Preface

The City Mobility Plan (CMP) for Trivandrum is the core summation of many of the prior studies such as Comprehensive Traffic Study (by NATPAC) 1979, Kerala Urban Development Project (KUDP, World Bank Funded) 1989, Comprehensive Traffic and Transportation Study co-funded by Government of India, the State Government of Kerala and the Local Self Government (LSG) of Trivandrum 2003, and includes the most recent City Development Plan (September 2006) prepared by the LSG in connection with the JNNURM.

The draft of the CMP has been discussed in a broad spectrum of the stakeholders, the few of the prominent ones amongst them being the Trivandrum Municipal Corporation, Kerala State Road Transport Corporation (KSRTC), which is the primary functionary providing urban transport in Trivandrum City, the Town Planning Department, National Transport Planning and Research Centre (NATPAC) head-quartered at Trivandrum, the Public Works Department (PWD) which is the stakeholder providing and maintaining major road networks within the State and Trivandrum and the Kerala Police etc. A workshop organized at Trivandrum by Corporation of Trivandrum and KSUDP on this subject also gave sufficient opportunities to think loudly on these critical subject and the outcome of the workshop have been included in the CMP suiting to ground realities.

The option by the KSRTC, of using LNG fuel instead of CNG, in dual-fuel mode along with diesel, are included in this CMP, since implementation of such measures and related components of the CMP will quantify for accessing parallel funding from the Global Environment Facility (GEF) of the World Bank (WB), also. Deliberations have been held on this draft CMP, on 22 October 2007 in Trivandrum with the representatives of the WB (GEF) in presence of ADB and KSUDP officials. Thiruvananthapuram has been chosen as a “Demonstration City” by Government of India in the GEF.

The City Development Plan included the proposals of switching over to CNG from diesel. In that sense the newer LNG concept of the KSRTC is complementary to that option. Similarly, the proposal of Town Planning Department’s to introduce “clean technology” buses (battery buses) is convergent upon similar objectives, of reducing pollution on account of Vehicular traffic in Trivandrum City’s roads. Through the generation of consensus on one or few of the many options under consideration is not within the scope of CMP. This CMP gives space for all the options to be considered and hence are included herein. The choices are expected to emerge.

Out of the Rs 4000 Crores (or Rs.40,000 million) estimated by the CDP (approved by the LSG Trivandrum, the State Government and the Government of India), the CMP prioritizes 180km of the City Roads from 350km considered. The Thiruvananthapuram Integrated Mass Transport System; which should have begun its Phase II of implementation by 2007 as per the phasing plan contained in the CTTS 2003; and the KSRTC’s LNG conversion plan, are also brought on top of the agenda of the ongoing reforms, since these are expected to have the maximum positive impacts on the urban transport scenario of the Trivandrum City. These three components are envisaged to comprise the ”First Phase” of the Works for which JNNURM funds may be sought, to begin with.
The possible implementation options range from preparation of DPR and tendering procedures as per the ADB Guidelines (since this is already in place in the State), the Toolkit for Preparation of DPRs for the JNNURM, Build Operate Transfer (BOT) option or through direct Line Agency actions (e.g., the LNG conversion Actions within KSRTC’s fleet by the KSRTC itself). These major components were also considered in the CMP.

Deliberations on modalities to be adopted are currently ongoing at the State and LSG levels. The PMU, PIU and the LSG Trivandrum are deeply involved in the process with the necessary assistances of the TSU and the DSC-1. Contracting options chosen will determine the implementation method. Details of pre-implementation works would emerge from these decisions.

The Draft CMP will be placed before the Council of the Trivandrum Corporation for approval. Long term plan and immediate implementable projects have been identified and incorporated, supported by a rough estimate, which would be possible to be implemented co-terminus with the KSUDP time frame.
## CONTENTS

List of Figures
List of Tables
List of Acronyms

### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>9</td>
</tr>
<tr>
<td>2.0</td>
<td>SURVEYS AND STUDIES</td>
<td>9</td>
</tr>
<tr>
<td>3.0</td>
<td>TRAFFIC ANALYSIS AND PROPOSALS</td>
<td>9</td>
</tr>
<tr>
<td>4.0</td>
<td>TRAVEL DEMAND MODELING AND FORECAST</td>
<td>9</td>
</tr>
<tr>
<td>5.0</td>
<td>CONCEPTUAL ROAD NETWORK PLAN FOR THIRUVANANTHAPURAM</td>
<td>10</td>
</tr>
<tr>
<td>6.0</td>
<td>THIRUVANANTHAPURAM INTEGRATED MASS TRANSPORT SYSTEM (TIMTS)</td>
<td>10</td>
</tr>
<tr>
<td>7.0</td>
<td>PHASING AND COSTING</td>
<td>10</td>
</tr>
</tbody>
</table>

### CHAPTER 1

**INTRODUCTION**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>GENERAL</td>
<td>11</td>
</tr>
<tr>
<td>1.2</td>
<td>STUDY AREA</td>
<td>12</td>
</tr>
<tr>
<td>1.2.1</td>
<td>GENERAL</td>
<td>12</td>
</tr>
<tr>
<td>1.2.2</td>
<td>REGIONAL SETTING</td>
<td>12</td>
</tr>
<tr>
<td>1.2.3</td>
<td>PHYSICAL CHARACTERISTICS</td>
<td>13</td>
</tr>
<tr>
<td>1.2.4</td>
<td>DEMOGRAPHY</td>
<td>13</td>
</tr>
<tr>
<td>1.2.5</td>
<td>TRANSPORT SYSTEM CHARACTERISTICS</td>
<td>14</td>
</tr>
</tbody>
</table>

### CHAPTER 2

**SURVEYS AND STUDIES**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>GENERAL</td>
<td>16</td>
</tr>
<tr>
<td>2.2</td>
<td>SURVEY PRELIMINARIES</td>
<td>16</td>
</tr>
<tr>
<td>2.2.1</td>
<td>ZONING SYSTEM</td>
<td>16</td>
</tr>
<tr>
<td>2.2.2</td>
<td>SCREEN AND CORDON LINES</td>
<td>17</td>
</tr>
<tr>
<td>2.2.3</td>
<td>SECONDARY DATA</td>
<td>17</td>
</tr>
<tr>
<td>2.2.4</td>
<td>PRIMARY SURVEYS</td>
<td>17</td>
</tr>
</tbody>
</table>

### CHAPTER 3

**TRAFFIC ANALYSIS AND PROPOSALS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>GENERAL</td>
<td>23</td>
</tr>
<tr>
<td>3.2</td>
<td>AVERAGE DAILY TRAFFIC</td>
<td>23</td>
</tr>
<tr>
<td>3.2.1</td>
<td>OUTER CORDON</td>
<td>23</td>
</tr>
<tr>
<td>3.2.2</td>
<td>SCREEN LINES</td>
<td>24</td>
</tr>
<tr>
<td>3.3</td>
<td>VARIATION OF DAY-NIGHT TRAFFIC</td>
<td>25</td>
</tr>
<tr>
<td>3.4</td>
<td>TEMPORAL VARIATION OF TRAFFIC</td>
<td>26</td>
</tr>
</tbody>
</table>
3.5 TRAFFIC MOVEMENT PATTERN
3.6 TURNING MOVEMENT SURVEY
3.7 PARKING SURVEY
3.8 PEDESTRIAN MOVEMENT SURVEYS
3.9 ROAD NETWORK INVENTORY
3.10 HOUSEHOLD (HOME INTERVIEW) SURVEY
3.11 PROPOSALS
   3.11.1 PROPOSALS OF PEDESTRIAN SUBWAYS
   3.11.2 PROPOSALS OF MULTILEVEL PARKING

CHAPTER 4

TRAVEL DEMAND MODELING AND FORECAST

4.1 GENERAL
4.2 BASE YEAR TRAVEL DEMAND MODELING
4.3 LAND USE TRANSPORT MODEL
4.4 SELECTION OF DEVELOPMENT STRATEGY
   4.4.1 REGIONAL DEVELOPMENT STRATEGY
   4.4.2 TRIDA DEVELOPMENT STRATEGY
4.5 TRAVEL DEMAND FORECAST

CHAPTER 5

CONCEPTUAL ROAD NETWORK PLAN FOR THIRUVANANTHAPURAM

5.1 GENERAL
5.2 CTTS ROAD NETWORK PROPOSAL
   5.2.1 REGIONAL ROAD NETWORK SYSTEM
   5.2.2 TRIDA ROAD NETWORK SYSTEM
5.3 TCRD ROAD NETWORK PROPOSAL
   5.3.1 INNER RING ROAD
   5.3.2 INTERMEDIATE RING ROAD 1
   5.3.3 INTERMEDIATE RING ROAD 2
   5.3.4 OUTER RING ROAD
   5.3.5 OTHER ARTERIAL ROADS
5.4 PPTA ROAD NETWORK PROPOSAL
   5.4.1 SIMILARITIES IN VARIOUS PROPOSALS/STUDIES
5.5 CMP ROAD NETWORK PROPOSAL
   5.5.1 GENERAL
   5.5.2 CMP ROAD NETWORK DEVELOPMENT
5.6 Proposals of Other Departments

CHAPTER 6

THIRUVANANTHAPURAM INTEGRATED MASS TRANSPORT SYSTEM (TIMTS)

6.1 GENERAL
6.2 TRAVEL DEMAND AND LAND USE TRANSPORT MODELING
6.3 INTEGRATED LAND USE - TRANSPORTATION PLAN 57
6.4 DEVELOPMENT OF THIRUVANANTHAPURAM INTEGRATED MASS TRANSPORT SYSTEM (TIMTS) 57
   6.4.1 SELECTION OF CORRIDORS 57
   6.4.2 SELECTION OF TECHNOLOGY AND PHASING OF TIMTS 59

CHAPTER 7 62

PHASING AND COSTING 62

7.1 GENERAL 62
7.2 PHASING AND COSTING OF TIMTS 62
7.3 PHASING AND COSTING OF PROPOSED ROAD NETWORK 64
7.3.1 LAND ACQUISITION FOR PROJECT CORRIDORS 66
7.4 PROJECT ROADS IDENTIFIED FOR IMPROVEMENT UNDER JNNURM SCHEME 67

CHAPTER 8 68

CONCLUSIONS 68

Annexure A
Annexure B
Annexure C
Annexure D
Annexure E
List of Figures

Fig 1.1    Thiruvananthapuram District Setting
Fig 2.1    Traffic Analysis Zones
Fig 2.2    Survey Locations at Outer Cordon and Screen Lines
Fig 2.3    Pedestrian Survey Locations
Fig 3.1    Pedestrian Subway at Medical College Junction
Fig 4.1    Regional Development Strategies Concept
Fig 4.2    Brown Field Development Strategy Concept
Fig 4.3    Green Field Development Strategy Concept
Fig 4.4    Corridor Development Strategy
Fig 4.5    Multi Nuclei Employment Structure
Fig 4.6    Road Network Options under N1 Network Strategy
Fig 4.7    Road Network Options under N2 Network Strategy
Fig 4.8    Road Network Options under N3 Network Strategy
Fig 4.9    Corridors for Provision of Integrated Mass Transport System
Fig 4.10   Desire Lines for Passenger Trips by Private Modes for 2021 Desire Lines for
Fig 4.11   Passenger Trips by Public Transport for 2021
Fig 4.12   Trip Assignment for all Mode Trips (PCU) under TIMTS for 2021
Fig 5.1    Proposed Regional Road Network Systems
Fig 5.2    TRIDA Road Network System
Fig 5.3    Road Network Proposal under TCRD
Fig 5.4    Road Network Proposal by PPTA Consultant
Fig 5.5    Conceptual Road Network Proposals
Fig 5.6    Conceptual Road Network Proposals on Map
Fig 5.7    Conceptual Road Network (JNNURM) for Thiruvananthapuram
Fig 5.8    Corridors for Provision of Integrated Mass Transport Facility
Fig 6.1    Trip Assignment for Public Transport Trips for the Horizon Year (2021)
List of Tables

Table 2.1    Screen Line Survey Locations and Durations
Table 2.2    Intersection Turning Movement Survey
Table 2.3    Locations of Cordon Survey
Table 3.1    Traffic Volume at Outer Cordon (16 hours)-Phase I
Table 3.2    Traffic Volume count at Outer Cordon (24 hours)–Phase II
Table 3.3    Traffic Volume across Killi River (Screen line -I)
Table 3.4    Traffic Volume across Railway Line (Screen line- II)
Table 3.5    Comparison of 16 hour and 24 hour Traffic
Table 3.6    Percentage Share of Peak Hour Traffic in Daily Traffic at Outer cordon
Table 3.7    Percentage Share of Peak Hour Traffic in Daily Traffic at Screen Line 1 & 2
Table 6.1    Corridors Selected for TIMTS
Table 6.2    Technology selection and Phasing of TIMTS (Option 1: HCBS only)
Table 6.3    Technology selection and Phasing of TIMTS (Option 2: HCBS and LRT)
Table 7.1    Phasing of TIMTS
Table 7.2    Phase-wise Costing of TIMTS
Table 7.3    Cost Summary of TIMTS (in crores)
Table 7.4    Phasing and Costing of Roads
Table 7.5    Projects that strengthen linkages with regional roads
Table 7.6    Projects forming major links in the city road network
Table 7.7    Summary of Phasing of JNNURM Corridors
### List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>Average Daily Traffic</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>CDP</td>
<td>City Development Plan</td>
</tr>
<tr>
<td>CMP</td>
<td>Comprehensive Mobility Plan</td>
</tr>
<tr>
<td>CRNP</td>
<td>Conceptual Road Network Plan</td>
</tr>
<tr>
<td>CTTS</td>
<td>Comprehensive Traffic and Transportation Study</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transport</td>
</tr>
<tr>
<td>DPR</td>
<td>Detailed Project Report</td>
</tr>
<tr>
<td>HCBS</td>
<td>High Capacity Bus System</td>
</tr>
<tr>
<td>IPT</td>
<td>Intermediate Public Transit</td>
</tr>
<tr>
<td>JNNURM</td>
<td>Jawaharlal Nehru National Urban Renewal Mission</td>
</tr>
<tr>
<td>KRFB</td>
<td>Kerala Road Fund Board</td>
</tr>
<tr>
<td>LoS</td>
<td>Level of Service</td>
</tr>
<tr>
<td>LRT</td>
<td>Light Rail Transit</td>
</tr>
<tr>
<td>LSG</td>
<td>Local and Self Government</td>
</tr>
<tr>
<td>LUTM</td>
<td>Land Use Transport Model</td>
</tr>
<tr>
<td>MC</td>
<td>Municipal Corporation</td>
</tr>
<tr>
<td>NATPAC</td>
<td>National Transportation Planning and Research Centre</td>
</tr>
<tr>
<td>NUTP</td>
<td>National Urban Transport Policy</td>
</tr>
<tr>
<td>OD</td>
<td>Origin – Destination</td>
</tr>
<tr>
<td>PCU</td>
<td>Passenger Car Unit</td>
</tr>
<tr>
<td>PHPDT</td>
<td>Peak Hour Peak Direction Trips</td>
</tr>
<tr>
<td>PPTA</td>
<td>Project Preparatory Technical Assistance</td>
</tr>
<tr>
<td>RoW</td>
<td>Right of Way</td>
</tr>
<tr>
<td>TCRD</td>
<td>Trivandrum Capital Region Development</td>
</tr>
<tr>
<td>TIMTS</td>
<td>Thiruvananthapuram Integrated Mass Transport System</td>
</tr>
<tr>
<td>TRIDA</td>
<td>Thiruvananthapuram Development Authority</td>
</tr>
<tr>
<td>UTPS</td>
<td>Urban Transportation Planning System</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

1.0 Introduction

Comprehensive Mobility Plan (CMP) for a city is an overall transport plan considering the existing traffic pattern and envisioning the future traffic movement pattern. The CMP should suggest transport proposals for meeting the future mobility needs of the people in integration with land use of the city. The preparation of this report should be in compliance with the National Urban Transport Policy. The proposals for road widening, flyovers, metros etc for a city must be part of the CMP to obtain funding under JNNURM.

A Comprehensive Traffic and Transportation Study (CTTS) for the Thiruvananthapuram Urban area has been conducted by the Department of Transport (DOT), Government of Kerala in 2003. The consultant engaged for preparation of this report was Consulting Engineering Services (I) Private Limited (CES), New Delhi and the report has been submitted in March 2003. This study is the basis for preparation of this CMP.

2.0 Surveys and Studies

The study area under JNNURM for Thiruvananthapuram consists of the TRIDA area and 10 adjacent Panchayats. The surveys and studies conducted in the study area include classified traffic volume count surveys, origin-destination surveys, road inventory surveys, household travel surveys, public and IPT operator surveys, parking surveys, pedestrian surveys and terminal surveys.

3.0 Traffic Analysis and Proposals

The existing traffic pattern prevailing in the study area has been assessed from the traffic data collected and proposals for grade separator, parking etc were drawn from the analysis of the results of the survey.

4.0 Travel Demand Modeling and Forecast

The travel demand modeling has been done for the base year by using the conventional four stage Urban Transport Planning System (UTPS) and the travel behaviour of the residents of the City are captured for the base year. The horizon year travel demand is assessed by using ‘Garin Lowry’ Land Use Transport Model. An integrated land use - transportation plan is conceptualized by considering...
planning forecast and alternate development strategies. The alternate developing strategies consist of Regional Development Strategies and TRIDA development strategies. In TRIDA development strategy, several combinations of population distribution, employment distribution and network development were considered and evaluated. The resultant scenario selected for future travel demand modeling exercises consists of, population and employment distributions assuming a natural growth and network development consists of developing ring and radial road network pattern along with mass transportation facilities in high intensity passenger traffic corridors.

5.0  Conceptual Road Network Plan for Thiruvananthapuram

The CTTS study has come out with a road network improvement program for Thiruvananthapuram. This network has formed the basis for the subsequent roads developed or upgraded through the TCRD roads project and ADB projects. The above roads for the Municipal Corporation area form a part of the CDP proposals (for the JNNURM) also. The CDP proposal for improvement of the City Network covers approximately 350 km., out of which the CDP recognizes the first priority section of roads for improvement to the tune of 180 Km in length. The CMP proposes to prepare DPRs under the programme of the KSUDP for these 180km.

