SUSTAINABLE CITIES THROUGH TRANSPORT

Transport Budget Proposals for Coimbatore, Madurai, Salem, Tiruppur and Tiruchirappalli

Prepared by the Institute for Transportation and Development Policy
with support from ICLEI South Asia
for the Commissionerate of Municipal Administration

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Contents

1. Executive Summary

The cities of Tamil Nadu are witnessing rapid motorisation, along with increased congestion and pollution. Public transport service is often unreliable, infrequent, and inadequate to meet demand, resulting peak-hour overcrowding and a shift toward informal paratransit services. Walking and cycling are critical modes for many urban residents in Tamil Nadu, providing essential low-cost mobility. However, dedicated pedestrian and cycle facilities are almost non-existent in most cities.

To address these mobility challenges, the Commissionerate of Municipal Administration (CMA) launched Sustainable Cities through Transport, a planning process to develop municipal transport budgets for five of the largest city corporations in Tamil Nadu after Chennai including Coimbatore, Madurai, Tiruchirappalli, Tiruppur, and Salem. The process was organised in partnership with the Institute for Transportation and Development Policy (ITDP) and with support from ICLEI–SA South Asia, adequately facilitated by inputs from municipal teams in the cities involved. The process sought to identify ways to provide safe, affordable, quick, comfortable, and reliable access for the growing number of city residents. In harmony with the 2006 National Urban Transport Policy, the process seeks out to achieve a more equitable allocation of road space by incorporating a focus on sustainable transport in the planning and budgeting stages.

1.1. Planning process

Sustainable Cities through Transport included the following stages:

- **Planning Session** on 19 November 2013 in Chennai. This half-day planning session brought together a core team of officials from each city. The teams were presented with a list of city-specific transport data requirements for the planning process. Each team reviewed the data collected by CMA and ITDP and began gathering the remaining information.

- **Surveys** were conducted by ITDP and ICLEI–SA in each of the five cities in November 2013 in consultation with the Municipal officials. ITDP and ICLEI–SA staff conducted detailed counts of share auto and city bus passenger volumes along major bus and auto routes in each city. The team visited key public transport nodes, identified areas with major pedestrian volumes, and observed on-street parking management practices.

- **Transport Budgeting Workshop** on 28-29 November 2013 in Coimbatore. The first day of the workshop was opened with a public lecture by Enrique Peñalosa, former mayor of Bogotá, Colombia, and sustainable urban development expert. The Peñalosa administration implemented TransMilenio, a citywide bus rapid transit system (BRT) that now moves over 1.6 million passengers per day, as well as a wide-ranging network of cycle tracks, footpaths, and public spaces. The day continued with presentations on key aspects of sustainable transport planning, including non-motorised transport, public transport, and travel demand management. The second day of the workshop consisted of breakout sessions for city teams from Coimbatore, Madurai, Tiruchirappalli, Tiruppur, and Salem, who worked collaboratively to develop conceptual transport plans and municipal budgets for their respective cities with support from team members of ITDP and ICLEI–SA (Figure 1).

- **Site visits and meetings** were held in each city to refine the transport proposals identified during the Transport Budgeting Workshop. ITDP and ICLEI–SA met with city Commissioners and Engineers to assess the feasibility of project proposals based on their

comprehensive local knowledge (Figure 2). The team also worked with city officials to set priorities and identify projects for immediate implementation.

- **Review of Final Budget Proposals** on 23 January 2014 in Chennai. At this workshop, cities presented their final sustainable transport plans to CMA and the Department of Municipal Administration and Water Supply. Municipal commissioners presented their transport goals, outlined 5-year strategic plans, and discussed specific year 1 project proposals to inform the 2014-2015 state and municipal transport budgets.

Figure 1. Officials from Coimbatore discuss the city's transport strategy during the Transport Budgeting Workshop (left). The ITDP and ICLEI-SA team visits the proposed BRT corridor in Tiruchirappalli with officials from the Municipal Corporation, Traffic Police, and Local Planning Authority (right).

1.2. Transport challenges

The Tamil Nadu cities are characterised by high non-motorised transport mode shares, significant levels of public transport use, and a growing paratransit share.

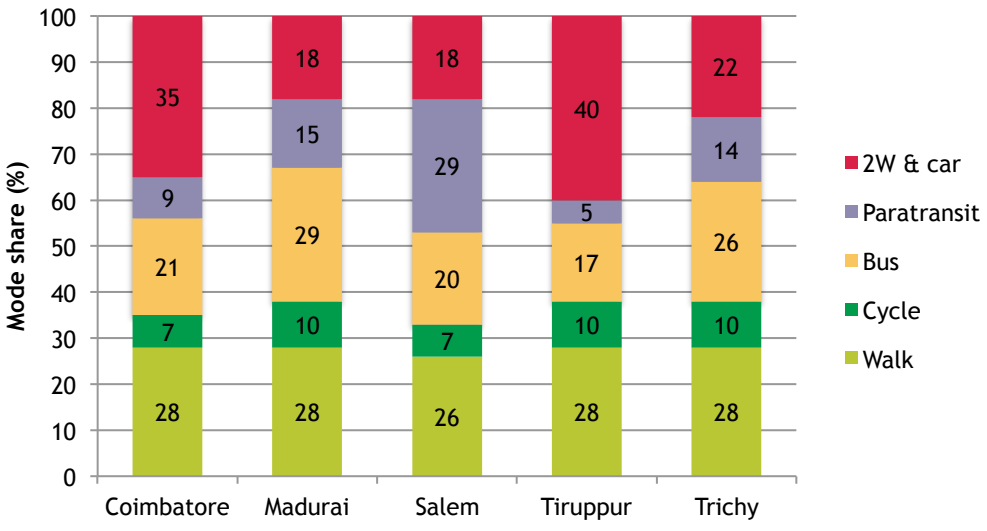


Figure 2. Existing shares estimated for the five cities.

Unless action is taken, the share of sustainable transport modes—cycling, walking, and public transport—is expected to decline in favour of greater use of two wheelers and cars. Cities identified several transport issues that need immediate attention.

- **Lack of facilities for non-motorised transport**. Most streets lack dedicated facilities for pedestrians and cyclists. Footpaths, where present, suffer from design flaws such as inadequate width, abrupt level differences, and obstructions. As a result, people are forced to walk in the carriageway.

- **Inadequate public transport**. Recently, most public transport in Tamil Nadu comprises of bus services operated by the Tamil Nadu State Transport Corporation (TNSTC) along with shared auto-rickshaws and some private bus services. None of the public transport modes are of high quality. As growing use of personal motor vehicles lead to worsening congestion, buses and share autos become slower and less reliable. Customers look for alternatives, resulting in a declining mode share for public transport.

- **Lack of vehicle restriction**. On-street parking was uniformly provided free of cost in all of the cities. As a result, the cities do not receive compensation for this use of valuable public space. Chaotic vehicle parking compromises the mobility function of streets, occupying space that could otherwise facilitate mobility of public transport, pedestrians, and cyclists.

Figure 3. Poorly designed footpaths near Coimbatore Junction station force pedestrians to walk in the carriageway (left). On Bharathiar Salai in Tiruchirappalli, unorganised parking occupies much of the right-of-way (right).

1.3. Transport goals

As part of the Sustainable Cities through Transport process, city officials discussed how they would like to see their cities' transport systems change over a five-year time horizon. These transport visions formed the basis for the selection of specific projects for implementation. The following themes emerged from the discussion.

1.3.1. Improve public transport

During the Transport Budgeting Workshop, the cities determined that the solution to this trend is to invest heavily in public transport and ensure that public transport services are attractive even to private vehicle users.

1.3.2. Support walking & cycling

The cities also sought to expand walking and cycling to ensure basic low-cost mobility and provide access to public transport. Non-motorised transport (NMT) modes are the most viable option for short trips and use scarce road space more efficiently than private motor vehicles. Cyclists use less than a third of the road space used by private motor vehicles, and pedestrians use less than a sixth.

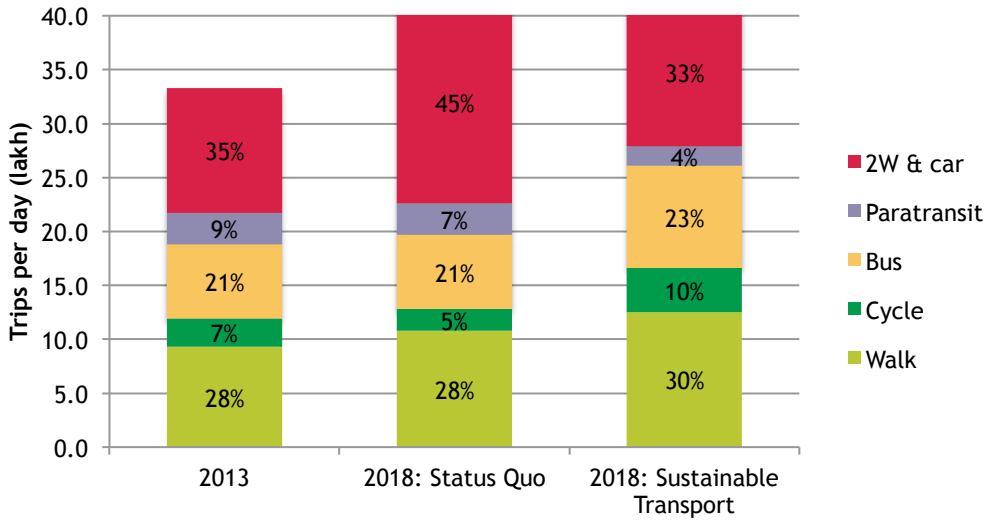


Figure 4. Each city compared existing trends with the mode shares that can be achieved if transport investments prioritise sustainable modes. For example, Coimbatore (displayed above) will see a decline in walking, cycling, and use of public transport under the status quo. Coimbatore officials set mode a goal of reversing these declines and achieving an increase in sustainable transport use over the next five years.

1.3.3. Improve safety

The cities aim to ensure zero fatalities per year from traffic crashes. Participants recognized that user awareness, while an essential element of a holistic approach to road safety, is only one component of an effective strategy to address road safety. Such an approach must also address existing design of streets, which seriously compromises the safety of citizens on any transport mode. Most streets in Tamil Nadu cities lack of footpaths, forcing pedestrians to walk in the carriageway. Wide, dedicated footpaths along with cycle tracks along major streets are essential to improve safety for NMT users. The introduction of a BRT also can improve road safety by separating buses from slower moving non-motorised vehicles.

1.3.4. Enhance public transport accessibility

Another common goal was to increase the reach of high quality public transport, ensuring that a majority of city residents within a five-minute walk of formal public transport. Expanding the catchment area of the public transport system will make sustainable modes a more viable means of

transport for more citizens.

1.3.5. Improve air quality

Cities also set a goal of reducing air pollution. Personal motor vehicles are a major source of particulate matter, nitrogen oxides, and other critical pollutants that compromise respiratory function and are associated with chronic diseases such as lung cancer and asthma. A shift to sustainable transport would help address these serious public health concerns by reducing harmful vehicle emissions.

1.4. Transport investments

The cities identified investment priorities to help achieve the goals outlined above. Key strategies identified by the cities included improvements to public transport service (especially bus rapid transit), new facilities for cycling and walking, and measures to manage the use of personal motor vehicles. Common strategies are outlined below.

1.4.1. Bus Rapid Transit (BRT)

The cities identified bus rapid transit (BRT) as a key mass transit option that can provide high quality public transport service to a majority of city residents and increase the public transport mode share significantly. BRT is a high quality bus based transit system that delivers fast, comfortable and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. An efficient BRT can accommodate up to 4,000 to 45,000 people per hour per direction and typically costs 10 to 20 times less than a metro system.

BRT includes the following features:

- Frequent, fast service in dedicated bus lanes;
- High quality stations with platform that match the level of the bus so that passengers can enter and exit quickly and easily without climbing steps;
- Specially designed buses that operate in exclusive lanes in the centre of the street;
- Special bus fleet that is electronically monitored from a control centre to ensure reliability and provide real-time information to passengers;
- Smart ticketing at stations enhances passenger convenience and improves efficiency.

BRT systems offer the following advantages over other forms of rapid transit:

- Not bound to a track, bus routes can be easily adjusted and consist of a combination of corridors;
- Buses can also exit the track and serve nearby areas, thus providing direct connectivity;
- BRT can be built in a short period of time (under 18 months) and at a fraction of the cost of rail systems (≈ ₹15 crores / km of BRT vs. ≈ ₹150 to ₹450 crores / km for rail-based systems);
- At grade, low-impact BRT stations are quick and easy for customers to access;
- BRT systems have the potential to provide a capacity over 20,000 pphpd (matching metro performance) using passing lanes and articulated vehicles;
- BRT operations plans can include multiple services per corridor and express services.

Figure 5. Tiruchirappalli identified bus rapid transit (BRT) as a key strategy to improve the quality of public transport service. BRT will transform Bharathiar Salai by giving dedicated space to public transport as well as pedestrians.

1.4.2. Bus fleet and facilities improvements

In most Tamil Nadu cities, high demand for public transport and low availability of transport vehicles means that existing buses are overburdened and usually of poor quality. Public transport bus fleets have increased marginally over the past decade but remain far short of international benchmarks. Per the World Bank's Urban Bus Toolkit, the minimum fleet requirement varies considerably from city to city, but typically lies between 50 and 120 buses per lakh population.[1] Most cities fall well short of the minimum requirement. To better match the bus supply to travel, the cities require additional buses to expand their fleet. In order to store and maintain these, additional bus depots and terminals are also required. In addition, bus stops also need upgrading with shelters, seating arrangements and real-time arrival information to enhance its user experience.

1.4.3. Footpaths

A significant proportion of trips below 2 km are performed on foot. Also all public transport passengers and many private vehicle users start and end their trips as pedestrians on public streets. Hence, accommodating safe pedestrian access is the most important task of transport planning. All footpaths need to have a frontage zone, a pedestrian zone and furniture zone. The frontage zone can vary between from 0.5 to 1 m. The pedestrian zone must provide a continuous clear space for walking with a minimum width of 2 m that is entirely free of obstructions. Street utilities such as manholes, trees, benches and other potential obstructions should be placed outside the path of travel, in the furniture zone.

[1] http://www.ppiaf.org/sites/ppiaf.org/files/documents/toolkits/UrbanBusToolkit/assets/1/evaluate.html

Figure 6. In Salem, pedestrians on Bazaar Street are forced to walk in the carriageway due to the lack of pedestrian facilities (left). The street will be redesigned with wide pedestrian footpaths and safe crossings (right).

1.4.4. Cycle tracks

Cycles offer low-cost, pollution free mobility and occupy just one tenth of a car space. Currently, cyclists witness inconvenience and safety hazards from faster moving traffic. A segregated cycle lane will provide a safe and convenient infrastructure and also attract new users. Cycling in a segregated track is often faster than using a private motor vehicle. A cycle track should have a minimum width of 2 m for one-way movement, a smooth surface material, shade from trees, an elevation of 150 mm above the carriageway, and a buffer of 0.5 m between the track and carriageway.

1.4.5. Cycle sharing

Cycle sharing a flexible form of personal public transport with cycles stored in a closely spaced network of stations. With the use of a smart card or other form of identification, a user can check out a cycle from a station and use it for a short ride, and return it to any other station. They are often placed near public transport systems to provide last-mile connectivity.

1.4.6. Greenways

A greenway is waterway or strip of land set aside for recreational use or environmental protection and where vegetation is encouraged along with exclusive facilities for cycling and walking. Greenways can be integrated with the larger network of on-street pedestrian and cycle facilities. By upgrading otherwise neglected drainage canals, greenway projects can enhance the environment and improve the quality of life of the surround area.

Figure 7. The Sabari Odai in Tiruppur, currently an unimproved drainage channel (left), can be redeveloped with continuous pedestrian paths and cycle ways (right).

1.4.7. Pedestrian zones

Along with constructing footpath along streets, it is important to identify areas where pedestrian density is the highest and ensure that these environments do more than facilitate movement. In the Tamil Nadu cities, many centrally located market streets are social as well as commercial spaces. These areas can be developed with plazas, seating, trees and structures for shade, as well as space for organised street vending.

Figure 8. Parking occupies much of the right-of-way on Madurai's West Avani Moola Street (left). Madurai plans to pedestrianise streets near the Meenakshi temple to create high quality public spaces (right).

1.4.8. Parking Management

With increasing use of private motor vehicles, free parking is often overused. Parking management is a critical mechanism to ensure the efficient use of street space, and over time, parking fees can be implemented to manage demand. Successful implementation requires good management structures and effective public private partnership arrangements between the municipality and parking operators. Parking management also involves providing clear, consistent customer information on parking rules and fee levels. Revenue gained from parking fees can help fund street improvements such as footpath maintenance and tree planting, helping to establish local buy-in for parking management.

1.5. Five-year transport strategies

Each city developed a five-year programme of improvements in the public transport system, upgrades in non-motorised transport, and travel demand management measures. Together, these investments were calibrated to ensure that the city can meet the mode share goals established in the initial phase of the planning process. For example, the expected mode share for public transport was cross checked against the planned expansion in the bus fleet to ensure that the combined BRT and city bus fleet in 2018 has sufficient capacity to carry the expected passenger volume in the same year. The investments in each project area are summarised in Table 1.

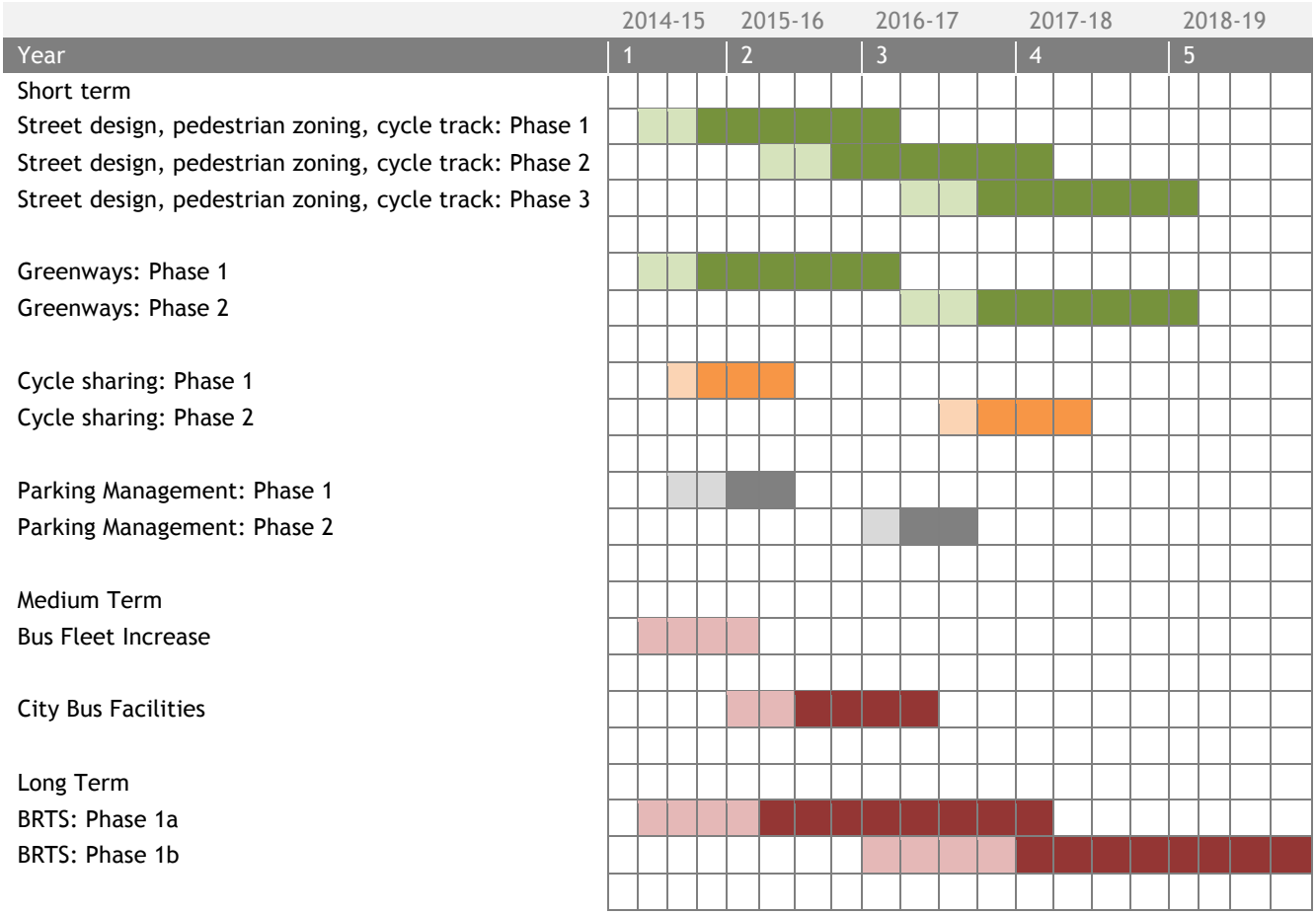
Table 1. Transport investments (crore Rs)

Area	Project	Coimbatore	Madurai	Salem	Tiruppur	Tiruchirappalli
Non-motorised Transport	Footpaths	54	60	47	22	58
	Cycle tracks and footpath upgrade	96	58	26	40	54
	Pedestrian zones	16	3	1	3	5
	Greenway	96	38	22	22	16
Public Transport	BRT	1,080	360	480	348	270
	City bus fleet expansion	84	105	90	150	78
	New bus depots	50	90	20	30	10
	New bus terminals	15	15	25	25	15
	New bus stops	20	9	10	-	-
	ITS & Customer Service	23	28	12	16	17
	Cycle Sharing	29	47	23	35	30
Travel Demand Management	On-street Parking management	-	-	-	-	-
Total		1,563	813	756	691	553

Table 2 shows a representative project timeline for implementation of the sustainable transport initiatives. Footpaths, cycle tracks, pedestrian zones, and greenways will be implemented in annual

packages, while BRT design and planning will last approximately 3 years for each phase. Cycle sharing and parking have relatively short implementation periods.

Table 2: Coimbatore project timeline. Design work for the respective transport initiative is shown in a lighter tint, while darker bars indicate implementation and civil works.



The following pages present two network maps for each city:

1. **Public transport network**, incorporating BRT corridors, new terminals or depots, and the phase 1 coverage area for cycle sharing.

2. **Non-motorised transport network**, including footpaths, cycle tracks, and greenways, along with the areas identified for management of on- and off-street public parking areas.

1.5.1. Coimbatore

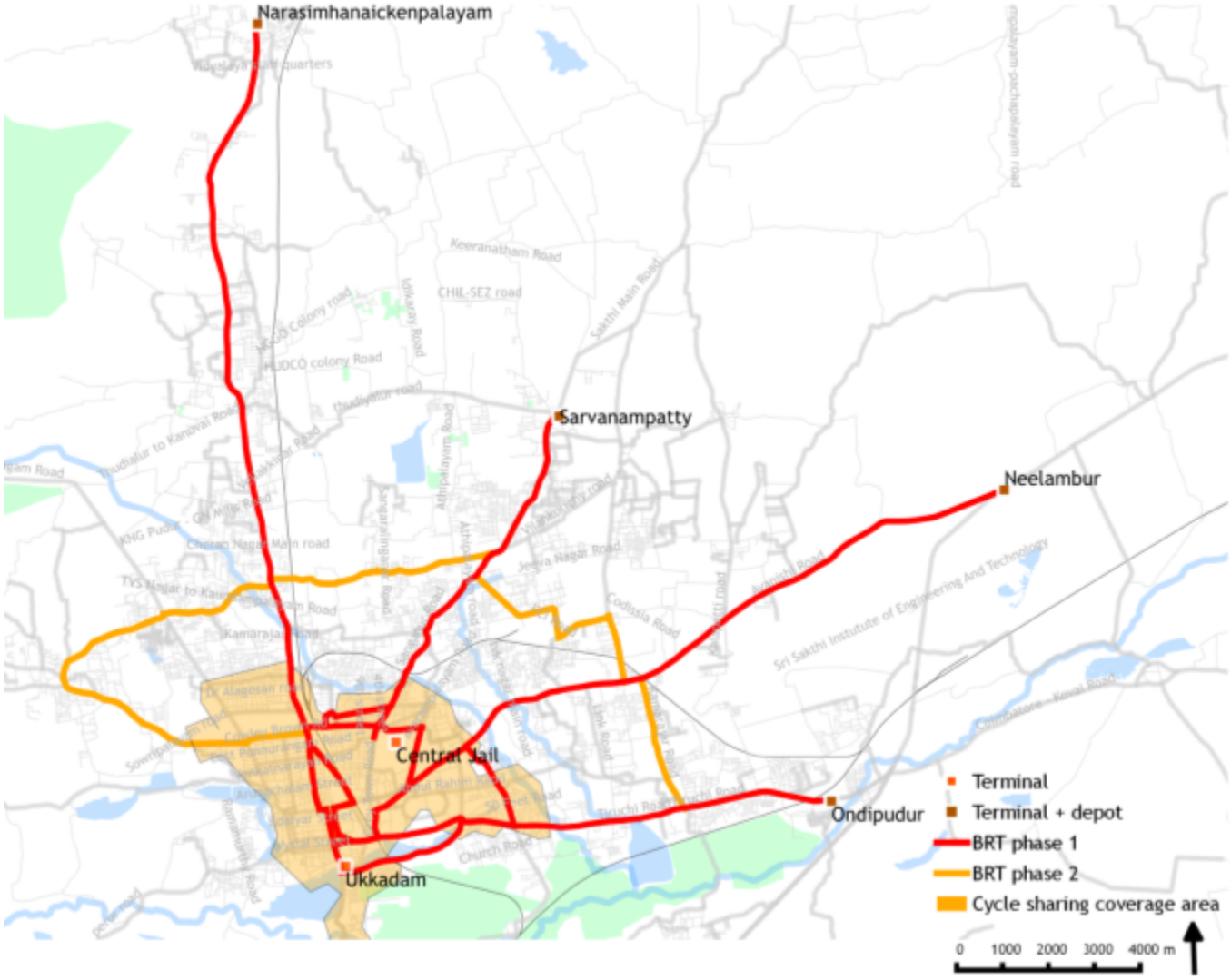


Table 3. Coimbatore public transport proposal

Project	Corridor	Length/area	Cost (crore Rs)
BRT	Avinashi Rd	20 km	300
	Sathyamangalam Rd	14 km	210
	Tiruchi Rd	15 km	225
	Mettupalayam Rd	23 km	345
Cycle sharing system		19 sq km	29

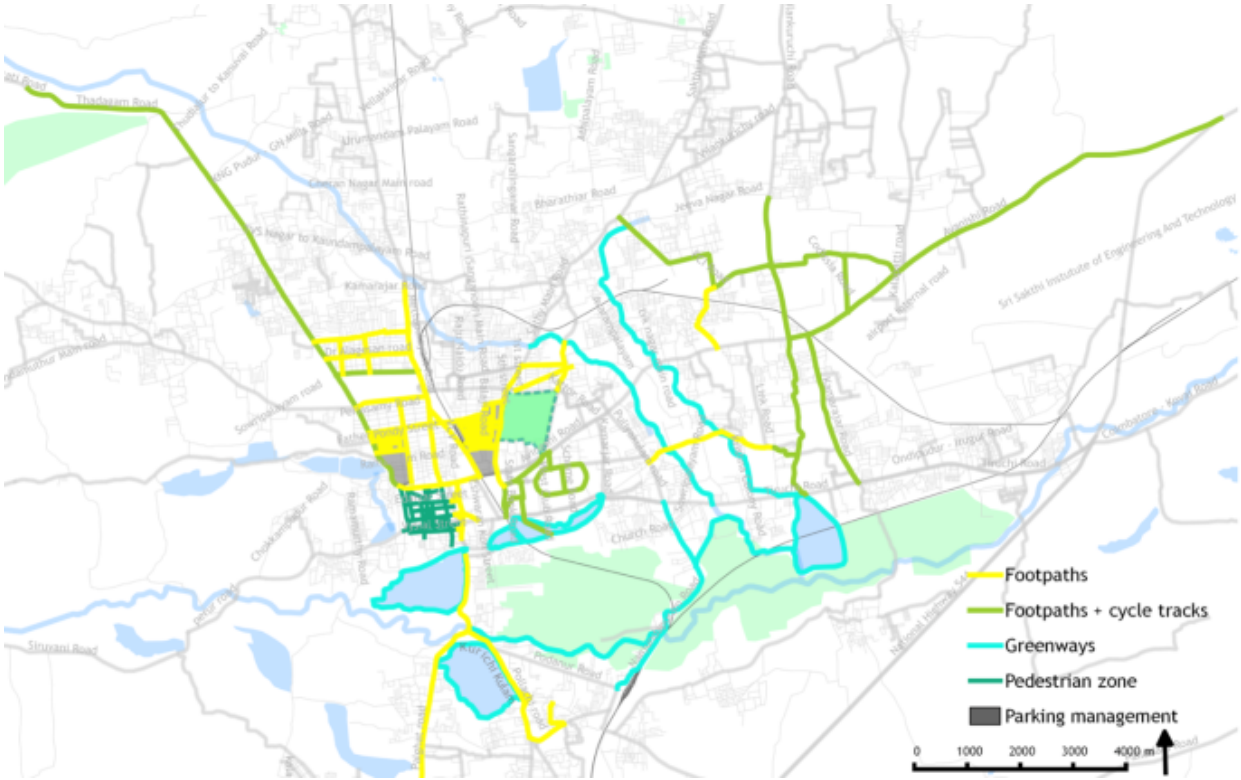


Table 4. Coimbatore non-motorised transport proposal

Project	Length (km)	Cost (crore Rs)
Footpaths	54	54
Cycle tracks and footpaths	48	96
Pedestrian zones	13	16
Greenways	48	96
Parking management	46	-

