Chapter V

TRAFFIC AND TRANSPORTATION

The rapid growth of population in the Chennai Metropolitan Area (CMA) has been causing a strain on the existing urban services and infrastructure, for want of expansion and better management. The transport sector is vital and needs carefully planned expansion to meet the demands of the increasing population.

5.02. The need to take an integrated long term view of transport needs of CMA and to plan road development, public transport services and suburban rail transport, as a part of the urban planning process, have been well recognised.

5.03. A résumé of the changing travel characteristics of the metropolis and the growth of sea and air traffic which have a bearing on the quality of the road and transport infrastructure are indicated in the Annexure I.

5.04. Many studies have been done in the past for development of transportation in CMA. These include Madras Area Transport Study (MATS - 1968), Integrated Transport Plan (1977), Madras Route Rationalisation Study (1986), Traffic and Transportation Study for MMA (Kirloskar 1986), Comprehensive Traffic and Transportation Study (CTTS 1992-95) and other studies done through consultants for specific transportation projects. Based on the recommendations of these studies several major projects such as formation of Jawaharlal Nehru Salai (IRR) , addition of buses, improvements to Metropolitan Transport Corporation (MTC) infrastructure, Mass Rapid Transit system (MRTS) etc have been implemented. But these efforts have not kept pace with the increase in travel demand. A list of major efforts taken is indicated in the Annexure II.

5.05 Major recommendations of some of the recent studies which qualify for implementation on their merits are summarised below. These studies also assisted in the development of a matrix comparing the system characteristics of various alternative transit technologies which is embodied in Annexure III.

CTTS for CMA, RITES Ltd., PTCS & KCL September 1995 & Updating the CTTS (1992-95), RITES Ltd., April 2004

5.06. The comprehensive Traffic and Transportation Study (CTTS) for CMA undertaken through a consortium of consultants, M/s. RITES and M/s. KCL, commenced in May 91 was completed in 1995. The expatriate consultant, W.S. Atkins Planning and Management Consultants Limited, U.K. provided technical assistance for the study. The cost of the

study, which was Rs.9.75 m, was shared partly by the GoI and partly under Technical Assistance component of TNUDP I. The schemes from the study report have been included in the Chennai Metropolitan Development Plan (CMDP).

5.07. The Study provided the core inputs for predicting the future travel demand for the CMA. The travel demands in 2004, 2006, 2011, 2016, 2021 & 2026 have been projected on the basis of increase in per capita trips (from 1.32 in 2004 to 1.6 by 2016 and 1.65 by 2026). Table no. 5.01 gives 3 scenarios based on different modal splits between the road and rail system. The 3 scenarios have been worked out gradually increasing the share of the public transport between the public and private transport modes and also increasing the share of the rail transport between the bus and rail modes. Scenario 2 has been selected based on the following assumptions.

i) The modal split between public and private transport will change from 43:57 to 35:65 (2004), 55:45 (2011) and 60:40 (2016), 65:35 (2021) and 70:30 (2026) in line with the trend in share of public transport increasing with City size.

ii) The sub-modal split between bus and rail will have to change from 91:9 to 85:15 (2004), 75:25 (2011), 70.30 (2016), 65:35 (2021) and 60:40 (2026) if the road transport system is not to break down in the context of increased commuter trips.

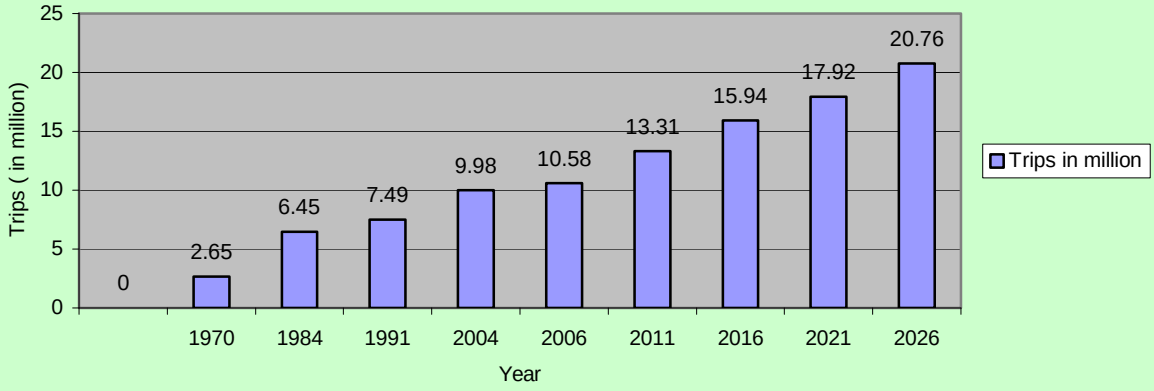
'able No. 5.01: Projected daily trips by public transport

		1991	2004	2006	2011	2016	2021	2026
1. Population in lakh		58.07	75.61	78.96	88.71	99.62	111.98	125.82
2. Daily per capita Trips		1.29	1.32	1.34	1.5	1.6	1.6	1.65
3. Total Daily Person Trips in lakh		74.91	99.81	105.81	133.07	159.39	179.17	207.60
Scenario 1 Modal Split %	Private	57	64.57	60.00	50	45	40	35
	Public	43	35.43	40.00	50	55	60	65
Total Daily Person Trips by Public Transport in lakh		32.21	35.36	42.32	66.53	87.67	107.50	134.94
	By Rail %	9.25	14.54	16.00	20	25	30	25
	By Road %	90.75	85.46	84.00	80	75	70	75
Daily Trips in lakhs								
	By Rail	2.98	5.14	6.77	13.31	21.92	32.25	33.74
	By Road	29.23	30.22	35.55	53.23	65.75	75.25	101.21

Scenario 2 Modal Split %	Private	57	64.57	55.00	45	40	35	30
	Public	43	35.43	45.00	55	60	65	70
Total Daily Person Trips by Public Transport in lakh		32.21	35.36	47.61	73.19	95.64	116.46	145.32
	By Rail %	9.25	14.54	16.00	25	30	35	40
	By Road %	90.75	85.46	84.00	75	70	65	60
Daily Trips in lakh	By Rail	2.98	5.14	7.62	18.30	28.69	40.76	58.13
	By Road	29.23	30.22	39.99	54.89	66.94	75.70	87.19
Scenario 3 Modal Split %	Private	57	64.57	50.00	40	35	30	25
	Public	43	35.43	50.00	60	65	70	75
Total Daily person Trips by Public Transport in lakh		32.21	35.36	52.90	79.84	103.60	125.42	155.70
	By Rail %	9.25	14.54	20.00	30	35	40	45
	By Road %	90.75	85.46	80.00	70	65	60	55
Daily Trips in lakhs	By Rail	2.98	5.14	10.58	23.95	36.26	50.17	70.07
	By Road	29.23	30.22	42.32	55.89	67.34	75.25	85.64

Source : *CTTS(MMDA, RITES, KCL & PTCS, 1992-95) & Short term study to updateCTTS (1992-95)(CMDA, RITES & PTCS, 2004)*

