SESSION I

Metropolitan Transport Planning & Policy Issues

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CMA : 1189 km^2 (city:176 km^2)

Population : 82.6 lakhs (2008) (59+66= lakhs in 2026) (2.3 lakhs/year)

CTTS :1970 (MATSU)
:1993 (CMDA)
:2008(CMDA)

Vehicle population : 28 lakhs (2009)

Bus : 40/ lack of population

2wheeler : 4 lakhs in (1991) to 22 lakhs in (2009)

Traffic volume exceeds road capacity/congestion

Trip rate/person :0.9 in 1971 to 1.2 in 1992 to 1.6 in 2008

Vehicle/HH :0.25 to 1.26

Fatal Accident :1125 persons (42% pedestrians & 10% cyclists) 2008

Percentage of trips by mode of travel

	1970	1992	2008
Bus	42	39	26
Train	12	4	5
Car/Taxi	3	5	6
2 wheeler	2	7	25
Auto Rickshaw	-	2.2	4
Bicycle	20	14	6
Walk	21	30	28

Trip length : **9.6km**

Walk trip : **1.55km**

Parking :**Reduces road capacity**

Vehicle Emission & Air pollution – CO & SPM – More than 100%

Problems

- Rapid Growth of population & vehicle population -congestion on roads
- Travel time & Trip length increases
- Roads safety & Environmental Issues
- Decreasing use of public Transport
- Parking Management
- Quality of Urban life
- Safety of road users

Vision

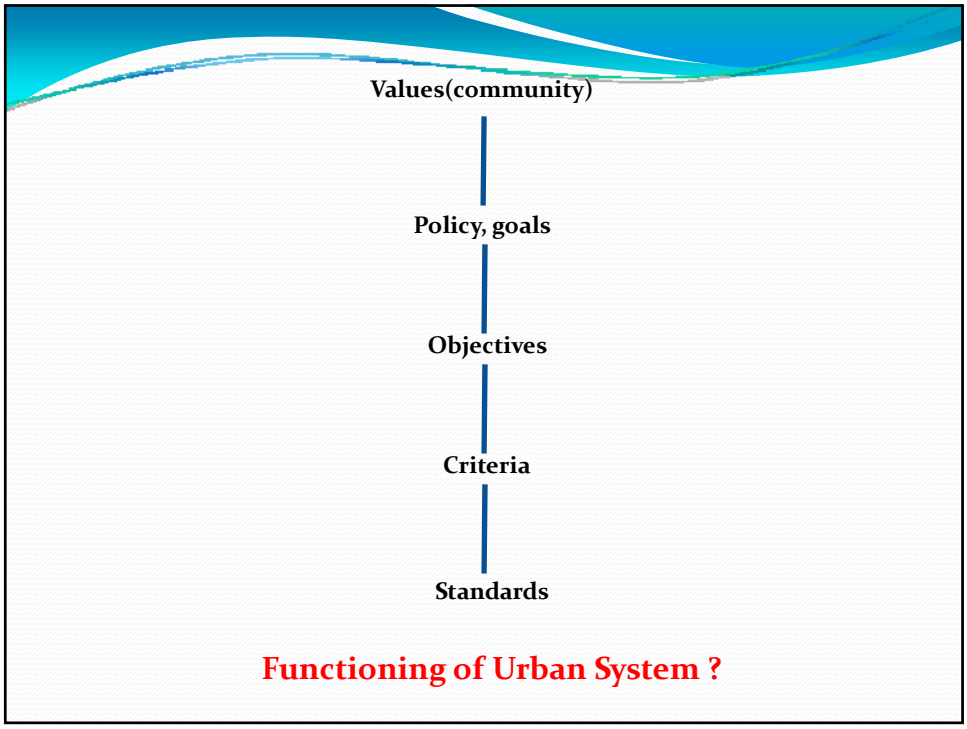
- People occupy centre–stage in cities-common benefit & well being
- Livable cities – engines of economic growth.
- Cities to evolve into an urban form best suited – geography , socio - economic activities.
- Sustainable cities -resources, investment & environment.
- Efficient Road network- accessibility, mobility, Services & Utilities

Policy objectives

- Integrating land use & transport planning
  - Future growth around preplanned transport network
  - Identify potential corridors
  - Constraints for development
- Equitable allocation of road space
  - LRT, BRT, Side walk
  - Trip reduction – walk ,school & social trips though land use planning
- Priority for public transport in planning
  - Technology, pricing, network, urban road
- Priority for Non-motorised transport
- Environmental area planning

- **Parking**
  - Parking in Residences
  - On street parking
  - Heavy vehicle parking
  - Multi level parking
  - Area licensing
  - Parking pricing
  - Contribution in-liew of parking

- Cleaner Technologies
- Safety and Environmental Audit
- Public co-operation
- Capacity building - Manual for road - Construction & maintenances , Training



Functioning of Urban System ?

Thanking you

Urban Transportation Infrastructure: Challenges and Opportunities

Presentation on

Case Study: Comprehensive Transportation Study for Mumbai Metropolitan Region

B M Setty

Chief General Manager, Traffic and Transportation

LEA Associates South Asia Pvt. Ltd.

25th February 2011

Structure of Presentation

- Background
- Major Challenges in Infrastructure Development
- Challenges in Transport Infrastructure Development
- Travel Scenario in MMR
- MMRDA's Initiatives
- Vision - Transform MMR
- Steps taken so far……

Background

- India: about 286 million persons (27.8% of the total population) living in urban areas – second largest urban population in the world;
- Urban population is expected to rise to about 38% by 2026;
- Number of million+ cities will increase from 35 to 61 during 2001-2026;
- Eleven cities will have population over 4 million by 2025 (Greater Mumbai, Delhi, Kolkata, Bangalore, Chennai, Ahmedabad, Hyderabad, Pune, Surat, Jaipur and Kanpur;

- The urban areas need lot of improvement in infrastructure to achieve objectives of economic development and creating sustainable human habitat.
- Huge investments, institutional reforms and efforts from political, bureaucratic, technocratic and private systems are required in India's urban sector.

- MMRDA has initiated number of projects to improve the infrastructure in MMR
- Carried out CTS for MMR and Business Plan during 2005-08

Million Plus Cities in India (Census 2001)

Sl. No.	Name of City	Population
1	Greater Mumbai	11,914,398
2	Delhi	9,817,439
3	Kolkata	4,580,544
4	Bangalore	4,292,223
5	Chennai	4,216,268
6	Ahmedabad	3,515,361
7	Hyderabad	3,449,878
8	Pune	2,540,069
9	Kanpur	2,532,138
10	Surat	2,433,787
11	Jaipur	2,324,319
12	Lucknow	2,207,340
13	Nagpur	2,051,320
14	Indore	1,597,441

Sl. No.	Name of City	Population
15	Bhopal	1,433,875
16	Ludhiana	1,395,053
17	Patna	1,376,950
18	Vadodara	1,306,035
19	Thane	1,261,517
20	Agra	1,259,979
21	Kalyan-Dombivli	1,193,266
22	Varanasi	1,100,748
23	Nashik	1,076,967
24	Meerut	1,074,229
25	Faridabad	1,054,981
26	Haora	1,008,704
27	Pimprichinchwad	1,006,417

Major Challenges in Infrastructure Development

Physical Challenges
- Difficult Landform and Geography
- Scarcity of Developable Land
- Inadequate transportation system capacity and unacceptable levels of safety

Social Challenges
- Re-housing Slums

Economic Challenges
- Increasing Job Opportunities and Incomes
- Global Competitiveness

Institutional Challenges
- Multiplicity of agencies and lack of coordination
- Lack of Institutional Framework/setup
- Inadequate Technical Resources to implement large scale projects

Financial Challenges
- Huge Gap in Demand and Supply of Infrastructure
- Resource Mobilization and Fiscal Management

Others
- Encroachments & Resettlement
- Environmental Degradation and Protection
- Traffic congestion resulting from private vehicle growth

Challenges in Transport Infrastructure Development

- Multiplicity of agencies and lack of coordination
- Huge gap in demand and supply of transport infrastructure
- Lack of adequate funds
- Lack of institutional frame work/setup
- Inadequate expertise in planning and implementation
- Encroachments
- Environmental Deterioration
- Model shift from public to private transport modes



How to overcome the problems.....

Master Planning & Monitoring ?

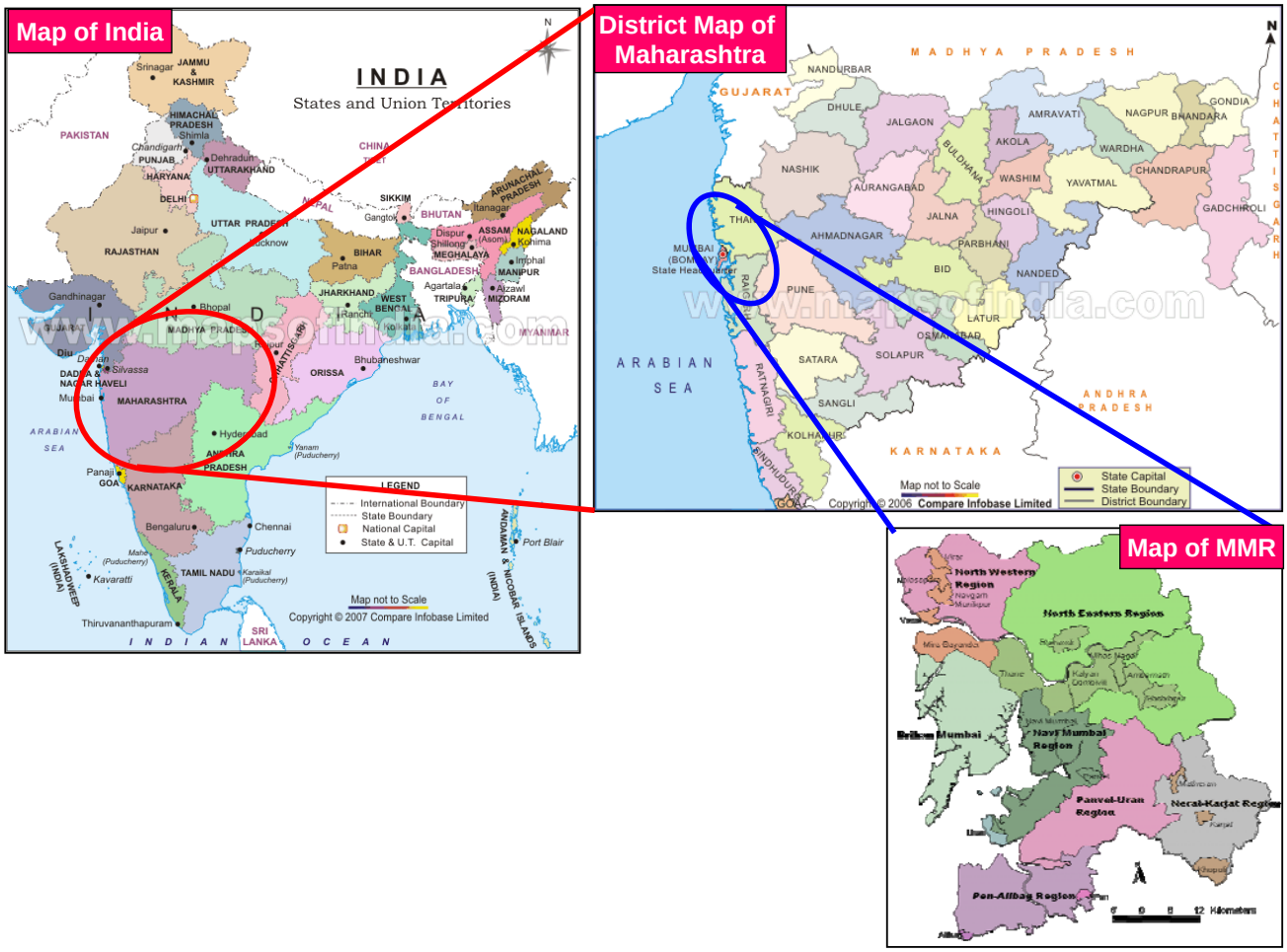
Institutional & Legal Framework ?

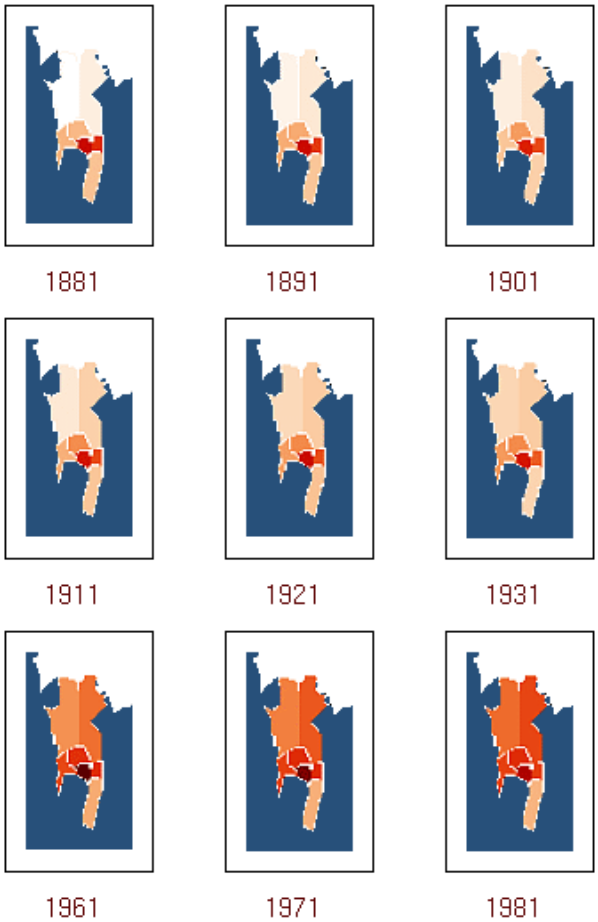
Dedicated Transport Infrastructure Fund?

Resource Mobilisation?

Sustainability?

Travel Scenario in MMR





Critical Dates and Development Schemes, Evolution of Bombay city

1668-Bombay leased to East India company

1686- East India HQ shifted from Surat to Bombay

1769-Fort George Built

1770-Bombay started trading Cotton with China

1796- Colaba declared as Cantonment

1805-Sion Causeway completed

1833-Town Hall Completed

1838- Colaba Causeway Constructed

1853-First Railway line Between Bombay and Thana Inaugurated.

1854-First Textile Mill opened in Tardeo

1867-BB&CI Railway Service between Bombay Backway and Verar

1872-Bombay Municipal Corporation Established

1888-Victoria Docks opened and Victoria Terminus Completed

1905- First Cuffe Parade reclamation completed

1912-Sewri-Mazagoan reclamation completed

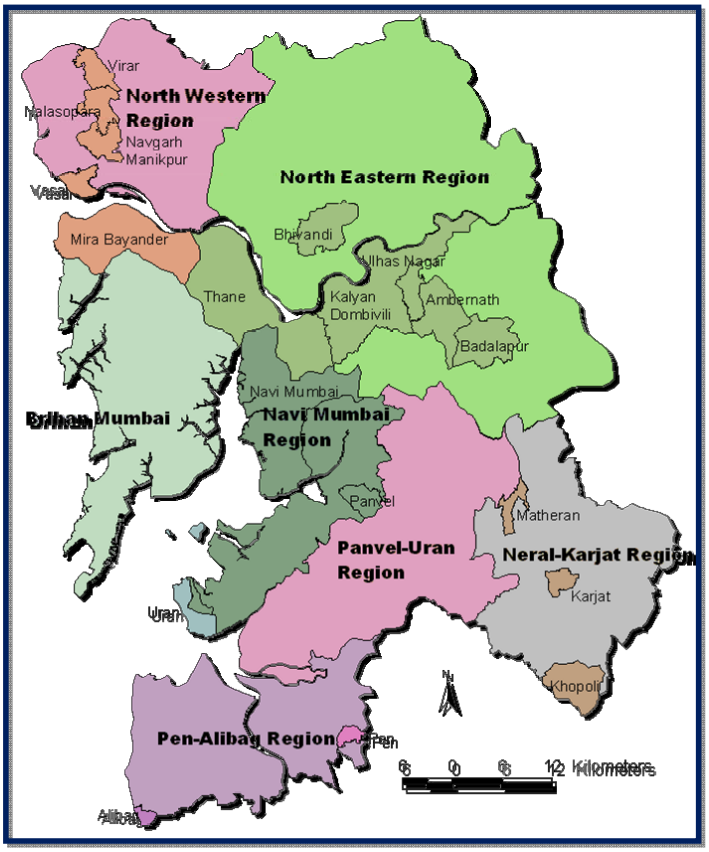
1924-Gateway of India Inaugurated

1929-Backway Reclamation Completed, Cuffe Parade Extension

1934- Marine Drive Promenade and Avenue Started

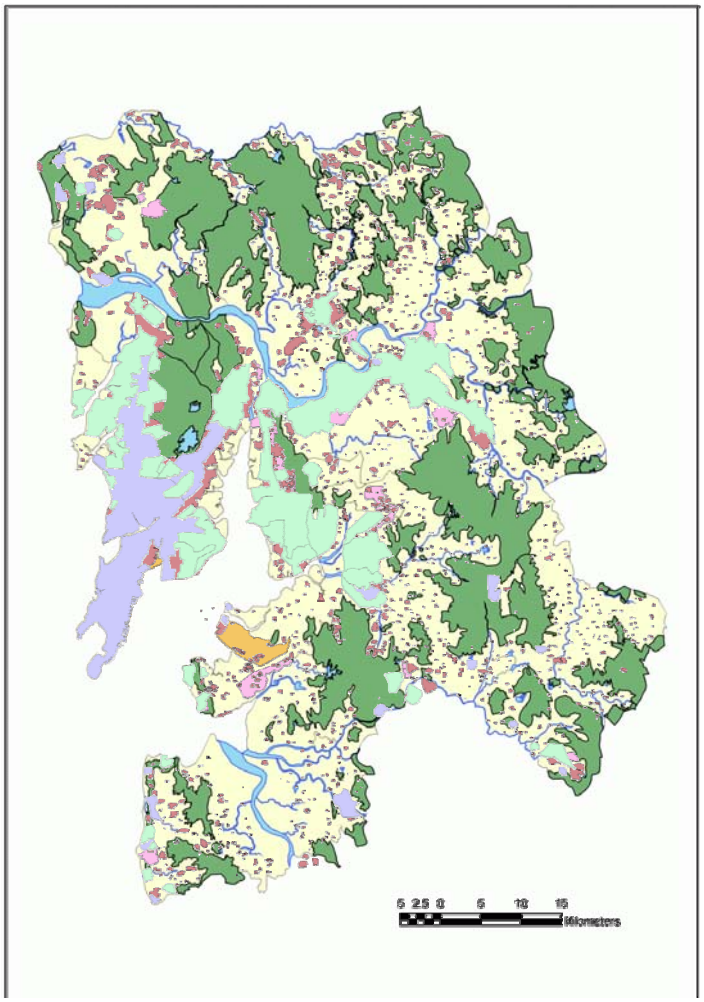
1945-Greater Bombay Came into being, city and suburbs merged

1970s- Nariman Point and Cuffe Parade High Rise Precinct Developed.



MMR Study Area

- **Covers entire Mumbai, Parts of Thane and Raigad Districts**
- **4,355 sq.kms area**
- **19 Urban Local Bodies (8 Municipal Corporations and 11 Municipal Councils)**



Urban Sprawl

Built up Area 1968

Built up Area 1987

Built up Area 2001

Legend

Forest

Water Bodies

MMR Region

MMR Industrial

MMR Port Airport

Current Travel Scenario in MMR

Surveys/ Studies Conducted

No.	Primary Survey	Extent
1	Home Interview Survey (HIS)	66,000 Households
2	Classified Volume count and OD Survey at Outer Cordon Locations	24 Hr., 9 Locations
3	Classified Volume count and OD Survey at Sub-regional cordons	24 Hr., 20 Locations
4	Classified Volume count at Inner Cordon Locations	16/24 Hr., 33 Locations (OD Survey at 3 Loc.)
5	Screen Line Points	16 Hr., 3 Locations
6	Mid-Block Locations	16 Hr., 11 Locations
7	Level Crossing Locations	16 Hr., 5 Locations
8	Sub-urban Rail Passenger Surveys	6.17%
9	Sub-urban Rail Passenger Surveys, Alighting Survey: Stations	16%
10	Operational Characteristics of Bus and Rail Transport Networks	5700 Bus Routes and 1767 Train Services
11	IPT (Auto and Taxi) Surveys	50 Locations
12	Bus Terminal Surveys	13 Bus Terminals
13	Airport Terminal Surveys	2000 air passengers
14	Goods Terminal Surveys	20 Goods Terminals
15	Speed-Flow Studies	16 Carriageway Types
16	Journey Speed and Delay Studies	550 Kms
17	Network Inventory	2,300 kms.
18	Pedestrian Surveys	50 Locations
19	Parking Surveys	50 Stretches
20	Workplace Based Surveys	4000 respondents

Major Surveys

Household Travel Origin-Destination Survey covering all of MMR

- **66,000** Households Surveyed
- **275,000** Persons Interviewed
- Details of **330,000** individual trips documented
- Plus data on places of work and school, shopping, incomes, frequency/cost of travel etc

Traffic Volume and Roadside Origin/Destination Surveys

- **20,000** Drivers interviewed entering/leaving MMR
- **130,000** drivers interviewed within MMR
- **90** Traffic counts were undertaken throughout the Region

Major Surveys

- **Airport Terminal Survey**

  - **2,000** Passengers interviewed in departure areas

- **Suburban Rail Passenger Survey**

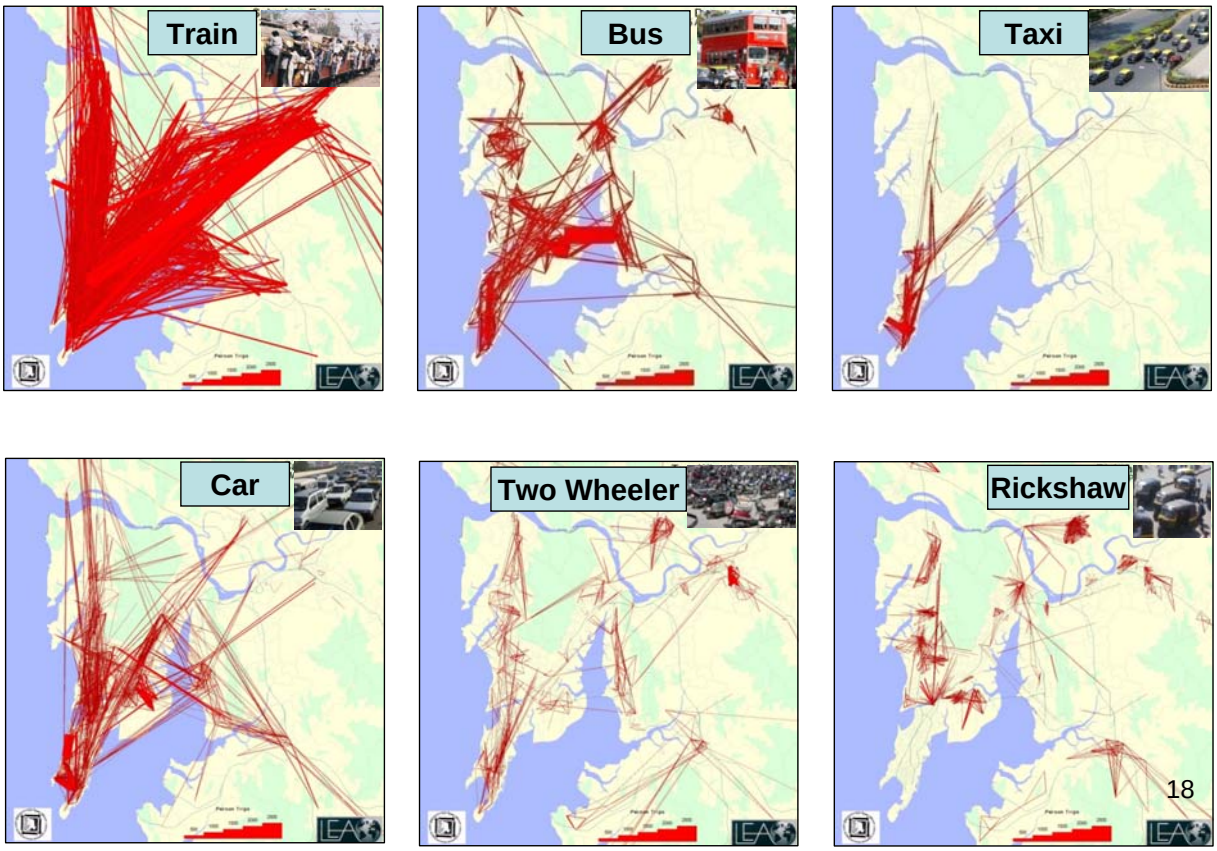
  - On board counts and train alighting counts to establish line volumes, passenger crowding levels and station use

