

9.0 TRAFFIC & TRANSPORTATION

9.1 Importance of Transportation in Thiruvananthapuram City Region

The importance of the City region of Thiruvananthapuram can be assessed from the following major activities/ functions located in the city and its environs.

- State capital with all top level decision making authorities located in the city
- As a city of higher learning – with the existence of a large number of educational institutions of advanced studies and central and state level research institutions
- As a world tourism destination with famed Kovalam Beach, backwaters, heritage areas/buildings, forest, ecotourism and unspoilt mountain resort of Ponmudi
- I.T hub with techno park, the first I.T Park in India now an SEZ and Techno city, on the anvil
- Space Research Centre with VSSC / ISRO employing many scientists and supporting personnel
- World health tourism destination with ayurvedic spas and health clinics, providing traditional holistic health care with modern comforts and ambience
- International Container Transshipment Terminal (ICTT) coming up at Vizhinjam, 20 km south of the city – at an investment of Rs.8,000 crores in 2 phases, offering thousands of direct and indirect jobs.
- Development of new civil station premises at Kudappanakkunnu which would boost up the supporting developmental activities in and around Kudappanakkunnu.

There is increasing demand to make quantitative and qualitative improvement to transport facilities. Traffic volume is increasing in geometric proportions in the city road corridors and in the regional corridors. Rail networks are also stressed beyond capacity.

It is in this context that the Government of Kerala took up Thiruvananthapuram Capital Region Development (TCRD) in 2004. The Comprehensive Traffic & Transportation Study (CTTS) prepared for Thiruvananthapuram Urban Region (TRIDA area) in 2002 came handy to prioritize Thiruvananthapuram City road improvements as the first task under TCRD. 13 road corridors were identified for widening and improvement based on the road network study carried out under CTTS. This work is now under implementation.

The present city road improvement project is only a partial attempt to tackle the traffic & transportation issues in the Capital City. A comprehensive approach, not only for problem solving measures but also for developing transportation systems, needed for the future growth of the Capital City is now envisaged under JNNURM.

9.2 Road Network

The road network within the TMC and TRIDA area is generally of ring and radial pattern. The city has five major regional roads:

- NH 47 (Kanyakumari-Salem) passing through Thiruvananthapuram-Kollam-Alappuzha & Ernakulam – 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 Poojappura 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 and acting as a coastal road in Thiruvallam, Ambalathara and Kovalam

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 NH47 at Parasala. Kazhakuttam-Kovalam stretch is completed now with two-lane carriageway and service roads on either side. Other major roads in the city are Mahatma Gandhi road, Palayam-Ulloor/ Nalanchira road, Palayam-Peroorkada road, Pettah-Medical College-Ulloor road, Vellayambalam-Sasthamangala-Vattiyoorkavu road and Chalai by pass.

9.2.1 EXISTING ROADS

The total road length in TMC area is 2586 km of which 56% are surfaced. As per the existing land use plan, the roads in the TMC area cover nearly 7% of urban land area with road density of 18 km per sq. km area. In the TRIDA area (the city area and surrounding 10 Panchayat areas), the share of roads in the land use is only 3%¹. This indicates that the outer region has less road network. 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 are inadequate or absent in most of the

¹Development Plan for Trivandrum (2001), Department of Town Planning, Government of Kerala.

roads as only 25 km of roads have footpaths. Generally, the road surface was found to be poor with cracks, rutting and potholes.

Table 9.1: Road Network in Thiruvananthapuram City

Road Category	Length (Km)	% Share
Black Top Road	901	34.84
Metal Road	305	11.79
Concrete Road	560	21.66
Others	820	31.71
Total	2,586	100.00

Source: Directorate of Urban Affairs, Govt. of Kerala.

Thiruvananthapuram Road Improvement Project now under implementation considers 42 km length of city roads as 4-lane / 3-lane or 2-lane roads based on projected traffic volume for 15 years and based on a road network pattern.

9.2.2 ROAD HIERARCHY AND OWNERSHIP

Most arterial and sub-arterial roads are under Public Works Department (Roads and Buildings Division and National Highways Division) with collector roads under the TMC. Each agency is responsible for its own road development and maintenance. Of the available road network, a length of 390 km constitutes major roads and is classified as indicated in the table below.

Table 9.2: Classification of Major Roads in Thiruvananthapuram

Road Classification	Length (Km)	Distribution (%)
Arterial roads	74.9	19.2
Sub arterial roads	103.7	26.6
Collector roads	211.4	54.2
Total	390.0	100.0

Source: 'Draft Report on Short, Medium & Long Term Measures and Feasibility for Integrated Mass Transport System', July 2002 under Thiruvananthapuram CTTS submitted to the Department of Transport (DoT), GoK.

9.2.3 MAJOR ISSUES

Problem of congestion on main roads and intersections is a result of a combination of factors. Most of the arterial roads have inadequate capacity, substandard road geometry and carry a significant amount of intercity traffic in addition to the local traffic.

Prime issues include:

- a) Inadequate parking facilities, resulting in on street parking, reducing capacity of the available carriage way
- b) Inefficient management of road space;
- c) Absence of pedestrian facilities;
- d) Poor geometry for the roads connecting important activity centers.

- e) Absence of by-pass or ring roads, because of which a major percentage of traffic is made to go through the central city roads, adding to traffic congestion.
- f) Absence of delineated hawkers zones leading to increased street vendors using precious road space for conducting petty trade activities.
- g) Regular traffic blockages due to demonstrations and other similar events, Thiruvananthapuram being the capital of the State.

9.3 Traffic Flow and Travel Demand

9.3.1 TRAFFIC FLOW

The average annual daily traffic (AADT) on some of the main roads indicate that traffic was in the range of 35,000 to 53,000 passenger car units (PCU) in the inner city road sections, 18,000 to 24,000 PCU for intermediate city road sections and in the range of 10,000 to 18,000 PCU on roads in the city's periphery. It is estimated that the AADT on inner city roads would reach 43,000-64,000 PCU during the year 2004. This high traffic volume exerts pressure on the existing narrow urban roads, causing frequent congestion and accidents.

