बृहन्मुंबई महानगरपालिका

MUNICIPAL CORPORATE OF GREATER MUMBAI

Comprehensive Mobility Plan (CMP) for Greater Mumbai

FINAL REPORT

Executive Summary

April 2016

LEA Associates South Asia Pvt. Ltd., India

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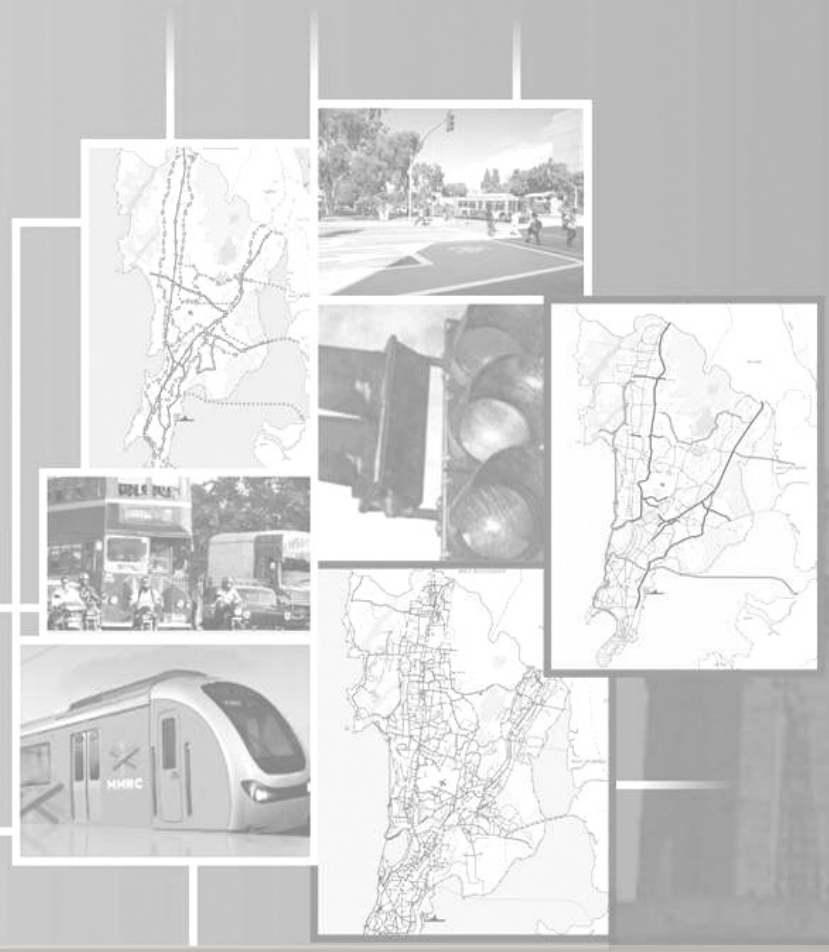

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Foreword

Greater Mumbai is the vibrant commercial capital of India. It is one of the world's top ten centres of commerce in terms of global financial flow, generating 6.16% of India's Gross Domestic Product (GDP) and accounting for 22% of GDP of urban India, 10% factory employment, 25% of industrial output, 30% pf income tax collection, 60% of custom duty collections, 20% of central exercise collections, 40% of foreign trade and 70% of capital transactions to India's economy, etc. The city houses important financial institutions such as the Reserve Bank of India, the Bombay Stock Exchange, the National Stock Exchange of India, the SEBI and the corporate headquarters of numerous Indian companies and multinational corporations. It is also home to some of India's premier scientific and nuclear institutes like BARC, NPCL, TIFR, AERB, AECI, IREL and the Department of Atomic Energy. The city also houses India's Hindi (Bollywood) and Marathi film and television industry. Mumbai's business opportunities, as well as its potential to offer a higher standard of living, attract migrants from all over India, making the city a melting pot of many communities and cultures.

As per census 2011, Greater Mumbai's population is about 12.44 million (about 51% of the Mumbai Metropolitan Region's population) is India's most populous city. Employment in Greater Mumbai is about 5.8 million. Greater Mumbai is, however, severely constrained by its geography and occupies a small land area of 458.28 sqkm (10.5% of MMR area of 4,355 sqkm). With a limited supply of land it has one of the highest population densities amongst the large metropolises in the world. Greater Mumbai has approximately 2,000 km of major roads. Roads constitute 8.16% of the total area of Greater Mumbai or 14% of the developed areas (2012). Public transport modes available for travel needs are suburban rail, bus, metro and monorail. Traffic congestion, transportation issues in Greater Mumbai are very complex as the population and employment densities are very high in many areas of Greater Mumbai, limited land for development and providing adequate transport infrastructure, linear city and narrow street networks, informal hawking activity near the suburban railway stations, on-street parking, pedestrian walking on the carriageway due to inadequate footpaths etc. The demands from various users exceed the available supply.

Considering the above issues, MCGM conceived preparation of ***Comprehensive Mobility Plan for Greater Mumbai*** that reflects the land use and its changes as well as the buoyant changes in population and economy, resulting in changing travel patterns in Greater Mumbai. The Comprehensive Mobility Plan (CMP) for the Greater Mumbai articulates a vision for Greater Mumbai's future traffic and transportation as a seamless, integrated system, in which commuters can make their journeys throughout the city safely and conveniently by various modes of transport with strong emphasis towards Non-Motorised Transport (NMT) i.e. pedestrian and cycle modes, traffic management measures and public transport systems. This study has provided insight to the current challenges of commuting in Greater Mumbai, addressed the issues and prepared an infrastructure and investment plan for the next few decades. The study outlines long term (2034), medium term (2024) and short term (2019) transportation strategies along with traffic & transportation infrastructure plans.

The study stresses the need for MCGM's continuing efforts and expanding on its commitment recognizing the varying needs and priorities of different transportation users, in developing Greater Mumbai's major traffic and transportation infrastructure. The study by recognising the significance of transport for the economic growth and social well-being of Greater Mumbai, proposes developing integrated multi-modal transportation system. It advocates focusing on the, an integrated network of roads, NMT (pedestrian and cycle) facilities, traffic management measures (intersection improvements, installation of traffic signals, expanding the Area Traffic Control (ATC) system, Station Area Traffic Improvement Scheme (SATIS), flyovers, elevated roads, FoBs/ Subways, road safety measures, traffic signs & marking, infrastructure for traffic police development of metro corridors, Exclusive Bus Lanes (EBL)/ Bus Rapid Transit System (BRTS) corridors in the city, capacity enhancements to the suburban system, inter-city bus terminals, truck terminals.

The estimated cost of the proposed traffic and transport infrastructure in Greater Mumbai for the period upto 2034 is about INR 1.68 lakh crores. The study strongly supports increased cooperation and coordination by all the transportation providers in the Greater Mumbai and emphasizes the need to be sensitive to the people and environment. Suggestions are made for more immediate solutions to current mobility problems to improve the existing transportation network's efficiency, reliability, and cost effectiveness that are currently impairing the city's prosperity and well-being of its citizens. It advocates increased participation in transportation decision making by regional and local authorities and public.

The CMP is closely monitored and guided by Traffic Department of MCGM through periodical meetings. Extensive primary surveys and secondary data collection and analysis has been carried out.

By virtue of mobility study, we may conclude that, timely implementation of the outcomes detailed in elaborate study carried out by M/s LEA Associates South Asia Pvt. Ltd., which has covered various aspects of traffic engineering and transportation planning covering entire Greater Mumbai, may helpful in reducing the traffic congestion, planning and implementation for well-equipped streets with desired traffic amenities (intersection improvements, traffic signals, traffic signs and pavement marking, etc.), better public transport options, parking solutions, strengthening and widening of roads, development of missing links, flyovers, RoBs/ RUBs, NMT facilities, etc. The scientific and holistic way of process carried out in comprehensive mobility plan study will serve the above stated aspects. CMP also studied the secondary data available from various Government organisations (MCGM, RTO, Mumbai Traffic Police, BEST, MMRDA, MRVC, etc.) to evaluate all public transport means which exists and proposed and further impact on traffic management in near future.