- **Goods Focal Point/Goods Movement Survey**
- **Parking Surveys**

Major Surveys

- Speed and Delay Surveys on all major roads
- Regional road network inventory survey and GIS data base compiled
- Inter-city bus terminal surveys 10,000 passengers interviewed
- Taxi and Auto rickshaw survey 5,400 drivers/passengers interviewed
- Workplace Based Surveys 4,000

Where and How People Travel in Mumbai -2005
(Morning Peak Period: 6:00 to 11: AM)



Trips per day (2005)

Mode	Trips (ml)	Mode Split with Walk	Mode Split without Walk
Walk	14.85	52.4%	-
Train	6.98	24.6%	51.8%
Bus	3.55	12.5%	26.3%
Auto	1.05	3.7%	7.8%
Taxi	0.23	0.8%	1.7%
Two Wheeler	1.05	3.7%	7.8%
Car	0.63	2.2%	4.6%
Total (with Walk)	28.33	100.0%	100.0%
Total (without Walk)	13.48		

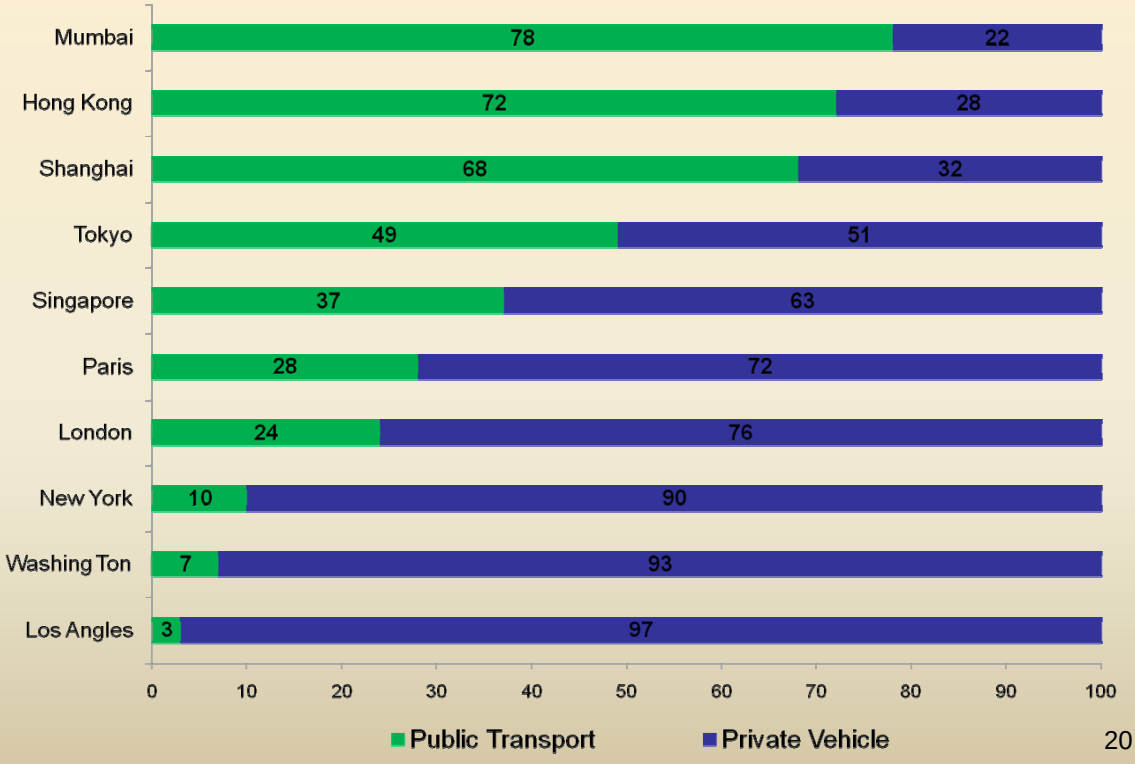
78%

TOTAL REGION

Per Capita Trip Rate

- With walk: 1.65
- Without walk: 0.65

Mode Split: Major Cities across the World



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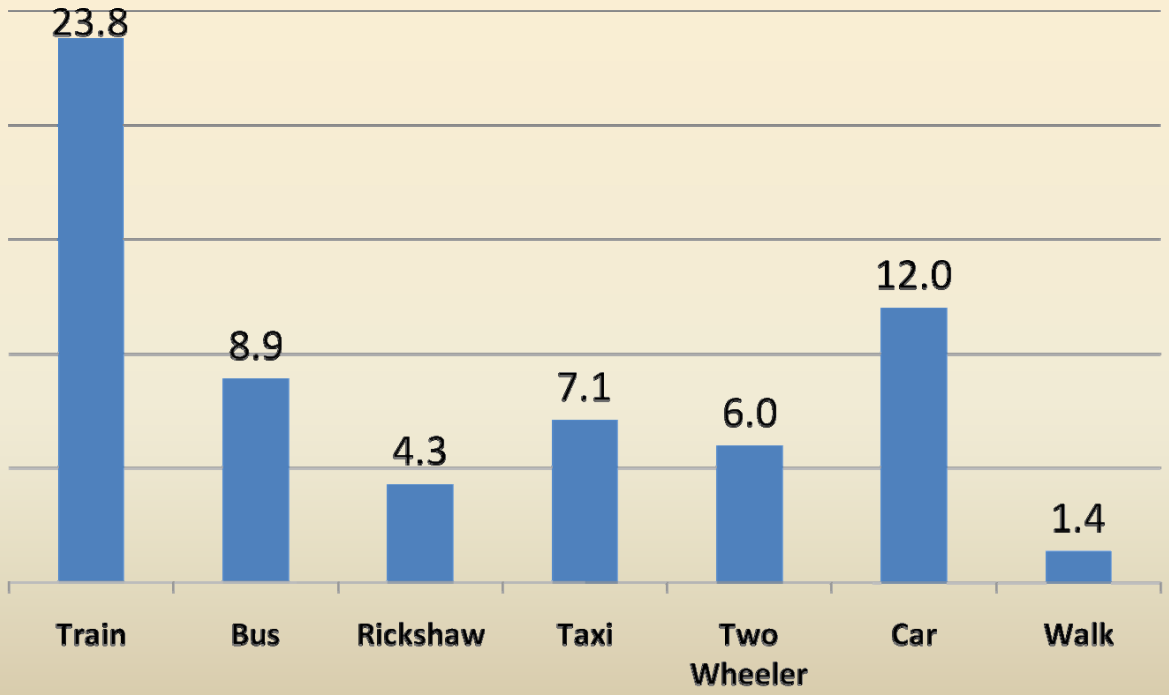
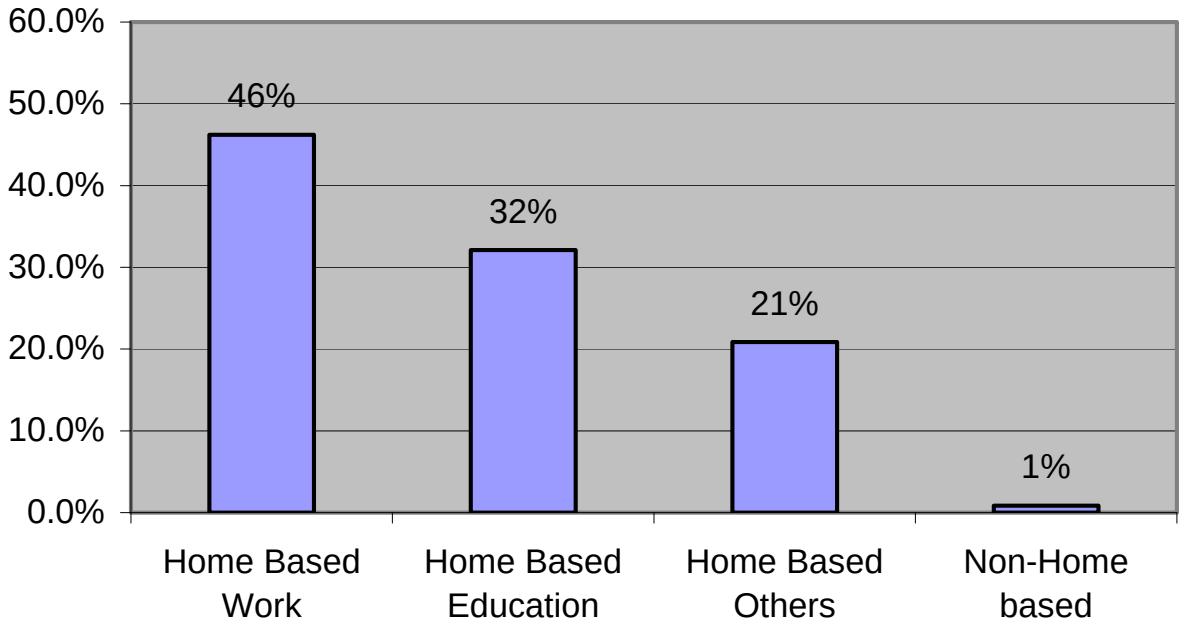
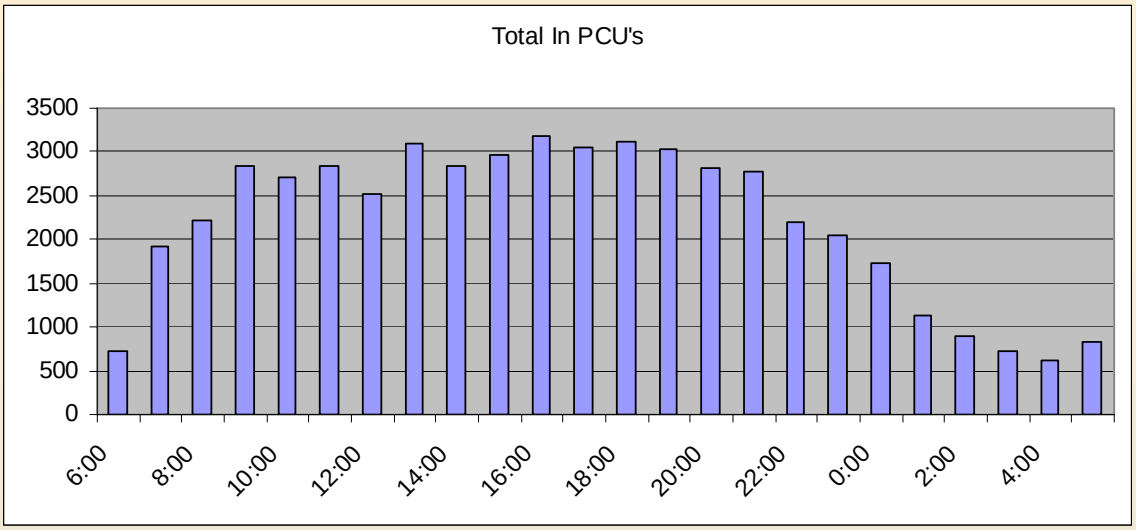
Average Trip Length (km)



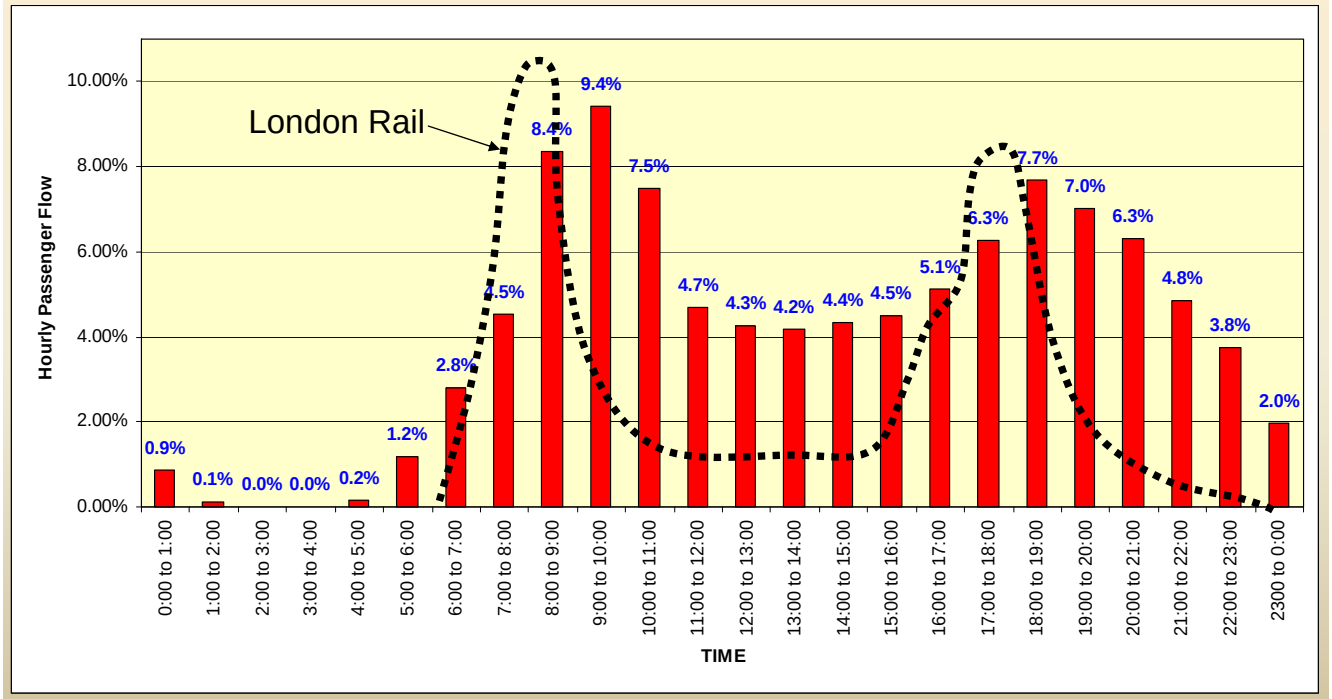
Purpose Split



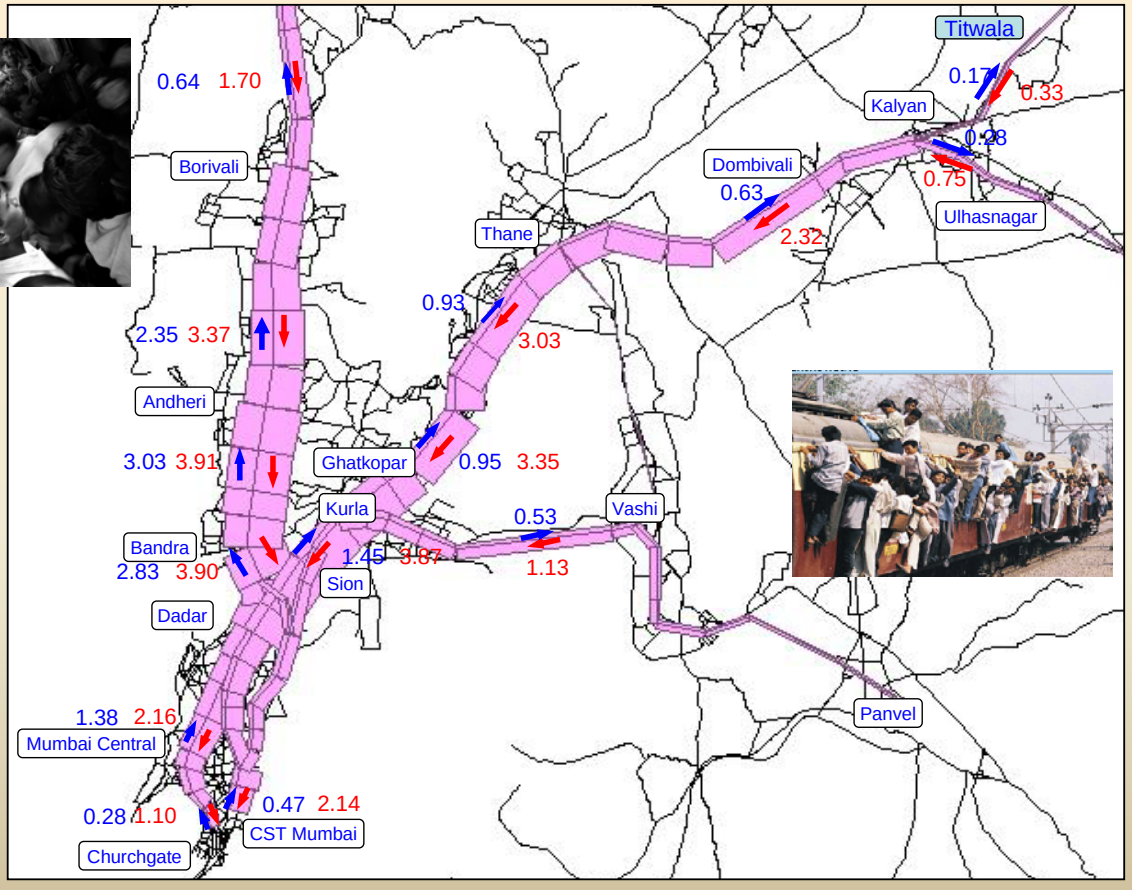
Hourly Variation of Road Traffic



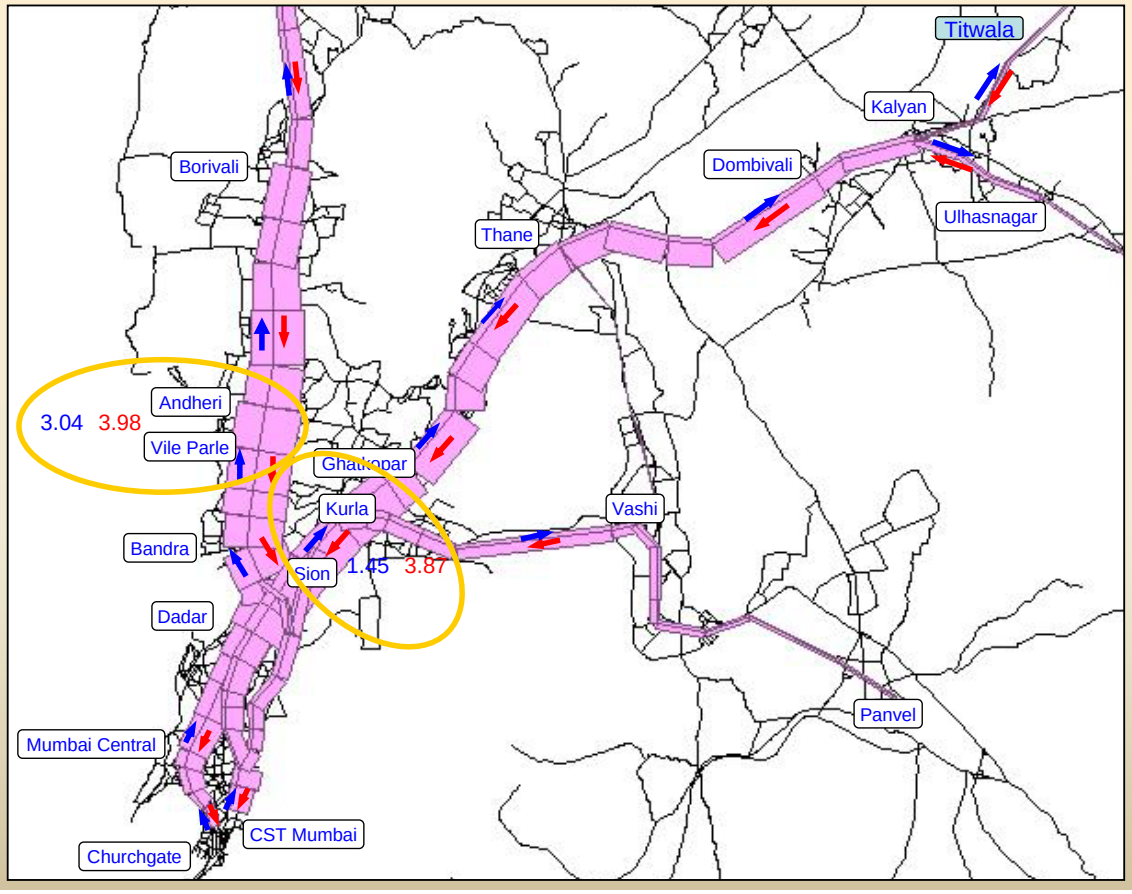
Peaking Characteristics of Train Passengers



Morning Peak Period (6:00 to 11:00 AM) Rail Passenger Loading (in Lakhs)

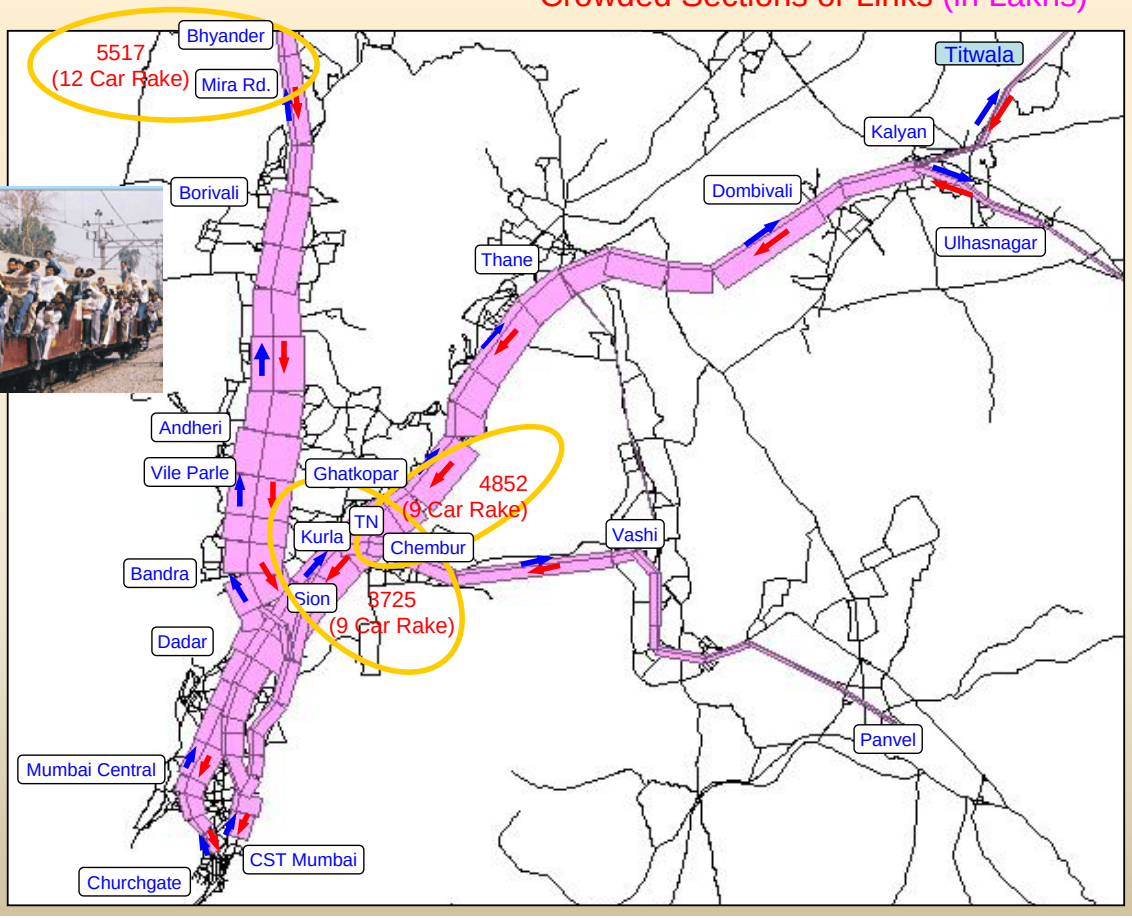


Morning Peak Period (6:00 to 11:00 AM) Densest Sections or Links (in Lakhs)

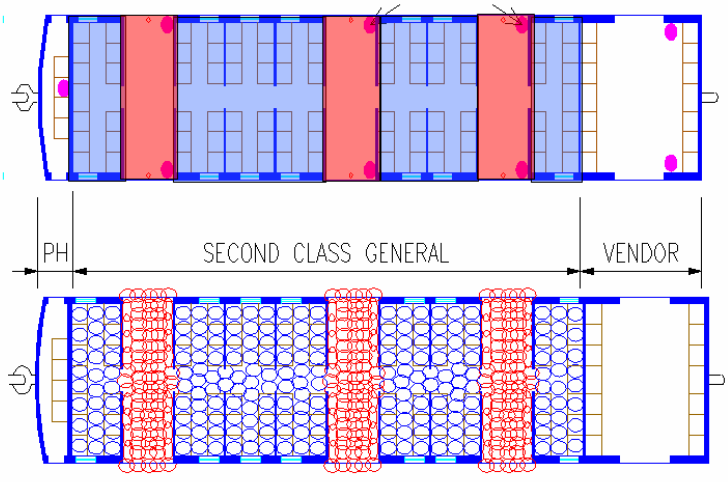


Morning Peak Period (6:00 to 11:00 AM)

Crowded Sections or Links (in Lakhs)



Rail Surveys: In-Train Boarding and Alighting Survey



No. of Passengers/ Sq.m	6	16	6	16	6	16	6

Average Standees Per Coach 12 pass/sq.m.