Fig.No. 5.01 Growth of Travel Demand in CMA

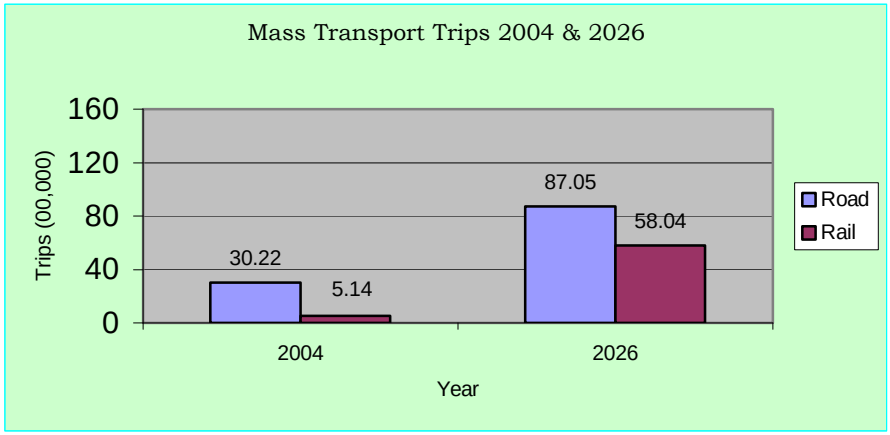


5.08. It will be seen from the Table no.5.01 that the number of trips carried by bus transport in 2004 would become nearly 2.8 times in the year 2026. Similarly the volume of passengers to be carried by rail transport will be nearly 11 times the present volume.

(in lakhs)

Table No. 5.02: Mass Transport Trips 2004 & 2026		
Mass Transport Trips (in lakhs)	2004	2026
Total Mass Transport Trips	35.36	145.09
Increase in 22 years	-	109.73
Total road (bus trips)	30.22	87.05
Increase in 22 years	-	56.83
Total rail trips	5.14	58.04
Increase in 22 years	-	52.90

Source: Short term study to update CTTS (1992-95)(CMDA, RITES & PTCS, 2004)



Detailed Project Report, DMRC & RITES, October 2007

5.09. Following a detailed feasibility study at a cost of Rs.5.4 m undertaken through Delhi Metro Rail Corporation (DMRC) GoTN have retained DMRC for preparing detailed project report at a cost of Rs.33 m for development of metro rail for Chennai for implementation during 2007- 2012. The gist of the DPR is as below:

Corridor-1: NH-45 (Airport) – Guindy – Sardar Patel Road – Kotturpuram High Road – Cenotah Road – Anna Salai – Gemini – Spencers – Tarapore Towers – Along Cooum River upto Rippon building – Central Station – Broadway (Prakasam Road) – Old Jail Road – Tiruvottiyur High Road (upto Tiruvottiyur).

Corridor – 2: Along Poonamallee High Road (Corporation limits) – EVR Periyar Salai – Rajaji Road (North Beach Road) covering Koyambedu – Anna Nagar Arch – Aminjikarai – Kilpauk Medical College – Egmore – Central-Fort-Beach.

Description	Underground		Elevated		Total	
	Length (km)	No. of Stations	Length (km)	No. of Stations	Length (km)	No. of Stations
Corridor 1	14.250	11	8.805	7	23.055	18
Corridor 2	-	-	23.449	19	23.449	19
Corridor 1 & 2	14.250	11	32.254	26	46.504	37

Options	Corridors	Cost including taxes @ 2007 price Rs. in m
Option I *(Recommended)*	Corridor 1 *(Underground from Washermanpet to Saidapet and remaining length up to Chennai Airport elevated)*	56890
	Corridor 2 *(elevated)*	33430
Option II	Corridor 1 *(underground)*	74080
	Corridor 2 *(elevated)*	79780

Detailed Project Report on Hybrid Mono Rail System for Chennai, Metrail India Private Ltd., November 2004

5.10. A detailed project report undertaken by a consortium of Metrail India (p) Ltd. has established the feasibility for development of hybrid monorail system for Chennai for a length of 25 km comprising parts of Periyar EVR salai and Anna salai at a cost Rs.9470 m. It recommended implementation of the project over a period of 27 months. Since the same corridors are being considered subsequently for development of metro rail, the project has not so far been implemented.

Infrastructure Development Plan for Ennore Area, CMDA, May 1999

5.11. At the instance of GTN, CMDA prepared an infrastructure development plan for Ennore area. The inputs for the Plan were collected from the agencies concerned and industries through a Core Group chaired by the Chief Planner. The cost of implementing the Plan was estimated at Rs.51620 m. The draft plan was presented before the High Level Official Committee for Major Infrastructure Projects in Tamil Nadu chaired by Chief Secretary to GoTN in Mar.1999. The schemes under the Plan have since been included in the Infrastructure Investment Plan for the CMA (now termed as CMDP) and the on-going TNUDP III.

MRTS Ph.III (Velachery to St.Thomas Mount), RITES Ltd., May ,2000

5.12. CMDA retained the services of M/s. RITES in February '97 for carrying out a short-term study for establishing the feasibility of the alignment proposed for MRTS from Velachery to Villivakkam for a distance of about 25 km. The cost of the Study was Rs.0.75 m. The consultancy report was approved by the Authority in Mar.2001. As a follow-up, the first stage of the MRTS Phase III (now termed as extension of MRTS phase II) envisaging the elevated MRTS on single pillars along the median of the IRR, projectised at a cost of Rs.4160 m, has since been approved by GoI in Feb.2007 for joint implementation with GoTN. The project has since been commissioned by MTP®.

Densification of MRTS Corridor Development, L&T-Ramboll, October 2001

5.13. The feasibility study on densification of MRTS corridor development undertaken in 2001-03 indicated that the daily transit ridership on the MRTS corridor could be increased to 3.86 lakh trips in 2006, 6.62 lakh trips in 2011 and 11.86 lakh trips in 2021 by allowing a modest density of 400 persons / ha and other minimal intervention. Based on the recommendations necessary changes in the development regulations and land use planning have since been incorporated.

Infrastructure Investment Plan for CMA, CMDA, February 2003

5.14. The investment plan termed Chennai Metropolitan Development Plan (CMDP) to be implemented in the short term (one year), medium term (3years) and long term (5-10 years) comprised urban transportation schemes to be implemented in the short- term at a cost of Rs.6726.3 m, the medium-term at a cost of Rs.34600.2 m and in the long-term at a cost of Rs.61135.6 m. Works on CMDP commenced in 2003- 2004 with budgetary support by GoTN. In tandem with investments by GoTN, a shelf of short and medium-term traffic and transportation subprojects culled out from CMDP (and validated through a quick study to update CTTS (1992-95))has since been included in the on-going TNUDP III at a cost of USD 150 m.

Study on Parking Requirements for CMA, Wilbur Smith Associates Pvt. Ltd., Nov. 2003

5.15. CMDA has undertaken a two-stage parking study for the CMA. The first stage study has principally focused on the problems of parking across the CMA and drawn up a comprehensive parking policy for the CMA as a whole. The upshot of the study is outlined as follows:

(a) Based on field surveys covering 360 critical stretches, the total peak parking demand in the city is in the order of 13,000 PCE against a supply of 5100 PCE. For example the supply in T. Nagar is 794 PCE against a demand of 2151 PCE and the supply in Parrys is 704 PCE against a demand of 4426 PCE. The haphazard parking has led to loss in the road capacity that ranges between15% to 60%.