We hope that, CMP study will bring fruitful effects in traffic management after its implementation. The study also useful for Roads & Traffic Department of MCGM in Skill & Knowledge transfer in the field of traffic engineering and transportation planning.

We are glad to present the CMP study and its recommendations which will provide full package of traffic and transportation plans and strategies for short term, medium term and long term planning including resource mobilisation, institutional arrangements and action plans. We hope that, the study recommendations are though ambitious will pave the way in realizing the vision for Transforming Mumbai into World-Class city.

M S Pawar
Chief Engineer (Roads & Traffic),
Municipal Corporation of Greater Mumbai

S V R Srinivas, IAS
Addl. Municipal Commissioner,
Municipal Corporation of Greater Mumbai

April, 2016

Acknowledgement

LEA Associates South Asia Pvt. Ltd., India, wish to gratefully acknowledge the unique opportunity granted by Municipal Corporation of Greater Mumbai (MCGM) in preparing a ***Comprehensive Mobility Plan (CMP) for Greater Mumbai.***

Preparation of transportation plan for the horizon period up to 2034 that covers detailed analysis of base year (2014) travel patterns, travel demand modeling, assessment of planning parameters, assessment of traffic and transport infrastructure and related environmental/social/economic/financing options analyses and technology transfer etc. could not have been accomplished without the active participation and key inputs from many individuals.

We take this opportunity to acknowledge with gratitude the encouragement and support given by the following:

- All the members of "Standing Committee" of MCGM
- All the members of "Works Committee" of MCGM
- All the members of "Improvements Committee" of MCGM
- All the members of UMMTA
- Shri. Ajoy Mehta, IAS, Municipal Commissioner, MCGM
- Shri. S V R Srinivas, IAS, Addl. Municipal Commissioner (ES), MCGM
- MCGM officials-Traffic Department
  - Shri. *M S Pawar, Chief Engineer (Roads & Traffic)*
  - Shri. *S Kori, Chief Engineer (Bridges) and his staff*
  - Shri., *Sanjay Dharade, Dy. Chief Engineer I/C*
  - Shri. *Rajendra Ingle, Executive Engineer*
  - Shri. *Jitendra Patel, Executive Engineer*
  - Shri. *Rajendra Gandhi, Assistant Engineer*
  - Shri. *Ghorade, Executive Engineer I/C*
  - Shri. *Pramod Mungekar, Sub-Engineer*
  - Shri. *Bhushan Kubal, Sub-Engineer (ATC)*
  - *All AEs/ SEs of Traffic Department*
- MCGM officials- Roads Department
- MCGM officials- DP Department
  - *Chief Engineer, DP and his staff*
- MMRDA officials
  - Shri. *P R K Murthy, Director (Projects), Metro PIU*
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  - *Smt. K. Vijaya Lakshmi, Chief, Transport & Communications Division*
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- MMRC officials
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- MSRDC officials
  - Shri. *Ohol, Chief Engineer and his staff*

In addition to those that are identified above, we wish to acknowledge the countless other persons and agencies who provided information and assistance to our consulting team during the progress of the study and who were instrumental in developing a transportation plan for Greater Mumbai that is reflective of the aspirations of its citizens and their elected decision makers. Finally, the citizens of Greater Mumbai and rest of Mumbai Metropolitan Region deserve special thanks for providing their inputs and extending their co-operation at the time of surveys, which formed the critical base for the preparation of Comprehensive Mobility Plan for Greater Mumbai.

We believe that the recommendations provide a realistic and achievable plan for the implementation of longer term traffic and transportation strategies and also more immediate action proposals, with one of the principal objectives being transformation of ***"Greater Mumbai into a world class city with a vibrant economy and globally comparable quality of life for all its citizens".*** We pray for a positive approach and willful implementation of various recommended traffic and transport infrastructure proposals, to the wider benefit of the society.

Respectfully Submitted

LEA Associates South Asia Pvt. Ltd., India

April, 2016

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Abbreviations

AGLR	Andheri-Ghatkopar Link Road
AM	Ante Meridian
ACP	Assistant Commissioner of Police
Addl. CP	Additional Commissioner of Police
API	Assistant Police Inspector
ATC	Area Traffic Control
ATL	Average Trip Length
BARC	Bhabha Atomic Research Centre
BEST	Brihanmumbai Electric Supply and Transport
BKC	Bandra Kurla Complex
BMEC	Bangalore Mumbai Economic Corridor
BOD	Biochemical Oxygen Demand
BOOT	Build Own Operate Transfer
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CDP	City Development Plan
CIDCO	City and Industrial Development Corporation of Maharashtra
CIP	Capital Investment Plans
CMLR	Chembur Mankhurd Link Road
CMP	Comprehensive Mobility Plan
CPCB	Central Pollution Control Board
CR	Central Railway
CRRI	Central Road Research Institute
CRT	Center for Research on Transportation
CSIA	Chhatrapati Shivaji International Airport
CST	Chhatrapati Shivaji Terminus (formerly known as Victoria Terminus)
CTS	Comprehensive Transport Study (known as TranSfoRM)
DCP	Deputy Commissioner of Police
DCR	Development Control Regulation
DDP	Draft Development Plan
DMIC	Delhi Mumbai Industrial Corridor
DMRB	Design Manual for Roads and Bridges
DMRC	Delhi Metro Rail Corporation
DO	Dissolved Oxygen
DP	Development Plan
DPR	Detailed Project Report
DRP	Dharavi Redevelopment Plan
ECS	Equivalent Car Spaces
EEH	Eastern Express Highway
EGC	Emerging Growth Centre
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ELU	Existing Land Use
EMME	Equilibre Multimodal Multimodal Equilibrium
EMU	Electric Mutiple Unit
EPP	Evening Peak Period
FATC	Fully Adaptive Traffic Control
FHWA	Federal Highway Administration
FOB	Foot Over Bridge
FSI	Floor Space Index
GDDP	Gross District Domestic Product
GIS	Geographic Information System
GMLR	Goregaon Mulund Link Road
GMUA	Greater Mumbai Urban Agglomeration
GoI	Government of India
GoM	Government of Maharashtra
GPS	Global Positioning System
HBE	Home Based Education
HBO	Home Based Others
HIS	Home Interview Survey
HWF	Home Based Work for Office
HWI	Home Based Work for Industry