US Federal Transit Administration Report (1996)

Totally Intolerable 5 pass/sq.m.

Unacceptable 8 pass/sq.m.

MMRDA's Initiatives

PROJECTS (Ongoing)

- Mumbai Urban Transport Project – MUTP
- Mumbai Urban Infrastructure Project – MUIP
- Mumbai Metro Rail
- Mumbai Monorail
- Skywalks

MUMBAI URBAN TRANSPORT PROJECT – MUTP

Project Outline

- With a view to improving traffic and transportation situation in MMR GoM has taken up MUTP
- Envisages Improving suburban railways, local bus transport, new roads, bridges, pedestrian subways and traffic management activities
- With World Bank assistance

Project Period: 2003-2010

Agreement Date : August 5, 2002
Effective Date : November 6, 2002

Project Benefits

- 35% addl. carrying capacity in suburban trains during peak period.
- Increase in carrying capacity of BEST buses
- Reduction in traffic congestion and increase in vehicular speed and safety on roads.
- Improvement in flow of passengers and vehicles in and around selected stations.
- Reduction in air Pollution.

Project Launched: Nov 23, 2002
Closing Date : June 30, 2008
Extended Date : Dec 31, 2010

MUMBAI URBAN TRANSPORT PROJECT – MUTP

Project Components

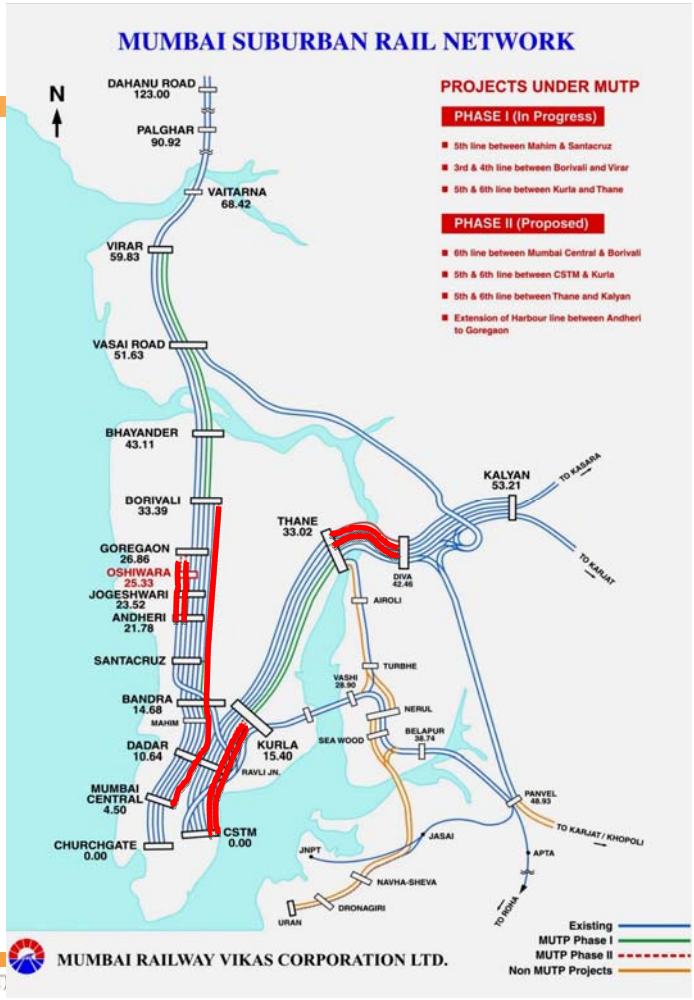
	Rs. Cr.	US $ mn
Railway	3764	784
Road	796	166
R & R	545	114
Fees	22	5
Total Cost	5127	1069
World Bank Loan	2313	482
Counterpart Funds	2814	587

Implementing Agencies

- Mumbai Metropolitan Region Development Authority
- Mumbai Railway Vikas Corporation
- Municipal Corporation of Greater Mumbai
- Maharashtra State Road Development Corporation
- BEST

MUTP II

S. No	Project	Cost In Rs.Cr.	US $ mn
1	5th & 6th line CST – Kurla	659	137
2	5th & 6th line – Thane – Diva	133	28
3	6th Line Mumbai Central – Borivili	522	109
4	Harbour line: Andheri – Goregaon	103	21
5	DC to AC	293	61
6	EMU Procurement	2930	610
7	EMU Maintenance facilities	205	43
8	Stabling lines	141	29
9	TA	62	13
10	Resettlement & Rehabilitation(2850 families)	124	26
11	Station Improvement & Tresspassers control	128	27



MUMBAI URBAN INFRASTRUCTURE PROJECT – MUIP

Project Need

- To supplement MUTP with emphasis on road network improvements
- Providing benefits to pedestrians and Public Transport users

Project Objectives

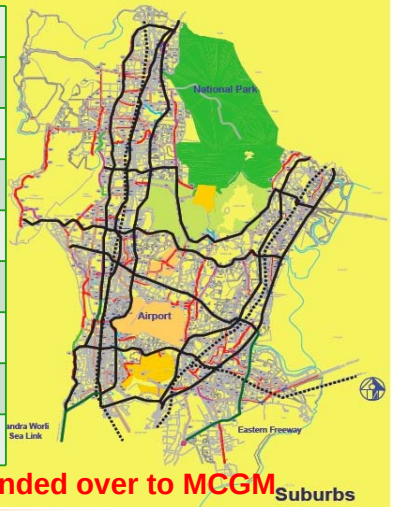
- Efficient traffic dispersal system
- Major North-south & East-West road links
- Safe, convenient & efficient movement for pedestrians
- Un-interrupted connectivity to International Airport
- Efficient/fast public transport corridors
- Elimination of railway level crossings

Schemes	Eastern Sub.	Western Sub.	Island City	Overall
DP Roads (No)	52	60	22	134
DP Roads (in Km)	195.41	150.87	116	462.28
Elevated Roads	6	-	4	10
Flyovers	10	17	14	41
ROBs	1	7	8	16
Vehicular Subways	8	1	1	10
Pedestrian Subways	27	5	24	56

MUMBAI URBAN INFRASTRUCTURE PROJECT – MUIP

1	SV Road
2	Western Express Highway
3	LBS Marg
4	Main Link Road
5	Andheri-Ghatkopar Link Road
6	Andheri-Kurla Link Road
7	AGLR Extn. (JP Road)
8	Eastern Express Highway.
9	Sahar Road

10	N.S.PhadkeMarg
11	Saki Vihar Road
12	MarolMaroshi Road
13	Mahakali Caves Road
14	B.D.SawantMarg
15	GMLR Ext.
16	JVLR Ext.
17	Sion-Dharavi Link Road
18	Anik –Panjarpol Link Road



Roads shown in Red colour handed over to MCGM

MUMBAI URBAN INFRASTRUCTURE PROJECT (MUIP)

Name of Flyovers	Length in Meters	Cost Rs. in crore	(US$ in Million)
Flyovers along WEH			
Airport Junction	800	36	**8**
Dindoshi Junction	400	10	**2**
Thakur Complex	505	25	**5**
Flyovers along EEH			
Navghar Junction	350	15	**3**
Dr.Ambedkar Road			
Sion Hospital Jn.	590	33	**9**
Hindmata	462	25	**5**

Sion Hospital Flyover

Hindmata Flyover

Mumbai Metro Rail

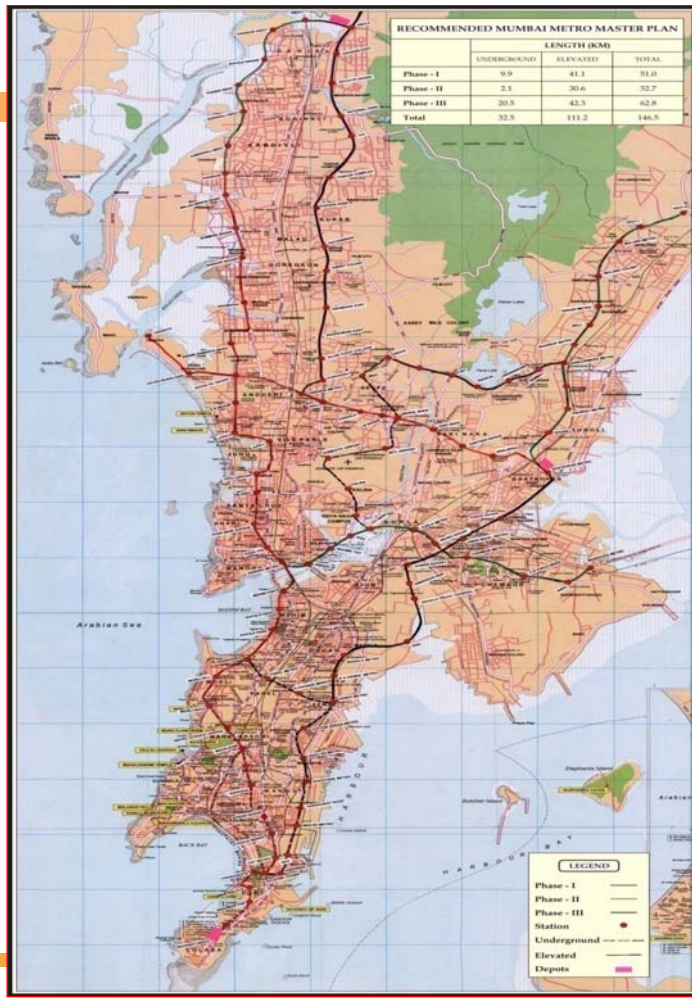
Versova-Andheri-Ghatkopar
Charkop-Bandra-Mankhurd
Colaba-Mahim-Bandra

Charkop - Dahisar
Ghatkopar – Mulund

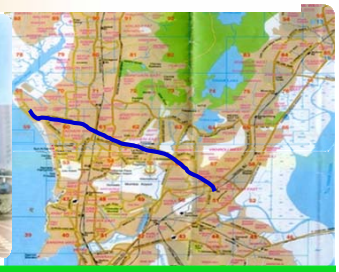
BKC-Kanjur Marg via Airport
Andheri(E) - Dahisar(E)
Hutatma Chowk - Ghatkopar
Sewri – Prabhadevi

Total Length: 146.5 km
Nine Corridors in 3 Phases

Estimated cost : Rs. 47,092 Cr
(US$ 9811 Million)



MUMBAI METRO : Versova-Andheri-Ghatkopar



Metro line 1

Total Length : 11.07 km

No. of stations : 12 Elevated

Year	2011	2021	2031
PHPDT	15565	23590	30550

Project Cost :Rs. 2356 Cr

(US$ 500 Million)

Implementing Agency : MMOPL

Implementation period : 2007-12

- **VGF Rs. 650 Crores (US$ 144 Million) to be provided by GOM/GOI.**
  - **MMRDA equity : Rs. 133Cr(26%)**
  - **Reliance Equity :Rs. 353.1Cr(69%)**
  - **Volia Transport Equity : Rs. 25.59 Cr.(5%)**

Commencement of work: February 2008

- **Project work progress on schedule.**
- **60% to 65% of work completed**
- **The Project is expected to be completed by June, 2011**

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MUMBAI METRO : Charkop-Bandra-Mankhurd

Metro line 2

Project Outline

Total Length : 31.871 km

Implementation period : 2009-13

Number of stations : 27 (Elevated)

Year	2016	2021	2031
PHPDT	24,700	30,460	35,840

Estimated Cost : Rs. 8,250Cr

(US$ 1830 Million)

Project BOT /PPP format

Bhoomi Poojan by Hon'ble President of India -18th August 2009

Concession agreement singed on 21st January ,2010

Financial closure by Concessionaire expected to be October 2010.

LOA given to Independent Engineer 13.09.2010.

Total project cost	Rs. 8250 Cr. (US$ 1830 Million)
Viability Gap Fund (VGF) demanded by Bidder	Rs. 2298 Cr. (US$ 510 Million)
MMRDA Contribution	Rs. 766 Cr (US$ 170 Million)
R&R & utility shifting	Rs. 382 Cr. (US$ 85 Million)
Land Acquisition	Rs. 665 Cr. (US$ 147 Million)
* Govt. Of India VGF support	Rs. 1532 Cr (US$ 340 Million)

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MUMBAI METRO : Charkop-Bandra-Mankhurd

Estimated Daily Ridership:

Year	2016	2021	2031
Daily Ridership	16.34	19.95	23.55

Mode shift from Other Modes

Mode	2016	2021	2031	2016	2021	2031
car	157818	211543	275951	9.6%	10.6%	11.7%
Two wheeler	199843	251909	319466	12.2%	12.6%	13.6%
Auto Rickshaw	27133	24934	26344	1.6%	1.2%	1.1%
Taxi	22948	47811	19626	1.4%	2.4%	0.8%
Bus	761840	879613	1017245	46.3%	44.1%	43.2%
Train	475162	579950	696742	28.9%	29.1%	29.6%
Total	**1644743**	**1995761**	**2355374**	**100.0%**	**100.0%**	**100.0%**

MUMBAI METRO : Colaba – Mahim – Bandra (U/G up to Mahalaxmi)

Metro line 3

Total Length :19.85 km

Implementation period:2009-14

Number of Stations :16

Underground :14

Elevated :02

Completion Cost(UG) : Rs.12152Cr.

(US$ 2700 Million)

Completion Cost(Part UG) :Rs.8857Cr.

(US$ 1968 Million)

Particulars	UG up to Mahim (US$ Million)	UG Up to Mahalaxmi (US$ Million)
Equity by GOI & MMRDA @ 40%	961 (35.59 %)	698 (35.50%)
Subordinated Debt by GOI & MMRDA for land	172 (6.38 %)	140 (7.15%)
Subordinated Debt by GOI & MMRDA for Central taxes	188 (6.99 %)	135 (6.86%)
Exemption/Reimbursement of State taxes	104 (3.88 %)	83 (4.25%)
JBIC loan	1273 (47.16%)	910 (46.29%)

9

Metro Remaining Corridors

		(cost in Rs. Cr.)	(US$ Million)
Line 4	Charkop – Dahisar	Rs. 2375	495
Line 5	Ghatkopar – Mulund	Rs. 3522	734
Line 6	BKC-Kanjur Marg via Airport	Rs. 9480	1975
Line 7	Andheri(E) – Dahisar(E)	Rs. 3999	833
Line 8	Hutatma Chowk – Ghatkopar	*	*
Line 9	Sewri – Prabhadevi (Extention up to Dhutam)	Rs. 11668	2431

- * DPR is under preparation
- Total Cost : **Rs.** 31,044 Cr. **(US$ 6467 Million)**
- Implementation: PPP Model
- Consultancies awarded for preparation of DPRs

44

MUMBAI MONORAIL : Jacob Circle-Wadala-Chembur

Salient Features

Length of Corridor:

Section 1 : 11.28 km (Jacob circle – Wadala)

Section 2 : 8.26 km (Wadala – Chembur)

No.of stations : 18

Design Speed: 80 kmph, Sch. Speed:31 kmph

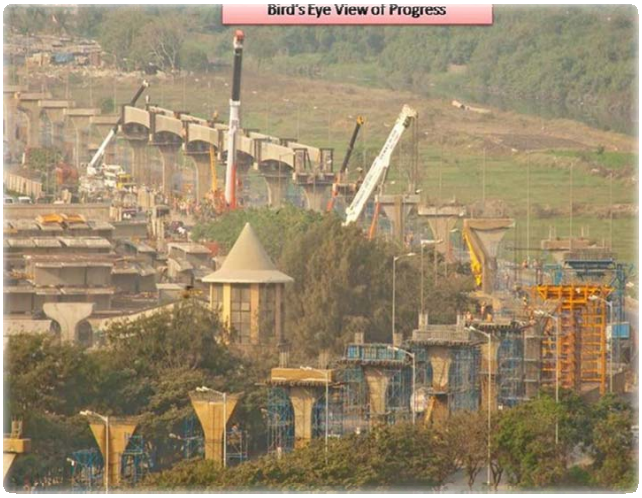
Travel time : Sec1 :25min, Sec2 : 19min

Fare Structure : Rs.8 to Rs.20

Cost of the Project : Rs.2460Cr + Taxes (US$ 546 Million)

- **LOA issued :** 7th November 2008
- **Implementing agency: L&T Scomi**
- **Date of Commencement : Dec'2008**
- **Scheduled Completion : by Dec. 2010 (phase 1)**
  April 2011 (Phase 2)
- **Construction work has started.**

45



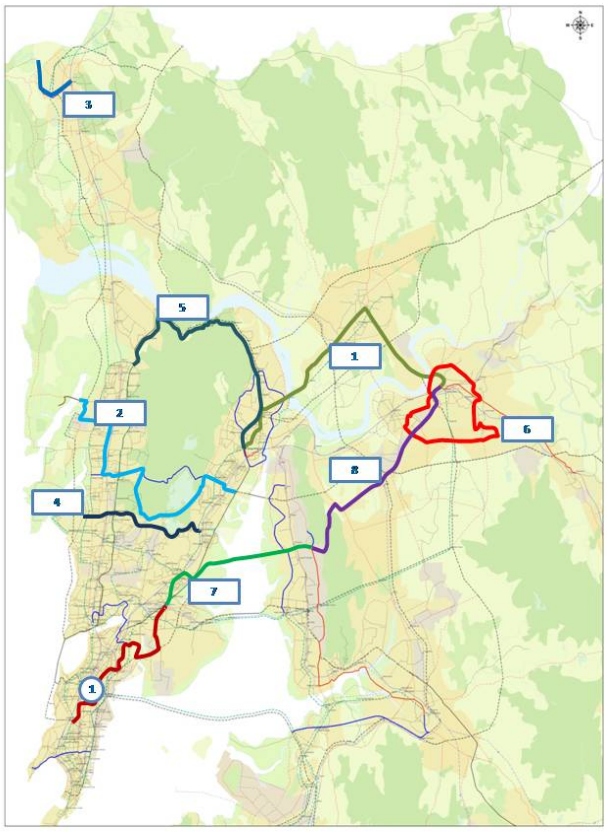
Mumbai Mono Rail

1.Jacob Circle-Wadala- Chembur

(Under implementation)

1. Thane-Bhiwandi-Kalyan
2. Mulund-Goregaon along GMLR
3. Virar –Chiklodongri
4. Lokhandwala-SEEPZ-Kanjurmarg
5. Thane –Ghodbunder-Mira Bhaynder-Dahisar
6. Kdmc Ring Monorail
7. Chembur-Ghatkopar-Koparkhairaine
8. Mahape-Shilphata-Kalyan

Total Length of corridor:-135.21 km



SKYWALKS

Projects Completed

- Project Period : Jan 2008 to Dec. 2010
- Skywalks opened for public – 18 out of 35
  - Kalanagar
  - Bandra (W)
  - Bandra (E)
  - Kanjurmarg
  - Mira Road-(E)
  - Vidyavihar (W)
  - Badlapur (E) & (W),
  - Virar (W)
  - Bhayendar (W)
  - Borivli (W)
  - Chembur (W)
  - Ulhasnagar (W)
  - Ghatkopar (W)
  - Santacruz (E) & (W)
  - Dahisar (E) & (W)

PROJECTS (Under Planning Stage)

- Multi Modal Corridor
- BRTS

MULTI MODAL CORRIDOR

- MMC From Virar- Alibaug
- Length of 140 km (Approx.)
- 4+4 lanes (other traffic including BRTS) +Service Roads
- Metro (In middle of the Corridor)
- Utility Corridor (Under ground
- Non Motorized Transport (Cycles) lane
- Estimated Cost : **Rs.** 10,000 Cr

(US$ 2083 Million)

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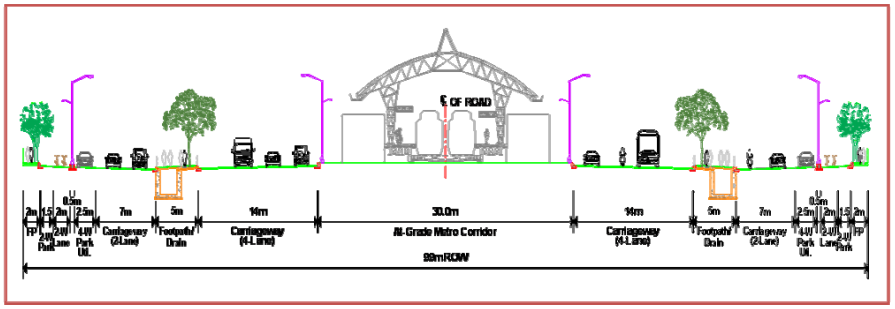
MULTI MODAL CORRIDOR



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BRTS

- Mumbai BRTS launched on Pilot basis at

➢ Western Express Highway

➢ Eastern Express Highway

Sr. No.	Components	Features
1	Study Corridor	WEH (25km) and EEH (25km)
2	Placing of Buslane	Median side with passing lanes at bus stop
3	Vehicle Technology	• Floor height : 400 mm • Acceleration : 1 m sec2
4	Capacity	• 12m length – 70 • 18m length - 125 • 25m length - 170
5	Operating System	Closed
6	Service Pattern	Trunk and Feeder
7	Bus Frequency	22.5 secs in Peak Hour
8	Bus Stops	• At Mid block & Staggered • At about 1km Spacing
9	Facilities at bus stop	• FOB with Staircase Escalators and Lifts • Toilet, shops, parking
10	Intelligent Transport System (ITS)	• Passenger Information System • Ticket Issue and Verification - off board at terminals • Vehicle Tracking, signal prioritization, bill payment system
11	BRTS Depots	Total 9, 6 in First Phase (Dharavi, Ghatkopar, Dindoshi, Poisar, Dahisar, Thane)
12	BRTS Terminals	Dahisar, Andheri, Ghatkopar, Thane
13	Integration with other Transport System	• Feeder Bus system • IPTS • Metro & Mono Rails • Existing Sub urban System With provision of Sky walks

Cost Estimates Details (Rs. In Cr.)			
Sr. No	Details	WEH	EEH
1	Cost of ROW & related infrastructure	522.49 (Us$ 109 million)	379.37 (Us$ 79 million)
2	Bus and Bus Depot	245.32 (Us$ 51 million)	138.68 (Us$ 29 million)
3	ITS / Fare collection	15.40 (Us$ 3 million)	11.49 (Us$ 2 million)
	Total	783.21 (Us$ 163 million)	529.76 (Us$ 110 million)

Financial Analysis Scenario	WEH	EEH	Combined
Return on Total Investment	4.83%	2.13%	3.79%
Return on BEST Operation	18.17%	18.17%	18.17%

Vision - Transform MMR

"Transforming MMR into a world class metropolis with a vibrant economy and globally comparable quality of life for all its citizens".