(b) While the field studies on on-street parking covered 27 critical areas, it covered 15 areas outside City. The field studies also covered parking provided at major industrial areas, various educational institutions, religious places, recreational centres, hospitals, bus terminals and rail terminals.

(c) After taking stock of the entire parking problems and issues in the CMA, the study recommended a parking policy for Chennai on the basis of best practices followed both inside and outside the country. The thrust of the recommended parking policy is as follows:

(i) Short-stay parking is preferably located in proximity to trip destinations and protected from long-stay parkers;

(ii) Institutions (e.g. education institutions), industrial establishments, commercial complexes, cinema theatres, kalyana mandapams, entertainment halls, hotels and restaurants should provide adequate off-street parking facilities for employees, visitors etc;

(iii) Commuter parking should be provided at the railway stations and at the MTC bus terminals by the respective authorities to facilitate the commuters to adopt the park and ride concept;

(iv) Multi level parking (ramp type and mechanical parking) facilities should be planned and developed at suitable locations;

(v) Considering the existing road network and the growth trend in the private vehicle population, it is necessary to bring down the demand on parking spaces, both on-street and off-street;

(vi) Since transportation is a function of land-use, allocation of spaces for various land-uses within the CMA could be done with a view on reducing the use of private motorised vehicles such as high dense developments, exclusive commercial neighbourhoods;

(vii) Parking pricing should be judiciously devised to manage parking problem on the demand side. Till the proposed Unified Metropolitan Transport Authority (UMTA), is formed the agencies / departments which are currently looking after parking related issues should be facilitated to perform their expected roles effectively and in a co-ordinated manner;

An effective institutional structure is necessary to implement the various provisions of the parking policy discussed above.

(d) A critical element of the parking policy is to evolve off-street parking standards for various activities, which would become ultimately part of the Development Regulation of the Master Plan for the CMA. With an objective of promoting transit ridership, a special set of parking standards for the influence area of rail corridors have been suggested where lesser parking standards has been mooted. Separate set of standards has thus been evolved for (i) the areas falling within Corporation limits, Municipalities and IT corridor, (ii) panchayat areas and (iii) transit corridors.

(e) These have since been incorporated in the Development Regulation.The study has also drawn up short-term strategies and solutions for managing the parking problems in the CMA. Recognising the urgency to increase the supply of parking space particularly at critical traffic generating locations, a 6- month long consultancy study has been commissioned in June 2005 through M/s. MEKON to prepare detailed project reports for development of multi-level parking complexes on public-private partnership at 6 locations at a total cost of Rs. 2.1 m. Based on the DPRs, schemes at a cost of Rs.929.8 m have since been included in the the Master Plan II.

Feasibility Study for Development of the Outer Ring Road in CMA, TNRDC / SOWIL, May 2007

5.16. The consultancy study undertaken by CMDA (through TNRDC and SOWiL) at a cost of Rs.6.71 m established the feasibility of implementing the 62.3 km long ORR project as a multi-modal corridor with area development on the western side to a depth of 50 m. The approximate cost of constructing the road with 2-lane divided carriageway with service road and footpath on either side in the first phase is estimated at Rs.9000 m. Based on the Study, action is being pursued for implementing the project with external assistance from JBIC through a SPV.

5.17. For the purposes of reestablishing or validating the need for most or all the major capital-intensive schemes enlisted for implementation in the medium or long term (which have been contained in the volume I of the Master Plan II), it is desirable that appropriate studies are taken up in course of implementation of the Master Plan II. The list of such studies, though not exhaustive shall include the following:

- Comprehensive Transportation Study for Chennai (CTS): The 18-month long study at a cost of Rs.16.2 m has just commenced with World Bank assistance. The broad terms of the study are indicated in the Annexure IV.
- Detailed Engineering Survey for construction of ORR: Once a SPV is floated by the TNRIDC, it would undertake the study through the consultants.

- Detailed feasibility study for the 3rd corridor for the proposed metro rail.
- Preparing a comprehensive road plan for the Outer-CMA as a whole with a grid of say 2 km x 2 km.
- Detailed feasibility study for the proposed elevated highways along City waterways.
- Detailed feasibility study for the elevated highways proposed along other corridors.
- Detailed feasibility study for the freight corridors proposed along selected corridors.
- Detailed feasibility study for the new out-station truck terminals proposed at the intersections of ORR with NHs and SHs.
- Detailed feasibility study for new rail lines in and around CMA.
- Detailed feasibility study for the primary and secondary road network immediately outside CMA but within the region.
- Study establishing the feasibility of the waterways in CMA as inland transport corridors.
- Study establishing the feasibility of the operation of hovercraft along the seacoast.
- Detailed feasibility study establishing the suitability of alternative transit systems customized to the specific corridors.
- Rationalization of bus routes in the context of the corridor(s) of the proposed metro rail.
- Detailed project report for all the corridors identified for full-fledged / partial BRT.
- Detailed project report for the next package of multi-level parking (with or without Government owned land).
- Planning a network of pedestrian-ways / malls / parkways.
- Planning a network of cycle-ways.
- Detailed study to review the adequacy of parking standards.

Annexure I

Travel characteristics of CMA

1. The modal preferences of the commuters in the CMA are best characterised in that in a group of 100, 26 travel by bus, 2 by train, 33 by walk, 13 by cycle, 19 by two wheeler, 4 by car and 3 by other modes (vide Table -1).

Table 1: Daily average person trip distribution by mode in CMA

(Trips in million)

Sl. No.	Mode	No. & percent of total trips by mode									
		1970		1984		1992		2004		2005	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Bus	1.10	41.5	3.074	45.5	2.84	37.9	2.89	29.0	2.47	25.8
2	Train	0.30	11.5	0.610	9.0	0.31	4.1	0.50	5.0	0.24	2.5
3	Car/Taxi	0.08	3.2	0.103	1.5	0.11	1.5	0.40	4.0	0.36	3.8
4	Fast TW	0.04	1.7	0.219	3.2	0.52	7.0	1.80	18.0	1.83	19.1
5	Auto rickshaw	-	-	0.024	0.4	0.16	2.2	0.20	2.0	0.29	3.0
6	Bicycle	0.57	21.3	0.720	10.7	1.06	14.2	1.30	13.0	1.23	12.8
7	Cycle rickshaw & others	0.00	0.1	0.105	1.6	0.24	3.5	0.10	1.0	0.03	0.3
8	Walk	0.55	20.7	1.895	28.1	2.21	29.5	2.79	28.0	3.14	32.7
	TOTAL	2.65	100.0	6.750	100.0	7.45	100.0	9.98	100.0	9.59	100.0

Source: MATS (1968-69), Short-term Traffic Improvement Programme Report (MMDA & KCL, 1984) & CTTS (MMDA, RITES, KCL & PTCS, 1992-95), & Short term study to updateCTTS (1992-95)(CMDA, RITES & PTCS, 2004), HHI Survey of the DPR for the Chennai Metro Rail Project, DMRC, 2005

