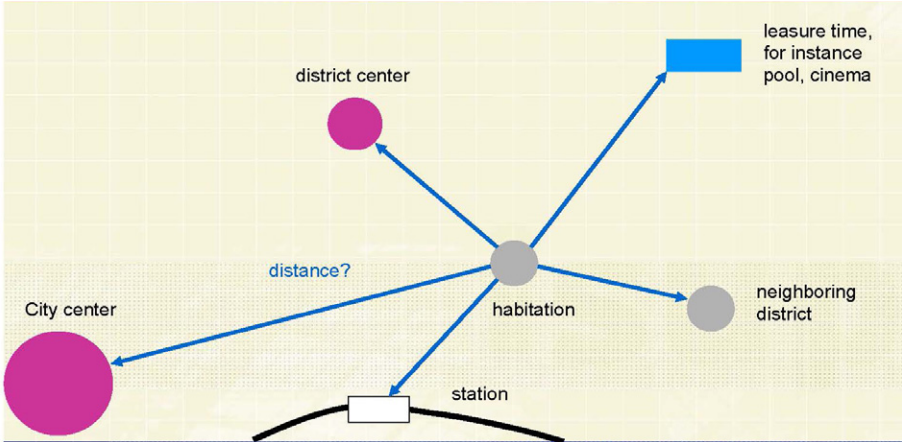


Figure 4: Example of wished relations for everyday cycling
Source: Michael Haase

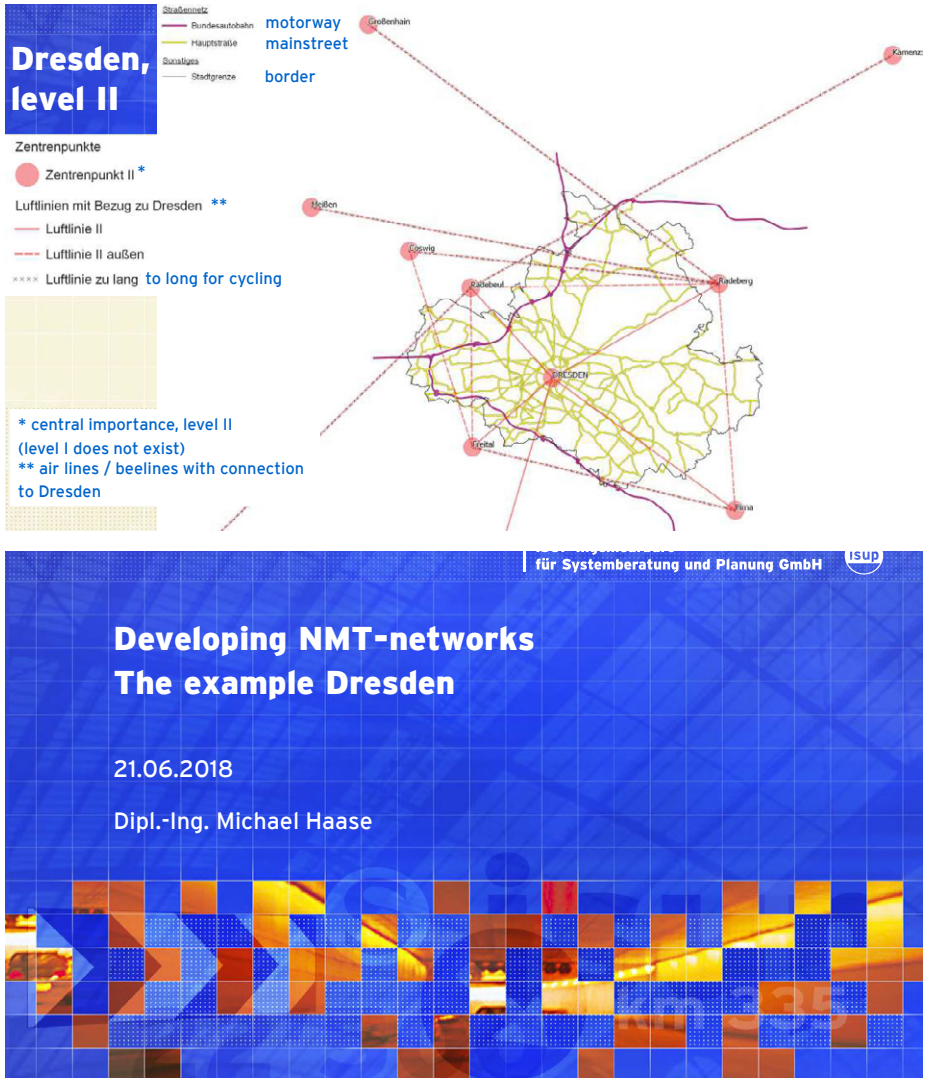


Figure 3: Illustration of Conversion of Beel Lines into High Level Cycle Routes
Source: Michael Haase

Step 5: Check for Integration

After mapping the potential routes at all levels, the final integrated map was checked for ensuring connectivity to schools, colleges, prominent work places & theatres. This further warrants easy accessibility and affordability of the mode of transport thereby increasing the choice of transport for the city dwellers.

"If you plan cities for cars and traffic, you get cars and traffic.

If you plan for people and places, you get people and places."

- Fred Kent, Project for Public Spaces

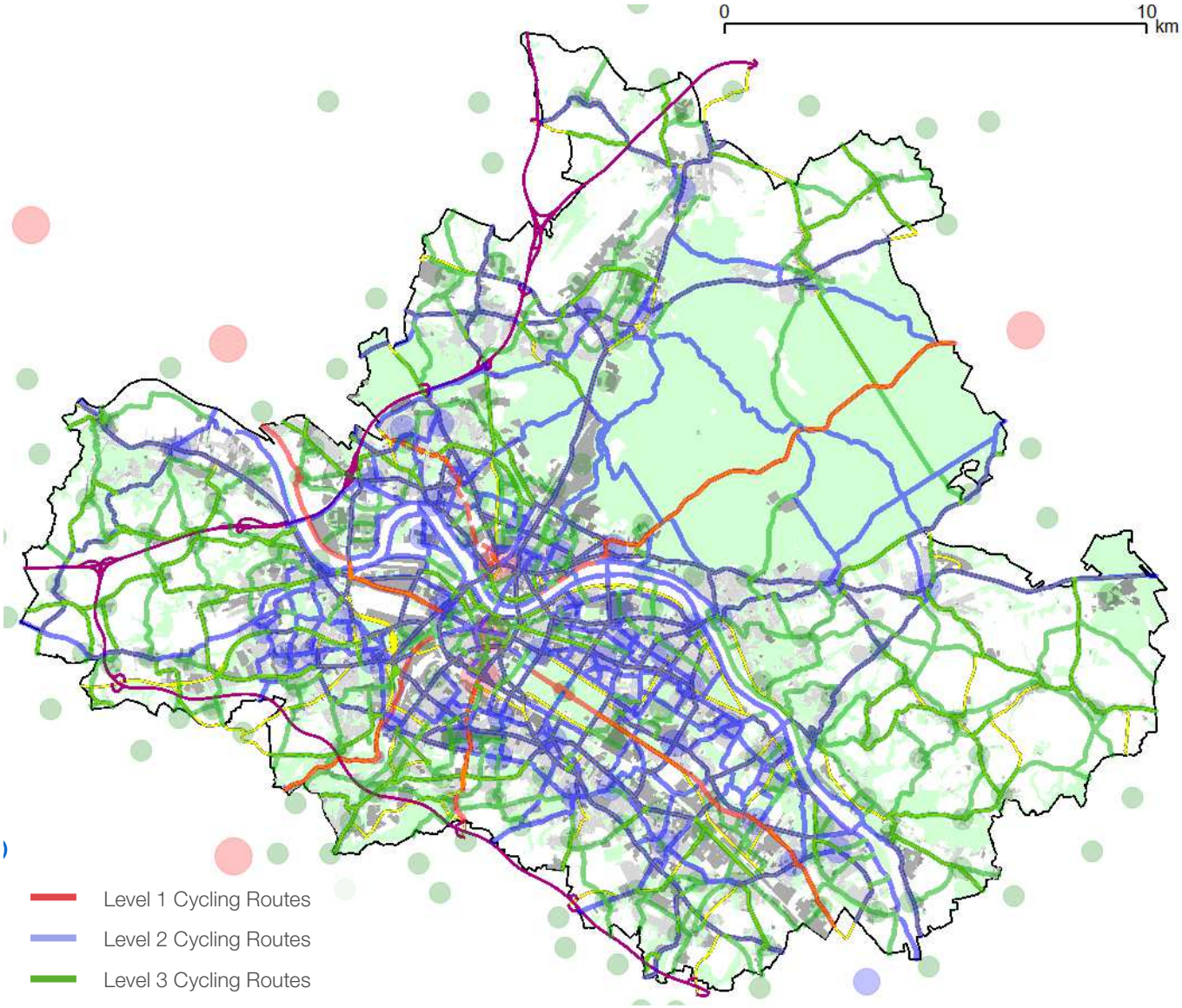


Figure 5: Integrated Cycling Network Plan
Source: Michael Haase

1.3 Reference Manuals and Guidelines

The National Urban Transport Policy (NUTP) of 2006, for this first time in India, called out focus on urban transport, emphasiing the importance of moving people rather than cars. Most notably, the NUTP prioritizes pedestrian and cyclist mobility over motorized transport. Consequently, different agencies and think-tanks have developed many manuals and guidelines over the years to help cities understand and plan for Non-Motorised Transport (NMT). Some of these manuals and guidelines are summarized here.

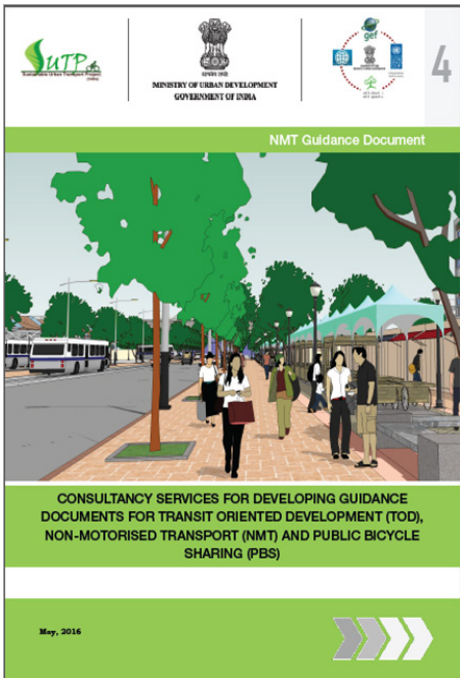
GUIDANCE DOCUMENTS FOR NON-MOTORIZED TRANSPORTATION PLANNING

This Guidance Document for NMT was developed by the Ministry of Urban Development under the Sustainable Urban Transport Project (SUTP) funded by World Bank and Global Environmental Facility (GEF). The document intends to promote NMT planning in Indian cities by addressing the challenges encountered in attempting to invest in pedestrian and cycling infrastructure; and thereafter suggesting a step-by-step guide to see NMT interventions from conceptualization through implementation.

Building on the lessons learned from international and Indian experiences, the focus of the Guidance Documents is on establishing a systematic process for plan preparation, serving more as an implementation manual with checklists of potential alternatives, rather than providing technical standards for development of detailed specifications.

Key Highlights of the Document

- Guiding Principles and Supporting Principles of NMT Planning in India
- Step-by-step guide to NMT Planning including the full planning cycle within a 5-step framework: Assess, Enable, Plan + Design, Invest, Implement
- Tools to help cities carry out specific tasks



Source: MOUD, World Bank
http://mohua.gov.in/cms/sustain-sutp-NMT.php

Applications: The NMT Guidance Document has proved useful in helping cities identify the scale and type of NMT interventions to be planned in the city. To test the practical value of the guidance document in Indian cities, NMT city specific plans were prepared for Aizawl and Visakhapatnam. The Visakhapatnam City Specific Plan derived from its own Low Carbon Mobility Plan for the full city area as the basis and developed details on the cycling network, using the step-by-step process described. The Aizawl Plan on the other hand focused on pedestrian mobility as a means to decongest the central city spinal roads.

IRC CODES SPECIFIC TO NMT

The Indian Roads Congress (IRC) was constituted by the Government of India to provide a forum for compilation of standardized specifications and engineering design principles for roads in India. The IRC Codes for pedestrians and cyclists, unlike the IRC codes of practice for roads and bridges, are in the form of recommended guidelines that are suggestive and not considered standard practice. Because of this, most road engineers are not code-bound to apply minimum standards for pedestrian and cyclist facilities even on urban roads. While the IRC codes are under revision, it is yet unknown if these codes will incorporate necessary minimum standards for pedestrians and cyclists.