BACKGROUND

- 1962 - Bombay Traffic and Transportation study- Wilbur Smith Associates- Collected Household information. Mainly focused on Island road transportation
- 1978 - CRRI - Planning of Road System for Mumbai Metropolitan Region - The first exhaustive study - Collected total Household information. Mainly focused on road transportation.
- 1992 CTS study by WS Atkins used 1978 Household Survey Data collected by CRRI

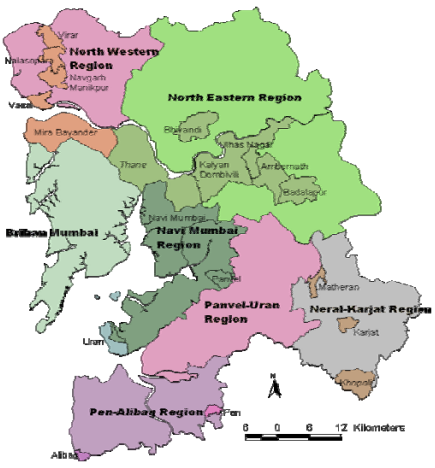
- WS Atkins recommended review/ updating of Data every 10 years
- All subsequent studies updated CRRI matrices and no fresh Home Interview surveys were carried out

World Bank recommended a fresh CTS to formulate MUTP extensions

MMR and its Sub-regions

Base Year (2005)

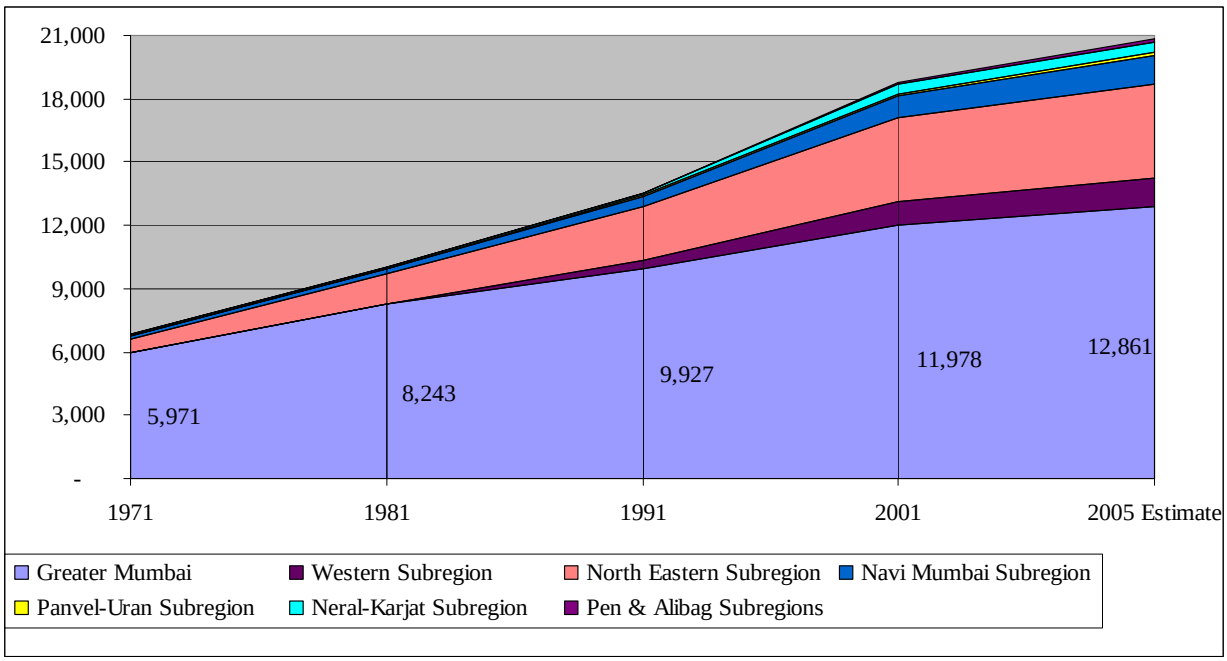
- Total population = 20.8 mil
- Total Employment = 7.6 mil



	Pop (m)	Emp (m)
Greater Mumbai	12.86	4.7
Region	7.94	2.9

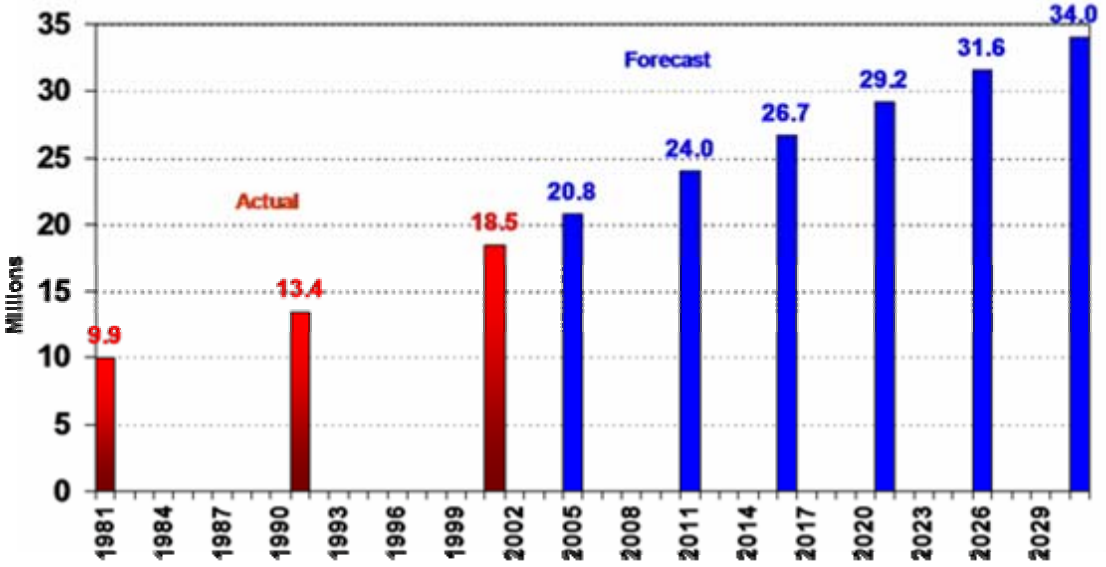
Alternative 2031 Population & Employment Land Use Scenarios

Demography- Previous trends

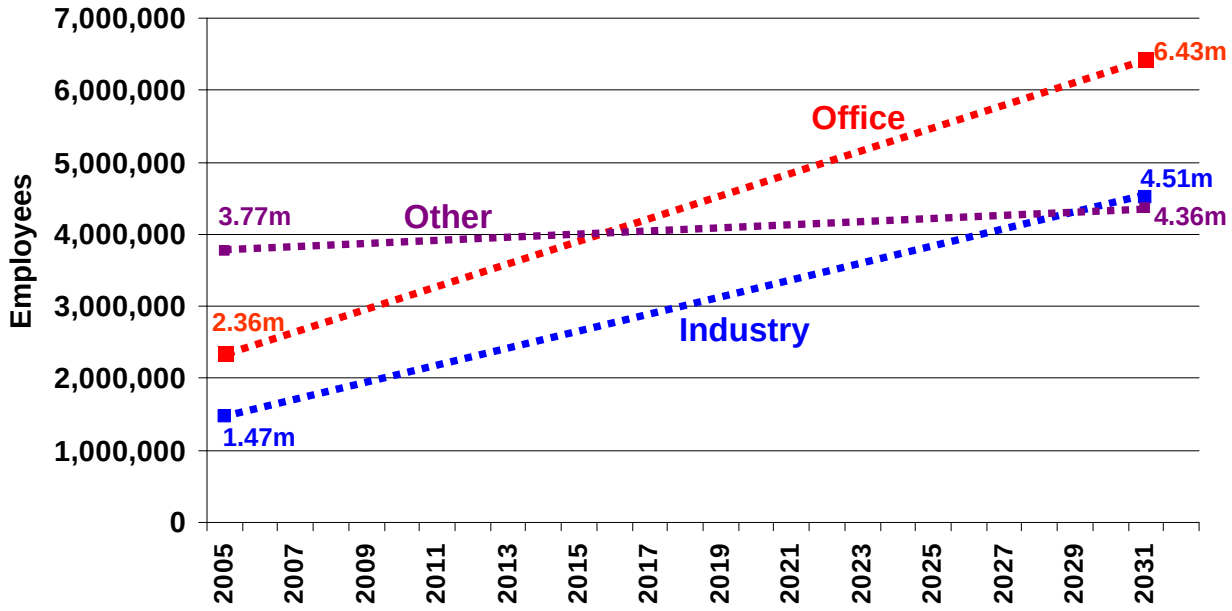


Population (000) 1971-2005

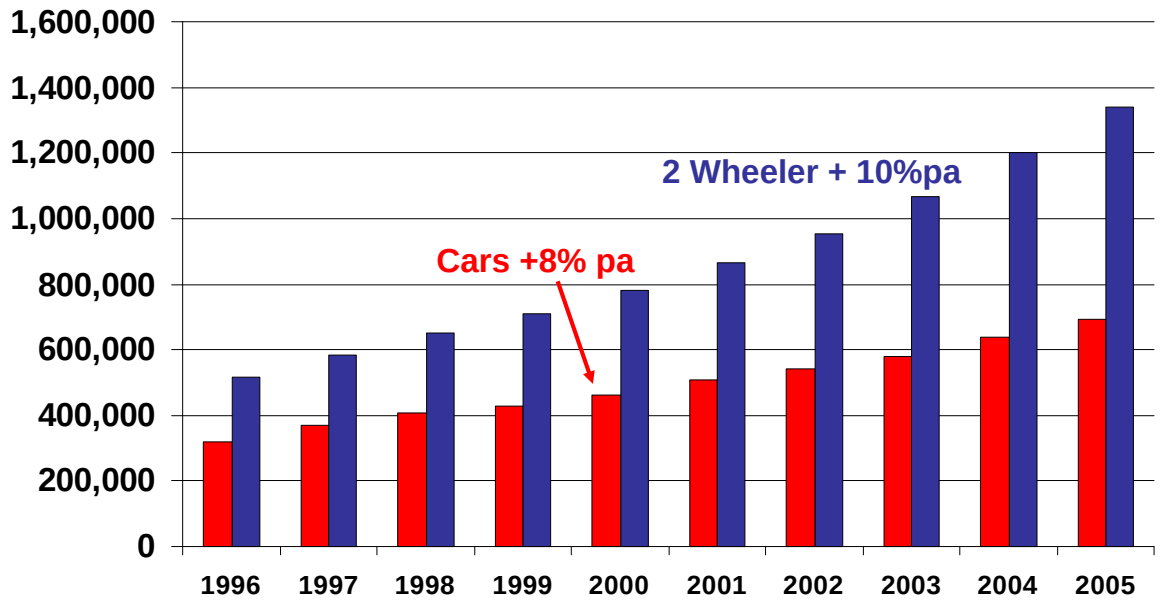
MMR Population Growth



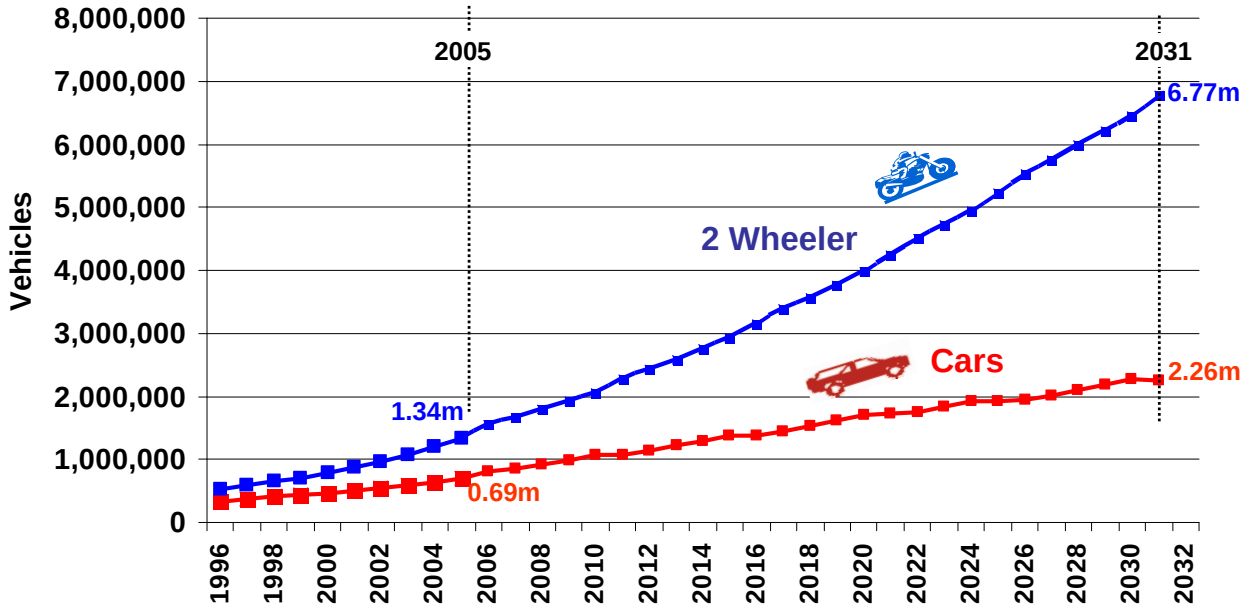
Target Employment Growth in MMR



10 Year Growth in MMR Vehicle Ownership



Projected Growth in MMR Vehicle Ownership



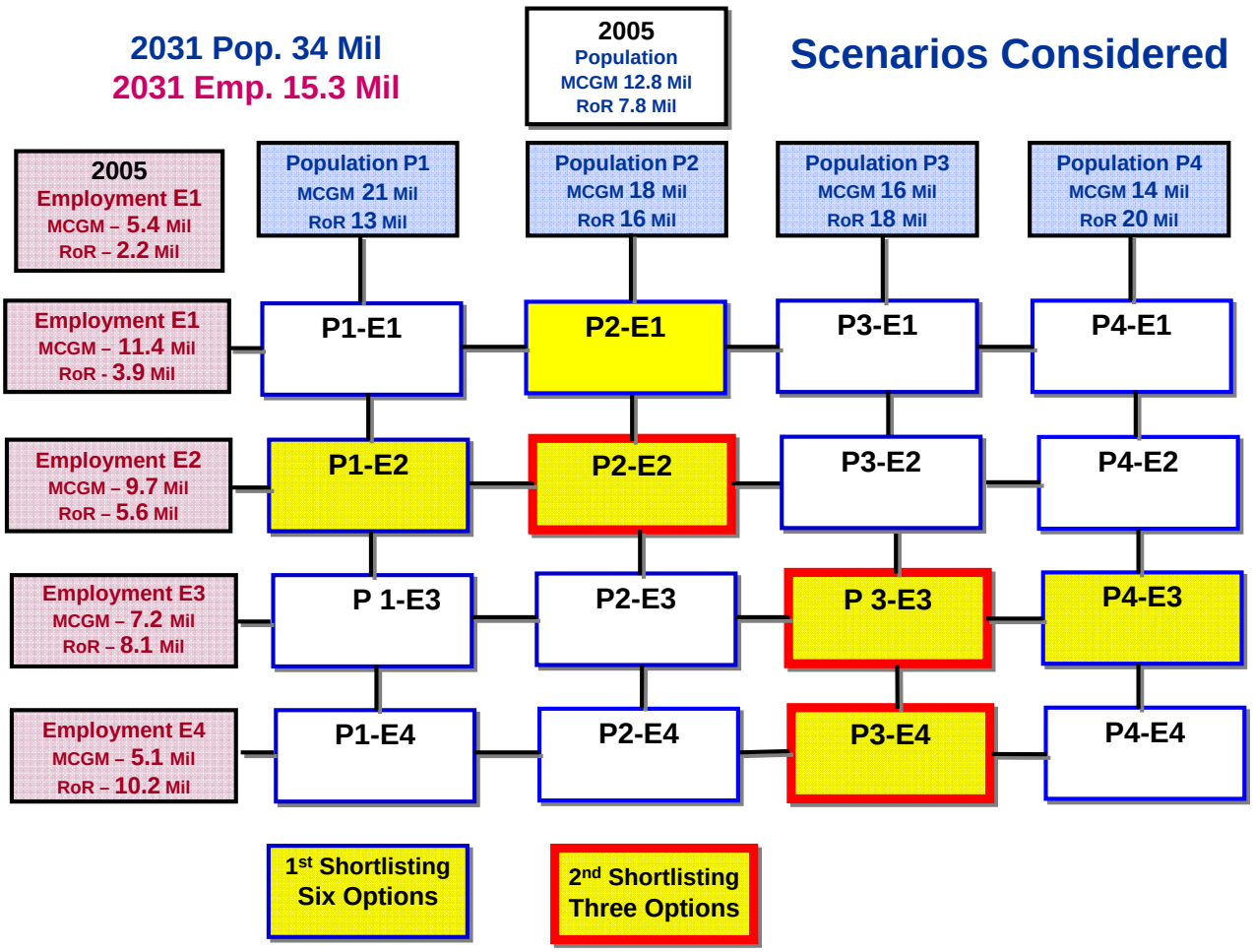
Summary of Potential Changes in Socio:Economic Factors and Urban Transportation

2005

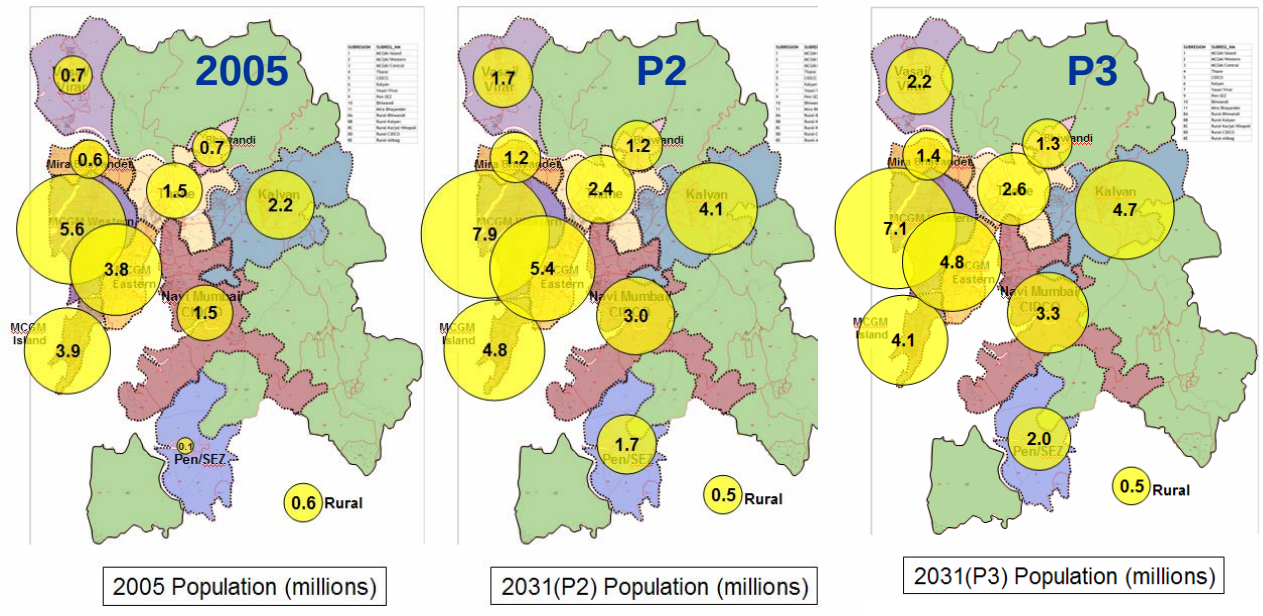
- Population 21 million
  - 48% living in slums
  - 1,505,000 apartments
  - 4.4 persons/household
- Employment 7.5 million
  - Employ. Partic. Rate 0.37
  - 2.3 million working in offices
  - 1.5 million working in industries
  - 56% employed in formal sector
  - 40% walk to work

2031 Projected

- Population 34 million
  - 14% living in slums
  - 6,400,000 apartments
  - 3.9 persons/household
- Employment 15.3 million
  - Employ. Partic. Rate 0.45
  - 6.4 million working in offices
  - 4.5 million working in industries
  - 70-80% employed in formal sector
  - 25-30% walk to work



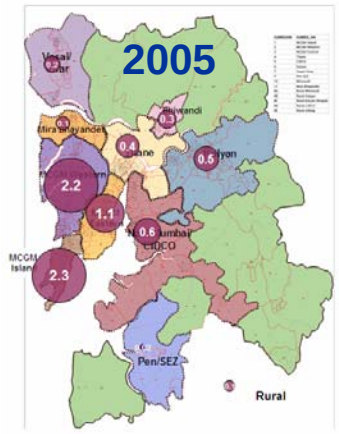
Population Growth Options 2005-2031



2005 Population (millions)

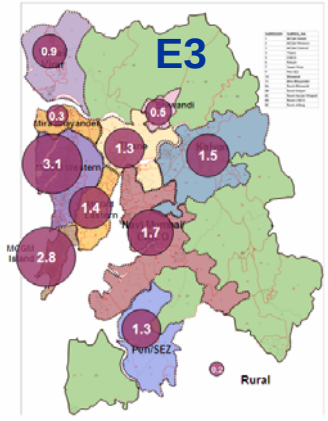
2031(P2) Population (millions)

2031(P3) Population (millions)



2005 Employment (millions)

2031(E2) Employment (millions)



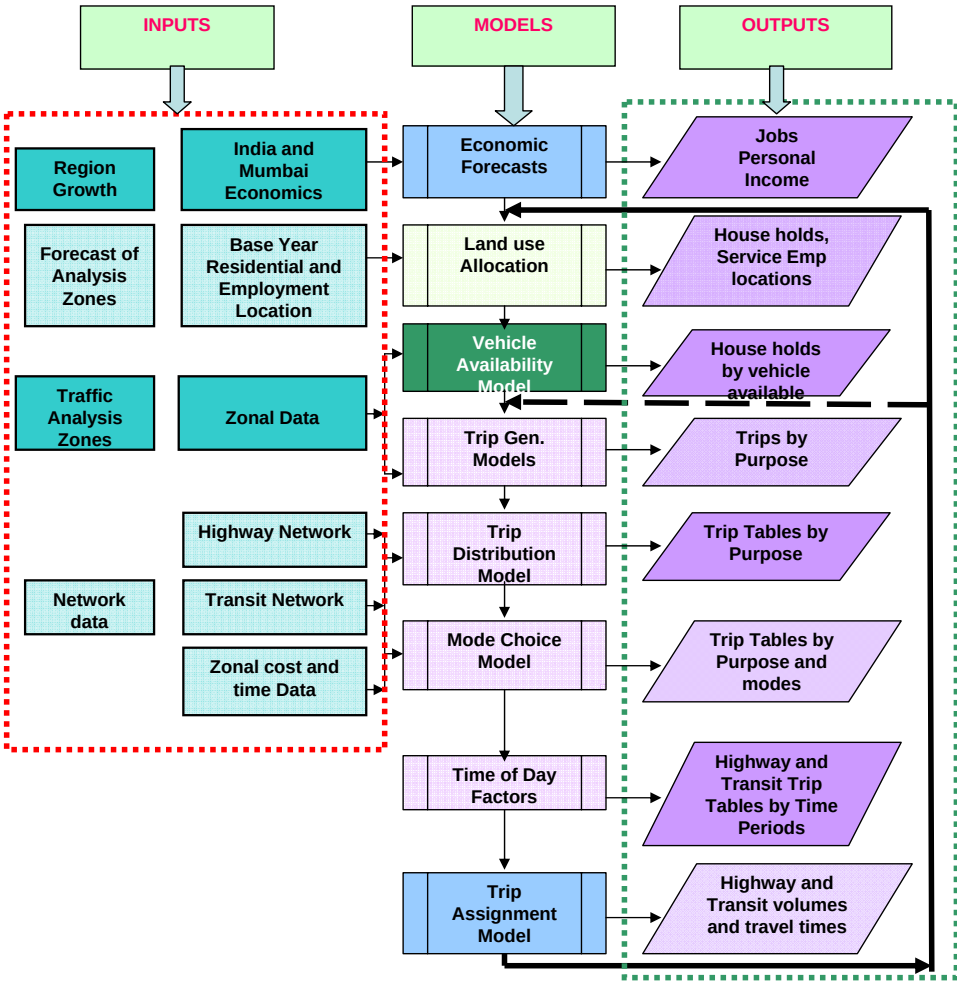
2031(E3) Employment (millions)