1.5.2. Madurai

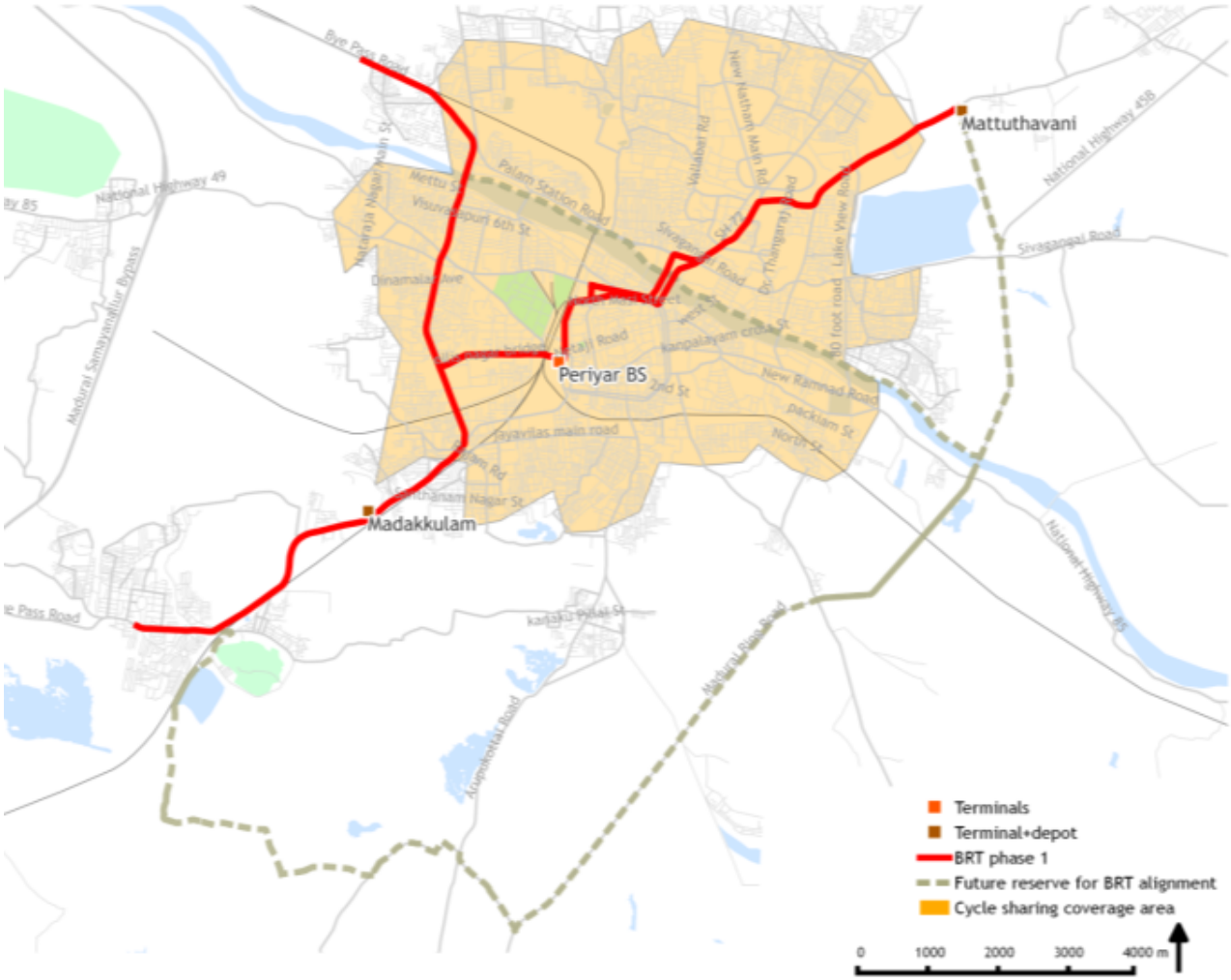


Table 5. Madurai public transport proposal

Project	Corridor	Length/area	Cost (crore Rs)
BRT (Phase 1)	Mattuthavani BS - NH 88 - Fatima College -West Velli St-Bypass Rd-Thirunagar	24 km	360
Cycle Sharing System		31 sq km	47

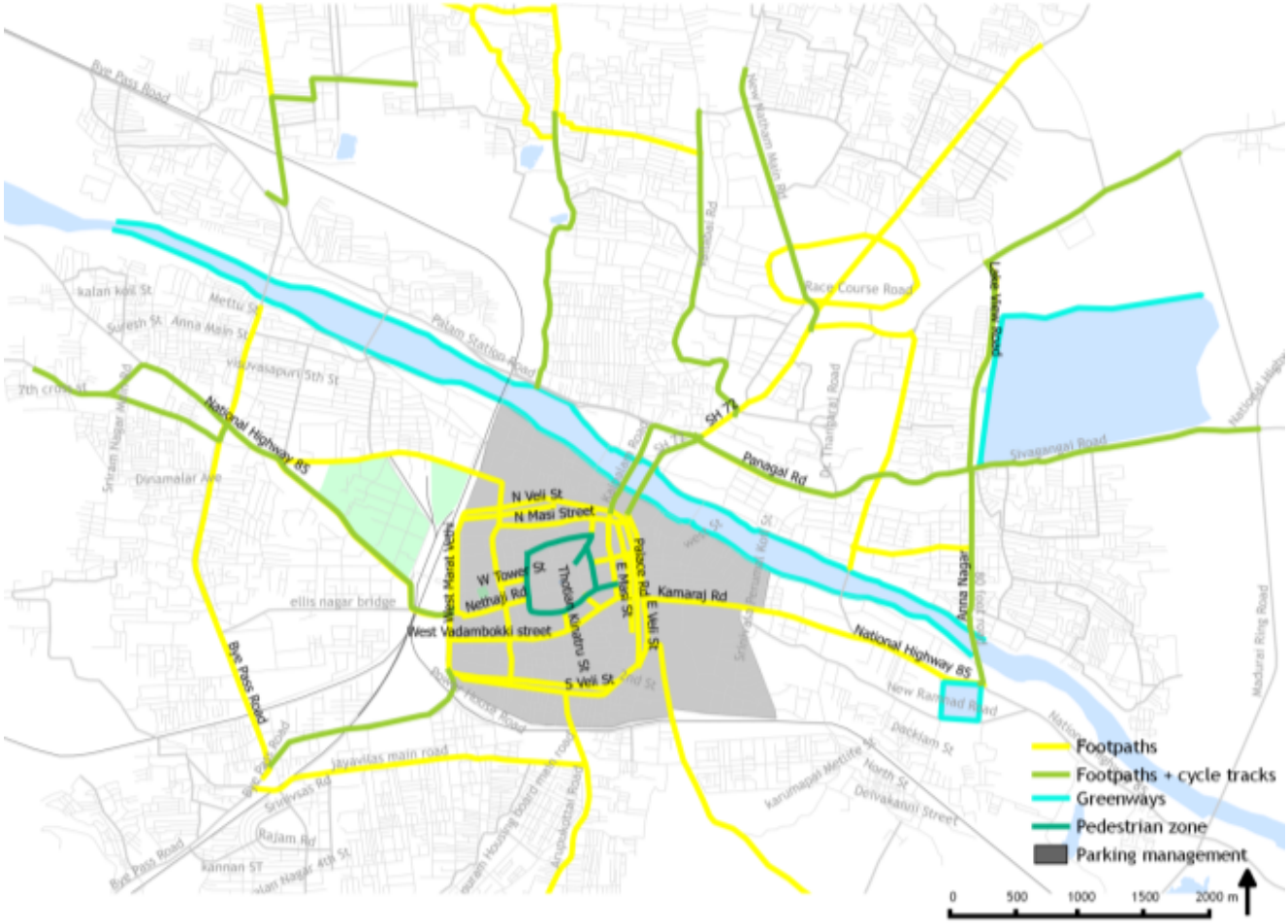


Table 6. Madurai non-motorised transport proposal

Project	Length (km)	Cost (crore Rs)
Footpaths	60	60
Cycle tracks and footpaths	29	58
Pedestrian zone	2	3
Greenways	20	40
Parking Management	84	-

1.5.3. Salem

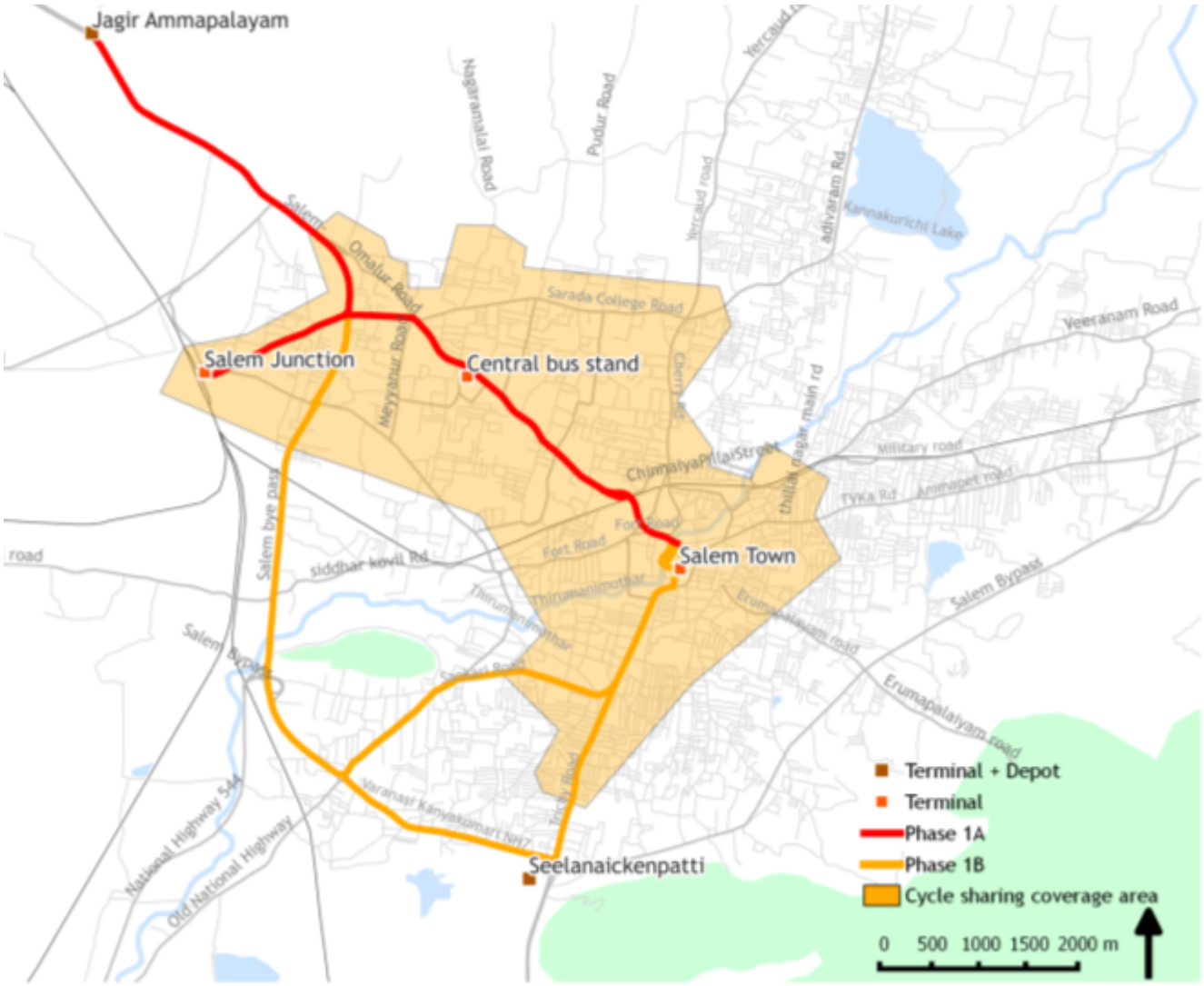


Table 7. Salem public transport proposal

Project	Corridor	Length/area	Cost (crore Rs)
BRT	Salem BS-Omalur Main Rd- Junction Rd- IT park	10 km	150
	Tiruchirappalli Rd-Sankari Rd- Bypass Rd	22 km	330
Cycle Sharing System		15 sq km	23

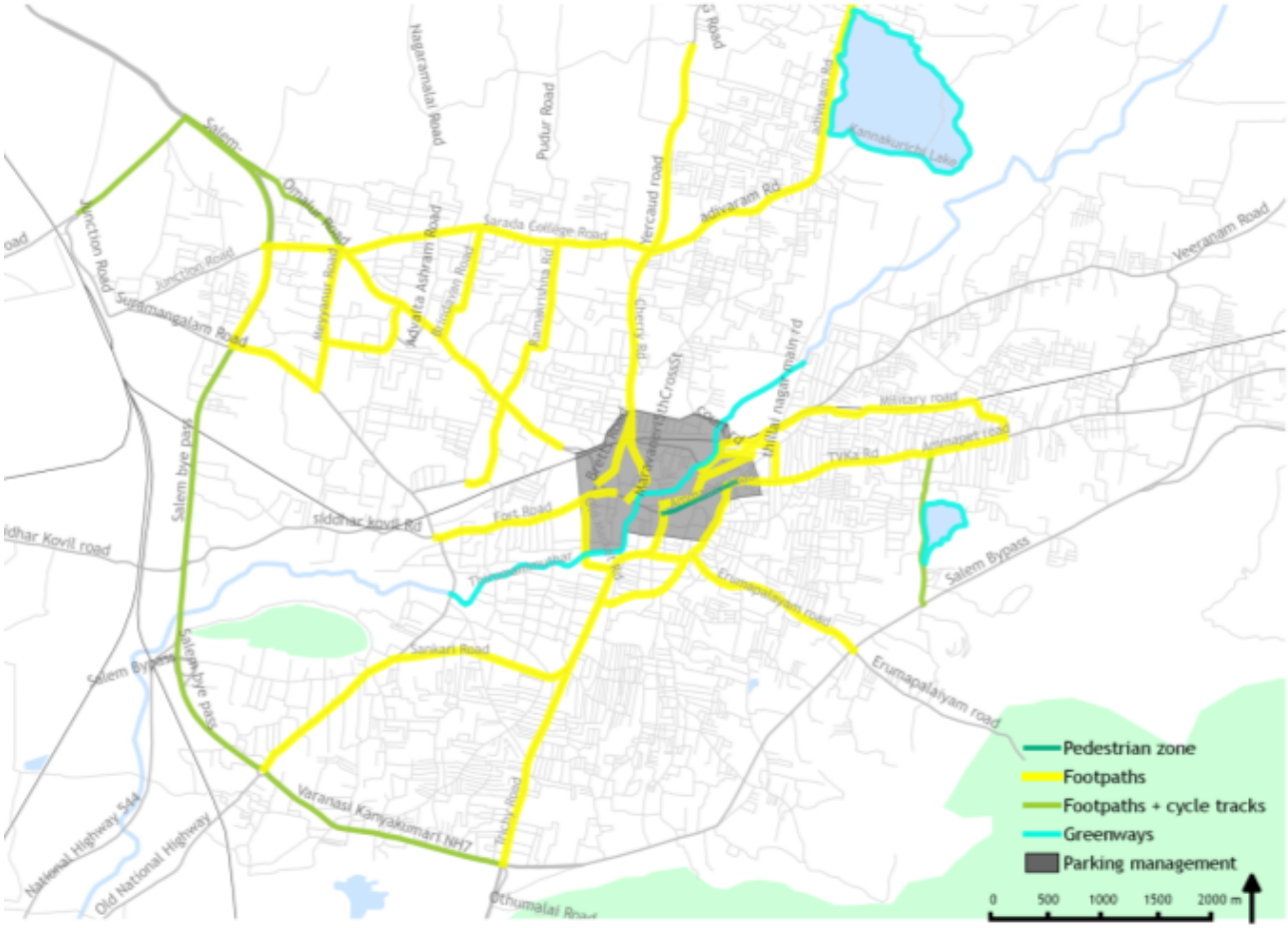


Table 8. Salem non-motorised transport proposal

Project	Length (km)	Cost (crore Rs)
Footpath upgrade	46	46
Cycle track and footpath upgrade	13	26
Pedestrian zone	0.7	1
Greenways	11	22
Parking Management	16	-

1.5.4. Tiruppur

Table 9. Tiruppur public transport proposal

Project	Corridor	Length/area	Cost (crore Rs)
BRT	Tiruppur Palladam Rd -SH 172- Dhararapuram Rd	14 km	210
	Avinashi Tiruppur Rd-Kumaran Rd- Avinashi Rd	10 km	150
Cycle Sharing System		23 sq km	35

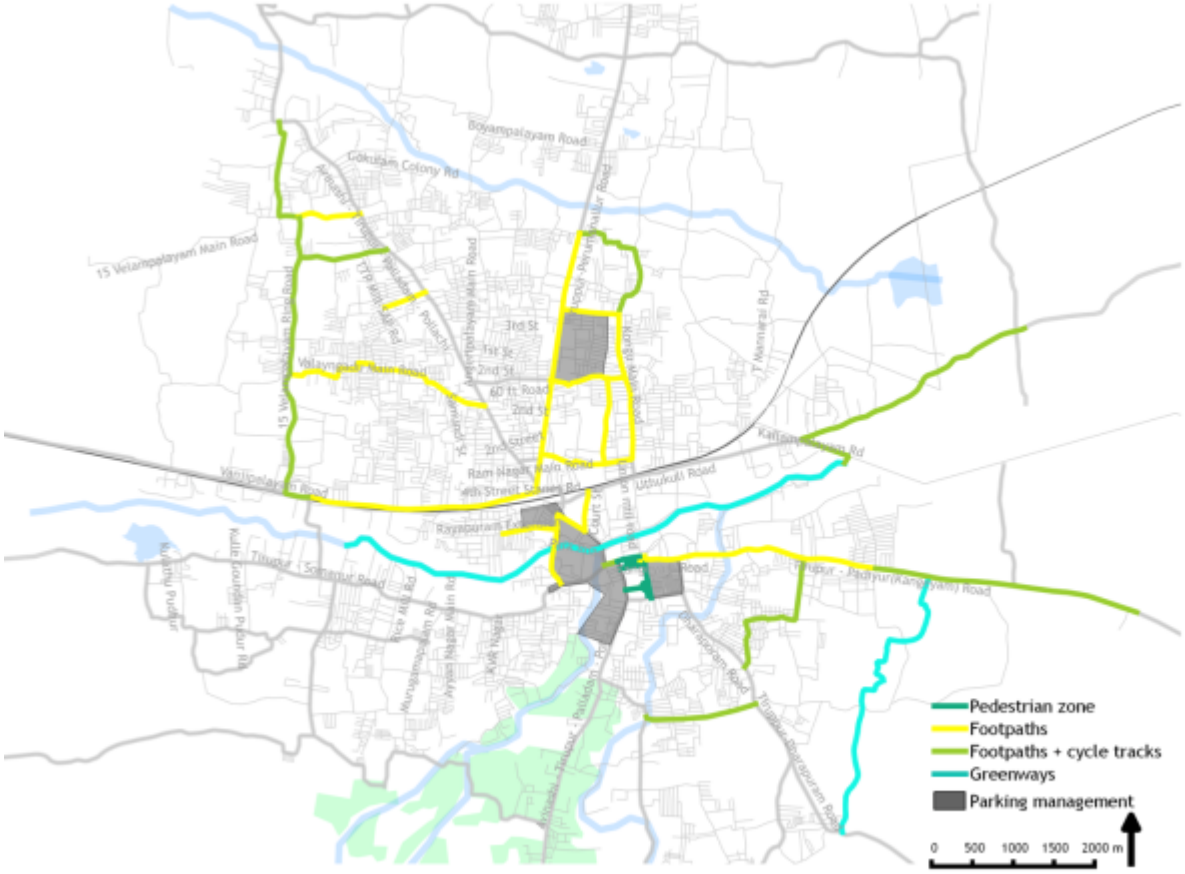


Table 10. Tiruppur non-motorised transport proposal

Project	Length (km)	Cost (crore Rs)
Footpaths	22	22
Cycle tracks and footpaths	20	40
Pedestrian zone	2	3
Greenways	11	22
Parking Management	27	-

1.5.5. Tiruchirappalli

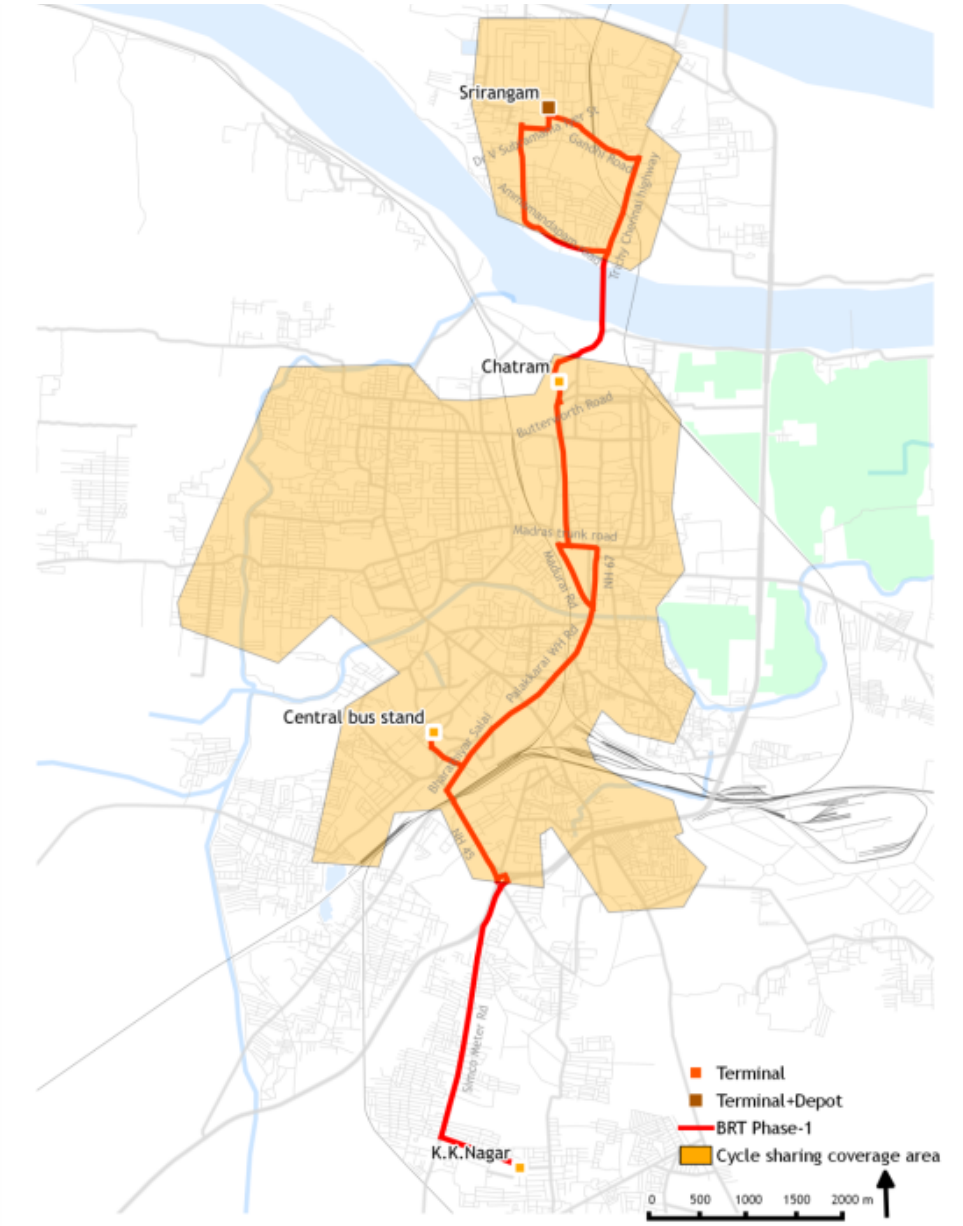


Table 11. Tiruchirappalli public transport proposal

Project	Corridor	Length/area	Cost (Rs crore)
BRT	Central BS - Palakkarai Rd-NH 67	13 km	195
	Central BS - Mannarpuram - Rajaram salai -K.K.nagar	5 km	75
Cycle Sharing System		20 sq km	30

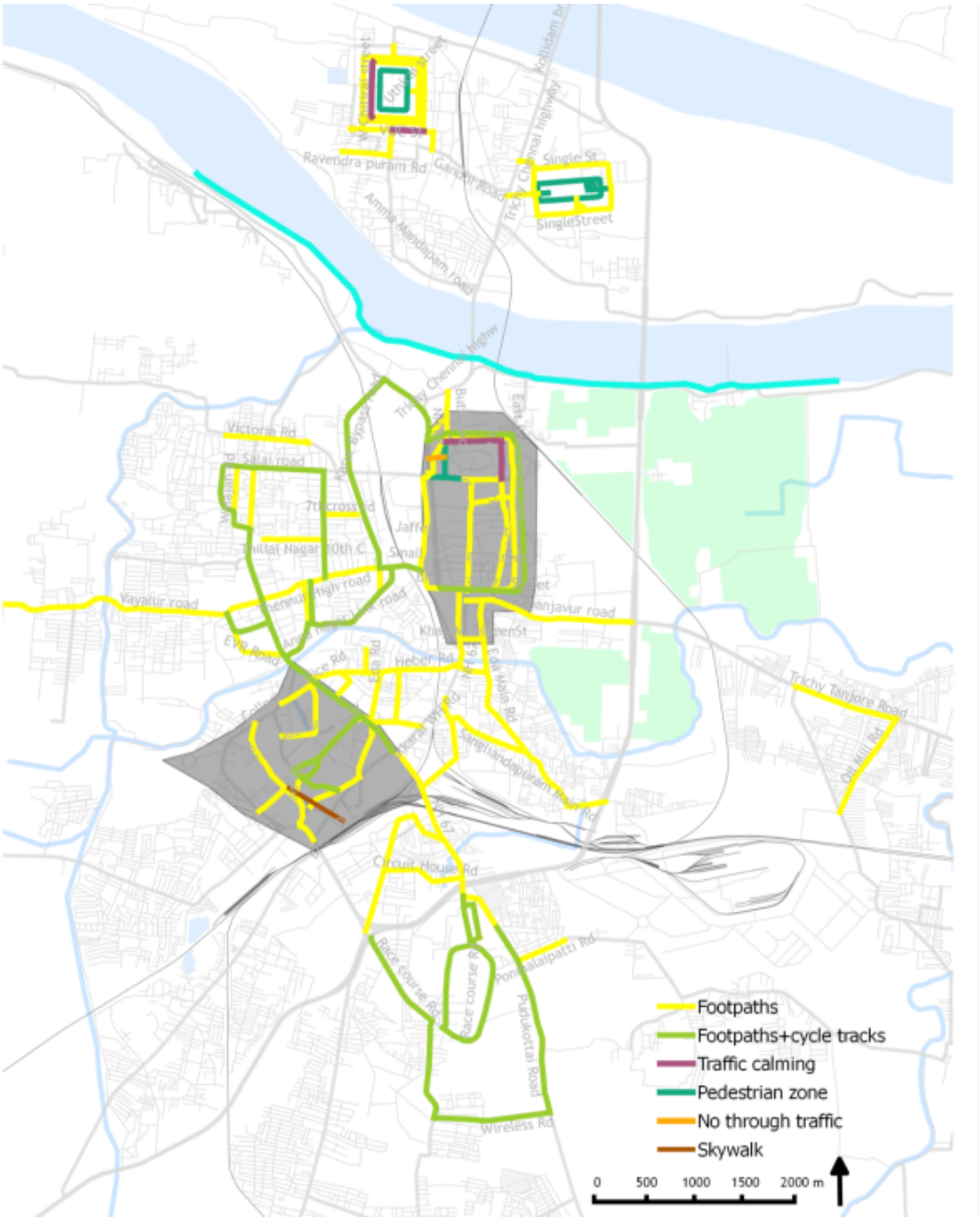


Table 12. Tiruchirappalli non-motorised transport proposal

Project	Length (km)	Cost (crore Rs)
Footpaths	58	58
Cycle tracks and footpaths	26	52
Pedestrian zone	4	5
Greenways	8	16
Parking Management	32	-

1.6. Special purpose vehicle (SPV)

In order to regulate public transport in the each of the cities, a special purpose vehicle (SPV) must be set up as a dedicated public transport agency in charge of planning and managing public transport operations. The SPV will not operate services directly, but will engage a number of private contractors to operate various elements of the public transport system. The SPVs set up in each city must be dedicated to cycle sharing system and public parking in particular.