6.0  Thiruvananthapuram Integrated Mass Transport System (TIMTS)

The CTTS conducted travel demand modeling to plan and structure an Integrated Mass Transport System to meet the travel demand for Thiruvananthapuram till 2021. The study identified 7 road corridors for provision of mass transport facilities. The CTTS proposes a combined multi modal system with phased introduction of high capacity technology along high demand corridors and re-deployment of displaced technology on low demand corridors. The CDP endorses these proposals in full. The CMP prioritizes it on the first set of projects to be taken up under the reform agenda.

7.0  Phasing and Costing

The CMP proposes a road network system coupled with a passenger movement system (TIMTS) for the horizon year (2021). The road projects are to be completed within the next 5 years and passenger movement system by 2021. The approximate cost for development of the road network is Rs 1072 crores and Rs TIMTS 393 crores. These estimated amount get reviewed on DPRs get prepared, and accurate figures will be evolved.
Chapter 1
INTRODUCTION

1.1 General

Comprehensive Mobility Plan (CMP) for a city is an overall transport plan considering the existing traffic pattern and envisioning the future traffic movement pattern. Ministry of Urban Development, government of India has declared Jawaharlal Nehru National Urban Renewal Mission (JNNURM). The National Urban Transport Policy (NUTP) has also been declared. For the allocation of funds by the MoUD, for cities under any state government, the CMP is a mandatory requirement.

This CMP should be NUTP compliant. NUTP is prepared with the objective of a convenient and efficient transportation system in cities meeting the mobility needs of current and future population. CMP is a document which is required to be submitted as a part of the JNNURM project of a city and each JNNURM road corridor whose Detailed Project Report (DPR) is submitted\(^1\) should be a part of the CMP.

Thiruvananthapuram, the capital of Kerala and located at 8\(^o\)25' North latitude and 76\(^o\)55' East longitude, is covered under the JNNURM scheme. The study area of JNNURM is limited to the Thiruvananthapuram Development Authority (TRIDA) limit which consists of Municipal Corporation area and adjacent 10 Panchayats namely Kazhakkootam, Sreekaryam, Kudappanakkunnu, Vattiyoorkavu, Kalliyoor, Vilavoorkkal, Vilappil, Pallichal, Venganoor and Vizhinjam.

Thiruvananthapuram city has a developed network of roads. However most of the roads are narrow and poorly maintained. The regional network consists of National Highway 47, State Highways and District roads. The influence area of the city, in terms of travel demand, is spread over most of the revenue district of Thiruvananthapuram. This has led to heavy inflow of traffic from the surrounding regions and suburbs to the city. Traffic on the city road has increased manifold in the last two decades due to increase in personalized vehicular ownership, as a result of improved economic status and living standards. This has resulted in traffic snarls and congestion on the city roads since road development activities have not kept pace with traffic growth. Ribbon development along most of the roads has further aggravated the problem in terms of bottleneck formation and congestion during peak hours of the day. The absence of proper routing and scheduling of bus services and no preferential traffic treatment has led to inordinate delays and long waiting time for passengers.

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\(^1\) To GoI, MouD, for accessing JNNURM funds
In order to study the traffic problems of the city and to evolve feasible solutions to these problems, The Department of Transport (DOT), Government of Kerala, had initiated a Comprehensive Traffic and Transportation Study (CTTS) for the Thiruvananthapuram Urban area, which has been completed by Consulting Engineering Services (I) Private Limited (CES), New Delhi in March 2003 with horizon year as 2021.

The Government of India declared the JNNURM in 2005. 63 national cities were selected in the first phase. An allocation of Central Fund for this scheme in the first Phase is Rs 50000/- crores. The Scheme closes on 2012. Thiruvananthapuram and Cochin are the 2 cities from Kerala State that are included in the central list of 63.

The concerned LSGs of the two State cities prepared the respective “Comprehensive Development Plans”. Chapter 1 of the CDP deals with the Transportation Sector. The estimated outlay requirement for this sector for Thiruvananthapuram is Rs.3788 Crores. The CDP for Thiruvananthapuram was prepared in September 2006 and received the approval of the GoI subsequently. The CDP’s proposals for the transport sector include all the proposals of the CTTS 2003. It also includes other proposals in terms of projects, works, reforms etc. which are included in this CMP. In the CMP however, inorder to make project implementation co-terminus with the ADB funded KSUDP, the most impactful projects have been prioritized out of the much large list of the CDP for the City of Thiruvananthapuram. These are detailed in the following section while the lower – on – priority ones are listed in the annexes.

1.2 Study Area

1.2.1 General

The study area² covers the entire Thiruvananthapuram Development Authority Area consisting of Municipal Corporation area and adjacent 10 Panchayats namely Kazhakkootam, Sreekaryam, Kudappanakkunnu, Vattiyoorkkavu, Kalliyoor, Vilavoorkkal, Vilappil, Pallichal, Venganooor and Vizhinjam.

1.2.2 Regional Setting

Thiruvananthapuram District comprises of a thickly populated low land and midland areas and a forest covered highland area. The total area of the district is 2192 sq. km and it contains of 12 blocks Community Development comprising of 84 Panchayats, 4 Municipalities and one Corporation. The total District population, according to 2001 census, was 32.35 lakhs, with a population density of 1476 persons per sq.km. Major municipal towns and urban centres like Neyyatinkara, Nedumangad, Attingal and Varkala and the Thiruvananthapuram Corporation are located along the coastal area. In addition, other locations of major settlements include Chiryinkil, Kilimanooor, Palode, Vithura, Venjaramoodu, Kattakada,

² CTTS – Final Report March 2003
Kazhakuttam, Balaramapuram, Parassala and Vizhinjam. The district setting and the major connection corridors to these settings are shown in Fig 1.1.

1.2.3 Physical Characteristics

The study area (TRIDA area) comprises of Thiruvananthapuram Corporation and adjacent 15 Panchayats spreading over 296.17 sq.km (13.51% of District area). The City Corporation is spread over an area of 74.93 sq.km (25.28% of TRIDA area) and the area of remaining Panchayats is 221.24 sq.km (74.7% of TRIDA area). The area has an undulating terrain with hills and dales and a number of rivers, canals and drains. Karamana and Killi rivers traverse the study area and flow into the sea near Edayar island. The physical development within the area is mainly along the transportation corridors (NH 47, MC road and Shencottah Road), which is a common feature in Kerala. However, out of 15 Panchayats 5 Panchayats (Kadakampalli, Attipara, Nemom, Thiruvallom and Ullor) where amalgamated with Thiruvananthapuram Corporation & and Corporation area increased to 141.55sq.km

1.2.4 Demography

The TRIDA has 296.17 sq.km\(^3\) under its jurisdiction with 141.55 sq. km (Trivandrum Corporation and 5 extended Panchayats) under the Thiruvananthapuram City Corporation and 154.6 sq.km for the 10 adjacent Panchayats. The population of TRIDA area as per 2001 census is 11,32,394. The population density is 5256 persons per sq.km for the Municipal Corporation area

\(^3\) Source: CTTS – Table 2.1: Demographic features – Study Area
and 2803 persons per sq.km for the total Panchayat area alone with an average value of 3026 persons per sq.km for the whole TRIDA area.

1.2.5 Transport System Characteristics

The traffic volume in the existing city road corridors of Thiruvananthapuram Corporation is mounting in geometric proportions as the Corporation is crammed with numerous number of activity centers like state level administrative buildings, tourism destinations (Kovalam, Ponmudi, etc.), technopark, health tourism destinations, VSSC etc. In order to effectively appraise the traffic and transportation issues due to ever-growing traffic and to evolve a comprehensive approach for the development of an efficient future transportation system, the Government of Kerala conducted ‘The Comprehensive Traffic and Transportation Study for Thiruvananthapuram Urban Region (CTTS)’ in 1999 -2003. This study forms the basis for the Comprehensive Mobility Plan for Thiruvananthapuram.

The road network within the Thiruvananthapuram Corporation is generally of ring and radial pattern. The Corporation has five major regional roads viz., NH 47 (Kanyakumari-Salem, entering the city from the south from Nagercoil and exiting on the north-west towards Kollam), SH 1- M.C. Road (Main Central Road, taking off from Kesavadasapuram in the city and leading to Kottayam & Angamali through Nalanchira and Mannanthala located in the north of the city), State Highway to Shenkottah (in Tamil Nadu border via Peroorkkada in the city and through Nedumangad town situated within 20 km of the city), Thiruvananthapuram-Kattakada road (taking off from Poopappura in the city towards east via Thirumala and Malayinkeezh), Thiruvananthapuram-Vizhinjam-Poovar road (taking off from East Fort in the city centre towards south-west. All these five regional roads radiate from the city and the other major roads of the city connect these roads as ring roads. The Thiruvananthapuram city by-pass for NH47 is aligned along the coast from Kazhakuttam Junction to Kovalam-Vizhinjam and Parasala meeting NH 47 at Parasala. Kazhakuttam-Kovalam stretch is completed now with two-lane carriageway and service roads on either side.


The total road length in the Thiruvananthapuram Corporation area is 2586 km of which 56% are surfaced. As per the existing land use plan, the roads in the Corporation area cover nearly 7% of urban land area with road density of 18 km per sq. km area. In the Most of the roads in the city are narrow and are unable to cater to the growing traffic volumes, often resulting in transportation gridlocks.
during peak hours. As per the Comprehensive Traffic & Transportation Study (2002), about 76% of major roads have Right of Way (RoW) between 7m and 14m and 10% with ROW between 14m and 21 m. Only 0.3% of the major roads have a divided carriageway. About 40% roads have shoulders up to 2m wide on either side. Footpaths inadequate or absent in most of the roads as only 25 km of roads had footpaths. Substandard geometry of the arterial roads, excessive traffic compared to capacity, inadequate parking facilities, inefficient management of road space, and absence of pedestrian facilities were some major problems associated with the other traffic network.

The aforesaid issues had resulted in speed reduction during peak-hours on city roads in general. The absence of development and negligence to maintenance of the roads had resulted in reduction of average peak-hour speed at the outer city road sections to 16 to 23 km per hour.

The situation was addressed subsequently through a structural development programme named City Road Development Project under a wider scheme called Capital Region Development Programme, under Kerala Road Fund Board (KRFB), detailed project reports were got prepared by the state government of Kerala through a competitively selected consultant and the implementation was started in 2004, including necessary land acquisitions, under an Annuity based BOT contract award to a JV company, an SPV called the TCRDL. 41.2 km along with 13 corridors come under this project. The implementation has however lagged on time-scale and approximately 70% of the project remains to be executed and completed.
Chapter 2
SURVEYS AND STUDIES

2.1 General

A number of traffic and transportation studies were conducted for the study area as part of CTTS study in order to assess the passenger and goods movement pattern, travel characteristics, pedestrian and parking characteristics and available infrastructure facilities. The data collection activities include classified traffic volume count surveys, origin-destination surveys, road inventory surveys, household travel surveys, public and IPT operator surveys, parking surveys, pedestrian surveys and terminal surveys. The results of these surveys can be acceptable on date (August 2007) being about 5 years old. The recommendations emanating out of the surveys still hold, and would be effective in instigating the impacts on the system, as briefly explained below.

2.2 Survey Preliminaries

2.2.1 Zoning System

Based on network connectivity and importance of town/region with respect to Thiruvananthapuram City, 84 zones were demarcated within the study area and 6 zones external to the study area. The administrative wards in the corporation area and census zones in the Panchayats were adopted as the traffic analysis zones (considering the ease in obtaining the required zonal information). The list of Traffic zones is presented in Chapter 3, Page 2 and Table 3.1 of CTTS and the zonal boundaries are depicted in Fig 2.1.

![Fig 2.1 Traffic Analysis Zones](image)
2.2.2 Screen and Cordon Lines

The TRIDA boundary was the Cordon line for the study area. There are two screen lines were identified for the project area. These are the Killi river (North-South screen line) and the Railway line (East-West screen line).

2.2.3 Secondary Data

The following data were collected from secondary sources:
- the characteristics of the existing demand for travel
- the existing supply of transport infrastructure including fleet size, operation, cost, performance, regulation and utilization
- demographic and socio-economic characteristics
- present and proposed land use pattern
- planned transport investments, policy changes and other government actions

2.2.4 Primary Surveys

The following primary traffic surveys were conducted; based on assessment made:

(i) **Road inventory survey**
Primary road network for a length of 475 km was identified for road inventory within the study area. The data collected include RoW availability, carriageway width, surface type, abutting land use, utility and services, on street parking, condition of drains, trees within RoW, traffic control and management measures and other special features.

The following data was extracted from the road network inventory survey.
- Road geometrics, in-terms of cross sectional elements
- Existing street infrastructure, in-terms of street lighting, guard rail etc
- Traffic regulation and management measures
- Existing capacity levels, LOS, bottleneck zones
- Existing available and potential capacity of the link
- Potentials, problems and constraints for evolving traffic management plan
- Identification of the existing road hierarchy

(ii) **Speed and Delay survey**
Speed and delay surveys were carried out along the identified road network during peak and off-peak hours for assessing the journey speed along the corridor, running speed along links and nature and extent of delay at intersections and mid blocks.
The following outputs were derived from the survey.

- Journey speed along the corridor
- Running speeds along the links between intersections
- Nature and extent of delay at intersections and mid blocks

The speed data has been used for developing the zone to zone travel time matrices for use in trip distribution and traffic assignment stages of demand modeling.

(iii) **Classified traffic volume count survey**

These surveys were conducted at the outer cordon line and screen lines. The outer cordon was the TRIDA boundary and 16 points of entry/exit were identified.

**Outer Cordon Survey**

Classified traffic volume count surveys were in two phases. In the first phase, 16 hour surveys were conducted at the 16 locations identified along the cordon line to the study area. Data collected at these locations was analyzed to identify locations with high intensity of traffic contributing to more than 85% of total vehicular traffic demand at the cordon line. Detailed Origin – Destination (OD) surveys and classified volume count surveys were then undertaken in the second phase for 24 hours at nine such identified locations (amongst the 16 locations)

The details of the cordon line survey are presented in *Chapter 3, Page 5 and Table 3.2* of CTTS and shown in Fig 2.2, below
Screen Line Surveys

Classified volume count and vehicle occupancy surveys were conducted at mid blocks along roads crossing the demarcated screen lines for 21 locations (Chapter 3, Page 7 and Table 3.3 of CTTS) and in Fig 2.2 and also listed down below.

### Table 2.1 - Screen Line Survey Locations and Durations

<table>
<thead>
<tr>
<th>Code</th>
<th>Name of Road</th>
<th>Location</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Killi River – Screen Line 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>Peroorkada-Vattiyoorkavu Road</td>
<td>Mannamoola Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>R2</td>
<td>Sasthamangalam-Vattiyoorkavu Road</td>
<td>Maruthamkuzhy Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>R3</td>
<td>Vazhuthacaud-Pangode Road</td>
<td>Pangode Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>R4</td>
<td>Jagathy-Poojapura Road</td>
<td>Jagathy Bridge</td>
<td>24 hrs</td>
</tr>
<tr>
<td>R5</td>
<td>NH 47</td>
<td>Killipalam Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>R6</td>
<td>Manacaud-Kalady Road</td>
<td>Chiramukku Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>R7</td>
<td>Thiruvananthapuram-Vizhinjam Road</td>
<td>Thiruvallom Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>Railway Line – Screen Line 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Mudavoorpara-Kattakada Road</td>
<td>Thamivila Railway Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S2</td>
<td>Pravachambalam-Kattakada Road</td>
<td>Pravachambalam Railway Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S3</td>
<td>Nemom-Poozhikunnu Road</td>
<td>Studio Junction Railway Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S4</td>
<td>Pappanamcode-Malayinkil Road</td>
<td>Industrial Estate Railway Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S5</td>
<td>Karamana-Poojapura Road</td>
<td>Kunjalumoodu Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S6</td>
<td>Valiyasala-Mettukada Road</td>
<td>Valiyasala Station Junction</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S7</td>
<td>NH 47</td>
<td>Thampanoor Bridge</td>
<td>24 hrs</td>
</tr>
<tr>
<td>S8</td>
<td>Overbridge Jn to East Fort</td>
<td>Over Bridge</td>
<td>24 hrs</td>
</tr>
<tr>
<td>S9</td>
<td>Uppilamoodu-Karthamukku Road</td>
<td>Uppilamoodu Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S10</td>
<td>Shanghumugham-Palayam Road</td>
<td>Pettah Bridge</td>
<td>24 hrs</td>
</tr>
<tr>
<td>S11</td>
<td>Pettah-Anayara Road</td>
<td>Pettah Level Crossing</td>
<td>24 hrs</td>
</tr>
<tr>
<td>S12</td>
<td>Kochuveli-Venpalavattom Road</td>
<td>Madhavapuram Railway Bridge</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S13</td>
<td>Stationkadavu-Attinkuzhy Road</td>
<td>Statiokadavu</td>
<td>16 hrs</td>
</tr>
<tr>
<td>S14</td>
<td>Meenankulam-Kazhakuttom Road</td>
<td>Gate Mukku</td>
<td>16 hrs</td>
</tr>
</tbody>
</table>

(Source: CTTS Final Report March 2003)

The following outputs were derived from the screen line survey data:

- Traffic characteristics, in terms of average daily traffic (ADT)
- Hourly variation of traffic
- Peak hour flows and directional distribution of traffic
Traffic composition and intensity along the corridors

(iv) Intersection Turning movement survey

Turning movement survey was conducted for 16 hours on a normal working day for 24 junctions within the TRIDA area. Data collected from these surveys has been used for preparation of geometric improvement plans for critical intersections.

This data along with pedestrian volume count data has been used to assess the pedestrian – vehicular conflicts at critical locations. The survey locations can be referred in Chapter 3, Page 12 and Table 3.6 of CTTS, and also given in Table 2.2.

(v) Origin-Destination survey

The Origin-Destination Surveys were conducted for assimilating information on travel pattern of passenger and goods vehicles at the cordon line.