2031(E4) Employment (millions)

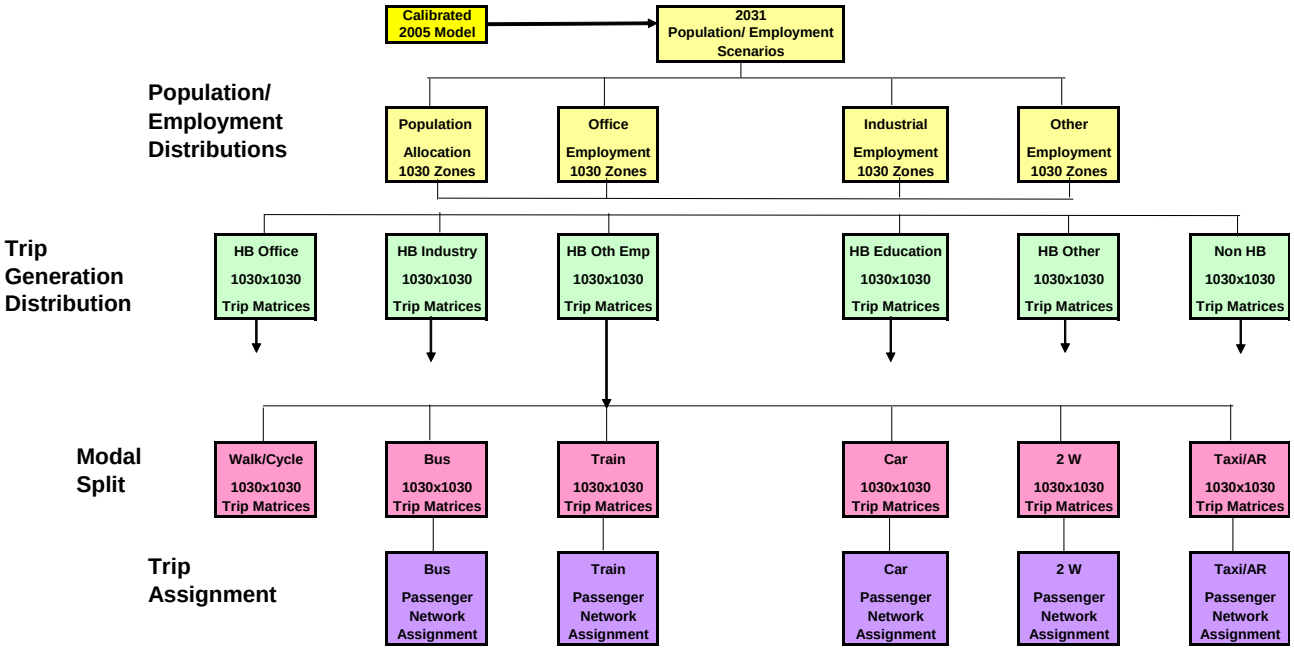
Employment Growth Scenarios 2005-2031

Travel Demand Modelling and Transport Networks

Estimating Travel Demand



Transportation Modeling Approach



National Urban Transport Policy

- Encourage public transport

  Encourage greater use of public transport enabling the establishment of quality focused multi modal public transport systems that are well Integrated providing seamless travel across modes

- Integrate Land use with transport

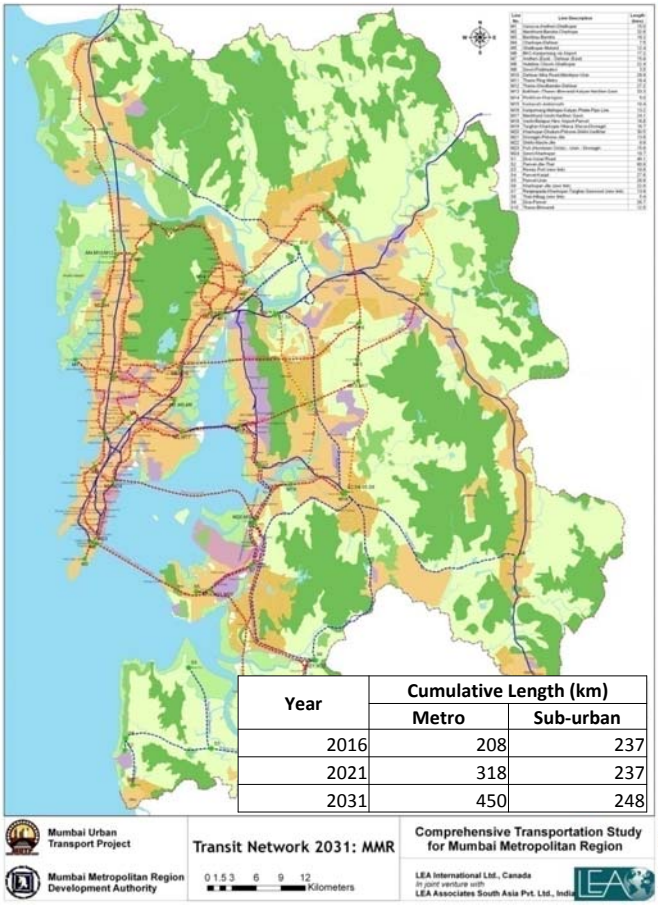
  Encouraging integrated land use and transportation planning so the travel distances are minimized and access to livelihoods education and other social needs

- Transport to guide development

  Incorporating urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement.

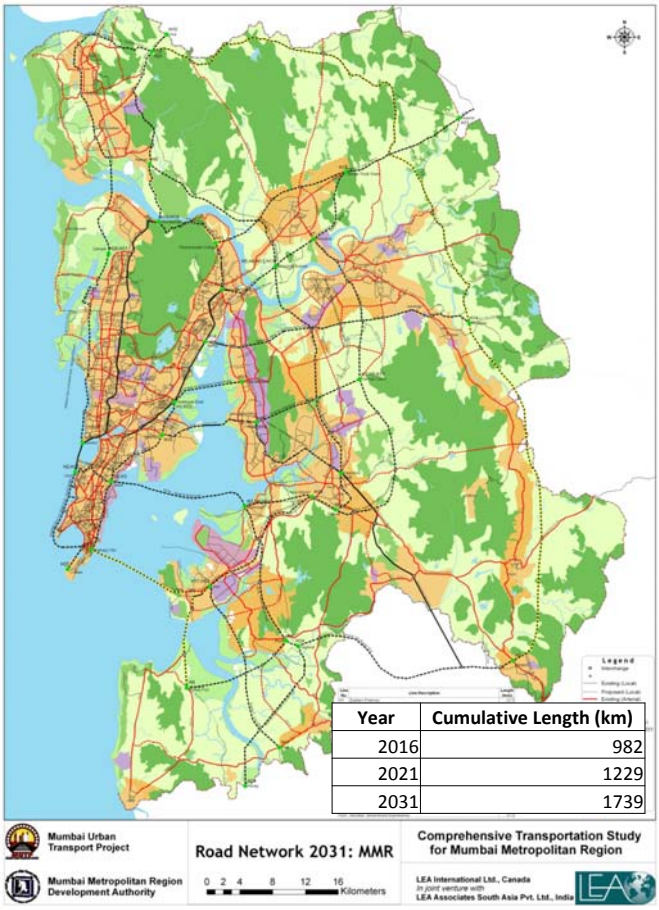
- Provide equitable allocation of space

  Bringing about more equitable allocation of road space with people rather than vehicles as its main focus



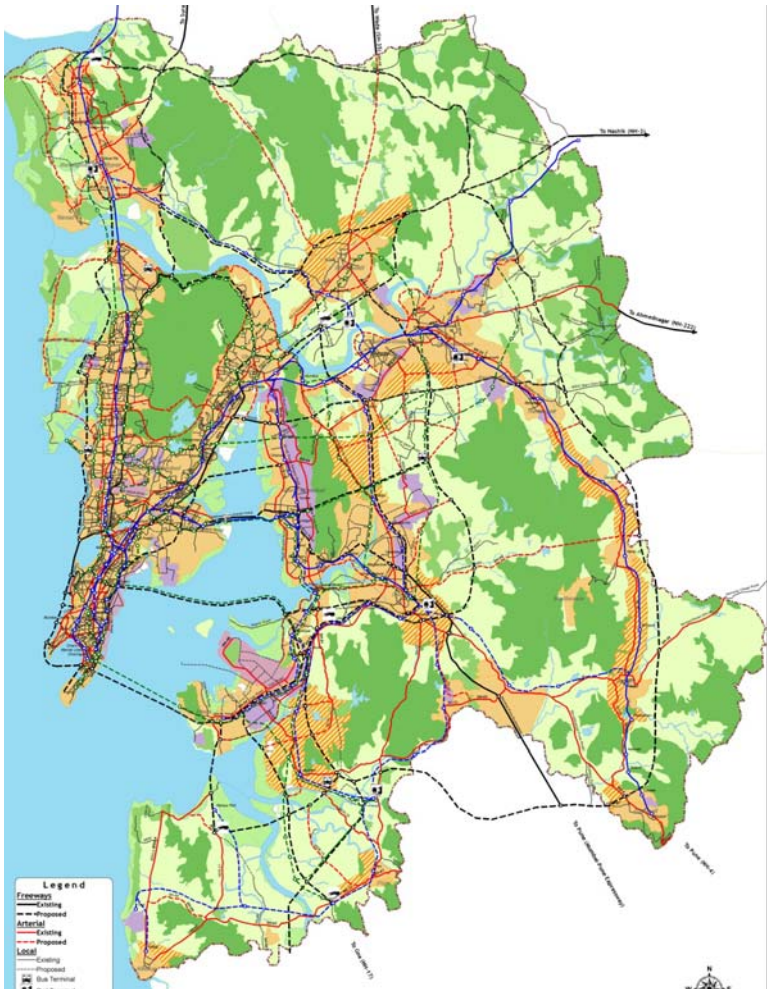
Year	Cumulative Length (km)	
	Metro	Sub-urban
2016	208	237
2021	318	237
2031	450	248

Long Term (2031)Metro and Sub-urban Network



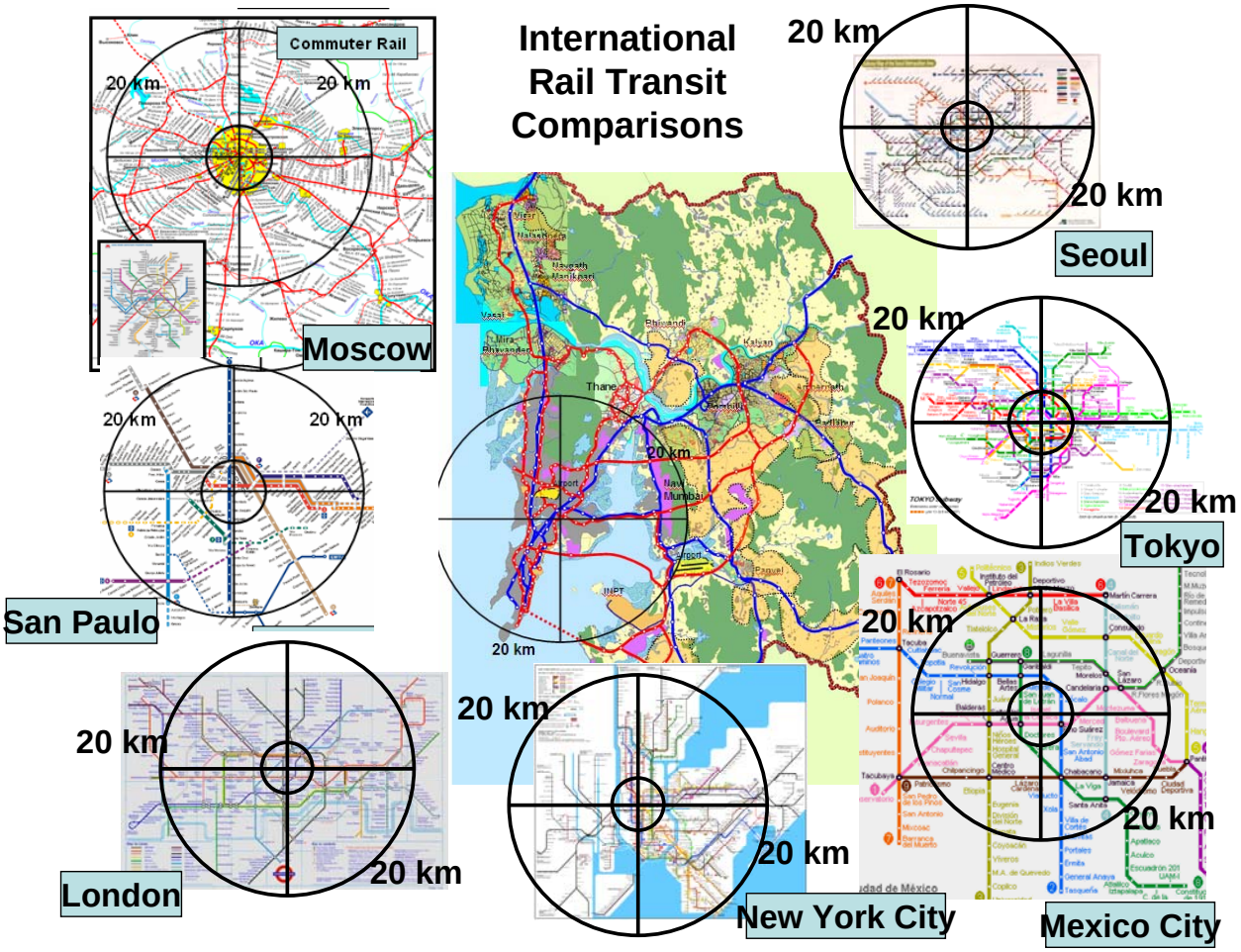
Year	Cumulative Length (km)
2016	982
2021	1229
2031	1739

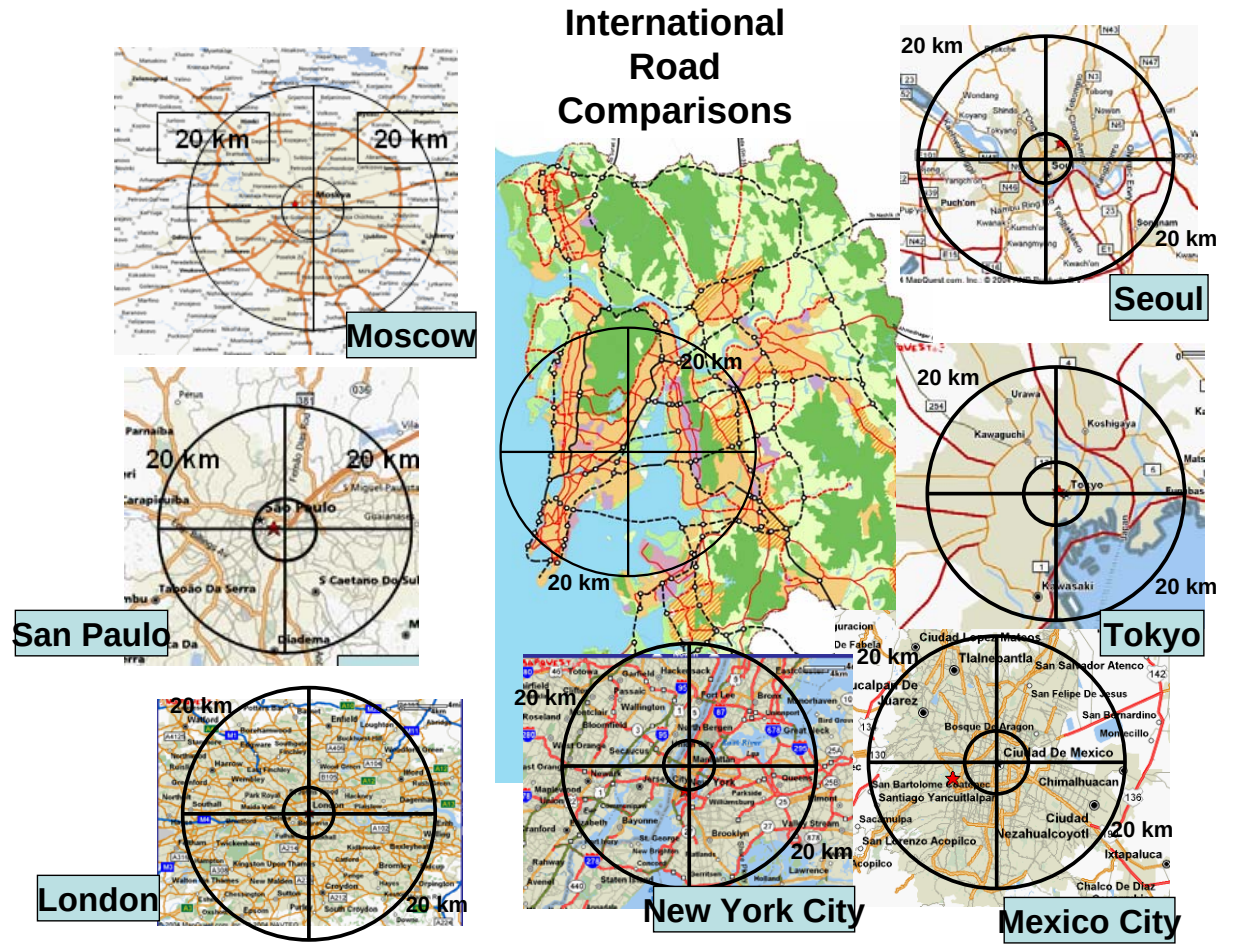
Long Term (2031)Highway Network



Proposed Terminals

- 17 Inter-State/ Inter-City Bus Terminals
- 6 Inter-City rail Terminals
- 5 Major Truck Terminals and 10 Mini Truck Terminals
- 13 Passenger Water Transport (PWT) Terminals


International Rail Transit Comparisons
Commuter Rail
20 km
20 km
Moscow
20 km
20 km
San Paulo
20 km
20 km
London
20 km
20 km
Seoul
20 km
20 km
Tokyo
20 km
20 km
New York City
20 km
20 km
Mexico City


International Road Comparisons
20 km
20 km
Moscow
20 km
20 km
San Paulo
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London
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Seoul
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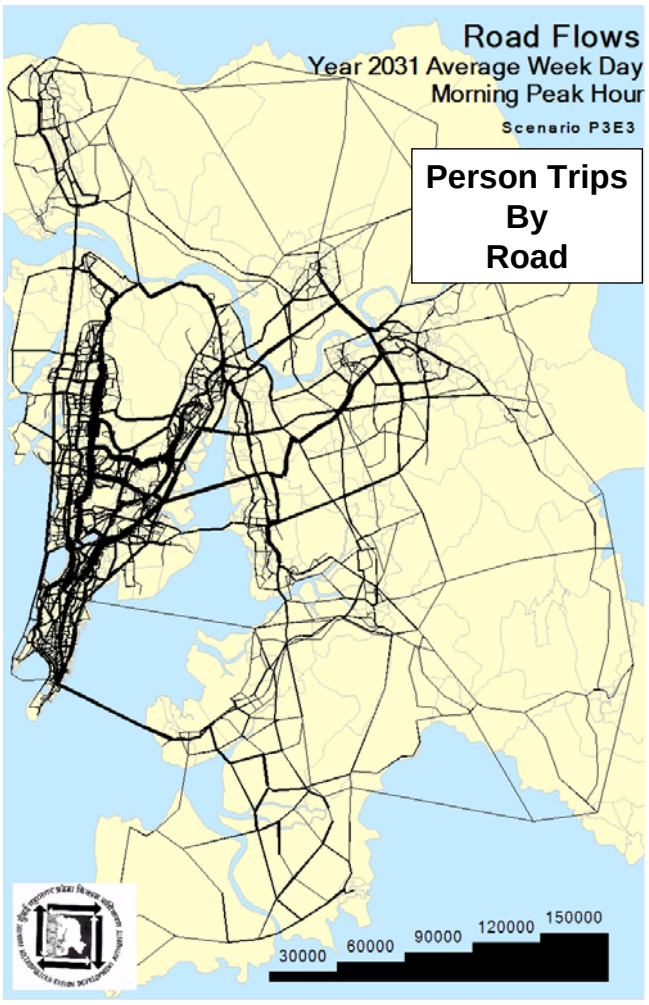
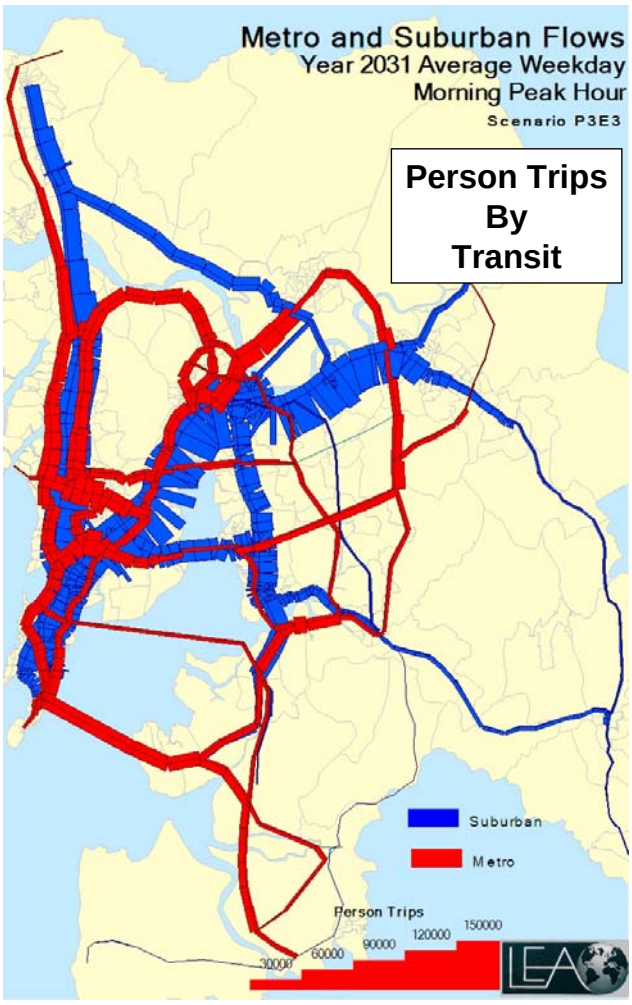
Tokyo
20 km
20 km
New York City
20 km
20 km
Mexico City