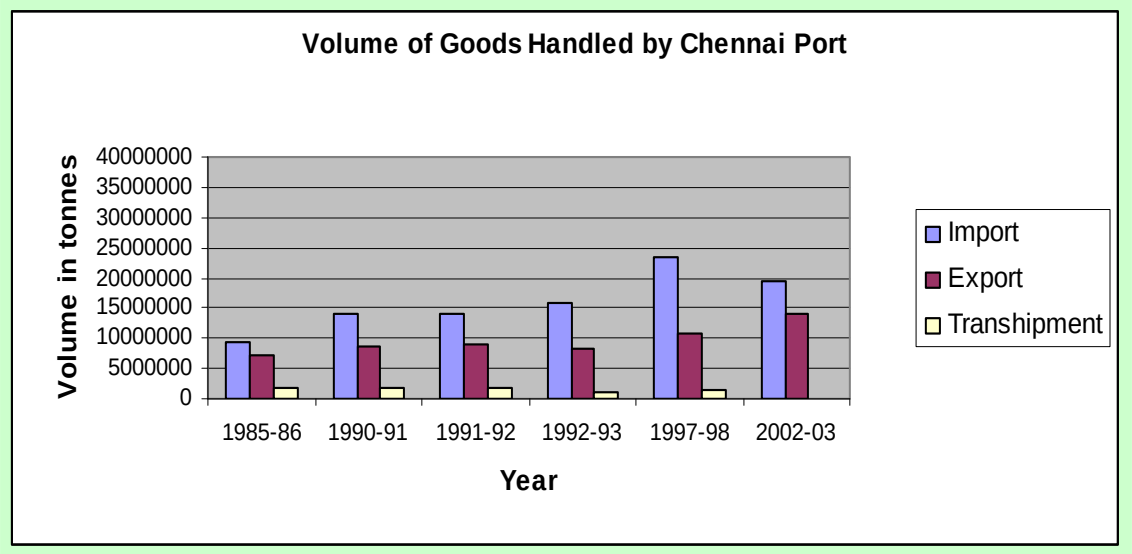
2. The growth of sea and air traffic is briefly described as below:

Seaport terminals

3. The Chennai Port Trust (CPT) located in the CBD handled 33.69 million tonnes in 2002-2003. While the imports increased from 1.8 million to 19.61 million tonnes for the period 1951-52 to 2002-2003 registering a growth of 989%, the exports increased from 0.3 million to 14.1 million for the same period registering a growth of 4600%. Of the total import and export the foreign traffic handled accounts for 93% and the coastal traffic 7% for the year 2002-2003. While mineral oils and other POL account for 41% of the imports, iron-ore accounts for 56% of the exports (2002-2003). The imports are predominantly from south-east Asian countries accounting for 41% and the exports are made predominantly to Japan accounting for 14% (vide Table - 2).

Table 2: Growth of Cargo Traffic in Chennai Port				
Year	Import	Export	Transshipment	Total (tonnes)
1951-52	1,775,134	279,157	--	2,054,291
1956-57	1,895,703	607,851	--	2,503,554
1961-62	2,268,853	1,198,290	--	3,467,143
1969-70	3,535,771	2,904,372	192,277	6,632,420
1974-75	4,760,511	3,155,479	--	7,915,990
1980-81	6,412,177	3,962,562	72,736	10,44,475
1985-86	9,303,071	7,040,719	1,802,902	18,146,692
1990-91	14,124,933	8,642,713	1,749,944	24,517,590
1991-92	14,182,056	9,100,779	1,763,348	25,046,183
1992-93	15,680,715	8,439,962	1,209,354	25,330,031
1997-98	23,352,921	10,825,638	1,352,450	35,531,009
2002-03	19,605,661	14,081,445	--	33,687,106

Source: Annual Report, Chennai Port Trust, 2004



4. CPT handled container traffic to the tune of 424,665 TEUs in 2002-2003, which is 23.3% more than that handled in the previous year. Some of the salient performance of the CPT includes exporting 8,432 cars in 2002-2003, which is 103% more than that handled in the previous year. The Railways handled 12.3 tonnes of cargo traffic through 5,24,320 wagons from the Port. A total of 1692 merchant vessels and 387 Government vessels entered the Port during the year (vide Table -3).

Table 3 : No. of vessels entered during 2002 - 2003		
S.No.	Classification	No. of ships
1	Foreign	1,111
2	Coastal	581
3	Government	387
	Total	2,079

Source: Annual Report, Chennai Port Trust, 2004

5. The Ennore Port Limited (EPL), developed as a satellite port to CPT, is the 12th major port in India and the first corporate port in India. Designed to develop 22 berths to handle a variety of bulk,liquid and container cargo,EPL has 3.775km channel (250m wide and 16m deep) to capable of handling 65,000-77,000 DWT vessels. The EPL commenced commercial operations on 22.6.2001. It presently handles around 10m tonnes of thermal coal per annum.