The survey elicits information regarding travel pattern in terms of size and desire, trip purpose, trip length, mode of travel, journey time and cost. In addition to these, details of goods movement in terms of quantity by type, tonnage, mode, trip length, lead-load spectrum etc were obtained. (The survey locations are listed in Chapter 3, Page 6 and Table 3.2 of CTTS) Details marked in Fig 2.2 and Locations given below

<table>
<thead>
<tr>
<th>Code</th>
<th>Road</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC1*</td>
<td>Vizhinjam Road</td>
<td>Pulinkudi</td>
</tr>
<tr>
<td>OC2**</td>
<td>Vizhinjam – Balaramapuram Road</td>
<td>Ponayera kunnu</td>
</tr>
<tr>
<td>OC3**</td>
<td>NH-47</td>
<td>Mudavoorpara</td>
</tr>
<tr>
<td>OC4*</td>
<td>Pravachambalam – Kattakada Road</td>
<td>Nadakkadu</td>
</tr>
<tr>
<td>OC5*</td>
<td>Pappanamcode – Malayankil Road</td>
<td>Althara Junction</td>
</tr>
<tr>
<td>OC6**</td>
<td>Peyad – Malayankil Road</td>
<td>Kairali Nagar</td>
</tr>
<tr>
<td>OC7*</td>
<td>Mulayara Road</td>
<td>Mulayara</td>
</tr>
<tr>
<td>OC8**</td>
<td>Vattiyoorkavu – Nettayam Road</td>
<td>Katchani</td>
</tr>
<tr>
<td>OC9**</td>
<td>Peroorkada – Nedumangad Road</td>
<td>Christ Nagar Jn.</td>
</tr>
<tr>
<td>OC10*</td>
<td>Mananthala- Peroorkada Road</td>
<td>East Mukkola</td>
</tr>
<tr>
<td>OC11**</td>
<td>MC Road</td>
<td>Mananthala</td>
</tr>
<tr>
<td>OC12*</td>
<td>Poudikonam – Pothencode Road</td>
<td>Charumoodu</td>
</tr>
<tr>
<td>OC13**</td>
<td>Kattakonam – Pothencode Road</td>
<td>Kattakonam</td>
</tr>
<tr>
<td>OC14**</td>
<td>NH-47</td>
<td>Vettu Road</td>
</tr>
<tr>
<td>OC15*</td>
<td>Veli – Menamkulam Road</td>
<td>Stationkadamu</td>
</tr>
<tr>
<td>OC16**</td>
<td>Stationkadavu – Perimathura Road</td>
<td>Stationkadamu</td>
</tr>
</tbody>
</table>

(Source CTTS Final Report March 2003)
(vi) **Household (home interview) survey**
A household survey was conducted to assess the household, socio-economic and trip characteristics of residents within the TRIDA area. The sample households were selected based on a simple random sample technique. The number of households within each ward was based on relative residential population in each ward obtained from latest electoral record available at the time of survey.

The survey provided details of socio-economic and personal characteristics at household and individual levels. It also provided detailed household trip making pattern (zone to zone trip table) and its relation with socio-economic characteristics. The zone wise number of households and the sample selected for survey within each zone is detailed in Chapter 3, Page 9 and Table 3.4 of CTTS (2003).

(vii) **Public transport operator survey**
This survey was conducted at various locations for buses and tempos to assess the operational characteristics in terms of vehicle utilization, passengers carried, operating expenses and revenues.

(viii) **Intermediate Public Transit (IPT) user survey**
The operational characteristics of the IPT (Auto rickshaw, cycle rickshaw, tempo etc) modes collected include origin-destination, purpose, frequency, cost of trips, passengers carried etc.

The survey provided information relating to trip characteristics in terms of origin and destination of trip by IPT modes, purpose, frequency and cost of trips, IPT operational characteristics in terms of route of operation, vehicle utilization, passengers carried, operating cost and revenue. The data has been used to assess the dispersal pattern of inter-city/intra-city trips from these terminals to reach the ultimate destination after alighting from buses / train.

(ix) **Parking Survey**
Parking surveys were conducted to appreciate the parking demand and supply characteristics, identify issues and constraints and suggest appropriate policies for meeting the horizon year parking demand.

The survey provided information on utilization of parking space by hour of the day, parking space turnover rates and the average parking duration. The parking survey locations are furnished in Chapter 3, Page 11 and Table 3.5 of CTTS.

(x) **Pedestrian Survey**
Pedestrian surveys were conducted to gather information regarding pedestrian flows along and across the important junctions and mid blocks and thereby suggesting measures for safe movement of pedestrians. The survey provided information relating to intensity of pedestrian volumes at the survey locations. The locations of pedestrian survey are furnished in Chapter 3, Page 11 and Table 3.6 of CTTS and in Fig 2.3.

(xi) **Terminal Survey**

**Bus Terminal Survey** was conducted for 12 hours at important passenger terminals (bus and rail) within the study area for assessing the physical characteristics (size, space), operational characteristics (bus, passenger flow), and user characteristics (origin, destination, mode, trip length and travel cost).

The survey data provided insight into the access and dispersal pattern of passengers to and from the terminals and the terminal physical characteristics.

**Goods Terminal Survey** was conducted to assess the truck operator characteristics and their requirements, issues and problems.

The survey data provided the basis for assessing the operational characteristics of truck operators.
Chapter 3
TRAFFIC ANALYSIS AND PROPOSALS

3.1 General

The traffic and travel characteristics of the study area are appreciated in this chapter based on the analysis of the field traffic surveys that were conducted. This chapter brings out the traffic intensity as in 2003, capacity of the transportation system and the prevailing Level of Service (LoS).

3.2 Average Daily Traffic

3.2.1 Outer Cordon

The outer cordon surveys were conducted in two phases. In the first phase 16 hour volume count surveys were done to select the traffic locations contributing to more than 85 percent of vehicular traffic volume at the cordon line. The traffic volume and locations\(^4\) are given below as well as furnished in final CTTS report (chapter 4, page 2, Table 4.2). Table 2.3 in chapter 2, gives the name of the corridors in the outer cordon.

<table>
<thead>
<tr>
<th>Location</th>
<th>PCUs</th>
<th>% Share at Cordon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FMV</td>
<td>Total</td>
</tr>
<tr>
<td>OC1</td>
<td>998</td>
<td>1102</td>
</tr>
<tr>
<td>OC2</td>
<td>1926</td>
<td>2243</td>
</tr>
<tr>
<td>OC3</td>
<td>8910</td>
<td>9181</td>
</tr>
<tr>
<td>OC4</td>
<td>871</td>
<td>983</td>
</tr>
<tr>
<td>OC5</td>
<td>736</td>
<td>857</td>
</tr>
<tr>
<td>OC6</td>
<td>2857</td>
<td>3072</td>
</tr>
<tr>
<td>OC7</td>
<td>707</td>
<td>829</td>
</tr>
<tr>
<td>OC8</td>
<td>1677</td>
<td>1910</td>
</tr>
<tr>
<td>OC9</td>
<td>5382</td>
<td>5548</td>
</tr>
<tr>
<td>OC10</td>
<td>1676</td>
<td>1790</td>
</tr>
<tr>
<td>OC11</td>
<td>4960</td>
<td>5073</td>
</tr>
<tr>
<td>OC12</td>
<td>696</td>
<td>744</td>
</tr>
<tr>
<td>OC13</td>
<td>1931</td>
<td>2026</td>
</tr>
<tr>
<td>OC14</td>
<td>7987</td>
<td>8265</td>
</tr>
<tr>
<td>OC15</td>
<td>957</td>
<td>1314</td>
</tr>
<tr>
<td>OC16</td>
<td>1782</td>
<td>2084</td>
</tr>
<tr>
<td>Total</td>
<td>44053</td>
<td>47021</td>
</tr>
</tbody>
</table>

Based on the percentage share in total Passenger Car Units (PCUs) at the outer cordon, the locations OC2, OC3, OC6, OC8, OC9, OC11, OC13, OC14, and

\(^4\) Chapter 2, page 3, Fig 2.2
OC16 shown in the above table were selected for detail study in the second phase. The 24 hour traffic volume was done at selected locations and details are given below.

This survey shows that National Highway (NH-47) crossing the outer cordon line at locations OC3 & OC14 cater the maximum traffic volume amongst the selected survey locations, contributing to 50.24% traffic at the outer cordon.

### 3.2.2 Screen Lines

About twenty one locations, comprising seven locations along Killi River and fourteen along railway screen line was identified. The details regarding locations are given in chapter 2, page -4, table 2.1 also in CTTS report March 2003 (Chapter 3 table 3.3 and Locations in Fig 3.3) and also given in Fig 2.2 and Table below.

The locations R4 (Jagathy – Poojapura road) and R5 (NH-47) catered to higher traffic volumes across Screen Line 1

---

5 Chapter 2, Page 3, Fig 2.2
The locations S7 (NH -47) & S8 (Over bridge junction – East Fort road) cater significant traffic volumes across Screen Line 2.

### 3.3 Variation of Day-Night Traffic

Data of 24 hour traffic counts was analyzed to obtain the share of 16 hours traffic in total daily traffic. The details of the comparison is shown in Table 4.8 and Fig 4.3 of CTTS report March 2003 and also given in Table 3.5.

The comparison results shows that the percentage of 16 hour traffic to daily traffic varied between 85 and 90 percent, indicating the night traffic between 10PM – 6AM constitute to about 10-15 % of the total traffic.
3.4 Temporal Variation of Traffic

The capacity requirement of the system during peak hours in comparison to the off peak hours was assessed to efficiently plan transport system and services. The peak hour traffic and its percentage share in daily traffic at the outer cordon locations and screen line locations are furnished in Chapter 4, Page 9,10 and Table 4.9 and Table 4.10 of CTTS and also given in the Table 3.6 and 3.7.

The peak hour traffic varies between 6 and 11 percent at individual survey locations. It is observed that as the average daily traffic increases the peak hour factor comes down.

The peak hour traffic varies between 7.3 and 13.2 percent at individual survey locations.

3.5 Traffic Movement Pattern

O-D surveys were conducted to assess the travel pattern of traffic entering and exiting the study area. It was observed that that there were 6.54 lakhs passenger trips across the outer cordon out of which 2.62 lakhs are outgoing. The passenger movement was found to be maximum at the locations on NH 47. The freight movement was also found to be maximum at the NH 47 outer cordon locations. The details of the Origin-Destination studies are available in Chapter 4, section 4.7 of CTTS.

The highlights are:
- O-D survey on sample size basis
- Travel pattern of passenger vehicle trips

### Table 3.6 Percentage Share of Peak Hour Traffic in Daily Traffic at Outer Cordon

<table>
<thead>
<tr>
<th>Cordon Location</th>
<th>ADT</th>
<th>Peak Hour Traffic</th>
<th>Percent Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC2</td>
<td>4840</td>
<td>431</td>
<td>8.9</td>
</tr>
<tr>
<td>OC3</td>
<td>29416</td>
<td>1385</td>
<td>4.7</td>
</tr>
<tr>
<td>OC6</td>
<td>9950</td>
<td>594</td>
<td>6.0</td>
</tr>
<tr>
<td>OC8</td>
<td>4279</td>
<td>370</td>
<td>8.6</td>
</tr>
<tr>
<td>OC9</td>
<td>13455</td>
<td>883</td>
<td>6.6</td>
</tr>
<tr>
<td>OC11</td>
<td>10126</td>
<td>883</td>
<td>8.7</td>
</tr>
<tr>
<td>OC13</td>
<td>3631</td>
<td>43</td>
<td>11.1</td>
</tr>
<tr>
<td>OC14</td>
<td>22622</td>
<td>1493</td>
<td>6.6</td>
</tr>
<tr>
<td>OC15</td>
<td>5250</td>
<td>434</td>
<td>8.3</td>
</tr>
</tbody>
</table>

(Outer Cordon (OC) locations are shown in Fig 2.2), (Source: CTTS March 2003)

### Table 3.7 Percentage Share of Peak Hour Traffic in Daily Traffic at Screen Line 1 & 2

<table>
<thead>
<tr>
<th>Location</th>
<th>ADT</th>
<th>Peak Hr Traffic</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Killi River- Screen Line I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>3315</td>
<td>341</td>
<td>10.3</td>
</tr>
<tr>
<td>R2</td>
<td>17759</td>
<td>1730</td>
<td>9.7</td>
</tr>
<tr>
<td>R3</td>
<td>10532</td>
<td>1184</td>
<td>11.2</td>
</tr>
<tr>
<td>R4</td>
<td>24433</td>
<td>2211</td>
<td>9.0</td>
</tr>
<tr>
<td>R5</td>
<td>34900</td>
<td>3101</td>
<td>8.9</td>
</tr>
<tr>
<td>R6</td>
<td>5042</td>
<td>568</td>
<td>11.3</td>
</tr>
<tr>
<td>R7</td>
<td>17755</td>
<td>1521</td>
<td>8.6</td>
</tr>
<tr>
<td>Railway Line- Screen Line II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>2445</td>
<td>318</td>
<td>13.0</td>
</tr>
<tr>
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(Screen Line location are listed in Table 2.1, Chapter 2), (Source: CTTS March 2003)
3.6 Turning Movement Survey

The turning movement survey results show that the junctions Pazhavangadi, Overbridge and Vellayambalam have peak hour traffic 9200 pcu, 6216 pcu and 6536pcu respectively in 2000. These survey results are available in Chapter 4, Page 20 and Table 4.26 of CTTS. But as per the recent traffic surveys (TCRD project), it was found that Vellayambalam and Pattom Junctions require a grade separator in the year 2007. The traffic volumes were 10509 and 8127 respectively in 2002.

3.7 Parking Survey

Parking surveys were conducted for a period of 12 hours at selected locations and the results are furnished in Chapter 4, Page 21 and Table 4.27 of CTTS. The survey shows that two wheelers are the predominant mode of parking in the commercial area. Peak hour parking at most of the location are at the evening hours.

3.8 Pedestrian Movement Surveys

Pedestrian surveys were conducted at selected locations where significant pedestrian-vehicular conflicts prevail. The locations comprise intersections at VJT hall, Statue, Medical College, Thampanoor, East Fort, General Hospital, Neeramankara, Pattom (St. Mary’s School vicinity) and Vazhuthacaud (Cotton Hill School Vicinity).

Pedestrian Subways are proposed at the following locations
- Underpass at Medical College for pedestrians (already mentioned in CTTS)
- East Fort – Starting from Putharikandam Maidan and ending at proposed bus bay in Trivandrum City Road Improvement Project

3.9 Road Network Inventory

The road network inventory surveys conducted for the base year 2000 road network collected data pertaining to road classification, carriageway, RoW, number of lanes, pavement type and condition, on-street parking, footpath, drainage condition, street lighting etc. Out of the 390 kms of roads surveyed, the arterial roads constitute about 74.8 km (19.2 %), sub arterials about 103.7 km (26.6 %) and collectors about 211.5 km (54.2 %). Majority of the roads constitute
single lane, 2-lane, or intermediate lane undivided carriageways (97%). The composition of 4-lane divided or undivided sections is about 0.3% of the total. Classification of roads by RoW availability shows that majority of roads, about 76%, have RoW between 7 and 14 m. The survey also reveals that about 50% roads do not have proper drainage facility resulting in water logging during rainy seasons.

3.10 Household (home interview) survey

The household surveys were conducted to collect details on personal characteristics of trip maker, household characteristics, vehicle ownership details, trip characteristics etc. A sample size of 5086 households, constituting 2% of the total households within the study area, was captured during the surveys. Random sampling method was adopted and the information provided by electoral rolls was used for deriving the sample households. According to the electoral rolls, the study area had about 2,53,540 households, comprising 1,11,677 households within the corporation area and 1,41,863 households within the adjacent 10 Panchayats. Accordingly, 2191 households in the corporation area and 2895 households within the Panchayats were interviewed during the survey. The household survey details are available in Chapter 4, section 4.13 of CTTS.

3.11 Proposals

The CTTS study had used the above survey results for proposing parking locations, pedestrian subways etc. Some of the short term proposals of CTTS are still relevant and can form part of CMP.

3.11.1 Proposals of Pedestrian Subways

Pedestrian Subways are proposed at the following locations

- VJT Hall
- Statue Jn
- Medical College
- Cotton Hill School
- Neeramankara
- General Hospital

One sample drawing for Medical College sub way proposal by CTTS is shown in Fig 3.1.
3.11.2 Proposals of Multilevel Parking

Multi level parking (against surface level parking in CTTS) may be provided at the following locations.

- Pulimoodu – Land behind Lens & Frames may be examined
- Medical College – Availability of low lying land opposite to Water Authority office can be examined
- Pazhavangadi – A portion of Putharikandam Maithan (eastern side) can be utilized for multi level parking, this may be examined.
- Thampanoor – It is proposed to shift the existing bus station for long distance running buses to Enchakkal. Preliminary works for this work is progressing. So the existing bus terminal at Thampanoor will be limited to buses plying within the city only. So the possibility of providing multi-level parking in this locality shall also be examined in detail.
Chapter 4
TRAVEL DEMAND MODELING AND FORECAST

4.1 General

The travel demand modeling and forecast has been done sequentially through the following steps:

- Base travel demand modeling is done based on the conventional Urban Transportation Planning System (UTPS).
- Land use – Transport Model (Garin-Lowry Model) calibration was carried out using the base year population and employment details.
- Different development strategies were considered and critically evaluated and the best strategy has been selected for travel demand forecast.
- The future population and employment details have been calculated using the calibrated Land use – Transport (Garin-Lowry) Model.
- The population and employment estimates of the Garin-Lowry Model for future years have been used for the travel demand forecast.

4.2 Base Year Travel Demand Modeling

Base year travel demand modeling has been done in four stages viz., trip generation, trip distribution, modal split and trip assignment. Home based and non home based trips are used for modeling purposes. The details of the modeling process are furnished in Chapter 6 of CTTS.

4.3 Land Use Transport Model

Land use transport modeling is essential to ensure that there is an efficient balance between land use activities and transport capability. The Garin Lowry Land Use Transport Model is used to assess the impact of land use pattern on transport system. The base year population and employment details are used to calibrate the Land Use Transport Model (LUTM). The calibration process is described in detail in section 6.7 of Chapter 6 of CTTS.