Table 9.3: Peak Hour Traffic Distribution at Selected Locations

Sl. No.	Road Section	AADT (PCU)-2000	Peak Hour Traffic (PCU)-2000	Peak Hour Factor (%) -2000	Estimated AADT (PCU)-2004	Estimated Peak Hour Traffic (PCU) -2004*
1.0	Outer City Sections					
1.1	Manacaud-Vizhinjam	17,755	1,521	8.6	21,581	1,849
1.2	Sasthamangalam - Vattiyoorkavu	17,759	1,730	9.7	21,586	2,103
1.3	Vazhuthacaud-Pangode	10,532	1,184	11.2	12,802	1,439
2.0	Intermediate City Sections					
2.1	Karamana-Poojapura	18,021	1,640	9.1	21,905	1,993
2.2	Uppilamoodu-Kaithamukku	24,304	2,432	10.0	29,542	2,956
2.3	Palayam-Pettah Road	24,369	2,533	10.4	29,621	3,079
2.4	Jagathy-Poojapura Road	24,433	2,211	9.0	29,698	2,687
3.0	Inner City Sections					
3.1	Thampanoor-Killipalam	35,088	2,947	8.4	42,650	3,582
3.2	Killipalam-Karamana	34,900	3,101	8.9	42,421	3,769
3.3	Over bridge-East Fort	52,802	3,848	7.3	64,181	4,677

* - Estimated with 5% annual growth rate.

Source: 'Draft Report on Short, Medium and Long Term Measures and Feasibility for Integrated Mass Transport System', July 2002 submitted to Department of Transport, Govt. of Kerala.

As per the studies under the Kerala Sustainable Urban Development Project (ADB assisted project) - City Report for Thiruvananthapuram, most of the road sections have reached their maximum capacity and need widening. The details of some of the road stretches are mentioned below.

Table 9.4: Peak-hour Traffic Volume on Selected Road Stretches

Sl. No.	Link Name	Peak-hour traffic volume (PCU)	Capacity in PCU
1	Manacaud-Kamaleswaram Section	2,650	2,143
2	Ulloor-Karyavattom Section of NH 47	4,676	2,143
3	Ulloor-Kesavadasapuram Section of NH 47	3,068	2,143
4	Poojapura-Pangode Section	4,106	1,714
5	Sasthamangalam-Maruthankuzhi Section	3,13	1,714
6	Paruthipara-Ambalamukku Section	2,433	1,714
7	Pettah-Anayara Road	1,673	800
8	Anayara-Veli Road	280	800

Source: Primary survey by ADB PPTA (2004).

The average annual traffic growth rate for the city roads during the period 2000-04 is 5.2%. This growth rate is only indicative as it is based on a few road sections.

Table 9.5: Traffic Growth Rate during 2000-04

Sl. No	Location	Peak hour traffic		
		PCU (2000)*	PCU (2004)**	Annual Growth Rate during 2000-04 (%)
1	Manacaud Junction	2,918	3,187	2.23
2	Vazhuthacaud-Pangode Road	1,184	1,570	7.31
3	Sasthamangalam-Vattiyoorkavu Road	1,730	2,105	5.03
4	Pettah-Aanayara Road	588	1,007	14.40

* - CES Study Traffic Survey in 2000

** - Primary Survey under ADB PPTA in 2004

Various issues like on-street parking, street vendors, etc. result in speed reduction during peak-hours on city roads. The average peak-hour speed at the outer city road sections is only in the range of 16 to 23 km per hour against a desired peak-hour speed of about 30 to 35 km per hour.

Table 9.6: Speed and Delay Characteristics at Selected Links

SI No	Name of the Road	Length (Km)	Peak Hour			Off-peak Hour		
			Journey Speed (Km/hr)	Delay (Sec)	Running Speed (Km/hr)	Journey Speed (Km/hr)	Delay (Sec)	Running Speed (Km/hr)
1	Kazhakootam-Kesavadasapuram Road	8.4	18.72	533	27.95	27.77	21	28.31
2	Paruthippara-Ambalamukku Road	2.3	23.46	58	28.07	38.69	13	41.19
3	Nettayam-Shasthamangalam Road	5.2	23.03	84	25.68	26.29	10	26.67
4	Karamana-Peyad Road	8.2	21.92	196	25.65	26.19	56	27.56
5	Venpalavattom-West Fort Road	5.8	16.04	521	26.73	25.13	79	27.77
6	Attakkulangara-Thiruvallam Road	4.7	23.83	96	27.56	38.37	31	41.27
7	PMG-Pottakuzhi Road	1.6	28.80	10	30.32	43.97	6	46.08
8	Venpalavattom-Veli Road	2.4	21.65	110	29.90	27.69	4	28.05

Source: Primary Survey under ADB PPTA (2004).

9.3.2 THROUGH TRAFFIC

Volume of commercial vehicles passing through the city is estimated as 2,000 vehicles per day with 19% of commercial traffic passing through the city in the absence of a bypass. 87% of through traffic plies along major radial roads.

Of the existing radial roads, five roads are on major corridors with high inter-city vehicular traffic entering / leaving the city. Traffic on these five roads constitutes 83% of the total inter-city vehicular traffic. These roads are:

- a) NH 47, towards Neyyatinkara;
- b) NH 47, towards Kollam;
- c) Peroorkada - Nedumangadu Road (Thiruvananthapuram Shenkottah road);
- d) Main Central Road (Thiruvananthapuram - Kottayam road); and
- e) Poojapura - Kottakada Road.

Table 9.7: Details of through Traffic of Commercial Vehicles

Sl. No	Outer Cordon Road Section	Commercial Traffic (No. of vehicles) – 2000			Estimated Commercial Traffic (No. of vehicles) – 2004		
		<i>Total per day</i>	<i>External - External Traffic</i>	<i>% Share</i>	<i>Total per day</i>	<i>External - External Traffic</i>	<i>% Share</i>
1	Vizhinjam-Balaramapuram Road	320	19	5.9	389	23	5.9
2	NH 47 towards Neyyatinkara	3,403	690	20.3	4,136	839	20.3
3	Peyad-Malayinkeezhu Road	733	88	12.0	891	107	12.0
4	Vattiyoorkavu-Nettayam Road	530	54	10.2	644	66	10.2
5	Peroorkada-Nedumangadu Road	722	88	12.2	878	107	12.2
6	MC Road	610	94	15.4	741	114	15.4
7	Kattaikonam-Pothencodu Road	235	26	11.1	286	32	11.1
8	NH 47 towards Kollam	2,239	578	25.8	2,722	703	25.8
9	Station kadavu-Perumathurai (Coastal Road)	83	2	2.4	101	2	2.4
	Total	8,875	1,639	18.5	10,788	1,992	18.5

Source: 'Draft Report on Short, Medium & Long Term Measures and Feasibility for Integrated Mass Transport System', July 2002 submitted to Department of Transport, Govt. of Kerala.