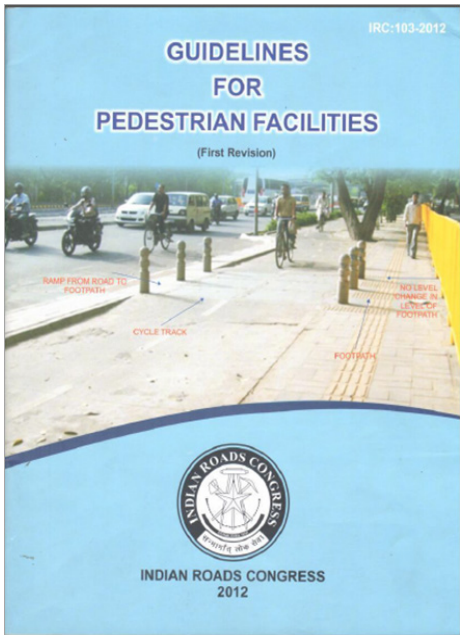
IRC 103:2012 - GUIDELINES FOR PEDESTRIAN FACILITIES

The guidelines are intended for use by the local authorities' responsible for creating and maintaining semi urban and urban road transport facilities. The guidelines are framed to serve the objectives of universal accessibility and social equity for sustainable transportation.

The revised guidelines unlike its earlier version dated 1989 for laying pedestrian facilities, includes more than mere laying of a footpath or installing a signal. It provides guidelines for accessible designs as the foundation and primary element for all pedestrian design that incorporates universal accessibility, connections of the pedestrian networks to work places, transit area, markets, schools and colleges.

Key Highlights of the Guidelines

- Introduces the concept of "Pedestrian Level of Service" based on pedestrian flow characteristics of speed, flow and density
- Covers engineering design and planning aspects of pedestrian facilities on road sides and at road crossings in urban and semi urban areas
- Includes pedestrian facility recommendations at special locations like schools, parking, and transit areas
- Provides pedestrian safety audit methods



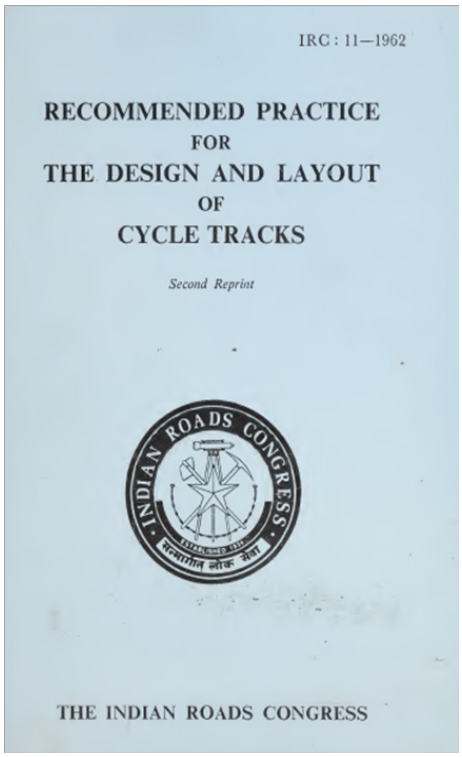
Source: IRC 103-2012

IRC 11:1962 - RECOMMENDED PRACTICE FOR THE DESIGN AND LAYOUT OF CYCLE TRACKS

These codes provide recommended practice for design of a separate cycle tracks, only where existing demand already justifies it. It does not promote a modal shift to cycling.

Key Highlights of the Code:

- Provides cycling volume thresholds for justifying cycle tracks
- Provides capacity of cycle tracks for design consideration in terms of the track width based on traffic volume.
- Provides specifications for horizontal and vertical curves, gradients, sight distances, lane width, clearance, crossing and lighting etc.



Source: IRC 11-1962

Applications: The IRC Codes for pedestrians and cyclists have been widely applied in New Delhi, however in situations where NMT mobility is not prioritized over motorized traffic. Because of this, pedestrian and cyclist facilities are only provided where space is available and where it does not conflict with or impair motorized traffic flow and speeds. This is one of the biggest criticisms of the IRC Codes.

PLANNING AND DESIGN GUIDELINES FOR CYCLING INFRASTRUCTURE

This Planning and Design guideline was produced as part of the Shakti Sustainable Energy Foundation (SSEF) sponsored project on Non-Motorised Transport by the Transportation Research and Injury Prevention Programme (TRIPP) at the Indian Institute of Technology, Delhi. It was prepared to contribute to the growing literature responding the NUTP 2007 and National Mission for Sustainable Habitat (NMSH) 2011 guidelines on prioritizing sustainable mobility.

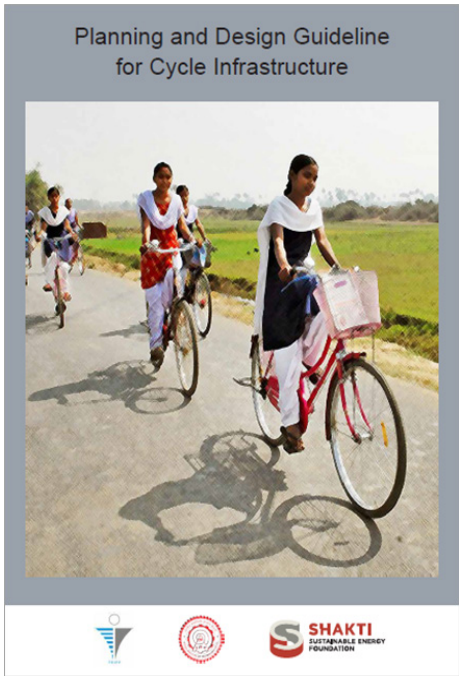
The report provides a comprehensive assessment on the current state of cycling mobility in various cities by analyzing trends in trip lengths, frequency of cycling, health, nature and economic status of cyclists.

Based on the findings, the guidelines lay down the sample methodology for NMT Planning beginning with NMT Network Planning; Infrastructure Design; Implementation; and Evaluation. Primarily the guidelines rely on the experience of preparing the Bicycle Master Plan for Delhi 2008, and develops for the first time in India a wholly evidence based method for defining the cycling network as shown below.

The report also reinterprets design standards from the Netherlands-based CROW 2007 guidelines for Indian conditions.

Applications: Besides Delhi, the NMT Network Planning methodology has been applied to many cities, foremost among them being Pune, where a Cycle Plan is currently under the process of notification. The NMT Guidance Document also endorses the network planning methodology from these guidelines.

The network planning method proposed in this report is somewhat similar, however, it is not reliant on detailed and accurate data or on the existing street network alone, and is in fact more flexible in accommodating growing city needs.



Source: Shakti Foundation 2014
http://shaktifoundation.in/wp-content/uploads/2017/06/NMT-Guidelines.pdf

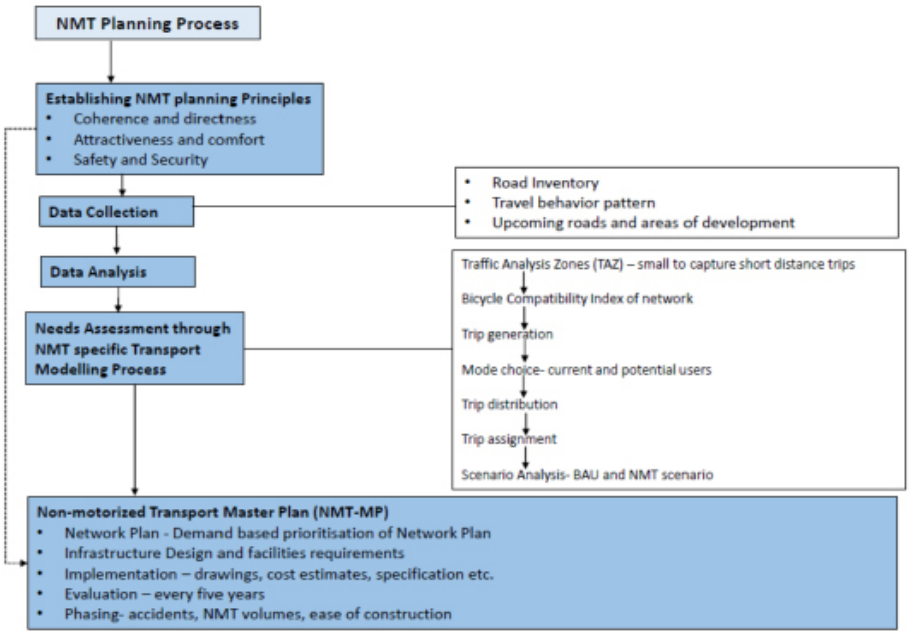


Figure 6: The outline of the planning process as described in the Planning and Design Guidelines for Cycling Infrastructure

ITDP BETTER STREETS BETTER CITIES MANUAL

This guide, prepared by the ITDP, for design of urban streets articulates the concept of 'equitable allocation of road space.' This is also one of the key principles outlined in the National Urban Transport Policy. This manual is intended for planners, urban designers, landscape architects, civil engineers, and, most importantly, government officials and citizens who are interested in improving the quality of urban environments and the character of streets in our cities.

As well-designed and robustly constructed streets can significantly improve the quality of life of the urban citizenry, the guide provides a framework for understanding various elements of street design and a toolkit for identifyign design treatments.

This manual aims to facilitate the design of beautiful, safe, walkable, and liveable streets. The manual identifies the different functions of streets and emphasizes the need to design complete streets that provide space for all users. Through the street and intersection templates the document bring out a sense of how the different elements come together for different types and sizes of streets. Finally, an overview of the activities that are undertaken as a part of the overall process of street design is also discussed.

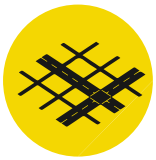
Applications: The better streets better cities manual has been used as reference for a number of streetscape design interventions in India recently, primarily include examples in Delhi and Chennai. Many cities such as Pune and Bhubaneswar have also developed city-specific street design guidelines based on this design manual.

Source: ITDP 2011
https://www.itdp.org/wp-content/uploads/2011/12/Better-Streets-Better-Cities-ITDP-2011.pdf

1.4 Basic Tenets of NMT Networks

The basic tenets of NMT Networks are derived from the basic needs of cyclists and pedestrians, including **Directness, Coherence, Safety, Attractiveness, and Comfort.** The importance of these needs is variable, depending upon the age and agility of the pedestrian and cyclist. The most vulnerable of users will prioritize safety and comfort, whereas the agile users who value time-saving will prioritize directness and coherence. Choice users, who have the choice for other motorized modes, will choose NMT only if provided all the basic needs.

The basic tenets of NMT Networks as suggested in the NMT Guidance Document (MOUD, World Bank 2016), primarily seek to address these needs. The definition of NMT Network in Coimbatore should seek to identify the most appropriate network based on these tenets.



Interconnected Street Network

An interconnected NMT network provides **direct connections** between origins and destinations, reduces detours, and makes NMT connections more time saving.

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.

Bicycle Friendliness

Bicycle friendly streets **improves navigation and coherence for cyclists** promoting it as a viable alternative to motorised modes of transport for all kinds of trips.

Walkability

Walkable networks lie within compact development patterns and provide an **attractive pedestrian environment with a high level of priority, safety and amenities.**

Comfort

Design elements, coordinated to provide **shade, weather protection, pedestrian amenities and visual interest**, improves NMT desirability and shortens the perception of distance.

Universal Accessibiliuty

Universal Accessibility **improves coherence, reducing physical effort** to an extent that a physically handicapped person should be able to navigate the pedestrian facilities without external assistance.

Safety

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

Security

Ensuring security of vulnerable groups such as women and children in the public realm will **increase attractiveness of NMT**.

NMT Wayfinding

Wayfinding assists NMT users in **navigation and improve sense of place, legibility and coherence** of the NMT network.

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 and attractiveness**.