4.4 Selection of Development Strategy

A multi level urban development strategy formulation is adopted and it consists of regional development strategies at the first level followed by TRIDA development strategies.

4.4.1 Regional Development Strategy

The regional strategy comprises of proper connectivity of Thiruvananthapuram Municipal Corporation with Municipalities Attingal, Nedumangad, Neyyattinkara
and Varkala. The schematic diagram of the regional development concept is given in Fig 4.1.

![Regional Development Strategies Concept](image)

**Fig 4.1 Regional Development Strategies Concept**

4.4.2 TRIDA Development Strategy

Various combinations of urban development strategies were formulated based on parameters population, economy, mobility, modal share and transport system. The strategies include Population Distribution Strategy, Employment Distribution Strategy and Network Development Strategy.

**Population Distribution Strategy:** Three different forms of population distribution strategies have been evolved as given below:

i) **P1:** Brown Field Development Strategy: Re-densification of low density area (do nothing scenario) as shown in Fig 4.2.
ii) **P2: Green Field Development Strategy: Densification of low density area in North-South direction as shown in Fig 4.3.**

The Greenfield Strategy envisages the extension of the city in all directions to accommodate the additional population and activities.
iii) P3: Corridor Development Strategy: Densification along N-S corridor and at selected nodes along radial corridors as shown in Fig 4.4.

![Fig 4.4 Corridor Development Strategy](image)

**Employment Distribution Strategy:** The employment distribution strategies will consider the population distribution strategies as well as employment opportunities created in certain areas due to committed projects. Three employment strategies were evolved as given below:

i) **E1:** Mono-Nucleus Structure Strategy – Natural Growth (Do Nothing Situation)

ii) **E2:** Multi-Nuclei Structure (Uniform) Strategy – Employment centers along north – south Kazhakuttam - Balaramapuram corridor as shown in Fig 4.5.
iii) E3: Multi-nuclei Structure (non-uniform) Strategy- Employment Centers along east-west, Nedumangadu-Vizhinjam corridor.

**Network Development Strategies:** The existing traffic movement and desire line diagrams formed the basis for evolving the following network strategies.

i) N1: Development of Thiruvananthapuram-Attingal and Thiruvananthapuram-Neyyattinkara (NH 47) corridors along with development of Inner Ring Road (Eastern Bypass) (Fig 4.6).
ii) N2: Development of Inner and Outer Ring Roads and radial corridors connecting nodes along Ring Roads to Central Business District (CBD) (Fig 4.7).
iii) N3: Development of radial corridors to Attingal, Nedumangad, Neyyattinkara and Vizhinjam along with development of CBD tangential, outer and inner ring roads (Fig 4.8).

iv) Development of Thiruvananthapuram Integrated Mass Transport System (TIMTS) along with road improvements under N3 scenario (Fig 4.9).
The above alternate scenarios were evaluated based on average trip cost to obtain the best possible combination of population and employment to optimize the selected network. After evaluation, the scenario P1E1N4 was adopted for future travel demand modeling exercises. These aspects are discussed in detail in Chapter 7 of CTTS.

4.5 Travel Demand Forecast

The population and employment were estimated for the horizon year using the LUTM model and the data was used for assessing the travel demand for the different horizon years (2012, 2017 and 2021). The details of trip distribution, modal split and traffic assignment are furnished in Chapter 8 of CTTS. The desire line diagrams for passenger trips by private and public transport modes are furnished in Fig 4.10 and Fig 4.11.

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6 P1-population distribution strategy, E1-employment distribution strategy, N4- network development strategy, also see section 4.4.2.
7 Land-Use Transportation Model (Garin-Lowry Model)
Fig 4.10 Desire Lines for Passenger Trips by Private Modes for 2021

Fig 4.11 Desire Lines for Passenger Trips by Public Transport for 2021
The traffic assignment result for the selected scenario of N4 (road network development with mass transport system), is furnished in Fig 4.12.

![Fig 4.12 Trip Assignment for all Mode Trips (PCU) under TIMTS for 2021](image)

Details of the traffic forecast are furnished in detail in Chapter 8 of CTTS. Based on the above results a road network system and improvement proposals are drawn for Thiruvananthapuram and the proposals are discussed in subsequent chapters.
Chapter 5

CONCEPTUAL ROAD NETWORK PLAN FOR THIRUVANANTHAPURAM

5.1 General

A well defined city road network ensures smooth and efficient traffic flow through the city. The first effort to suggest a road network for Thiruvananthapuram with predefined road hierarchy has been made by the Master Plan for Thiruvananthapuram in 1971. The Master Plan suggested 18 Detailed Town Planning Schemes containing state level roads, major district roads, important city roads and local roads. The second and third efforts to study the travel and road network characteristics of Thiruvananthapuram have been made by National Transportation Planning and Research Centre (NATPAC) in 1979 (Comprehensive Traffic Study) and Consulting Engineering Services (I) Pvt. Ltd in 1989 (Road Development and Traffic Management Studies, Kerala Urban Development Project, World Bank aided) respectively. But, these studies lack a comprehensive approach for the city road network development over the long term.

A Comprehensive Traffic and Transportation Study (CTTS) for the TRIDA area has been conducted by Consulting Engineering Services (I) Pvt. Ltd in 2003 with the objective of matching the transport demand with supply in terms of transport infrastructure, system control and management with optimal utilization of the existing infrastructure. This study has come out with a road network improvement program for Thiruvananthapuram and this network has formed the basis for all future proposals with regard to road sector. The details of the background studies which have lead to the above network are already discussed in the previous chapters.

In continuation with the CTTS project the Government of Kerala under short term projects for ‘Thiruvananthapuram Capital Region Development (TCRD)’, considered certain road improvement measures. This project was undertaken by Kerala Road Fund Board which was formed in 2001. The DPRs for the road corridors selected under this program was also prepared by Consulting Engineering Services (I) Pvt. Ltd. The advisor of this project Dr. N. S. Srinivasan has formulated a conceptual road network for Thiruvananthapuram for this project using CTTS proposals as guidelines. This network proposed for the TCRD programme has been updated by the Project Preparatory Technical Assistance (PPTA) consultant (KSUDP) based on CTTS. However, the extent of this network is restricted in the Municipal Corporation Area of Thiruvananthapuram. The CTTS network is planned for the TRIDA area (Corporation area and adjacent 10 Panchayats). So the network proposed by the PPTA consultant is to be extended over the JNNURM area by incorporating the missing links from the CTTS network and this revised network will form the Comprehensive Mobility Plan for the JNNURM/CDP area.
5.2 CTTS Road Network Proposal

The CTTS has proposed a Regional Road Network System and TRIDA Road Network System for Thiruvananthapuram. The proposed network is of the ring-and-radial type.

The CTTS carried out detailed studies with regard to existing road network, traffic movement and socio economic characteristics of the study area. In the study, base year travel demand modeling and land use transport modeling has been done with the collected data. Then alternate possible development strategies has been studied, evaluated and suitable development strategy is selected. The travel demand forecast has been done for the horizon year (2021) with the selected strategy and network proposals are prepared based on the forecast.

5.2.1 Regional Road Network System

The Regional Road Network System for Thiruvananthapuram District consists of Coastal Axial, Radial Roads, Midland Orbital and Highland Distributor. These corridors are shown in Fig 5.1.
Fig 5.1 Proposed Regional Road Network System
5.2.1.1 Coastal Axial
The existing NH 47 within the District is proposed as the Coastal Axial. The approximate length is 48 km.

5.2.1.2 Radial Roads
The radial roads connect TRIDA area with Kottarakkara/Shencottah at North and Nedumangad with Shorlacode at South-East. The following are the radial Roads:

- State Highway from TRIDA boundary at Arivyod to district boundary at North via Vattapara-Vembayam-Venjaramood-Vamanapuram and Kilimanoor (28 km).
- State Highway from TRIDA boundary at Edasseri to district boundary at North via Karakulam-Nedumangad-Parandode-Palod (30 km).
- State Highway from Nedumangad to Arathukuzhi at South-East, via Aryanad-Kallikadu-Mayilur (34 km).

5.2.1.3 Midland Orbital
The midland orbital is a regional bypass to NH 47 connecting major settlements of Attingal, Venjaramoodu, Nedumangad, Poovachal, Neyyatinkara and Poovar. The following are the major sections of Midland orbital:

- Attingal on NH 47 to Venjaramoodu on SH 1 (10 km)
- Venjaramoodu to Vembayam along SH 1 (7 km), (included in radial roads also)
- Vembayam to Nadumangad on Shencottah Road (9 km)
- Nedumanghadu to Aryanadu along Nedumangad – Shorlacode Road (14 km), (included in radial roads also)
- Aryanadu to Neyyatinkara on NH 47 via Poovachal-Kattakada-Aruvukara-Balaramapuram (22 km)
- Neyyatinkara to Poovar

The total length of corridors for midland orbital is about 72 km.

5.2.1.4 Highland Distributor
The highland distributor is proposed to connect important radial roads while simultaneously linking major settlements within the district. It traverses through the highland area. The major sections of the highland distributor include:

- Kallambalam on NH 47 at North to Kilimanoor on SH 1 (12 km)
- Kilimanoor to Palode on Shencottah road (18 km)
- Palode to Aryanad on Shorlacode road (18 km)
- Aryanadu to Arathakuzhi on Shorlacode road (18 km), (included in radial roads also)
- Arathakuzhi to Parassala on Nagarcoil road (16 km)
- Parassala to Poovar till sea coast (12 km)
The total length of the highland distributor is about 94 km.

5.2.2 TRIDA Road Network System

The TRIDA road network system consists of arterial radial roads, CBD tangential, inner ring road, outer ring road and Thiruvananthapuram Integrated Mass Transport System. These corridors are shown Fig 5.2.

Fig 5.2 TRIDA Road Network System
5.2.2.1 Arterial Radial Roads

The arterial radial roads include the following corridors:
- NH 47 from TRIDA boundary to Kesavadasapuram, via Kazhakuttam, Sreekariyam, Pongumoodu and Ulloor (12.8 km)
- PMG to Palayam on NH 47 (0.4 km).
- Palayam to Manacaud via Secretariat, East Fort and Attakulangara (1.9 km).
- Mananthala to TRIDA boundary on MC Road (3.1 km)
- Ambalamukku to TRIDA boundary via Peroorkada on Shencottah Road (1.2 km)
- Karamana to TRIDA boundary at Peyad via Kundamankadavu (5.3 km)
- Pappanamcode to TRIDA boundary on NH 47 via Nemom, Pravachambalam and Mudavoorpara (9.3 km)

The total radial road length for improvement is about 34 km.

5.2.2.2 CBD Tangential

The CBD Tangential is proposed to skirt the CBD at its periphery thus providing a high speed facility for through traffic not destined within the central area. The sections of the CBD Tangential are:
- Sanghumughom near Engineering Workshop to Pattoor after crossing NH bypasss (2.1 km)
- Pattoor to Palayam (1.4 km)
- Palayam to Poojapura via Bakery, Vazhuthacaud and Jagathy (2.4 km)
- Poojapura to Karamana (1.2 km)
- Karamana to Kaladi (1.8 km)
- Kaladi to Manacaud via Chiramukku and Kuriyathy (2.3 km)
- Manacaud to Valiyathura after crossing NH bypass (2.6 km)

The total length of the CBD tangential is about 13.8 km.

5.2.2.3 Inner Ring Road

The sections of the inner ring road are:
- Akkulam Kayal to Ulloor (3.8 km)
- Ulloor to Kesavadasapuram (0.9 km)
- Kesavadasapuram to Paruthipara (0.75 km)
- Paruthipara to Jagathi via Ambalamukku, Pippinmoodu and Edapazhanji (6.5 km)
- Jagathi to Poojapura (1.05 km)
- Poojapura to Karamana (1.20 km), (included in CBD Tangential also)
- Karamana to Kaimanam (1.20 km)
- Kaimanam to Maruthakadavu (1.05 km)
- Maruthakadavu to Thiruvallam near Edayar Island.

The total length of the inner ring road is about 20.55 km.
5.2.2.4 Outer Ring Road
The outer ring road is proposed to run along the outer periphery of the TRIDA area. The sections of the outer ring road are:

- Kariavattom on NH 47 to MV High School (1.50 km)
- M V High School to Chengottukonam Junction (1.40 km)
- New link from Chengottukonam Junction to Poudikonam (2.45 km)
- Poudikonam to Mananthala on M C Road (3.1 km)
- Mananthala to Peroorkada on Shencottah road via Mukkola and Kudappanakunnu (4.85 km)
- Peroorkada on Shencottah road to Kundamankadavu (5.45 km)
- Kundamankadavu to Poozhankunnu (5.5 km)
- New link from Poozhankunnu to Pravachambalam (3.1 km)
- Pravachambalam to Vizhinjam junction via Pallichal, Peringamala and Venganoor (7.3 km)

The total length of the outer ring road is about 34.65 km.

5.2.2.5 Thiruvananthapuram Integrated Mass Transport System (TIMTS)
An Integrated Mass Transport System is proposed for the Thiruvananthapuram City extending over a length of 52.15 km.

- Ulloor to Karamana via East Fort (7.3 km)
- Ulloor to Kazhakuttam (6.72 km)
- Karamana to Balaramapuram with link from East Fort to Airport (12.18 km)
- Pattom to TRIDA boundary on Shencottah Road (3.25 km)
- Kesavadasapuram to TRIDA boundary on MC road (7.5 km)
- Karamana to Peyad (7.3 km)
- Manacaud to Vizhinjam (7.9 km)

These corridors have become part of the TIMTS master plan for Thiruvananthapuram. The total length of the TIMTS is 52.15 km. Details about TIMTS are furnished separately in Chapter 6 of this report.

5.3 TCRD Road Network Proposal
As part of the Trivandrum Capital Region Development (TCRD) Programme, the Government of Kerala constituted a Ministerial level sub-committee to identify actions required for development of Thiruvananthapuram. A senior Government level committee headed by the Additional Chief Secretary and Principal Secretary (public works) as chairman and the secretary to Government L S G (Urban Development) Department as secretary identified the priority projects to be considered for implementation. This project was undertaken under the Kerala Road Fund Board (constituted in 2001) wing of PWD. A Road Network System
has been developed for this TCRD by Dr. N. S. Srinivasan. The CTTS study and the road network proposals have become the basis for the TCRD road network development. The proposed Road Network consists of an inner ring road, two intermediate ring roads, an outer ring road and other arterial roads. Road corridors are selected from this road network on priority basis for improvement under the TCRD programme. The entire network proposal is shown in Fig 5.3.

5.3.1 Inner Ring Road

The inner ring road of the TCRD network is given below:

5.3.2 Intermediate Ring Road 1

The first intermediate ring road of the TCRD network is given below:

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8 Advisor, Government of Kerala

5.3.3 Intermediate Ring Road 2

The second intermediate ring road of the TCRD network is given below:

5.3.4 Outer Ring Road

The outer ring road of the TCRD network is given below:

5.3.5 Other Arterial Roads

The following arterial roads are also part of the TCRD network. They improve the connectivity between the ring roads ensure smooth and efficient traffic movement among the rings of the network.
1. Vellayambalam – Kowdiar
2. Vellayambalam – Sasthamangalam
3. LMS – Attakulangara (MG Road)
4. Museum – Bakery Jn
5. LMS to Nandavanam Police Camp
6. Pattoor – Pallimukku
7. Pettah – Chacka - Airport
8. Uppidamoodu – Sreekanteswaram
9. Nalumukku – Uppidamoodu
10. Thakaramparambu to NH Bypass (Arat Road)
11. Enjakal to Sreekanteshwaram
12. Vanross - Oottukuzhy – Secretariat
13. Pattom – Marappalam – Kowdiar
14. GG Hospital Jn –Medical College – Ulloor
15. Kowdiar – Amabalamukku
16. Peroorkada – Vazhayila
17. Thampanoor to Choorakkatupalayam (flyover portion)
18. Bakery Jn to Vazhuthakadu
20. Vazhuthakadu – Jagathy – Poojappura  
22. Karamana to Kaimanam  
23. Attakulangara – Manacaud – Thiruvallam  
24. Manacaud - NH bypass – Airport  
25. Pettah – Kadakampalli - KIMS Hospital  
26. Pallimukku to Kannamool  
27. Kannamool to Kamarapuram  
28. Kamarapuram to Medical College  
29. Medical College – Chalakkuzhi Road  
30. Kesavadasapuram to Pattom  
31. Pattom to PMG Jn  
32. Hanuman Temple Jn to Palayam  
33. LMS – Nanthancode – (vellayambalam-kowdiar rd)  
34. Peroorkada – Pipinmoodu  
35. Sasthamangalam – Maruthumkuzhi – Vattiyoorkavu  
36. Maruthumkuzhi to Palace Jn

5.4 PPTA Road Network Proposal

The PPTA studies duly considered the TCRD network for the scheme selection and proposed the TCRD network as the Conceptual Road Network Plan (CRNP) of Thiruvananthapuram after due discussions with the Municipal Corporation, Development Authority, Town Planning Department, Public Works Department and the Transportation Advisor to Government of Kerala (Prof. Dr. N.S Srinivasan). The CRNP also takes into consideration the existing network, directions of likely development, Master Plan/Traffic Study proposals, stakeholder’s suggestions, etc.

The CRNP consists of ring roads, radial roads, mid orbital road and link roads. The CRNP proposed by PPTA studies is attached in Fig 5.4.
5.4.1 Similarities in Various Proposals/Studies

The CTTS network is the background for the preparation of TCRD network. The section of CBD tangential of CTTS from Pattoor junction to Bakery is considered as part of inner ring road of TCRD network. The sections of the inner ring road of CTTS from Akkalam kaiyal to Peroorkada and Pipinmoodu to Jagathy forms a part of the outer ring road and second intermediate ring road of TCRD network respectively. The inner ring road, intermediate ring roads and outer ring road of the PPTA network is the same as that of TCRD network. This make certain that the logic of development of TCRD network based on CTTS proposals is accepted and established.