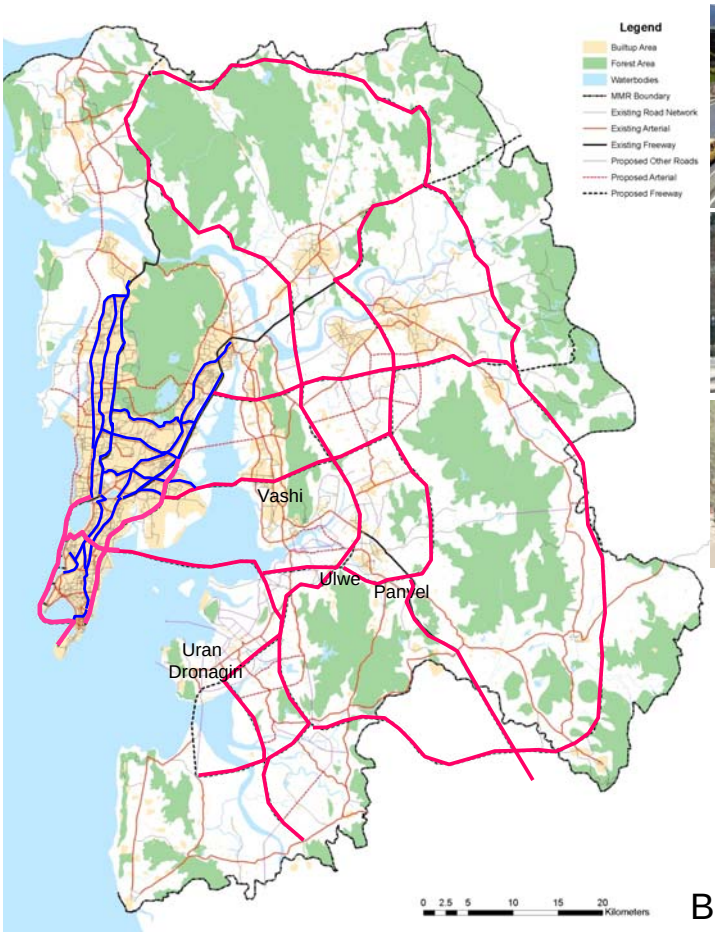




Summary of Growth Indicators

MMR	Actual 15 year 1991-2005	Forecast 25 year 2005-2031
Population Growth	43%	63%
Sub-urban Train Daily Trips*	35%	170%
Bus Daily Trips (Main Mode + Feeder Trips)	9%	36%
Registered Cars	137%	230%
Registered Two wheelers	306%	400%
Registered Auto Rickshaws	420%	20%
Registered Taxis	128%	50%
Registered Commercial vehicles	200%	200%
Airport Passengers	94%	600%

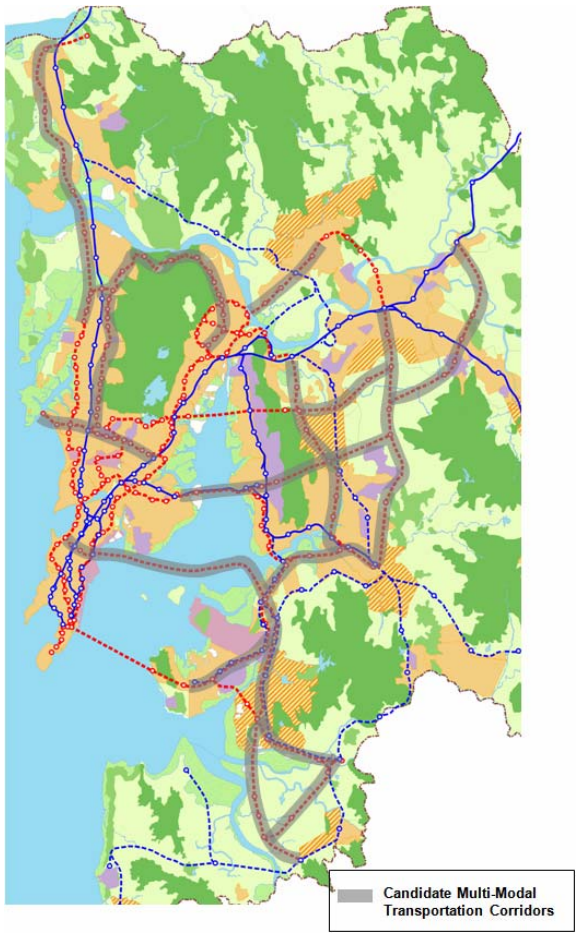
* Includes metro trips for the horizon year 2031



On Existing Roads

On Proposed New Roads

Candidate Roads
for
Bus Rapid Transit/ EBL/ Mono Rail



Multi-Modal Corridors

London LRT on Grade

Mexico City - Metro on Grade
in Centre of Expressway

Calgary - Metro on Grade
in Centre of Expressway

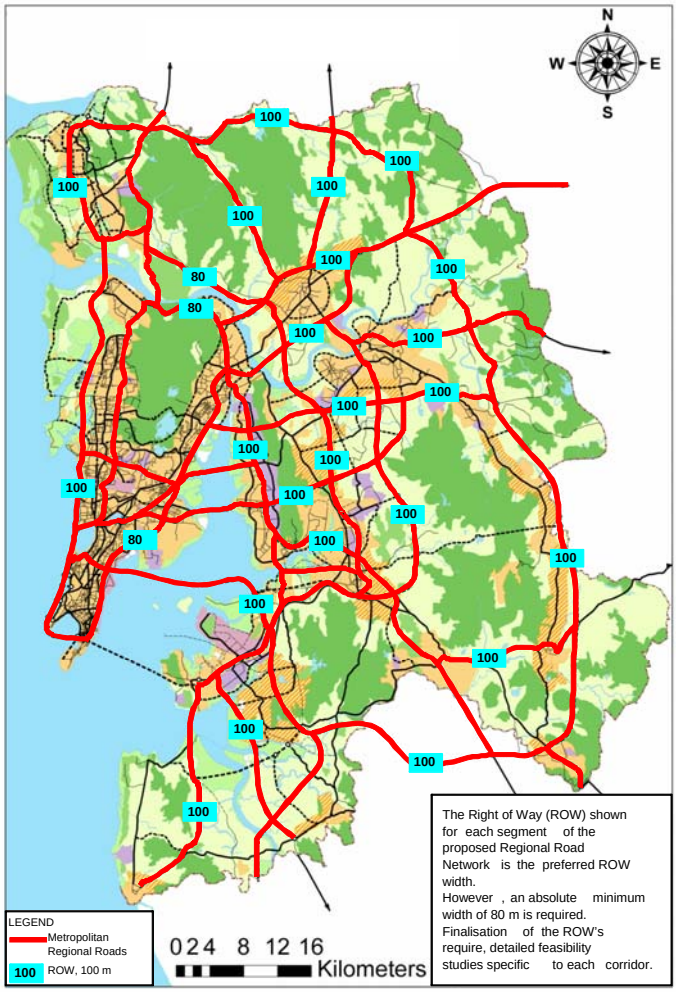
Toronto Metro on Grade

Shanghai Metro on Grade

Strasbourg LRT on Grade

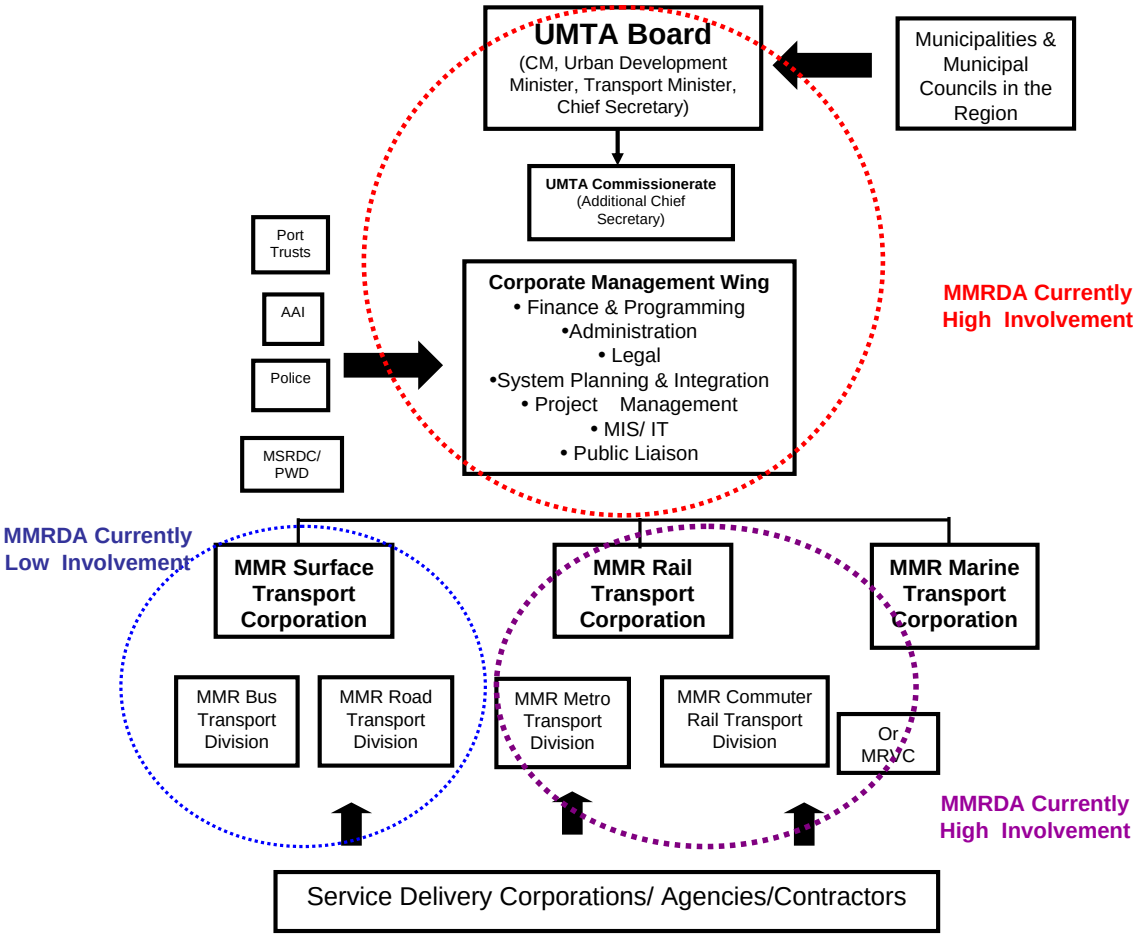
Note:
Only 45% of London's Underground is in tunnel
The balance is on the surface

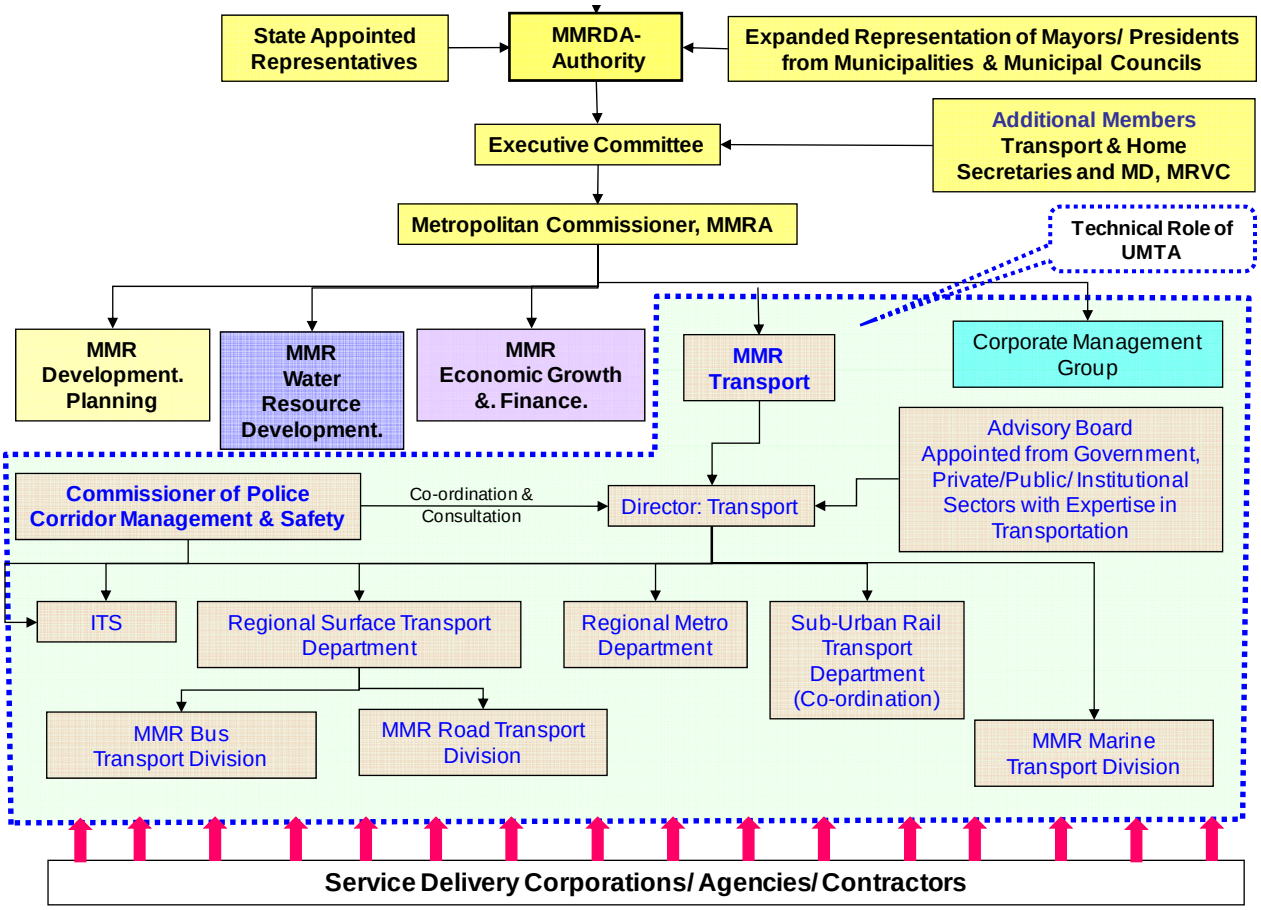
Right of Way Requirements

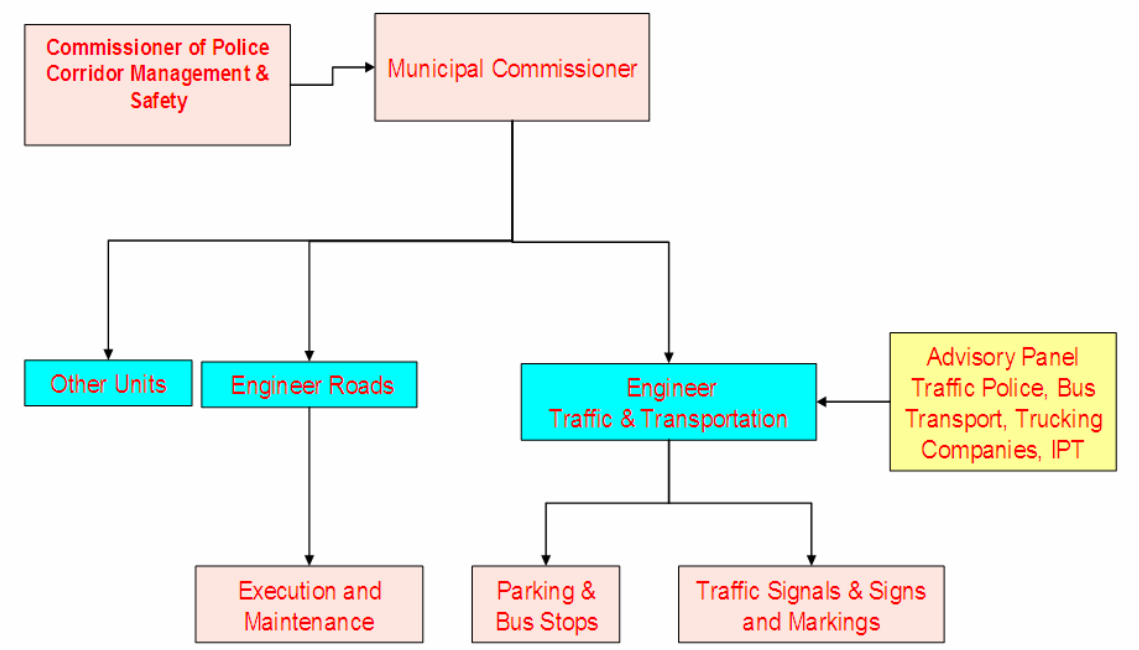


Institutional Options for MMR

CTS for MMR and Business Plan


UMTA Board
(CM, Urban Development Minister, Transport Minister, Chief Secretary)
Municipalities & Municipal Councils in the Region
UMTA Commissionerate
(Additional Chief Secretary)
Port Trusts
AAI
Police
MSRDC/ PWD
Corporate Management Wing
• Finance & Programming
•Administration
• Legal
•System Planning & Integration
• Project Management
• MIS/ IT
• Public Liaison
MMRDA Currently High Involvement
MMRDA Currently Low Involvement
MMR Surface Transport Corporation
MMR Rail Transport Corporation
MMR Marine Transport Corporation
MMR Bus Transport Division
MMR Road Transport Division
MMR Metro Transport Division
MMR Commuter Rail Transport Division
Or MRVC
MMRDA Currently High Involvement
Service Delivery Corporations/ Agencies/Contractors


State Appointed Representatives
MMRDA- Authority
Expanded Representation of Mayors/ Presidents from Municipalities & Municipal Councils
Executive Committee
Additional Members Transport & Home Secretaries and MD, MRVC
Metropolitan Commissioner, MMRA
Technical Role of UMTA
MMR Development. Planning
MMR Water Resource Development.
MMR Economic Growth &. Finance.
MMR Transport
Corporate Management Group
Advisory Board Appointed from Government, Private/Public/ Institutional Sectors with Expertise in Transportation
Commissioner of Police Corridor Management & Safety
Co-ordination & Consultation
Director: Transport
ITS
Regional Surface Transport Department
Regional Metro Department
Sub-Urban Rail Transport Department (Co-ordination)
MMR Bus Transport Division
MMR Road Transport Division
MMR Marine Transport Division
Service Delivery Corporations/ Agencies/ Contractors



Proposed Transportation Organizations in Municipal Corporations and ULB's

UMMTA: Mumbai Metropolitan Region

- **UMMTA setup through an executive order in Feb., 2008**
- **Jurisdiction covers the entire Mumbai Metropolitan Region**
- **Objectives:**
  - **Bring about co-ordination between the different institutions under the govt. of Maharashtra on transport matters of Mumbai Metropolitan Region**
  - **Function as an empowered Authority for transport related issues**
  - **Decisions taken by UMMTA regarding priorities of infrastructure facilities, fund raising, distribution and management shall be considered as final**
- **It is not permitted to take any such decisions which may interfere with the Constitutional Rights of ULBs.**

Existing UMMTA Composition and Sub Committees

UMMTA Composition

- Chief Secretary- Chairman
- Principal Secretary, UDD
- Principal Secretary, Planning Department
- Principal Secretary, Finance Department
- Principal Secretary, Transport Department
- Principal Secretary, Law & Judiciary Department
- Principal Secretary, Environment Department
- Principal Secretary, Special Projects
- General Manager, Central Railway
- General Manager, Western Railway
- Chairman & Managing Director, Konkan Railway
- Secretary, PWD
- Metropolitan Commissioner, MMRDA
- Commissioner, MCGM
- Police Commissioner, Mumbai
- Transport Commissioner, Mumbai
- Vice **Chairman** & Managing Director, CIDCO
- Vice **Chairman** & Managing Director, MSRDC
- Vice President & Managing Director, MSRTC
- General Manager, B.E.S.T
- Representative of Chatrapathi Shivaji International Airport
- Joint Metropolitan Commissioner, Member secretary

UMMTA Sub Committees

- **Strategic Planning Committee;**
- **Finance Committee;**
- **Traffic Engineering Committee;**
- **Traffic Operation & Management Committee;**
- **Regulation, Safety and Environment Committee;**
- **Terminals and Parking Committee;**
- **Legal Committee with specific focus in transport sector**
- **MIS & Research Committee**

Functional Jurisdiction of UMMTA

- **UMMTA shall bring about coordination amongst the agencies working in the transport sector in MMR;**
- **Without prejudice to the Constitutional autonomy of the ULBs, UMMTA's decisions in respect of Unified Transport Plan, Modal Preference, Priority of Infrastructure, Raising of Finances and their allocation and Working Procedures shall be final;**
- **UMMTA will be competent to make recommendations or issue directives on following aspects:**
  1. **Comprehensive Transport Plan for the Metropolis;**
  2. **Coordination amongst the Regional or City Development Plans and the Regional Transport Plans;**
  3. **Modal priorities and integration;**
  4. **Prioritisation of infrastructure development and integration;**
  5. **Selection of executive agencies for operating infrastructure services;**
  6. **Bus Rapid Transit;**
  7. **Economic planning and allocation of financial resources;**
  8. **Techniques of execution and Public Private Partnership;**
  9. **Bringing about unanimity amongst various agencies;**
  10. **Transport related research and knowledge;**
  11. **Training in transport sector; and**
  12. **Other work assigned by Mumbai City Planning Committee.**

Cost Estimates and Funding Sources

Summary of Preliminary Cost Estimates Proposed Transport Networks Horizon Years 2031, 2021 and 2016

Component	2008- 2031		2008- 2021		2008- 2016	
	Length km	Cost Rs Crores	Length km	Cost Rs Crores	Length km	Cost Rs Crores
Metro System	450	1,10,095	316	82,707	204	59,623
Suburban Railway System	241	30,978	231	28,670	231	27,920
Highway System	1660	57,412	1114	44,844	836	31,173
Highway Corridors with EBL	77	1,670	111	2,000	147	11,079
Bus System		4,280		2,150		1,104
Passenger Water Transport		480		480		480
Truck Terminals, Inter-Bus and Rail Terminals		3,040		2,038		1,126
Total	2,429	2,07,956 US $ 50.72 Billion	1,772	1,62,890 US $ 39.73 Billion	1,418	1,32,504 US $ 32.32 Billion

Note:

1. *The cost estimates are @ 2005-06 prices*
2. *The metro system cost includes the cost of rolling stock*
3. *The sub-urban railway system cost includes the cost of rolling stock for new lines, capacity enhancement of the to the existing sub-urban railway system*

Funding Sources

Sl. No.	Transport System	Estimated Total Cost (Rs. Crore) @ 2005-06 Prices	Inter Governmental Transfer (%)	Development Charges (%)	Borrowing (%)	Private Investment (%)
I	Metro System	1,10,095	15	25	0	60
II	Sub-Urban Railway System	30,978	30	30	40	0
III	Highway System	57,412	25	25	30	20
IV	Highway Corridors with Exclusive Bus Lanes (EBL)	1,670	25	25	30	20
V	Bus System	4,280	25	25	30	20
VI	Passenger Water Transport	480	12	12	16	60
VII	Terminals	3,040	21	21	28	30
Total Investment, Average % Funding Sources		2,07,956 (US$ 43324 million)	20	28	12	40

Potential Need for Re-allocation from Private to Development Charges Particularly for Metro

Creation of Dedicated Infrastructure fund for MMR for implementation of Proposed Infrastructure Projects in MMR

CTS Major Recommendations (upto 2031)

- 450 km of metro network
- 240 km of sub-urban network
- 1740 km of highway network
- Terminals:
  - 4 Inter State Bus Terminals
  - 13 Inter City Bus Terminals
  - 6 Inter City Rail Terminals
  - 5 Major Truck Terminals and 10 Minor Truck Terminals
  - 13 Passenger Water Transport Terminals
- Seamless Travel
- Institutional Options
- Funding Requirements and Creation of Dedicated Transport Infrastructure Fund

92

Steps taken so far….