9.3.3 PEDESTRIAN FACILITIES

Apart from all the major road corridors in the inner and intermediate city area, the locations of commercial, hospital and educational activities in the city indicated heavy pedestrian traffic for parallel and crossing movement. Even the outer city road sections indicated considerable pedestrian traffic, particularly during peak hours, as indicated in the Table below. Critical sections with heavy pedestrian traffic include Chalai, Railway Station Road, VJT Hall, Secretariat, Power House Road, Palayam, East Fort and Cotton Hill School. Peak hour pedestrian traffic at these locations is projected to cross 6,000 persons by 2006². Except a few sections, many of the roads do not have footpaths.

Table 9.8: Mid-block Pedestrian Count at Selected Outer City Locations

Sl. No.	Section Name	Peak Hour	Pedestrian Volume (No)
1	Manacaud-Kamaleswaram Section	3.15-4.15 PM	638
2	Paruthippara-Ambalamukku Section	3.15-4.15 PM	618
3	Ulloor-Kesavadasapuram	8.30-9.30 AM	621
4	Ulloor-Karyavattam	4.45-5.45 PM	375
5	Sasthamangalam-Maruthakhuzhi	8.30-9.30 AM	900
6	Poojappura-Pangode	8.00-9.00 AM	774

Source: Primary Survey under ADB PPTA 2004.

9.4 Vehicular Growth and Composition

Due to lack of data at city level, district level growth trend of motor vehicles during the last five years was studied. The trend shows that the percentage increase in 2005 is highest in case of 2-wheelers (12.64%) followed by car/jeep/taxi (11.34%), buses (9.90%) and goods vehicle (9.29%). The lowest increase was observed in the growth of 3-wheelers (5.19%).

Table 9.9: District level growth trend of motor vehicles

Year	2-wheeler	Car/Jeep/Taxi	3-Wheeler	Buses	Goods Vehicles	Others	Total
2005	281382	78143	31551	16909	21676	3807	433468
2004	249817	70183	29993	15386	19834	3550	388763
2003	224274	62668	28042	13862	18460	3149	350455
2002	203658	56163	26750	12717	17657	3116	320061
2001	184519	52064	25386	11877	16485	2868	293199
2000	165615	48266	23673	10312	15565	2742	266173

Source: Motor Vehicles Department, Government of Kerala.

² Traffic Engineering and Management Study – Trivandrum, December 1991, KUDP (CES, New Delhi).

9.5 Mode Split and Modal Split

The modal distribution of the trips performed by the residents show a heavy dependence on personalized vehicles inside the city area.

Table 9.10: Modal Distributions in the City and Panchayat area

Region	Personalized Vehicles	IPT	Mass Transport	Total
City Corporation	50.74	13.90	35.36	100.00
Panchayats	33.65	4.11	62.24	100.00
TRIDA	42.65	9.32	48.03	100.00

Source: Comprehensive Traffic and Transportation Study of Thiruvananthapuram Urban Area, conducted by CES in association with ICF Kaiser and PEMS for Department of Transport, Government of Kerala, 2003

The overall share of mass transport, including institutional vehicles does not appeal in the modal distribution. This result in a high share of personalized vehicles which makes the roads congested and indicates the operational problems of public transport.

9.6. Public Transport System

Though the recent years have seen tremendous effort in improving the transport network in the region, lot needs to be done to provide an efficient public transport system. Road improvement projects are in progress under the KSUDP and the City Road Improvement Project. The traffic condition is expected to show some sign of relief in a few of the busy corridors once these projects are completed. Recent years have seen doubling of the rail lines providing better rail connectivity to Thiruvananthapuram. Electrification of the rail line, which is underway, will further improve the rail system. But the economic benefits achievable through these partial improvements of the transport system would multiply several folds by improvement of the public transport system. The issues currently faced by the road system and inadequacy of public transport system needs to be resolved. The city badly needs a mass transport system to provide connectivity to the outskirts where large scale activities concentrate in a few development zones. It also needs an improved, clean, cost efficient public transport system to provide service within the city area.

9.6.1 BUS TRANSPORT

The city bus service is mainly operated by the Kerala State Road Transport Corporation (KSRTC) and supplemented by private bus operators. KSRTC also operates both inter-city and intra-city services. There are five depots for city bus services and one regional terminal at Thampanoor for inter-city / inter-state services. Some of the areas with city bus depots are very crowded and congested and need redevelopment or shifting of depots to better

locations. All the buses ply on the same carriageway as that of other private vehicles and thus the level of service offered by bus system is severely limited by the congested road network. The mode split of KSRTC is 9% and the modal split share caters to more than 35%³. This indicates that the existing bus system is unable to cater to the peak hour passenger demand, resulting in over crowded buses, long waiting time and slower speeds. In total KSRTC operates 449 buses in 790 routes with a total trip length of 95680 km (average trip length of 16 km)⁴ and private buses operate 103 buses (1714 trips per day) with a total route length of 1770 km (average route length of 16.2 km)⁵.

As an effort to improve the quality of services, KSRTC is in the process of reducing the average age of buses put to operation. Thiruvananthapuram district was among the three districts that showed the highest General Accident Proneness (GAP) index. Studies available reveal that majority of the bus accidents are linked with road conditions and driver behaviour. Performance of KSRTC was also studied by NATPAC. (Source: "Performance Analysis of Kerala State Road Transport Corporation", NATPAC, Thiruvananthapuram, April 1994). Compared to the operation of KSRTC at state level, performance of Thiruvananthapuram city bus operations were poorer. The study brought out issues like high level average load factor, low fleet/ vehicle utilisation, high staff ratio and low punctuality for corrective actions.

Some of the areas that need development of bus depots or construction of new ones have been identified in consultation with various stakeholders. They are listed as below.