The main functionalities of the SPV include:

- Operations management;
- Planning and regulation;
- Project implementation and contracting of services;
- Financial management
- Marketing.

The SPV should comprise of a team of specialists hired on competence in management and transport planning. The Figure 37. Internal structure of the SPV show illustrates the structure of the SPV which should be headed by a board of directors, a managing director and four primary departments – planning and design; operations; admin and finance; and communications and marketing.

All the revenues from cycle sharing and parking management will be controlled by the SPV. Covering the SPV's expenses through its own revenue (parking fee etc.) is central to ensuring the economic autonomy of the body and retaining high quality staff. Economic independence will help insulate the Directors of the SPV from making decisions heavily affected by political considerations contrary to the SPV's interest of maintaining excellent service quality.

1.7. Unified Metropolitan Transport Authority

Each city must establish a Unified Metropolitan Transport Authority (UMTA) as the main planning body, to co-ordinate activities among transport bodies to best utilise the available infrastructure facilities and resources.

UMTA will undertake the following activities to support the deliverables of successful public transport projects in each of the cities:

- Convene regular meetings of key transport system actors in the city to facilitate the exchange of information about projects currently under information, to exchange information on best practices, to coordinate strategic plans, and develop designs for intermodal facilities.
- Develop a database of indicator data to monitor transport service levels, usage patterns, and trends, and populate the database with information gathered from transport operators and primary surveys. The database will be updated on a monthly basis.
- Develop a knowledge-sharing portal to facilitate the sharing of information about transport projects currently under implementation. The portal can aid in making best-practice plans, reports, and tender documents available across all agencies in Tamil Nadu.
- Facilitate surveys needed to gather transport data needed to provide technical support.

1.8. Next steps

Clear policy direction and corresponding budget allocations by relevant departments of the Government of Tamil Nadu are essential to facilitate rapid implementation of the strategic plans developed by Coimbatore, Madurai, Salem, Tiruppur, and Tiruchirappalli.

With the budget allocation in place, the first step is for all the cities to form UMTA and the SPV as two institutional structures to develop strategic plans, oversee implementation and manage on-going operations. In order to set-up the SPV, the Corporation should:

1. Register the SPV;
2. Hire staff for the SPV;
3. Plan for a cycle sharing system and parking management;
4. Procure services for operations and management of the cycle sharing system and parking management system.

Following the formation of UMTA and SPV, the Corporation can commence the tendering process for the design for the other transport projects including footpaths, cycle tracks, pedestrian zones and greenway,

In addition, ITDP and ICLEI–SA propose to support the implementation process in the following ways:

- Carry out further engagement with municipal corporation officials, political representatives, and local stakeholders
- Provide technical assistance to CMA, municipal corporations, and consultants through one-on-one interactions, training workshops, and study tours.
- Develop terms of reference for the hiring of consultants for specific project areas, including street design, greenways, and BRT.
- Develop request for proposals and contract documents for the operation of parking management, cycle sharing, BRT bus operations, and BRT intelligent transport systems solutions.
- Review consultant work and monitor implementation progress.

2. Introduction

The Sustainable Cities through Transport programme, launched by the Commissionerate of Municipal Administration (CMA) in partnership with Institute for Transportation and Development Policy (ITDP) and with support from ICLEI–SA South Asia, aims at addressing mobility challenges in Tamil Nadu (TN) Cities. The project brought together five TN city corporations—Coimbatore, Madurai, Tiruchirappalli, Tiruppur, and Salem—to develop municipal transport budgets for the next five years.

Sustainable Cities through Transport seeks to address the issue of increased congestion and pollution as the cities witness rapid motorisation. Public transport service is often unreliable, infrequent, and inadequate to meet demand, resulting peak-hour overcrowding and a shift toward informal paratransit services. Walking and cycling are critical modes for many urban residents in TN, providing essential low-cost mobility. However, dedicated pedestrian and cycle facilities are almost non-existent in most cities.

In harmony with the 2006 National Urban Transport Policy, the process seeks to achieve a more

equitable allocation of road space by incorporating a focus on sustainable transport in the planning and budgeting stages. Through a series of participatory exercises, municipal officials identified ways to provide safe, affordable, quick, comfortable, and reliable access for the growing number of residents in their respective cities.

2. Planning process

Sustainable Cities through Transport included the following stages:

- **Planning Session** on 19 November 2013 in Chennai. This half-day planning session brought together a core team of officials from each city. The teams were presented with a list of city-specific transport data requirements for the planning process. Each team reviewed the data collected by CMA and ITDP and began gathering the remaining information.
- **Surveys** were conducted by ITDP and ICLEI–SA in each of the five cities in November 2013 in consultation with the Municipal officials. ITDP and ICLEI–SA staff conducted detailed counts of share auto and city bus passenger volumes along major bus and auto routes in each city. The team visited key public transport nodes, identified areas with major pedestrian volumes, and observed on-street parking management practices.
- **Transport Budgeting Workshop** on 28-29 November 2013 in Coimbatore. The first day of the workshop opened with a public lecture by Enrique Peñalosa, former mayor of Bogotá, Colombia, and sustainable urban development expert. The Peñalosa administration implemented TransMilenio, a citywide bus rapid transit system (BRT) that now moves over 1.6 million passengers per day, as well as a wide-ranging network of cycle tracks, footpaths, and public spaces. The day continued with presentations on key aspects of sustainable transport planning, including non-motorised transport, public transport, and travel demand management. The second day of the workshop consisted of breakout sessions for city teams from Coimbatore, Madurai, Tiruchirappalli, Tiruppur, and Salem, who worked collaboratively to develop conceptual transport plans and municipal budgets for their respective cities adequately supported by team members from ITDP and ICLEI–SA (Figure 1).

Figure 9. Officials from Coimbatore discuss the city's transport strategy during the Transport Budgeting Workshop (left). The ITDP and ICLEI-SA team visits the proposed BRT corridor Tiruchirappalli with officials from the Municipal Corporation, Traffic Police, and Local Planning Authority (right).

- **Site visits and meetings** were held in each city to refine the transport proposals identified during the Transport Budgeting Workshop. ITDP and ICLEI–SA met with city Commissioners and Engineers to assess the feasibility of project proposals based on their comprehensive local knowledge (Figure 2). The team also worked with city officials to set priorities and identify projects for immediate implementation.
- **Review of Final Budget Proposals** on 23 January 2014 in Chennai. At this workshop, cities presented their final sustainable transport plans to CMA and the Department of Municipal Administration and Water Supply. Municipal commissioners presented their transport goals, outlined 5-year strategic plans, and discussed specific first-year project proposals to inform the 2014-2015 state and municipal transport budgets.

3. Travel behaviour and transport challenges

In order to plan for urban transport interventions, it is important to understand the existing travel characteristics of each city, challenges faced by users of different mode, and resulting transport system trends. As a starting point in the planning process, the share of trips accomplished by each mode was estimated for the five cities. Major modes include public transport (publicly and privately operated city buses), paratransit (including private and share autos), private vehicles (2-wheelers and 4-wheelers), walking, and cycling.

Existing data sources for estimation of mode shares in the five Tamil Nadu cities are limited. While some cities have Comprehensive Traffic and Transport Studies or Comprehensive Mobility Plans, the data were determined to be incomplete,[2] out-dated,[3] or inaccurate.[4] As a substitute, mode shares were derived using data from various sources, including information provided by the cities, RTO vehicle registration statistics, and site surveys. Travel patterns were estimated for the entire urban agglomeration, rather than respective municipal corporation boundary, because daily commuting movements generally extend beyond the corporation areas.[5] Population growth rates for each urban agglomeration were estimated based on population growth trends between 2001and 2011. Existing and future populations for the five cities are presented Table 13.

[2] The mode share estimates in the Comprehensive Mobility Plan for Coimbatore (Wilbur Smith 2007) do not include shares for walking and cycling. The mode shares in the Comprehensive Mobility Plan for the Salem Local Planning Area (CDM Smith, 2014) omit share auto services, a predominant form of public transport in the city.
[3] The Comprehensive Traffic and Transportation Study for Madurai (Anna University, 1997) identifies shares for all modes but is considered too old to reflect present travel patterns in Madurai.
[4] The draft Comprehensive Mobility Plan for the Coimbatore Local Planning Area (ICRA Management Consulting services Ltd 2013) estimates a walk mode share of 0 per cent, an implausible figure given the widespread presence of pedestrians in the city. The report's estimate of the public transport mode share, 44 per cent, far exceeds figures derived from ridership data from the city bus operator TNSTC.
[5] Population Census 2011, <www.census2011.co.in>.

Table 13. Estimated urban agglomeration populations and population growth rates.

City	2013 urban agglomeration population	Annual growth rate (%)	2018 urban agglomeration population
Coimbatore	2,264,797	2.60	2,574,933
Madurai	1,520,607	1.97	1,676,405
Tiruchirappalli	1,056,543	1.69	1,148,890
Tiruppur	995,414	1.67	1,081,354
Salem	952,350	1.79	1,040,692

The mode share calculations make use of per capita trip rate figures, which are multiplied by the agglomeration population to determine the total number of trips made per day in each city. Since local data are not available, per capita trip rate figures are derived from Ministry of Urban Development (MOUD)'s 2008 study on traffic and transport in Indian cities (Table 14). [6] The trips rates are expected to grow somewhat as per capita incomes and the ability to travel increase over the next five years.

Table 14. Estimated per capita trip rates for TN cities in 2013 and 2018.

City	2013 trip rate	2013 total trips/day	2018 trip rate	2018 total trips/day
Coimbatore	1.47	3,329,251	1.62	4,171,392
Tiruchirappalli	1.43	1,510,856	1.58	1,815,245
Tiruppur	1.20	1,194,497	1.35	1,459,828
Salem	1.20	1,142,820	1.35	1,378,809
Madurai	1.43	2,174,467	1.58	2,648,720

Once the total trips per day have been established, trips per mode can also be determined based on bus and auto-rickshaw fleet numbers, daily bus boarding, and other available information. The bus fleet numbers for all cities were obtained from Transport Department, Government of Tamil Nadu. Data included bus fleet size and daily boardings from 2011 to 2013. Official data on privately operated city buses were not available, but could be estimated from information provided by traffic police, TNSTC officials, and city officials. In cities where fleet size estimates were not available, frequency and occupancy counts were used to estimate the relative proportion of privately and publicly operated city buses. The bus mode shares include both private and TNSTC buses in order to provide an accurate estimate of the usage of city bus services.

To derive at auto mode shares, the number of registered autos from 2008 to October 2013 in each city was gathered from Regional Transport Offices (RTO). The total number of autos registered was divided into private and share-autos based on ratios observed in traffic counts in each city. Using basic assumptions about the number of passengers carried by share autos and private autos, the fleet sizes were used to estimate overall daily boarding on paratransit.

[6] Wilbur Smith Associates (2008). Study on Traffic and Transportation Policies and Strategies in Urban Areas in India. Ministry of Urban Development.

Table 15. Paratransit and public transport fleet sizes and estimated ridership in 2013.

	Salem	Tiruchirappalli	Madurai	Coimbatore	Tiruppur
Total auto fleet (Source: RTO)	6,016	9,843	13,360	8,652	1,133
Estimated daily auto boardings (share auto and private auto)	329,316	210,837	317,968	297,110	64,332
Total TNSTC fleet (Source: RTO)	226	218	507	632	281
Daily bus boardings (TNSTC & private buses)	229,720	394,200	636,768	699,000	198,229

NMT mode share numbers for Coimbatore and Salem have been derived in part from Coimbatore's older CMP and the Salem CMP interim report.[7,8] Due to lack of information available for the other three cities, Chennai mode share figures for walking and cycling have been adopted as a presumed floor for the mode shares in the cities. With lower incomes and shorter trip distances than those in Chennai, the other TN cities are assumed to have a higher proportion of trips by walking and cycling. Thus, the Chennai numbers can be taken as a lower bound.

Based on the preceding information, existing mode shares for each of the city were obtained, as summarised in Figure 10. Travel patterns in the cities are characterised by high non-motorised transport mode shares and significant levels of public transport use. Paratransit use is significant and growing, given the lack of quality public transport in the cities. Similarly, private vehicle use is rapidly increasing as incomes grow and commuters respond to the deteriorating conditions for pedestrians, cyclists, and public transport users.

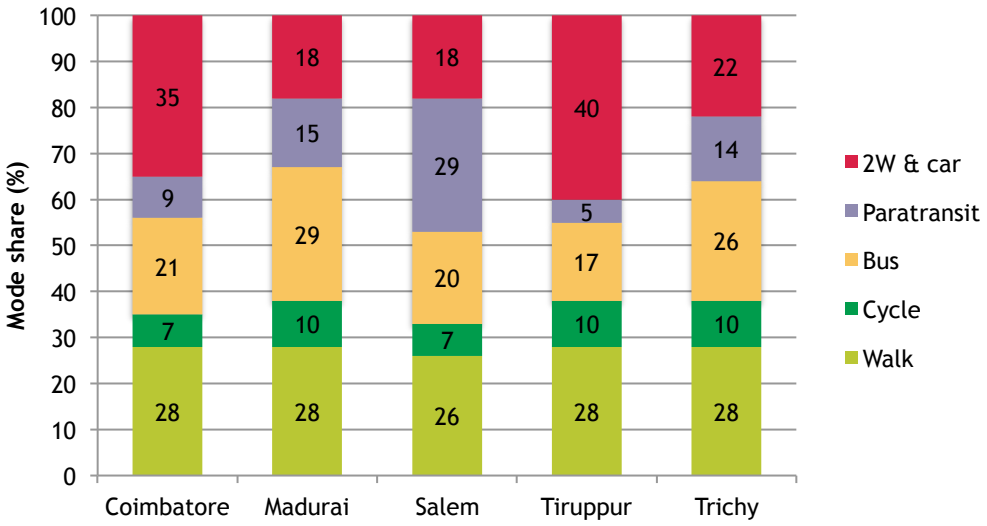


Figure 10. Existing mode shares estimated for TN cities.

[7] Wilbur Smith Associates (2007), Comprehensive Mobility Plan for the City of Coimbatore.
[8] CDM Smith (2014).

After identifying present overall travel patterns, cities identified several transport issues that need immediate attention. The following points summarise common observations across the five cities:

- **Lack of facilities for non-motorised transport**. Most streets lack dedicated facilities for pedestrians and cyclists. Footpaths, where present, suffer from design flaws such as inadequate width, abrupt level differences, and obstructions. As a result, people are forced to walk in the carriageway near fast-moving vehicles.
- **Inadequate public transport**. Most public transport in Tamil Nadu comprises bus services operated by the Tamil Nadu State Transport Corporation (TNSTC) along with shared auto-rickshaws and some private bus services. None of the public transport modes are of high quality. As growing use of personal motor vehicles leads to worsening congestion, buses and share autos become slower and less reliable. Customers look for alternatives, resulting in a declining mode share for public transport.
- **Lack of vehicle restriction**. On-street parking was uniformly provided free of cost in all of the cities. As a result, the cities do not receive compensation for this use of valuable public space. Chaotic vehicle parking compromises the mobility function of streets, occupying space that could otherwise facilitate mobility of public transport, pedestrians, and cyclists.

Figure 11. Transport challenges faced by commuters in the TN cities (counter-clockwise from upper left): poorly designed footpaths near Coimbatore Junction Station that force pedestrians

to walk in the carriageway; unorganised parking on Bharathiar Salai in Tiruchirappalli; commuters waiting in the sun at an unmarked bus stop along Palladam Rd in Tiruppur; and open drains in place of pedestrian infrastructure just outside Tiruppur's main bus terminal, the Old Bus Stand.

4. Future transport scenarios for TN cities

Travel demand in the five cities is expected to expand rapidly over the next five years, resulting in a 20 to 25 per cent increase in the number of trips taken every day. For example, the number of daily trips in Coimbatore is likely to grow from 33 lakh presently to 42 lakh by 2018. These additional trips will present a major challenge to the TN cities. Under a "status quo" scenario in which higher travel demand is addressed through new infrastructure for personal motor vehicles, the transport system will quickly reach capacity limits, resulting in higher congestion and air pollution and a diminishing quality of life. An alternative approach that prioritises sustainable transport modes, namely public transport, cycling, and walking, has the potential to accommodate future travel demand while providing improved travel speeds, environmental dividends, and road safety improvements, all with a lower financial burden.

4.1. Transport goals

To begin the discussion on ways to initiate a shift toward sustainable transport solutions, city officials identified goals that could guide the improvement of their transport systems over a five-year time horizon. Key goals emerging from the discussion were to improve public transport, support walking and cycling, improve safety, enhance public transport accessibility and improve air quality. These goals are consistent with the 2006 National Urban Transport Policy, which clearly expresses an aim of facilitating the movement of people rather than vehicles.[9]

4.1.1. Improve public transport

During the Transport Budgeting Workshop, the cities determined that the solution to this trend is to invest heavily in public transport and ensure that public transport services are attractive even to private vehicle users. For this purpose, Bus Rapid Transit (BRT) was identified as the most feasible option to provide high quality public transport. In addition, improvements to the existing bus facilities and increased bus fleets were recognized as important investments to improve public transport.

4.1.2. Support walking & cycling

The cities also sought to expand walking and cycling to ensure basic low-cost mobility and provide access to public transport. Non-motorised transport (NMT) modes are the most viable option for short trips and use scarce road space more efficiently than private motor vehicles. Cyclists use less than a third of the road space used by private motor vehicles, and pedestrians use less than a sixth. In order to support NMT modes the cities identified that it was necessary to upgrade footpaths, include cycle tracks, incorporate a cycle sharing system, develop greenways and pedestrian zones.

4.1.3. Improve safety

The cities aim to ensure zero fatalities per year from traffic crashes. Participants recognized that user awareness, while an essential element of a holistic approach to road safety, is only one component of an effective strategy to address road safety. Such an approach must also address existing design of

[9] http://urbanindia.nic.in/policies/TransportPolicy.pdf

streets, which seriously compromises the safety of citizens on any transport mode. Most streets in TN cities lack footpaths, forcing pedestrians to walk in the carriageway. Wide, dedicated footpaths along with cycle tracks along major streets are essential to improve safety for NMT users. The introduction of a BRT also can improve road safety by separating buses from slower moving non-motorised vehicles.

4.1.4. Enhance public transport accessibility

Another common goal was to increase the reach of high quality public transport, ensuring that a majority of city residents within a five-minute walk of formal public transport. Expanding the catchment area of the public transport system will make sustainable modes a more viable means of transport for more citizens.

4.1.5. Improve air quality

Cities also set a goal of reducing air pollution. Personal motor vehicles are a major source of particulate matter, nitrogen oxides, and other critical pollutants that compromise respiratory function and are associated with chronic diseases such as lung cancer and asthma. A shift to sustainable transport would help address these serious public health concerns by reducing harmful vehicle emissions.

4.2. Scenario development

To establish quantitative metrics for monitoring progress toward the sustainable transport goals described above, the cities compared existing trends with the mode shares that can be achieved if transport investments prioritise sustainable modes. These possibilities were summarised through two mode split scenarios: a "status quo" scenario and a "sustainable transport" scenario. The sustainable transport scenario represents aspirational mode shares that are contingent on significant investments walking, cycling, public transport, and travel demand management.

For example, under the status quo, Coimbatore will see a dramatic increase in private vehicle trips but a decrease in cycling. Coimbatore officials set a goal of reversing these declines and achieving an increase in sustainable transport use (Figure 12).

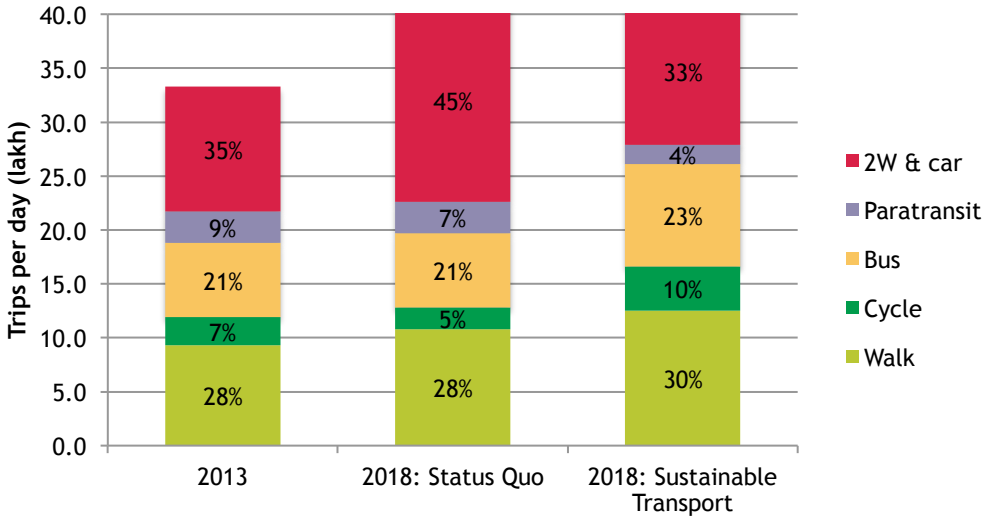


Figure 12. Alternative transport scenarios for Coimbatore in 2018.

Similarly, Madurai witnesses a 4.7 lakh increase in private vehicle trips under status quo. By 2018, over 1,800 lane-km of new road space and an additional 90,000 car equivalent spaces for parking will be required to accommodate their movement. The additional road and parking space demanded would cost roughly Rs 4,800 crores to construct, not including the cost of land. It is sufficient to say that Madurai cannot afford to let this trend to continue. The sustainable transport option can reverse this increase and invest heavily to increase trips made by public transport.

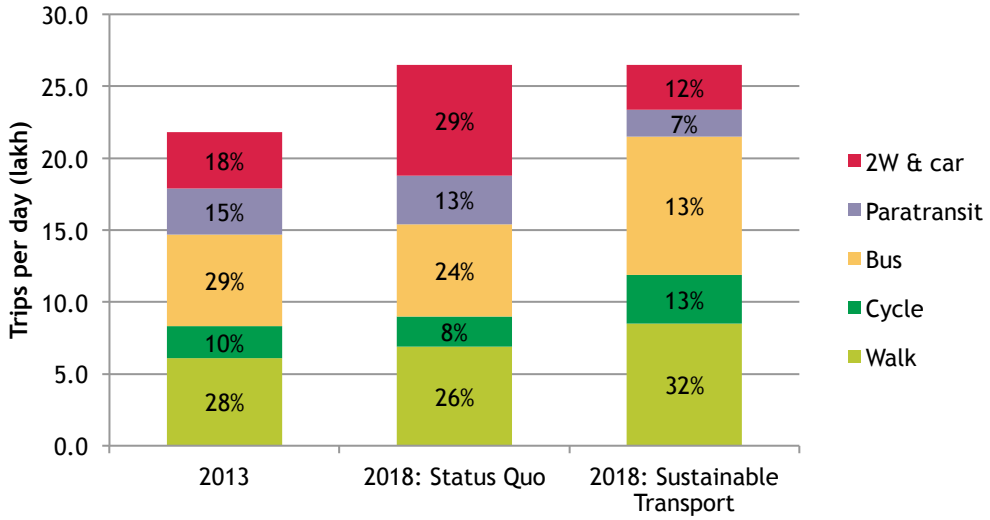


Figure 13. Alternative transport scenarios for Madurai in 2018.

Under the status quo, Salem will see a 77 per cent increase in private vehicle trips numbers without any change in NMT or public transport trips. Salem officials set mode a goal of reversing this increase and achieving an increase in sustainable transport use and NMT (Figure 14).

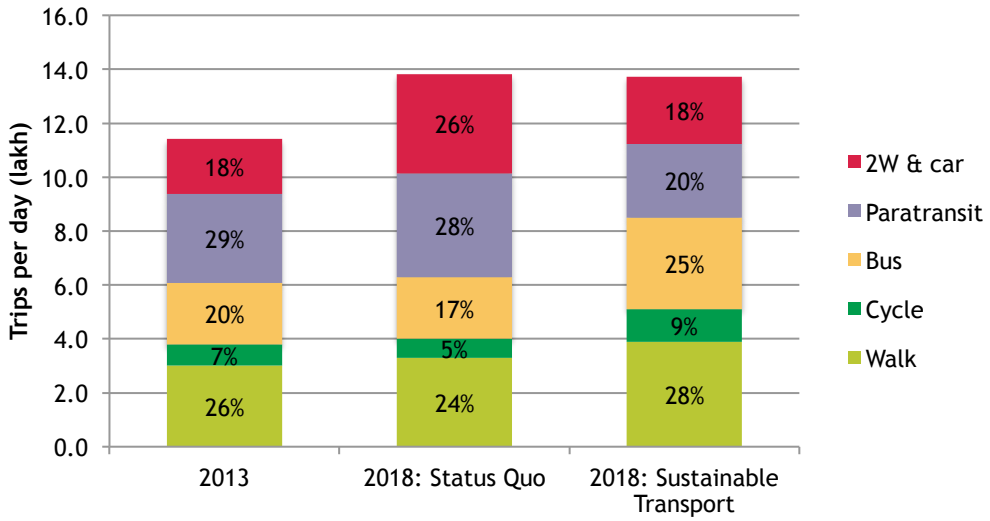


Figure 14. Alternative transport scenarios for Salem in 2018

Tiruppur currently has a very high rate of 2-wheeler usage, and under status quo it will see a 40 per cent increase in private vehicle trips. In this case, by 2018, over 1,900 lane-km of new space and 1 lakh car-equivalent space for parking will need to be constructed at a cost of Rs 5,300 crores, excluding cost of land. Tiruppur officials set mode a goal of reversing this increase and achieving an increase in sustainable transport and NMT trips (Figure 15).

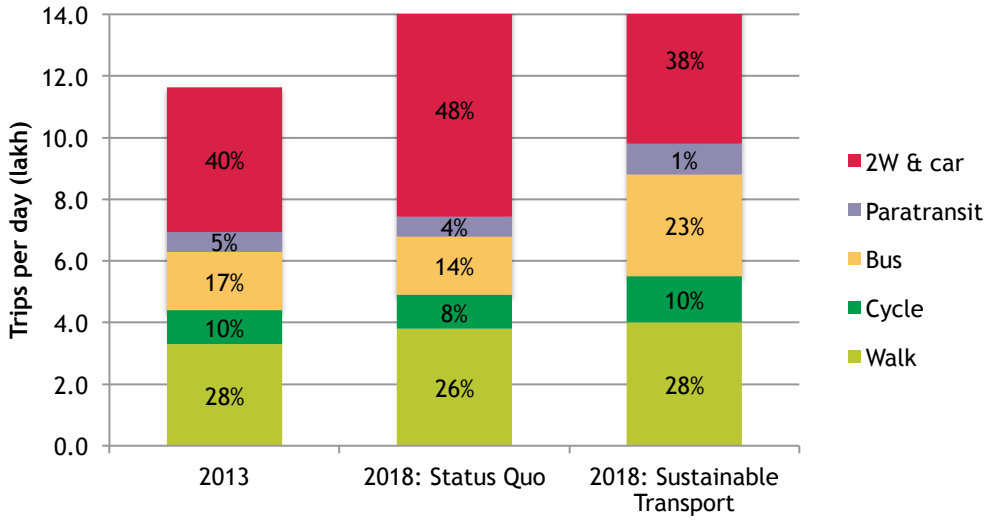


Figure 15. Alternative transport scenarios for Tiruppur in 2018.

Under the status quo, Tiruchirappalli will see a dramatic increase in private vehicle trips. Tiruchirappalli officials set a goal of reversing these increases and concentrating on investing in sustainable transport option thereby, increasing bus and NMT trips.

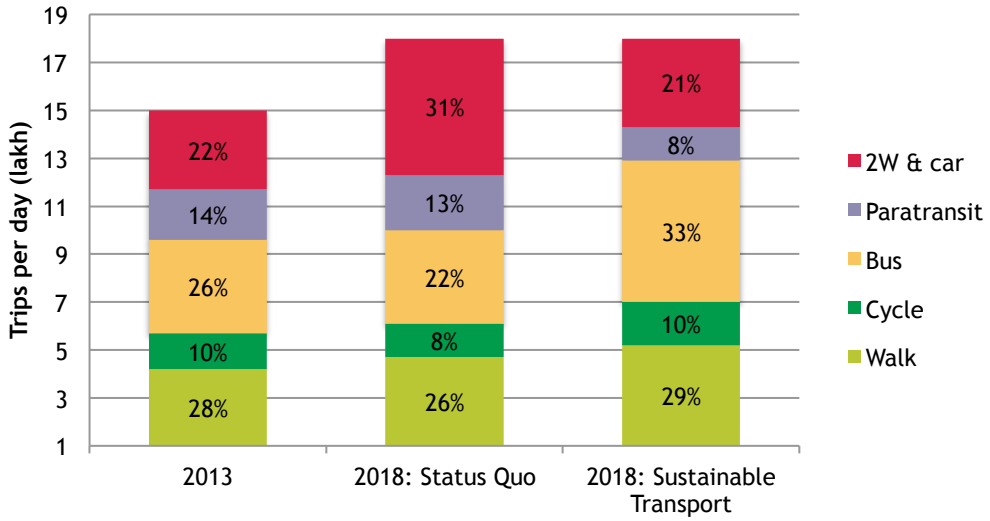


Figure 16. Alternative transport scenarios for Tiruchirappalli in 2018.