5.5 CMP Road Network Proposal

5.5.1 General

The extent of the Conceptual Road Network Plan (CRNP) is limited to the Municipal Corporation (MC) Area. But the City has to grow towards the Northern, Eastern and Southern sides in future. This expected and obligatory growth of the City should be induced now with sufficient road facilities. So the road network proposed for the MC area has to be extended beyond the outer ring road of the CRNP. These aspects are attended in the City Development Plan (CDP)\(^9\) for Thiruvananthapuram and the CDP proposes an outer ring road, an intermediate ring road, an inner ring road, and 21 other link roads. The outer ring road and a part of the intermediate ring road of the CDP proposals are beyond the outer ring road of CRNP (PPTA), but within the mid orbital road (CTTS) (ref Fig 5.5). Five link roads out of 21 of the CDP proposal are out side the Municipal Corporation (MC) area and the rest are inside. Therefore, the additional features of CDP proposals, ie beyond MC area, have to be integrated with the CRNP (PPTA) and vice versa, TCRD network and CTTS proposals to harmonise all the proposals. It is imperative to revisit the Conceptual Road Network Plan (CRNP), which remains

\(^9\) Chapter 9, section 9.3 of CDP for Thiruvananthapuram

Comprehensive Mobility Plan, Thiruvananthapuram
the basic road network for the Comprehensive Mobility Plan (CMP) for Thiruvananthapuram. The conceptual networks, overlapped, is presented in the figures below.

Fig 5.5 Conceptual Road Network Proposals
5.5.2 CMP Road Network Development

The revised CRNP for JNNURM is a hierarchical and systematic road network developed with regard to land use, population, motor-vehicle ownership, and economic growth. The revised CRNP is an integration of TCRD network and PPTA network and complies with the CTTS studies and proposals. This network will ensure integrated and energy efficient transportation pattern in the City. The road development proposals in future will be in compliance with the revised CRNP.

The components of the CRNP for JNNURM are:
1. Inner Ring Road
2. First Intermediate Ring Road
3. Second Intermediate Ring Road
4. Third Intermediate Ring Road
5. Fourth Intermediate Ring Road
6. Outer Ring Road
7. Major Radial Roads
8. Link Roads

5.5.2.1 Inner Ring Road
The inner ring road encircles the CBD of the City with the MG road from Palayam to East Fort as axis. This road will ensure smooth flow of traffic around CBD and bypass that traffic which does not have any business within the CBD. The alignment of the inner ring road is kept same as that proposed by the TCRD network.

The route of the inner ring road is given below:

5.5.2.2 First Intermediate Ring Road
The alignment of the first intermediate ring road is kept same as that proposed by the TCRD network.

The route of the First Intermediate Ring Road is given below:

5.5.2.3 Second Intermediate Ring Road
The alignment of the second intermediate ring road also is kept same as that proposed by the TCRD network.

The route of the Second Intermediate Ring Road is given below:

5.5.2.4 Third Intermediate Ring Road
As the JNNURM network considers an extended area than that considered by previous networks, the outer ring road of the TCRD network is treated as the third intermediate ring road of CRNP.

The route of the Third Intermediate Ring Road is given below:

5.5.2.5 Fourth Intermediate Ring Road
The Fourth Intermediate Ring Road is proposed to the North of the third intermediate ring road. It will provide bypass access to traffic from the Northern arm of NH 47 to Eastern zones like Peroorkada, Thirumala etc., without traversing the City. This road starts at NH bypass near Kulathoor and traverses through Kulathoor, Engineering College, Sreekaryam, Powdikonam, Mannanthala and Kudappanakunnu and joins the third intermediate ring road at Peroorkada.

The North – Eastern portion of this ring road from NH bypass to Peroorkada is selected from the intermediate ring road of CDP proposals.

5.5.2.6 Outer Ring Road
The outer ring road envisages the development of the North - Eastern portions of the City. This road can also act as an Eastern bypass of the City, thus enhancing the connectivity between North-East and South-East zones of Thiruvananthapuram. The alignment of the outer ring road is beyond the TRIDA
area for its Northern half and within the TRIDA area for the remaining stretches. Except at the initial stretches from Mangalapuram to Pothencode, the alignment of this road is taken along new formations.

The route of the Outer Ring Road is given below:

5.5.2.7 Major Radial Roads
The major radial roads connect the major traffic generating zones to the CBD or any ring road. The following are the major radial roads of the CRNP.
- NH 47 from City Centre to Southern side (Kollam)
- NH 47 from City Centre to Northern side (Parasala)
- NH 47 bypass
- SH 1 from Kesavadasapuram to Kilimanoor
- SH from Peroorkada to Nedumangadu
- Road Corridor from Vellayambalam to Nettayam
- Road Corridor from Karamana to Kattakkada through Poojappura and Malayinkeezhu.
- Road Corridor from Thiruvallam to Vizhinjam

5.5.2.8 Link Roads
1. Vellayambalam – Kowdiar
2. Overbridge – Attakulangara (MG Road)
3. Museum – Bakery Jn
4. LMS to Nandavanam Police Camp
5. Pattoor – Pallimukku
6. Pallimukku – Chacka - Airport
7. Uppidamoodu – Sreekanteswaram
8. Nalumukku – Uppidamoodu
9. Thakaramparambu to NH Bypass (Arat Road)
10. West Fort Gate to Sreekanteshwaram
11. Vanross - Oottukuzhy – Secretariat
12. GG Hospital Jn –Medical College – Ulloor
13. Kowdiar – Amabalamukku
14. Bakery Jn to Vazhuthakadu
15. Vazhuthakadu – Edapazhanji – Pangode – Pallimukku
16. Vazhuthakadu – Jagathy – Poojappura
17. Attakulangara – Manacaud – Thiruvallam
18. Manacaud - NH bypass – Airport
19. Pettah – Kadakkampalli - KIMS Hospital
20. Kannamoola to Kumarapuram
21. Kumarapuram to Medical College
22. Medical College – Chalakkuzhi Road
23. Hanuman Temple Jn to Palayam
24. LMS – Nanthancode – (vellayambalam-kowdiar rd)
25. Peroorkada – Pipinmoodu
26. Kariavattom-Thrippadapuram-Arasummoodu-Kuzhiliva-NH bypass
27. Poojapura-Mudavanmugal-Kunnapuzha
28. Panavila Jn-Oottukuzhy Road
29. Oottukuzhy-KSHB Jn-SS Kovil
30. Model School Jn-Govt. Press-SMSM Jn
31. Karamana-Thaliyal-Kalady Road
32. Maruthankuzhy-Vattiyoorkavu-Nettayam-Vazhayila-Kudappanakunnu Road
33. Manacaud-Attukal-KAlady-Maruthoorkadavu

The final Conceptual Road Network Plan for Thiruvananthapuram is furnished in Fig 5.7. The approximate lengths and costs of the road corridors in the above network are furnished in Table 7.4 of Chapter 7.

The new transportation facility proposed for Trivandrum City and 10 Panchayats for the horizon year 2021 is detailed in the next chapter.

5.6 Proposals of other departments on anvil

- **Trivandrum Municipal Corporation has formulated City Development Plan with broad views to develop in various sectors which include proposals that ease the mobility of traffic in the city. This is annexed in Annexure B and the costing is indicated in Annexure C.**

- **Trivandrum Town Planning department has also mooted the proposal to encourage use of non-polluting mode of mass transportation for passenger movement. The project for cleaner mobility in Urban area for Trivandrum City Region envisages sub-projects like walkways, mainstreet ancillary alleys, walking walkway connecting main areas like Chalai market, Central Railway Station, Central Bus Stand, Mass Transport Promotion, Connectivity from Kochuveli to NH Bypass, introduction of new buses to terminals to facilitate connectivity etc. The details on proposals are annexed as Annexure D.**

- **In order to improve upon the conditions prevailing and to bring energy efficient system, and pollution free environment, KSRTC has planned to introduce LNG fuel (in place of the earlier considered, CNG) for their transport system which is elaborated in Annexure E.**

- Certain proposals emerged from various eminent citizens, councilors and as outcome of deliberations, discussions and workshops etc are listed below
  - Pedestrian Crossing Provision at St.Mary’s School Junction, Pattam GHS Junction and Kendriya Vidyalayam Junction, Pattom.
  - Road from GPO to Uppilamoodu Bridge (Ambujavilasam road) has been proposed to be added to the network improvement proposals.
  - Multi level parking near GH Junction and parking in the area below the flyover near Chandreasekaran Nair Stadium and Central Stadium (Back side of Secretariate) to be considered.
Fig 5.7 Conceptual Road Network (CMP) for Thiruvananthapuram
Chapter 6
THIRUVANANTHAPURAM INTEGRATED MASS TRANSPORT SYSTEM (TIMTS)

6.1 General

Integrated Mass Transport Systems (IMTS) are inevitable in view of the ever growing vehicle population, pollution, congestion and lack of road safety. The Comprehensive Traffic and Transportation Study (CTTS) for Thiruvananthapuram brought out a comprehensive proposal for IMTS for the City after detailed studies. It conducted travel demand modeling to plan and structure an Integrated Mass Transport System to meet the travel demand for Thiruvananthapuram till 2021. The TIMTS has been designed for the peak hour traffic demands considering home based and non home bases trips, as detailed below.

6.2 Travel Demand and Land Use Transport Modeling

Integration of transport planning and land use is essential for Thiruvananthapuram City to minimize the travel distances and to improve the access to livelihoods, education and other social needs. The travel demand modeling has been done for the base year by using the conventional four stage Urban Transport Planning System (UTPS) and the travel behaviour of the residents of the City are captured for the base year. The horizon year travel demand is assessed by using ‘Garin Lowry’ Land Use Transport Model.

6.3 Integrated Land Use - Transportation Plan

An integrated land use - transportation plan is conceptualized by considering planning forecast and alternate development strategies. The alternate developing strategies consist of Regional Development Strategies and TRIDA development strategies. In TRIDA development strategy, several combinations of population distribution, employment distribution and network development were considered and evaluated. The resultant scenario selected for future travel demand modeling exercises consists of, population and employment distributions assuming a natural growth and network development consists of developing ring and radial road network pattern along with mass transportation facilities in high intensity passenger traffic corridors.

6.4 Development of Thiruvananthapuram Integrated Mass Transport System (TIMTS)

6.4.1 Selection of Corridors
The base year travel demand modeling studies have identified seven high passenger density corridors in the ring and radial road network of Thiruvananthapuram having the potential for development of an Integrated Mass Transportation System. These corridors are listed in Table 6.1.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name of the Corridor</th>
<th>Proposed Route</th>
<th>Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Green Corridor</td>
<td>Ulloor to Karamana via East Fort</td>
<td>7.30</td>
</tr>
<tr>
<td>2</td>
<td>Brown Corridor</td>
<td>Ulloor to Kazhakuttam</td>
<td>6.72</td>
</tr>
<tr>
<td>3</td>
<td>Orange Corridor</td>
<td>Karamana to Balaramapuram with link from East Fort to Airport</td>
<td>12.18</td>
</tr>
<tr>
<td>4</td>
<td>Blue Corridor</td>
<td>Pattom to TRIDA boundary on Shencottah Road</td>
<td>3.25</td>
</tr>
<tr>
<td>5</td>
<td>Yellow Corridor</td>
<td>Kesavadasapuram to TRIDA boundary on MC road</td>
<td>7.50</td>
</tr>
<tr>
<td>6</td>
<td>Red Corridor</td>
<td>Karamana to Peyad</td>
<td>7.30</td>
</tr>
<tr>
<td>7</td>
<td>Indigo Corridor</td>
<td>Manacaud to Vizhinjam</td>
<td>7.90</td>
</tr>
</tbody>
</table>

(Source: CTTS, March 2003)

The map showing the above corridors are given in Fig 6.1. These corridors will become part of the TIMTS master plan for Thiruvananthapuram.
Travel demand forecast is done for the horizon year (2021) based on the scenario selected in the Integrated Land use – Transportation Plan. The trip assignment for public transport trips in the Conceptual Road Network of Thiruvananthapuram is given in Fig 6.2.

From the public transport assignment it was observed that of the total TIMTS network as mentioned in Table 1, three corridors namely Green, Brown and Orange have Peak Hour Peak Direction Trips (PHPDT) in excess of 10000, thus justifying the need for a high capacity mass transport system (road or rail based). The road based public transport system, in the form of existing standard bus system, was found sufficient enough to cater to the peak hour peak direction travel demand along the Blue, Yellow, Red and Indigo corridors.

6.4.2 Selection of Technology and Phasing of TIMTS

The technology selection is based on a number of criteria comprising capacity, cost, LoS, impact, feasibility etc. Matching capacity to demand is an important criterion for selection of appropriate technology for IMTS. But from Fig 1, it is clear that there is a wide range of travel intensity along the TIMTS corridors. So it is extremely difficult for one technology to offer services at high LoC and still be viable. To tackle with this dilemma, CTTS proposes a combined multi modal system with phased introduction of high capacity technology along high demand corridors and re-deployment of displaced technology on other corridors.
The choice of technology for TIMTS is given below.

1. Conventional Standard Bus with modernization like CNG fuel, power steering etc.
2. High Capacity Bus with features like high capacity (165 passengers, against 65 in standard bus), high speed, non-polluting fuel (CNG/electricity), modernized engine technology (power steering), GPS based control and communication system etc.
3. Light Rail Transit (LRT)

The phasing of TIMTS (for option 1 and option 2) is furnished below in Table 6.2.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Corridor</td>
<td>Standard buses to be operated. Construction of elevated corridor to be taken up.</td>
<td>HCBS to be operated on elevated corridor. Standard buses withdrawn and redeployed in other routes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown and Orange Corridors</td>
<td>Standard buses to be operated</td>
<td>Standard buses to be operated. Construction of surface level corridor for HCBS to be taken up.</td>
<td>HCBS to be operated on surface level dedicated bus way.</td>
<td></td>
</tr>
<tr>
<td>Blue, Yellow, Red and Indigo Corridor</td>
<td>Standard buses to be operated</td>
<td>Standard buses to be operated. Construction of surface level corridor for HCBS to be taken up.</td>
<td>HCBS to be operated on surface level bus lanes</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Chapter 9, CTTS 2003)
The option I requires an investment of 3928 millions and option II 14346 millions. So option I with HCBS only system has been recommended for Thiruvananthapuram urban area by CTTS to cater to the passenger demand till 2021. The phasing of this project has to be done as per Table 1.
Chapter 7
PHASING AND COSTING

7.1 General

A proposed road network system coupled with TIMTS will cater to the mobility needs of people of Thiruvananthapuram till 2021. The phasing for implementation and approximate costs are furnished in the following sections.

7.2 Phasing and costing of TIMTS

The selected option of TIMTS in phases is given in Table 7.1.

<table>
<thead>
<tr>
<th>Table 7.1: Phasing of TIMTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corridor Name</strong></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Green Corridor</td>
</tr>
<tr>
<td>Brown and Orange Corridors</td>
</tr>
<tr>
<td>Blue, Yellow, Red and Indigo Corridor</td>
</tr>
</tbody>
</table>

(Source: Chapter 9, CTTS 2003)

The costing of TIMTS in phases is furnished in Table 7.2.
Table 7.2 Phase-wise Coasting of TIMTS
The summary of the costs are furnished in Table 7.3.

### Table 7.3: Cost Summary of TIMTS (in crores)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>148.16</td>
<td>106.19</td>
<td>88.48</td>
<td>50.0</td>
</tr>
</tbody>
</table>

(Source: Chapter 10, CTTS 2003)

7.3 Phasing and Costing of Proposed Road Network

The costing of the proposed JNURM network (as detailed in Chapter 5) is furnished in the Table given below. These roads are to be taken up for improvement in the period 2008-2012.