- Redevelopment of KSRTC bus terminal at Thampanoor for city and district level services
- Shifting the city bus terminal from East Fort to KSRTC bus terminal at Thampanoor and maintaining a sub-operating terminal at East Fort.
- Development of inter-district and inter-State bus terminal at Eanchakkal, by the side of the NH bypass.
- Development of city-level sub-operating terminals at Kochuveli, Medical College / Ulloor, Thirumala, Nalanchira, Kudappanakunnu, Ponnumangalam and near the proposed international airport terminal, by the side of NH bypass.

9.6.2 RAIL TRANSPORT

Thiruvananthapuram is connected by a broad gauge railway line running north-south, linking Nagercoil-Kanyakumari on the south to Kollam-Kochi on the north. The city is well connected

³ Motor Vehicles Department, Government of Kerala

⁴ Economic Review 2003, State Planning Board, Govt. of Kerala

⁵ Compiled by National Transportation Planning and Research Centre (NATPAC), Thiruvananthapuram

to other parts of the State and the country through the rail network. On an average around 50 trains are serving the city every day. The daily commuter traffic coming from the north and south of the city mainly depend upon the rail transport system. The railway line divides the city into two parts. The old city is on the south and the new development of the city are mainly on the north. The growth of the city is taking place along the railway line towards the north.

There are three railway stations serving the city, which are, Trivandrum Central at Thampanoor (city centre), Pettah (secondary station in the city) and Kochuveli (on the outskirts). The second terminal of the city is being developed at Kochuveli (Veli) to allow a few long distance trains to terminate at this station without entering the city centre. Other small stations in the TRIDA area include Kazhakkootam, Nemom and Balaramapuram.

Six rail-over-bridges (ROBs) provide uninterrupted access between the two parts of the city. Three level crossings at Melarannur, Pettah and Kochuveli in the city obstructs road traffic due to frequent gate closures. Traffic at Pettah level crossing is about 0.63 million train vehicle unit (TVU) per day, whereas Kochuveli and Melarannur level crossings will reach 0.1 million TVU soon. This justifies the requirement of ROBs at these locations.

Development proposals with regards to Railways to improve rail travel facilities to Thiruvananthapuram include the following:

- (a) Double laning of Thiruvananthapuram-Nagercoil route;
- (b) Running of commuter trains between Thiruvananthapuram & Kollam and Thiruvananthapuram & Parassala (perhaps Nagercoil-Kollam EMUs based on traffic surveys);
- (c) To encourage further inter-relationships between Thiruvananthapuram and Kochi, as the two prime activity nodes of the state, fast train connections, with less than three hour travel time and better comforts, need to be established between these two cities;
- (d) Establishment of Thiruvananthapuram-Vizhinjam rail link to serve ICTT at Vizhinjam Port; and
- (e) Establishment of Thiruvananthapuram-Nedumangad-Palode-Thenmala rail link to serve the north-eastern corridor and to link with Kollam-Shencottah rail line, which is undergoing gauge conversion (in the second phase, this link can be connected to Kollam-Kottayam railway line).

Terminal facilities

- (a) Redevelopment of Thiruvananthapuram Central Railway Station with the following features:
- Construction of a multi-level vehicle parking facility, separate areas for four-wheeler and two-wheeler parking, and separate areas for long duration and short duration parking with computerized parking ticket facility and also monthly parking fee arrangement;
 - Lift and ramp facilities to link all the platforms (PPP);
 - Free service luggage trolleys which can be operated by the passengers;
 - Better traffic management in the front yard with taxi parking area shifted from front yard to the old Arya Bhayan – C.P. Sathram area; and
 - Pedestrian over bridge to be extended up to KSRTC bus terminal.
- (b) Development of Kochuveli (Veli) second terminal with good passenger facilities and also with facilities for overnight stay;
- (c) Rail coach and engine serving facility at Nemom;
- (d) Kochuveli-Kazhakuttom transport facility along the NH bypass; and
- (e) Goods terminal at Kochuveli and at Vizhinjam.

9.6.3 AIR TRANSPORT

Thiruvananthapuram has an International Airport catering to both domestic and international flights. During the year 2002-2003, 10,524 flights were operated from this airport of which 62% were international. Little more than one million air passengers boarded or alighted at this airport and this was 5.6% more than the air traffic in the previous year. The new airport terminal is being developed with access from NH bypass. The increasing air traffic exerts pressure on the city road network. Adequate mode change facilities to public transport are required from the airport.

9.6.4 WATER TRANSPORT

Except for tourism, water transport is seldom used in the region, though an inland water network of about 16 km exists on the western part of the city connecting the north and south of Kerala.

The Kovalam - Veli reach of the West Coast Canal has a length of about 16 km. The waterway is passing through Veli, Akkulam, Thiruvananthapuram city, Poonthura and Moonnattumukku near Kovalam. Veli and Poonthura are the two sea openings in this section. Some of the portions of the canal are presently navigable by small country boats. This stretch of land in the city has tremendous potential as it also provides connectivity

between the airport and the famous tourist destination at Kovalam on the south and to the Technopark at Kazhakuttam.

9.6.5 INTERMEDIATE PUBLIC TRANSPORT (IPT)

Lack of efficiency in intra-city Public Transport System has forced people in the middle and lower income groups to opt for IPT. The most popular mode of IPT is the three-wheeler (autorickshaw). However, increasing use of autorickshaws within the city area tend to increase traffic congestion and accidents.

There are a few intra-city road corridors, which are not well served by KSRTC buses. It is roughly assessed that about 40 percent of jobs in the organized sector and about 60 percent of jobs in the unorganized sectors (especially in the construction industry) are availed by worker community daily from the immediate region around. They depend partly on the illegally operated IPT modes like vans and mini buses. These vehicles regularly operate in the following corridors:

- (a) Thiruvananthapuram – Kattakada;
- (b) Thiruvananthapuram – Vizhinjam;
- (c) Thiruvananthapuram – Nedumangad and;
- (d) Thiruvananthapuram – Attingal

These IPT operations need to be brought under surveillance.

The Airport does not have Public Transport linkage and the proposed railway terminal at Veli also need road transport transfer facilities.

9.7 Vehicular Parking

9.7.1 PROBLEMS AND ISSUES

On-street parking is a major issue due to the absence of off-street parking facilities. Heavy parking demands on the major corridors reduce the usage of carriageway, causing congestion and blocking connecting roads. In most of the critical areas the mode predominant on the on-street parking is two-wheeler as shown in the table below.