HWO	Home Based Work for Other (which are neither office nor industry)
IAS	Indian Administrative Service
IC	Inner Cordon
IFBC	International Finance and Business Centre
IMP	Integrated Mobility Plan
INCCAT	Individual Income Category
IPT	Intermediate Public Transport
IRC	Indian Roads Congress
IT	Information Technology
ITES	Information Technology Enabled Service
IVTC	In Vehicle Travel Cost
IVTT	In Vehicle Travel Time
JCP	Joint Commissioner of Police
JICA	Japan International Cooperation Agency
JNPT	Jawaharlal Nehru Port Trust
JVLR	Jogeshwari-Vikroli Link Road
KDMT	Kalyan Dombivali Municipal Transport
LASA	LEA Associates South Asia Pvt. Ltd.
LBS Marg	Lal Bhahadur Shastri Marg
LCV	Light Commercial Vehicle
LDC	Lane Divided Carriageways
LED	Light-Emitting Diode
LOS	Level of Service
LT Terminus	Lokmanya Tilak Terminus
LUT	Land Use Transport
MAV	Multi Axle Vehicle
MB	Mid Block
MBMT	Mira Bhyandar Municipal Transport
MbPT	Mumbai Port Trust
MCGM	Municipal Corporation of Greater Mumbai
MIAL	Mumbai International Airport Limited
MIDC	Maharashtra Industrial Development Corporation
MIS	Management Information System
MMC	Multi Modal Corridor
MMIF	Mumbai Metropolitan Infrastructure Fund
MMR	Mumbai Metropolitan Region
MMRDA	Mumbai Metropolitan Region Development Authority
MNL	Multi Nomial Logit
MoEF	Ministry of Environment and Forests
MoR	Ministry of Railways
MoUD	Ministry of Urban Development
MPCB	Maharashtra Pollution Control Board
MPP	Morning Peak period
MPPA	Million Passengers Per Annum
MR&TP	Maharashtra Regional and Town Planning
MRVC	Mumbai Railway Vikas Corporation
MSL	Mean Sea Level
MSRDC	Maharashtra State Road Development Corporation
MTHL	Mumbai Trans Harbor Link
MTNL	Mahanagar Telephone Nigam Limited
MTP	Mumbai Traffic Police
MTSU	Mumbai Transformation Support Unit (under AIILSG)
MUIP	Mumbai Urban Infrastructure Project
MUTP	Mumbai Urban Transport Project
NAAQS	National Ambient Air Quality Standards
NAINA	Navi Mumbai Airport Influence Notified Area
NDDP	Net District Domestic Products
NDP	Net Domestic Products
NEERI	National Environmental Engineering Research Institute
NH	National Highway
NHAI	National Highways Authority of India
NHB	Non Home Based
NMIA	Navi Mumbai International Airport
NMMC	Navi Mumbai Muncipal Corporation
NMT	Non Motorised Transport
NPV	Net Present Value

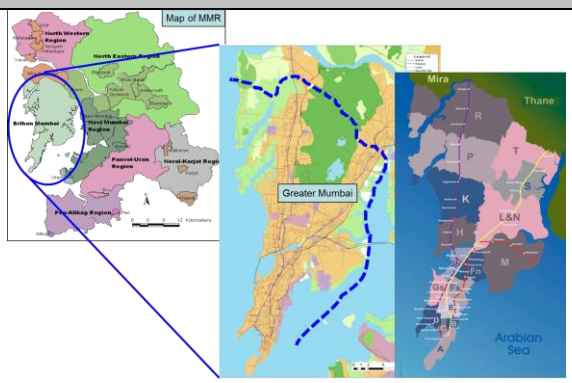
NUTP	National Urban Transport Policy
OC	Outer Cordon
OD	Origin Destination
OPP	Off Peak Period
OVDI	Out of Vehicle Distance
PCTR	Per Capita Trip Rate
PCU	Passenger Car Unit
PE	Population and Employment
PHPD	Peak Hour Per Direction/ Peak Hour Peak Direction
PI	Police Inspector
POL	Petroleum, Oil and Lubricant
PPP	Public Private Partnership
PU	Polyurethane Coating
PV	Private Vehicles
PWD	Public Works Department
PWT	Passenger Water Transport
RHS	Rental Housing Scheme
RoB	Road over Bridge
RuB	Road under Bridge
RoR	Rest of the Region
RoW	Right of Way
RP	Regional Plan
RSI	Road Side Interview
SCLR	Santa Cruz –Chembur Link Road
SEEPZ	Santacruz Electronics Export Processing Zone
SEZ	Special Economic Zone
SGNP	Sanjay Gandhi National Park
SH	State Highway
SI	Sub Inspector
SL	Screen Line
SPA	Special Planning Authority
SPM	Suspended Particulate Matter
SRD	Slum ReDevelopment
TA	Technical Assistance
TAC	Technical Advisory Committee
TAZ	Traffic Analysis Zones
TBM	Tunnel Boring Machine
TDM	Travel Demand Modelling
TDR	Transferable Development Rights
TDS	Total Dissolved Solids
TLFD	Trip Length Frequency Distribution
ToR	Terms of Reference
TPHQ	Traffic Police Head Quarters
TRANSFORM	TRANsportation Study FOr the Region of Mumbai
TSS	Total Suspended Solids
UDD	Urban Development Department
ULB	Urban Local Body
UMMTA	Unified Mumbai Metropoltan Transport Authority
USEPA	United States Environmental Protection Agency
UTF	Urban Transport Fund
UTP	Urban Trasnport Planning
VMS	Variable Message Sign
VRS	Voluntary Retirement Schemes
VT	Victoria Terminus (now called as CST)
WBSL	Worli Bandra Sea Link
WEH	Western Express Highway
WFPR	Work Force Participation Ratio
WFSL	Western Freeway Sea Link
WR	Western Railway
WTO	World Trade Organization

1. INTRODUCTION

1.1 Background

The Mumbai Metropolitan Region (MMR) is one of the fastest growing metropolises in India. With a population of 24.4million (Census, 2011), it is ranked as the sixth largest metropolitan region in the world. Greater Mumbai is in effect the mother city and represents a significant engine of growth for the whole region. Greater Mumbai with a population of 12.44 million (about 51% of the MMR's population) is India's most populous city. Greater Mumbai is, however, severely constrained by its geography and occupies a small land area of 458.28 sqkm (10.5% of MMR area of 4,355 sqkm). With a limited supply of land it has one of the highest population densities amongst the large metropolises in the world. Although, over time, other areas in MMR viz. Thane, Navi Mumbai and Mira Bhayander have also experienced major economic growth. About 700,000 people enter Greater Mumbai from the surrounding areas in the morning peak period for work and other purposes. The Mumbai Region still is the epitome of Maharashtra and India. It has and continues to be the focal point of hope, aspirations and opportunities for a wide range of urban migrants seeking to improve their well-being and economic advancement. It tends to imbibe in it several dimensions together, apart from being the vibrant financial capital of India. MMR has been seen as the land of opportunities for many people in India. From an overall planning, economic and transportation perspective, all the urbanized areas of the Region are functioning as a single entity with people travelling between municipal jurisdictions for work, education, shopping and personal needs.

Traffic congestion, transportation issues in Greater Mumbai are very complex as the population and employment densities are very high in many areas of Greater Mumbai, limited land for development and providing adequate transport infrastructure, linear city and narrow street networks, informal hawking activity near the suburban railway stations, etc.



Economic growth and spatial developments are quite often governed by the quality and quantity of transport infrastructure provided. While inadequate transport facilities create problems of congestion, delays and hazards causing significant socio-economic costs to the society, an over-supply, apart from being uneconomical, often acts counter to the long term spatial development strategies of settlements and regions. Supplying and maintaining an optimal level of infrastructure is the key to planned development. Under this overall guiding principle, MCGM aims to prepare an investment program for augmenting and upgrading transport infrastructure in Greater Mumbai area in line with CTS proposed transport infrastructure facilities as well as more focussed approach on traffic and transportation systems management measures that would be evolved through Comprehensive Mobility Plan (CMP). Hence, MCGM conceived a study on "Preparation of Comprehensive Mobility Plan for Greater Mumbai area.

The present study has been evolved by formulating strategies and traffic & transport plans with a long term (2034 year) perspective and then developing medium, and short term (2024 and 2019) traffic & transport plans and investment programs within the context of the long term strategy and ongoing investments being planned in Greater Mumbai.

Multiple demands for the limited financial resources at the disposal of all the Urban Local Bodies (ULBs) have restrained them from undertaking major development programs. This over-riding constraint to development has not only made the ULBs adopt reactive incremental planning process, it has also restricted their capacity to handle larger projects and has relegated strategic planning into the background. In the absence of a short term (5 year)

or medium term (10 year) urban transport infrastructure development plan, there is no ready list of projects.