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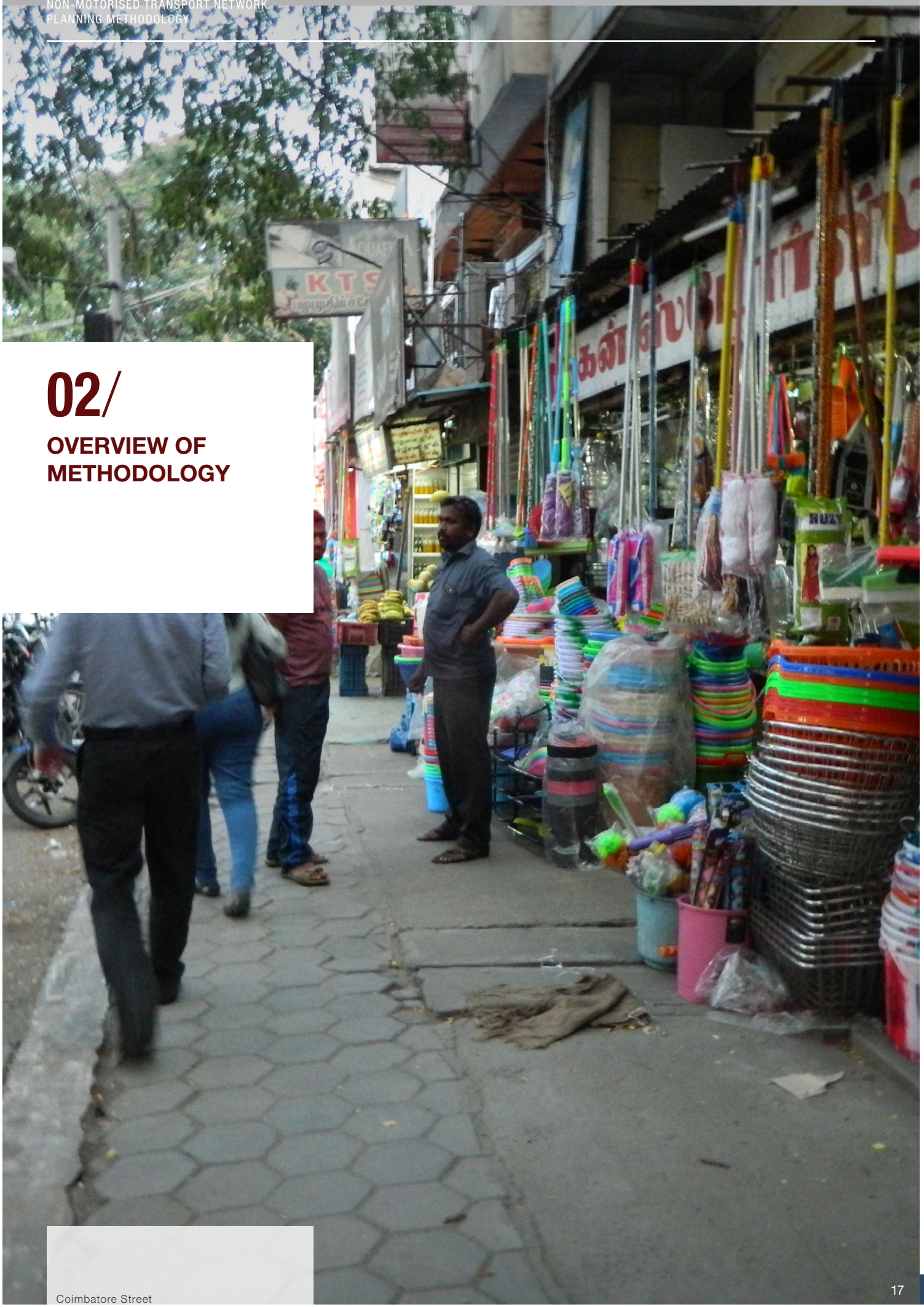
OVERVIEW OF METHODOLOGY



Coimbatore Street

2.1 Defining the Scope for the NMT Network Plan

The historic city of Coimbatore is located in the centre of the urban agglomeration (UA) of Coimbatore. Most growth in the city is radiating outwards towards the north, east and south, along major mobility corridors as seen below.

The central (old municipal area) remains the most urban in land use; while larger land parcels of industrial and educational uses flank the major radial corridors. Many off-road developments in the outer peripheries are sprawling in nature and largely unserved by a cohesive network of hierarchical roadways.

Most of the city either travels by bus or 2-wheeler, with the latter showing the maximum increase in the previous decades. Pedestrians and cyclists together make up to 34% of the total trips in Coimbatore City[1].

1 Coimbatore Comprehensive Mobility Plan 2013

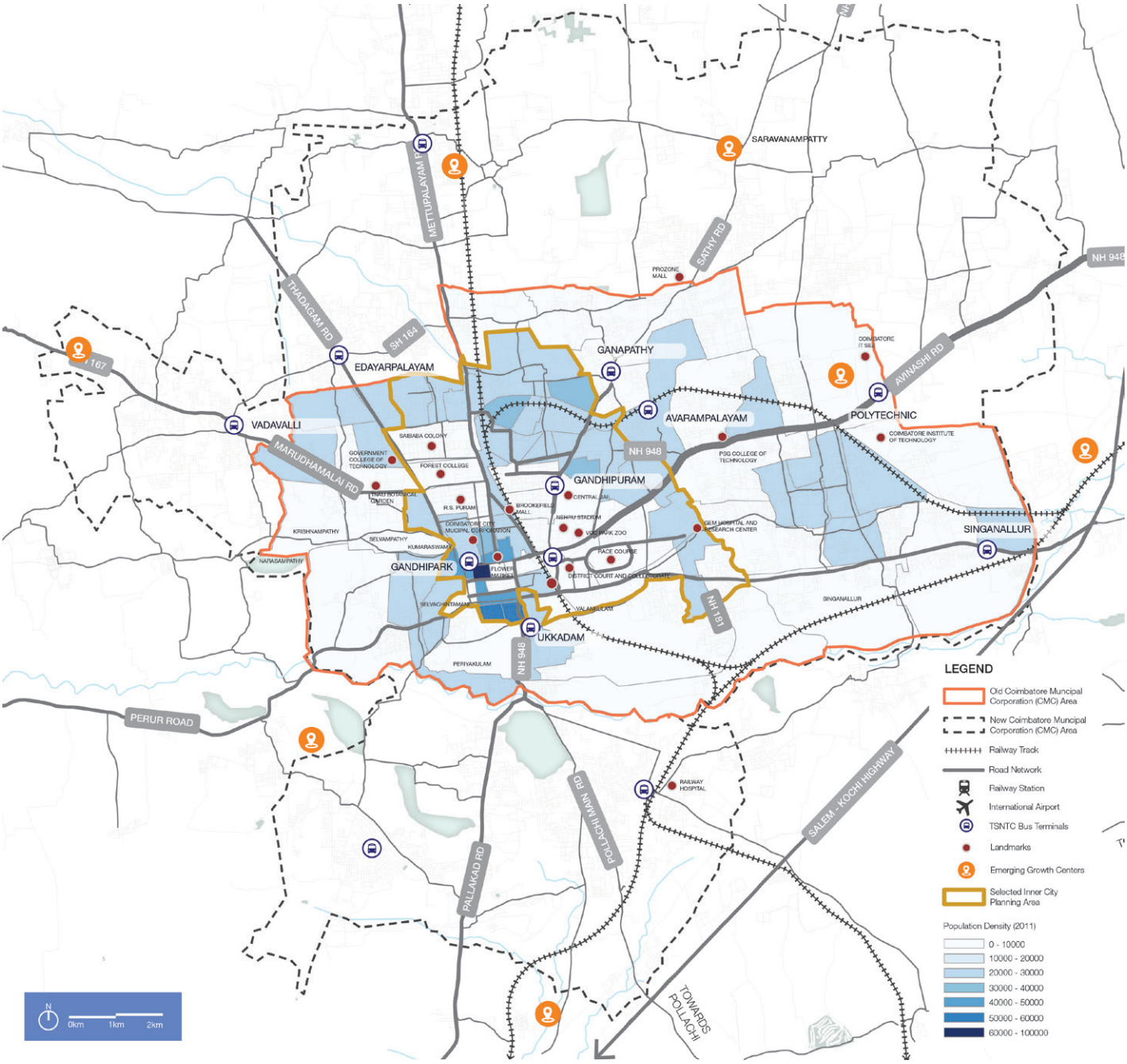


Figure 7: Population variations in the city core and emerging growth centers in Coimbatore

2.1.1. History of NMT Planning in Coimbatore

Since 2013, many stakeholders in the city including ICLEI, ITDP and GIZ have worked with city agencies as part of preparation of the Comprehensive Mobility Plan and Smart City Plan to identify a network of roads for NMT improvements. This network was refined into the final selection of Model Roads by the CCMC for NMT improvements. The Ecomobility Corridor is to be implemented as part of the 8 Lakes Restoration Project.

In addition, the Comprehensive Mobility Plan of 2013 suggested three phases of cycle tracks and 2 phases of MRT. City-stakeholder engagements have also led to delineation of proposed pedestrian zones, footpath zones, and parking management zones. All of these proposals are mapped below for baseline reference during preparation of the NMT Plan.

In 2017, the CCMC adopted the Coimbatore Street Design & Management Policy, which is to form the basis of a Street Design Manual. Designs for the 6 model roads were also presented to the public at this time.

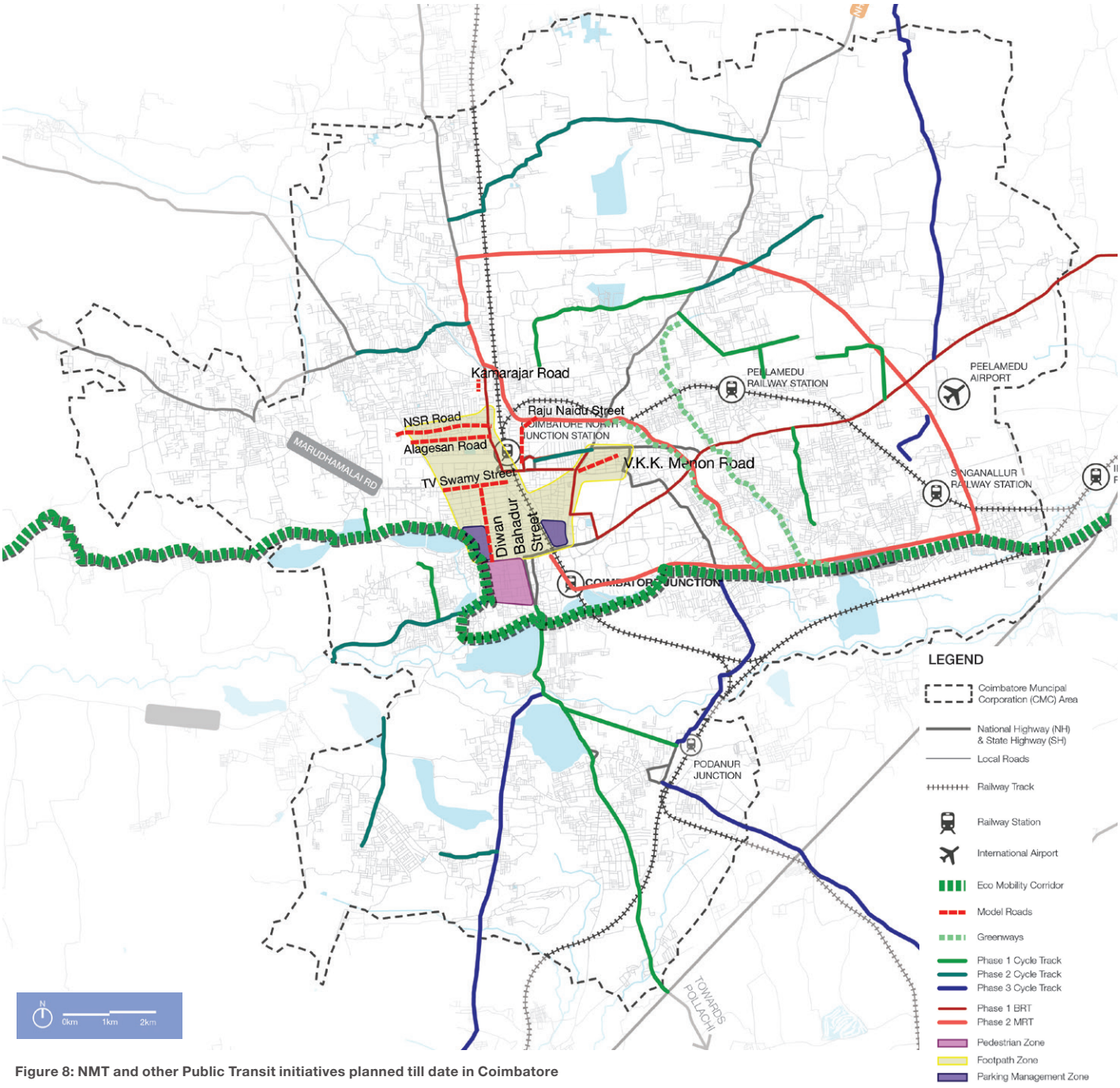


Figure 8: NMT and other Public Transit initiatives planned till date in Coimbatore

2.1.2. User-based NMT Needs

For the two main types of NMT users, pedestrians and cyclists, the scoping process should identify the required scales of planning and the potential output at each scale of planning.