Table 9.11: Peak Hour On–Street Parking Accumulation

Location	Predominant Mode in Peak Hour	Peak Hour Parking Accumulation (No.)	Predominant Mode Accumulation in Peak Hour (No.)
Vazhuthacaud	Car	247	85
Power House Road	2 wheeler	205	109
Pulimoodu-MG Road	2 wheeler	112	70
Pulimoodu-Press Road	2 wheeler	108	55
SMV High School-MG Road	2 wheeler	86	52
Pulimoodu-Kaithamukku Road	2 wheeler	82	63
Secretariat	2 wheeler	78	38
Vellayambalam-Sasthamangalam Road	2 wheeler	77	67
East Fort	Car	70	35
Museum	2 wheeler	70	39
Station Road	2 wheeler	55	33
Palayam	2 wheeler	54	37
VJT Hall	2 wheeler	52	44

Source: 'Draft Report on Short, Medium & Long Term Measures and Feasibility for Integrated Mass Transport System', July 2002 submitted to Department of Transport, Govt. of Kerala.

9.7.2 PARKING DEMAND AND CRITICAL AREAS

The life line of Thiruvananthapuram is the MG Road passing through the central area. The volume of traffic moving through this road is very high because it cuts across the CBD and commercial centres and administrative offices of the State including the State Secretariat are located on this road. A parking demand study conducted in 2003⁶ estimated a deficiency of 1867 Equivalent Car Spaces (ECS) on the MG Road alone. The study projected the parking deficiency as below.

Table 9.12: Parking Deficiencies on MG Road

Year	Demand in ECS	Supply in ECS	Deficiency in ECS
2003	4108	2241	1867
2008	5092	2459	2633
2013	6232	2671	3561
2018	7260	2738	4522
2023	8215	2738	5477
2028	9170	2738	6432

Source: Parking Management Plan for MG Road, prepared by National Transportation Planning and Research Centre (NATPAC), Kerala State Science, Technology and Environment Council, Government of Kerala.

The inability to supply parking spaces to meet the parking demand on the arterial roads within the city, in areas like Medical College, East Fort, the markets in Palayam, Chalai,

⁶ Parking Management Plan for MG Road, prepared by National Transportation Planning and Research Centre (NATPAC), Kerala State Science, Technology and Environment Council, Government of Kerala

Manakkadu and Edappazhanji have resulted in the use of scarce road space for parking thus reducing the effective road width for moving traffic. Major parking demand corridors in the city are at:

- East Fort,
- Thampanoor,
- Statue,
- Vellayambalam,
- Sasthamangalam,
- Vazhuthacaud,
- Palayam,
- Pulimoodu,
- Over bridge,
- Power House Road,
- Museum,
- Medical College,
- Pattom,
- Peroorkada,
- Kesavadasapuram,
- Pazhavangadi and,
- Fort area

The concentration of commercial and institutional activities along the MG Road between Palayam and East Fort has generated heavy on-street parking demand on this section and its connector roads. TMC has identified three locations along the MG Road and one at Pattom for providing multi-level off-street parking facilities. The three locations identified along MG Road are:

- Statue area;
- Near G.P.O. junction; and
- Near Overbridge junction.

9.8 Traffic and Transportation Safety

In 2003, Thiruvananthapuram District had 350,455 registered motor vehicles, of which majority of them were in the city region. This suggests that on average, there are 106 motor vehicles for every 1,000 persons and 160 vehicles per sq. km of area. This is significantly higher than the State average (78 motor vehicles per 1,000 persons and 65 vehicles per sq.

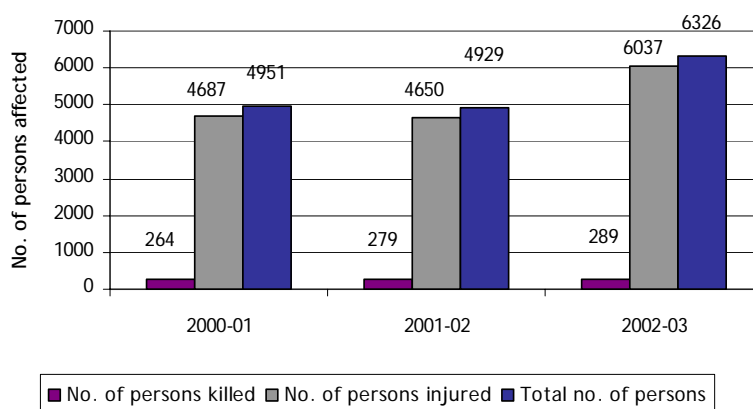
km area). During the period 1991-2003, the average annual growth of vehicle population was 11%. From 2001 to 2003 a declining trend is seen (9.30%)⁷.

Table 9.13: Details of Road Accidents in Thiruvananthapuram District

Sl No.	Year / Annual Growth Rate	Annual Growth Rate		
		Accidents (%)	Persons injured (%)	Persons killed (%)
1	2001-02	-0.71	-0.79	5.68
2	2002-03	14.63	29.83	3.58
Average Annual Growth Rate				
1	2001-03	6.96	14.52	4.63

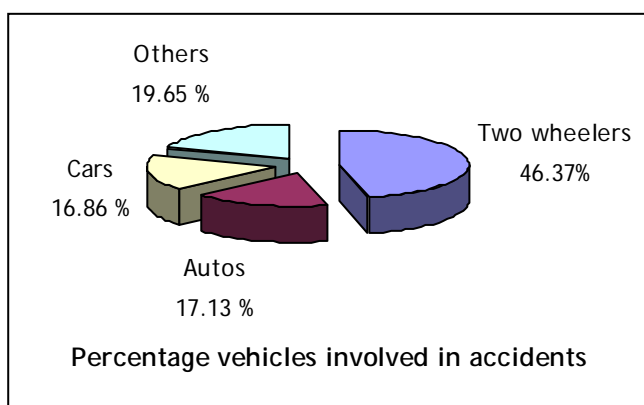
Source: Economic Review 2002 and 2003, State Planning Board, Govt. of Kerala.

Growth of motor vehicles and its pressure on the road network is significant, resulting in over utilization of road network in the region with frequent traffic problems like congestion and accidents. Available statistics indicate that road accidents are a major concern in Thiruvananthapuram District with 7% average annual growth rate during 2001-03.