- MMRDA initiated the DPR for Phase II and Phase III metro corridors of Mumbai Metro Master Plan
- MMRDA completed the DPR study for Metro corridor from Siddhi Vinayak-Sewri-Kharkopar-Dhutum-Dushmi (about 50 kms)
- MMRDA initiated the process for Techno-Economic Feasibility Study of Multi-Modal Corridor from Virar-Alibag Study (150 kms) which covers some of the higher order highway corridors as well as some metro corridors as proposed in the CTS study
- Process initiated for Common Ticketing and Fare Integration, Dialogue with various operators/ ULBs is in progress
- UMMTA established under Chairmanship of Chief Secretary
- All the ULBs requested to include the proposed arterial roads and higher order highway corridors, metro corridors, sub-urban rail corridors, monorail corridors in the Development Plans for the reservation of RoW
- Initiated Technical Assistance project for implementation of CTS and Business Plan proposals. The focus of this TA shall be on preparatory actions that are needed on priority related to the projects which have to be implemented by 2016/2021 with specific attention to sustainability.
- The study on Monorail Master Plan for MMR is completed

Thank you

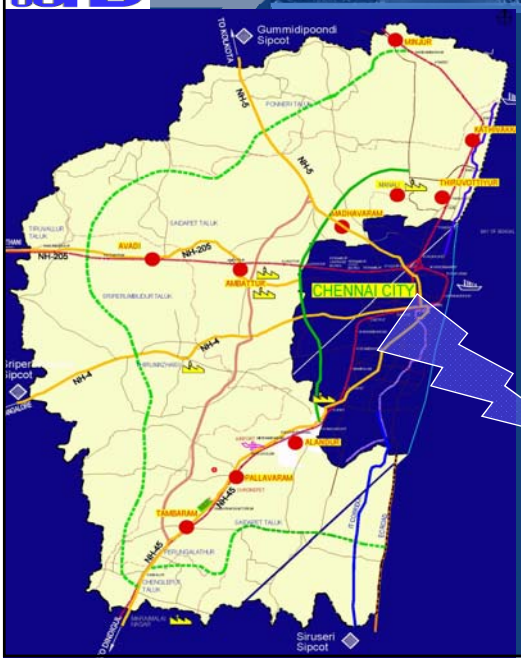
Presentation on

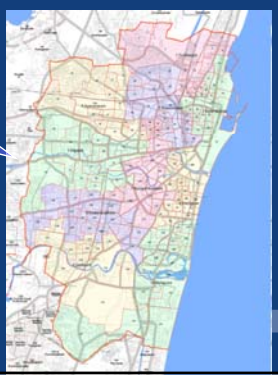
Transportation infrastructure for Chennai Metropolitan Area

Chennai Comprehensive Transportation Study (CCTS)

CMA - Profile

- CMA
  - Chennai City
  - 16 Municipalities
  - 20 Town Panchayats
  - 214 Village Panchayats
  - Falls in three districts
    - Chennai
    - Part of Thiruvallur and
    - Part of Kancheepuram.

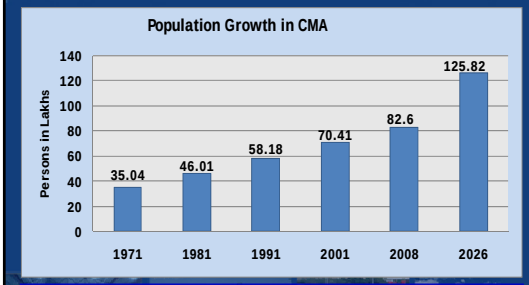




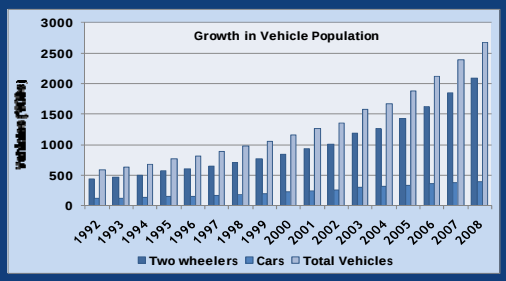
CTS Comparison

Sl. No.	Parameters	CTTS 1970	CTTS-1993	CCTS-2008
1	Population in lakhs	33.5	58.18 as per 1991 census	70.41 as per 2001 census (82.6- 2008)
2	Per capita trip rate	0.80	1.28	1.60
3	Total trips in lakhs	26.50	74.5	129
4	Share of - Two Wheeler trips	1.70	7.0%	25%
	- Car trips	3.2	1.50%	6%
5	Share of public transport (Bus & Rail)	53%	42.70%	31%
6	Trip Length - Two Wheeler		6.3 km	10.3 km
	- Car		8.0 km	14 .0 km
8	Average house hold income		Rs. 2300	Rs. 8700

Vehicle Registered & Population Growth



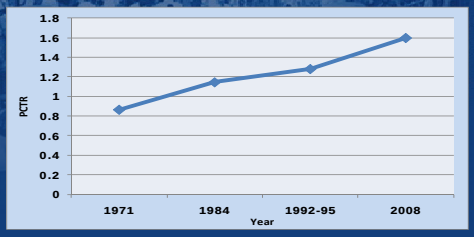
- Compound Annual Average Growth Rate (CAAGR) 2%

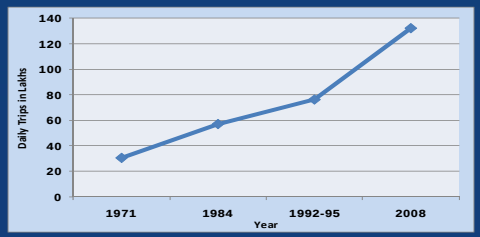


- Total vehicle population- 28.14 lakhs (2009)

- Registered vehicles increased 5 times during last 16 years
- Around 2 lakh vehicle registration per year

Travel Demand





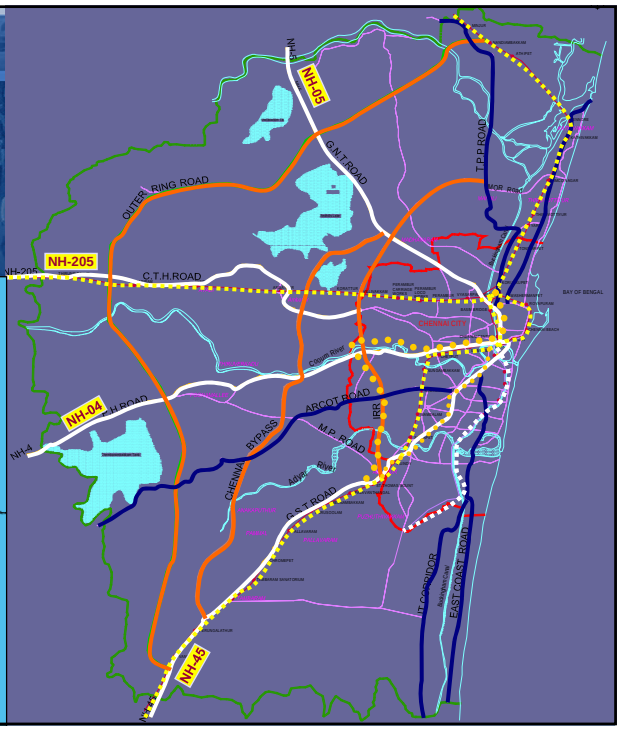
- Per Capita Trip Rate 1.6 - 2008
  1.28 -1992

- Daily Trips have doubled in the time period 1992 - 2008

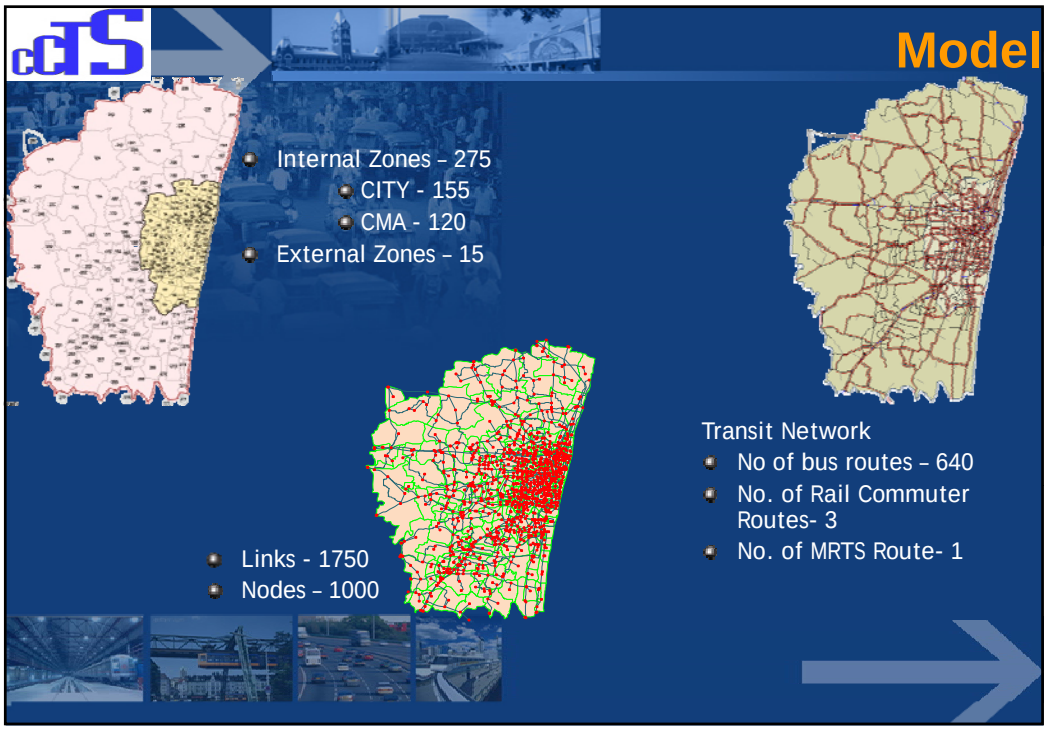
- Traffic Volumes have increased with an average growth rate of 10% over the decade.

- Level of congestion on arterials and other major roads has increased three-fold for the period 1992 to 2008.

Major Transport Corridors




Need

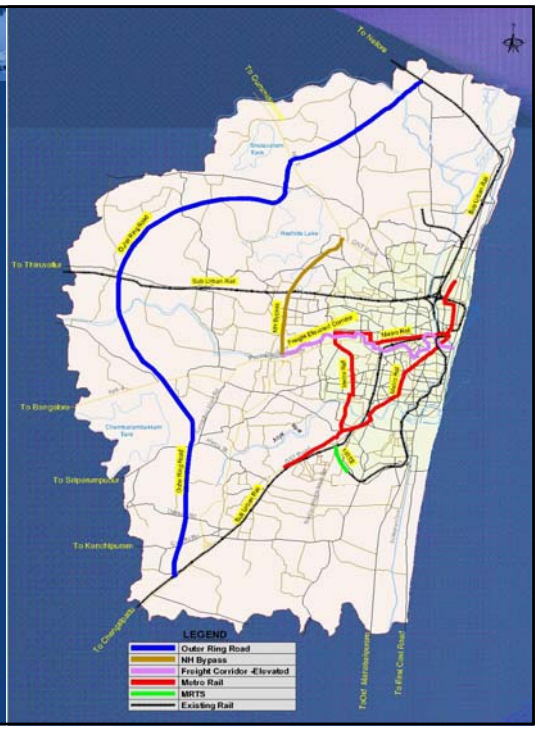

Model
Internal Zones – 275
CITY - 155
CMA - 120
External Zones – 15
Links - 1750
Nodes – 1000
Transit Network
No of bus routes – 640
No. of Rail Commuter Routes- 3
No. of MRTS Route- 1

Strategies

- Integration of land use and transport-connectivity between areas of activities within the CMA
- Accessibility within and outside CMA
- Substantial increased use of Public Transit
- Improved non-motorized and pedestrian facilities
- Improved safety of travel
- Reduction in pollution
- Optimization of network layouts

The Complex Transport situation needs a multipronged approach

MAJOR COMMITTED PROJECTS



Outputs

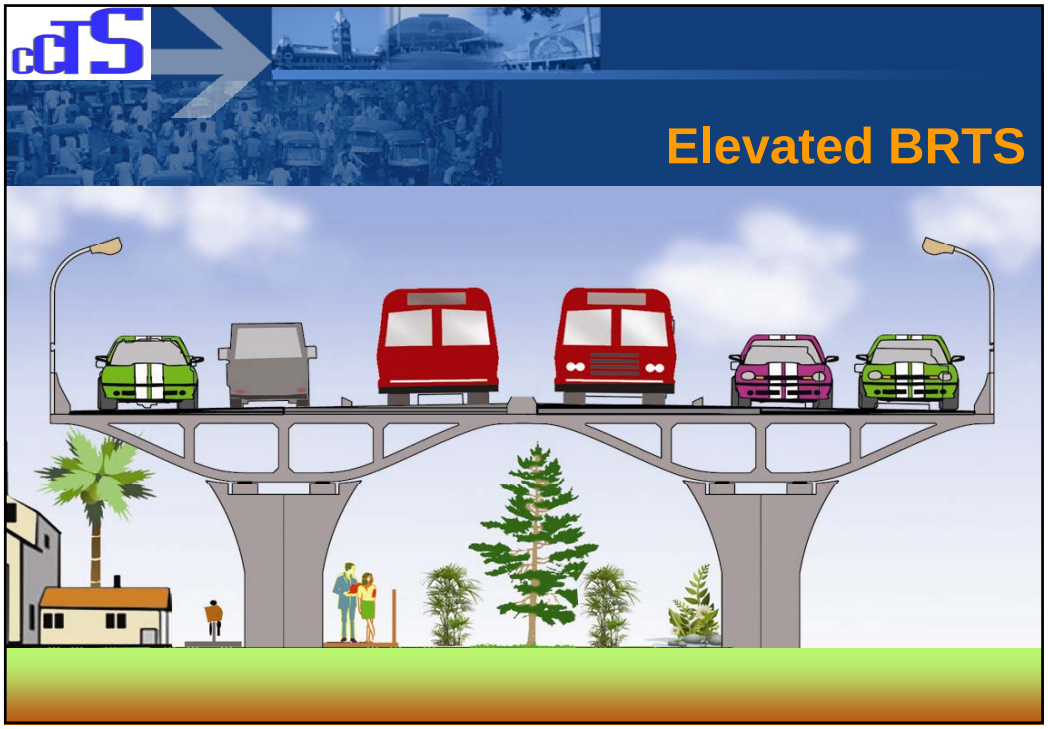
Summary of Proposals- Long Term

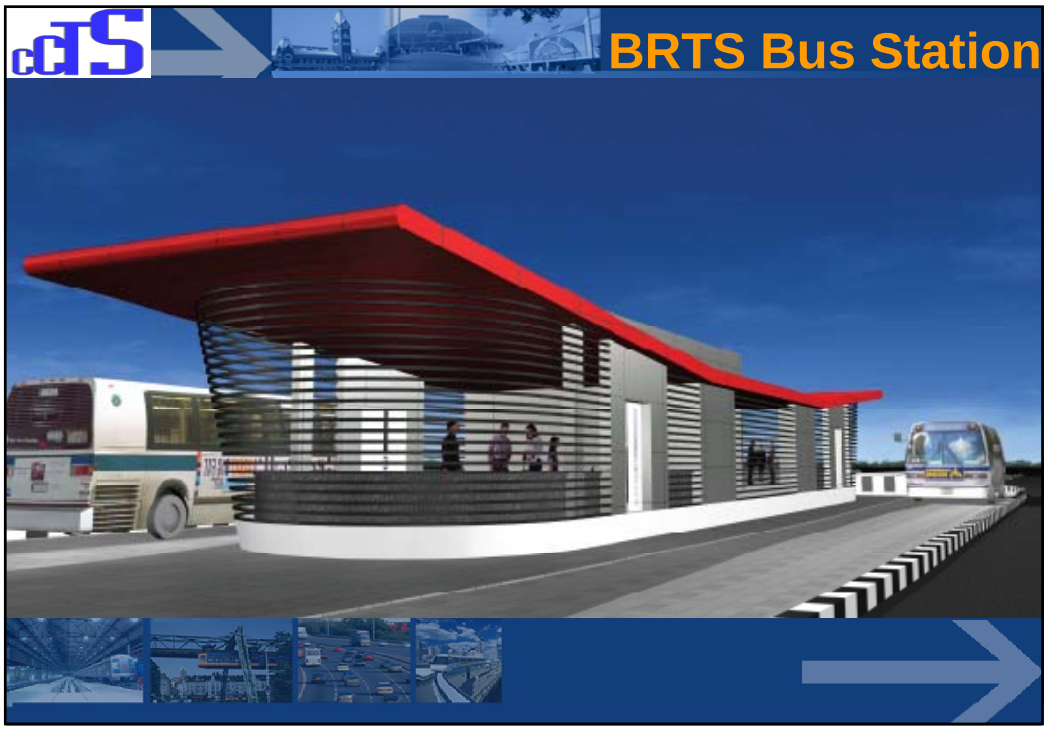
Schemes	Details	Length (km)
MRTS	From Velachery to St. Thomas Mount*	5
Metro	1. From Washermenpet to Airport* 2. From Chennai Central to Thirumangalam* 3. From Thirumangalam to Mount*	45
	Washermenpet – Wimco Nagar	9
	GNT Road – Madhavaram High Road-Perambur – Mc Nichols Road- Anna Flyover – Luz - Lighthouse	19
	Total Length	73
Mono Rail / LRT	Pallavaram – Kundrathur - Poonamallee - Ambattur - Koyambedu	27
	Avadi – CTH Road-Ambattur I.E - Padi – New Avadi Road – Kilpauk	24
	NH Bypass from Porur- Maduravoyal-Ambattur –Puzhal - Madhavaram	18
	Sriperumbudur - Poonamallee - Porur – Arcot Road-T Nagar- Teynampet- -Luz	42
	Total Length	111

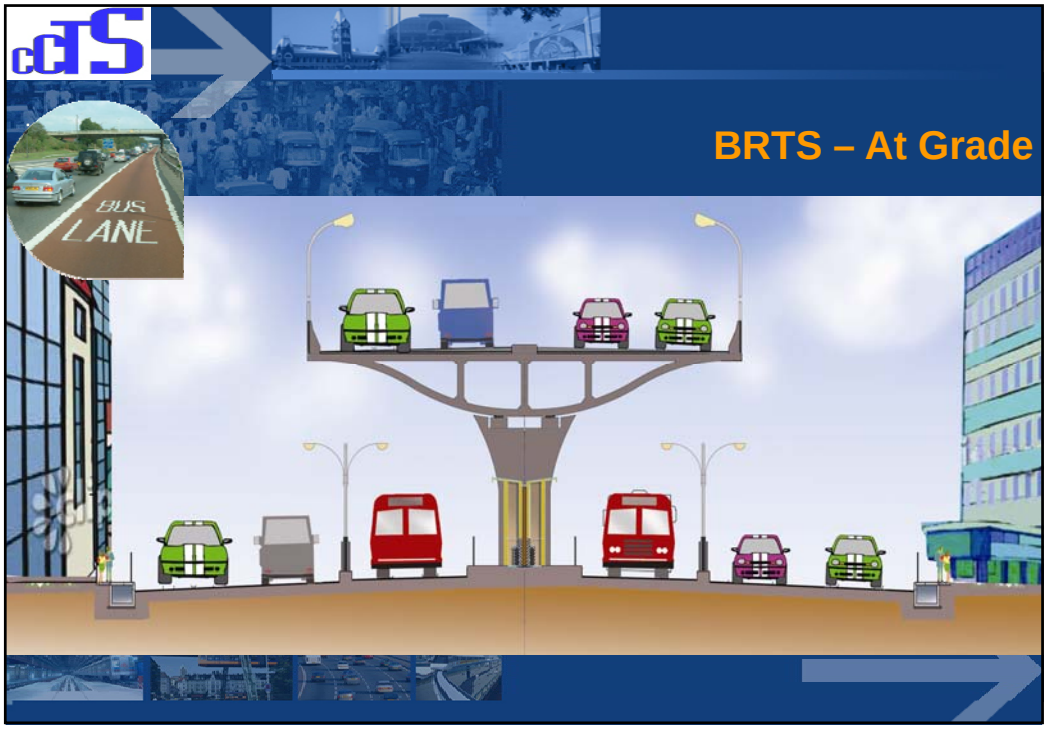
Mass Transit Improvements

Contd..

Schemes	Details	Length (km)
BRTS	Outer Ring Road (Vandalur)-Kundrathur –– Thandarai	30
	Medavakkam – Kilkattalai – Ullagaram - St.Thomas Mount (El.BRT)	11
	Northern Section of Jawaharlal Nehru Road	16
	Tiruvanmiyur- Kandhanchavadi-Thoraakkam-Mettukuppam-Kelambakkam	23
	Thorapakkam – Kovilambakkam-Kilkattalai-Srinivasapuram-Pallavaram	11
	Vandalur-Tambaram-Velachery Road-Medavakkam-Thiruvanmiyur	20
	Adyar-Saidapet-Nandambakkam-Porur (Elevated)	16
	NH Bypass from Porur – Maduravoyal – Ambattur – Pudur – Puzhal - Madhavaram	18
	Total Length	145
Proposed Suburban Rail Links	4th line from Beach to Athipattu* 2. 5th & 6th line from Central to Avadi*	42
	Chengalpattu-Tiruvallur	47
	Thiruvanmiyur - Perungudi-Mamallapuram	42
	Thiruvallur - Gummudipoondi	46
	Chengalpattu-Mamallapuram	27
	Total Length	204


Elevated BRTS


BRTS Bus Station



Contd...

Schemes	Details	Length (km)
Elevated Roads	Thiru-vi-ka Bridge to Nandambakkam	11
	Along Medavakkam High Road	9
	Pallavaram – Tirusulam along NH45	3
	Nandambakkam-NH Bypass	5
	NH Bypass – Poonamallee Bypass along NH4	6
	MORR to Dr.Radha Krishnan Salai	16
	Kamarajar Salai– Kottivakkam	9
	Total Length	59
Major New Links (6 lanes)	ORR from NH 45 to TPP road*	62
	NH bypass From NH 4 to NH 5*	13
	CMA Peripheral Ring Road sections	56
	Link between Vandalur-Wallajabad Road & Sriperumbudur-Kodambakkam	10
	Link between NH Bypass & ORR & NH4	23
	Ennore Port Connectivity Road	23
	NH bypass (MEPZ) to ORR	3
	Southern Segment ORR	10
	Jawaharlal Nehru Road southern segment*	5
	Thorapakkam – ECR line	2
	Velachery - Karapakkam	4
	Total Length	211

Highway Improvements

Contd..