The NMT Guidance Document (MOUD, World Bank 2016) suggests four primary scales of NMT interventions: the city, an area, a corridor, or a street. The process of identifying the appropriate scale and its appropriate boundary, and the planning outcomes should be defined by the user-specific planning needs as explained here.

At present, the City has identified NMT interventions at two scales; the Ecomobility Corridor at a Corridor Scale and Model Roads at the Street Scale. As a Plan, however, there is a need to look at macro and micro-level needs for each user type, and ascertain the nature of planning interventions.

	CITY	CORRIDOR	AREA	STREET
Purpose	Involves integration of multiple corridors and modes of mobility as well as integration with land use. Used for decision making related to citywide infrastructure investments. Provides a point of intervention for NMT as a policy in statutory documents (Master Plan/Mobility Plan)	Enables creation of newer/ alternative corridors or revitalization of existing corridors connecting points of origin and destination. Continuity of NMT treatments along an entire corridor can be ensured through corridor plans.	Focuses on areas of homogenous characteristics, such as historic areas, neighbourhoods, station areas. Provides opportunities for integrating NMT proposals with smaller placemaking and developmental initiatives.	Focuses on individual street improvements, addressing specific needs such as footpath upgradation, road diets, traffic calming, cycle tracks etc. Improvements focus on addressing immediate challenges.
Boundary Definition	Administrative Boundaries	Origin - Destination Connectors or Desire Lines.	Neighbourhoods or Areas bound by physical barriers such as roads or utilities.	Individual Streets.
Outcomes	NMT Policies + Network Plan + Identification of Priority Areas/Corridors + Institutional Framework for Implementation. Generic DCR Modifications may also be proposed for NMT inclusion.	Link and Intersection Typologies + Streetscape Detail Design + Phasing + Implementation Plan	Network Plan + Street Typologies + Streetscape Detail Design + Phasing + Implementation Plan	Streetscape Detail Design + Phasing + Implementation Plan

Figure 9: Scales of NMT from the MOUD NMT Guidance Document

PEDESTRIAN PLANNING NEEDS

Pedestrians form the bulk of NMT users in Coimbatore. Its historically compact form with mixed land uses allows for plenty of walking activity. Because most public transport and personal vehicle users also walk for the first or last mile, pedestrian needs are the most basic and very critical at the same time and are applicable on each and every city road. Quality of the footpath, zebra crossings, pedestrian signals, safety, signage, and encroachments are the most prevelant pedestrian issues[1], that the Pedestrian NMT Plan must address, in the form of a **uniform street design manual,** which is already under preparation as per the mandate of the Coimbatore Street Design & Management Policy.

At the micro-level, there are many locations with extremely high levels of pedestrian accummulation. The first need therefore is to identify the **Pedestrian Priority Network**, for which basic pedestrian provisions are insufficient and more **context-specific complete street design interventions** are needed to adequately address pedestrian needs while also maintaining a balance with other requirements.

CYCLIST PLANNING NEEDS

Cyclists form only 8% of the modal share in Coimbatore City[2]. Most cyclists at present are captive cyclists who cycle to work or cycle to the nearest bus station. Cyclists who cycle by choice are choosing to cycle for recreational purposes more than commuting. Based on the willingness of children to cycle and the current cycle ownership in the city, there is a potential for much higher cyclist volumes, given that safety and comfort against climate conditions are improved[3].

The Cycle Network Plan must then address two key needs:

- provide existing cyclists an alternative to unsafe and accident-prone roads, and
- provide new and potential cyclists with attractive and comfortable choices to reach their intended destinations by cycle.

The goal is not to merely identify streets where cycle tracks can be proposed, but to identify an interconnected network of streets where basic safety and comfort can be achieved for cyclists.

Due to the sparse interconnectedness of streets in the outer areas of the city, for now, it is proposed to plan a **citywide cycling network** over primary and trunk roads, and delineate desired cycling corridors for adding into the future street network as the city grows. In addition **an inner city cycling network** over all streets including local roads should be planned for immediate implementation.

1 Survey Findings. See Appendix A for Summary of Survey Findings
2 Census 2011 Data and Smart City Mobility Fact Sheet
3 Survey Findings. See Appendix A for Summary of Survey Findings

2.1.3. Pedestrian Planning Scale

The Pedestrian NMT Plan is proposed to have 2 outputs, one at the macro level and the second at the micro-level. The parameters for selecting the appropriate scale for the high and micro-level plans are shown below.

PEDESTRIAN PLANNING SCALE SELECTION PARAMETERS

- Select the city area corresponding with municipal administrative boundaries
- Select an area where all or most roads come under the same roads department
- Select all existing and upcoming growth areas in the city

High level Planning Tier

At the macro level, the Pedestrian Plan includes ALL ROADS in the City's road network. The minimum design standards should be applied on the FULL ROAD NETWORK.

CITY LEVEL

- Select a 500m buffer around primary nodes such as railway stations, institutional and office nodes
- Select a 500m buffer around all streets with major bazaars and markets
- Select a 500m buffer around all streets in and around school and college campuses
- Select a 500m buffer around all parks and jogging/walking corridors
- Select a 500m buffer around all religious centers with high pedestrian volumes

Micro level Planning Tier

At the micro-level of the pedestrian hotspots on streets, the Pedestrian Plan must be in the form of specific design interventions that are specific to prevailing conditions and competing demands.

STREET LEVEL

2.1.4. Cycle Network Planning Scale

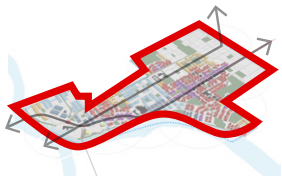
The Cycling NMT Plan is also proposed to have 2 outputs, one at the macro level and the second at the micro-level. The parameters for selecting the appropriate scale for the high and micro-level plans are shown below.

CYCLING NETWORK PLANNING SCALE SELECTION PARAMETERS

- Select the city area corresponding with municipal administrative or local planning area boundaries
- Select a city area including one or more primary nodes or city centers
- Select all existing and upcoming growth areas in the city

High level Planning Tier

At the macro level, the Cycling Network Plan must be in the form of citywide cycling network connecting all the primary and secondary nodes across the city via direct, high speed and safe cycling corridors.

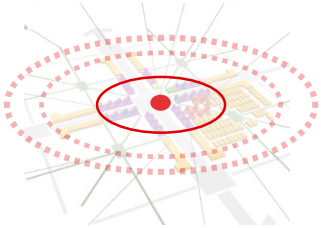


CITY LEVEL

- Select the historic centers of the city including institutional and transit gateways
- Select all municipal wards with a population density above the city average
- Select all employment zones and market areas with high daytime traffic
- Select all areas with a compact, interconnected street network and traditional neighbourhoods
- Refine the inner city planning area boundary based on the road network or natural features.

Micro level Planning Tier

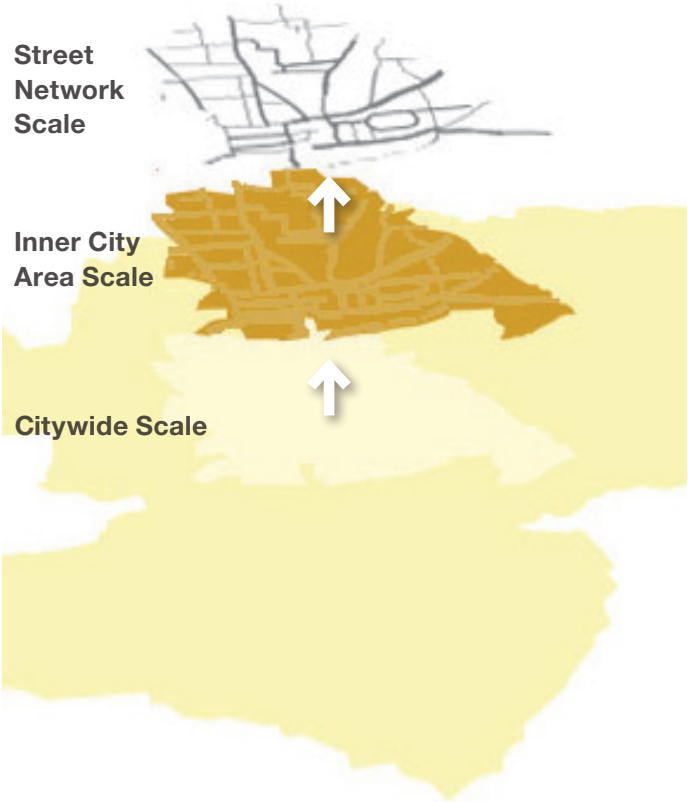
At the micro-level, the Cycling Network Plan must be in the form of an inner city cycling network connecting all primary, secondary, and tertiary nodes across the inner city via the most direct, safe and comfortable routes.



AREA LEVEL

2.2 Step-by-Step NMT Network Planning Methodology

Based on the scoping described above, the proposed NMT network planning methodology for Coimbatore follows a three-layered approach, incorporating the scales of the entire city, the inner city area, and the streets. The intent is to consider roadway limitations as well as user preferences to create a comprehensive and integrated NMT Network Plan.



ASSUMPTIONS & LIMITATIONS

For the purposes of this assignment, the following assumptions have been considered.

1. The proposed methodology for NMT network for the city of Coimbatore is an overlay network that provides inputs on taking up NMT related initatives in a systematic manner. The network so arrived for the city shall be an overarching layer to be achieved over a set period of time, say 20-30 years, and by no means suggests NMT improvements for specific streets, their typology or implementation mechanisms.
2. The implementation and institutional arrangements are essential requirements but are not the focus of this methodology.
3. The methodology assumes that the city needs to build on its basic level of provision for pedestrian facilities on ALL streets. So the complete city road network equals pedestrian network, with no additional need for defining a full city-level Pedestrian Network.
4. Average cycling distance/ preferred cycling distance is assumed to be within 3-5km range (as per National Standards and as observed from cyclist surveys undertaken in Coimbatore) between any two given origin-destination.
5. The Coimbatore Municipal Corporation boundary is considered as the limits of the study area.
6. The methodology does not question the relevance or the need for any of the existing proposals by the city, rather intends to integrate with the overall city framework.
7. The application of the methodology will require a minimum of the following resources:
   - Two Transport Planners, at least one of whom should have GIS expertise
   - One Urban Planner with basic GIS knowledge
   - One Urban Designer

Denotes Tentative Resource Needs per Corridor KM

I PREPARE BASE NMT NETWORK

A TIER 1 – PREPARE CITYWIDE CYCLING NETWORK PLAN — 4 HRS/KM

+

B TIER 2 – PREPARE INNER CITY CYCLING NETWORK PLAN — *Public Engagement* — 8 HRS/KM

+

C TIER 3 – PREPARE PEDESTRIAN PRIORITY NETWORK PLAN — *Public Engagement* — 8 HRS/KM

II FINALIZE COMPREHENSIVE NMT NETWORK PLAN AND COMPLETE STREET DESIGN MANUAL

A FINALIZE COMPREHENSIVE NMT NETWORK PLAN — *Public Engagement* — 1 HR/KM

+

B PREPARE CITYWIDE STREET DESIGN MANUAL — **as per requirements of the Coimbatore Street Design and Management Policy*

+

C ESTABLISH STATUTORY RELEVANCE — *Public Engagement*

III DEFINE NMT NETWORK PLAN PHASING

Public Engagement

2 HRS/KM

IV DESIGN NMT MEASURES FOR PRIORITY STREETS

Public Engagement

For the three scales of planning introduced above, the map below illustrates the proposed planning area boundaries:

Tier 1: Citywide Cycling Network - the full revised CCMC boundary, measuring 257 sqkm should be considered as the planning area.

Tier 2: Inner City Cycling Network - the proposed inner city planning area comprises of the most populated wards with highest number of employment destinations. A total road network of 115 km should be considered for network development within the Inner City Planning Area.

Tier 3: Pedestrian Hotspots - the proposed hotspots comprise of all major destinations where pedestrian accummulation was observed, and from stakeholder input.