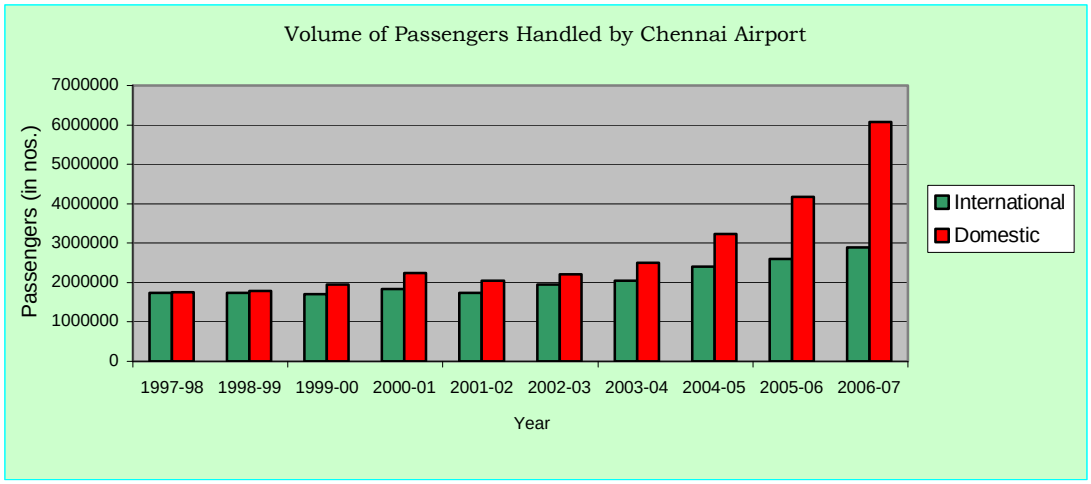
Airport terminals

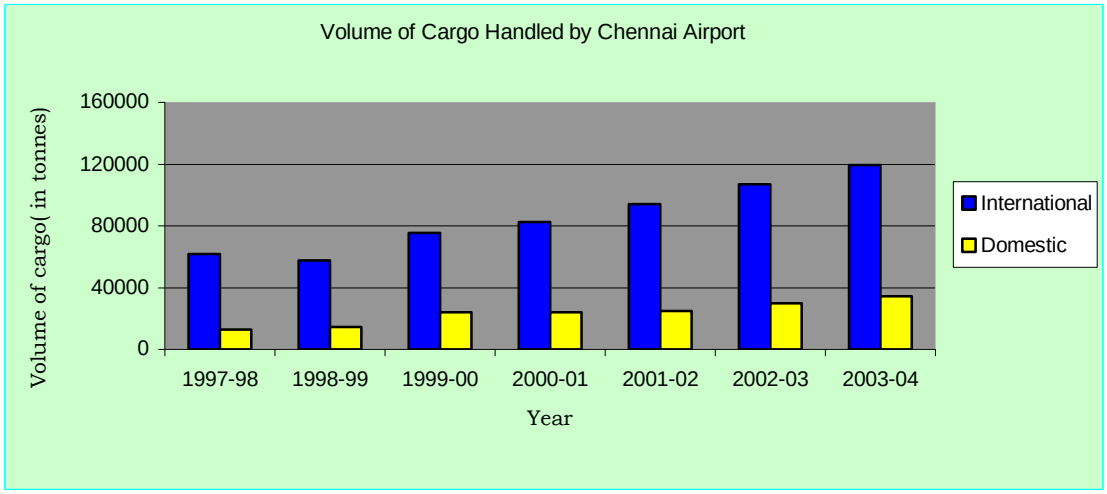
6. Chennai has a national air terminal viz. Kamarajar Domestic Terminal and an international terminal viz. Anna International Terminal located at Meenambakkam. Totally 20 international flights per day are operated from Chennai. While the growth of international traffic is 5%, that of the national air traffic is 7%. The AAI imports 44,000 to 51,000 tonnes of cargo per year and exports 63,000 to 68,000 tonnes per year. While the growth of international passenger movement is 17.8% for the period 1997-98 to 2003-2004, the growth of passenger traffic within the country is 42.5%. Similarly the growth of international cargo movement is 93% for the same period and that within the country is 167% (vide Table -4).

Table 4: Growth of air traffic in Chennai				
	Year	International	Domestic	Total
Aircraft movements (Nos.)	1997-98	10862	20231	31093
	1998-99	11169	19813	30982
	1999-00	11080	23531	34611
	2000-01	12063	25293	37356
	2001-02	12398	25673	38071
	2002-03	14490	29863	44353
	2003-04	14515	36749	51264
	2004-05	18111	43122	61233
	2005-06	21155	47900	69055
	2006-07	23567	76162	99729
Passenger movements (Nos.)	1997-98	1744037	1755854	3499891
	1998-99	1736021	1788005	3524026
	1999-00	1702534	1945587	3648121
	2000-01	1837954	2235011	4072965
	2001-02	1741458	2042784	3784242

	2002-03	1947937	2213409	4161346
	2003-04	2054043	2501778	4555821
	2004-05	2400670	3233256	5633926
	2005-06	2606638	4173345	6779983
	2006-07	2895930	6078196	8974126
Cargo movements (Tonnes)	1997-98	61902	12925	74827
	1998-99	57646	14304	71950
	1999-00	75423	24185	98608
	2000-01	82316	23930	106246
	2001-02	94171	24941	119112
	2002-03	106834	29825	136659
	2003-04	119563	34560	154123

Source: Airport Authority of India, 2004 & Sep. 2007





Annexure II

List of major efforts taken

1. Various measures taken to improve and strengthen the transport supply in CMA in the past include:

a) Procurement of about 305 buses under Madras Urban Development Project MUDP-I, 915 buses under MUDP-II and 1600 buses under Tamil Nadu Urban Development Project (TNUDP) through PTC and DATC (now merged into MTC) was made at a cost of about Rs.63 m, Rs.221 m and Rs.927.50 m respectively.

b) In addition, 3 bus depots and 8 terminals were constructed during MUDP-I and 10 bus depots/terminals under TNUDP.

c) The following rail projects were implemented by Southern Railway.

i) Quadrupling Chennai-Arakkonam B.G. Line (upto Pattabiram);
ii) Gauge conversion of Chennai Beach - Tambaram - Chengelpattu lines including optimisation of the line (by replacing road/rail level crossings by overpasses or underpasses) (under implementation);
iii) Development of Mass Rapid Transit System (MRTS) from Chennai Beach up to Thirumylai for a length of 8.5 km in the I Phase at a cost of Rs.2690 m commissioned in 1997; and
iv) Commissioning of II phase of MRTS from Thirumylai to Velachery (11.165 km) at cost of Rs.7690m on 19, Nov. 2007

2. Critical bottlenecks in the road network have been improved under MUDP I (Rs.15.20 cr), MUDP II (Rs.63 m) and TNUDP (Rs.839 m) through Department of Highways (DoH) and Chennai Corporation (CoC). These included forming an inner ring road for a length of 17.5 km initially and dualling its carriageway subsequently. The balance of it comprising the northern segment for a length of 12.5 km has been formed and the southern segment for a length of 6 km. is being formed. The First phase of Chennai Bypass connecting NH 45 and NH 4 for a length of 19 Km at a cost of Rs.900 m has already been completed and commissioned in November 2002. Development of Chennai Mofussil Bus Terminal (CMBT) at Koyambedu has been completed at a cost of Rs.1030 m and commissioned in Nov. 2002. Chennai City Contract Carriage Bus Terminal (CCCBT) has also been constructed and commissioned. Improvements to radial roads in and around CMA have been carried out for a total length of 250 km at a cost of 2120 m.

3. The major road and rail investments proposed for the future comprise the following:

a) Extension of MRTS Phase II from Velachery to St.Thomas Mount for a length of 5 Km at a cost of Rs.4160 m;
b) Development of II phase of Chennai Bypass from NH4 to NH5 for a distance of 13 km. at a cost of Rs.4450 m;
c) Construction of 4 No. grade-separators, 3 on IRR and 1 on NH-45 opp. airport at a cost of Rs. 2100 m;
d) Gauge Conversion of Chennai Beach-Tambaram rail line at a cost of Rs.2350 m;
e) Development of an Outer Ring Road for a distance of 62 Km at a cost of Rs.9000 m;

f) Developing the 2nd BG coaching terminal at Egmore;
g) Development of 3rd rail line from Beach to Athipattu;
h) Development of 4th rail line from Beach to Athipattu;
i) Quadrupling the rail line between Pattabiram and Thiruvallur;
j) Development of 3rd rail line from Thiruvallur to Arakkonam;

4. Drawing a cue from the document viz. Action plan for IT corridor, 2003 prepared by CMDA, GoTN have commenced implementation of a high quality 6-lane arterial road from Chennai to Mammallapuram for a length of 47 km at a cost of Rs.1217.4 m through IT Expressway Ltd., a special purpose vehicle floated through TNRDC to serve the IT and ITES industries located primarily in the southern outer-CMA.

5. Recognising the fact that the capacity of the urban road network can be appreciably increased by removing the major bottlenecks in the network particularly along such strategic roads such as IRR, it has been proposed to construct well-designed grade separators at all the critical intersections of radial roads with IRR. In the first phase NHAI on its own is developing 3 grade separators at Kathipara, Padi and Koyembedu intersections and one opposite airport on GST Road at a total cost of Rs.2100 crores. These are expected to be completed with a period of 18 to 24 months. The GoTN are proposing to develop the grade-separators at Thirumangalam and Vadapalani intersections of IRR in the second phase.

Non-transport developments

6. The Government in the Transport Department have already taken various initiatives for introducing innovative technologies for motorised vehicles. The Govt. have recently directed for induction of 5000 LPG operated autos in the City. There are also 14 no. ALDS (automatic LPG Dispensing System) in the City. Already electric operated cars manufactured by a company (Reva) are on the roads of Chennai. The strategy to improve the air quality in the metropolis will be principally governed by such conscious measures as to tilt the modal share in favour of public transport modes and the initiatives being taken both by GoI and GoTN to phase out lead in petrol and sulphur dioxide in diesel, making it mandatory on the part of vehicle manufacturers to conform to Bharat II, to introduce pollution-free fuels such as CNG/LPG for vehicle operation.