Traffic congestion, transportation issues in Greater Mumbai are very complex as the population and employment densities are very high in many areas of Greater Mumbai, limited land for development and providing adequate transport infrastructure, linear city and narrow street networks, informal hawking activity near the suburban railway stations and major activity centres, etc. These issues are briefly presented as follows.

a) Socio economic: Immigration and mobility between closely located municipal corporations and councils;
b) Demographic transition: Compound Annual Growth Rate (CAGR) of population of MMR is about 1.61% and Greater Mumbai is 0.38%;
c) Growth in private vehicle ownership;
d) Pedestrian movement: Inadequate facilities;
e) Road user behavior: Private vehicle users, IPT drivers/ operators, Bus drivers, etc.;
f) Road accident characteristics: Casual approach of road users in observing driving rules, adhering to safety precautions and regulations;
g) Parking problems: High private vehicle growth, inadequate on-street and off-street parking facilities;
h) Encroachments: Shops, informal hawking activity, etc.;
i) Intersections: High traffic and pedestrian traffic volumes, improper geometrics, uncontrolled, sub optimal traffic signal design and coordination;
j) Intermodal Integration: Suburban/ Metro/ Monorail station areas; and
k) Traffic management measures: Traffic signal optimization, traffic simulation, signalization of intersections, Area Traffic Control system, one-way schemes, turn restrictions, locations of U-turns, etc.).

Considering the above issues it is appropriate to prepare a Comprehensive Mobility Plan that reflects the land use and its changes as well as the buoyant changes in population and economy, resulting in changing travel patterns in Greater Mumbai. MCGM intend to prepare a Comprehensive Mobility Plan for the period 2014-2034 in line with National Urban Transport Policy, 2006 (NUTP), which focuses on the mobility of people and not vehicles. NUTP, 2006 censes, upon the need of promoting safe pedestrian movement, bicycle movement and public transport, integration of land use and transport planning. There is a need for preparing a Comprehensive Mobility Plan for Greater Mumbai area addressing the above said aspects based on travel demand modelling and forecasting for the horizon period up to 2034.

1.2 Goals of the Study

The objectives set for "Comprehensive Mobility Plan for Greater Mumbai" are as follows:

a) Development of transportation network and comprehensive mobility plan for all modes including pedestrians, cyclists and IPT to achieve convenient and cost effective accessibility to places of employment and education; and
b) Optimal utilisation of funds and human resources.

1.3 Objectives/ Scope of Work

The objectives/ scope of work for the study to achieve the said goals is as follows:

a) Study of existing and proposed landuse pattern and transport network pattern;
b) Identify travel pattern of residents of the local planning area of Municipal Corporation of Greater Mumbai (MCGM);
c) Develop land use transport model to evolve a long-term strategy for urban structure and road network pattern;
d) Select, develop and operationalise an Urban Transport Planning (UTP) model using state of the art modelling techniques and software package, appropriate to the conditions and planning needs of the study area;
e) Assess the relevance of the existing strategy, identify the consequences of pursuing alternative transportation strategies and recommend/ update a short term, medium term and long term comprehensive transportation strategy for the study area upto 2034 based on cost benefit analysis of alternatives;
f) Strategies for transport policy and parking policy as an integrated part of urban planning;
g) Identify for all modes a phased program of appropriate and affordable investments and policy proposals and also integration of various modes of mass transit as well as public transport with Intermediate Public Transport (IPT);
h) Assess the existing infrastructure requirements and forecast short term and long term requirements;
i) Recommend institutional mechanism for inter-agency co-ordination;

j) Help strengthen transport planning skills and transfer all data, planning model/ tools and knowledge obtained through the study to agencies such as MCGM, MMRDA, BEST, Railway, Metro, Monorail, Traffic Police, etc.; and

k) Operationalise LUP Model, Transport Model and Transport Circulation model as decision tools for use by city planners, traffic police and public transport company.

The study examined the important factors that greatly influence travel in the city, and the changing economic and social conditions, challenges and opportunities that will need to be satisfied and captured. The final recommendations of the study will be useful guiding the MCGM, Traffic Police, BEST, MMRDA and other organisations in planning of traffic and transport infrastructure in Greater Mumbai.

The *Comprehensive Mobility Plan for* Greater Mumbai is divided in five major components namely:

- *Primary and Secondary travel demand surveys;*
- *Travel demand estimation for horizon period upto 2034;*
- *Preparation of Long (2034), Medium (2024) and Short Term (2019) Transportation Strategies/ Plans;*
- *Plan Financing Options and Institutional Arrangements; and*
- *Training and knowledge transfer to the concerned departments.*

This Executive Summary document is intended to provide an insight and overview of the "CMP for Greater Mumbai" study proposed traffic & transport infrastructure for Greater Mumbai for the period upto 2034, assessment of investment needs, brief on Economic Analysis, funding sources, proposed institutional changes and way forward.

2. TRAVEL CHARACTERISTICS – ISSUES & PROBLEMS

2.1 Historical Trends

Population of Greater Mumbai grew at decadal growth rates of around 18% during 1901-41. However, during the following four decades, in the post- independence era, population grew at decadal growth rates of over 35%. It is from 1991 that the growth rate has significantly reduced and during 2001-11 has sharply reduced to 3.87%. Decadal population growth of Greater Mumbai observed during 1901 to 2011 is shown in Figure 2-1. It may also be noted that the population in the towns surrounding Greater Mumbai in MMR has continued to grow at higher rate since 1991. Since 1901, the population of Greater Mumbai has grown from just 9.27 lakh to 12.44 million in 2011, an increase of over 13 times. Greater Mumbai is most populous city in India (World's 5th largest city) and its share in Maharashtra state's population is about 11.1% or about 1% of India's population.

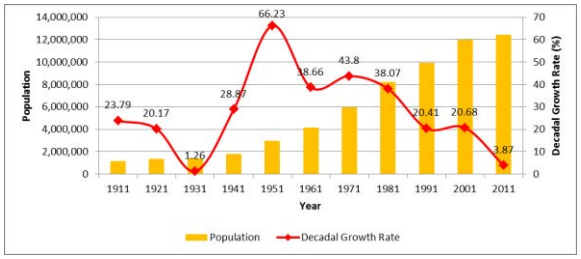


Figure 2-1: Decadal Population Growth of Greater Mumbai (1901 to 2011)

Workforce participation rate of Greater Mumbai was hovering 36% to 40% during 1961 to 2011. WFPR as per census 2011 is 40.34%. Workforce rate of males in Greater Mumbai has been higher than that for urban India for all years. The male participation rate fell from 61.73% in 1961 to 57.66% in 1971 and has since then been consistent. The female worker participation has been rising steadily, but at 16.38% in 2011, is still considerably lower than the male participation rate. The large gap between worker participation rate between male and female is expected to reduce in future.

Motor vehicle statistics on road for the period 2001 to 2015 indicates that, the total no. of vehicles have increased from 1.03 millions to 2.55 million which is about 2.47 times (about 6.68% CAGR). During the same period, the total no. of private vehicles i.e. two wheelers and cars have increased from 0.79 million to 2.27 million which is about 2.89 times (about 7.87% CAGR). Private vehicles/ 1000 persons in Greater Mumbai shown in Figure 2-2. The increase in private vehicles ownership during the period 2001 to 2015 in Greater Mumbai is from 66 to 178. CTS for MMR study estimated private vehicles ownership in Greater Mumbai for the year 2011 as 112/ 1000 population, whereas the observed is 131/ 1000 population. This is alarming. The possible reasons could be convenience of the private vehicles for travel, easy auto finance. The other possible reasons could be overcrowding levels of suburban and bus modes and project implementation delays of public transport modes i.e. suburban, metro and monorail.

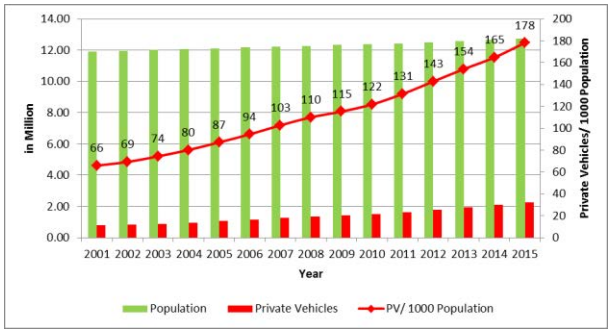


Figure 2-2: Private vehicle Population of Greater Mumbai, Veh./1000 persons

The total no. of IPT modes (Auto and Taxi) have increased from 0.16 million to 0.19 million which is about 1.18 times (about 1.2% CAGR).