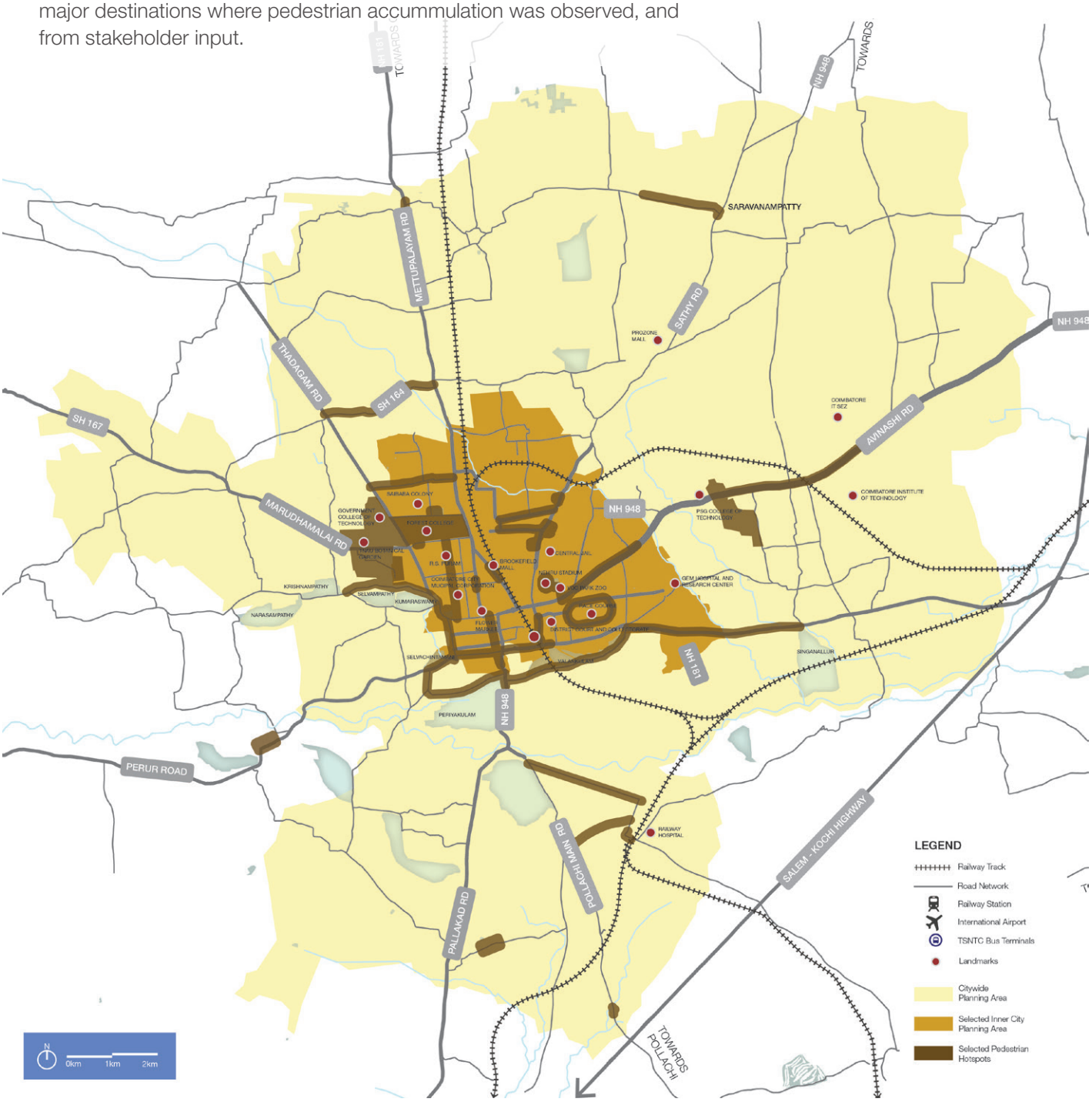


Figure 10: Overlapping scales of the Citywide and Inner City Planning Areas and Pedestrian Hotspots

03 /

STEP BY STEP NMT NETWORK PLANNING PROCESS

NMT Stakeholder Workshop in Coimbatore

PREPARE BASE NMT NETWORK

The Base NMT Network Plan shall be prepared as a three tiered Plan and the output shall consist of a spatial plan preferably comprising of three GIS shapefiles. The three tiers are:

Tier 1. Citywide Cycling Network Plan

Tier 2. Inner City Cycling Network Plan

Tier 3. Pedesstrian Priority Network Plan

The Base NMT Network should be developed using the same GIS base data that will include the following: (The Base GIS shapefile is prepared for Coimbatore - See Appendix C)

1. Boundaries of CCMC area, inner city planning area, and pedestrian hotspot area
2. Roads shapefile including all primary, trunk, secondary and tertiary roads
3. Rail tracks
4. Natural areas and waterbodies, streams
5. Signanized intersections
6. Elevation data
7. Black spots and fatal accident spots
8. TNSRTC Bus terminals and other bus stops
9. Preliminary identified primary, secondary, and tertiary nodes
10. Pedestrian hotspots with user survey feedback
11. Transport proposals and photoinventory

IA: TIER 1 CITYWIDE CYCLING NETWORK PLAN DEVELOPMENT

The Tier 1 Cycling Network Plan is to be developed for the entire municipal area under CCMC measuring 257 sq km. All data relevant to this step should be collected for this entire area.

Accounting for the lack of consistent and accurate data throughout the city, the process for the Citywide Cycling Network preparation is designed to be reliant only on readily available data that is easily verifiable. The more information that is available, the more informed the decisions for defining the cycling network would be. However, such data constraints must not stall the planning process.

Because the current numbers of cyclists in the city is low, the citywide cycling network must be planned to attract more cyclists by offering better safety and better comfort for short and long distance riding. The network identification must be based on this understanding. The detailed steps for developing the Citywide Cycling Network are explained below.

STEP 1: DEVELOP BASE ROAD NETWORK USING GIS

Prepare a road network on a GIS-compatible platform using readily-available road data. The road data should include all highways and arterial roads in the city. Each road should have the following attributes at a minimum:

- Existing Right Of Way width
- Proposed Right of Way width
- Relative Traffic Volumes and Speeds
- Road Configuration

In addition, the following supporting GIS layers should be compiled into the same database from sources such as Bhuvan satellite imagery, Master Plan, and the

Comprehensive Mobility Plan (CMP):

- Natural areas and waterbodies
- Elevation and physical barriers such as hillocks, rail crossings, etc.
- Number of intersections/ type of intersections
- Land uses
- Major urban and suburban centers and landmarks
- Blackspots and accident spots
- Future transpot related or public realm proposals, if any.

STEP 2: IDENTIFY CITYWIDE PRIMARY AND SECONDARY NODES

Mark citywide primary and secondary nodes on the base GIS Map. Preliminary marking of nodes is proposed in Figure 12.

Citywide primary nodes include:

- All major urban and suburban centers, including employment nodes
- All major transport terminals such as railway stations and bus terminals with large volumes of first and last mile riders

Citywide secondary nodes include:

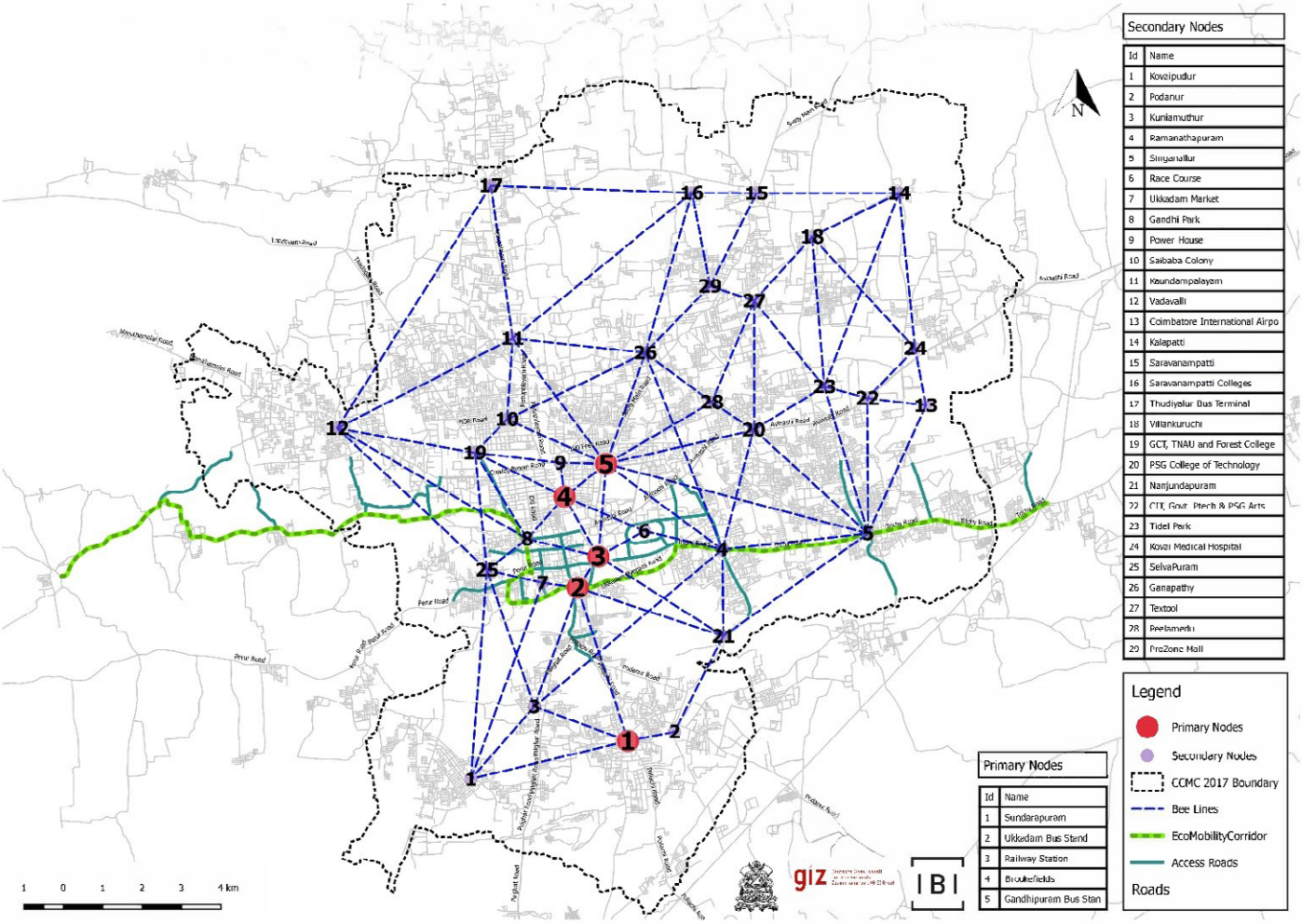


Figure 12: Preliminary Mapping of Primary and Secondary Nodes and Connecting Desire Lines

- All major landmarks with the potential to generate high cycle traffic, such as major college campuses, residential nodes, and recreation points

Sources to help locate the primary and secondary nodes include:

- City residents
- CCMC engineers
- Google/Bing Maps
- Existing Plans and Reports

STEP 3: CONNECT DESIRE LINES BETWEEN NODES (BEE LINES)

Draw out desire lines between the primary and secondary nodes. These demonstrate the desired movement patterns of people. Unlike traditional travel demand models, these desire lines are not weighted by volumes because they are not based on historic demand, rather they are intended to attract cyclist demand.

Preliminary desire lines are proposed in Figure 12.

STEP 4: IDENTIFY CYCLE ROUTE ALTERNATIVES

Identify 2-3 alternatives for the optimal cycle route for each corresponding desire line by selecting the best possible combination of streets and intersections after consideration of the following priorities:

- **The Shortest Route:** Run the shortest route length program on GIS or equivalent platform to find the best route based on route length. Some suggested programs for performing this function include:
  - GIS Network Assignment Tool
  - Google Maps direction tool
  - Naviki (www.naviki.org)
- **The Safest Route:** Identify the safest route by avoiding:
  - road links or intersections that are accident prone,
  - road links with high freight traffic volumes,
  - road links with frequent major intersections of two or more major roads

  Where the road links listed above cannot be avoided, ensure that the right of way is atleast 24m wide to accommodate fully segregated cycle tracks.
- **Natural Corridor Route:** Identify, where available, routes that run along natural waterfronts, heavily-planted parks and campuses, or along green infrastructure corridors. Such routes may not necessarily run along existing streets, but may use dirt roads instead,
- Also, refer to online real-time maps, such as Strava, to identify the routes preferred by cyclists.