### Table 7.4 Phasing and Costing of Roads

<table>
<thead>
<tr>
<th>Name of Road</th>
<th>Length (km)</th>
<th>No of Lanes (exp.)</th>
<th>Per km Cost</th>
<th>Total Cost (Crores)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inner Ring Road</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Palayam – Bakery – Panavila – Thampanoor – Overbridge</td>
<td>3.9</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overbridge – Mathrubhoomi Jn</td>
<td>0.75</td>
<td>4</td>
<td>3</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>Mathrubhoomi Jn – Vanchiyoor – Pattoor Junction</td>
<td>1.5</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First Intermediate Ring Road</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kannamoola – Thukkumoodu – Law College Jn</td>
<td>4.0</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Law College Jn – PMG</td>
<td>0.5</td>
<td>Included in ADB Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMG – LMS – Museum Jn</td>
<td>1.5</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vellayambalam – Vellayambalam – Vazhuthakadu – Thycaud – Choorakatupalayam</td>
<td>2.0</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Choorakatupalayam – Thakaraparambu</td>
<td>3.0</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sreekanteshwaram Park</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sreekanteshwaram Park – Pettah – Pallimukku</td>
<td>1.5</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pallimukku – Kannamoola</td>
<td>1.0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Second Intermediate Ring Road</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venpalavattom (NH bypass) – KIMS Hospital – Kumarapuram – GG Hospital Junction</td>
<td>3.7</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GG Hospital Junction – Pottakuzhy – Pattom</td>
<td>0.5</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pattom – Kuravankonam – Kowdiar</td>
<td>2.3</td>
<td>Included in TCRD Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kowdiar – Pipinmoodu</td>
<td>2.0</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Name of Road</td>
<td>Length (km)</td>
<td>No of Lanes (exp.)</td>
<td>Per km Cost</td>
<td>Total Cost (Crores)</td>
<td>Remarks</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------------</td>
<td>-------------</td>
<td>--------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Pipinmoodu – Sasthamangalam – Edapazhanji – Jagathi – Killipalam Killipalam – Attakulangara</td>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in ADB Project</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>4</td>
<td>0.5</td>
<td>1.5</td>
<td>Improvement and road safety only required.</td>
</tr>
<tr>
<td>Attakulangara – Sreevaraham – NH bypass</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td><strong>Third Intermediate Ring Road</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH bypass – Akkulam Kayal – Ulloor</td>
<td>5.0</td>
<td>2</td>
<td>3</td>
<td>15</td>
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</tr>
<tr>
<td>Ulloor – Kesavadasapuram</td>
<td>1.0</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>Included in ADB Project</td>
</tr>
<tr>
<td>Paruthippa – Ambalamukku</td>
<td>2.0</td>
<td></td>
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</tr>
<tr>
<td>Ambalamukku – Peroorkada</td>
<td>1.0</td>
<td></td>
<td></td>
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<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Peroorkada – Mannamoola</td>
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<td><strong>Fourth Intermediate Ring Road</strong></td>
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<td><strong>Outer Ring Road</strong></td>
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<td><strong>Major Radial Roads</strong></td>
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<tr>
<td>City Centre to Mangalapuram (NH 47)</td>
<td>25.0</td>
<td>4</td>
<td>5</td>
<td>125</td>
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</tr>
<tr>
<td>City Centre to Pravachambalam (NH 47)</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>NH 47 bypass to Kanyakulangara</td>
<td>28.0</td>
<td>4</td>
<td>5</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Peroorkada to Karakulam</td>
<td>6.0</td>
<td>4</td>
<td>5</td>
<td>30</td>
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</tr>
<tr>
<td>Vellayambalam to Nettayam</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Karamana to Peyad</td>
<td>8.0</td>
<td>3</td>
<td>4</td>
<td>32</td>
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</tr>
<tr>
<td>Thiruvallam to Vizhinjam</td>
<td>8.0</td>
<td>4</td>
<td>5</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td><strong>Link Roads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vellayambalam – Kowdiar</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Overbridge – Attakulangara (MG Road)</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Museum – Bakery Jn</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>LMS to Nandavanam Police Camp</td>
<td>0.3</td>
<td>4</td>
<td>3</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Pattoor – Pallimukku</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Pallimukku – Chacka - Airport</td>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Uppidamoodu – Sreekanteswaram</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Nalumukku – Uppidamoodu</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Thakaramparambu to NH Bypass (Arat Road)</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Name of Road</td>
<td>Length (km)</td>
<td>No of Lanes (exp.)</td>
<td>Per km Cost</td>
<td>Total Cost (Crores)</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------------------</td>
<td>-------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>West Fort Gate to Sreekanteshwaram</td>
<td>1.0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Vanross - Oottukuzhy – Secretariat</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>GG Hospital Jn – Medical College – Ulloor</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Kowdian – Amabalamukku</td>
<td>1.0</td>
<td>3</td>
<td></td>
<td></td>
<td>Included in TCRD Project</td>
</tr>
<tr>
<td>Bakery Jn to Vazhuthakadu</td>
<td>0.4</td>
<td>3</td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Vazhuthakadu – Edapazhanji – Pangode – Pallimukku</td>
<td>4.5</td>
<td>3</td>
<td>4</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Vazhuthakadu – Jagathy – Poojappura</td>
<td>3.5</td>
<td>4</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Attakulangara – Manacaud – Thiruvallam</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manacaud - NH bypass – Airport</td>
<td>6.0</td>
<td>2</td>
<td>3</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Pettah – Kadakampalli - KIMS Hospital</td>
<td>3.5</td>
<td>2</td>
<td>3</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>RoB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.0</td>
</tr>
<tr>
<td>Kannamoola to Kumarapuram</td>
<td>1.0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Kumarapuram to Medical College</td>
<td>1.0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Medical College – Chalakkuzhi Road</td>
<td>1.0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Hanuman Temple Jn to Palayam</td>
<td>0.4</td>
<td>3</td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>LMS – Nanthancode – (vellayambalam-kowdian rd)</td>
<td>2.5</td>
<td>2</td>
<td>3</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>Peroorkada – Pipinmoord</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td>Included in ADB Project</td>
</tr>
<tr>
<td>Kariavattom-Thrippadapuram-Arasummoodu-Kuzhivila-NH bypass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poojapura-Mudavanmugal-Kunnapuzha</td>
<td>5.0</td>
<td>3</td>
<td>3.5</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Panavila Jn-Oottukuzhy Road</td>
<td>0.50</td>
<td>2</td>
<td>3</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Oottukuzhy-KSHB Jn-SS Kovil</td>
<td>1.00</td>
<td>3</td>
<td>3.5</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Model School Jn-Govt. Press-SMSSM Jn</td>
<td>0.50</td>
<td>3</td>
<td>3.5</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>Karamana-Thaliyal-Kalady Road</td>
<td>4.00</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Maruthankuzhy-Vattiyoorkavu-Nettayam-Vazhayila-Kudappanakunnu Road</td>
<td>4.5</td>
<td>2</td>
<td>3</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>Manacaud-Attukal-Kalady-Maruthookkadavu</td>
<td>3.50</td>
<td>3</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Total excluding TCRD and ADB projects</td>
<td>265.0</td>
<td></td>
<td></td>
<td>1071.8</td>
<td></td>
</tr>
</tbody>
</table>

These road projects have to be taken up in the period 2008-2012.

7.3.1 Land Acquisition for Project Corridors

Land Acquisition is a major hurdle in the implementation of these schemes. As far as the areas proposed to be covered by JNNURM scheme, the value of land varies considerably in the City area and outside. The actual land to be acquired for the implementation of the scheme can be assessed only after conducting the field topo surveys and on-spot verification of built up areas. However, as per an
overall assessment, based on the preliminary reconnaissance study, reveals the following.

Total Length of road=265km

Approximate width of land to be acquired=3.0m (say 1.5m on both sides)

Total Acquirable Area=8.0 lakh sq.m.

Assuming 60% of this area is built up area, 25% open area and 15% government land.

Built up Area=4.80 lakh sq.m

Open Area=2.0 lakh sq.m

Govt. Land=1.2 lakh sq.m

As per present trend, the rate of built up area is between 5000/sq.m to 8000/sq.m depending on the nature of construction and internal finishing of the building. Land value also varies from 50,000/cent to 5,00,000/cent depending on location of land. The actual amount required for land acquisition can be assessed only after field surveys.

While initiating the Land Acquisition process based on actual requirements, lot of resistances can be expected from the residents of the respective locality. They may even approach the Court of Law, which will delay the implementation of the project considerably. This practical difficulty is actually experienced while proceeding with the process of acquisition of land for the TCRD project. To overcome such difficulties and also for speedy implementation of the Land Acquisition process, a system was introduced by the Government of Kerala to deal with the Land Acquisition complaints. The process followed is explained in Annexure A.

7.4 Project Roads Identified for Improvement under JNNURM scheme

About 180 kms of road stretches in and around Thiruvananthapuram has been identified for improvement under JNNURM scheme on priority basis. The identification is done based on the proposals detailed in CDP Thiruvananthapuram. The above road stretches (180 km) have been categorized into four phases for the preparation of DPR. The phases are as detailed below.

(i) Phase –I Projects (that Strengthen Linkages with Regional Roads)

The following road corridors (5 nos) are considered for improvement as these corridors improves the connectivity of the conceptual road network to the regional roads. These corridors are about 26 km in length. The length and lane configuration of these corridors are as per the CDP report.

<table>
<thead>
<tr>
<th>Table 7.5: Projects that strengthen linkages with regional roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Kesavadasapuram-Ulloor-Kochuluor-Sreekaram</td>
</tr>
<tr>
<td>ii. Ulloor – Akkulam – NH Bypass road</td>
</tr>
<tr>
<td>iii. Karivattom – Thrippadapuram - Arasummooldu – Kuzhirivila – NH Bypass</td>
</tr>
<tr>
<td>iv. Manacaud – NH Bypass road</td>
</tr>
<tr>
<td>vi. Mannanthala – Vattapara S.H. 1</td>
</tr>
</tbody>
</table>

Total 26 km
(ii) Phase-II Projects (Inner and Intermediate Ring Road)

The proposed inner ring road connects Killipalam – Melarannur – Jagathy – Edappazhanji – Sasthamangalam – Pipinmoodu and Kowdiar, thus completing the inner ring with Kowdiar – Killipalam link presently undertaken under City road improvement works. The approximate length of the corridor measured from the map is about 9 km.

Intermediate ring road is the eastern outer ring road for the city opening out areas for development with partial investment recovery mechanism by land development and disposal & levy of development charges for non-acquired land abutting this development corridor. It connects NH Byapass – Kulatur – Engineering College – Sreekariam – Poudikonam – Mannanthala – Kudappanakunnu – Peroorkada – Vattiyoorkavu – Thirumala – Thrikkannapuram – Kaimanom– Maruthhoorkadavu – Thiruvallam NH Bypass. The approximate length of the corridor measured from the map is about 30 km.

(iii) Phase-III Projects (forming Major Links in the City Road Network)

The following road corridors (16 nos) selected for improvement will improve the connectivity between the conceptual rings in the network. These corridors are about 26 km in length. The length and lane configuration of these corridors are as per the CDP report.

<table>
<thead>
<tr>
<th>Table 7.6: Projects forming major links in the city road network</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Pettah – Kannammoola – Kumarapuram</td>
</tr>
<tr>
<td>ii. Kumarapuram – Medical College Jn.</td>
</tr>
<tr>
<td>iii. R.B.I. Jn. - Vazhuthacaud - Jagathy- Poojapura - Thirumala - Thachottkavu road</td>
</tr>
<tr>
<td>iv. Attakulangara – Thiruvallam road</td>
</tr>
<tr>
<td>v. Thycaud – Choorakkattupalayam – Aryasala road</td>
</tr>
<tr>
<td>vi. Aryasala – Chalai bypass road</td>
</tr>
<tr>
<td>vii. Poojapura – Mudavanmugal – Kunnapuzha</td>
</tr>
<tr>
<td>viii. Panavila Jn. – Oottukuzhy road</td>
</tr>
<tr>
<td>ix. Oottukuzhy – KSHB Jn.- SS Kovil</td>
</tr>
<tr>
<td>x. Model School Jn.- Govt. Press- SMSM Jn</td>
</tr>
<tr>
<td>xi. Karamana – Thaliyal – Kalady road</td>
</tr>
<tr>
<td>xii. Sasthamangalam – Maruthankuzhy road</td>
</tr>
<tr>
<td>xiii. Maruthankuzhy – Valiyavila – Peyad – Malayinkizh</td>
</tr>
<tr>
<td>xiv. Maruthankuzhy – Vattiyurkavu- Nettayam – Vazhayila – Kudappanakunnu road</td>
</tr>
<tr>
<td>xv. Manacaud – Attukal – Kalady – Maruthhoorkadavu</td>
</tr>
<tr>
<td>xvi. Ambalamukku – Muttada – Paruthippara</td>
</tr>
</tbody>
</table>

(v) Phase –IV Projects (Outer Ring Road)
Eastern outer ring road for the city region opens out areas for development activities requiring large extent of land. Serviced land can be provided for such activities. This development corridor can be constructed with full investment recovery mechanism by land development and disposal and levy of development charges as envisaged in the Town Planning Acts for non-acquired land abutting this development corridor. It connects N H 47 from Mangalapuram – Pothencode - Kanyakulangara – Karakulam – Kachani – Vellaikadavu – Peyad – Pallichal- N H Bypass - Vizhinjam crossing N H Bypass. The approximate length of the corridor measured from the map is about 60 km.

The total length of the JNNURM corridors is about 180 km. The summary of phasing of JNNURM corridors are given in Table 7.7.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Name</th>
<th>Length (km)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Projects that strengthen linkages with regional roads</td>
<td>26.0</td>
<td>DPR will be completed by January 2008</td>
</tr>
<tr>
<td>Phase II</td>
<td>Inner and Intermediate ring road</td>
<td>39.0</td>
<td>DPR will be completed by March 2008</td>
</tr>
<tr>
<td>Phase III</td>
<td>Projects forming major links in the City Road network</td>
<td>55.0</td>
<td>DPR will be completed by August 2008</td>
</tr>
<tr>
<td>Phase IV</td>
<td>Outer Ring Road</td>
<td>60.0</td>
<td>DPR will be completed by January 2009</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>180.0</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 8
Conclusions

A Comprehensive Mobility Plan for Thiruvananthapuram City evolved includes various components that increase the mobility of the city. Components generally incorporated in the plan are as follows.

- A network in the form of ring and radial pattern with links is developed from previous studies. This network ensures smooth and efficient traffic flow through the City. This also helps in the growth of city towards Northern, Eastern and Western Sides.

- Reconstruction and new construction of bridges which carry heavy traffic and that require widening.

- Truck terminals to facilitate efficient and economic operation of goods transport. This will give a solution to the demand for truck parking generated due to the wholesale and ware housing activities. Most of the traffic problems due to uncontrolled concentration of goods carriers and transshipment activities can be reduced by this.

- Parking facilities to avoid traffic obstruction, congestion, accidents etc.

- Pedestrian facilities to improve smooth and safe movement of pedestrians.

- Improvement of Public Transport system with introduction of Thiruvananthapuram Integrated Mass Transport System. The public transport system which is now operating in Low level of service will be modified with new buses with high standards and High Capacity buses running in dedicated right of way. This also includes the quality up gradation of KSRTC services, up gradation and construction of new us stand, making good co-ordination between different modes etc.

- Traffic Management and Environmental Management. This mainly involves the construction of proper bus shelter, signalization of various intersections, and introduction of Intelligent Transport System, Training Institute for Road Users etc. Town Planning department has mooted the introduction of non polluting mode of transportation and envisage projects for cleaner mobility in urban area.

- Proposals emerged from various eminent citizens, councilors etc. A proposal of the Draft CMP was presented in front of invited guest from various departments like, Police, NATPAC, Town Planning department, Engineering Colleges. Public Work Departments, Councilors etc. The proposals put by them are include in this.
Land Acquisition Petition Process followed in Trivandrum Project.

In the Thiruvananthapuram City Road Improvement Project, the Government had constituted a High Level Committee with the Chief Secretary as the Chairman and the Chief Engineer KRFB, Dr. N.S. Srinivasan, Advisor, GoK for the Project, Mayor, District Collector, Chief Town Planner, TRIDA Chairman and all the M.L.A’s concerned as members to review the Land acquisition complaints. This committee reviewed all the complaints that were received for the Trivandrum Capital Region Development Project and suitable decisions were taken within a short time. Such a procedure can be followed for KSUDP and JNNURM road projects also for dealing with the petitions.

The procedure followed for dealing with the complaints for Thiruvananthapuram City Road Improvement Project with regard to Land Acquisition is explained below for reference.

Based on the technical requirements, the lane configurations of all the selected roads in Trivandrum City had been finalized, and the final alignment drawings were prepared, which were approved by the client (KRFB). After getting approval to the alignments, the proposed revised alignments were transferred to the respective revenue maps obtained from the village offices, which gave the survey numbers of the affected structures. This was done with the assistance of an expert village officer and Thasildar retired from the revenue department. Corridor-wise lists were prepared showing the extent of properties to be acquired from the respective survey numbers. This area would be approximate since the revenue maps were prepared long ago. The final approved alignment drawings together with the lists were forwarded to TRIDA for initiating land acquisition procedures.

The revenue authorities issued notices to all the owners of the properties, which were proposed to be acquired. The public started approaching the government with complaints and petitions either to reduce the proposed acquisition or to avoid it. Seeing the increasing numbers of petitions, the committee constituted as mentioned above was entrusted to review the petitions and take final decision.

When a complaint was received by the Government, it was forwarded to CES (the consultant), for verification of the petition with respect to the present location and condition of the property.

Accordingly each and every individual complaint was scrutinized in detail and on the spot verification of the proposed acquisition from every complainant’s property was made and the actual proposed extent of acquisitions were assessed. Based on this a detailed report with an enlarged sketch of each affected properties were made and submitted to the Advisor, Govt. of Kerala (Dr. N.S. Srinivasan) for verification and approval. This approved technical reports, were presented in the High Level Committee and the committee took decisions on the recommendations of the Advisor. Based on the decision of the High Level Committee the petitions were either rejected or the alignment was revised by reducing the proposed acquisition from the complainant’s property without affecting the geometry of the road. If the geometry of the road did not permit any
revision in a particular locality, this technical problem was presented in the next Committee and the committee rejected the petition.

If any body approached a court of law with a complaint, then the Honorable Court disposed the petitions with directions to the High Level Committee to hear the grievance of the complainant and to take a suitable decision within a time frame fixed by the court. In such case a personal hearing was given to the complainants by asking them to appear before the Committee.

This procedure was found to be very effective and almost all the petitions were disposed off within 2.5 years.

Typical generic issues in Land Acquisition for road widening as discussed in the next page, gives an overview of the actionable points for carrying ahead the “development” or “upgradation”, desired in the Kerala situation.

Kerala is a thickly populated state with a high density of population. The density of population in the urban areas is so high that the implementation of Resettlement and Rehabilitation process faces many practical difficulties.

The business establishments are the livelihood of thousands of people and hence topmost care should be taken in re-settling these business establishments. If these establishments are proposed to be located away from the central business area, this will adversely affect their day to day business activities and hence there may be resistance from the traders for such resettlement. So the selection of location for the resettlement of such establishments is most important. The project design should be able to select suitable locations and multi storied shopping complexes can be constructed for rehabilitation.

In the Thiruvananthapuram Capital Region Development case this has been successfully implemented at Palayam. The Trivandrum Development Authority has constructed a shopping complex at Palayam and all the business establishments at Palayam have been relocated and the development process is nearing completion without any hindrance.

Regarding the Rehabilitation of residents of a particular locality, care should be taken to see that it will not affect their day to day work. For example, the rehabilitation of fisherman folk from the coastal areas, should not be far away from the sea coast. Similarly labourers, whose livelihood is dependant on the Central Business Area of the city will not agree for a rehabilitation away from these areas, since it will adversely affect their daily earnings. Low cost high density housing at selected locations not far from the locality of their livelihood activities is a suitable solution to this problem, which can be taken up by Kerala State Housing Board, if necessary.