In Greater Mumbai, Brihanmumbai Electric Supply and Transport Undertaking (BEST) is the largest public bus transport service provider with a fleet strength of 4,336 and operating on 507 routes (2012-13 as on 31st March). BEST operates services within Greater Mumbai, and to major destinations outside Greater Mumbai. Ferry services between Manori and Malad are also run by the organisation. One-way passenger trips originated daily of BEST buses observed during the last 20 years is more or less stagnant (hovering in between 40 to 45 lakhs/day). As per 2012-13 data there are a total of 3,799 buses are on road per day and one-way passenger trips originated daily is about 38.6 lakhs (314 lakh Passenger-km/day). During last two years (2013-14 and 2014-15), the bus ridership has further gone down (Dec., 2013: 36.12 lakhs/day; Dec., 2014: 35.15 lakhs/day; Dec., 2015: 29.4

lakhs/day; Feb., 2014: 36.34 lakhs/day and Feb., 2015: 33.1 lakhs/day).

MMR suburban railway is a mass transit system carrying more than 7.81 million passenger trips daily (Central Railway: 4.06 million and Western Railway 3.75 million as per 2011-12 statistics) and it is considered as the lifeline of MMR. As per 2012-13, numbers of passenger trips carried are 7.34 million per day (Central Railway: 3.50 million and Western Railway 3.84 million). These figures indicate a reduction of about 6% in suburban ridership.

On-street parking is one of the major problems causing traffic congestion in Greater Mumbai. Generally, on-street parking facilities on major corridors and service roads are planned when the traffic flows are low and the parking manoeuvres are not interfering with the main traffic movement. Under high traffic flows conditions, the on-street traffic hinder with traffic movement causing traffic congestion. Improper and insufficient provision of parking also leads to irregular/ spill over on-street parking and interferes with traffic flow. Moreover, on-street parking leads to accidents and pollution (Air & Noise). Hence, in the context of increase in traffic flows on major corridors and increasing demand for parking, optimal utilization of road space for parking or traffic flow need to be assessed. Further, there is a need for addressing the issue of parking demand through demand management measures (parking regulation, parking charges, parking policy, etc.) as well as supply management measures (creation of off-street parking facilities).

2.2 HIS Analysis

The sample size of Home Interview Survey (HIS) carried out in Greater Mumbai is about 6,000 covering the Greater Mumbai area and rest of MMR with a sample size of 5,000 and 1,000 respectively. In all, a database of about 19,558 trips performed for various purposes and by various modes is gathered and provided inputs for analyzing several travel characteristics and understanding travel behaviour in Greater Mumbai. They include trip rates, mode choices, trip purposes, and lengths, trips by occupation and income, expenditure on transport, time of day journeys, and origin destination patterns.

HIS analysis indicates that, the phenomenon of multi-modal trips (utilising more than one mode for a single trip) is high in the study area. It is observed that it is particularly true for trips which involve train as primary or main mode, and to a lesser extent, bus as the primary or main mode. The term access mode is used for the modes which act as a connector to the main or primary mode of travel. For classifying a trip by particular mode in multi-modal trip, a rule based criteria has been used i.e. choosing one particular mode and consider it as main mode. For example, if a multimodal trip is walk/auto/taxi/bus/car/two-wheeler-suburban-walk/auto/taxi/bus/car/two-wheeler then the trip is classified as trip by train. Similarly, if a multimodal trip is walk/auto/taxi/car/two-wheeler-metro-walk/auto/taxi/bus/car/two-wheeler then the trip is classified as trip by metro. The trips by car, two-wheeler observed were mostly by single mode. The salient findings based on main mode trips are as follows:

a) Majority in Greater Mumbai (about 46%) walk for various purposes and the rest use other modes -train, bus, metro or auto rickshaws. A marginal (10.9%), use other type of private mode of transport;
b) Local trains are the major mode of transportation amongst mechanized modes in the Greater Mumbai with 43% of people use;
c) Over 26% use bus as their main mode of transportation and an appreciable number of journeys are made by Metro, rickshaws, cars and two wheelers as well; and
d) Mode share by number of trips is presented in Figure 2-3. It is important to mention that, while calculating the share of public transport (train, bus and metro), only main mode trips by train and bus were considered.

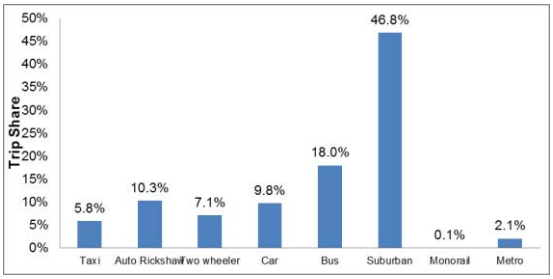


Figure 2-3: Mode Share without Walk

The estimated internal travel for the morning peak period is about 4.25 million trips. Approximate no. of motorized trips made/day is 1.4 million. On an average, a commuter in Greater Mumbai spends about 11% of individual income per month on

transport. When average expenditure is plotted against total personal income, it can be inferred that expenditure rises with rising income. Figure 2-4 establishes important trends in expenditure on transport by commuters of Greater Mumbai.

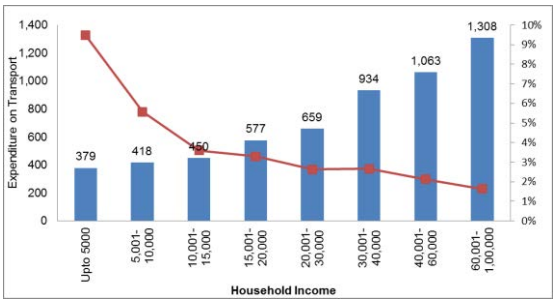


Figure 2-4: Expenditure on Travel (Rs per month): Variation by Income

Reported household income by income range considering all types of housing types is shown in

Figure 2-5. The potential changes in income levels over the next 25 years could have a major impact on the amount of urban travel. One of the major influences on urban travel is the practice of people changing jobs but not homes, even if this involves increased travel. The experience of developed economies is that this phenomenon in itself is creating a 30% increase in travel even with no overall increase in employment. India is now experiencing high volatility in the job market with companies aggressively competing for qualified staff and retaining employees is becoming a major business issue and is driving inflation pressures. The observed experience of large cities as they expand the average person trip lengths get longer which further generates increased travel on the transportation networks.

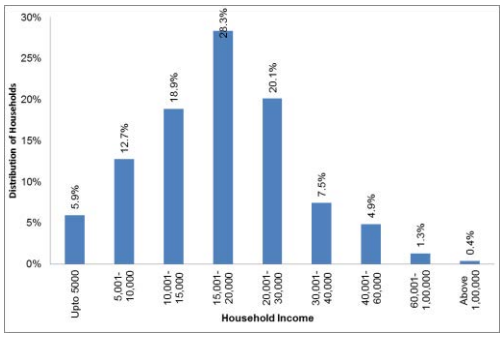


Figure 2-5: Reported Average Household income by Income Range

2.3 External Travel

External demand i.e. passenger and goods vehicle travel from the study area to outside the study area (internal to external), from outside to inside of the study area (external to internal) and outside of the study area to outside (external to external) play crucial role, especially traffic flows on corridors connecting the study area with rest of the study area (Western Express Highway,LBS marg, Eastern Express Highway, Mulund – Airoli Bridge, Sion Panvel Highway, Gorai – Uttan Road). The directional split at all locations is balanced 50% traffic in each direction. Traffic flow observed at outer cordon locations is shown in Figure 2-6.