STEP 5: REFINE ASSIGNMENT OF CYCLE ROUTES

This previous step may result in upto 2-4 possible routes corresponding to a single desire line. Select and refine a preferred route through an iterative process based on the following criteria:

1. **Accessibility to Schools and Institutions**: Select the road links that offer good accessibility to schools and other institutions, to where captive and or potential cyclists travel.
2. **Use of Existing or Assigned Cycle Routes**: Select the road links that are already demarcated for cycling either as part of the inner city cycling network or other initiatives.
3. **Detour Index**: Calculate the Detour Index (route length÷desire line length) of each route alternative. The preferred route shall be less than the threshold value of 1.2 to 1.6. The threshold value should be considered as 1.2 for flat terrains where the desire line is in the same orientation as the road network. For networks in sloped terrains and diagonal desire lines, higher threshold values may be allowed.
4. **Potential Improvements**: Propose minor road geometric improvements or addition of cycle-only links across public land, to improve route characteristics described above. Provision of new links can significantly improve the detour index.
5. **Bundling of Project Costs**: Where possible, cycle routes should be identified on road links, where other construction is proposed such as laying of underground infrastructure etc, so that cycling improvement can be bundled with other project costs.

In some cases where an existing road is not available to define a cycling route on, the desire line must be left as a desired connection, to indicate a need for a road connection in the Master Plan.

STEP 6: SITE VALIDATION

Parallel to Step 4, conduct a site validation visit to ensure that the proposed routes have the potential to serve as cycling routes. This will also allow the team to find the possibilities and opportunities for improvement.

IB: TIER 2 INNER CITY CYCLING NETWORK PLAN DEVELOPMENT

The Tier 2 Inner City Network Plan is to be established on a finer grained street network within the inner city planning area shown in Figure 10 and measuring 27.7 sq km. This network will consist of local cycling routes and will be overlaid on the city-wide cycling network, prioritizing safety, accessibility and directness over comfort and space availability.

The process defined for the Inner City Cycling Network preparation is reliant on the planner having the required knowledge of basic attributes related to NMT safety and comfort along the local road network. A GIS base network, including geo-tagged photos and basic attributes, is already prepared for a 115km long road network within the Inner City Planning Area.

The inner city cycling network must be planned to make it attractive for everyone to cycle for short inner city trips to school, work, or simple errands. The detailed steps for developing the Inner City Cycling Network are explained below.

STEP 1: DEVELOP BASE INNER CITY ROAD NETWORK USING GIS

Prepare a a detailed inner city road network on a GIS-compatible platform using the baseline road data shapefiles. This database should be built over the database developed for the citywide cycling network. The baseline road shapefiles contains all primary, secondary, and tertiary roads in the inner city, and for each road the following attributes are available:

i. Existing Right of Way (ROW) width
ii. Road and lane configuration
iii. Road pavement type – paved, unpaved, uneven/ broken pavement
iv. Presence of footpath – one side, both sides, no footpath
v. Quality of footpath - continuous, discontinuous or no footpaths
vi. Presence of street lighting – well lit, partially lit
vii. Presence of parking - one side, both sides, no parking
viii. Vending – street vending, no vending
ix. Shade and presence of trees

The planner should also add a congestion value, such as LOS (from the CMP) or a qualitative value (from crowdsourced platforms such as Google Traffic) to the above road network attributes.

In addition to the citywide GIS database and the detailed road network for the inner city, the following supporting GIS layers should also be added:

- Type of intersections and presence of signals
- Secondary and tertiary landmarks
- Bus routes and stops

STEP 2: IDENTIFY SECONDARY AND TERTIARY NODES IN THE INNER CITY

Within the inner city planning area, mark additional secondary and tertiary nodes on the base GIS Map.

Secondary nodes include:

- All major landmarks with the potential to generate high cycle traffic, such as major college campuses, residential nodes or recreation points.

Tertiary nodes include:

- All minor neighbourhood landmarks that have the potential to generate some cycle traffic, such as important employment, residential or recreational buildings, or local markets.
- In many cases, a primary node may include multiple tertiary nodes within its influence area, which should all be marked.

Sources to help locate the secondary and tertiary nodes include:

- City residents
- Site visits and Google/Bing Maps
- CCMC engineers
- Existing Plans and Reports

STEP 3: CONNECT DESIRE LINES BETWEEN NODES (BEE LINES)

Draw out desire lines between all nodes marked in the previous step as well as the nodes marked in the citywide planning stage. The planner should choose to draw a direct desire line between two nodes only if it is considerable shorter (70% or less) than a series of desire lines passing via other nodes.

As stated before, these desire lines are not weighted by volumes because they are not based on historic demand, rather they are intended to attract cyclist demand.

STEP 4: IDENTIFY CYCLE ROUTE ALTERNATIVES

Identify 2-3 alternatives for the optimal cycle route for each corresponding desire line by selecting the best possible combination of streets and intersections after consideration of the following priorities:

- **The Shortest Route:** Run the shortest route length program on GIS or equivalent platform to find the best route based on route length. Some suggested programs for performing this function include:
  - o GIS Network Assignment Tool
  - o Google Maps direction tool
  - o Naviki (www.naviki.org)
- **The Least Resistance Route:** Identify the route that minimizes passage along or across large scale infrastructure such as flyovers and large intersections where 3 or more arterial or district roads meet.
- **The Least Impedence Route:** Identify the route with the least impedence score, as calculated using the Bicycle Impedence Framework described below (Table 1). The framework incorporates an all-comprehensive measurement of aspects important to cyclists, including physical safety, security, and comfort. A bicycle impedance value may be assigned to each link in each direction (depending on data availability) and intersection. The weightage for each parameter in the impedance framework is suggestive and may be modified based on stakeholder inputs.

STEP 5: REFINE ASSIGNMENT OF CYCLE ROUTES

This method may result in upto 2-4 possible routes corresponding to a single desire line. Select and refine a preferred route through an iterative process based on the following criteria:

1. **Accessibility to Schools and Institutions**: Select the road links that offer good accessibility to schools and other institutions, to where captive and or potential cyclists travel.
2. **Use of Existing or Assigned Cycle Routes**: Select the road links that are already demarcated for cycling either as part of the citywide cycling network plan or other initiatives.
3. **Detour Index**: Calculate the Detour Index (route length÷desire line length) of each route alternative. The preferred route shall be less than the threshold value of 1.4 to 1.8. The threshold value should be considered as 1.4 for flat terrains where the desire line is in the same orientation as the road network. For networks in sloped terrains and diagonal desire lines, higher threshold values may be allowed.
4. **Potential Improvements**: Propose minor road geometric improvements or addition of cycle-only links across public land, to improve route characteristics described above. Provision of new links can significantly improve the detour index.
5. **Bundling of Project Costs**: Where possible, cycle routes should be identified on road links, where other construction is proposed such as laying of underground infrastructure etc, so that cycling improvement can be bundled with other project costs.

In some cases where an existing road is not available to define a cycling route on, the desire line must be left as a desired connection, to indicate a need for a road connection in the Master Plan.

STEP 6: COMMUNITY INPUT AND SITE VALIDATION

Parallel to Step 4, conduct a site validation visit to ensure that the proposed routes have the potential to serve as cycling routes. This will also allow the team to find the possibilities and opportunities for improvement.

Also, conduct community workshops to gather input on the selected routes. The community workshops should be conducted in neighbourhood schools,

municpal ward offices, and other community facilities. The community workshops should be primarily used to help in selecting and refining the preferred route. The route alternatives should be prepared before suggesting them to the public.

Table 1: Suggested Bicycle Impedence Framework for Inner City Cycling Network Planning

(adapted from the SSEF Planning and Design Guideline for Cycling Infrastructure)

LEVEL 1	LEVEL 2	DESCRIPTION	IMPEDANCE SCORE (SCORE FROM 1 TO 10)	% WEIGHTAGE SUGGESTED
Physical Safety	Black Spots	Links and intersections identified as accident prone need to be marked as blackspots. The spots with highest observed accidents should have the highest impedance score		20%
	Heavy Vehicle Volumes	Links with high traffic movements of heavy vehicles such as buses and trucks are dangerous and will have higher impedance values		10%
	Motor Vehicle Congestion	Links where motor vehicle volumes are higher by 2 or more times the design capacity should have higher impedance value		10%
Security	Large Segregated Land Use Parcels	Links that are flanked with inactive land uses or large, continuous and opaque boundary walls should have higher impedance values		5%
	Availability of Lighting	Dimly lit or unlit links will have a higher impedance value		10%
	Deserted Streets	Links where no pedestrians or cyclists are seen, probably due to lack of active frontages, will have a higher impedance value		5%
Comfort Barriers	On-street parked vehicles	Presence of high on-street parking may be an impedance to cycling. Links with very high parking should be given a high impedance value.		5%
	Poor Pavement Quality	Asphalt and concrete paving is preferred for cycling. Links with unpaved roads or paver blocks should be given a high impedance value		10%
	Steep Gradient	Links with steep gradients should have high impedance value		5%
	Pedestrian interference	Links with extremely high pedestrian volumes due to presence of vending or retail should be given a high impedance value.		5%
	Lack of Shade	Links with insufficient tree cover and no shade should be given a high impedance value		10%
ROW Availability	Space Availability for Cycly Lanes or Tracks	Links that are narrower, i.e. less than 15m, may be assumed to have limited availability of space for cycle lanes or tracks and will therefore have higher impedance values		5%

IC: TIER 3 PEDESTRIAN PRIORITY NETWORK PLAN PREPARATION

The Tier 3 Pedestrian Priority Network is the final layer in the Comprehensive NMT Network. The pedestrian network definition approach is based on the assumption that every street should have a minimum sidewalk of 1.5m width on both sides or 2m width sidewalk on one side as per IRC Pedestrian Facility requirements. Only in areas where pedestrian traffic is extremely high and pedestrian level of service (as per IRC guidelines) is low, enhanced pedestrian facilities should be proposed. The intent of this task is to demarcate a pedestrian network for which enhanced pedestrian facilities are required.

Because pedestrian activity in Coimbatore is already high, the pedestrian priority network definition should be based on existing demand. The potential pedestrian hotspot locations should be shortlisted based on the parameters explained in Section 2.1.2.

Within these hotspot buffer areas, the pedestrian priority network should be defined using the process described below.

STEP 1: ASSIGN A HOTSPOT TYPOLOGY TO EACH SHORTLISTED HOTSPOT

Assign a typology for pedestrian hotspots to streamline the kind of studies or surveys to be conducted and the kind of network planning and designing approach to undertake. For example, campuses should be looked as potential pedestrian cut-throughs, whereas retail streets will need considerations for pedestrianization and parking.

Due to the characteristic nature of activities in Coimbatore, the pedestrian hotspots could be identified into the following typologies:

1. **Station area zone:** Predominantly to support the first n last mile connectivity for all transit stations, this zone is defined around the transit terminals. These zones should have minimum parking allowances and high standards of pedestrian facilities, supported with informal vending where possible.

   Example: Coimbatore Junction, Ukkadam bus stand, Airport etc.

2. **Campus zone**: Large campuses are included in this category to enhance and promote the use of NMT among the students. It also provides an opportunity to integrate other city wide NMT planning initiatives with the institutions, which otherwise pose as barriers. Campuses offer excellent opportunities to plan natural NMT cut-throughs with no interference from commerce or vehicles.

   Examples: GCT, Forest College, TNAU, PSG College etc.

3. **Retail zone:** is defined to address the needs of retail streets and destinations in the city to operate in conjunction with its support system around them to facilitate, secondary services, parking, movement of goods and access routes for pedestrians.

   Example: Townhall area planning unit, DB road, Brookefield mall, Fun Republic mall, Podanur main road etc.

4. **Religious/cultural zone:** The religious centres support an ecosystem around them that demands NMT friendly precincts to be defined accordingly. The various activities including, processional routes, supporting retail, event grounds, kalyan mandap etc together need to be accommodated in this type of hotspot.

   Example: Arulmigu Vinagar temple, Patteeswarar swamy temple, Palamalai Ranganathar Temple etc

5. **Lakefront zone:** As the city has numerous network of lakes, each lake has its own need for addressing the access concerns, conservation needs & development potential. These type of hotspots will prioritize ecological and recreational needs.

   Example: Periyakulam, Singanallur, Kurichikulam etc.