7. Several non-transport measures were also implemented over the last decade to reduce traffic congestion. These include decentralisation of the CBD, viz., shifting of the whole-sale market to koyambedu, the Iron and Steel Market to Sathangadu, construction of truck terminal at Madhavaram which have relieved the arterials and other City roads considerably from the lorry and bus traffic.

Institutional arrangement

8. The traffic and transportation schemes are presently implemented by several departments and agencies. While long-term planning and coordination is carried out by CMDA, individual schemes are executed by Railways, DoH, CoC, MTC; The traffic enforcement is carried out by Chennai Traffic Police (CTP). There are a number of committees to coordinate the implementation of transport schemes in the CMA. They are:

i) High Level Coordination Committee for MRTS (Chaired by Vice-Chairman, CMDA) for coordinating implementation of MRTS Phase-I&II
ii) Chennai Road Safety Council (Chaired by Commissioner of Police) for traffic enforcement

iii) Coordination Committee (Chaired by Superintending Engineer, Chennai Corporation)

iv) Indian Transport Road Development Association (Chaired by Rane Power Steering Ltd.).

v) Besides these agencies, there are agencies, which are concerned with licencing of vehicles and policy making such as Regional Transport Office etc.

In the absence of financial and administrative powers vested with these committees, the coordination effected by these committees is limited.

9. Under the UNDP-UNCHS supported Sustainable Chennai Project, through the deliberations of the action committee and working groups certain actions for sub-strategies such as

(i) optimising the utility of existing transport infrastructure;
(ii) enhancing the modal share of rail and bus and
(iii) improving the air quality

were discussed and implemented.

Annexure III

Comparison of various urban transit options

Sl.No.	Characteristics	Hybrid Monorail	Sky Bus	Metro	MRTS	Elevated Bus Way
1	Gauge (m)	Standard (1.435)	Standard (1.435)	Standard (1.435)	Broad (1.676)	Standard (1.435) (for LRT later)
2	Speed (KMPH)	37	36 – 150	40	36	30
3	Headway (Seconds)	120	30	180	180	15 -32
4	Passenger / unit or coach	320 (3 car unit)	300 (2 car unit)	2200 (6 car unit)	2844 (9 car unit)	100 (SB) 180 (VB)
5	Capacity (PPHPD)	4500 – 32000	18,000 – 72,000	45,000 – 50,000	60,000 – 90,000	30,000
6	Radius of curvature (m)	20	50	300	250	150
7	Gradient	1 in 6	1 in 25	1 in 50	1 in 70	1 in 25
8	Distance between stations (Km)	0.80 – 1.00	0.70 – 1.35	1.00	1.20	1.10
9	Station size in m (length x width)	50 x 17	18.5 x 3.0	135 x 30 / 180 x 30	300 x 30	60 x 6.5
10	Single column - size	0.80 m x 1.0 m or 1.55 m x 2.0 m	1.0 m dia	1.45 m dia	1.2 m dia	1.5 m dia
11	Power	Battery	Electric	Electric	Electric	Diesel
12	Construction cost/ Km (Rs. in crore) (excluding land cost)	37 – 39	34	70	53	36.78 23.7 (1995 price)
13	O & M Cost Rs. in crore / Km	0.30	6.97	1.20	-	0.02 (maintenance only)
14	Fare Rs. / Passenger / Km.	0.95	0.50	1.00	0.53	0.45

PPHPD – Passengers per hour per direction ; KMPH – Kilometer per Hour ;
SB – Standard Bus ; VB – Vestibule Bus; LRT – Light Rail Transit ; dia –diameter
Source : As given by the corresponding system promoters

Annexure IV

The broad terms of reference of the Comprehensive Transportation Study

SCOPE OF WORK: PRINCIPAL AREAS OF ACTIVITY

The consultant work is to divide roughly into six areas of activity, which are as follows:

i) Collection / updating of household, land use, and travel demand data
ii) Development and operation of an urban transport model
iii) Formulation of transport strategy;
iv) Identification of a phased program of transport investments and management proposals;
v) Organising a communication campaign with a view to move the stakeholders, public and govt. agencies to accept and implement the preferred programme of transport investment and management; and
vi) Training for and knowledge transfer to CMA and other agencies

Activity 1. Collect and Update Household, Land use and Transport Data

The data to be updated and collected are those required for the purpose of metropolitan transport strategic planning. These would include both historical and spatial data. Spatial data are needed for the calibration of the UTP model. A traffic zonal system shall be determined in collaboration with CMDA for the purpose of spatial data collection, traffic forecasts and sub area analysis. Considering the vast area under CMDA, the population and its distribution over the area, the sample size for the survey should be determined based on the size and spread of the geographical sections. A sample size of 2% for household survey for the entire region shall be adopted.

As no recent data on employment exists in Chennai, the consultant should present a methodology to address this lack of the data for the model, in the inception report.

The following tasks shall be conducted under this activity.

- Baseline Data Collection
- Design, Supervision and Implementation of Household Travel Origin-Destination
- Survey including a stated preference survey
- Screenline Traffic Counts
- Suburban Commuter Rail Passenger Survey
- Bus Passenger Survey
- Roadside Motor Vehicle O-D Survey (including Goods Vehicles)
- Survey of large traffic generators (e.g. bus stations)
- Estimating Speed Flow Functions
- Taxi and autorickshaw surveys (IPT Surveys)
- Speed and delay surveys
- Workplace surveys
- Goods focal point survey
- Parking survey (Limited data collection to update the comprehensive parking study carried out in 2002-03)
- NMT survey
- Survey Data Processing and Analysis

Activity 2. Development and Operation of an urban Transport Planning Model

The consultant shall recommend a model package that would be suitable for CMA planning needs. The purpose of the travel demand model is to provide good policy-related and future travel forecasts, and therefore, should be simple. The conventional approach of developing the 4-stage model at aggregate level (except the modal choice at disaggregate level) should be followed.

The model should integrate household activities, land use patterns, traffic flow, and regional demographics. The core of the proposed model system is a household activity simulator that determines the locations and travel patterns of household members daily activities by trip purpose. The model should estimate travel behavior with regard to longer term choices of residential and employment location, and land use and adaptive behavior in response to transportation system changes, including fare and pricing policy.

It should be noted that given the high volume of passengers that travel in the suburban train network, the model should pay particular attention to mode split between bus and rail as well as private car and rail and conducting sensitivity analysis of demand with regard to rail fare. Attention should be paid to the issue of how travel time (walk and wait time), comfort, and mobility or access to transport is treated in the model and how improving these parameters could affect mode split in favour of the urban rail network. Similarly attention should be paid to these issues for travel on the bus network, as well as the impact of traffic congestion on bus speeds.

The consultant should recommend appropriate software package(s) suitable for the development of the requisite model in the Inception Report. The consultant shall undertake an overview of various models such as TransCAD, SATURN, CUBE, etc. with their merits and demerits and recommend a model package that would be suitable for CMA planning needs. The final decision on the selection of software package (s) will be made by CMDA within 10 days of presentation of options along with merits and demerits. The software package (s) should in particular be capable of:

- Modeling mode split, including walk, public transport modes (autorickshaws, taxi, bus and rail) and private transport (motorcycle and car), good's vehicles
- Assigning trips to urban rail and bus networks taking into account the condition in trains, variations in bus speeds and frequency due to changes in overall traffic volume, and fares
- Reflecting the impact of new land use developments and / or control policies, including truck terminals, truck parking lots, interstate bus terminal etc.
- Responding to traffic demand management measures such as parking fees, road user charges and congestion pricing as well as the staggering of working hours, flexi hours and multiple shift work.