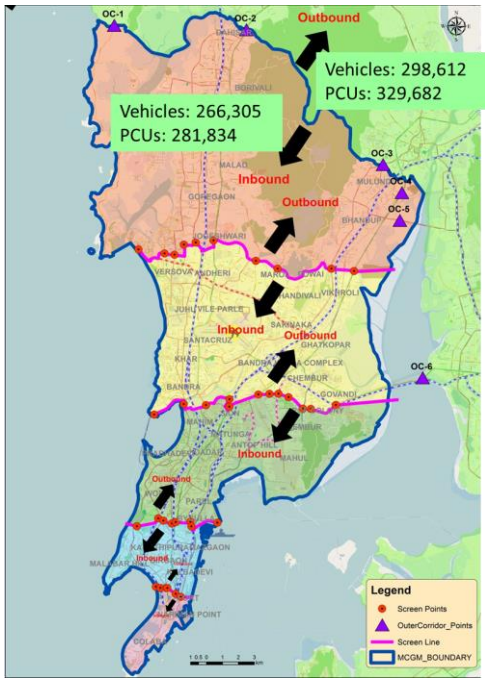


Figure 2-6: Traffic Flow at Outer Cordon (In PCUs and Vehicles/day)

Analysis of traffic counts on the outer periphery (cordon) show that, a total 5,65,000 vehicles (6,12,000 PCUs) enter or leave Greater Mumbai every day. The major traffic handling corridors in PCUs are Western Express Highway and Sion - Panvel Highway with 28% each, followed by Eastern Express Highway (20%), Mulund – Airoli Bridge (13.5%), Lal Bahadur Shastri Road (11%) and Gorai Uttan Road (0.5%).

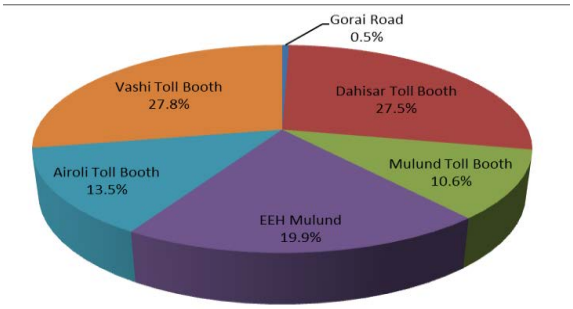


Figure 2-7: Location wise Share of Total Daily Traffic at Outer Cordon

The average traffic composition observed at outer cordon locations is shown in Figure 2-8. Traffic composition of private vehicles i.e. cars/jeeps/vans, two wheelers is 41.0% and 29.1% respectively and the total is 70%. Traffic composition of IPT modes i.e. Autos and Taxi is 9.7% and 3.7% respectively and the total is 13%. Traffic composition of Buses and Goods vehicles is 4.4% and 11.5% respectively. Traffic composition of Non Motorised Traffic (NMT) is very small with 0.7%.

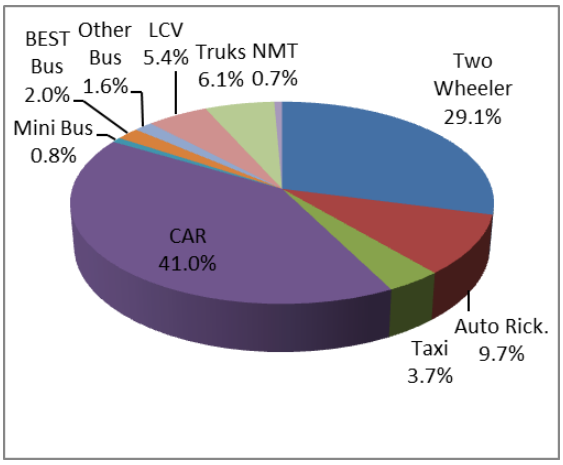


Figure 2-8: Average Traffic Composition at Outer Cordon

Travel pattern of passenger vehicles is shown in Figure 2-9. Out of the 4,85,873 passenger vehicles observed at the outer cordon locations, approximately 9.1% of the traffic is by passable traffic.

Figure 2-9: Travel Pattern of Passenger Vehicles – Outer Cordon Locations

Travel pattern of goods vehicles is shown in Figure 2-10. Out of the 62,854 goods vehicles observed at the outer cordon locations, approximately 6.4% of the traffic is by passable traffic.

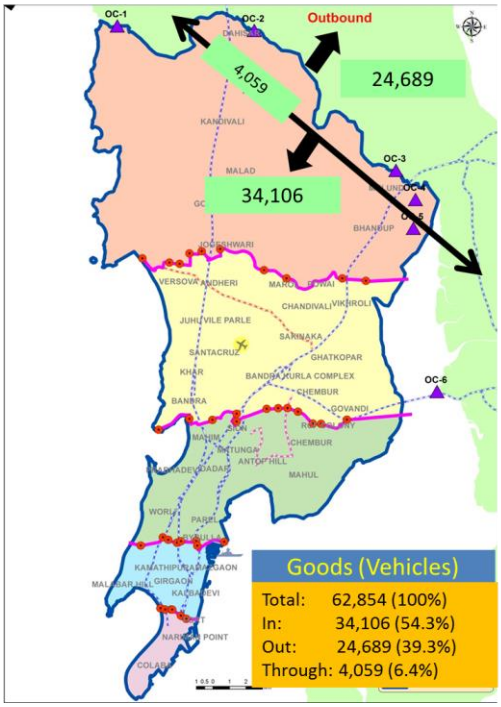


Figure 2-10: Travel Pattern of Goods Vehicles – Outer Cordon Locations

A comparison of traffic volume across OC locations

observed during TranSfoRM study done during 2005-08 and CMP study indicates that, the CAGR is 6.5% considering vehicles (5.5% considering PCUs). Taxi and LCV have registered highest growth rates i.e. 11.1% & 9.1% respectively. Cars and two wheelers have exhibited growth rates of 8.4% and 6.5% respectively.

2.4 Sub-Urban Railways

The history of transit in Mumbai and history of railways in India are tied together. Just thirteen years after the first train of India was flagged off from CST to Thane 153 years ago, the first suburban operation started between Virar and Back bay in 1867 (near Churchgate of today). For these deeply historical reasons, unlike any other city of India, Mumbai Region has greatly benefited by having a very mature and efficient rail based transit system developed, operated and maintained by Indian Railways for more than 140 years. While Indian Railways is now mainly a national intercity passenger and freight operator of India, it has continued to operate and maintain the Mumbai Transit System, a non-core activity.

Mumbai region is served by two of India's zonal railways, the Western Railway (WR) and the Central Railway (CR). The Western line runs northwards from Churchgate terminus station in Island City which is exclusive to serve sub-urban passenger parallel to the west coast. The Central Railway runs from CST, Mumbai (Chhatrapati Shivaji Terminus) station situated very close to Churchgate in Island City and serves large part of central to the east of Mumbai. Central Railway also has a harbour line which now basically serves Navi Mumbai. It also helps passengers originating at CST to go to west coast. Within the Mumbai region both railways carry a combination of sub-urban, long distance and freight traffic.

The Western Railway operates 1191 public sub-urban service in which 592 are up (towards South) and 599 are down (towards North) per weekday over 60 km route between Churchgate and Virar. The majority of WR sub-urban services run between Churchgate and Borivali (38%) followed by Churchgate – Virar (16%) and Churchgate – Andheri (12%). As many as 922 sub-urban train services start or terminate their journeys at Churchgate. However there are few services between intermediate stations.

The Central Railway operates 1613 public sub-urban service in which 805 are up (towards South) and 808 are down (towards North) per weekday over 208km route between Mumbai CST on south, Kotputari on north-east, Khopoli on south-east, Panvel via Mankhurd, Andheri on WR and between Thane and Vashi via Ghansoli. The majority of CR sub-urban services run between Mumbai CST and Panvel (12%) on Harbour line followed by Mumbai CST and Andheri (10%) on Harbour line. As many as 1203 sub-urban train services start or terminate their journeys at Mumbai CST on both the lines.