STEP 2: SELECT ROADS FOR PEDESTRIAN PRIORITY NETWORK

Within the basic GIS road shapefile, identify the road network including ALL roads within the 500m hotspot buffer zones. From among these roads, select the roads where pedestrian LOS would be D or worse in peak conditions with a minimum footpath width as per the IRC pedestrian LOS guidelines shown below:

Table 2: Pedestrian LOS standards as per IRC 103:2012

LOS	PEDESTRIAN SPACE (SQM/P)	FLOW RATE (PERSON/MIN/M)
A	> 4.9	< 12
B	3.3 - 4.9	12 - 15
C	1.9 - 3.3	15 - 21
D	1.3 - 1.9	21 - 27
E	0.6 - 1.3	27 - 45
F	< 0.6	varies

The following assumptions should be used for priority network selection:

1. Calculate minimum footpath area by multiplying road link length with 2M (for roads less than 15m width) or 3M (for roads morth than 15m width).
2. Extrapolate peak hour pedestrian volumes at intersections from CMP data for all roads, assuming 80% of pedestrian volumes travel on spinal roads and 20% pedestrian volumes are distributed on additional internal roads.
3. Calculate pedestrian space by dividing extrapolated pedestrian volumes by minimum footpath area
4. Assume pedestrian flow rates of 21 per/min/m or more for all roads with schools/colleges of minimum 500 children per gate.
5. Select all roads where pedestrian space is calculated as 1.9 sqmpp or less, or pedestrian flow rates are 21 per/min/m.
6. In addition to the streets selected by pedestrian volumes, select all missing links to form an interconnected street network. This should include any cut-through streets inside campuses.

STEP 3: DEVELOP BASE ROAD NETWORK

For the identified pedestrian priority network, add the following attributes to the GIS road shapefile to assist in pedestrian priority definition:

- Existing RoW width - from satellite imagery)
- Presence and quality of footpaths - from photo-inventory
- Adjacent primary land use - from land use data and photo-inventory
- Presence of parking and/or street vending - from photo-inventory
- Pedestrian LOS - as calculated previously
- Functional hierarchy within the citywide road network - from CMP

In addition to the above physical characteristics, also note intangible or socio-cultural attributes, where applicable, including:

- User preferences - from user preference survey
- Historical significance - old city streets etc.
- Cultural significance - for example event venues, processional route corridor, etc.

STEP 4: DEFINE PEDESTRIAN PRIORITY HIERARCHY

Define the Pedestrian Street Hierarchy, as proposed in Table 3 for the selected pedestrian priority network. In addition to the suggested street characteristics, consider the following criteria in identifying the appropriate priority hierarchy:

- Does the street serve a major mobility function for bus routes and/or motorized vehicles?
- Will the economy related to the adjacent land uses benefit or suffer because of pedestrianization?
- Are there other alternative routes to divert traffic?
- Are there other alternative streets or new links, which can be added to the network to reduce pedestrian volumes on roads that cannot accommodate enhanced pedestrian priority?

STEP 5: COMMUNITY INPUT AND SITE VALIDATION

Parallel to Step 4, conduct a site validation visit to ensure that the proposed priority assignments have the potential to serve the purpose. This will also allow the team to find the possibilities and opportunities for improvement.

Also, conduct community workshops to gather input on the pedestrian priority network. The community workshops should be conducted in neighbourhood schools, municpal ward offices, and other community facilities. The community workshops should be primarily used to help in selecting and refining the the priority network selection and assignment of priority hierarchy. The priority assignments should be prepared before suggesting them to the public.

Table 3: Suggested Pedestrian Priority Hierarchy

S. NO.	STREET TYPE	SUB-CATEGORIES	PREFERRED ROW	PEDESTRIAN COUNT (AS PER IRC CODES)	CYCLISTS COUNT (AS PER IRC CODES)	VEHICULAR FUNCTION	FOOTPATHS	CYCLE TRACKS
1	Pedestrian-Only Street		<12m	very high (>3600)	recreational cyclists, moderate volume	car-free zone	entire street to act as pedestrian zone	NMT shared zone, cycle tracks optional
2	Pedestrian Priority Street	Shared Street	upto 18m	high (3600-2250)	low speed, high	slow moving traffic	wide and continuous footpaths at grade with vehicular lanes	shared lane
		Transit Priority Street	upto 18m	high (3600-2250)	high speed, moderate	dedicated transit lane	wide and continuous footpaths	shared use path
		Traffic Calmed Street	upto 18m	high (3600-2250)	moderate	slow moving traffic	wide and continuous footpaths with seamless movement across travel lanes	shared use path
3	Balanced Street (Complete street)		18m - 24m	moderate (2250-1800)	moderate	moderate volume	continuous footpaths	dedicated cycle track
4	Vehicular Priority Street		above 24m	low (<1800)	high speed cyclists, moderate	high volume	minimum footpaths as per IRC Code	dedicated cycle track with dedicated signals & safety buffer

STREET CHARACTERISTICS						
NO. OF LANES	ON-STREET PARKING	LANDSCAPE	PUBLIC AMENITIES	STREET LIGHTING	MEDIAN	MATERIALI TEXTURE
0, emergency access only	nil, supported by offsite provision of MLCP or similar alternatives	shaded street with integrated landscape elements for seating and recreation	Seating, toilets, vending zones, dustbins, pedestrian signage & wayfinding	4.5m height pedestrian lighting along with other pedestrian oriented lighting like bollards, floor lighting etc.	no median	hard-paved surface (cobblestone, paver blocks or tiles)
narrow lanes (1+1)	no on-street parking	shaded street	Seating, toilets, vending zones, dustbins, pedestrian signage & wayfinding	4.5m height pedestrian lighting	no median	paved street
narrow lanes (1+1)	no on-street parking	shaded street	Seating, toilets, vending zones, dustbins, pedestrian signage & wayfinding	4.5m height pedestrian lighting along with high intensity lighting for transit stops	transit lane dividers	paving variation between travel lane and footpaths with relevant material for transit lanes
narrow lanes (1+1)	paid on-street parking	shaded street	Seating, toilets, vending zones, dustbins, pedestrian signage & wayfinding	4.5m height pedestrian lighting	no median	paving variation between travel lane and sidewalk
Narrow lanes (2+2) max.	where feasible	shaded street with landscape buffer	At strategic locations: Seating, toilets, vending zones, dustbins, pedestrian signage & wayfinding	Provision for both travel lane lighting (8m lights) & pedestrian lighting at 4.5m height	median with pedestrian refuge	Hard paved footpaths, concrete cycle tracks and relevant material for travel lanes
as per vehicular demand, without compromising on minimum NMT needs	where feasible	shaded street with adequate landscape buffer for NMT zone	minimal provision for seating, dustbins & adequate signage	Provision for both travel lane lighting (8m lights) & pedestrian lighting at 4.5m height	landscaped median with pedestrian refuge	Hard paved footpaths, concrete cycle tracks and relevant material for travel lanes

FINALIZE COMPREHENSIVE NMT NETWORK PLAN AND COMPLETE STREET DESIGN MANUAL

The final step of network preparation is to compile the 3 network layers together and prepare a Comprehensive NMT Network Plan. Because minimum pedestrian standards are assumed to be applicable to the ENTIRE road network, a Complete Street Design Manual should be included as part of the Comprehensive NMT Plan.

IIA: FINALIZE COMPREHENSIVE NMT NETWORK PLAN

Overlay and consolidate the three layers developed through the city wide "Strategic" bicycle network development, inner city "Local" bicycle network development, and "Pedestrian Priority" network development. Any overlaps or conflicts should be addressed to refine the respective layer. The Final NMT Network Plan should have the following LEGEND (sub-types may be changed based on planning results):

1. Strategic Cycling Routes:
   - ***Sub-type 1: On-road protected cycle track***: This includes protected cycle lanes that run alongside the main travel lanes.
   - ***Sub-type 2: Off-road cycle track***: This includes cycle-only tracks that run independent of roadways, either through natural areas, or along streams or pipelines. Such routes offer safer and shorter routes to cyclists compared to the main traffic.
   - ***Sub-type 3: Grade separated cycle track***: This includes cycle-only bridges or similar infrastructure that separates cycle traffic from major conflict zones.
2. Local Cycling Routes:
   - ***Sub-type 1: On-road protected cycle tracks***: This includes protected cycle lanes that run alongside the main travel lanes.
   - ***Sub-type 2: On-road shared and traffic calmed cycle streets***: This includes roads that are traffic-calmed through application of road diets or other visual cues that force motorists to slow down and give priority to cyclists and other types of non-motorized traffic.
   - ***Sub-type 3: Off-road multi-use cycle routes***: This includes pedestrian pathways and cycle tracks that run independent of roadways, either through natural areas or through neighbourhoods.

Figure 13: On-road protected cycle track example in Pune along the side of a road.

Figure 14: Off-road cycle track and pedestrian pathway example in Bogotá through low income neighbourhood.
Source: ITDP, China

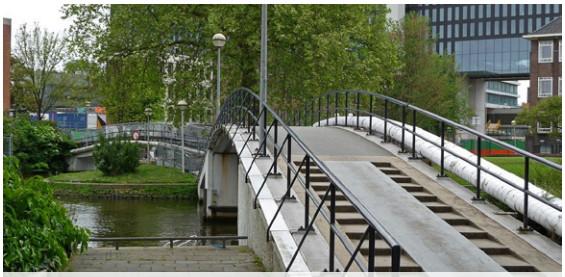


Figure 15: A foot and bicycle bridge in Amsterdam

Figure 16: Proposed traffic-calmed street in Bangalore

3. Pedestrian Priority Routes:
   - ***Pedestrian-only street***: This includes streets where all motorized traffic is blocked and only pedestrian movement is allowed.
   - ***Pedestrian priority street***: This includes streets where pedestrian mobility is prioritized through application of wide footpaths and pedestrian-friendly amenities.
   - ***Complete street***: This includes large streets where all modes are accommodated in a safe manner.

IIB: PREPARE CITYWIDE COMPLETE STREET DESIGN MANUAL

To address the dismal state of pedestrian facilities throughout the city, it is important to build pedestrian-friendly design capacity within the road engineering department in CCMC. For this purpose, the Coimbatore Street Design and Management Policy recommends preparation of a Complete Street Design Manual at the citywide scale for adoption by CCMC. The Manual should include minimum standards for pedestrian facilities for each type of roadway (categorized by function or Right-of-Way (ROW)).

At a minimum, the Design Manual must include:

- Minimum footpath width including clear width;
- Minimum and maximum kerb heights;
- Type of cycle facilities
- Minimum and maximum cycle lane widths;
- Tree planting requirement for different ROWs;
- Minimum spacing between trees;
- Minimum pedestrian illumination;
- Minimum universal accessibility standards, including ramp slopes, distance between bollards, etc;
- Paving material standards for footpaths, cycle tracks and other spaces;
- Minimum spacing between trash bins, cycle parking stands, and drinking water fountains;
- Details for manhole covers and utility box locations; and
- Details for bus stop placement.

Figure 17: Pedestrian-only street in Curitiba

Figure 18: Pedestrian-priority street in Pune

Figure 19: Proposed Complete Street in Bhubaneswar

IIC: ESTABLISH STATUTORY RELEVANCE

The finalization of the Comprehensive NMT Plan is dependant ultimately on the statutory relevance of the Plan. It is recommended that statutory relevance be sought at two levels:

Level 1: Incorporation of proposals in Master Plan - The Master Plan adopted by the CCMC must include the NMT Network as an overlay, so that future developments are guided by the proposals. For this, minimum ROW should be defined for each NMT network sub-type to incorporate into Master Plan. In addition, the Development Control Regulations (DCRs) should include a clause for "NMT Route Easements", wherein a property owner, on whose land an NMT desired route is marked, will be required to give up part of his land for construction of the NMT route when he decides to develop.

Level 2: Incorporation of proposals in CCMC Budget - The CCMC Budget-making committee should accept the NMT proposals for incorporation in future budgets as per the phasing plan.

DEFINE NMT NETWORK PHASING PLAN

After preparation of the Comprehensive NMT Network Plan and Citywide Complete Street Manual, define a phasing timeline for each route, including identification of priority streets and intersections from within the Network Plan. This will help to define the phasing strategy, including budgeting needs for the CCMC every year. The phasing plan should also form the basis of establishing time-bound targets. The following steps are suggested for defining priority streets and intersections

Step 1: Develop a prioritization strategy by evaluating the readiness of implementation of each NMT route. The evaluation may be based on criteria including:

- The urgency of the need, derived from the social, environmental, and economic costs of "doing nothing".
- Ease of implementation based on land availability, project scale and interagency coordination requirements.
- Estimated budget and availability of funding.
- Risk potential and possibility of opposition.

Step 2: Prepare a compendium of NMT routes, and rate them within a prioritzation matrix as suggested below in Table 4. Weightages can be applied to the prioritization matrix, based on the level of importance of different criteria shown below.