Source: Economic Review 2002 and 2003, State Planning Board, Govt. of Kerala.

Out of the 4,662 accidents reported in Thiruvananthapuram district during the year 2002, about 39% of the accidents (1,818 accidents involving 2,616 vehicles) were from Thiruvananthapuram city. 58% of the reported accidents in



⁷ Compiled from Economic Review 2002 and 2003, State Planning Board, Govt. of Kerala.

Thiruvananthapuram city occurred at road junctions⁸. Of the 2,616 vehicles involved in city accidents, the major share was that of two-wheelers (1,213 vehicles) followed by three wheelers (448 vehicles) and car/jeep (441 vehicles). These three together constitute 80% of the total number of vehicles involved in accidents. Available accident analysis indicates that pedestrians (38.45%) and cyclists (10.19%) are the most affected persons in Thiruvananthapuram and together constitute 49% of the total road accident victims.

9.9 Street Lighting

Urban roads are generally provided with streetlights of different categories. As per the CES Study (2000), about 80% of major roads in the city are provided with adequate streetlights. Thiruvananthapuram MC maintains the streetlights through Kerala State Electricity Board (KSEB). Road inventory survey conducted under the PPTA at selected major roads, mostly in the outer-city area, revealed that roads are adequately lit with tubes (45%) and Sodium Vapour Lamps (51%). Average distance between lampposts on major roads was 39 m. About 19% of streetlights at selected road sections were not working due to delay in maintenance.

Table 9.14: Details of Street Light Availability at Selected Road Sections

Sl. No.	Road Section	Length (km)	No. of lights					Avg. space between street lights (m)	Lights not working on the survey day	
			Bulbs	Tubes	MVL	SVL	Total		No.	%
1.	Attakulangara-Manacaud-Thiruvallom Bypass Junction	5.20	2	12	101	-	115	45	18	15.65
2.	Karamana-Pangode-Peyad Section	8.15	2	115	113	-	230	35	49	21.30
3.	Kesavadasapuram-Ulloor - Kazhakootam Section	9.32	19	78	94	14	205	45	40	19.51
4.	Paruthipara-Ambalamukku Section	2.27	-	56	4	-	60	38	15	25.00
5.	PMG-Pottakuzhi Section	1.63	-	25	26	-	51	32	13	25.49
6.	Sasthamangalam-Vattiyookavu - Nettayam Section	5.06	2	33	107	-	142	36	26	18.31
7.	West Fort-Pettah-Anayara Section	5.35	4	109	59	-	172	31	27	15.70
8.	Anayara-Veli Section	2.40	1	28	7	-	36	67	6	16.67
	Total	39.38	30	456	511	14	1,011	39	194	19.19

Source: Primary Survey under PPTA, 2004.

⁸ Hand Book on Road Accident Statistics, (2004), NATPAC.

A few intersections and major road corridors, including the NH Bypass portion, are insufficiently lit. The existing maintenance system needs improvement as 20% of the street lights do not work or they lack maintenance. The Capital Region Road Development lays emphasis on providing adequate streetlights. The 42 km of city roads are proposed for widening and improvement under Thiruvananthapuram City Road Development Project, which is now under implementation.

9.10 On-Going and Proposed Projects

9.10.1 ON-GOING PROJECTS

Table 9.15: Thiruvananthapuram City Road Improvement Projects

SI No	Road description	Length (km)
1	Student centre – Vellayambalam – Kowdiar & Vellayambalam – Sasthamangalam	3.751
2	LMS – Attakulangara (MG Road)	3.37
3	Museum – Bakery Jn. - Thampanoor – Over bridge (Including Bakery flyover & Palayam underpass)	3.905
4	Asan Square – Pettah – Airport	9.503
5	Collectorate – Pattoor and Uppidamoodu – Sreekanteswaram	4.485
6	Nalumukku –Sreekanteswaram – Mele pazhavangadi – Choorakkattu Palayam	
7	Vanross - Oottukuzhy – Secretariat	1.42
8	Pattom – Marappalam – Kowdiar	2.3
9	Pattom –Medical College – Ulloor – Kochulloor	3.2
10	Kowdiar – Peroorkada – Vazhayila	3.473
11	Attakulangara – SreeVaraham - NH Bypass (Puthen Street)	1.47
12	Thakaramparambu to NH Bypass (Arat Road)	1.43
13	Murinjalapalam to NH Bypass (Poonthi Road)	3.76
	Total	42.067

Table 9.16: Road projects under KSUDP with ADB assistance.

SI No	Road description	Length (km)
A	Road upgrading	
1	NH Bypass – Veli Tourist Village road	1.90
2	PMG – Law College Junction	0.50
3	Peroorkada – Pipinmoodu – Sasthamangalam – Edapazhanji – Jagathy - Killipalam	8.10
4	Ulloor – Kesavadasapuram section of NH 47	1.00
5	Poojapura – Thirumala – Peyad road	5.80
6	Attakulangara – Manacadu – Thiruvallom – NH Bypass road	5.20
B	Street Lighting	
	Total	22.50

9.10.2 PROPOSED PROJECTS

Different agencies are involved in planning, construction and maintenance of the urban road network in Thiruvananthapuram region. Recently, a major thrust on road improvement was initiated through the Thiruvananthapuram City Road Improvement Project and other initiatives. These include:

- a) Under the Capital Region Road Development Program (through Kerala Urban Development Project and Kerala Road Fund Board under PWD (R&B)), 13 major road corridors covering 42 km are being widened (with improvements to 64 intersections and other road safety aspects) and another 52 km of access roads are being improved at a cost of Rs.2,000 million;
- b) Thiruvananthapuram Development Authority (TRIDA) road improvement schemes (improvement to Bakery-Poojapura Road, and Manacaud-Attukal-Chiramukku-Kaimanam Road);
- c) PWD (R&B), City Roads Schemes capacity augmentation to Ulloor-Aakulam Road;
- d) PWD (NH) scheme of widening Nalanchira-Kesavadasapuram-Plamoodu Section;
- e) Tourism Department schemes - Model Road Scheme for Kesavadasapuram-Pattom Section of NH 47 and improvements to the access road at Veli Tourist Complex.