The next important problem will be regarding the compensation fixed by the Government to the land owners. There may be huge variations in the value fixed by the authorities and the existing market value and hence there may arise serious disputes between the authorities and the land owners. This has to be settled suitably. Negotiations, is one applicable method.
Complaints from the land owners about the extent of acquisition from their respective properties have also to be settled. Almost all the affected residents and land owners will submit written complaints to the Government against the acquisition proposed from their properties. Some of the owners may even approach the Court of Law which can delay the implementation of the project considerably, unless dealt suitably as explained earlier.
Annexure-B

**Priority Project Components identified in CDP for JNNURM**

**A. PROJECTS THAT STRENGTHEN LINKAGES WITH REGIONAL ROADS**

i. Kesavadasapuram-Ulloor-Kochulloor-Sreekaram  
   – Chavadimukku road (part of NH 47) 4 km 4 lane road

ii. Ulloor – Akkulam – NH Bypass road 5 km 4 lane road

iii. Kariavattom – Thrippadapuram  
    Arasummoodu – Kuzhivila – NH Bypass 8 km 3 lane road

iv. Manacaud – NH Bypass road 3 km Std.2 lane

vi. Mannanthala – Vattappara S.H. 1 6 km 4 lane road

**B. PROJECTS FORMING MAJOR LINKS IN THE CITY ROAD NETWORK**

i. Pettah – Kannammoola – Kumarapuram 3.50 km 3 lane road

ii. Kumarapuram – Medical College Jn. 1.00 km 4 lane road

iii. R.B.I. Jn. - Vazhuthacaud - Jagathy-  
    Poojapura - Thirumala - Thachottkavu road 7 km 4 lane road

iv. Attakulangara – Thiruvallam road 6 km 4 lane road

v. Thycaud – Choorakkattupalayam – Aryasala road 2 km 4 lane road

vi. Aryasala – Chalai bypass road 1 km 2 lane road

vii. Poojapura – Mudavanmugal – Kunnapuzha 5 km 3 lane road

viii. Panavila Jn. – Oottukuzhy road 0.50 km 2 lane road

ix. Oottukuzhy – KSHB Jn.- SS Kovil 1.00 km 3 lane road

x. Model School Jn.-  
   Govt. Press- SMSM Jn. 0.50 km 3 lane road

xi. Karamana – Thaliyal – Kalady road 4 km 3 lane road

xii. Sasthamangalam – Maruthankuzhy road 0.50 km 4 lane road

xiii. Maruthankuzhy – Valiyavila – Peyad – Malayinkizh 7 km 3 lane road

xiv. Maruthankuzhy – Vattiyrkavu- Nettayam –  
    Vazhayila – Kudappanakunnu road 10.50 km 3 lane road

*Comprehensive Mobility Plan, Thiruvananthapuram*
C. INTERMEDIATE AND INNER RING ROAD

Intermediate ring road is the eastern outer ring road for the city opening out areas for development with partial investment recovery mechanism by land development and disposal & levy of development charges for non-acquired land abutting this development corridor.


The proposed inner ring road connects Killipalam – Melarannur – Jagathy – Edappazhanji – Sasthamangalam – Pipinmoodu and Kowdiar, thus completing the inner ring with Kowdiar – Killipalam link presently undertaken under City road improvement works.

Feasibility Study and Detailed Project Report are to be prepared.

D. OUTER RING ROAD FOR THE CITY REGION

Eastern outer ring road for the city region opening out areas for development activities requiring large extent of land. Serviced land can be provided for such activities. This development corridor can be constructed with full investment recovery mechanism by land development and disposal and levy of development charges as envisaged in the Town Planning Acts for non-acquired land abutting this development corridor.


Feasibility Study and DPR are to be prepared.

E. DEVELOPMENT OF ROADS IN AND AROUND THE MAJOR ACTIVITY ZONES

To improve better accessibility to the development zones and for better traffic management within the zone identified roads including secondary roads/streets would be considered for widening / rehabilitation and improvement under a package. Such activity zones include Kazhakuttam, Kudappanakunnu, Ulloor-Medical College Hospital, Vattiyoorkavu, Peyad, Chackai – Airport zone (including three access roads across the TS canal to the new airport terminal) and Vizhinjam.

The proposed port at Vizhinjam is expected to cater to the growing container transshipment demand of the country. The port location at Vizhinjam has the advantage that it can cater to the largest container vessels operating in the region and the natural water depth of more than 20 meters available could attract future mega container carriers as well. This mega project is estimated to cost Rs 4360 crores and is structured through PPP.
The project is to be provided with the following support infrastructure as envisaged in the project report of Vizhinjam Port:

i) Road connectivity from Vizhinjam to NH bypass exclusively for container movement

ii) Road connectivity from Vizhinjam to NH bypass and connecting the outer ring road to other traffic

iii) Two lane road parallel to NH bypass for container movement to and from Vizhinjam port for about 30 km that falls within the JNNURM project area

F. RECONSTRUCTION AND NEW CONSTRUCTION OF ROAD BRIDGES

Widening and reconstruction of the following bridges:
   a. Kundamankadavu
   b. Mulavana kampipalam
   c. Vallakadavu
   d. Ponnara palam

Construction of the following new bridges:
   a. Mudavanmukal – Vettikuzhi leading to NH 47
   b. Parayilkadavu – Thrivikramangalam – Papanamcode
   c. Vellayani – Kudathravilakom – Nemom
   d. Bund road – Soman nagar
   e. Kalady – Kalladimukhom
   f. Edavancode –Kannanmoola – Ulloor thodu
   g. Kulasekharam
   h. Malamukal – Cheriyangonni
   i. Myladkadavu
   j. Footbridge at Ukkachavila slum to Kannettumukku
   k. Railway overbridge near Karamana

G. TRUCK TERMINALS

The wholesale and warehousing activities in the CBD area of the city generates demand for truck parking. Uncontrolled concentrations of goods carriers and transshipment activities cause environmental and traffic problems. To facilitate efficient and economic operation of goods transport, infrastructural facilities for truck terminals are proposed at Enchakkal (major), Vallakadavu (minor) and Chalai Bypass (minor).

Facilities proposed include vehicle service facilities, booking offices, crew facilities like rest rooms, changing rooms, toilets and eateries, fuel outlet, and storage facility.
H. GRADE SEPARATORS FOR IDENTIFIED ROAD INTERSECTION

In the Central Business area and places where major work centres are located, the pedestrian is in sharp conflict with vehicular traffic. In Thiruvananthapuram, pedestrians cross the roads at grade. Where a high volume of pedestrians cross a road of an equally heavy volume of vehicular traffic, proper grade separated pedestrian facilities should be provided. Atleast in some location, these grade separations could be constructed with private participation by suitably incorporating commercial use attached to the facility. Traffic studies in the city has identified a few road intersections on the major roads which now have nearly 10000 PCUs per hour and the traffic projections show substantial increase in traffic volume. At grade solutions like signaling have been counterproductive leading to queuing up of vehicles especially at peak hours, disruption of traffic flow and resulting in increase in accidents.

Possible solution to this (apart from better mass transport facilities) is to construct grade separators (flyovers or underpasses). Road junctions identified are:

Pattom, PMG Jn., Medical College Jn., Vellyambalam, Sreekaram, Ulloor Jn., Widening & improvements to Thampanoor flyover, Pettah – Anayara road, Peroorkada etc.

I. PARKING FACILITIES

Absence of off street parking facilities have caused traffic obstructions on many a road in the city by on street haphazard vehicle parking. Off street parking facilities are proposed as ground level facility, underground facility and/or multilevel facility.

A few critical locations are identified below.

Palayam, Statue – Secretariat area, Vazhuthcaud, near Museum & Zoo, Ulloor – Medical College Hospital area, Peroorkada, East Fort – Chalai area, Thampanoor area & Vellyambalam – Sasthamangalam road.

J. PEDESTRIAN FACILITIES

Improvements to pedestrian facilities include footpaths along the roads (for the road corridors included in the widening / rehabilitation and improvement programme, provision of footpaths is a component), foot over bridges, subways, at grade pedestrian road crossing facilities, exclusive pedestrian pathways etc.

About 12 locations have been identified for providing pedestrian road crossing facilities. They are Thampanoor, East Fort, SMV School, Statue, Medical College, Pattom, Kesavadasapuram, Cotton Hill, General Hospital Jn., Karamana, Vazhuthcaud and Manacaud.

K. PUBLIC TRANSPORT SYSTEM IMPROVEMENT

- Proposed project components include improvement to existing bus transport facilities (fleet strengthening, construction of bus terminals, improvements to depots/workshops, computerization of organizational management & operational
management etc.), introduction of HCBS (high capacity bus system) in selected corridors, reservation of selected road corridors only for mass transport system with improved level of service etc.

- Construction of bus operating centres for private long distance omni buses - It is proposed to construct such a facility by the side of N H By-pass near Enchakkal with bus parking facilities, booking offices, passenger amenities and crew facilities.

- Introduction of LRTS (Light Rail Transit System) or Electric Multiple Units (EMU) along selected high density traffic corridors. Preferred stretch in the first phase is Kazhakuttam (I.T. Centre) – along NH bypass – Veli – Akkulam (tourism centre, water transport terminal & second railway terminal) – Airport – (Kovalam – Vizhinjam in the second phase) – Manacaud – Chalai bypass – Killipalam.

- This Mass Transport System can be extended from the Airport to Vizhinjam ICTT, when the ICTT is commissioned. The MTS can also be extended from Kazhakuttam to Ulloor so as to enable linking with High Capacity Bus System (HCBS), proposed to be operated from Ulloor to Palayam – East Fort – Peroorkada.

Thiruvananthapuram Capital City region Mass Transport System shall have the following components:

- The present bus system – with improvements
- HCBS in selected corridors
- City region rail transport system in selected stretches
- Water transport system

In order to propose an integrated approach in planning, development and management of all these mass public transport systems, it is proposed to constitute a single Transport Agency, perhaps as ‘Thiruvananthapuram City Region Transport Authority’, suitably delinking with the all Kerala single agency set up, but retaining interrelationships with KSTRC in certain aspects.

Development of water transport facilities utilising the existing canal systems in the city, and also taking into account the fact that the National Waterway (NW3) now terminating at Kollam may in future be extended to Thiruvananthapuram, with a Water Transport Terminal at Veli and further extending up to Kovalam via T.S.canal, now considered for improvement.

Improved rail connectivity and passenger facilities at Thiruvananthapuram Central Railway Terminal, the second Terminal at Veli and Servicing Terminal at Nemom.
L. PROJECTS FOR ROAD REHABILITATION AND MAINTENANCE

- Within Thiruvananthapuram City region, the major roads including highways, MDRs & ODRs are with the State PWD for improvements and maintenance. Feeder roads, collector roads and neighbourhood levels, which can grouped under secondary roads are under the City Corporation. Whenever new housing developments take place, those newly formed streets are also surrendered to the TMC for maintenance and upkeep.

- The TMC now has about 2000 km length of roads for maintenance and management. About 450 km of these streets are concreted. Financial resources now available with the TMC do not permit even resurfacing of the roads once in 5/7 years. Regular maintenance programme has to be devised for these roads. Many of the roads require removal of obstructions, construction of drains, adequate street lighting etc.

- The project component identified under JNNURM envisages rehabilitation of 400 km of roads and maintenance of 600 km of roads, now under the City Corporation.

M. TRAFFIC MANAGEMENT AND ENVIRONMENTAL MANAGEMENT

- The National Urban Transport Policy aims to introduce Intelligent Transport System for traffic management. The policy is meant to improve safety, efficiency and economic productivity of transport system in an urban area. Though the full adaptation of the ITS available today is yet to get implemented in India, Area Traffic Control System (ATCS) which is one of the components of ITS, is applied to manage traffic here. NATPAC has carried out a study on the various technologies which can be implemented in India in the Immediate future (Source: “Intelligent Transport System”, NATPAC, Thiruvananthapuram, 2005). ATCS is implemented in 63 intersections in Delhi. The same is under implementation in Mumbai. While both these systems rely on imported know how, CDAC, Thiruvananthapuram has already developed an ATCS for Indian conditions and implemented in Pune. The system is in place for the last six months and cover 38 intersections in the first phase. A similar traffic control system is proposed in Thiruvananthapuram. Other specific projects required for traffic enforcement and management, which become essential part of the Road Development & Transport Improvement Programme are included are the following.

- Capacity building by setting up a training institute under NATPAC, the R & D Centre of Kerala State Council for Science, Technology and Environment, Government of Kerala. The training institute is meant to cater to all categories of road users and its managers, including planners, engineers and police;

- Traffic enforcement and monitoring with the help of camera stations and centralised traffic regulation;
• Planting suitable trees on and off the street with public transportation;

• Ornamental and information gates to the city at Kazhakkuttam, Kovalam, Pallichal, Malayinkeezhu, Karakulam, Vembayam and Pothencode. These gates will have an information centre, police aid post and a camera system for surveillance;

• Phased CNG conversion for public utility vehicles, signages etc.; and

• Public utilities near high density pedestrian streets. Each unit of the proposed public utilities will have two closets and two urinals, drinking water facilities, space for a serviceperson and an information centre.
### Costing and Phasing of JNURM Priority Project Components (Source : CDP 2006)

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<td>Projects that strengthen linkages with NH &amp; regional roads 26 km @ Rs 2.50 crores per km</td>
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<td>Development of roads in and around major activity zones - Kazhakuttom, Chackai -Airport - Kochuveli, Vizhinjam, Kudappanakunnu, Medical College Hospital, Karakulam &amp; Peyad</td>
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<td>Public Transport System Improvement</td>
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<td>i  LRTS / EMU train from Kazhakuttam - Anayar - Air port - Manacaud - Chalai - Killipalam (1st phase) 12 km including Feasibility study &amp; DPR @ Rs. 65 crores per km</td>
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<td>DPR</td>
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<td>iv Quality upgradation of KSRTC services</td>
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<td>Commuter trains between Neyyattinkara and Varkala</td>
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<td>Inland Water Transport Sector</td>
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<td>Mobile road repair units (Private participation)</td>
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<td>New footpaths by covering drains with RCC slabs, and providing service ducts for all major roads for cables and pipes</td>
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<td>Traffic Management</td>
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<td>i. Bus bays with shelter (100 nos)</td>
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<td>iv. Capacity Building: Training Institute for Road Users (under NATPAC)</td>
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<td>v. Enforcement &amp; monitoring, Camera Stations, Centralised traffic regulation</td>
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<td>Projects for Environmental Management</td>
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<td>ii. Green Corridors</td>
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<td>iv. Pollution control</td>
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<td>11</td>
<td>a. CNG conversion of public transport vehicles (now proposed as LNG)</td>
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<td>b. Providing public utilities near high density pedestrian areas (25 nos)</td>
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Comprehensive Mobility Plan, Thiruvananthapuram

DSC-01
Preliminary Project Report for

THIRUVANANTHAPURAM CITY REGION

Submitted to:
Government of India

Submitted by:

Comprehensive Mobility Plan, Thiruvananthapuram DSC- 01
THIRUVANANTHAPURAM CITY REGION

CONTENTS

1 BACKGROUND

2 THIRUVANANTHAPURAM – AN OVERVIEW

2.1 Regional Settings
2.2 Demography
2.3 The Present and future role of the City Region
2.4 Growth of Automobiles
2.5 Automobile Pollution

3. PROJECTS

3.1 Project Components
3.2 Responsible Agencies
3.3 Project Package – I Walkways to promote walking
3.3.1 Chalai main street and ancillary alleys
3.3.2 Walkway connecting Chalai Market, Central Railway Station and Central Bus Station
3.4 Project – II Promotion of Mass Transport
3.4.1 New Road connecting Kazakkootom Railway Station and Technopark
3.4.2 Road Linkage connecting Kochuveli Railway Station with NH Bypass
3.4.3 Introduction of new buses to facilitate connectivity with transport terminals:
3.5 Summary of Projects
1 BACKGROUND

The Government of India has conceptualised a project entitled Cleaner Mobility in Urban Areas with a view to reduce the emission of Green House Gases (GHG) associated with transportation in Urban Areas. By encouraging greater reliance on public transport and non-motorised transport as well as incorporation of sustainable transport principles in urban areas, the project aims to reduce GHG emissions to the optimal level. Thiruvananthapuram, the capital of Kerala is one of the cities selected for the project.

2 THIRUVANANTHAPURAM – AN OVERVIEW

2.1 REGIONAL SETTINGS

Thiruvananthapuram, the capital of Kerala is located close to the southern end of the Indian peninsula. The city is 1315 km from Chennai, 753 km from Bangalore, 1604 km from Mumbai and 2794 km from the national capital. The NH 47 links the city with the rest of India. The historic city is also connected by rail and air and is one of the major tourist destinations in Kerala - the Gods own country.

2.2 DEMOGRAPHY

The present City Region of Thiruvananthapuram extends over an area of 296.17 sq.km. including Thiruvananthapuram City and 10 neighbouring Grama Panchayats. This area under the jurisdiction of Thiruvananthapuram Development Authority, held a population of 746139 in the year 1971, 907040 in 1981 and 1035481 in 1991. The figure rose to 1132394 as per the 2001 census. The Municipal Corporation alone holds a population of 7,44,739, which is the most populous local body in the state, with an area of 141 sq.km. Thiruvananthapuram Urban Agglomeration holds 81.4% of the total urban population of the district in 2001, indicating the strong influence the city exerts in the district. The National Commission on Urbanisation had also identified Thiruvananthapuram as one of the National Priority Cities in the country.
2.3 THE PRESENT AND FUTURE ROLE OF THE CITY REGION

The city is the apex centre of all governmental functions. The Executive and Legislative arms of the Government have their apex bodies functioning in this city, which will continue to lead towards migration and flow of floating population. The city region also continue to host regional headquarters of many central government departments/agencies, commonly associated with state capitals.

The city is the seat of major institutions of national and international repute like Vikram Sarabai Space Centre,-Indian Space Research Organisation, Southern Air Command HQ, Regional Cancer Centre, Sree Chithra Institute of Medical Science, Electronic Research & Development Centre, Central Tuber Crops Research Institute, Centre for Development Studies, Centre for Earth Science Studies, Lakshmi Bai National Centre for Physical Education, Regional Research laboratory of CSIR,
Rajiv Gandhi Institute of Bio-Technology etc. The city still has the potential to attract such institutions in future too. The city is also attracting investments in medical tourism and is growing as a leading healthcare centre in South India. The country's first I.T. Park was established in this city in early 90s. Today, it contributes around 80% of IT exports from the state. The second and third phase of expansion of Technopark is underway which will be a SEZ. The city is poised to become a major IT-BT destination in the country, with the materialization of Technocity project. The Film & Video Park will also be a SEZ for film and animation related industries. The city is emerging as a high tech industrial destination with such novel projects. The region is bestowed with the availability of skilled manpower and presents ample scope for further expansion.