1. Impact on Safety and Security
2. Impact on Efficiency of Public Transport and NMT Mobility
3. Contribution to the NMT Network
4. Ease of Construction and Maintenance

Table 4: Suggested Format for Evaluation/ Prioritization of NMT Interventions

(adapted from the SSEF Planning and Design Guideline for Cycling Infrastructure)

CRITERION	ROUTES				
	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5
Accidents (safety) (Rate on a scale of 1 to 20 for each proposal where 20 is highest priority for proposals with the highest possibility of reducing accidents and improving NMT safety and 1 is the lowest)					
Current and Potential NMT Volume (efficiency) (Rate on a scale of 1 to 15 for each proposal where 15 is highest priority for proposals that will serve large NMT volumes or improve the efficiency of sustainable modes such as bus or rail transit modes and 1 is the lowest)					
Contribution to the Network (Rate on a scale of 1 to 10, for each proposal; where relative points are awarded to links/intersections, such as 10 points to the link connecting directly between one or more existing or selected routes, 1 point for links which are isolated or at considerable distance from routes already developed or selected for development)					
Ease of Construction and Maintenance (cost) (Rate on a scale of 1 to 5 for each proposal, where 5 is highest priority for proposals with less obstructions/complications; or those within the same municipality limit as well under the same development body; or roads which are new developments or proposed to be re-developed with a sanctioned budget which includes provision for NMT infrastructure and 1 is the lowest for proposals with high independent costs and complications related to implentation)					
Total Points					

Priorities for development may be based on the total points allotted to each route/corridor, with routes having higher points placed higher on the priority.

Step 3: Prepare a phasing stratey by identifying the following:

- **Long-term projects** - those that rate low on safety impact as well as ease of implementation should be marked as long-term projects (5-10 years)
- **Mid-term projects** - those that rate moderate on all prioritization criteria should be marked as mid-term projects and laid out for implementation in the next 2-5 years for implementation. Projects that offer political gain can be highlighted.
- **Short term projects** - these include projects for immediate implementation such as those that will have a substantial impact on safety or NMT connectivity. Among the short term projects, the planner should identify:
  - **Tactical Urbanism Projects**: temporary time-bound changes that are cheap to implement and precede long term interventions in the future;
  - **Pilot Projects**: that are experimental in nature and may help in developing better designs for future projects of a similar nature; and
  - **Signature Projects**: that are expected to attract very little opposition while also attracting interest in NMT.
- An evaluation system must be put in place for all short term interventions to study successes and failures and improve design considerations in the future. Because the Ecomobility Corridor and Model Roads are already under implementation, the evaluation strategy must be developed for these two projects.

Figure 20: An example of Tactical Urbanism showing Temporary Street Closure at Madison Square in New York before Pedestrianization was implemented.
Source: NYC DOT

IV DESIGN NMT MEASURES FOR PRIORITY STREETS

For the selected Priority Streets, follow the steps below to design context-appropriate measures:

Step 1: Identify design strategies viz-a-viz design gaps, user needs and preferences.

To identify design gaps, conduct site reconnaissance surveys. In addition traffic and pedestrian volume surveys, activity mapping, and user surveys may also be conducted for collecting more evidence. See Appendix A for summary of survey findings at selected spots.

The surveys should help identify key issues along the street. For each issue, a design strategy must be identified. Additional design strategies should be proposed for value-based propositions such as placemaking, providing shade and natural drainage measures, integration with Smart City Proposals, etc.

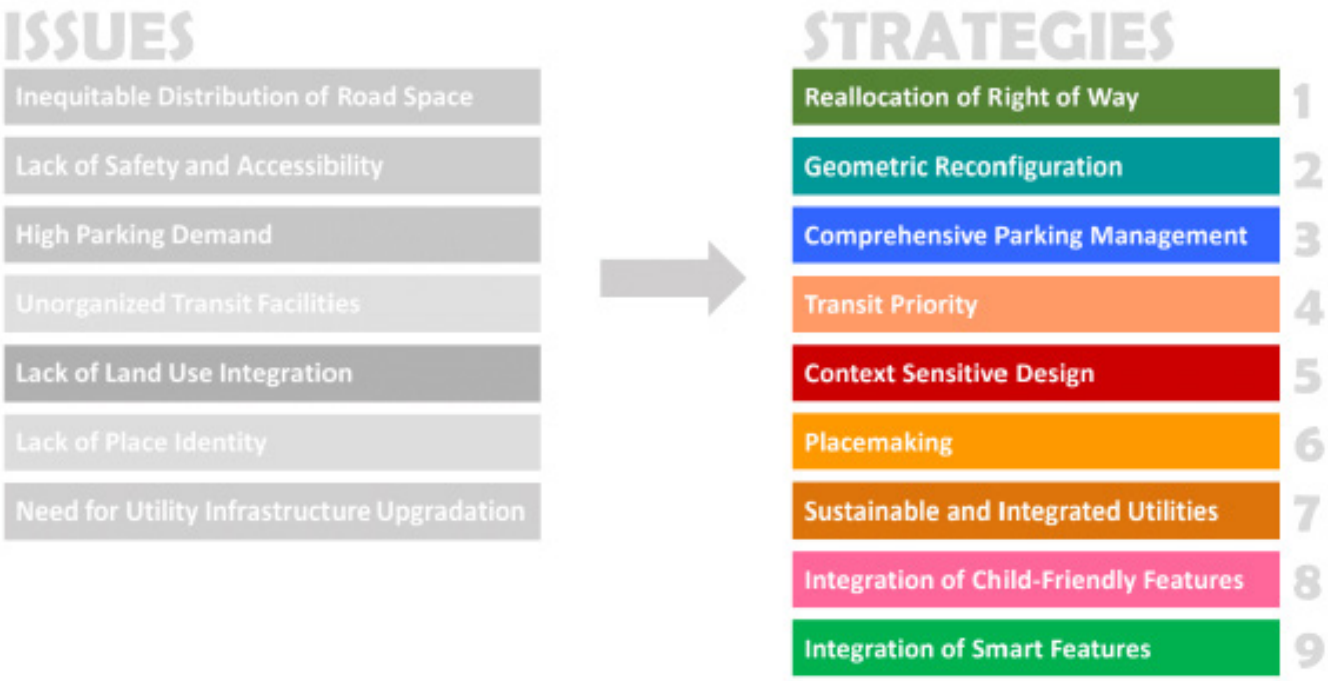
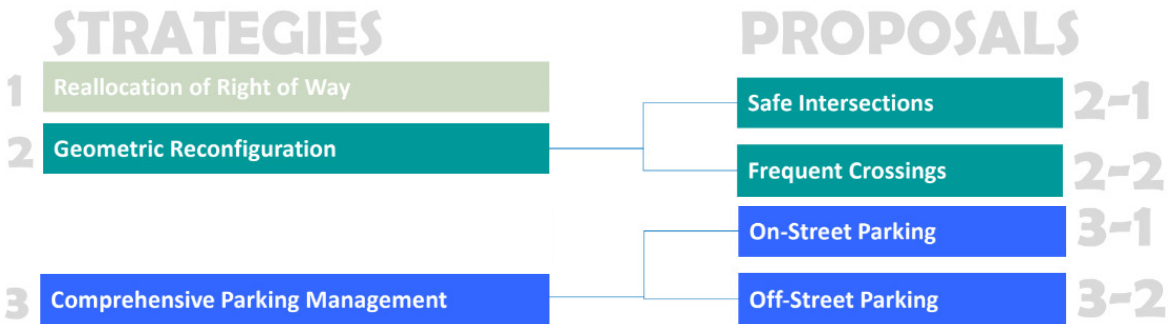


Figure 11: An illustration of identification of street-specific issues and corresponding strategies

Step 2: Identify key proposals under each design strategy suitable to the street context and existing constraints as shown below.



Step 3: Select typical street and intersection templates from the Complate Street Guidelines or the ITDP Better Streets Better Cities Guide, based on the design strategies and proposals identified earlier

Step 4: Develop a design solution that contextualizes the typical street template to the prevailing opportunities and constraints, and adheres to the NMT Guiding Principles, as far as possible.

Note: View Menu of Design Elements for NMT in Appendix B

Step 5: Make note of NMT supportive plans that need to be developed at larger scales in order to justify the design measures for the priority streets. Examples of NMT supportive plans include:

- Parking Management Plans
- Traffic Circulation Plans
- Transit Priority Plan
- Street Vendor Plan
- Area Development Plans in cases where land readjustment or development is applicable

Step 6: Prepare a monitoring and evaluation framework in accordance with the project goals to evaluate if the project design was able to serve the project needs for encouraging cycling and providing safe access to pedestrians. This is recommended to encourage higher community support as the NMT network is built out.

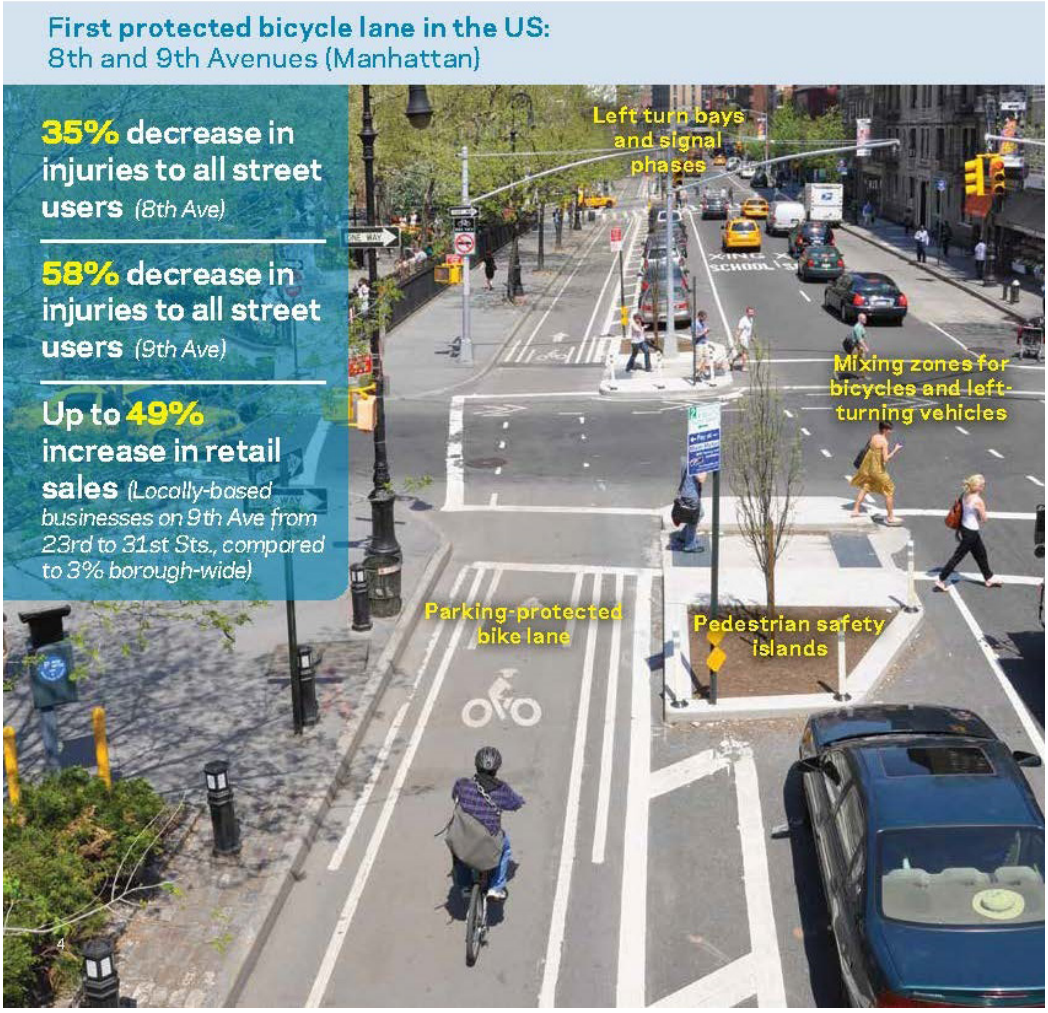


Figure 21: A page from "Measuring the Street", a report released by NYC Department of Transportation reporting on the impacts of streetscape changes on several New York streets to make them safer for NMT | Source: NYCDOT


Cell World

APPENDIX A:

WHAT WE HEARD - SURVEY DOCUMENTATION

APPENDIX B:

MENU OF DESIGN ELEMENTS

APPENDIX C:

DATA COMPILATION