9.10.3 Provision of transport to the poor

Other than the roads taken under slum area development and the transport facilities proposed, the roads in the City too directly benefit the poor. These Corporation roads are functioning as link roads to major traffic corridors through the arterial/radial roads considered in the CDP. Specific benefits of these roads to the poor will be discussed separately in the DPR.

9.10.3.1 Expectations of common citizens with respect to transport sector

The projects under the transport sector are prepared on the basis of a series of consultations made with various forums representing the public. Since transport sector issues are visible and experienced on a day-to-day basis, a large number of suggestions have come for this sector. Such suggestions are broadly appended to the CDP. The priority road components included in the CDP are derived based on these suggestions and the study of the road network system and the present and future traffic volume on these roads.

Generally the expectation of the citizens had been for a good road network with improved riding surface and capacity, good mass transportation facilities and specific off-street parking facilities.

Importance given to mass transport system by road and rail are expected to satisfy the travel needs of the common man. The thrust given to safety aspects in designing road improvement schemes and in building road safety awareness are further meant for a reassurance to the common man in meeting his travel needs.

9.10.3.2 Institutional issues

- Multiplicity

The transport sector development is possible only with the contribution of private and public sectors. Within the public sector, three broad sectors emerge – road, water and rail. Except rail, the other two sectors are developed / maintained with State intervention. Within the road sector itself, multiple agencies manage the roads viz. PWD (NH), PWD (B&R) and City Corporation. Each of these agencies has their own way of developing and maintaining the roads under them, in accordance with the functions of each.

- Overlapping responsibilities

Since there is a clear demarcation regarding the roads under each agency, the responsibilities of the agencies are also clearly defined. There is no overlapping of responsibilities.

- Coordination

Road sector as a whole expects to carry out the works in coordination with utility providers and agencies whose networks use road space. Coordination is required before construction, during construction and also after the construction. To enable such coordination under the Thiruvananthapuram Road Development Project a Road Protocol was drafted and approved. This example would be emulated.

- Institutional mechanism

Since the JNNURM will not support Land Acquisition (LA), and since some of the road development requires LA, there need to be an institutional mechanism to make the land available for road constructions. The form and constitution of such a mechanism will be finalized in consultation with the Government.

9.11 Key Issues and Challenges

- Various studies on traffic and transportation for the city and the city region have been undertaken in different contexts which have brought out the salient issues, which need to be tackled as short term measures and long term measures. Therefore it is possible to directly identify the priorities for project preparation and implementation.
- A few major activity nodes have either already developed or are being developed immediately around the city. These activity zones, which become major job providers, attract heavy traffic converging to them from the city. Therefore it is necessary to address the issue of improved connectivity to these development zones.
- Urban activities have a tendency to converge into the city centre causing increased traffic density and greater stress on infrastructure. This trend can be positively utilised for urban development if these new growth factors can be guided to selected

development corridors, which are planned and developed not only to accommodate these activities, but also to provide for the required infrastructure support.

- Road corridors which link to the regional roads should be prioritized for development and these radial links should be interconnected by ring roads. Such a network would avoid convergence of traffic unnecessarily to the city centre.
- Maximisation of the available ROW (right of way) of roads, by suitable rehabilitation measures and planned use of the road space avoiding non-traffic activities getting located within the ROW.
- Planned parking facilities for vehicles. The city does not generally have planned off-street parking spaces, whether at grade or multilevel. As a result of this precious road space is invaded for on-street parking, affecting traffic movement, especially in a situation where 70 percent of the roads have V/C ratio (volume capacity ratio) greater than 0.70. (Source: CTTS).
- Surveys reveal that the share of public (mass) transport system in the city region is only slightly more than 50 percent. This is decreasing every year. This results in the city roads being flooded with single passenger occupied vehicles, invading precious road space. This situation is due to various factors like, inefficiency of the existing bus transport system and vehicle market getting flooded with two and four wheelers luring the public with financial assistance. An efficient urban transport system has to attract at least 60 to 70 percent of the travelling public to the mass transport system. This would not only reduce traffic volume on the city roads, but would also reduce accident rate and reduce expenditure on road development and maintenance.
- High accident rate at the road intersections (junctions) – need for signalization of intersections where traffic volumes are high.
- ‘Status hazard’ of being a capital city – attracting frequent demonstrations and road blocks- always leading to ad hoc traffic diversion measures – lack of ‘intelligent transport systems’.
- Increasing road accidents.
- Poor road lighting.
- Inadequate pedestrian facilities.
- Need for greater coordination of agencies / departments.

9.12 Vision Goals and Strategies

Vision

Thiruvananthapuram Capital City aspires to have a road network with an efficient transport system linking residential zones, work places, commercial centres and recreational places providing safe, fast and affordable travel which pollutes little and which contributes to the urban environment .

The following goals are set towards realizing the vision:

Road safety: To bring down the average rate of growth of accidents from 7% to 0% in 15 years.

Speed of traffic: To achieve average speed of 30 to 35 km per hour in peak hours in the main traffic corridors of the city in 7 years

Public transport system: To increase the share of public transport system from the present 35% in the city area to 50% in 15 years.

Strategies

1. Thiruvananthapuram City Road Improvement Project which is under implementation has prioritized a few road stretches, selected from the road network study carried out under CTTS, for widening and improvement. If this project has to become effective it is necessary to select some more road stretches for widening and improvement;
2. It is necessary to strengthen the linkages of the city roads with the regional roads;
3. It is imperative to improve connectivity to the development zones and also to improve the road network within the development zones;
4. Roads which are important in the city road network and which are not considered for widening and improvement on priority must be considered for total rehabilitation, by removing obstructions, removing encroachments, maximizing utility of available ROW, providing pedestrian facilities and road furniture and improving the service networks under the road surface;
5. Effecting substantial improvements to Mass Transport Systems;
6. Improvements to road intersections;
7. Improvements to rail transport;
8. Better mode change transport facilities to and from airport, railway stations, and bus terminals;
9. Establishing water transport facilities; and
10. Due importance for environment and greenery in transport projects.