Task 2.1 Transport Network Coding

Consultants shall compile a transport network inventory with sufficient details with a view to ensuring traffic assignments to network at link level. The consultants shall compile attribute data for the network (link and node characteristics). The consultant shall prepare input files including network coding based on the inventory collected as a part of Task 1.1 to code the network. In addition, the consultant shall also develop traffic origin and destination matrix by mode and time (day / peak / off

peak). The consultant shall review current speed volume function and assess the adequacy of this function for the purpose of planning and update speed / volume if necessary specially the speed / volume for the new road facilities (flyovers, bypass etc.).

The consultants in consultation with the client shall identify the committed schemes, proposed schemes and accordingly prepare do-nothing, do-minimum, do-something networks to assess the impact.

Task 2.2 Model Calibration

The model should reflect the travel behavior of different income and social groups in a disaggregate fashion and should be sufficiently sensitive to test policy measures and physical improvements to the transportation network and services. The model should be calibrated for travel costs, speed and other factors.

Traffic assignment should be done on both peak and off-peak hour. The model result should be sufficiently detailed for the identification of project benefits among different income groups and users by different modes. The consultants, upon calibration, must demonstrate to the client how reliable the model is in replicating the current modal splits and traffic flows at screen lines and cordons. As the model is to be used for evaluating micro-investments including inter alia major landuse changes (commercial development exceeding 10000 sq.m. of built up area), grade separators at junctions, widening of carriageways on a corridor basis, providing bus lanes, introduction of ATC system etc. cost of more than Rs.100 million (US$ 2 million), the consultants should show how reliable the calibrated model is for more detailed flows than at screens / cordons.

The consultant should produce a working paper presenting the main data and assumptions used by the model.

The consultant should present the process that would be put in place to ensure good quality control of the data that are entered in the model and satisfactory performance of the model. Calibration and validation of the model is a well identified step in the process of the study. The consultant should therefore produce a specific report on the same that should be formally accepted by CMDA before the consultant progresses further in the step.

Task 2.3 Establish Economic Evaluation Procedures

Consultants should establish the framework for economic evaluation that would be used in the formulation of a long-term transport strategy and the identification of a phased investment program. The framework should allow the economic feasibility to be expressed in terms of expected Net Present Value (NPV) and Internal Rate of Return (IRR). Special attention should be given to the following major areas:

- Identify major items of economic benefits;
- Establish appropriate vehicle operating costs (VOC) and value of travel time (VTT); and
- Develop appropriate economic evaluation procedures to make full use of UTP model outputs including link traffic volumes and speeds by vehicle type for existing and planned networks

Activity 3. Update the Long-Term Transport Strategy for CMA

Task 3.1 Review of 1992-95 CTTS

The consultant should review the 1992-95 CTTS strategy, assess its relevance to the current and future transport needs of CMA, identify major changes in socioeconomic conditions, land use, and transport since 1995 and suggest strategic areas that need to be considered, improved and strengthened.

Task 3.2 Review of Institutional Arrangement of Transport

The purpose of this task is to clarify current arrangements for formulating, monitoring and implementing transport policy and for identifying, appraising, authorising, sanctioning, financing and implementing transport schemes and operational policies. The study is required to identify the role and responsibilities of the various bodies both within and outside CMA, concerned with transport policy, financing, investment and regulation of operations. This task is intended essentially as a review of earlier work. The main issues to be addressed by the consultant shall include the following:

- the current lack of a clear institutional structure with regard to urban transport planning, management and investment coordination;
- institutional and policy barriers to positive change in the delivery of transport services to the people and businesses;
- the number of staff qualified in transport planning and management;
- the relative roles of public and private passenger transport operations, and the means of regulating them;
- the relative roles of central, state and municipal governments in transport planning, investment and management

The study should advise on the needs and possible scope of (i) institutional and policy reform; and (ii) post-study professional development and training in transport planning and management.

Task 3.3 Review of Transport Financing

The study should pay careful regard to the financial resources available for transport investments, maintenance and operations, both in total and by agency, on the basis of an assessment of the level of funding available annually during the past 5 years, current changes in the fiscal framework and economic trends. The outcomes of this work should be estimates, on the basis of a number of assumptions and scenarios, of resources likely to be available for transport investments, maintenance and operations during the coming years, with distinction between tied resources (such as commuter rail surcharges) and untied resources. Potential sources of private sector finance identified in earlier studies should also be reviewed and updated. Likely candidates for private sector financing / PPP based on feasibility of levying tolls or user fees should be identified.

Task 3.4 Traffic Demand Analysis and Forecast

The consultant shall review the CMA master plan for 2006-2026 and may consider alternate land use scenarios (maximum 3) for future development in

consultation with CMDA. CMDA will provide forecasts of population for the years 2019 and 2026. The consultants shall forecast travel demand by mode using the calibrated UTP model for the years 2009, 2014 and 2019 on the existing transport network plus all committed transport investments, under the assumed alternative income, population, and land use growth scenarios. These exercises will give indications on the likely traffic problems in the future years, thus providing a basis for strategy formulation.

Task 3.5 Definite Alternative Long-Term Transport Strategies

The long-term transport development and management strategy should be a combination of policies (e.g. demand management, user charges etc.) and physical improvements. In collaboration with CMDA, the consultant should define the specific objectives, principles, and criteria required to guide the formulation of the long-term strategy.

Having regard to various policy options and transport strategies and systems, alternative feasible scenarios for horizon years should be developed in consultation with CMDA. It is likely that the scope to manage transport demand by control of land use development will be limited but that the implications of transport developments on land use developments will be great. It is likely, for example, that restricted space in the CBD, combined with demand management measures and improvement of rail and road links in the CMA, will lead to faster development of less developed areas in peri-urban areas. The study should seek to identify the scale of such development pressures.

The UTP model linking land use pattern, travel demand and modal split, should be used to test the impact of major modifications of strategy and will be used mainly for the 20-25 year horizon. All options for improving transportation in CMA should be considered and compared. Alternative transport strategies and their evaluation should focus on agreed land use strategy and show whether any significant easing of future transport problems could follow from revision of the land use strategy. The consultant shall recommend an integrated land use transport model. CMDA would confirm the form of land use strategy to be assumed by the consultants for the development of a long-term transport strategy when it is presented to the Steering Committee.

Task 3.6 Evaluation of Alternative Strategies and Selection of Preferred Strategy

A comprehensive evaluation system should be developed in consultation with CMDA, taking into account all relevant factors such as capital and operational costs and environmental, social and political factors, services to the poor and vulnerable. The evaluation should be comprehensive, on the basis of four major criteria: (i) economically viable; (ii) socially acceptable; (iii) environmentally sustainable; and (iv) financially feasible. At the strategic planning level, a preliminary assessment of economic and financial feasibility and social and environmental impacts should be made for each proposed alternative strategy. In defining the alternative strategies, the consultant should pay special attention to the services to poor and the vulnerable.