MMR suburban railway system carried more than 7.81 million passenger trips daily (Central Railway: 4.06 million and Western Railway 3.75 million as per 2011-12 statistics) and it is considered as the lifeline of MMR. As per 2012-13, numbers of passenger trips carried are 7.34 million per day (Central Railway: 3.50 million and Western Railway 3.84 million). These figures indicate a reduction of about 6% in suburban ridership. Reduction in ridership on Central Railway might be due to the diversion to private vehicles (Easter Freeway and Sion Panvel Expressway widening).

2.5 Travel by Bus

After, sub-urban rail mode, travel by Bus is predominant in Greater Mumbai. Daily travel by Bus as a main mode in the base year (2015) is about 3.1 million, which is 21.9% of total travel (Without walk trips). It is pertinent to mention here that bus mode is acting as a major feeder service to the sub-urban train.

In Greater Mumbai, Brihanmumbai Electric Supply and Transport Undertaking (BEST) is the largest public bus transport service provider with a fleet strength of 4,336 and operating on 507 routes (2012-13 as on 31st March). BEST operates services within Greater Mumbai, and to major destinations outside Greater Mumbai. Ferry services between Manori and Malad are also run by the organisation. One-way passenger trips originated daily of BEST buses observed during the last 20 years is more or less stagnant (hovering in between 40 to 45 lakhs/day). As per 2012-13 data there are a total of

3,799 buses are on road per day and one-way passenger trips originated daily is about 38.6 lakhs (314 lakh Passenger-km/day). Average trip length of bus passenger is about 8 km.

During last two years (2013-14 and 2014-15), the bus ridership has further gone down (Dec., 2013: 36.12 lakhs/day; Dec., 2014: 35.15 lakhs/day; Dec., 2015: 29.4 lakhs/day; Feb., 2014: 36.34 lakhs/day and Feb., 2015: 33.1 lakhs/day). AC buses used to carry about 76,000 passenger trips in 2007-09 and the numbers have dropped to 22,000 in 2012-13 and further dropped to 8,000 in 2015. The possible reasons for decline in bus ridership is mainly due to relatively high travel times due to traffic congestion, public using the IPT modes on share basis, etc. CTS for MMR study projected that the importance of bus transport would face major threat due to growth of personnel vehicles (car and two wheelers) and increase of rail based transport such as metro and monorail. If all the proposed metro projects are implemented in MMR, the bus transport share would decline further. However, the advantage that bus public transport offers is that it entails lesser operational cost and offers more flexibility.

2.6 Travel by Para Transit Modes

Intermediate Public Transport (IPT) modes i.e. Taxi and Auto in metropolitan cities plays an important role in meeting unstructured travel demands of users. It performs as feeder service to the main mass transport system (Both rail and road based) and provides accessible movement in predefined areas. The services provided by the IPT are intermittent in nature and this has complete flexibility in destination which is determined by the passengers.

Intermediate Public Transport (IPT) modes i.e. Taxi and Auto in Greater Mumbai plays an important role in meeting unstructured travel demands of users. It performs as feeder service to the main mass transport system (Both rail and road based) and provides accessible movement in predefined areas.

The services provided by the IPT are intermittent in nature and this has complete flexibility in destination which is determined by the passengers. In Greater Mumbai, IPT is acting as competent access/ egress mode and competing with road based public transport system, especially on short trip lengths. Trip characteristics by these modes is entirely different compared to the trips made by other motorised modes, as these modes offer high flexibility, services from almost door to door, fare, etc.

Based on IPT studies, it is found that, on an average, taxis perform 10 trips a day with an average trip length of 5.1 km. The proportion of taxis owned and hired by operators/drivers is 40%:60%. Autos perform 16 trips day with an average trip length of 2.9 km. The proportion of autos owned and hired by operators/drivers is 61%:39%.IPT vehicle registration data in terms of vehicles on road as on 31st March of every year for the period 2001 to 2015 for Greater Mumbai is presented in Table 2-1.

Table 2-1: IPT Vehicles (Auto and Taxi) on Road as on 31st March of each year: Greater Mumbai

Year	IPT Vehicles (Numbers)		
	Auto	Taxi	IPT
2001	101,914	62,447	164,361
2002	101,829	63,679	165,508
2003	98,527	54,809	153,336
2004	102,224	56,459	158,683
2005	104,104	58,049	162,153
2006	104,899	57,383	162,282
2007	104,862	55,486	160,348
2008	104,725	57,865	162,590
2009	104,716	56,958	161,674
2010	107,853	60,279	168,132
2011	108,715	50,914	159,629
2012	109,495	54,148	163,643
2013	111,591	57,095	168,686
2014	109,170	57,798	166,968
2015	128,120	66,130	194,250

It can be inferred that, growth of IPT numbers is almost stagnant in Greater Mumbai during 2001 to 2014 (1.62 lakhs), due to growth of personal vehicles. However, there is increase in Auto and Taxis in 2015 (1.94 lakhs). The share of Autos is increasing due to positive growth trend of autos and negative growth trend of taxis. It is assessed that while the share of IPT modal split is expected to reduce due to availability of metro and monorail services and increase of personalised vehicles, the actual number of trips by IPT is expected to increase in the future in Greater Mumbai.

2.7 Travel by Private Vehicles

Daily travel by private vehicle modes, Two Wheelers and cars in the base year (2014) is about 2.1 million and 1.6 million respectively, which is 14.8% and 11.6% of total travel (Without walk trips).

Private vehicle registration data in terms of vehicles on road as on 31st March of every year for the period 2001 to 2015 for Greater Mumbai is presented in Table 2-2. It can be inferred that, Two wheelers have grown at 8.88% CAGR, Cars have grown at 6.38% CAGR and Private Vehicles growth is 7.87% CAGR.

Table 2-2: Growth of Motor Vehicles in Greater Mumbai (On Road as on 31st March, every year)

Year	Private Vehicles (Numbers)		
	Two Wheelers	Car	Private Vehicles
2001	440,517	344,870	785,387
2002	475,352	353,417	828,769
2003	527,108	366,805	893,913
2004	584,180	384,258	968,438
2005	647,892	409,120	1,057,012
2006	714,209	436,213	1,150,422
2007	792,512	464,139	1,256,651
2008	859,075	492,975	1,352,050
2009	909,993	512,857	1,422,850
2010	967,479	542,362	1,509,841
2011	1,044,829	590,361	1,635,190
2012	1,139,363	648,009	1,787,372
2013	1,235,282	705,552	1,940,834
2014	1,329,461	757,226	2,086,687
2015	1,448,759	819,828	2,268,587

Source: RTO

2.8 Pedestrian Movement

In Greater Mumbai, 51% of the total trips made are by walk. 72.5% trips for education purpose are also by walking. Workers of economically weaker sections, especially women and children, who often do not afford motorised modes of transport, constitute a significant proportion of pedestrians. In addition most of the public transport journeys (60%) necessarily start and end as walk trips. The walk trips are also considerable short in length: more than 80% of walk trips to work places or schools are less than 15 minutes. Presently, several conditions discourage pedestrian movement. These include several permanent and semi-permanent structures located along edges of the right of way of streets; haphazard parking of vehicles in the absence of footpath; lakh of designated hawking area especially around the railway stations; discontinuous footpaths with changing levels at every property entrance and intersections. Moreover, the pedestrian footpaths and facilities are not equipped to serve universal accessibility for differently abled people. Undesirable and unsafe pedestrian walk environments force commuters to switch to other mechanised modes. Longer North-South rail trips and distances greater than 1 km between places of work/ residential areas and stations (especially in the northern parts of the Western Suburbs, for example, at Malad, Kandivali) discourage walking as a mode of travel. The lakh of adequate pedestrian footpaths, inadequate traffic management solutions around transit nodes and lakh of pedestrian cross over facilities at strategic locations increases pedestrian and vehicular traffic conflict.