4.3. Scenario outcomes

Besides their direct mobility benefits, the sustainable transport scenarios identified by the cities are expected to have a number of co-benefits, including reduced pollution, lives saved from avoided traffic crashes, lower expenditures on vehicle fuel, and the avoided expense of costly road infrastructure.

Personal motor vehicle are a major source of particulate matter, nitrogen oxides, and other critical pollutants that compromise respiratory function and are associated with chronic diseases such as lung cancer and asthma. Encouraging residents to choose sustainable transport modes, such as public transport, walking and cycling, will help address the issue of public health and citizen well-being, and assist in reducing road accidents. In addition, personal motor vehicles are a major source of greenhouse gas emissions. For example, in Coimbatore personal motor vehicles account for 35 per cent of daily trips in the city, yet they produce 74 per cent of carbon dioxide emissions (Figure 17). These figures clearly indicate a need to encourage sustainable travel by making public transport, walking and cycling more attractive and effective.

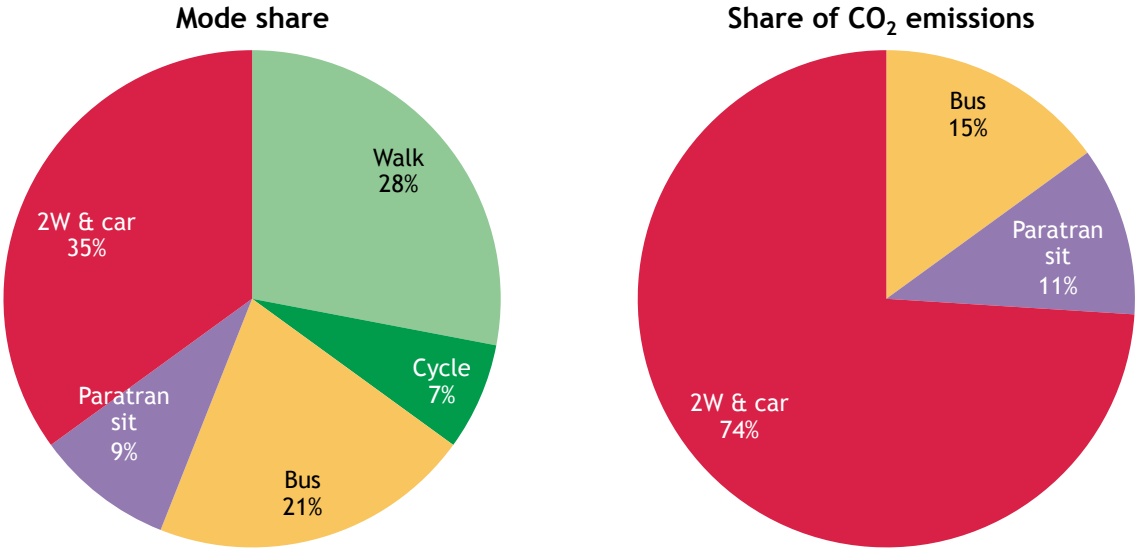


Figure 17. While private vehicles account for 35 per cent of trips in the city, they produce fully 74 per cent of the CO_2 emissions (right).

If travel behaviour in the TN cities continues with under business as usual trends, carbon dioxide levels will increase significantly by 2018. However, investing in sustainable transport, and helping residents make better transport choices, will deliver the shift in travel behaviour and reduce carbon emitted by transport (Table 16 and Figure 18).

Table 16. Greenhouse gas emissions under transport scenarios for TN cities (t CO_2 per year).

	2013	2018: Status quo	2018: Sustainable transport	2018: Difference
Coimbatore	243,000	350,000	260,000	90,000
Madurai	104,000	150,000	110,000	40,000
Tiruchirappalli	74,000	100,000	80,000	20,000
Salem	54,000	70,000	60,000	10,000
Tiruppur	53,000	70,000	60,000	10,000

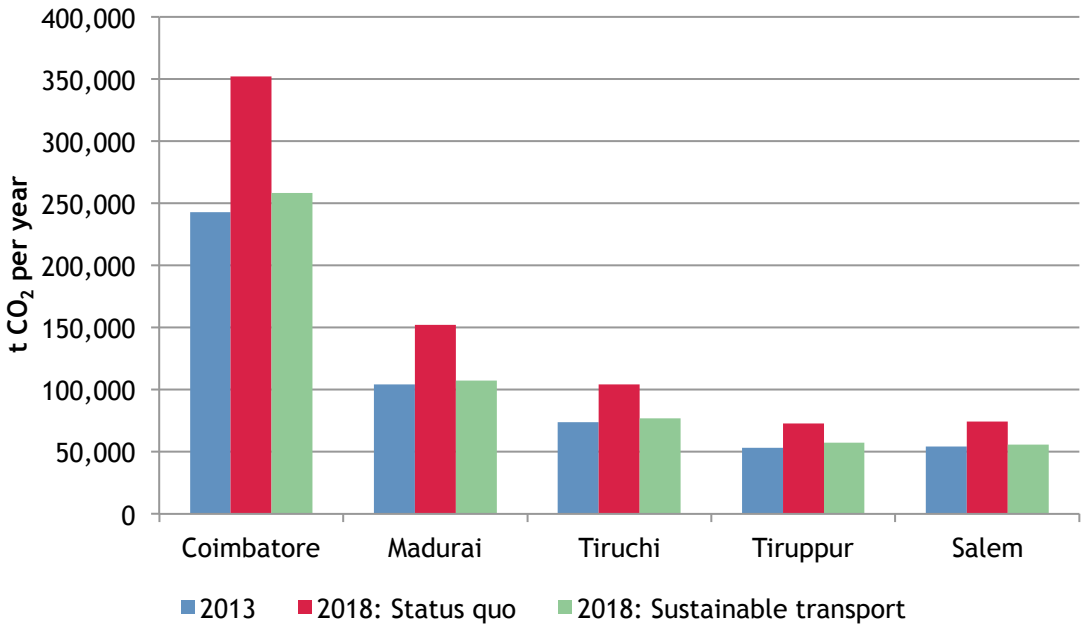


Figure 18. Greenhouse gas emissions under transport scenarios for TN cities (t CO_2 per year).

In addition to pollution benefits, the sustainable transport scenarios will help improve road safety, leading to a reduction in injuries and fatalities due to traffic collisions (Figure 19). Street design projects will have a direct impact on road safety by reducing speeds, providing safe facilities for pedestrians, and improving safety at intersections. The overall shift to sustainable transport modes will reduce overall vehicle-kilometres travelled by private motorised modes—reducing commuters' overall risk exposure.

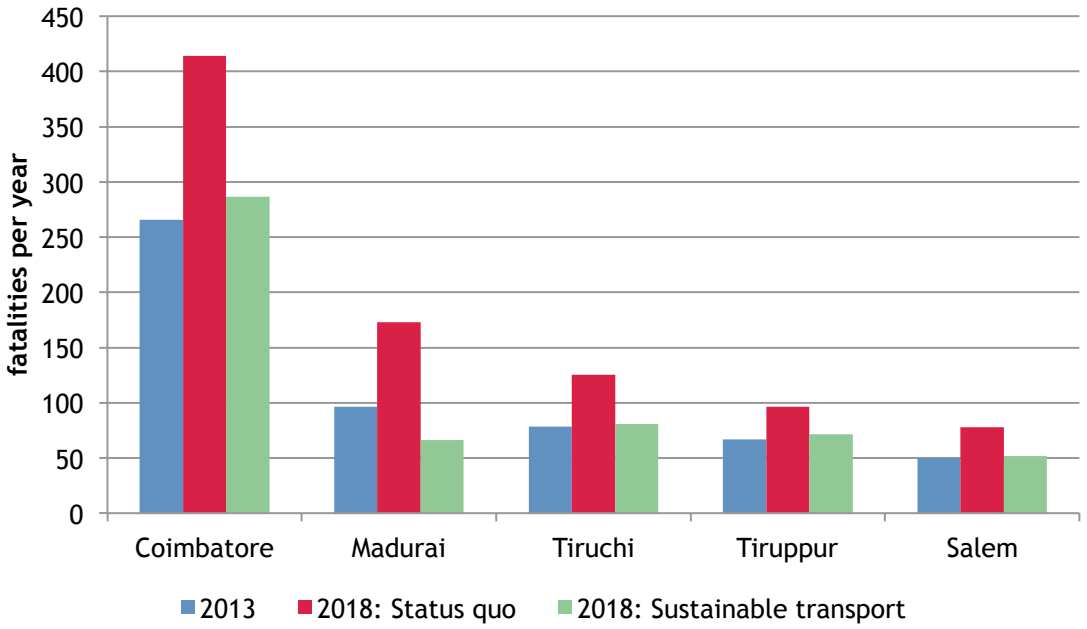


Figure 19. Fatalities from traffic crashes under transport scenarios for TN cities.

5. Transport projects

The cities identified investment priorities to help achieve the goals outlined above. Key strategies identified by the cities included improvements to public transport service (especially bus rapid transit and expanded city bus fleets), new facilities for cycling and walking, and measures to manage the use of personal motor vehicles. Common strategies are outlined below.

5.1. Bus rapid transit (BRT)

Bus rapid transit (BRT) is a high quality bus-based public transport system that delivers fast, comfortable and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. An efficient BRT can accommodate up to 4,000 to 45,000 people per hour per direction and typically costs 10 to 20 times less than a metro system.

BRT includes the following features:

- Frequent, fast service in dedicated bus lanes;
- High quality stations with platform that match the level of the bus so that passengers can enter and exit quickly and easily without climbing steps;
- Specially designed buses that operate in exclusive lanes in the centre of the street;
- Special bus fleet that is electronically monitored from a control centre to ensure reliability and provide real-time information to passengers;
- Smart ticketing at stations enhances passenger convenience and improves efficiency.

Figure 20: High quality BRT systems feature median stations with level boarding.

BRT systems offer the following advantages over other forms of rapid transit:

- Not bound to a track, bus routes can be easily adjusted and consist of a combination of corridors;
- Buses can also exit the track and serve nearby areas, thus providing direct connectivity;
- BRT can be built in a short period of time (under 18 months) and at a fraction of the cost of rail systems (≈ Rs 15 crores / km of BRT vs. ≈ Rs 150 to Rs 450 crores / km for rail-based systems);
- At grade, low-impact BRT stations are quick and easy for customers to access;
- BRT systems have the potential to provide a capacity over 20,000 pphpd (matching metro performance) using passing lanes and articulated vehicles;
- BRT operations plans can include multiple services per corridor and express services.

5.2. Bus fleet and facilities improvements

In most Tamil Nadu cities, high demand for public transport and low availability of transport vehicles means that existing buses are overburdened and usually of poor quality. Public transport bus fleets have increased marginally over the past decade but remain far short of international benchmarks. Per the World Bank's Urban Bus Toolkit, the minimum fleet requirement varies considerably from city to city, but typically lies between 50 and 120 buses per lakh population.[10] Most cities fall well short of the minimum requirement.

To better match the bus supply to travel, the cities require additional buses to expand their fleet. Cities must strive to provide a "comfortable journey," where buses do not carry more than 72 persons (48 seated and 24 standing). To effectively support an expanded bus fleet is it important to develop a finance plan that includes not just vehicles, but other essential facilities such as stops, terminals and depots. Per observations and experiences with other bus depots, bus depot for 100-300 buses will require a space of 5-12 acres.

[10] http://www.ppiaf.org/sites/ppiaf.org/files/documents/toolkits/UrbanBusToolkit/assets/1/evaluate.html

Figure 21. Bus terminals should provide high quality passenger waiting areas with real-time passenger information (left). All bus stops in the city should have high quality shelters that provide protection from the elements (right).

5.3. Customer information centre

To fully support and increase the use of public transport, it is important to prioritize enhancements that better the public transport customer experience. Providing easy-to-use customer information is a critical component of these efforts. To deliver time-sensitive, essential information for all potential public transport users, robust systems must be created to expand access, including a website, call centre, and improved signage.

First and foremost, public transport operators should disseminate basic system information including routes, timings, and fares. It should also deliver customized multimodal trip planning information via SMS, website, and over the phone. These systems will rely on an up-to-date central database with information from all transport providers in the city. Information on the city's public transport system gathered as part of this project will be made available to the public to facilitate the development of innovative services by third party developers.

Figure 22. Transport customer information services offered by Transport for London.

5.4. Footpaths

A significant proportion of trips below 2 km are performed on foot. Also all public transport passengers and many private vehicle users start and end their trips as pedestrians on public streets. Increasingly, engineers and planners are emphasising the need to design “complete streets” that make walking safe, comfortable, and convenient. While previous approaches to street design focused only on the movement of private vehicles, planners now recognize that all streets must have space for pedestrians. Hence, accommodating safe pedestrian access is the most important task of transport planning.

The utility of footpaths as spaces for social and economic activity must not be ignored. Thus they must be designed with dedicated space for other uses besides simply walking. Again, comfort, continuity and safety are the governing criteria for the design of pedestrian facilities. Thus, the footpaths are divided into three main zones: A. the frontage zone, B. pedestrian zone, and C. the furniture zone (Figure 23). The frontage zone can vary between from 0.5 to 1 m. The pedestrian zone must provide a continuous clear space for walking with a minimum width of 2 m and must be entirely free of obstructions. Street utilities such as manholes, trees, benches and other potential obstructions should be placed outside the path of travel and in the furniture zone.

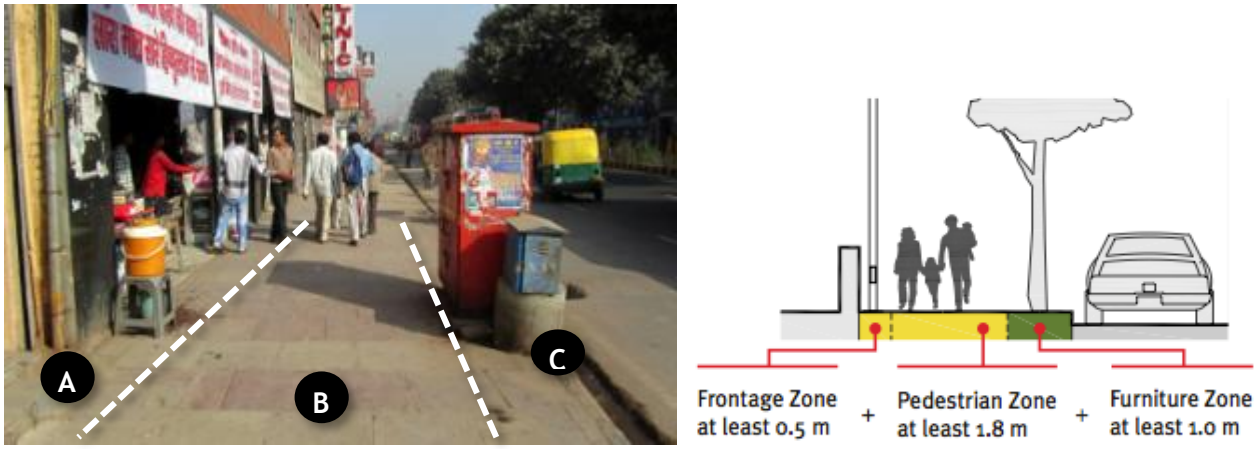


Figure 23. A footpath in a commercial area demonstrating three main zones: (A) the frontage zone, (B) pedestrian zone, and (C) the furniture zone.

Well-planned footpaths provide continuous space for walking. They also support other activities such as street vending and waiting at bus stops without compromising pedestrian mobility. The success of a footpath depends on the integration of multiple elements in a coherent design.

5.5. Cycle tracks

Cycles offer low-cost, pollution free mobility and occupy just one tenth of a car space. Currently, cyclists witness inconvenience and safety hazards from faster moving traffic. A segregated cycle lane will provide a safe and convenient infrastructure and also attract new users. Cycling in a segregated track is often faster than using a private motor vehicle. A cycle track should have a minimum width of 2 m for one-way movement, a smooth surface material, shade from trees, an elevation of 150 mm above the carriageway, and a buffer of 0.5 m between the track and carriageway.

Figure 24. Wide, unobstructed footpaths and continuous cycle tracks are an important component of a complete network of facilities for non-motorised transport users.

5.6. Cycle sharing

Cycle sharing a flexible form of personal public transport with cycles stored in a closely spaced network of stations. With the use of a smart card or other form of identification, a user can check out a

cycle from a station and use it for a short ride, and return it to any other station. They are often placed near public transport systems to provide last-mile connectivity.

Modern cycle sharing systems employ the following best practice features:

- A dense network of stations across the coverage area, with approximately 200 to 300 m between offices and residences and the nearest cycle sharing station.
- A fully automated locking system at stations that allows users to check cycles in or out without the need for staffing at the station.
- Radio frequency identification devices (RFIDs) to track where a cycle is picked up, where it is returned, and the identity of the user.
- Real-time monitoring of station occupancy rates through General Packet Radio Service (GPRS), used to guide the redistribution of cycles.
- Cycles with specially designed parts and sizes to discourage theft and sale as whole or for parts.
- Real-time user information provided through various platforms, including the web, mobile phones, and/or on-site terminals.
- Advertising space on cycles and at stations (provides revenue generation options for system operator or city).
- Pricing structures that incentivise short trips, helping to maximize the number of trips per cycle per day.

Figure 25. Modern cycle sharing systems feature a dense network of stations. A user checks out a cycle using an RFID-enabled smart card and can return it to any other station. A unique, robust cycle design is critical the branding and reliability of the system. The cycle should be a unisex model with an adjustable seat.

5.7. Greenways

To supplement walking and cycling improvements on existing streets, open spaces in the city can be developed as non-motorized transport (NMT) corridors that support long-distance commuting as well as recreational uses. The terminology *greenway* is used to describe walkways and cycle paths that utilize an independent right-of-way (ROW), such as in a park or along a transport corridor. In many

cities the presence of several rivers and canals presents the opportunity to create high quality greenways that improve mobility for all NMT users.

The following actions are recommended to support successful footpath, cycle and greenway network:

- Integrate greenways into the existing networks of cycle tracks and pedestrian footpaths.
- Clean the waterways along rivers and canals and remove encroachments to open up these spaces for recreational uses.
- Develop pedestrian and cycling pathways around parks in open spaces.

Figure 26. Greenways can offer pedestrian and cycling paths along clean waterways.

5.8. Pedestrian zones

In areas where the demand for pedestrian activity is the greatest, municipal corporations are recommended to work collaboratively with key municipal and public stakeholders to develop pedestrian-only zones. These zones should include the prohibition of all private vehicle traffic, using bollards and other barriers to physically prevent vehicles from encroaching on NMT space. Examples of possible spaces for pedestrian-only zones include important market streets, historical and cultural areas, schools, and municipal institutions per the pedestrian zone criteria developed.

Pedestrian zones must ensuring compliance of the zones with disability access guidelines, as well as providing cycle parking. Commercial deliveries should only be accommodated during hours outside of normal usage.

Figure 27. Proposed pedestrian zone in Mylapore, Chennai (left) and an existing pedestrian zone in Guangzhou (right) with streets free of vehicles.

5.9. Travel demand management

At present, on-street parking is free of charge in all five cities. Parking enforcement mechanisms are limited, resulting in haphazard parking arrangements that compromise the ability of streets to serve as mobility corridors.

Cities must develop competitive alternatives for travel private vehicles. They must also mitigate the negative impacts of motorized transport infrastructure (such as urban sprawl, traffic congestion, oil dependence, climate change, etc.) through managing the demand for road space and travel. In Tamil Nadu, the easiest, cheapest and most effective manner to control the demand for motorized travel is to manage vehicle parking. Unregulated (free or cheap) parking is simply a subsidy for private vehicle use.

To implement a robust on-street parking management and enforcement system, on-street parking spaces must be regulated by the Municipal Corporation, and priced according to the demand for parking (See above). The existing parking management system, including current earnings and expenditures, operational systems, and public perception must be documented, assessed and improved. An expanded and improved parking management system can help facilitate the efficient allocation of road space, generate revenue for sustainable transport projects, and encourage a shift to more sustainable modes.

The improved management system's required equipment (hardware, software, etc.) includes the following:

- Handheld devices are required so that the field executives will use to administer parking fees and the enforcement personnel will use to check whether vehicles have paid the requisite parking fees and issue fines in cases of default.
- Management software that will serve as the interface between the field executives, system managers, and the municipal corporation.
- On-street signage, consisting of static signs indicating the parking rules on each road stretch as well as dynamic message boards alerting drivers about the available capacity in nearby parking facilities.
- Customer centres must also be created to give maximum available assistance to vehicle owners.

- A telephone hotline will have to be created which would work during the hours when the parking meter is functioning.
- Mobile apps will have to be created to give customers live information on parking availability with duration and cost.

Figure 28. Use of parking meters in San Francisco (left) and real-time parking information display in Beijing (right).

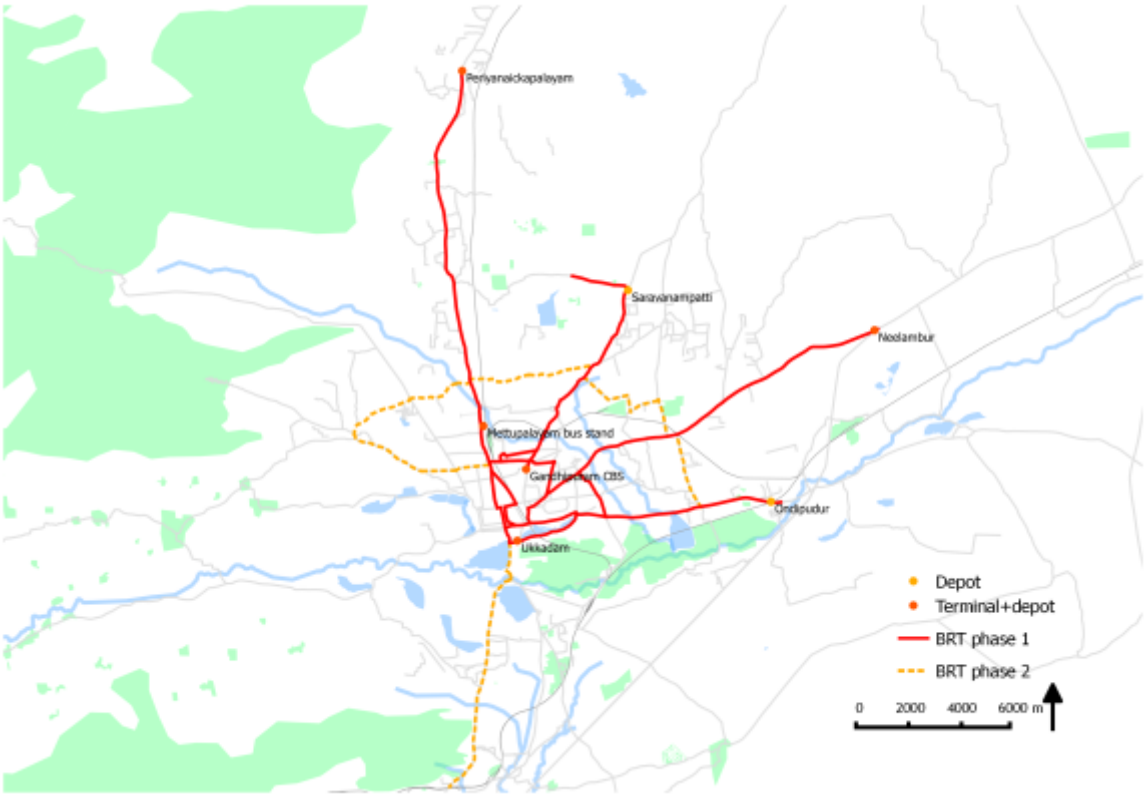
Implementation of parking management will not incur additional costs to the city. The cities can employ a service provider to establish, operate and maintain the parking system. In the Chennai parking management system, the fee is Rs 5 per hour per car. In the city's initial tender, the winning bidder offered to provide parking services for a service payment of Rs 3.90. The Corporation collects the surplus Rs 1.1 as revenue.

6. Five-year strategic transport plans

6.1. Coimbatore

6.1.1. BRT

Coimbatore has proposed a 72 km Phase 1 BRT network covering major arterial corridors including Mettupalayam Rd, Sathyamangalam Rd, Avinashi Rd, and Tiruchirappalli Rd. During the ITDP survey, these corridors were observed to have high passenger volumes ranging from 3,000 to 6,000 passengers per hour per direction. These corridors provide essential connectivity and linkages to important towns such as Mettupalayam, Sulur, Neelambur etc. Phase 1 is estimated to cost Rs 1,080 crore. The city has also identified a circular Phase 2 corridor that links the Phase 1 corridors. The corridor includes Cowley Brown Road, Nallapalayam Road, and Kamaraj Road, from R.S. Puram to Singanallur, and Palghat road covering a length of 35 km and is estimated to cost approximately Rs 525 crores. Map 1 indicates these routes and their lengths.



Map 1. Coimbatore phase 1 BRT corridors covering a length of 72 km

Table 17. Proposed BRT corridors in Coimbatore.

Corridor	From	To	Peak volume (pphpd)	Length (km)	Cost (Rs crore)
Avinashi Rd	Ukkadam	Neelambur	6,100	20	300
Sathyamangalam Rd	Gandhipuram Town Bus Stand	Saravanampatty	3,459	14	210
Tiruchi Rd	Ukkadam	Ondipudur	3,900	15	225
Mettupalayam Rd	Ukkadam	Narasimhanaickenpalayam	5,600	23	345
Total				72	1,080

Figure 29. Coimbatore identified bus rapid transit (BRT) as a key strategy to improve the quality of public transport service. BRT will transform Mettupalayam Rd by giving dedicated space to public transport as well as pedestrians.

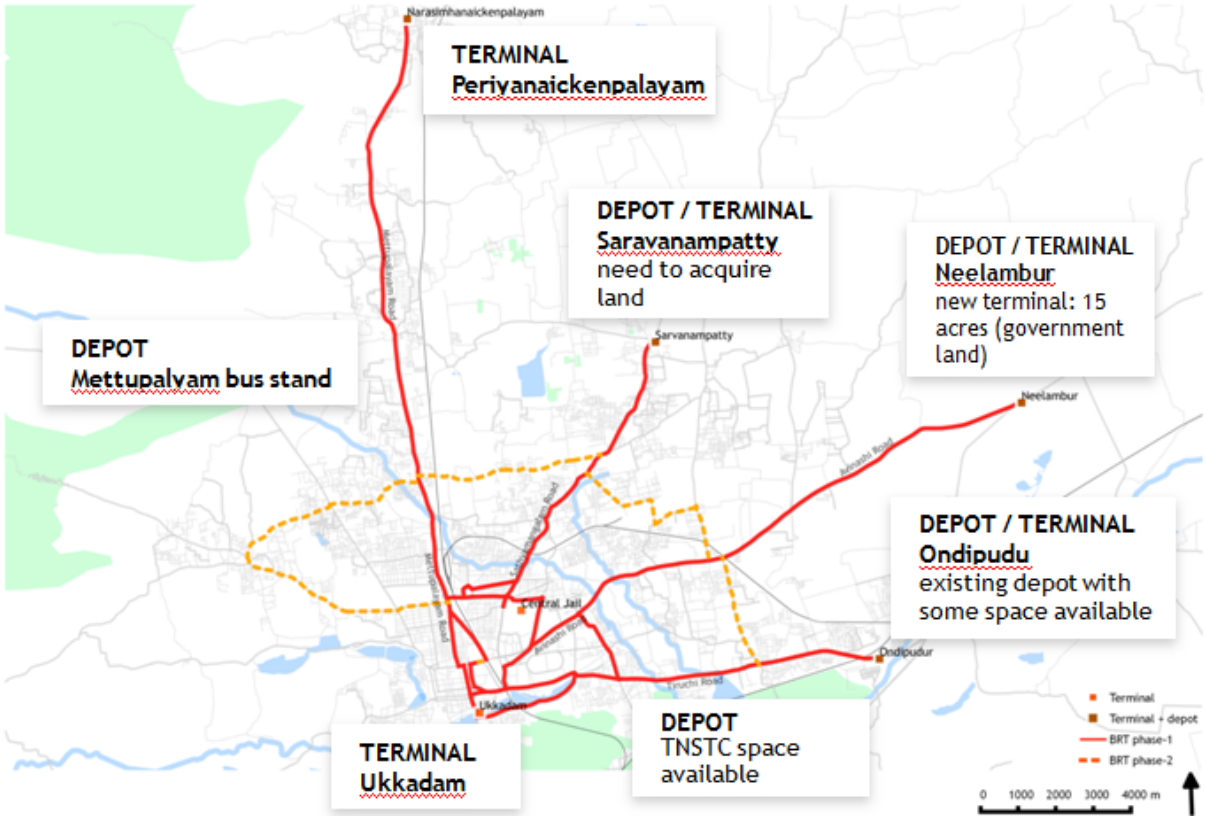
6.1.2. City Bus Expansion

Coimbatore has an existing bus fleet of 932 buses. This is the highest fleet size in comparison to the other four cities. However, Coimbatore's public transport system has not kept pace with the region's population growth. During peak hours, it was witnessed, that these buses experience extremely crowded, unsafe conditions with more than 100 passengers per vehicle. With low availability of buses, passengers are forced to ride on footboards. Passenger comfort is also compromised by the overall poor quality of the rolling stock.