The comprehensive evaluation should result in the recommendation of a preferred long term transport strategy. The consultant in collaboration with CMDA and other transport agencies should explain the basis for its recommendations.

Task 3.7 Prepare a Draft Transport Strategy Document

The outline strategy should amount to a directional plan indicating the main imperatives of transport policy during the foreseeable future, having regard to need, desirability (with regard to factors such as land use development and environmental and social impacts), affordability and uncertainty. This strategy should take account of economic growth, current initiatives of CMDA, the need to conserve and enhance the urban environment, land use plans and likely land use development patterns.

The strategy document should cover the following patterns:

i) **Current Situation**. Clarification in broad but objective terms of the current situation and trends: the quantity of personal movement by commuter rail, bus, car, autorickshaws, NMT, two-wheelers, taxis, water transport and on foot; the amount of goods vehicle movement; Intercity traffic, long distance Bus / Railway passenger movement; origin-destination patterns; current problems.

ii) **Traffic Growth**. Clarification of current growth rates, potential growth rates (with reference to experience elsewhere), potential problems.

iii) **Current Constraints**. Clarification of current constraints with regard to government policies on vehicle licensing, vehicle and fuel prices and trends, land use policies and the resources available for transport investment and the scope of cost recovery through direct user charges such as tolls

iv) **Long Term Trends and Prospects**. Review of implications for transport (supply and demand) of economic growth and land use developments; and of the implications for transport planning of uncertainty.

v) **Transport Investment Options**. Review of the main means of providing additional transport capacity with regard to their effectiveness, magnitude of orders of cost (including both capital and recurrent costs), economic and financial viability, etc. including;

vi) **Demand Management**. The need for and means of achieving the management of the potentially high growth in the use of motor vehicles (including motorcycles).

vii) **Environmental Measures**. Review the need for measures to ameliorate adverse environmental impacts, either existing or resulting from proposed projects or increased development.

viii) **Land Use Strategy**. Review of the scope and limitations of reducing / controlling traffic demands through land use policy and of the scope for using transport policy to influence land use development.

ix) **Institutional Arrangement**. A diagnostic assessment of the current institutional arrangements for administering and planning transport activities in CMA, including policy formulation, regulation of transport operations, financing, and investments, and recommendations for improving the arrangement.

x) **Conclusions and Recommendations on Transport Strategy**.

Broad conclusions and priorities for development of commuter rail, bus transit, highway construction, goods transport and interregional bus / rail transport, water transport, ferry services, traffic management and demand management in short, medium, and long terms; observations on land use strategy.

Activity 4. Identify a Medium-Term Investment Program

The product required for this Activity is a rolling program of investments and management proposals sufficient and appropriate for the period to 2019. The emphasis of the work will depend upon the conclusions reached on the transport strategy. The Medium-Term Investment Program shall comprise the following parts:

i) **Commuter Rail Development Programme**. Identification of a staged programme of commuter rail development including consideration of the Metro-rail Study and its cost implications, etc.

ii) **Highway Network Development Programme**. Identification of staged programme of highway investments, having regard to traffic demands, economic benefits, system effects, etc.

iii) **Bus System Development Programme**. Identification of proposals for investment in buses and civil works (depots, workshops, terminals, segregated bus lanes, exclusive busways, etc.) and operational management, taking account of bus transport policy recommendations outlined in the transport strategy.

iv) **Traffic Management**. On the basis of the initial batch of traffic management effort funded under the TNUDP III, identification of low-cost physical and regulatory measures to improve the efficiency and safety of traffic circulation. Particular attention should be given to the management of NMT, pedestrians, bus priority measures, etc.

Task 4.1 Identification and Costing of Investment Options

The identification of a phased programme of transport investments proposals shall first involve a sifting of options and pre-feasibility studies. The consultant shall take into consideration of the candidate projects already proposed by the transport agencies in CMA. For each investment project, the consultant shall define a base option and two or more alternative options. For each option, the consultant shall propose preliminary alignment, conceptual design option, technology choice, and timing of construction and start of operations. The consultant should also provide preliminary (or pre-feasibility study level) estimates of the associated capital and operating costs, traffic, revenues if applicable, and operating characteristics.

Task 4.2 Evaluation of Options

The consultant shall evaluate these options using the comprehensive criteria specified in para 3.6 but at a more detailed level. The evaluation should consist of two parts. The first, which may be partially quantitative and largely qualitative, shall consist of categories such as operational feasibility, integration with existing systems and physical environment, ease of response to changing conditions, land use effects, travel generation potential, environmental quality, requirement for involuntary resettlement, and other. The second part shall consist of simplified economic and

financial evaluation, based on capital and operating costs and revenues, passenger costs and financial costs of each option.

Evaluation of investment options shall be based upon the network assignment of traffic demand matrices derived from the results of the transport surveys.

Task 4.3 Prioritise the Investment Projects and Formulate an Investment Programme for Year 2019

On the basis of comprehensive evaluation of the above options, the consultant shall prioritise the identified investment projects and formulate a Medium-Term Investment Program. The program should focus on identification of capital investments to be made in the 10-year period 2009-2019. The schemes thus identified would be prepared and largely implemented during TNUDP III phase II or as a separate package. The medium-term programme shall include background assumptions, rail, road, road based PT, mass transit system proposals and water transport investment proposals. When proposing the program, the consultants should assess the impact / implication of various scenarios / strategies / fiscal policies on transport network.

The background assumptions shall include a summary of the transport strategy emerging from the outline long-term study, the form of land use distribution assumed to apply in the medium term, assumptions about institutional changes or developments and assumptions about investment levels. Unless good reason emerges to the contrary, one land use disposition should be defined for the medium term.

Activity 5 Communication Campaign

The objective of the communication campaign is to

a) to collect suggestions from the stakeholders (public and govt. agencies);
b) to disseminate the results of the study; and
c) to help in determining priorities among the various options that can be envisaged.

Activity 6 Skill and Knowledge Transfer

The study should advise on the needs and possible scope of professional development and training in transport planning and management.

The new CTS model should be installed in CMDA and CMDA, CC, MTC, DHRW & S.Rly. personnel should be provided necessary training in its use. A two week workshop shall be conducted for senior officers on the usage of model.

The consultant shall train core staff (7) on model update and calibration so that they could use the model proficiently as a planning tool with only minimal assistance from the consultant on the need basis after the study is completed.

With the objective of making the training more productive, two persons from CMDA would work along the consultants' team. One would work full time on the model. The other would be involved in more strategic aspects. The consultant should define their functions and the results expected from both these trainees in the Inception Report.

The consultant should work with the Transportation Engineering Division, IIT, Chennai. The objective is that the institution would be able to provide support and advisory services to CMDA after the study is completed. While the consultant shares the data with the institution, the institution would provide advice to the consultant in the building of the model and interpretation of the outputs of the model. As the

services/support of the institution is made available free of cost, it would be the responsibility of the consultant to ensure that the support of the institution is fully utilised. The above institution would review and validate the data collected by the consultant within 2 weeks of submission.

All data, in the form of both raw data and structured database, should be fully transferred to CMDA. The data collected at various stages of the study should be organised and integrated in a database and provided to both CMDA and the institution mentioned above. The consultant should also provide the final set of data used by the model that are consistent with the results in the final report to CMDA. Partial payment of the consultancy fee would be subject to compliance with this requirement.