Schemes	Details	Quantity
Missing Links (4 lanes)	Kannadasan nagar to CPCL (Manali Rd)	3 km
	Puzhal to Jawaharlal Nehru Road - Madhavaram – Red hills road	3 km
	Medavakkam – Kovoor	15 km
	Nesapakkam to Nandambakkam (Trade centre)	3 km
	Sub Total	24 km
Major Road Widening	NH45-NH4 via Oragadam (6 lane)	25 km
	Sriperumbudur-Tiruvallur (6 lane) (Singaperumal Koil – Sriperumbudur Rd)	22 km
	Redhills-Tiruvallur (4 lane)	33 km
	Kelambakkam-Vandalur (6 lane)	19 km
	Sub Total	99 km
Elevated freight corridor from Chennai port to Maduravoyal*		18 km
Bus Augmentation		8000 Nos
Intermodal Stations		13 Nos
Truck terminals		10 Nos
Intercity bus terminals at intersections of ORR and NHs		4 Nos

Bus Augmentation

Year	Number of Buses Needed
2011	4600
2016	5500
2021	6600
2026	8000

Freight Corridors & Truck Terminals

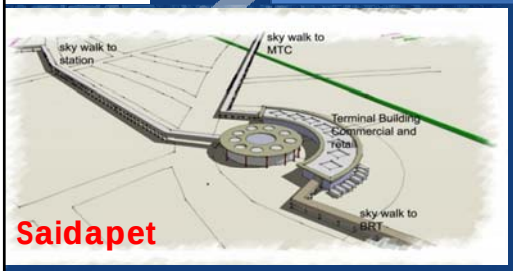
Sl. No.	Freight Transport Corridors
1	NH Bypass
2	Suryanarayana Road
3	TPP Road
4	Manali Oil Refinery Road
5	Northern Segment of IRR
6	Ennore Port Connectivity Road
7	Port - Maduravoyal Road
8	ORR
9	Vandalur Kelambakkam Road
10	NH4 / NH205 upto NH Bypass
11	NH45 upto ORR
12	NH5

Sl. No.	Truck Terminals
1	Vandalur
2	Varadharajapuram
3	Karunakarancheri
4	Nallur
5	Madhavaram
6	Koyembedu
7	Maduravoyal
8	Manali
9	Manjambakkam
10	Annembedu

STRR

- The total length of STRR is about 190 km.
- Ring Roads around
  - Mamallapuram,
  - Chenglepet,
  - Kancheepuram,
  - Arakonam,
  - Uthukottai and
  - Gummidipoondi

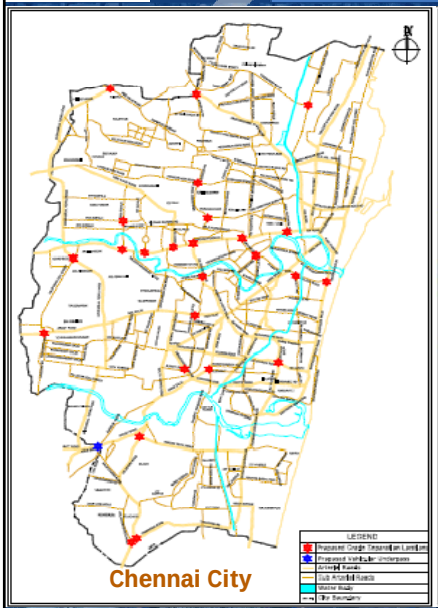
Inter -Modal Stations



Saidapet

- Luz
- Gemini
- Tirumangalam
- Porur
- Saidapet
- St.Thomas Mount

Grade Separators

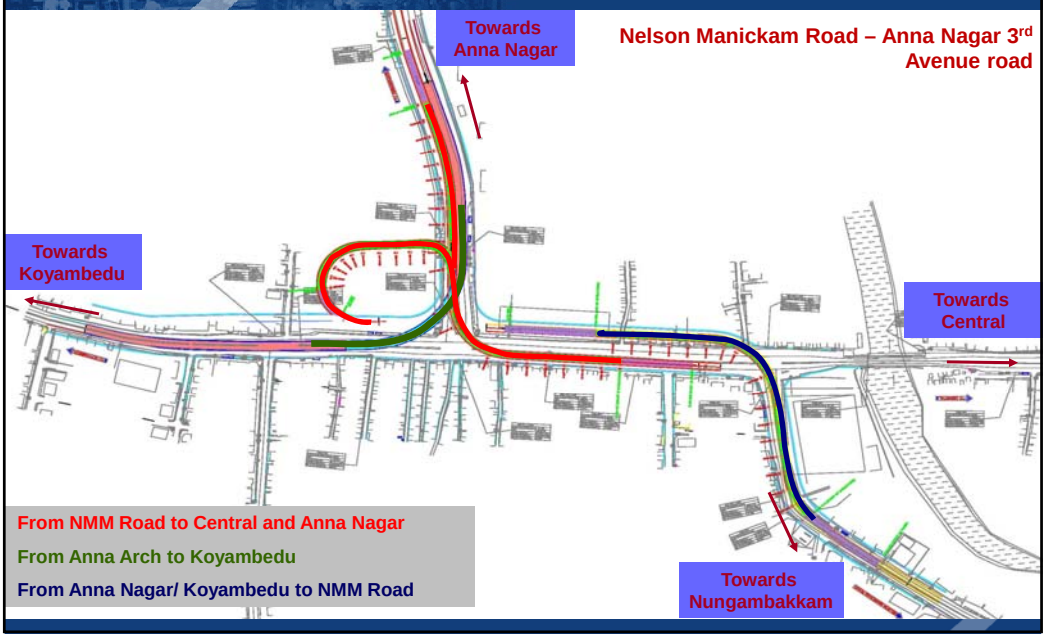


Chennai City

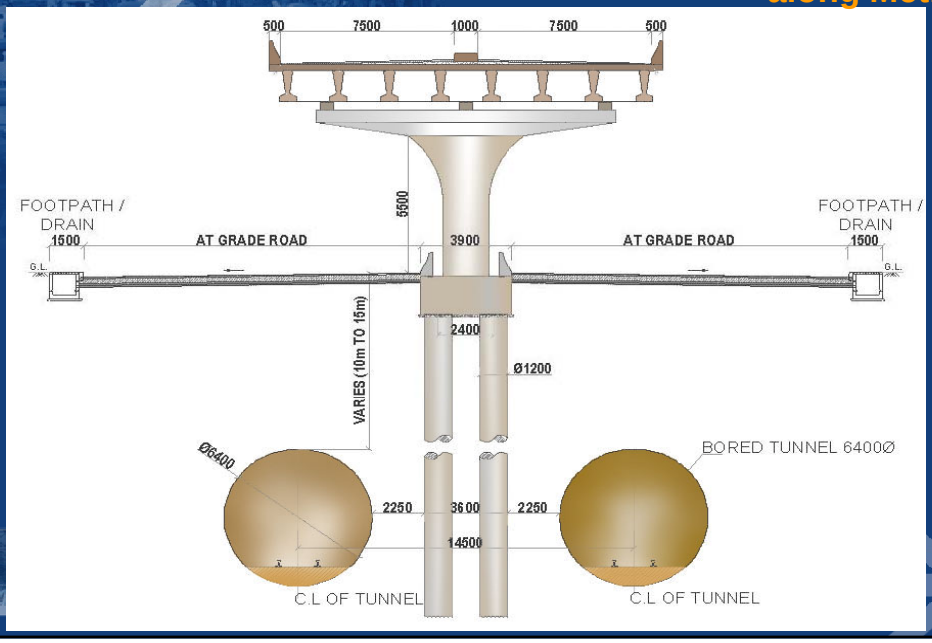
CMA

Flyovers at 37 Locations

Flyover Proposal

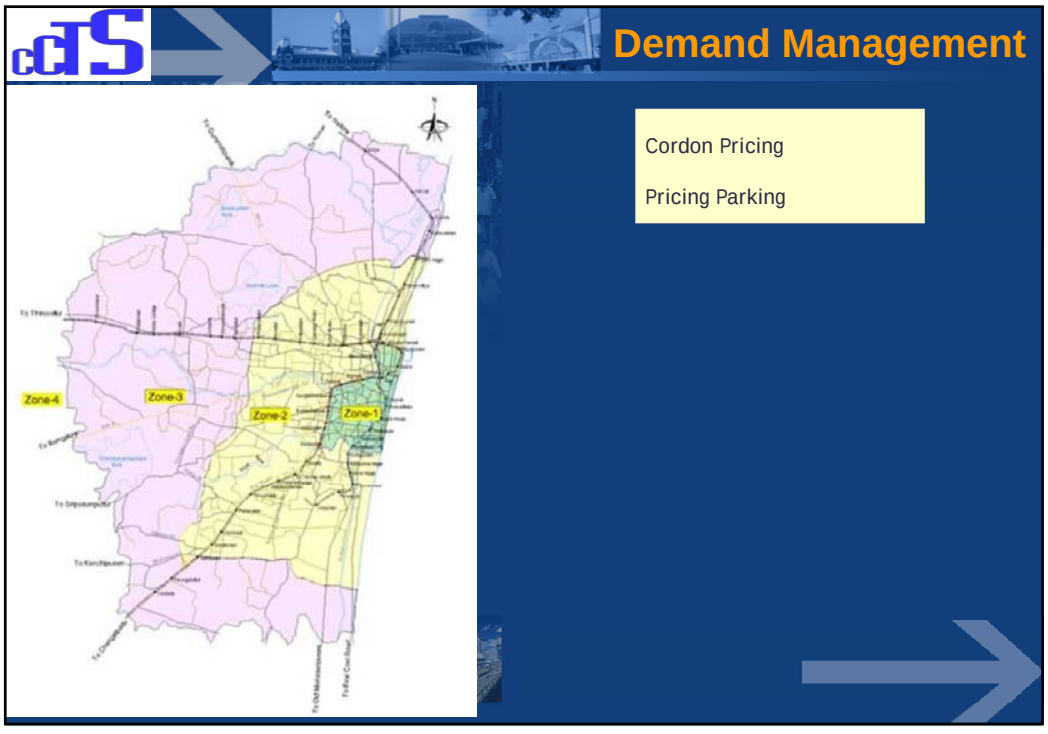


Cross section of flyover along Metro



Pedestrian Subways

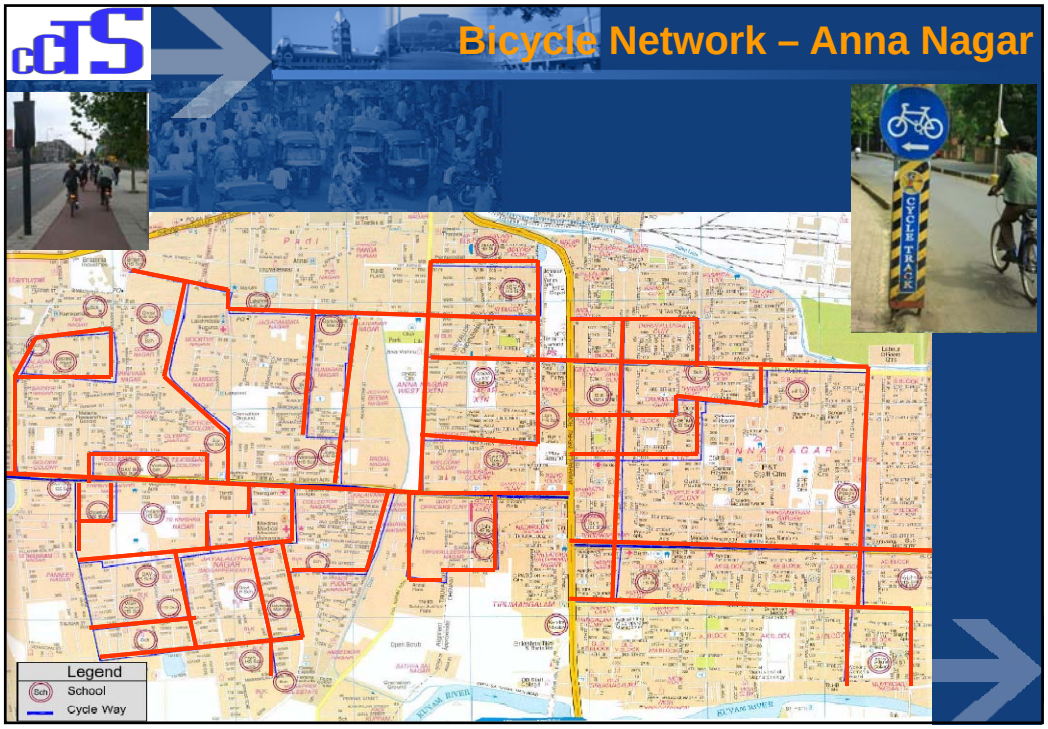
Subways recommended at 47 locations



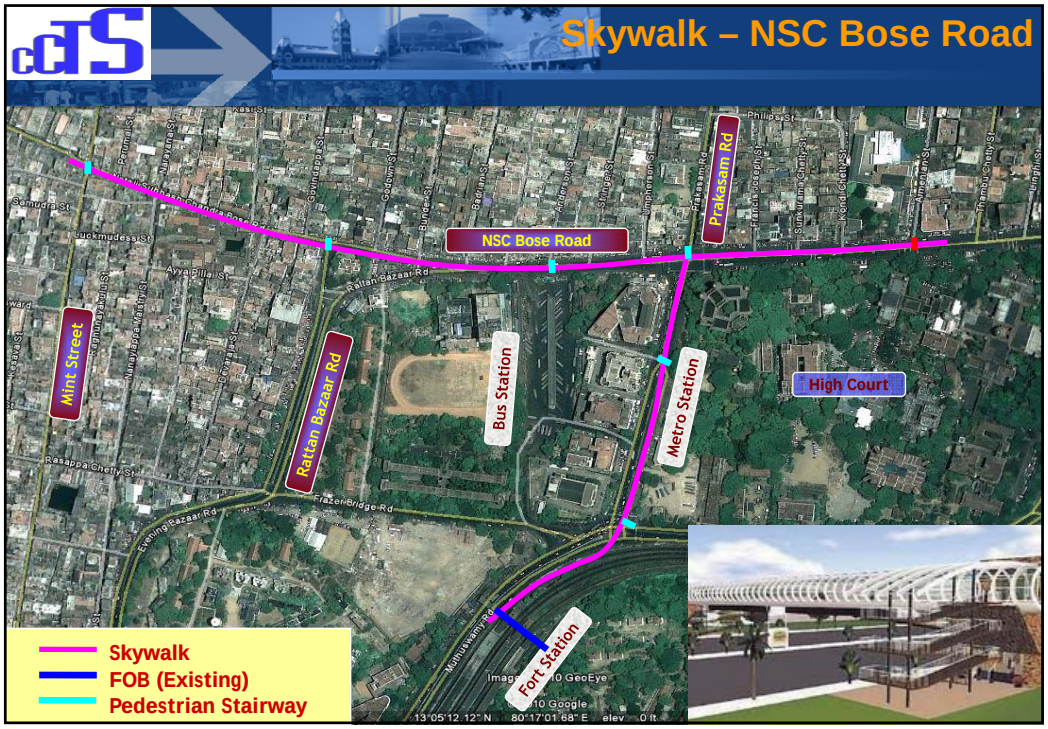
Demand Management

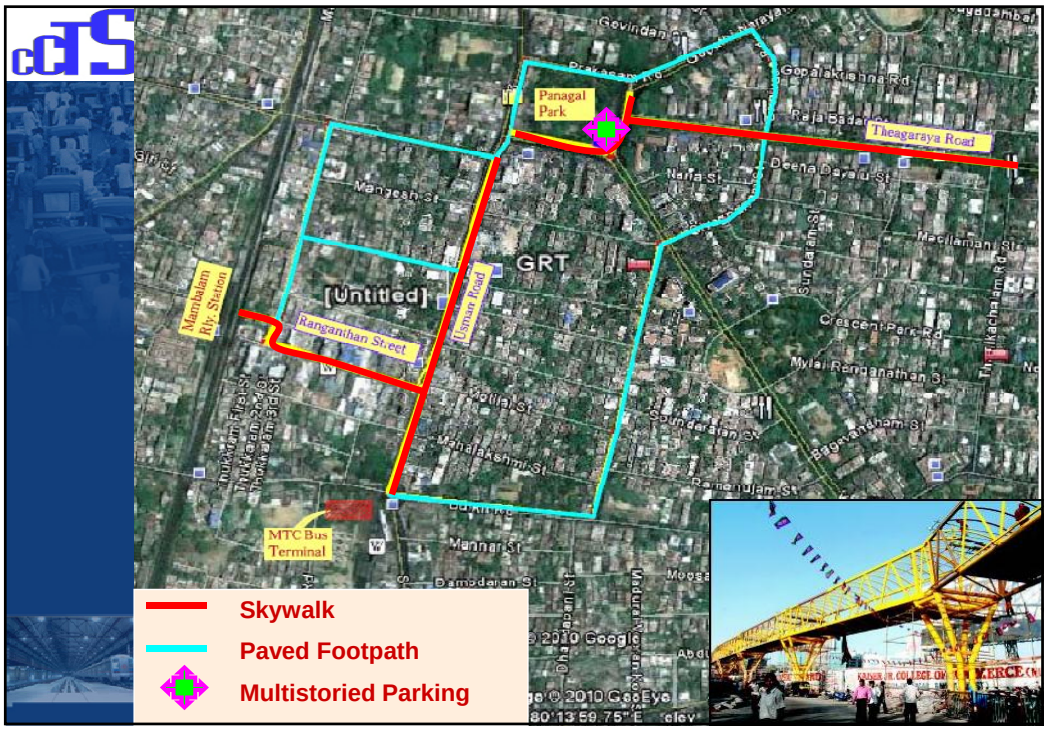
Cordon Pricing

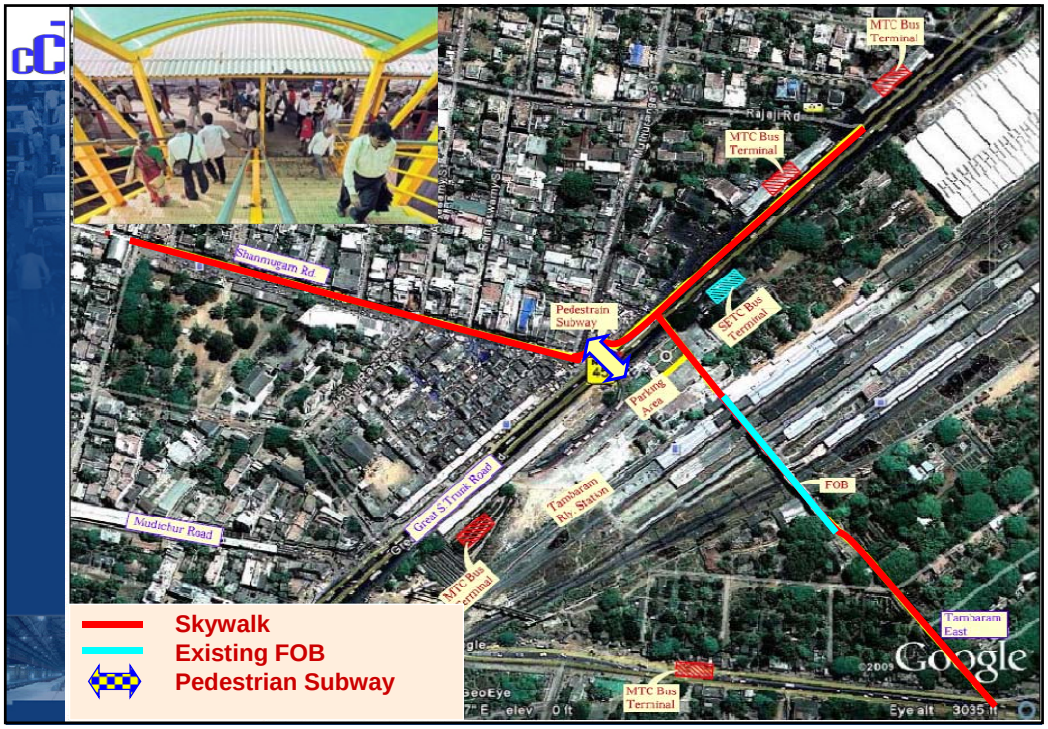
Pricing Parking


Bicycle Network – Anna Nagar
CYCLE TRACK
Legend
School
Cycle Way


Skywalk - Central
Rly. Reservation Office
Two Wheels Parking
Car Parking
Car Parking
Auto Parking
Central Station
MTC Bus Stop
Pedestrain Subway
Southern Rly. Office
EVR Periyar Salai
MTC Bus Stop
Pedestrain Subway
General Hospital
Pedestrain Subway
FOB
Park-Station
Pedestrain Subway
MRTS Station
Legend
Pedestrain Subway
MRTS Station
Skywalk
© 2010 Google
Image © 2010 GeoEye
Google


Skywalk – NSC Bose Road
NSC Bose Road
Prakasam Rd
Mint Street
Rattan Bazaar Rd
Bus Station
Metro Station
High Court
Fort Station
Skywalk
FOB (Existing)
Pedestrian Stairway


Panagal Park
Thegaraya Road
GRT
[Untitled]
Ranganathan Street
Usman Road
Mambalam Rly. Station
MTC Bus Terminal
Skywalk
Paved Footpath
Multistoried Parking



Multilevel Parking – Automatic Parking

Tower Parking

Vertical Tower Parking

Impact of Transport Proposals

The implementation of the CCTS schemes and strict demand management can result in substantial improvements

The Public Transport mode share is expected to improve to 43%
Figures in bracket represent share of motorized mode

Category	Index	2008	Goal	Achievable (2026)
Modal Shares (all trips)	Public Transport	27% (41%)	46% (70%)	43% (66%)
	IPT	7% (11%)	5% (8%)	5% (8%)
	Private Transport	32% (48%)	15% (22 %)	18% (26%)
	NMT	34%	34%	34%

Phasing of Investments

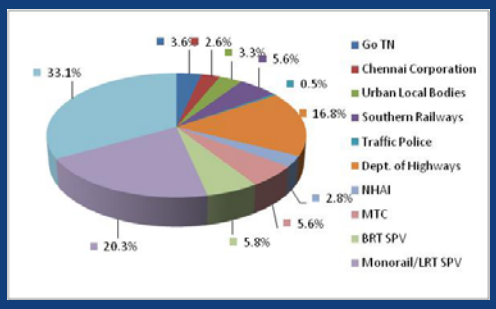
Phasing	Rs. In Crores	%
Phase 1 (2010 - 2015)	52,689	64%
Phase 2 (2016 - 2021)	21,899	27%
Phase 3 (2022 - 2026)	7,532	9%

Total investment is Rs. 82,120 crores.

Investment Requirements

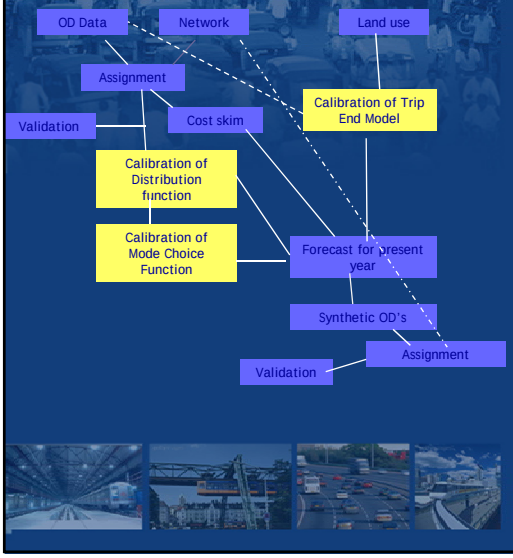
Total Fund Requirement (Rs. In Crores)

Agencies	Total	% Share
Go TN	2926	3.6%
Chennai Corporation	2170	2.6%
Urban Local Bodies	2702	3.3%
Southern Railways	4605	5.6%
Traffic Police	372	0.5%
Dept. of Highways	13807	16.8%
NHAI	2325	2.8%
MTC	4623	5.6%
BRT SPV	4740	5.8%
Monorail/LRT SPV	16650	20.3%
CMRL	27200	33.1%
Total	82120	100.0%



THANK YOU

Model Development



- Developed in Cube Software
  Purpose wise Transport Model
  Four step Modeling Process
- Trip Generation
- Trip Distribution
- Modal Choice
- Traffic Assignment

Calibration

- Trip Generation by Multi-linear Regression Equation
- Trip Distribution cum Mode Choice by Gravity Model

Modes: Two Wheelers, Cars, Taxis, Auto rickshaws, Public Transport

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Present Investment Schedule

Existing Funding Pattern for transport investments and O&M in CMA

Sl. No	Agency	Budget available Rs. in Crores						
		2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10 [8]
1	Highways Dept.(1)	30	52.5	129.02	176.48	NA	NA	300
2	Corporation of Chennai (2)	NA	NA	156.71	130.77	189.01	NA	100
3	Traffic Police Department (3)	1.25	0.60	0.60	0.60	0.60	0.60	16.84
4	Chennai Metro Rail Limited (CMRL) (4)	NA	NA	NA	NA	NA	NA	1573.92
5	Local Bodies (5)	NA	NA	NA	NA	NA	65.67	18
6	Other Local Bodies (6)	NA	NA	NA	NA	NA	30.7	30.65
7	MTC (7)						600	600
	Total							**2639.41**

40

Investment Requirements

Total Fund Requirement (Rs. In Crores)

Agencies	Phase 1 (2010 - 2015)	Phase 2 (2016 - 2021)	Phase 3 (2022 - 2026)	Total	% Share
Go TN	2270	396	260	2926	3.6%
Chennai Corporation	1823	346	1	2170	2.6%
Urban Local Bodies	2698	3	1	2702	3.3%
Southern Railways	2205	1860	540	4605	5.6%
Traffic Police	346	16	10	372	0.5%
Dept. of Highways	8717	2911	2180	13807	16.8%
NHAI	2325	0	0	2325	2.8%
MTC	1265	1518	1840	4623	5.6%
BRT SPV	4740	0	0	4740	5.8%
Monorail/LRT SPV	7650	6300	2700	16650	20.3%
CMRL	18650	8550	0	27200	33.1%
Total	52689	21899	7532	82120	100.0%