To address these issues, the city has proposed for an additional 240 buses. These new buses will allow the city to replace some of the old fleet and provide relief from overcrowding. Increase supply of buses would also provide opportunity for the existing 35% who use private vehicles, to switch their mode of travel to a more sustainable one. It is anticipated that at least 3-4% of private vehicle users will choose to travel by bus if the fleet expands along with new BRT buses.

These buses are high quality, semi-low floor buses with automatic transmissions. The additional 240 buses are estimated to cost Rs 84 crore at the rate of Rs 35 lakh per bus.

In order to store and maintain the existing and the new fleet, the city has proposed to upgrade seven depots and terminals, which is estimated to cost Rs 65 crore. Map 2 identifies the locations of the proposed depots and terminals.



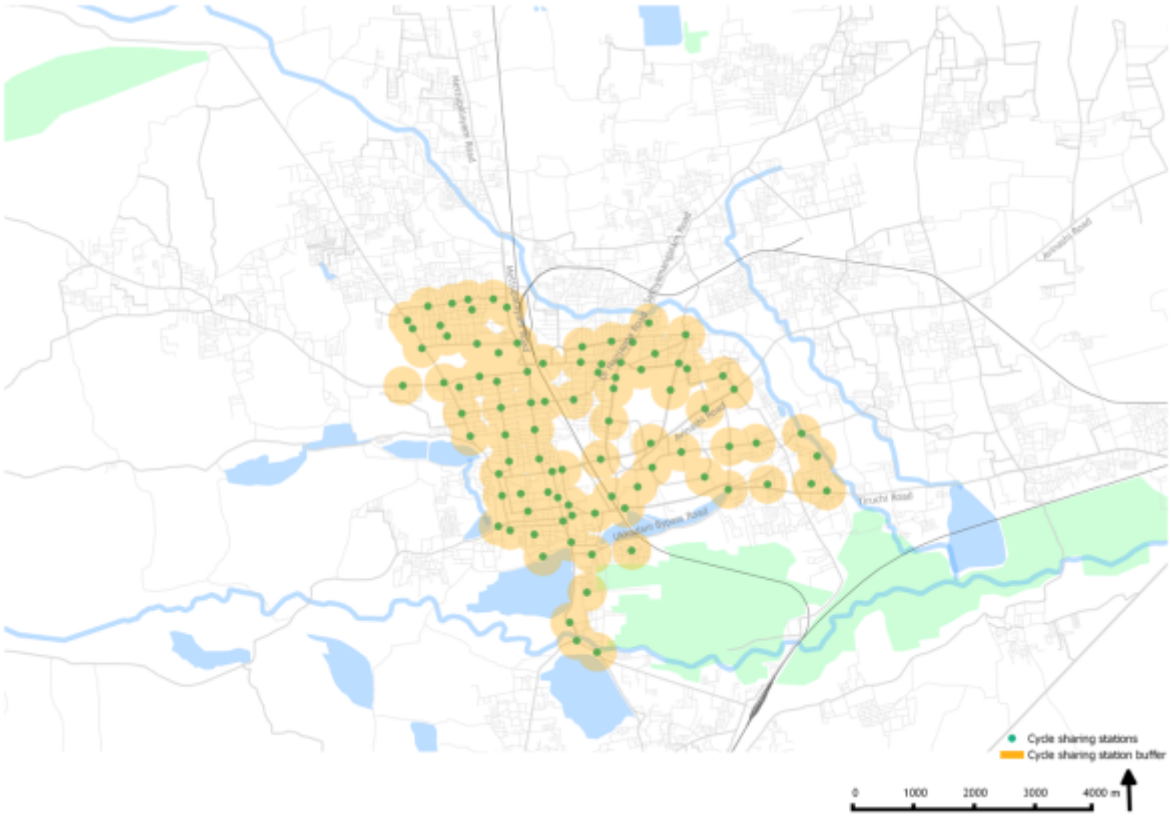
Map 2. Location of proposed terminals and depots

The city has proposed additional support infrastructure including upgrade of 200 bus shelters, ITS and customer service improvements. The bus shelters that do exist are significantly undersized with lack of seating arrangements. The proposed bus shelter upgrade will include amenities for transport customers and be sized according to passenger demand. Upgrading bus stops is estimated to cost Rs 20 crore.

In addition, passenger travel experience can also be enhanced with improved ITS and customer service. The customer information system should include a website as well as a call centre to serve customers without web access. Improving ITS and including a customer information centre will approximately cost Rs 23 crore. The cost includes ITS improvement for existing and new TNSTC buses and well as private buses. This is to ensure than an integrated bus system is achieved.

6.1.3. Cycle Sharing

As Coimbatore proposes to implement a bus rapid transit system, cycle sharing is increasingly an important means of providing first-mile/last-mile connectivity to mass rapid transit stations. Coimbatore has proposed a cycle sharing system of 19 sq km coverage area. Map 3 has identified potential cycle stations locations where demand for its use is expected to be much greater. This is estimated to cost Rs 29 crore.



Map 3. Potential cycle station locations for the proposed Cycle Sharing system Station covering an area of 19 sq km.

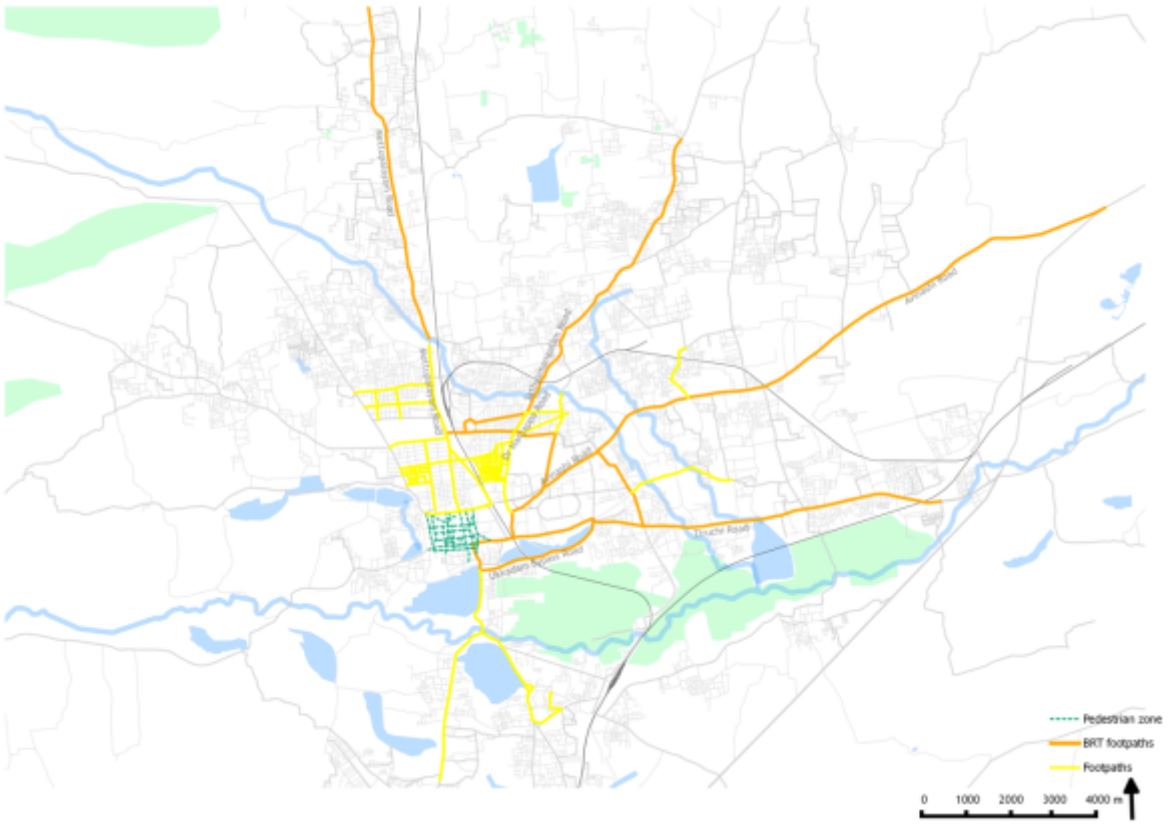
6.1.4. Footpaths and pedestrian zones

Coimbatore has proposed 54 km of footpaths and a 13 km network of pedestrian streets. A significant proportion of trips below 2 km are performed on foot and Coimbatore aims to increase its walking mode to 30 per cent in 2018. Hence, upgrading footpaths for safe pedestrian access is the most important task to improve NMT.

Along with constructing footpath along streets, it is important to identify areas where pedestrian density is the highest and ensure that these environments do more than facilitate movement. In Coimbatore the central local market streets bordered by Sukrawarpet Street, Oppanakara Street, Big Bazaar Street and Sullivan Street are proposed to be developed with plazas, seating, trees and structures for shade, as well as space for organised street vending.

Upgraded footpaths and construction of pedestrian zone will encourage walking within the city and increase its mode share by at least 3%. However, if business continues as usual, it would only result in a reduction of 1.5 lakh walking trips within the next five years.

Footpath upgrade is estimated to cost 54 crore and 13 km of pedestrianised streets will cost Rs 16 crore. Map 4 indicates the locations of both these NMT improvements.

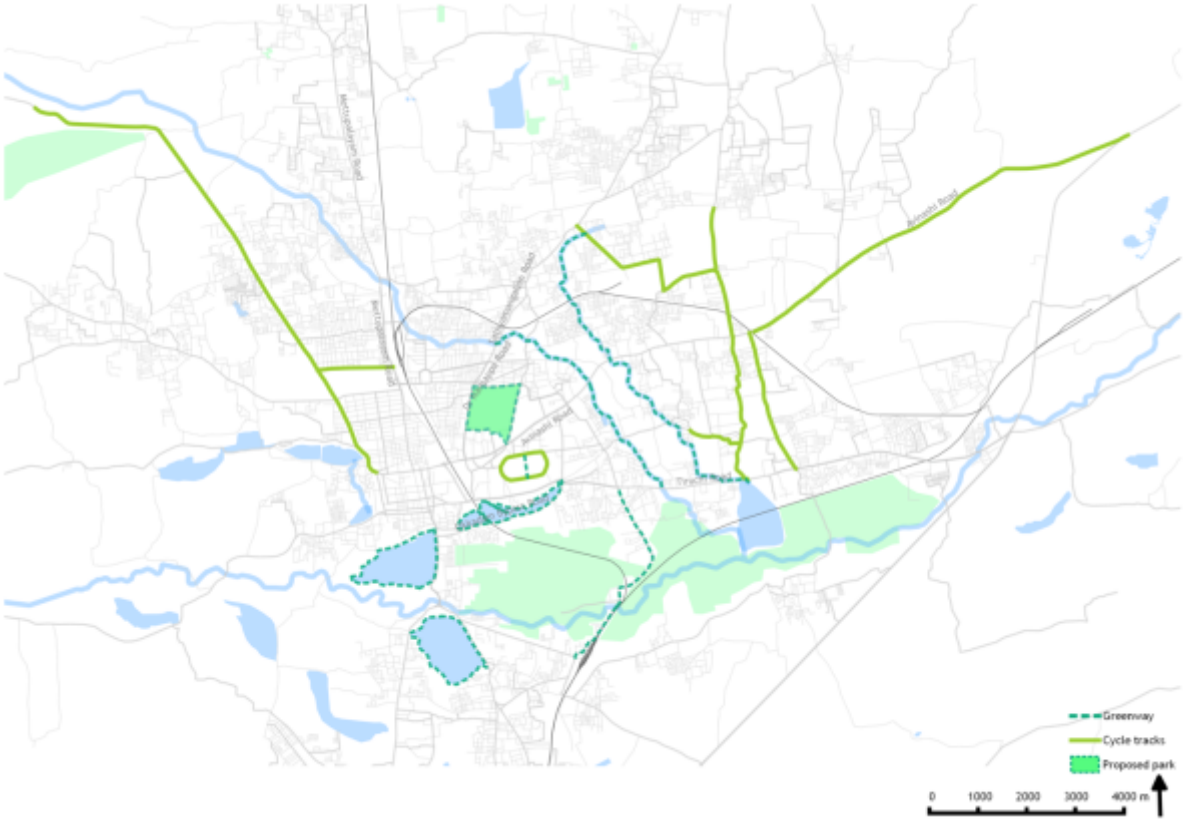


Map 4. Streets identified for its footpaths and location of the proposed pedestrian zone in Coimbatore.

5.1.1 Greenways and cycle tracks

Coimbatore has proposed a 48 km long greenway along two water bodies that run from Sathyamangalam Road to Tiruchirappalli Road and Peelamedu railway crossing to Singanallur Tank, and around Periya Kulam, Perur, Kurichi Kulam, Chinna Kulam and Valankulam. The greenways along the river are appropriately proposed to act as feeder routes to the BRT corridor and form a part of the 48 km long cycle track.

The city' segregated cycle tracks proposes to provide a safe movement of people cycling by 2018 (Map 5). Coimbatore currently has a cycling mode share of only 7%; however, it is anticipated that with improvements to the cycling infrastructure, its mode share is expected to increase to 10%. The 48 km long greenway is estimated to cost Rs 96 crore, while the cycle tracks will cost Rs 48 crore.



Map 5. Proposed locations of the 48 km long greenway network proposed within the city and 48 km of segregated cycle tracks.

6.1.5. Parking Management

Coimbatore's private vehicle mode share will increase by 10 per cent if the use of private vehicles is encouraged through mediums such as free parking. Free parking in Coimbatore is increasingly over-used around commercial areas such as Town Hall, Ram Nagar etc. Parking management is critical to ensure efficient use of street space and parking demand management.

With the proposal of a pedestrian zone around Town Hall, a parking management system is proposed to be implemented to manage displaced parking of approximately 13,800 vehicles. 46 km of parking management is proposed to be implemented north of Gandhi Park up to the post office, around Race Course and around Ram Nagar (Map 6).

Map 6. Streets identified for parking management in Coimbatore.

6.1.6. Summary of transport investments

The following table summarises Coimbatore's transport investment in public transport systems, NMT, and parking management. These investments were calibrated to ensure that the city can meet the mode share goals established in the initial phase of the planning process.

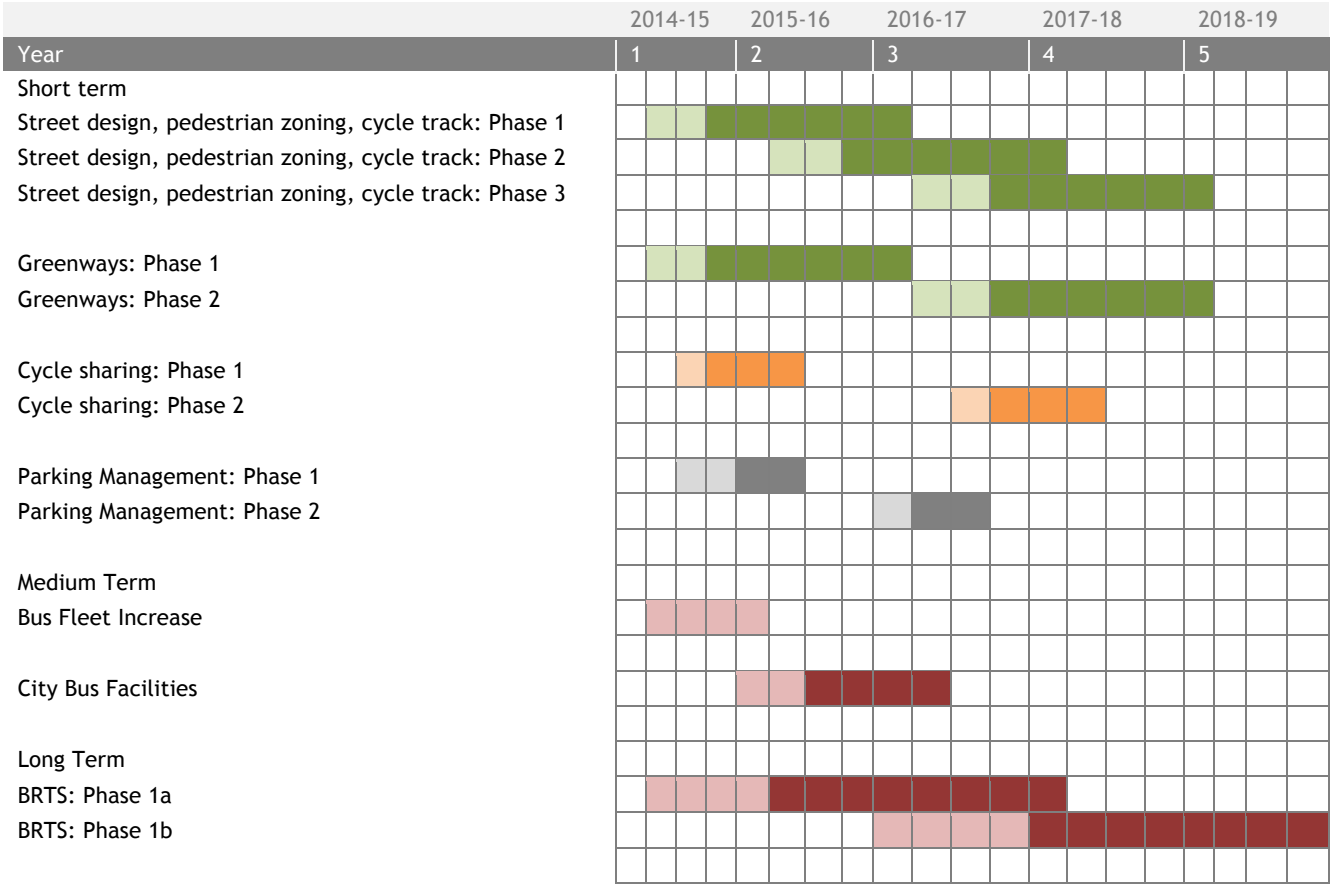
Table 18. Coimbatore transport investments

Area	Project	Details	Cost (Rs crore)
Non-motorised Transport	Footpaths	54 km	54
	Cycle tracks and footpath upgrade	48 km	96
	Pedestrian zones	13 km	16
	Greenway	48 km	96
Public Transport	BRT	72 km	1,080
	City bus fleet expansion	240	84
	New bus depots	5	50
	New bus terminals	3	15
	New bus stops	200	20
	ITS & Customer Service	1	23
	Cycle Sharing	19 sq km	29
Travel Demand Management	On-street Parking management	46 km	-
Total			1,563

6.1.7. Timeline

The table below is a representative project timeline for implementation of the sustainable transport initiatives by Coimbatore. Footpaths, cycle tracks, pedestrian zones, and greenways will be implemented in annual packages, while BRT design and planning will last approximately 3 years for each phase. Cycle sharing and parking have relatively short implementation periods.

Table 19. Coimbatore project timeline. Design work for the respective transport initiative is shown in a lighter tint, while implementation and civil works are indicated by darker bars.



6.2. Tiruppur

6.2.1. BRT

Tiruppur has proposed a 24 km long BRT corridor that is estimated to cost Rs 360 crore. Map 7 indicates these routes and their proposed BRT lengths. The first corridor runs from Tiruppur Palladam Road, along SH 172 to Dhararapuram Road; the second corridor is from Avinashi-Tiruppur Road, along Kumaran Road, to Avinashi Road. Both these corridors provide important north-south connection with heavy public transport volumes. With the introduction of a BRT, Tiruppur's bus mode share is expected to increase from 17 per cent to 23 per cent in the next five years. This is essential to avoid an increase to the existing 40 per cent private vehicle mode share, which is the highest in comparison to the other four cities.

Map 7. Tiruppur phase 1 BRT corridors covering a length of 24 km

Table 20. Proposed BRT corridors in Tiruppur.

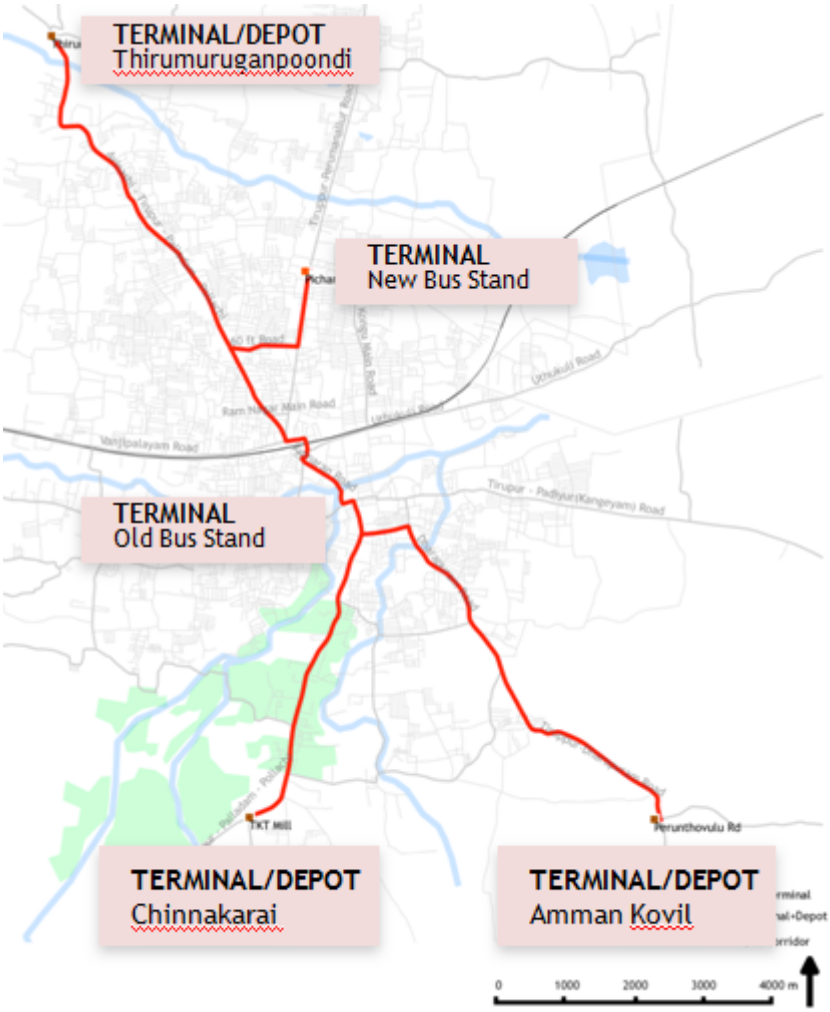
Corridor	From	To	Peak volume (pphpd)	Length (km)	Cost (Rs crore)
Tiruppur Palladam Rd -SH 172-Dhararapuram Rd	Veerapandi	K Chettipalayam (Perunthovulu Rd)	2,039	14	210
Avinashi Tiruppur Rd-Kumaran Rd-Avinashi Rd	Tiruppur Old	Thirumurgan Poondi	4,050	10	144
Total				24	354

Figure 30. Tiruppur identified bus rapid transit (BRT) as a key strategy to improve the quality of public transport service. BRT will transform Avinashi Rd by giving dedicated space to public transport as well as pedestrians.

6.2.2. City Bus Expansion

The city has proposed an additional 250 buses to complement the existing bus fleet of 281 TNSTC buses. With the introduction of new buses, along with the existing fleet and BRT buses, bus boarding would increase by a staggering 68 per cent by 2018. This increase would assist in shifting private vehicle mode share to buses as these buses are high quality, semi-low floor buses with automatic transmission. Additional 250 buses are estimated to cost Rs 150 crore at the rate of Rs 35 lakh per bus.

In order to store and maintain the existing and the new fleet, the city has proposed to have three new bus depots and five new bus terminals. The new depots are estimated to cost Rs 30 crore and Rs 25 crore for the new terminals. Map 8identifies the locations of the proposed depots and terminals.

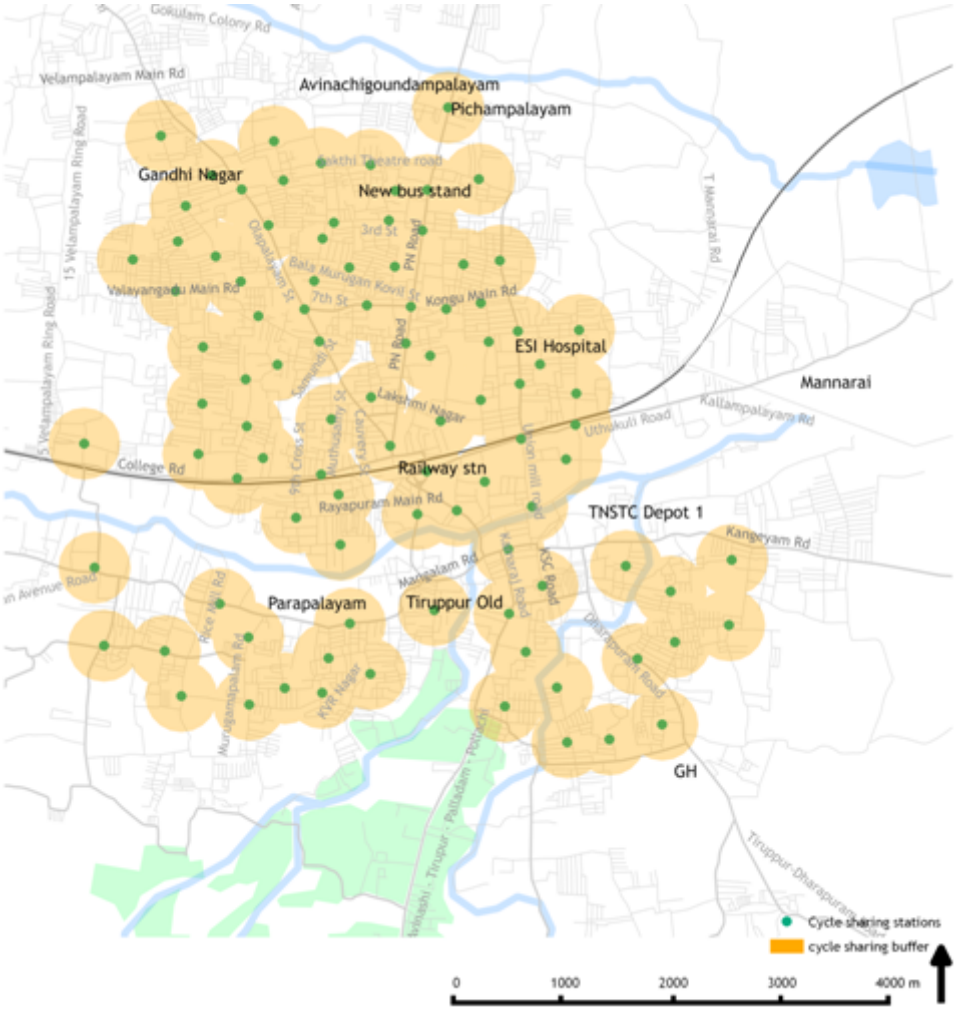


Map 8. Location of proposed terminals and depots

The city has proposed additional support infrastructure including ITS improvements and customer service improvements. Passenger travel experience can be enhanced with improved ITS and customer service. The customer information system should include a website as well as a call centre to serve customers without web access. Improving ITS and including a customer information centre will approximately cost Rs 16 crore. This amount includes existing and new proposed TNSTC buses along with private buses to ensure that an integrated transport system is achieved.

6.2.3. Cycle Sharing

With the implementation of a BRT system, cycle sharing is increasingly an important means of providing first-mile/last-mile connectivity to mass rapid transit stations. Tiruppur proposed a cycle sharing system of 23 sq km coverage area. Map 9 has identified potential cycle stations locations where demand for its use is expected to be high. This is estimated to cost 35 crore.



Map 9. Proposed cycle sharing station locations in Tiruppur.

6.2.4. Footpaths and pedestrian zones

Tiruppur has proposed 58 km of footpaths around the city and a 2.1 km pedestrian zone along Flower Market. It is essential to improve pedestrian accessibility within the city as walking shares 28 per cent of the total mode share. This is because, majority of trips below 2 km are done on foot. If these improvements are not executed, Tiruppur may witness a loss of 45,000 walking trips per day. Tiruppur cannot afford to lose its NMT mode share.

Thus, the central local market streets from the Flower Market to the end of Eswaran Koil street and Town Extension, covering a length of 2.1 km, is proposed to be developed as a pedestrian only zone. This zone would be designed with seating, trees and structures for shade, as well as space for organised street vending.

Footpaths are estimated to cost Rs 58 crore and the 2.1 km pedestrian zone will cost Rs 3 crore. Map 10 indicates the locations of both these NMT improvements.