9.13 Priority Project Components

A. Projects that strengthen linkages with regional roads

- | | | | |
|------|--|------|-------------|
| i. | Kesavadasapuram-Ulloor-Kochulloor-Sreekariam | | |
| | – 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 – Vattiyurkavu- Nettayam – Vazhayila – Kudappanakunnu road	10.50 km	3 lane road
xv.	Manacaud – Attukal – Kalady – Maruthoorkadavu	3.50 km	Std. 2 lane
xvi.	Ambalamukku – Muttada – Paruthippara	2.00 km	3 lane road

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

NH Byapass – Kulatur – Engineering College – Sreekariam – Poudikonam – Mannanthala – Kudappanakunnu – Peroorkada – Vattiyoor kavu – Thirumala – Thrikkannapuram – Kaimanom– Maruthoorkadavu – Thiruvallam NH Bypass.

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.

N H 47 from Mangalapuram – Pothencode - Kanyakulangara – Karakulam – Kachani – Vellaikadavu – Peyad – Pallichal- N H Bypass - Vizhinjam crossing N H Bypass

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 – CheriyaKonni
- i. Myladikadavu
- 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. At least 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., Vellayambalam, Sreekariam, 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 & Vellayambalam – 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 upto 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 atreets 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 service person and an information centre.

9.14 Broad Costing and Phasing

TRAFFIC AND TRANSPORTATION – INVESTMENT PLAN (Rupees Crores)

Table 9.17: Broad costing and phasing for Traffic and Transportation

Sl. No	Components	Cost (in Rs. Crores)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
A	Projects that strengthen linkages with NH & regional roads 26 km @ Rs 2.50 crores per km	65.00	5	15	20	25		
B	Projects for improvement of major links in the city road network 53 km @ Rs 2.5 crores per km	106.00	5	15	20	30	30	06
C	Intermediate and inner ring road	211.00	DPR	15	20	50	75	51
D	Outer ring road for city region	231.00	DPR	15	30	70	85	31
E	Development of roads in and around major activity zones - Kazhakuttom, Chackai -Airport - Kochuveli, Vizhinjam, Kudappanakunnu, Medical College Hospital, Karakulam & Peyad	75.00	5	10	15	15	15	15
F.	Dedicated two-lane road connectivity from Vizhinjam Port to National Highway (parallel to NH by-pass) exclusively for container movement (30 km) @Rs.7 crores per km	210.00	DPR	DPR	50	60	50	50
G	Construction/ Reconstruction of Road Bridges	36.00	6	10	10	10	-	-
H	Truck Terminals - Vallakadavu, Chalai & Enchakkal	8.00	2	3	3	-	-	-
I	Grade Separators - flyovers & underpasses	130.00	DPR	20	30	50	30	-
J	Parking facilities for vehicles(at grade & multi level)	54.00	4	15	21	10	-	-
K	Pedestrian facilities - foot over bridges, sub ways, at grade crossing facilities, foot paths	72.00	2	20	20	30	-	-
L	Public Transport System Improvement							
i	LRTS /EMU train from Kazhakuttam - Anayar - Air port - Manacaud - Chalai - Killipalam (1st phase) 12 km including Feasibility study & DPR @ Rs. 65 crores per km	780.00	DPR	20	60	200	300	200
ii	LRTS / EMU train / additional link to Ulloor	369.25	DPR	50	100	100	100	19.25
iii	Introduction of HCBS (High Capacity Bus System) along selected corridors and regulation to discourage personal vehicles along these road corridors (Feasibility studies & Implementation through PPP)	100.00	DPR	50	25	25	-	-

Sl. No	Components	Cost (in Rs. Crores)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
iv	Quality up gradation of KSRTC services							
	HR training	5.00						
	Improvement of existing infrastructure like bus depots, workshops	40.00	10	30	50	50	50	40.60
	Computerisation of depots and corporate office	5.60						
	Augmentation and replacement of old buses	180.00						
v	Bus terminals (for KSRTC & Private Buses)							
	Upgradation of Thampanoor bus stand & new bus stand at Enchakkal	30.00						
	Kochu Veli, Kodappanakkunnu, Kovalam, Thirumala, Medical College	10.00	5	10	10	10	10	-
	Construction of Operating Terminals for private long distance omni buses	5.00						
vi	Development of Railway stations							
	Pettah	IR						
	Kochu Veli	IR						
	Augmentation of infrastructure facilities at Trivandrum Central Railway Station	IR						
vii	New rail link to Vizhinjam from Balaramapuram	16.00		DPR	10	6		
viii	Commuter trains between Neyyattinkara and Varkala	IR						
ix	Inland Water Transport Sector							
a	Improvement of Kovalam to Veli section of WCC for navigation	7.26	3	4.26	-	-	-	-
b	Waterway development from Kovalam to Kolachal	142.00	DPR	2	40	50	50	-
c	Waterway connection to airport	5.00	-	5	-	-	-	-
	Total (Public Transport System Improvement)	1698.11	18	171.26	295	441	510	259.85
M	Projects for road rehabilitation & maintenance							
i	Mobile road repair units (Private participation)	5.00						
ii	Rehabilitation of TMC roads - secondary roads (400 km) @ Rs.50 lakhs per km	200.00						
iii	Heavy maintenance of TMC roads - secondary roads (600 km) @ Rs.30 lakhs per km	180.00						

Sl. No	Components	Cost (in Rs. Crores)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
iv	Rehabilitation of PWD roads (150 km)	210.00						
v	New footpaths by covering drains with RCC slabs, and providing service ducts for all major roads for cables and pipes	20.00						
	Total (Projects for road rehabilitation & maintenance)	615.00	15	100	150	150	100	100
N	Traffic Management							
i	Bus bays with shelter (100 nos)	3.00						
ii	Signal system in identified intersections (50 nos)	6.00						
iii	Intelligent transport system for the project area Seed Capital for establishing Capital Region Transport Authority	135.00						
iv	Capacity Building: Training Institute for Road Users (under NATPAC)	30.00						
v	Enforcement & monitoring, Camera Stations, Centralised traffic regulation	10.00						
	Total (Traffic Management)	184.00	14	50	50	50	20	-
O	Projects for Environmental Management							
i	Erosion protection cum road (15 km)	37.5						
ii	Green Corridors							
	Planting of suitable trees on and off the streets	1.00						
iii	Ornamental and information gates to the city at 7 locations	0.28						
iv	Pollution control							
	CNG conversion of public transport vehicles	55.00						
	Providing public utilities near high density pedestrian areas (25 nos)	0.65						
	Total (Projects for Environmental Management)	94.43	5	20	20	20	20	9.43
	Grand Total	3786.54	81	479.26	758	1011	935	522.28