Thiruvananthapuram is a major tourist destination in the country with internationally renowned tourist centres like Kovalam. The city and its region bestowed with immense scope for development in its facets -Heritage, Beaches, Backwaters, Culture, Wild Life and Hill Stations to name. The prospects are still to be optimally tapped, compared to what the region can offer. Rising investments in this sector will also contribute to growth of the city.

The deep water Container Transshipment Port proposed at Vizhinjam in Thiruvananthapuram, will make it a gateway to the nation. The project is expected to have impact on all development sectors, transforming the city as one of the major trading centre. Expansion of the existing International airport in the city is already in progress.

The above potential of the city region is expected to contribute considerably to the growth of population and income, at a rate higher than the present trend. This is expected to reflect in the rise in automobiles and additional concerns on air pollution and Green House Gas emissions.

2.4 GROWTH OF AUTOMOBILES

The growth rate of population in Thiruvananthapuram District was 10% during 1991-2001. However, the number of automobiles grew by 200% during that decade. This phenomenon indicates that there is an increase in dependency on automobiles, disproportionate to the population growth in the district. This calls for immediate effective intervention.

The analysis of the composition of different types of vehicles during
the 2001-02 shows that the number of registered vehicles in 2-wheeler and 4-wheeler passenger vehicle segments contribute 81% of the total figure. The share of public transport bus is a mere 4%. The dependency on private owned passenger vehicles is very high in the district.

Rate of growth of the two wheeler and four wheeler passenger vehicles are 232% and 90% respectively during the said decade. Though the rate of growth of passenger buses is encouraging during the last half of the decade, their share is nowhere near satisfactory levels. Measures need to be taken to enhance the share of mass transport significantly.

<table>
<thead>
<tr>
<th>Type of Vehicles</th>
<th>1991-92</th>
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<th>2001-02</th>
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</tr>
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<tr>
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<td>8753</td>
<td>26750</td>
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</tr>
<tr>
<td>2 w wheelers</td>
<td></td>
<td>1201</td>
<td></td>
</tr>
<tr>
<td>others</td>
<td>56163</td>
<td>3116</td>
<td></td>
</tr>
</tbody>
</table>
2.5 AUTOMOBILE POLLUTION

The automobiles have direct impact on the environment. A study conducted by NATPAC in 1994 had estimated gaseous pollutants emitted from petrol and diesel vehicles from Thiruvananthapuram city. The study revealed that nearly 206 tonnes of gaseous substances consisting of 120 tonnes of Carbon Monoxide (CO), 39 tonnes of Hydro Carbons (HC) and 17 tonnes of oxides of Nitrogen (NOx) emitted daily from motor vehicles in the city alone. 40% of CO loading is due to autorickshaws alone, whereas that of two wheelers and cars were 31% and 20% respectively. Nearly 69% of HC emissions came from two wheelers. 81% of the NOx was the contribution of Trucks and buses. Since that period, the vehicles have increased manifold and so did the air pollution level.

The phenomenal increase of two wheelers needs serious thought, as their share in air pollution is of deep concern. The use of such vehicles for short trips is high in the city region. The passenger vehicles on road are still growing exponentially. The city region, on the other hand, is poised for an added accelerated development in comparison to previous decades, which are contributed mainly by IT-BT sector, tourism, and the activities induced by the Container Transshipment Port. All these new economic development avenues will be reflected as the automobile explosion and there is an urgent need to adopt workable measures to reduce the dependency on automobiles and to adopt environmentally sustainable transport models.

3. PROJECTS

3.1 PROJECT COMPONENTS
(1) Encourage non-polluting modes of mass transport for passenger movement

(2) Encourage walking for short distance travel in potential pedestrianisable areas, by providing quality walkways and footpaths, park-n-walk facilities

3.2 RESPONSIBLE AGENCY

All the projects identified hereunder falls in the Municipal corporation area or connecting the corporation area with other areas in the region. In the above context and upholding the spirit of the decentralised planning, the Corporation of Thiruvananthapuram shall be the responsible authority for materialisation of the projects. The corporation shall either implement the projects directly or facilitate other agencies for getting the projects completed within 5 years. In the case of projects involving rail based mass transport, the corporation, in consultation with and through southern railways, shall finalise the details and implement the project. In the case of introduction of new buses, the corporation, in consultation with and through Kerala State Road Transport Corporation, shall operate and maintain the buses.

3.3 Project – I

WALKWAYS TO PROMOTE WALKING

It is expected that, by way of creating quality walking space, use of automobiles in potential areas can be reduced considerably. The downtown area of the city is identified as the apt location. The following are the major traffic attracting destinations in the downtown.

(1) Thiruvananthapuram Central railway station
(2) Thiruvananthapuram central bus terminus
(3) East Fort city bus stand
(4) Chalai Bazar -the first order market in the city
(5) Putharikandom – the city maidan and
(6) the Padmanabha swamy temple – the major pilgrim centre

It is significant to note that there is considerable passenger movement between these destinations. Though all these destinations fall well within a radius of 1 km,
the present street pattern makes the travel between these destinations circuitous; that even through busy corridors. Coupled with the pedestrian safety issues in these roads, people normally resort to automobiles for travel. This in turn is resulting in heavy automobile traffic in this area.

The dependence on automobiles can be significantly reduced, if exclusive pedestrian corridors are developed in the area connecting all these first order facilities in the city, since they are all located within walkable distances. More people could be attracted, if automobile parking facilities are introduced at a later stage, so that people could park their vehicles and walk to their destination in the area.

### 3.3.1 Chalai main street and ancillary alleys:

At present, Chalai road is a chaotic commercial street, where the pedestrians and vehicles vie for space to move about. Being the first order trading area in the city, the main street attracts population as well as vehicles from all around the city region. Even after new wider road came up to by-pass the market...
The project aims at re-designing the Chalai street and its continuation towards Padmanabha swamy temple (Eastern entry) into an auto free zone and remodeling it as a pedestrian corridor during the busy hours and limiting controlled loading-unloading during night. A pedestrian corridor of in the downtown also has to be more attractive to pedestrians, in order to shed their dependency of automobiles. For this purpose, it is also proposed to be designed as a quality walkway with good quality paving, surface drains, lighting arrangements, signages and landscaping. Some of the alleys will also be pedestrianised and redesigned. The total length of the walkway proposed to be developed in this style is 1.5 km. At the rate of Rs. 15 Million/ km length, this component of the project works out to be Rs. 22.50 million.

Already quality parking space has been developed at Gandhi Park at the main entrance to the Bazaar Street jointly by the Municipal corporation and Department of Tourism. In addition, two parking spaces may also be developed close to the two main entries at East Fort and Killippalam at a later stage. This will facilitate the people to park their vehicles in any one of the parking lots and walk to shop. Land for arranging the automobile parking facilities proposed, is expected to be made available from parts of parcels under the possession of public sector agencies (KSRTC and Government school). Public facility centres shall also be developed at these locations. The approximate development cost for this work is Rs.2.5 Million, in addition to Rs. 8.0 million for the public amenities centres, one each at the parking areas.

The pedestrian way starts from Killippalam Jn to Padmanabhaswamy temple main entry. The walkway has to cross the MG road at East fort. The pedestrian crossing and vehicular volume at this place is the highest in the city and hence require construction of a pedestrian crossing arrangement. Since this point assumes great visual value due to proximity of Fort Heritage zone, the pedestrian crossing shall be in the form of a subway.

**Total Estimate:**

- Development of quality walkways (1.5 km) = Rs. 22.50 Million
- Development of multilevel Automobile = Rs. 45.00 Million
- Parking plaza (2 x 3000 sq.m built-up area)
Public Convenience Centre = Rs. 8.00 Million
Pedestrian subway = Rs. 40.00 Million
Architects fee, DPR preparation fee, tendering costs and contingencies = Rs. 3.50 Million
Total Cost = Rs. 119.00 Million

3.3.2 Walkway connecting Chalai Market, Central Railway Station and Central Bus Station

The connectivity of major locations in the downtown with the central bus stand and Central railway station is the vital link in the downtown pedestrian corridor network. Though these transport terminals are close to other major destinations, the existing street pattern creates a tendency among the people to resort to automobiles for the journey. The walkway will directly connects the Central Bus station with Central Railway Station(preferably both Platforms & terminal buildings), and Putharikandom Maidan (on the rear side), ultimately joining with the walkway already proposed for Chalai.

This needs construction of a continuous walkway bridge across the railway lines, Station road and Powerhouse road, which measures approximately 0.40 km. The remaining length of the pathway measuring 0.50 km can be laid on the ground. It is also proposed to design the walkway with good quality paving, surface drains, lighting arrangements, signages and landscaping. The project includes construction of foot over-bridge, pavings, landscaping/tree plantation and adequate lighting. Public facility centres is also proposed en-route.

The project is expected to reinvent walking in the downtown area, shedding considerably the dependence on automobiles for short distances.

**Total Estimate:**

Development of quality walkways = Rs. 5.00 Million
(0.50km @ Rs. 10 Million/ km)
Development of foot over-bridge = Rs. 30.00 Million
Public Facility Centres = Rs. 8.00 Million
Ornamental fencing and entrance gates (rear sides) to Putharikandom Maidan (0.50 km) = Rs. 5.00 Million
Architects fee, DPR preparation fee, = Rs. 2.00 Million
tendering costs and contingencies

Total Cost = Rs. 50.00 Million

3.4 Project – II

PROMOTION OF MASS TRANSPORT

Electrification of railway track in the city region is in the finishing stages. At present, the Central Railway Station at Thampanoor is the major railway terminus in the city. Since this railway station has reached saturation, the railway station at Kochuveli is being elevated as the second multi-platform railway terminal. The construction of the new terminal building for this railway station is also completed. In addition, the railway terminal at Kahakkottom is also gaining significance, with the expansion and growth of Technopark and other industrial parks (including SEZs). Improving the road connectivity of these railway stations and operation of bus routes to these stations will encourage the rail-based mass transport system in the region. It is also proposed to operate bus route connecting the international airport with the city.

The following are the components of this project:

1. Development of road to the Kochuveli Railway station from the NH-47 bypass

2. Development of a new link road connecting Kazhakkottom railway station with NH-47 Bypass (near Technopark) and improving the existing road to the railway station from the railway station

3. Introduction of less polluting buses in the routes connecting passenger transport terminals.

3.4.1 New Road connecting Kazhakkottom Railway Station and Technopark

Technopark, the largest IT park in the state accommodates around 15 million sq. ft built-space with around 15,000 IT professionals. The 2nd and 3rd phase of the IT park is in progress, and the number of IT employees is expected to triple within three years. Since each job in IT sector will contribute 5 other jobs indirectly, Kazhakkottom, where the park is located, is poised for a development boom. The floating population to the park from outside the city will also considerably increase.
The present mode of transportation to Technopark is by road. Though the nearest railway station is Kazhakkootom, the connectivity of the same with Technopark is poor. By developing a new direct 4lane access road (0.5 km) from the Railway station to Technopark (meeting at NH bypass) in the first phase, introducing stops to more trains in the second phase and developing Kazhakkootom railway station in the third phase as a joint venture between government & railways in the third phase, the dependency over personal automobiles to commute to Technopark can be reduced considerably. The road project proposed include development of 4 lane carriage way, footpaths with quality pavements, avenue plantation, street lighting and street furniture.

Total Estimate:

Development of new 4 lane road with 21 m ROW and improving the existing road from the rly stn to Kazhakkottom jn (including land development & procurement, quality footpaths & lighting & other street infrastructure)

Development of Parking space at rly stn

Detailed estimation/tendering costs and contingencies

Total Cost

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3.4.2 Road Linkage connecting Kochuveli Railway Station with NH Bypass

Kochuveli Railway station is being developed as the second major station in the city. The railway station once developed has the potential to attract intra-city passenger traffic too. It is hence necessary to improve the road connectivity....
to the railway station for facilitating more people to use this station. It is hence proposed to improve road connectivity to this station with NH bypass (1.3 km). A road development project (21 m ROW) is hence proposed.

Total Estimate:

Development of 4-lane road with 21 m ROW= Rs.49.50 Million
(including land development & procurement,
quality footpaths lighting & other street infrastructure)
Detailed estimation/tendering costs = Rs. 1.50 Million
and contingencies
Total Cost = Rs. 51.00 Million

3.4.3 Introduction of new buses to facilitate connectivity with transport terminals:

It is essential to provide quality buses which are quiet, clean fuelled, visually attractive and powered by low-emission modern engines for changing people’s mindset to have a modal-shift from personalized to public modes of transport. The routes proposed are those connecting various parts of region with mass transport terminals, to facilitate accessibility to major transport terminals.

It is proposed to introduce electric buses, in the following routes:

(a) Thampanoor (Central Bus Stand) – Palayam – Chakai – Kochuveli railway station (10.0 km) - 4 buses
(b) Kaniyapuram Bus Station - Kazhakkoottom – Technopark – Kochuveli railway station (11.5 km) - 2 buses
(c) Pappanamcode – Killippalam – Eanchakkal – Kochuveli Railway station (12.0 km) – 2 buses
(c) Int’l Airport – Sanghumughom - Chakai – Palayam – Thampanoor (Central Bus Stand) (10.0 km, connecting the downtown, central bus stand and Central Rly station with the Airport) - 2 buses
(d) 2 spare buses for breakdown etc.
Since the Central Bus Stand and Central Railway station are located opposite to each other at Thampanoor, the new bus routes (a) and (d) will both facilitate connectivity to the Central Railway station also.

Estimate:

- Purchase of low-polluting buses (12 no:s) = Rs. 30.00 Million
- @ Rs. 2.5 million each
- Constriction of bus bays, bus shelters & passenger amenity centre including lighting, landscaping etc. at Kochuveli Station = Rs. 4.00 Million
- Contingencies = Rs. 1.00 Million

Total Cost = Rs. 35.00 Million

3.5 SUMMARY OF PROJECTS

Project – I
PROMOTE WALKING

Chalai main street and ancillary alleys = Rs. 119.00 Million

Walkway connecting Chalai Market,
Central Railway Station and Central Bus Station = Rs. 50.00 Million

Project – II
PROMOTION OF MASS TRANSPORT

New Road connecting Kazakkoottom Railway-Station and Technopark & Kzhakkootom Jn = Rs. 47.50 Million

Road Linkage connecting Kochuveli Railway-Station with NH Bypass = Rs. 51.00 Million
Introduction of new buses to facilitate connectivity = Rs. 35.00 Million

with transport terminals:

Total Estimated cost = Rs. 302.50 Million

Out of the above, construction and development of foot over-bridge estimated at Rs.30.00 Million in Project Package – I and purchase of 12 no: of buses, estimated at Rs.30 Million in Project Package – II is proposed to be materialised with the grant from Government of India under the project entitled ‘Cleaner Mobility in Urban Areas’. Total Grant requested under the project is Rs. 60 Million.

Proposal of Kerala State Road Transport Corporation (KSRTC) to improve transportation system

These proposals have been mooted by KSRTC

1. LNG conversion of Public Transport Vehicles: - The present diesel engines of the public transport vehicles are proposed to be converted to diesel-cum-LNG engines. The LNG is comparatively more environments friendly and low-priced compared to diesel. The LNG as well as its technology may be imported from competent foreign firms working in this sector.

2. Replacement of Buses: - 10 year old buses completed 10 lakh run are to be replaced with new buses.

3. Addition of Buses: - To meet the additional passenger demand, 620 new buses will be required to be organized within the next 5 years.

4. New Bus Depots: - New bus depots are proposed at Medical College, Kochu Veli, Kudappanakkunnu, Thirumala and Kovalam to meet the future transport demand.

5. Upgradation of KSRTC bus stand at Thampanoor: - The intra city bus terminal will be shifted to Thampanoor from East Fort and the proposed new terminal will have all the infrastructural facilities of international standards.

6. New Bus terminal at Enchakkal: - A new bus terminal is proposed at Enchakkal for intercity bus services.
7. Improvements to Bus Depots: - The bus depots at Pappanamcode, Vikas Bhavan, City and Peroorkada will be modernised with essential amenities.

8. Upgradation of Pappanamcode Central Works: - The 50 yr old work shop, machines and tool are to be replaced with new machines by effecting new procurements.

9. Regional Workshop for City Buses: - A regional work shop for city buses is proposed at Pappanamcode.

10. Construction of Staff Training Centre at Attakkulangara: - The staff training centre proposed will contain, Administrative Block, Lecture Hall, Library rooms, Dormitories, Kitchen, Dining Hall etc.

11. Computerisation of Corporate Office/Depots/Workshop at Trivandrum City: - This includes the complete set of computers, software and training materials.

12. Implementation of Intelligent Public Transportation system: - This includes providing most modern systems in the buses for effective monitoring.

### Costing of Project Components - KSRTC

<table>
<thead>
<tr>
<th>SI No</th>
<th>Project Components</th>
<th>Cost (Crore)</th>
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<tbody>
<tr>
<td>1</td>
<td>LNG conversion of Public Transport Vehicles</td>
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<tr>
<td>2</td>
<td>Replacement of Buses – 580 Nos @ Rs. 15 Lakhs each</td>
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<tr>
<td>3</td>
<td>Augmentation of Buses- 620 Nos @ Rs.15 lakhs each</td>
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<td>4</td>
<td>New Bus Depots</td>
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<td>5</td>
<td>Upgradation of KSRTC bus stand at Thampanoor</td>
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<td>6</td>
<td>New Bus terminal at Enchakkal</td>
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<td>Improvements to Bus Depots</td>
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<td>Construction of Staff Training Centre at Attakkulangara</td>
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<td>Computerisation of Corporate Office/Depots/Workshop at Trivandrum City</td>
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<td>12</td>
<td>Implementation of Intelligent Public Transportation system</td>
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**Total** 895.60

Source: KSRTC, deliberation on CMP – Oct 2007