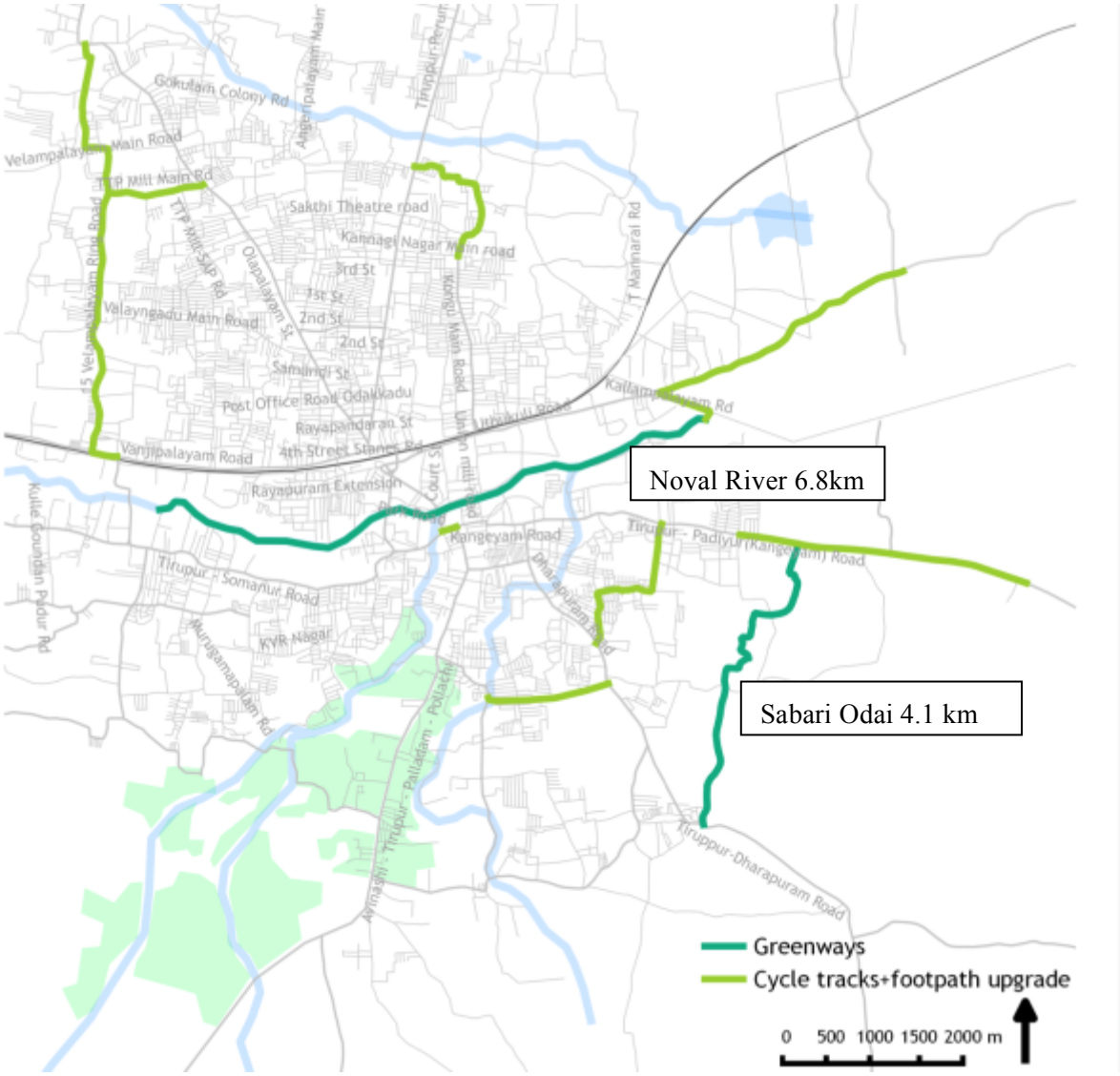
Map 10. Streets identified for footpaths and location of the proposed 2.1 km pedestrian zone in Tiruppur.

Figure 31. In Tiruppur, pedestrians at Flower Market are forced to walk in the carriageway due to the lack of pedestrian facilities (left). The street will be redesigned with a dedicated pedestrian zone with landscaping and street furniture (right).

6.2.5. Greenways and cycle tracks

Tiruppur has proposed 11 km long greenways along Noyal River, and Sabari Odai (from Sarvana Mahal to Kangeyam Road). The existing development along Noyal River, such as educational institutions, industries etc., would benefit from a greenway as it provides a safe space for recreation and opportunity for environmental protection of the River. In regards to Sabari Odai, the Tiruppur Corporation has already conducted preliminary study on improving the health of this Odai and thus, designing it into a greenway would better help this cause.

Furthermore, both these locations are appropriately proposed to act as feeder routes to the wide BRT network and form a part of the 20 km long cycle track (Map 11). The 11 km long greenway is estimated to cost Rs 22 crore and approximately Rs 20 crore for its segregated cycle track.



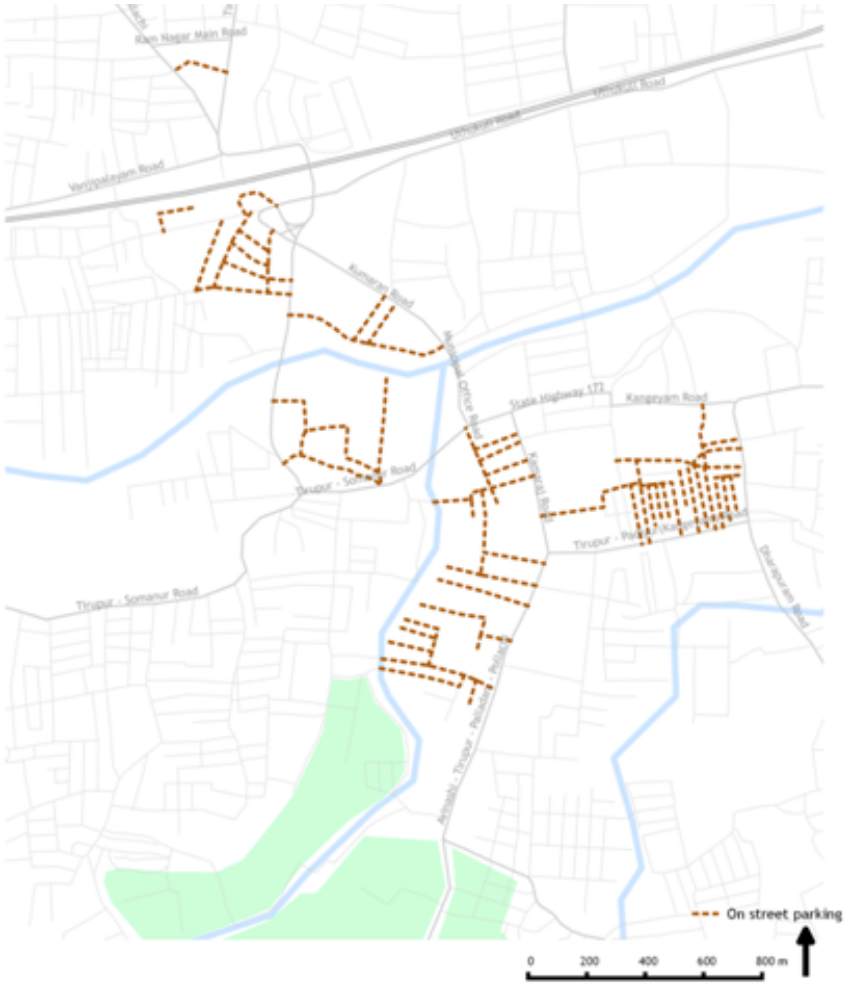
Map 11. Proposed locations of the 11 km long greenway network proposed along Noyal River and Sabari Odai

Figure 32. The Sabari Odai in Tiruppur, currently an unimproved drainage channel (left), can be redeveloped with continuous pedestrian paths and cycle ways (right).

6.2.6. Parking management

Tiruppur has one of the highest uses of private vehicles, especially two-wheelers, among the five cities. It needs to mitigate the negative impacts of motorized transport by managing the demand for road space and travel. The cheapest and most effective way of doing so is to manage vehicle parking.

In conjunction with the proposal of a pedestrian zone from the Flower Market to Eswaran Koil Street, a parking management system is proposed to manage the displaced parking. Parking management is required around other areas of central Tiruppur to allow for safer walking spaces within the city and encourage commuters/shoppers to use public transport to access commercial activities. Parking management will help redistribute parked vehicles from congested streets like Kumaran Rd to other streets where more road space is available.



Map 12. Streets identified for parking management in Tiruppur.

6.2.7. Summary of transport investments

The following section summarises Tiruppur's transport investment in public transport systems, NMT and parking management. These investments were calibrated to ensure that the city can meet the mode share goals established in the initial phase of the planning process.

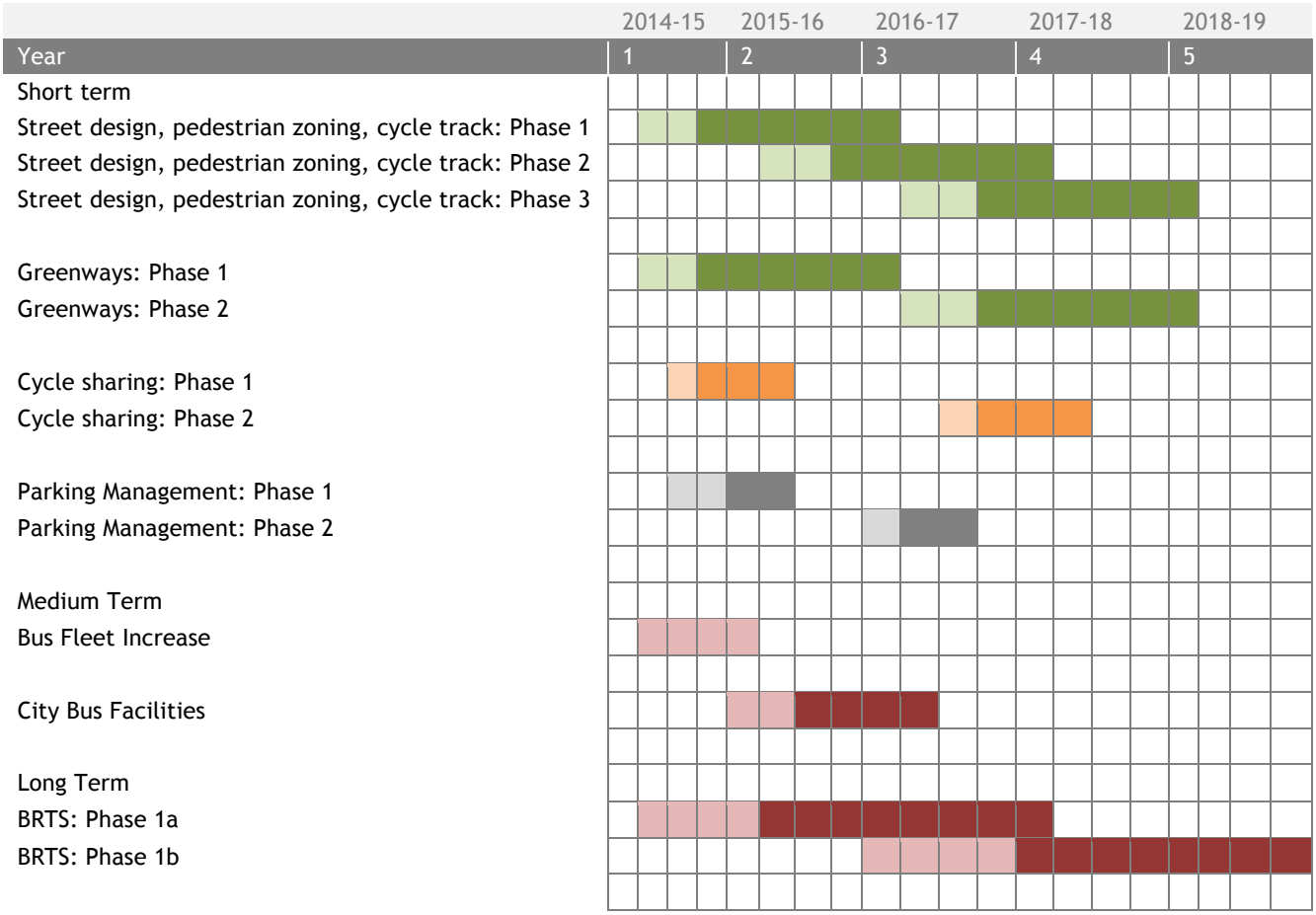
Table 21. Required transport investment for Tiruppur (Rs crore)

Area	Project	Details	Cost
Non-motorised Transport	Footpaths	22 km	22
	Cycle tracks and footpath upgrade	20 km	40
	Pedestrian zones	2.1 km	3
	Greenway	11 km	22
Public Transport	BRT	24 km	348
	City bus fleet expansion	250	150
	New bus depots	3	30
	New bus terminals	5	25
	ITS & Customer Service	1	16
	Cycle Sharing	23 sq km	35
Travel Demand Management	On-street Parking management	16 km	-
Total			691

6.2.8. Timeline

Table 22 shows a representative project timeline for implementation of the sustainable transport initiatives Tiruppur.

Table 22. Tiruppur project timeline. Design work for the respective transport initiative is shown in a lighter tint, while implementation and civil works are indicated by darker bars.



6.3. Tiruchirappalli

6.3.1. BRT

Tiruchirappalli's proposed BRT corridor covers a length of 18 km and is estimated to cost Rs 270 crore. Map 13 indicates these routes and their proposed BRT lengths. The two corridors proposed are from Central Bus Stand (CBS) to Srirangam (13km) and from CBS to K.K. Nagar (5 km), connecting north and south Tiruchirappalli Map 13).

The proposed corridors provide an important north-south linkage within the city from Srirangam to K.K. Nagar. With the implementation of a BRT, Tiruchirappalli's bus mode share is expected to increase by 7 per cent by 2018, which is equivalent to an increased 2 lakh trips each day.

Map 13. Tiruchirappalli phase 1 BRT corridors covering a length of 18 km

Table 23. Proposed BRT corridors in Tiruchirappalli.

Corridor	From	To	Peak volume (pphpd)	Length (km)	Cost (Rs crore)
Central BS - Palakkarai Rd- NH 67	Central Bus Stand	Srirangam	5,424	13	195
Central BS - Mannarpuram - Rajaram salai - K.K.nagar	Central Bus Stand	K.K.Nagar	N/A	5	75
Total				18	270

Figure 33. Tiruchirappalli identified bus rapid transit (BRT) as a key strategy to improve the quality of public transport service. BRT will transform Bharathiar Salai by giving dedicated space to public transport as well as pedestrians.

6.3.2. City Bus Expansion

Tiruchirappalli has proposed to add 150 buses (100 low floor buses and 50 semi-low floor buses). These additional buses are expected to replace some of the old fleet and provide relief from overcrowding. Tiruchirappalli has a current figure of 3.9 lakh bus boarding per day, however, with the introduction of new bus fleet along with the BRT buses Tiruchirappalli can witness an increase of 5.9 lakh bus boardings in 2018 by attracting users from paratransit and private vehicles. The additional 150 buses are estimated to cost Rs 78 crore at the rate of Rs 35 lakh per bus for a semi-low floor and Rs 60 lakh for low floor buses.

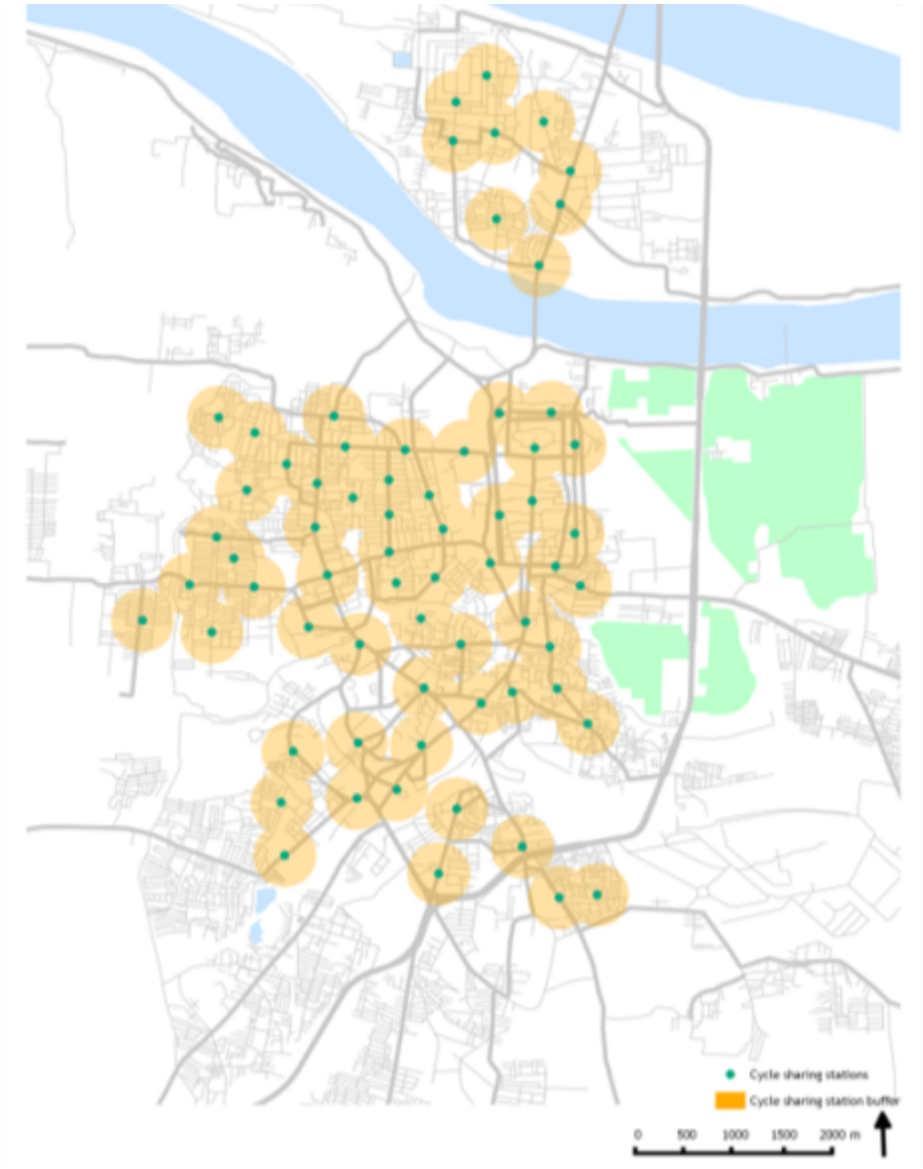
In order to store and maintain the existing and the new fleet, the city has proposed to upgrade three bus terminals at Chatram, CBS, and K.K. Nagar at an estimated cost of Rs 15 crore. In addition, the city has proposed to upgrade one bus depot at Srirangam.

In addition, passenger travel experience can be enhanced with improved ITS and customer service. To deliver time-sensitive, essential information for all potential public transport users, robust systems must be created to expand access, including a website, call centre, and improved signage. Improving ITS and including a customer information centre will approximately cost Rs 17 crore. These costs include ITS for existing and proposed TNSTC buses as well as private buses, to ensure an integrated transport system.

6.3.3. Cycle Sharing

Tiruchirappalli has proposed a cycle sharing system of 20 sq km coverage area. Map 14 has identified potential cycle stations locations where demand for its use is expected to high for short trips of 1 to 5 km. Its strategic location, such as the stations around temples, will solve the ‘last-mile’ problem that will help passengers travel from a transit mode such as a BRT, to their final destination. This is why the stations have been densely distributed along the proposed BRT corridors.

A cycle sharing system of 20 sq km is estimated to cost Rs 30 crore.



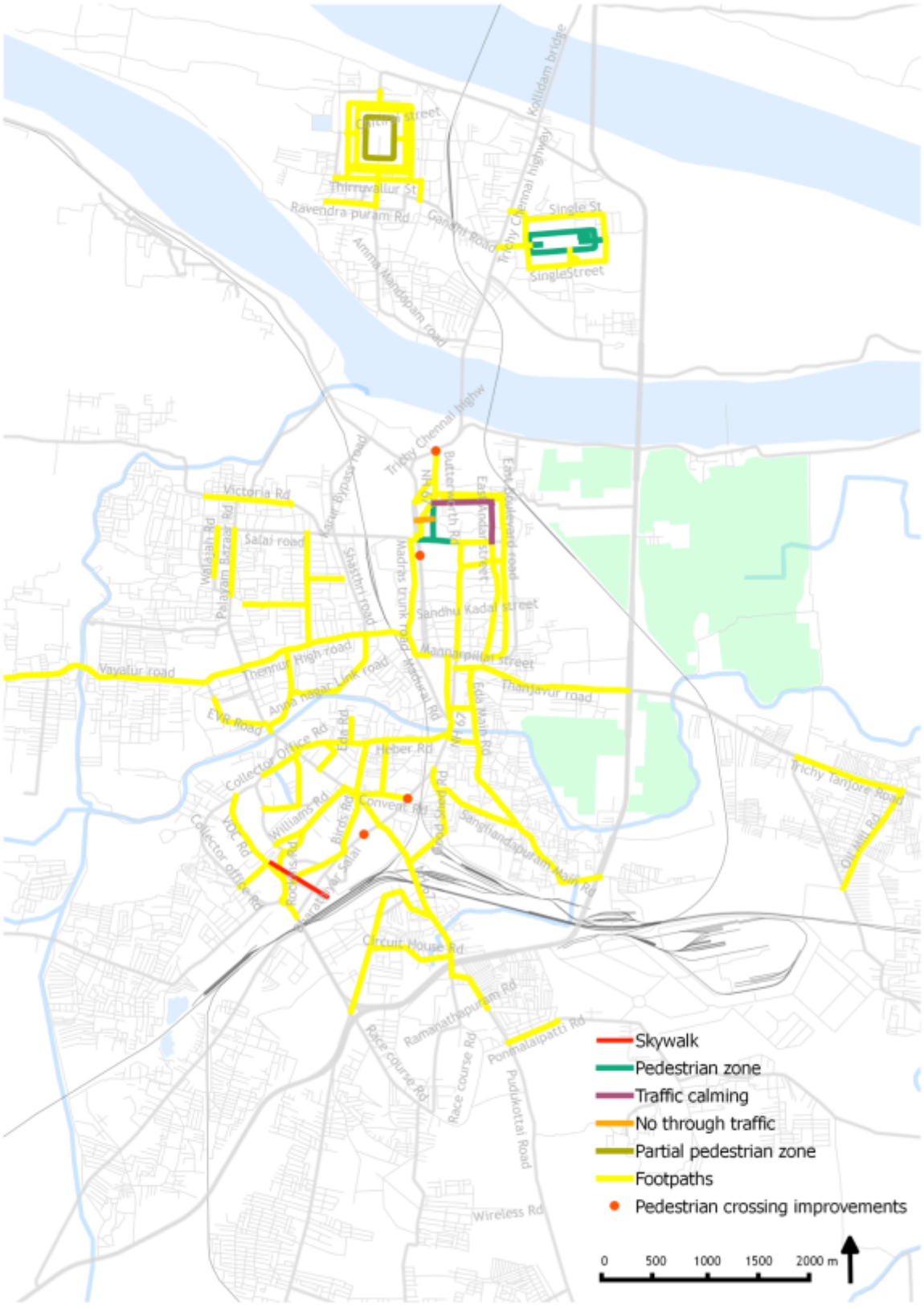
Map 14. Proposed cycle sharing station locations in Tiruchirappalli.

6.3.4. Footpaths and pedestrian zones

Tiruchirappalli has proposed 58 km of footpaths and 4 km of pedestrianised streets. The pedestrian zones are proposed around Sri Ranganathaswamy Temple, Thiruvanaikovil Jambukeswarar Akilandeswari Temple and Rockfort Ucchi Pillayar Temple. These streets have high pedestrian density with temple visitors, but are currently unsafe to walk as they compete with movement of private vehicles.

The utility of footpaths as spaces for social and economic activity is ignored as these streets are usually parked out or occupied by street vendors. Thus, NMT improvements surrounding these areas and around Tiruchirappalli is important for comfort and safety of pedestrians.

Footpaths are estimated to cost Rs 58 crore and 4 km of pedestrian zone will cost Rs 5 crore. Map 15 indicates the locations of both these NMT improvements.



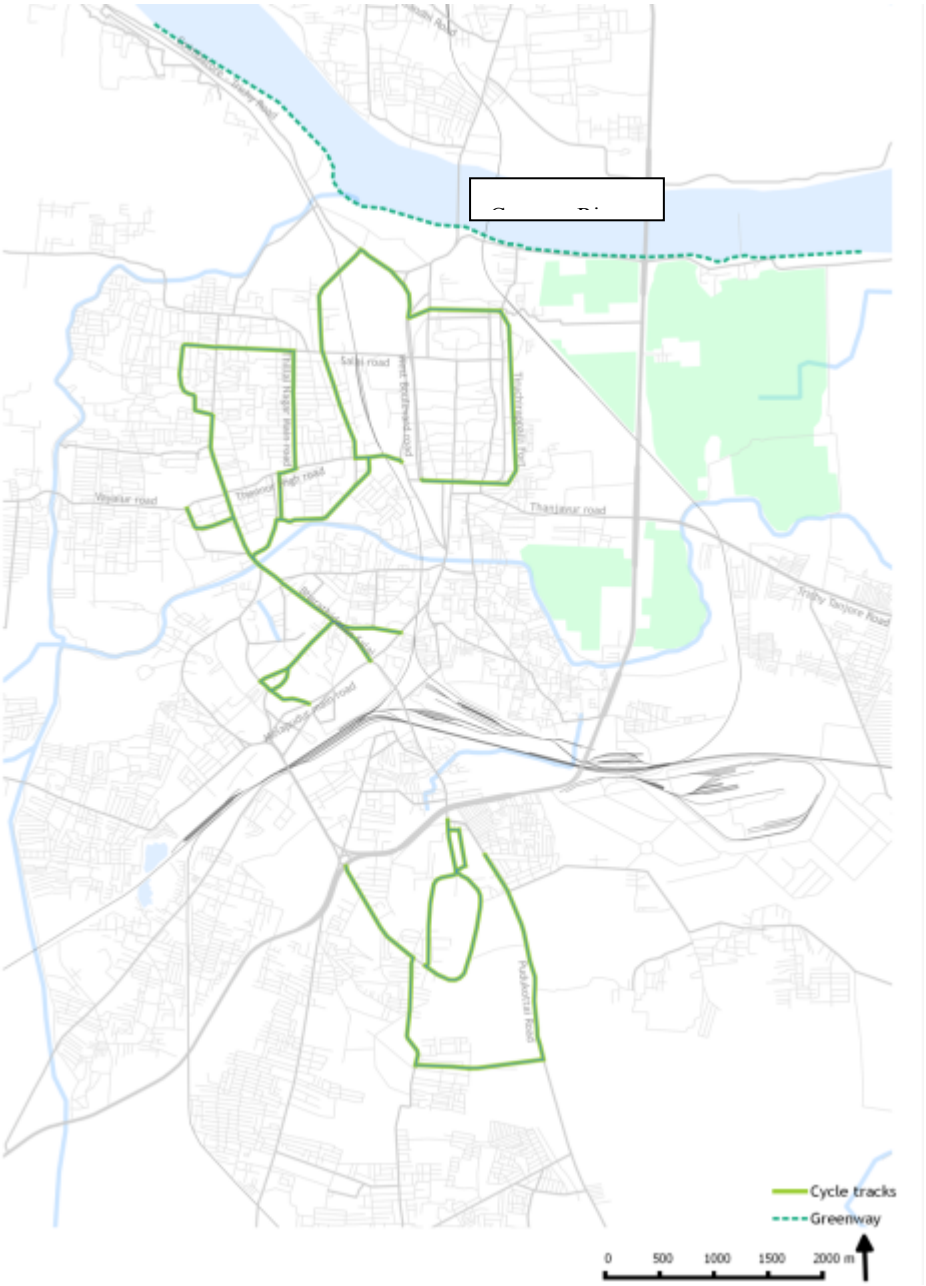
Map 15. Streets identified for its footpaths and location of the proposed 4 km pedestrian zone in Tiruchirappalli.

6.3.5. Greenways and cycle tracks

Tiruchirappalli has proposed an 8 km long greenway along Cauvery River. The greenway provides an east-west pedestrian/cycling friendly environment along the river feeding into the north-south BRT corridor. Transforming the river front into a greenway will provide easy mobility and recreational opportunity for all NMT users.

In addition, the greenway will facilitate a successful cycle network, which has been proposed south of Cauvery River. The proposed cycle network extends 27 km, around important landmarks such as the Rockfort Temple and busy commercial areas to feed into the linear BRT corridor (Map 16).

The 8 km long greenway is estimated to cost Rs 16 crore and approximately Rs 27 crore for its segregated cycle track.



Map 16. Proposed locations of the 8 km long greenway network proposed within the city and 27 km of segregated cycle tracks.

6.3.6. Parking management

With the proposal of a pedestrian zone around the three temples, a parking management system is proposed to be implemented to manage its displaced parking of approximately 9300 vehicles. Thus, 31 km of parking management is proposed to be implemented on streets bordered by Bharathidasan Salai and Collector Office Road and in Tharanallur, south of Rockfort Ucchi Pillayar Temple.

Map 17. Streets identified for parking management in Tiruchirappalli.

6.3.7. Summary of transport investments

The following section summarises Tiruchirappalli's transport investment in public transport systems, NMT and parking management. These investments were calibrated to ensure that the city can meet the mode share goals established in the initial phase of the planning process.

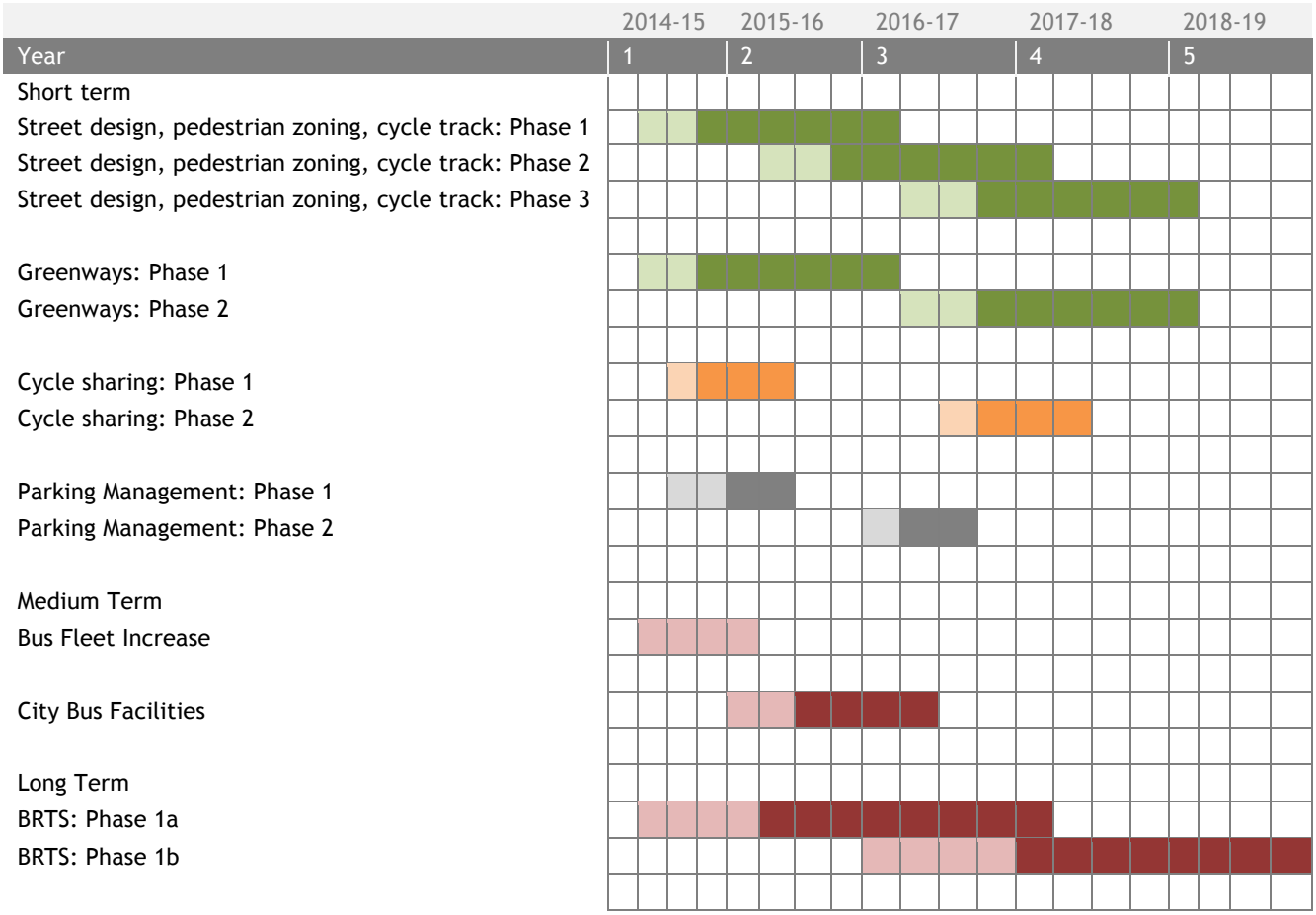
Table 24. Tiruchirappalli transport investments.

Area	Project	Details	Cost (Rs crore)
Non-motorised Transport	Footpaths	58 km	58
	Cycle tracks and footpath upgrade	27 km	54
	Pedestrian zones	4 km	5
	Greenway	8 km	16
Public Transport	BRT	18 km	270
	City bus fleet expansion	150	78
	New bus depots	1	10
	New bus terminals	3	15
	ITS & Customer Service	1	17
	Cycle Sharing	20 sq km	30
Travel Demand Management	On-street Parking management	31 km	-
Total			553

6.3.8. Timeline

The table below shows a representative project timeline for implementation of the sustainable transport initiatives by Tiruchirappalli.

Table 25. Tiruchirappalli project timeline. Design work for the respective transport initiative is shown in a lighter tint, while implementation and civil works are indicated by darker bars.



6.4. Salem

6.4.1. BRT

Salem's proposed BRT corridor covers a length of 32 km and is estimated to cost Rs 480 crore. The two corridors proposed are from Salem Bus Stand (SBS) to Jagir Ammapalayam (10 km) and from SBS to Seelanaickenpatti (22 km). Both these routes link important junctions, such as the Salem Town Bus Stand and Salem Train Station, to each other.

With the implementation of a BRT, Salem's bus share is expected to increase by 5 per cent over the next five years. This mode shift is necessary for Salem because if business continues as usual it will witness a constant increase in private vehicle and paratransit usage. Salem cannot afford for the current scenario to continue due to its high auto fleet numbers (6,000) and bus patronage (1.6 lakh bus passengers per day). The implementation of a BRT will help reduce paratransit mode share and control private vehicle usage.

Map 18. Salem phase 1 BRT corridors covering a length of 32 km.

Table 26. Salem BRT corridors.

Corridor	From	To	Peak volume (pphpd)	Length (km)	Cost (Rs crore)
Salem BS-Omalur Main Rd- Junction Rd- IT park	Salem Bus stand	Jagir Ammapalayam	7,546	10	150
Tiruchirappalli Rd-Sankari Rd- Bypass Rd	Salem Bus stand	Seelanaickenpatti	N/A	22	330
Total				32	480

Figure 34. Salem identified bus rapid transit (BRT) as a key strategy to improve the quality of public transport service. BRT will transform Omalur Road by giving dedicated space to public transport as well as pedestrians.

6.4.2. City bus expansion

Salem has an existing bus fleet of 226 TNSTC buses. The limited supply of formal public transport has resulted in a significant expansion of the paratransit system, with over 6,000 share autos operating in the city. The city has proposed to buy an additional 150 low-floor buses to accommodate a greater portion of this demand on formal public transport. An additional 150 buses are estimated to cost Rs 90 crore.

In order to store and maintain the existing and the new fleet, the city has proposed to upgrade depots and terminals at Salem IT Park and Seelanaickenpatti. In addition, proposed upgrades of three terminals at Salem Junction, Central Bus Stand and Salem Town Bus Stand. These upgrades are estimated to cost Rs 45 crore.

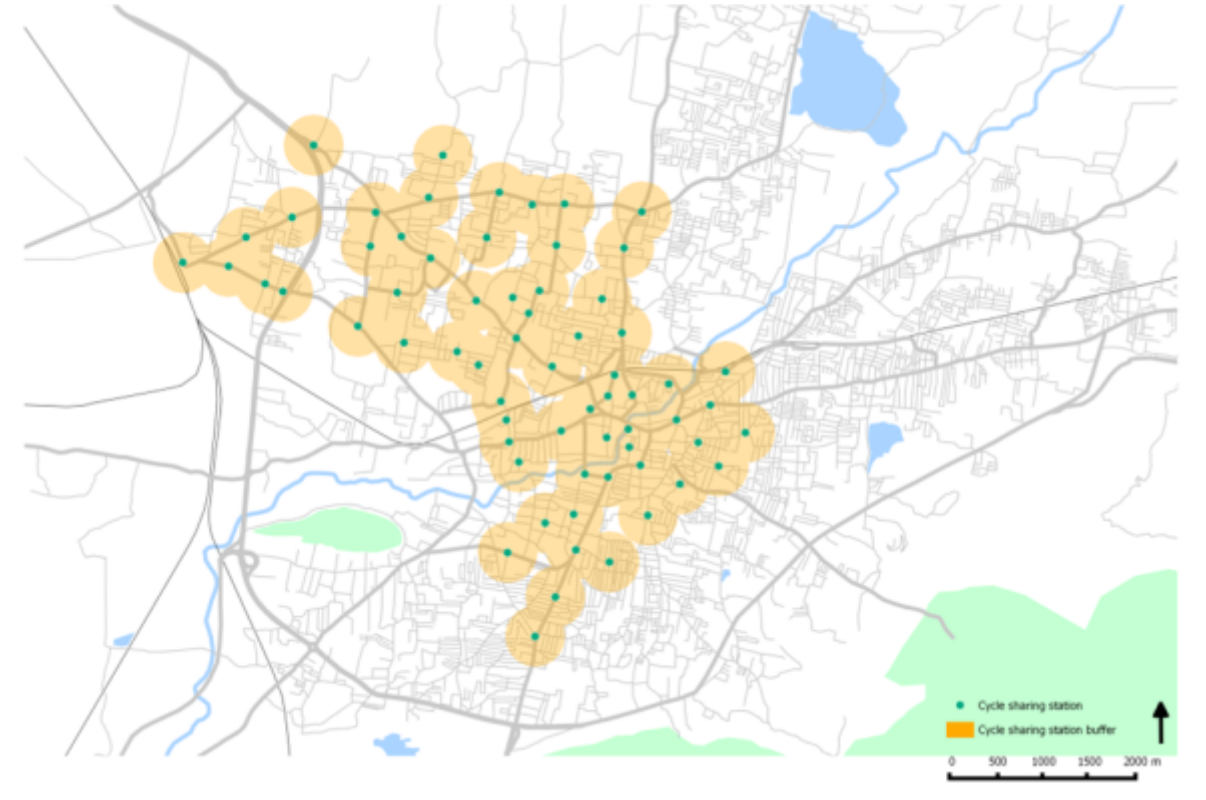
To enhance passenger travel experience, Salem has proposed to introduce an ITS and customer service information centre. Its aim is to provide easy-to-use customer information, which is a critical component of enhancing passenger experience. Essential information should be provided to all users through websites, call centres and improved signage.

Improving ITS and including a customer information centre will approximately cost Rs 12 crore. The ITS cost includes improvements for existing and proposed TNSTC fleet as well as private buses, to ensure that an integrated transport system is achieved.

6.4.3. Cycle sharing

The proposed 22 sq km cycle sharing system will provide first/last-mile connectivity to the BRT stations. The cycle sharing stations are densely populated along Salem-Omalur Road to give more residents and commuters access to high quality public transport along that corridor (BRT Phase 1A). This dense network of cycle infrastructure with approximately 300m spacing between stations will ensure that commuters can easily access the cycle.

Map 19 has identified potential cycle stations locations where demand for its use is expected to be much greater. The 15 sq km cycle network is estimated to cost Rs 23 crore.



Map 19. Proposed cycle sharing station locations in Salem.

6.4.4. Footpaths and pedestrian zones

A significant proportion of trips below 2 km are performed on foot and Salem aims to increase its walking mode to 30 per cent in 2018. Hence, upgrading footpaths for safe pedestrian access is the most important task to improve NMT.

Salem has proposed 47 km new footpaths within the city and a 700 m pedestrian zone along Bazar Street. Currently, pedestrians on Bazar Street are forced to walk on the road and compete with cars for equal road space. Bazaar Street has one of the highest pedestrian volumes in Salem City. The issue of space for pedestrians can no longer be ignored, thus, a pedestrian zone has been proposed to ensure that these environments are safe, convenient and comfortable. Such improvements will benefit existing users as well as encourage new users.

These footpaths are estimated to cost Rs 47 crore, while the 700 m pedestrian zone will approximately cost Rs 1 crore. Map 20 indicates the locations of both these NMT improvements.

Map 20. Streets identified for footpaths and pedestrianisation in Salem.

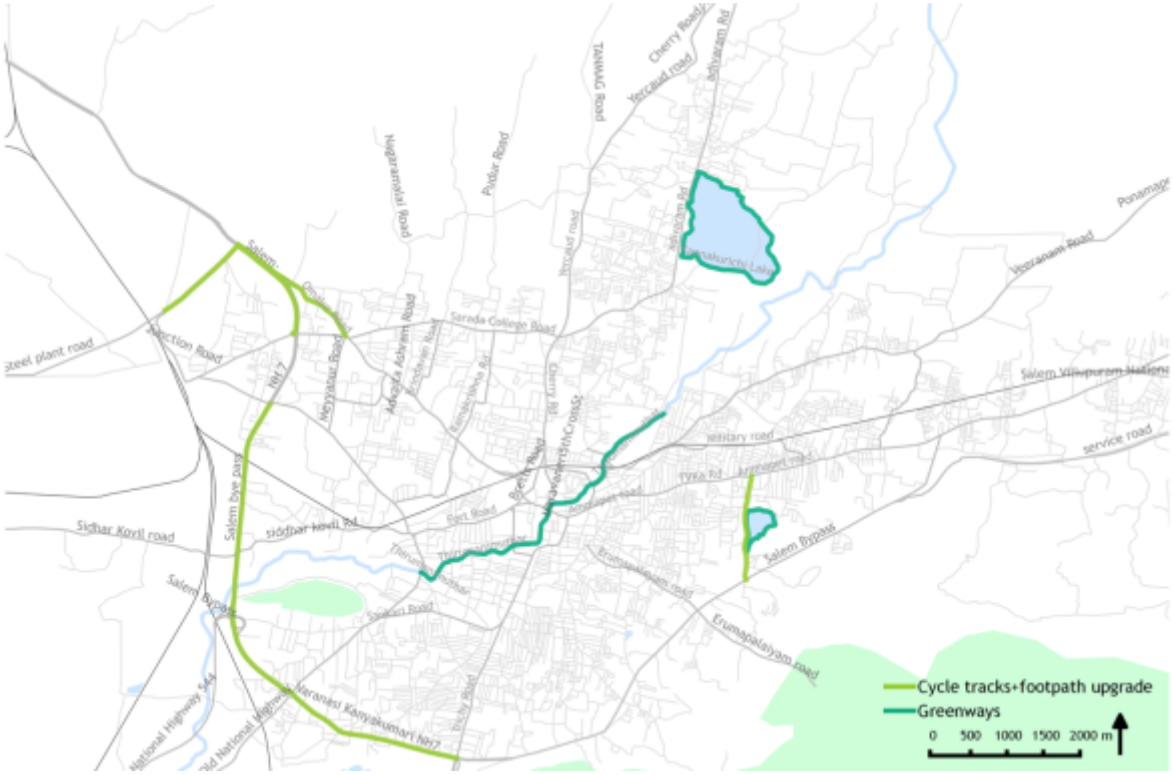
Figure 35. In Salem, pedestrians on Bazar Street are forced to walk in the carriageway due to the lack of pedestrian facilities (left). The street will be redesigned with wide pedestrian footpaths and safe crossings (right).

6.4.5. Greenways and cycle tracks

Salem has proposed 11 km greenway along Thirumanimuthar River, around Kannankurichi Lake and Kumaragiri Lake. The greenways have been strategically located around lakes and river for recreational use and forms part of the larger walking and cycling network proposed by the city. The city has also proposed 13 km of segregated cycle tracks for safe movement of people cycling as 10%

of passenger trips are estimated by cycling by 2018 (Map 21).

The 11 km long greenway is estimated to cost Rs 22 crore and approximately Rs 13 crore for segregated cycle tracks around the city.



Map 21. 11 km greenway and 13 km cycle network proposed by Salem

6.4.6. Parking management

With the proposal of a pedestrian zone along Chinnakadai Street to Bazaar Street, Riverside road can manage the parking displaced from Bazaar Street. A parking management system, to include paid parking, is proposed along Riverside Road and the entire central market area. 16 km of parking management should be implemented for 4800 displaced vehicles.

Map 22. Streets identified for parking management in Tiruppur.

6.4.7. Summary of transport investments

The following section summarises Salem's transport investment in public transport systems, NMT and parking management. These investments were calibrated to ensure that the city can meet the mode share goals established in the initial phase of the planning process.

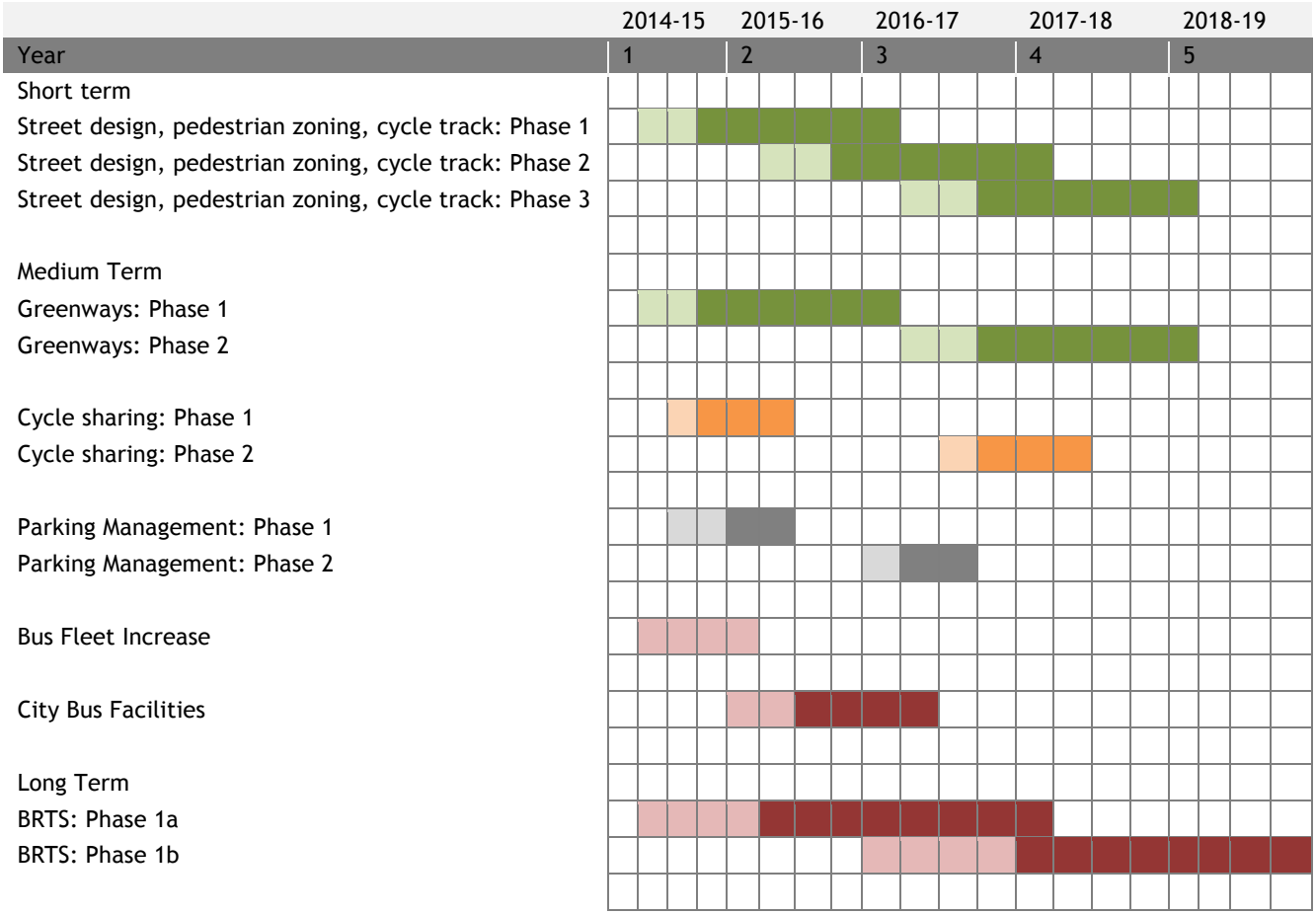
Table 27. Transport investments for Salem.

Area	Project	Details	Cost (Rs crore)
Non-motorised Transport	Footpaths	47 km	47
	Cycle tracks and footpath upgrade	13 km	26
	Pedestrian zones	700 m	1
	Greenway	11 km	22
Public Transport	BRT	32 km	480
	City bus fleet expansion	150	90
	New bus depots	2	20
	New bus terminals	5	25
	New bus stops	100	10
	ITS & Customer Service	1	12
	Cycle Sharing	15 sq km	23
Travel Demand Management	On-street Parking management	16 km	-
Total			756

6.4.8. Timeline

The table below shows a representative project timeline for implementation of the sustainable transport initiatives by Salem. Footpaths, cycle tracks, pedestrian zones, and greenways will be implemented in annual packages, while BRT design and planning will last approximately 3 years for each phase. Cycle sharing and parking have relatively short implementation periods.

Table 28. Salem project timeline. Design work for the respective transport initiative is shown in a lighter tint, while implementation and civil works are indicated by darker bars.



6.5. Madurai

6.5.1. BRT

Madurai has proposed a BRT in two phases: phase 1 is a 24 km corridor from Mattuthavani Bus Stand to Harveypatti, while phase 2 is a 44 km corridor proposed from Mattuthavani Bus Stand to Madakkulam along the Rind Road. Surveys indicated that both these corridors have high passenger volumes due to its north-south connectivity across the Vaigai River.

Madurai has potential to encourage its residents to use sustainable transport modes, as 29 per cent of trips are already made by bus. However, if improvements to the public transport system are not provided for, it risks losing 4 per cent of its mode share in just five years. This would equate to a 10 per cent hike in private vehicle usage, which is not a sustainable scenario for Madurai.

Map 23shows the routes of the two proposed corridors. As part of the five year transport strategy, Madurai's Phase 1 BRT is estimated to cost Rs 360 crore.

Map 23. Madurai BRT corridors covering a length of 24 km (phase 1).

Table 29. Proposed BRT corridors in Madurai.

Corridor	From	To	Peak volume (pphpd)	Length (km)	Cost (Rs crore)
Mattuthavani BS-NH 88 - Fatima college -West Velli St-Bypass Rd-Thirunagar	Mattuthavani	Jagir Ammapalayam	Harveypatti	24	360
Total				24	360

6.5.2. City Bus Expansion

Madurai's existing bus fleet of 507 TNSTC buses is insufficient to meet passenger demand, as reflected by the large number of private and share autos in the city. To address these issues, the city

has proposed for an additional 300 semi-floor buses with automatic transmission and AC. These additional buses are expected to replace some of the old fleet and provide relief from overcrowding. Additional 300 buses are estimated to cost Rs 105 crore.

To effectively support an expanded bus fleet is it important to develop a finance plan that includes not just include vehicles, but other essential facilities such as stops, terminals and depots. To store and maintain the fleet, the city has proposed to upgrade 9 depots of which 3 are proposed to be upgraded as terminals as well, located on approach roads. Upgraded depots are estimated to cost Rs 90 crore and Rs 15 crore for the three terminals.

To ensure passenger travel experience is enhanced, Madurai has also proposed for an improved ITS and customer service. The customer information system should include a website as well as a call centre to serve customers without web access. Improving ITS and including a customer information centre will approximately cost Rs 28 crore. These costs include ITS improvements on existing and proposed fleet, as well as private buses to achieve an integrated bus system within the city.

6.5.3. Cycle Sharing

With the implementation of a proposed BRT system, cycle sharing is increasingly an important means of providing first-mile/last-mile connectivity to mass rapid transit stations. 10 per cent of total trips are already done by cycles, but the critical aim is to attract new users who would not otherwise use cycles. Thus, Madurai has proposed a cycle sharing system of 31 sq km coverage area around BRT corridors. This essentially would help passengers access their final destination from the BRT.

Providing the last/first-mile connection will provide alternative for short trips done by paratransit, bus or walking. This would help in significantly reducing paratransit trips in Madurai. Map 24 has identified potential cycle stations locations where demand for its use is expected to be much greater. This is estimated to cost Rs 47 crore.

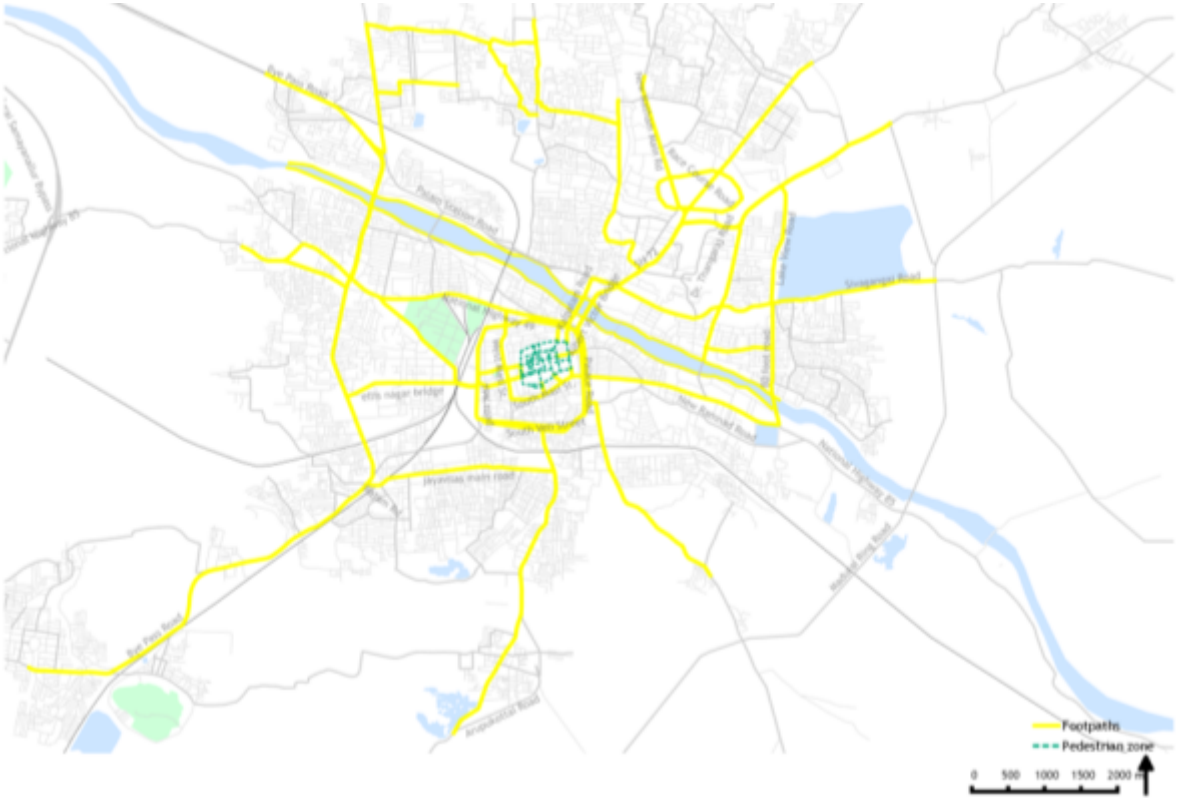
Map 24. Proposed cycle sharing station locations in Madurai.

6.5.4. Footpaths and pedestrian zones

Walking is fundamental to urban life, however, poor quality of pedestrian infrastructure as witnessed in Madurai compromises safe pedestrian movement. Currently, 28 per cent of trips are made by foot, signalling the urgency of improving pedestrian infrastructure.

Madurai aims to increase walking mode share to 32 per cent thus, 60 km of new footpaths within the city and a 2 km pedestrian zone has been proposed by the city. The pedestrian zone is located around the Meenakshi Amman Temple as the temple witnesses high pedestrian volumes by its visitors. However, pedestrians around the temple have to compete with parked out streets and heavy vehicle movement. Thus, to ensure that the streets have space for pedestrian for free, comfortable movement, 2 km of pedestrianised streets around the temple has been proposed. Map 25 indicates the location of both these NMT improvements.

The 60 km of new footpaths are estimated to cost Rs 60 crore and the 2 km pedestrian zone is estimated to cost Rs 3 crore. Map 25 indicates the locations of both these NMT improvements.

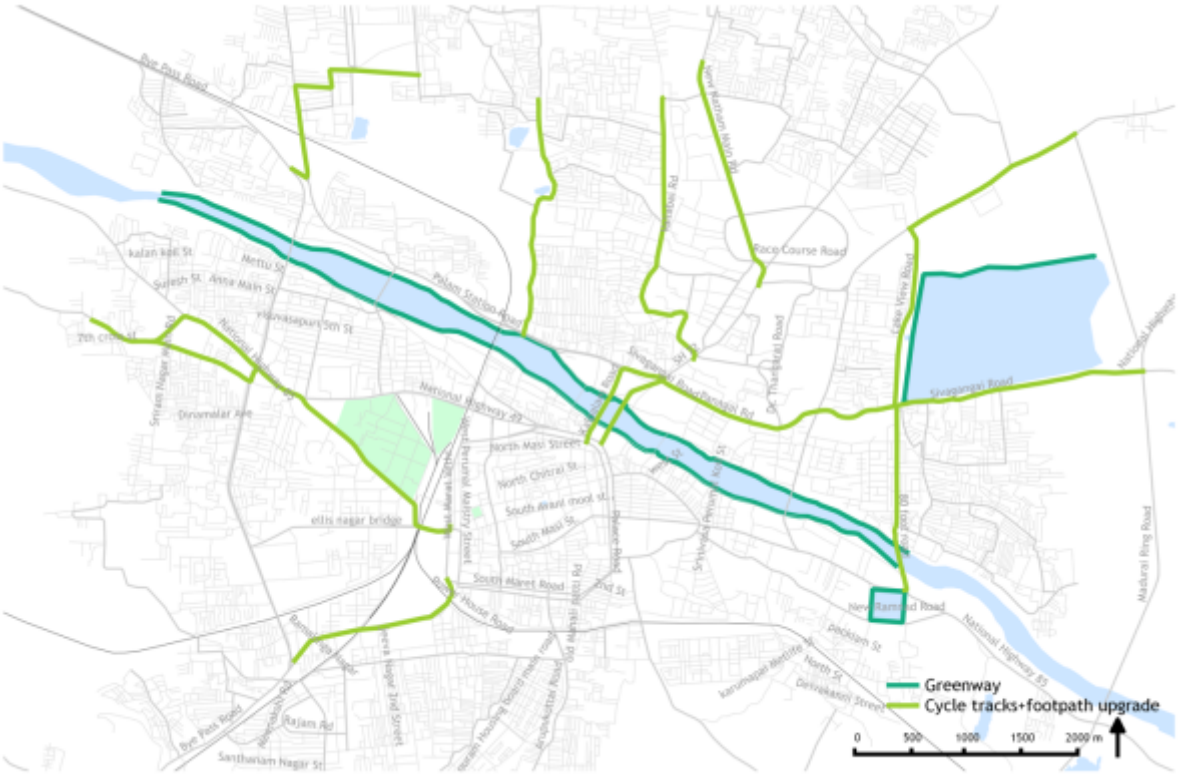


Map 25. Proposed 60 km footpath upgrade and 2km pedestrian zone around Meenakshi Amman Temple.

Figure 36. Parking occupies much of the right-of-way on Madurai's West Avani Moola Street (left). Madurai plans to pedestrianise streets near the Meenakshi temple to create high quality public spaces (right).

6.5.5. Greenways and cycle tracks

Madurai has proposed a 19 km greenway along Vaigai River, around Vandiyur Mariamman Teppakulam and Vandiyur Lake. The greenways have been strategically located around lakes and river for recreational use and forms part of the larger walking and cycling network proposed by the city. The city has also proposed 29 km of segregated cycle tracks for safe movement of people cycling as 10 per cent of passenger trips are estimated by cycling by 2018 (Map 26). The 19 km long greenway is estimated to cost Rs 38 crore and approximately Rs 29 crore for segregated cycle tracks around the city.



Map 26. Proposed 19 km greenway and 29 km cycle track in Madurai.

6.5.6. Parking Management

To help manage the city's increasing 2-wheeler population and support the proposal of a pedestrian zone around Meenakshi Temple, Madurai has proposed a parking management system covering the entire city centre. The parking management system will cover 84 km of streets and will include paid parking on streets with higher demand (Map 27).

Map 27. Streets identified for parking management in Madurai.

6.5.7. Summary of transport investments

The following table summarises Madurai's transport investment in public transport systems, NMT and parking management.

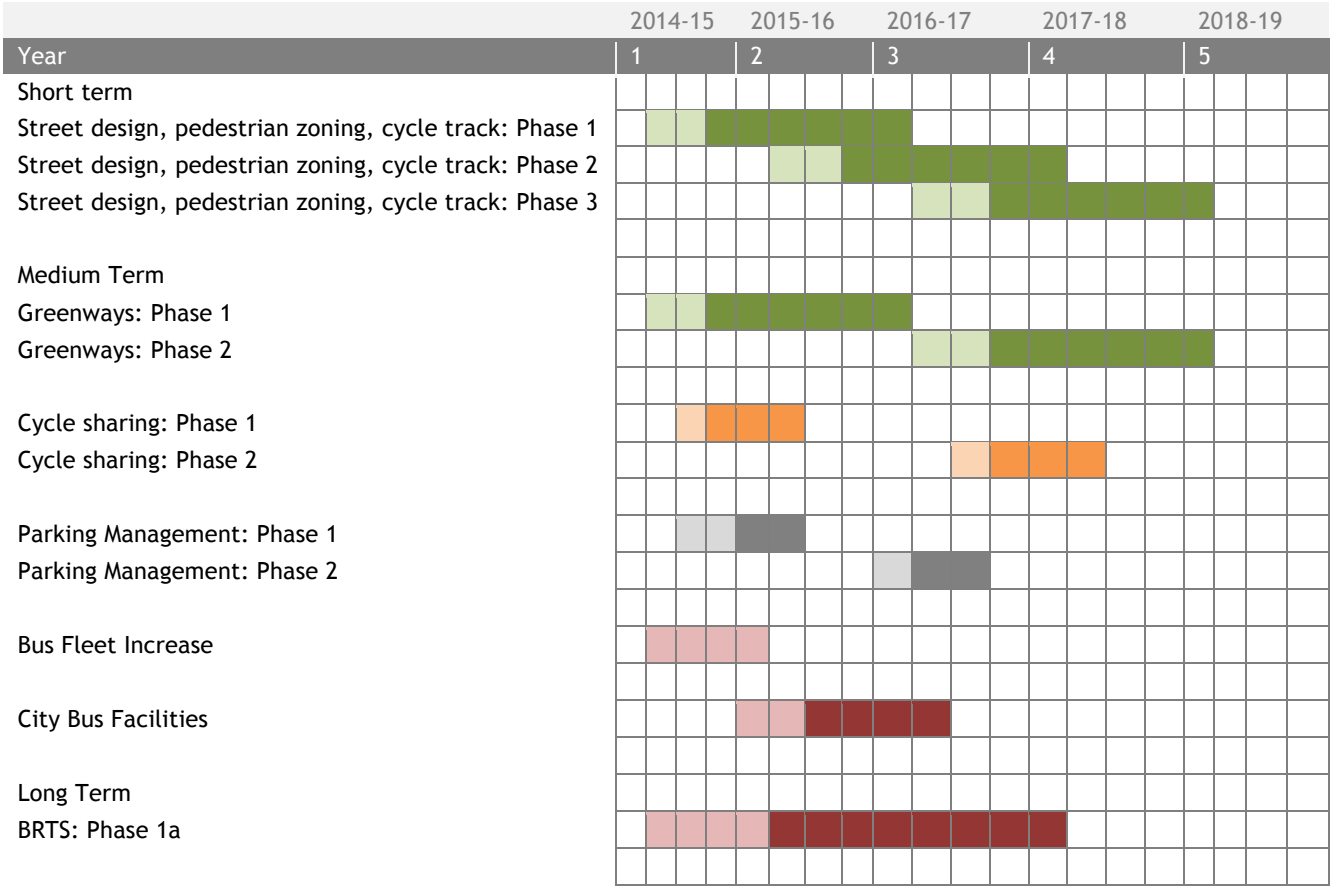
Table 30. Transport investments for Madurai.

Area	Project	Details	Cost (Rs crore)
Non-motorised Transport	Footpaths	60 km	60
	Cycle tracks and footpath upgrade	29 km	58
	Pedestrian zones	2 km	3
	Greenway	19 km	38
Public Transport	BRT (Phase 1)	24 km	360
	City bus fleet expansion	300	105
	New bus depots	9	90
	New bus terminals	3	15
	New bus stops	85	9
	ITS & Customer Service	1	28
	Cycle Sharing	31 sq km	47
Travel Demand Management	On-street Parking management	84 km	-
Total			813

6.5.8. *Timeline*

The table below shows a representative project timeline for implementation of the sustainable transport initiatives by Madurai. Footpaths, cycle tracks, pedestrian zones, and greenways will be implemented in annual packages, while BRT design and planning will last approximately 3 years for each phase. Cycle sharing and parking have relatively short implementation periods.

Table 31. Madurai project timeline. Design work for the respective transport initiative is shown in a lighter tint, while implementation and civil works are indicated by darker bars.



6.5.9. *Summary of investment requirements*

The investments in each project area are summarised in Table 32.

Table 32. Summary of investment requirements for five-year strategic plans

Area	Project	Coimbatore	Madurai	Salem	Tiruppur	Tiruchirappalli
Non-motorised Transport	Footpaths	54	60	47	22	58
	Cycle tracks and footpath upgrade	96	58	26	40	54
	Pedestrian zones	16	3	1	3	5
	Greenway	96	38	22	22	16
Public Transport	BRT	1,080	360	480	348	270
	City bus fleet expansion	84	105	90	150	78
	New bus depots	50	90	20	30	10
	New bus terminals	15	15	25	25	15
	New bus stops	20	9	10	-	-
	ITS & Customer Service	7	7	7	7	7
	Cycle Sharing	29	47	23	35	30
Travel Demand Management	On-street Parking management	-	-	-	-	-
Total		1,563	813	756	691	553

7. Institutional structure for transport

An effective institutional structure is essential to guide the planning process, oversee implementation, and manage on-going operations of transport systems in the TN cities. A unified metropolitan transport authority (UMTA) can be established in each city to carry out planning activities and monitor the performance of the projects. For day-to-day operations of BRT, parking management, cycle sharing, and other activities, a special purpose vehicle (SPV) should be created. An SPV will function as an execution body that can supervise operations of these systems.

7.1. Unified Metropolitan Transport Authority

Each city must establish a Unified Metropolitan Transport Authority (UMTA) as the main planning body to co-ordinate activities among transport bodies to best utilise the available infrastructure facilities and resources. The UMTA must develop a strong internal team including a chief executive officer, chief programme officer, chief finance officer, and support staff in order to prepare plans, evaluate project proposals, and provide technical assistance to member authorities.

The UMTA will undertake the following activities to support the deliverables of successful public transport projects in each of the cities:

- Convene regular meetings of key transport system actors in the city to facilitate the exchange of information about projects currently under information, to exchange information on best practices, to coordinate strategic plans, and develop designs for intermodal facilities.

- Develop a database of indicator data to monitor transport service levels, usage patterns, and trends, and populate the database with information gathered from transport operators and primary surveys. The database will be updated on a monthly basis.
- Develop a knowledge-sharing portal to facilitate the sharing of information about transport projects currently under implementation. The portal can aid in making best-practice plans, reports, and tender documents available across all agencies in Chennai.
- Facilitate surveys needed to gather transport data needed to provide technical support.

7.2. Establishing SPV to manage operations

In order to regulate public transport in the each of the cities, an SPV must be set up as a dedicated public transport agency in charge of planning and managing public transport operations. The SPV will not operate services directly, but will engage a number of private contractors to operate various elements of the public transport system. The SPVs set up in each city will be able to look after cycle sharing and on-street parking management in particular.

7.2.1. SPV functions

The SPV established in each city will focus on operations of the cycle sharing system and parking management in particular, and create required infrastructure for these systems. In addition, the SPV will oversee the implementation of any future mass transport projects in the city, mainly BRT. In general, the SPV will aim to maximise the quality of service at the minimum possible cost. The responsibilities of the SPV include:

1. Operations management:
    - Monitoring the operations of the cycle sharing system and parking management and adherence to service level standards, while ensuring proper enforcement mechanisms are in place;
    - Oversee the collection of fare revenues from the cycle sharing system and parking management and issue payments to service providers.
2. Planning and regulation:
    - Undertake regular assessments of travel patterns in order to expand as well as optimise the cycle sharing system;
    - Frame policies towards promoting sustainable transport and controlling the growth of private motor vehicle use;
    - Plan for the expansion of the on-street parking management system.
3. Project implementation and contracting of services:
    - Procure services from private sector service providers for operating the cycle sharing system and parking management through fair competitive bidding process.
4. Financial management:
    - Prepare financial plan for public transport operations;
    - Manage the Urban Transport Fund (UTF) and develop policies to guide the use of UTF resources to support the implementation of sustainable transport projects.

5. Marketing:
    - Employ print, radio, social media, and other mechanisms to promote the use the cycle sharing system of public transport.
    - Develop partnerships with external government agencies, business, NGOs, and other local stakeholders to promote the use of sustainable transport in the city.

7.2.2. Structure of the SPV

The SPV should comprise of a team of specialists hired on competence in management and transport planning. The figure show illustrates the structure of the SPV which should be headed by a board of directors, a managing director and four primary departments—planning and design; operations; admin and finance; and communications and marketing.

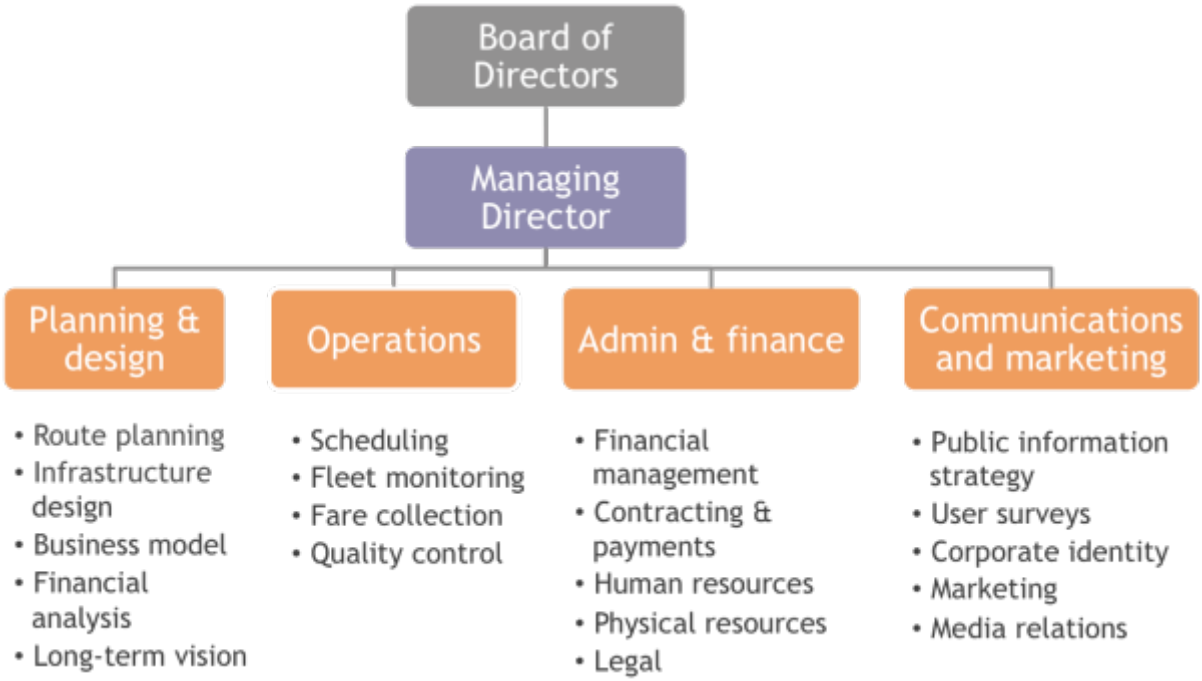


Figure 37. Internal structure of the SPV

The Board plays an important role in decision of fare structure, system expansion and implementation of policy-level decisions. The board of directors will include of the heads of various state and local entities including the Regional Development Authority, Urban Development Department, Traffic Police, and RTO. The Board may constitute an Advisory Panel comprised of technical experts as well as representatives of local academic institutions. Members of the Board should include:

- Secretary, Urban Development Authority (Chairperson of the Board)
- Secretary, Public Works Department
- Mayor, Corporation
- Chairperson, Corporation Standing Committee
- CEO, SPV

- SP, Traffic
- Managing Director, SPV
- Local Planning Authority
- Transport Department
- Traffic Police
- RTO

7.2.3. SPV finances and Urban Transport Fund

All the revenues from cycle sharing and parking management will be controlled by the SPV. Covering the SPV's expenses through its own revenue (parking fee etc.) is central to ensuring the economic autonomy of the body and retaining high quality staff. Economic independence will help insulate the Directors of the SPV from making decisions heavily affected by political considerations contrary to the SPV's interest of maintaining excellent service quality.

As per the recommendations of Ministry of Urban Development (MoUD), Government of India, cities are required to create a dedicated Urban Transport Fund to manage financial resources for the transport system. The UTF will be a separate head in the city's annual budget. The fund flows and resources to the UTF will be pulled from various sources, including public transport farebox revenue, transport user charges (road taxes, vehicle tax, parking fees etc.), and advertising revenue. The SPV will have control over the allocation of funds from the UTF.

8. Next steps

Clear policy direction and corresponding budget allocations by relevant departments of the Government of Tamil Nadu are essential to facilitate rapid implementation of the strategic plans developed by Coimbatore, Madurai, Salem, Tiruppur, and Tiruchirappalli.

Key steps that the respective municipal corporations can take include the following:

1 Retain the services of consultants to carry out detailed planning work for street design improvements, including footpaths, cycle tracks, and pedestrian zones. Planning for greenways can also be initiated.

2 Plan for phase 1 implementation of cycle sharing system and parking management. Procure services for operations and management of the cycle sharing (including the cycles, cycle stations and IT monitoring system) and parking management systems.

3 Form SPVs to oversee the management of transport systems. Hire staff for the SPV as soon as it is registered so that the staff can participate in the planning process.

In addition, ITDP and ICLEI–SA propose to support the implementation process in the following ways:

- Carry out further engagement with municipal corporation officials, political representatives, and local stakeholders
- Provide technical assistance to CMA, municipal corporations, and consultants through one-on-one interactions, training workshops, and study tours.

- Develop terms of reference for the hiring of consultants for specific project areas, including street design, greenways, and BRT.
- Develop request for proposals and contract documents for the operation of parking management, cycle sharing, BRT bus operations, and BRT intelligent transport systems solutions.
- Review consultant work and monitor implementation progress.

9. Appendix: Projects for immediate implementation

The following tables list the projects that the cities identified for implementation during the first year.

Table 33. Coimbatore year 1 projects

Project	Location	From	To	Length (km)	Cost (Rs crore)
Footpath	NSR Road	Venkittapuram	Saibaba Kovil	1.8	1.8
	Diwan Bhadur Road	Forest college quarters	Gandhi park/Kaliamman kovil	1.6	1.6
	Mettupalayam Rd	Mettupalayam Bus stand	Poo market	3.9	3.9
	TV Samy St	Thadagam Rd (RS puram)	Sukrawar pettai (RS puram)	1.2	1.2
	Footpath subtotal			8.5	8.5
Cycle tracks	Gandhima Nagar Rd	APG matriculation higher school	Near Bharathi nagar BS	3.9	7.8
	Vilankurichi Rd – Masakalipalayam Rd- Tiruchirappalli Rd	Jeeva nagar	Singanallur Boat house	7.3	14.6
	Vilankurichi Rd – Codissa – Kalapatti- Iskon- Avinashi Rd	Thaneer Pandal BS	Neelambur BS	13.0	26.0
	State bank -Arts College –GH-Race Course- Valankulam	Stanes School BS	EVR arts college- Valankulam lake	7.4	14.8
	Cycle tracks subtotal			31.6	63.2
Greenways	River channeleast of Tiruchi Rd			8.1	16.2
	Singanallur			4.1	8.2
	Noyal Channel			7.4	14.8
	Valankulam			6.9	13.8
	Greenways subtotal			12.2	24.4
Pedestrian zone	Big Bazaar St	Cheety St	Town Hall	1.1	1.5
	Pedestrian zone subtotal				1.5
Cycle sharing	Phase 1				7.0
	Cycle sharing subtotal				7.0
Public transport	Bus procurement				163.4
	BRT DPR				8.0
	Public transport subtotal				201.0
Grand total					305.6

Table 34. Madurai year 1 projects.

Type of project	Location	From	To	Length (km)	Cost (cr)
Footpaths	W Tower St	Central theater	APS Hall/Malliga Movies	0.2	0.2
	Maret Sts	Hotel park plaza	Vinayakar Temple	3.3	3.3
	Masi Sts	Near Apollo Hospital	Vilakuthoon	4.7	4.7
	Palace Rd	Near Apollo Hospital	East gate	2.2	2.2
	Nethaji Rd	Kattaboman Statue	Kalyan Jewelers	0.6	0.6
	Veli Sts	near Apollo Hospital	East gate	5.2	5.2
	Zone office - Theni Rd	Zonal Office -1	Bypass Rd	2.4	2.4
	Panagal Rd - Arch	Arch (dist court)	Kurivikaran Rd(TN Milk Federation)	3.2	3.2
	Bypass Rd	Vasanth Nagar	Vagai River	3.9	3.9
	Kamaraj Rd-Teppakulam	East gate BS	Mariamman Teppakulam	2.8	2.8
	Lake View Rd	PTR Bridge	Flower market	2.9	2.9
	Elu kadal St	E avani moola	Thaer Mutti	0.2	0.2
	Thotian Kinatru St	S Avani moola st	Maravar chavadi	0.3	0.3
	Chithraikara St			0.6	0.6
	Footpath subtotal			32.5	32.5
Pedestrian zone	Avani Moola Sts			2.3	2.8
	Pedestrian zone subtotal				2.8
Parking management	4.3 sq km city centre zone				13.2
	Parking subtotal				13.2
Public transport	Buses & terminals				104.0
	Public transport subtotal				104.0
Grand total					48.4

Table 35. Salem year 1 projects.

Type of project	Location	From	To	Length (km)	Cost (cr)
Footpath	Tiruchirappalli Road	Salem Town PS	Seelanaickenpatti	3.6	3.6
	Gugai Rd - Erumapalyam Main Rd	Sendarapatti	Bypass Rd	3.9	3.9
	1st, 2nd Agraharam St	Jamiya Masjid	Near Municipal School	1.1	1.1
	TVKa Rd – Ammapet Rd	Pattai kovil/Hanuman temple	Ammapet Roundana	2.5	2.5
	Military road	Ponnamapet BS	Ammapet Roundana	2.6	2.6
	Cherry Rd	Sugavaneswarar temple	Hasthampatti BS	1.5	1.5
	Bretts Rd	Regional DMA	Collector Office	0.7	0.7
	Ramakrishna Rd	Chatram BS	Ramakrishna Rd BS	2.6	2.6
	Sarada College Rd	Five Rd junction	Hasthampatti BS	2.8	2.8
	Brindavan Rd	AVK arcade	Sarada Vidyalaya School	1.1	1.1
	Meyyanur Rds	Central BT, 3 roads	Five Rd junction	2.3	2.3
	Suramangalam Rd	Thirukavaundanur BS	3 Rd	0.9	0.9
	Fort Rd	srinivasa park	Periyar statue/ CSI	1.7	1.7
	Sankari Main Rd	Sowdeswari College	Near Prabath	3.2	3.2
	Old Market Rd	Javulikadai	Govt Medical College	0.9	0.9
	Footpath subtotal			31.4	31.4
Pedestrian zone	Bazar St - Chinnakarai St			0.7	0.9
	Pedestrian zone subtotal				0.9
Greenway	Kalliaman Temple to Station Rd			3.2	6.4
	Greenway subtotal				6.4
Grand total					38.7

Table 36. Tiruppur year 1 projects.

Type of project	Location	From	To	Length (km)	Cost (cr)
Footpath	College Rd	Devangapuram School	Anjapaalam	2.9	2.9
	Gandhinagar 60 Ft Rd	TTP Mill Rd	Gandhi nagar BS	0.5	0.5
	Velampalayam Rd	Annupparpalayam Pudur	Near Velampalayam Elementary school	0.8	0.8
	Rayapuram – Nanjappa School - Thaadikaran	Rayapuram Park	Thaadikaran BS	2.0	2.0
	Dharapuram – Kangeyam - Rakkiapalayam	Near Noyal Govt School	Manikarampalayam Rd& SH 172 Jn	3.0	3.0
	Court St - Kumaran Rd	Opp Sabari salai	TMF hospital	0.5	0.5
	Kannagi Main Rd – Kongu Main Rd- Om Sakthi Koil- Lakshmi Nagar	Miller BS	MS nagar2 BS , Ayyapan Temple	7.7	7.7
	Footpath subtotal			17.4	17.4
Greenway	Sabari Odai	Saravana Mahal	Kangeyam Rd	4.1	8.2
	Noyal River			6.8	13.6
	Greenway subtotal			10.9	21.8
Parking management	Central areas				4.0
	Parking management subtotal				4.0
Pedestrian zone	Flower Market – Eswaran Koil – KSC School			2.1	2.7
	Pedestrian zone subtotal				2.7
Public transport	Amman Kovil depot				10.0
	BRT DPR				2.3
	Public transport subtotal				12.3
Grand total					58.2

Table 37. Tiruchirappalli year 1 projects

Type of project	Location	From	To	Length (km)	Cost (cr)
Footpaths	Bharathidasan Salai	GH	Puthur 4 Rd	0.767	0.8
	Birds Rd	RC school	Bharathidasan Salai	0.550	0.6
	Reynolds Rd	Collector office Rd	Court bus stop	0.400	0.4
	Convent Rd	Perumbidugu Mutharaiyar Statue	St Joseph Secondary school	0.700	0.7
	Good Shed Rd	Good shed	Warehouse	1.090	1.1
	Heber Rd	Gandhipark /Court BS	Beemanagar BS	0.900	0.9
	Marsing Pet Rd	Beemanagar BS	Marsing pettai BS	0.540	0.5
	NH 67	Head post office	Sethuraman pillai Colony BS	1.562	1.6
	Old Post office Rd	Convent Rd	Heber Rd	0.510	0.5
	Palakkarai WH Rd	Rockins Rd	Paruppakara St	1.580	1.6
	Parupukkara St	Palakkarai WH Rd	Eda St Main Rd	0.290	0.3
	Pudukottai Road	TVS tollgate	Commissioner's office	0.630	0.6
	Rockins Rd	Thillainagar bus bay	Central Bus stand	0.770	0.8
	VOC Rd	Hotel Sangam (raja colony bs)	Viralimalai bus bay	1.390	1.4
	Warners Rd	Andhra bank (Cantonment)	McDonalds Rd (Rocket park)	0.880	0.9
	Williams Rd	Central excise	Bharathidasan salai	1.870	1.9
	EVR Rd	Bishop Heber COllege	GH	0.600	0.6
	Madurai Rd	Marakadai BS	Prabath	0.600	0.6
	Eda Main Rd	Gandhi market	SangliandapuramBS	2.330	2.3
	Khajamohideen St	Nanna Munna Mosque	Holy Remeeders Church	0.200	0.2
	Sangliandapuram Main Rd	Kemps Town School	Chennai Theni Hwy	1.970	2.0
	Oil mill Rd	Malayappa nagar BS	Ambikapuram Rd	1.120	1.1
	Sangillyandapuram	Tiruchirappalli Tashildar Office	Heber Rd	0.356	0.4
	Usman Ali Rd, Mannarpuram	Kallukuzhi	Sethuraman pillai BS	0.800	0.8
	Ravendrapuram Rd	Srirangam BS	Vignesh Mantralaya	0.500	0.5
	EB Rd	Gandhi Children's park	Fish market	1.800	1.8
	Thennur High Rd	Puthur 4 Rd	Rajaji Vidyalaya School	1.300	1.3
	Karur Bypass	Taj Marriage Hall/NH 67	TNSTC	1.100	1.1
	Sastri Rd	Rajaji Vidyalaya School	TNSTC	1.000	1.0
	Salai Rd	TNSTC	Puthur 4 Rd	2.583	2.6
	Pattabiraman Salai	Guru medical hall BS	Uzhavar Sandai	0.470	0.5
	Railway Colony	Govt school/Tennur Bank BS	Uzhavar Sandai	0.428	0.4

	Anna nagar+ Sivaprakasam Salai	Govt meeting stage	EB Head office/MG school	1.200	1.2
	McDonalds	Pudhukotai Bus bay	Breeze residency	0.400	0.4
	Thillai Nagar Main road	Near Jeyanthi BS	Near Tennur Bank BS	1.090	1.1
	Footpath (including Cycle tracks)			34.276	34.28
Pedestrian zone	Uthirai street				2.0
	S Chitirai street				2.8
	E Adayavalanjan St				0.4
	N Chitrai St				0.1
	VOC St				0.8
	Uthirai street				0.3
	Ammamandapam Rd				0.2
	Thiruvanaikoil 1				0.3
	Thiruvanaikoil 2				2.1
	Thiruvanaikoil 3				0.1
	Thiruvanaikoil 4				0.1
	Thiruvanaikoil 5				0.5
	Pedestrian zone subtotal				9.5
Cycle sharing	Phase 1				3.0
	Cycle sharing subtotal				3.0
Bus procurement	75 buses & facilities				104.0
	Bus procurement subtotal				104.0
Grand total					151.9