2.9 Average Journey Speeds

Average Journey Speed is one of the important Measure of Effectives (MoEs) generally considered for assessing the quality of traffic flow or magnitude of traffic congestion. The purpose of the journey speed survey was to identify the bottlenecks, major reasons for delay, etc. Delays are often used to measure the performance of traffic flow at intersections. In general travel time studies involve significant lengths of a facility or group of facilities forming a corridor. It is often conducted on the arterial or major roadway, along which there are several intersections (signalized or stop/yield signs). Travel time plays key role in city's life and it indicates the level of service of roadway network performance. From mobility point of view travel time reflects degree of convenience from one point to the other point.

The primary purpose of this Travel Speed Study was to calibrate and validate the transportation planning model. Travel time runs were conducted using the GPS instruments and floating car technique. Roadways included major local roads, sub-arterial roads, arterials, expressways and freeways. There were a total of 3 runs in each direction (Morning and Evening peak periods). Intersection delay for through vehicles was recorded at signalized intersections.

Approximate length of road considered for Journey Speed survey is 550 km. The average speed

observed in the Western Suburbs is higher than Island City and lower than the Eastern Suburbs. The road network with average journey speeds less than 20 kmph is not only due to congestion but also due to road conditions. The observed speeds on some of the major corridors in the study area indicate that, overall, the speeds are decreasing with time and most probable reason is the increasing trend of traffic levels.

a) Average journey speed is 20 Kmph during morning (UP) and evening (DOWN) peak periods, whereas in off peak period the average journey speed is 27 Kmph;
b) Average delay is 55 sec/km during morning (UP) and 46 sec/km in the evening (DOWN) peak periods whereas in off peak period the average journey speed is 30 sec/km; and
c) About 57% and 67% of the road network is having journey speed of less than or equal to 20 Kmph during morning (UP) and evening (DOWN) peak period respectively.

2.10 Intercity Rail Terminals

Mumbai city houses headquarters of both, Central and Western Railways, which handle a major share of the inter-regional/city rail passenger traffic in India. Mumbai city has the history of “First passenger railway line from "Boree Bunder" (now Chhatrapati Shivaji Terminus) and “Tannah” (now Thane) in 1853 covering a distance of 34 km (21 miles), formally heralding the birth of railways in India.

The railway line was extended from Thane to Kalyan (20 kilometers) after about a year. From Kalyan, the railway line branched into two directions, viz. the North Eastern line leading towards Igatpuri and Bhusaval and the South Eastern line towards Pune and Solapur.

The inter city rail passenger demand in MMR has been met by Western Railway and Central Railway which are busiest and largest railway networks among 16 zones of Indian Railways. Western Railway serves the entire state of Gujarat, the eastern portion of Rajasthan, some portions of western Madhya Pradesh and some places of coastal Maharashtra. It also operates the Western line of the Mumbai suburban railway system which extends from Churchgate to Dahanu Road. On the other hand Central Railway which has its headquarters at Chatrapati Shivaji Terminus (formerly Victoria Terminus) covers a large part of the state of Maharashtra as well as parts of north-east Karnataka and southern Madhya Pradesh.

A number of intercity trains originate from Greater Mumbai, these include regular (trains that run on all days/ weekdays) and staggered trains (trains that run on alternate days or few days in a week). The Western Railway operates 72 intercity trains and the Central Railway operates 152 trains in Greater Mumbai. The intercity rail passenger terminals in Greater Mumbai under the jurisdiction of western Railway are Mumbai Central, Dadar, Bandra, Andheri and Borivali stations are significant as halt stations. On Central Railway, terminal stations are Chhatrapati Shivaji Terminus, Lokmanya Tilak Terminus and Dadar.

2.11 Intercity Bus Terminals

Major regional bus terminals in Greater Mumbai are Mumbai Central, Parel and Dadar located within Island City. These locations are the major hubs of transit, commercial and institutional activities. Bus terminals such as Kurla, Borivali and Nancy Colony connect to residential areas in the suburbs. Bus terminals are generally located near suburban railway stations and inter-city railway stations so that public transport can also effectively act as feeders to the rail network.

On analysing the location of existing terminals and accessibility to areas that are under served, CTS for MMR study notes that new inter-city bus terminals are required between Bandra and Borivali in the Western suburbs and between Kurla and Mulund in the Eastern suburbs. It proposes to develop on priority, a dedicated Inter State Bus Terminal (ISBT) near Wadala Truck terminal in Greater Mumbai. Parking facilities for private vehicles at the existing terminals are either non-existent or needs augmentation. Existing terminals at Dadar, Sion, Kurla-Nehru Nagar, Borivali and Borivali-Nancy Colony bus stations lack basic infrastructure facilities such as waiting hall, drinking water facility, toilets, etc. and improvements are proposed.

2.12 Goods/Truck Terminals

Goods transport movement in MMR is important as two major ports of the country are located in Mumbai region and the region is well connected by rail and road with rest of the country. Moreover, Mumbai region accommodates no. of industrial growth centres which generate lot of goods traffic movement.

Economic and physical characteristics, transportation, parking, loading and unloading requirement of goods leads to special approach. The flow of goods into and out of urban area (Inter-city movements) is characterized by bulk shipment whereas their movement within urban area (Intra-city movements) by smaller shipments. Though the physical boundary of urban area gets enlarged over time, the locations of goods activities remains unaltered. This leads to traffic congestions within the urban area. In addition to this, increase in urban area over a period of time demands more quantity of commodities.

Interaction analysis of movement of goods in the MMR by CTS for MMR study reveals that Greater Mumbai attracts the maximum quantum of goods amounting to 46.3% in terms of tonnage recorded in the MMR. Greater Mumbai also attracts 29.8% of movement of goods vehicles in the MMR. A high percentage of goods attracted to Greater Mumbai are from Navi Mumbai contributing to 48.3% of total tonnage. Correspondingly 43.0% of goods vehicles coming to into Greater Mumbai are originated in Navi Mumbai. This is due to the location of Jawaharlal Nehru Port, APMC, steel markets and other goods handling in Navi Mumbai. Therefore in terms of movement of goods vehicles connectivity to Navi Mumbai is of major importance. Other important origin-destination with respect to goods related connections to Greater Mumbai are Kalyan, Vasai, Virar, and rural areas of MMR and Thane.

There are 14 goods terminals located in Greater Mumbai including Wadala Truck Terminal, Railway Yard Mulund, Railway Yard Goregaon, Reay Road Terminal yards, FCI godowns, Borivali, Wadi Bunder Railway yard, HPCL Sewri Oil Depots, BPCL Sewri Oil Depots, IOCL Sewri Oil Depots, HPCL Terminal II Sewri, HPCL, Terminal I, Wadala, and FCI Godowns Wadala. The CTS for MMR study has projected a 5.7% growth of goods traffic for MMR and has proposed additional truck terminals at strategic locations in rest of MMR.

MCGM owns Octroi operational areas at five Mumbai entry points i.e. Dahisar check naka, LBS Marg, Mulund check naka, EEH, Anand Nagar check naka, Airoli check naka and Vashi check naka. Once Octroi is abolished, the check naka operational areas may be used for inter-city bus terminals and/or truck terminals.

3. MUNICIPAL CORPORATION OF GREATER MUMBAI: LANDUSE

Analysis of Existing Landuse distribution is essential to understand the functional composition of the city and existing deficiencies in availability of land for social and physical infrastructure of the city. The analysis is based on the Existing Landuse map 2012 which was prepared on the basis of the Existing Landuse Survey (ELU Survey). The ELU Survey was one of the key initial stages towards ELU Plan preparation. It has two main objectives, one, to determine current land uses, and, two, to assess the extent of implementation of the current DP.

A Base Map was created through a series of overlays of spatial data as provided by MCGM on a base layer of the Quick Bird satellite image. The Base Map delineates various levels of spatial disaggregation in Greater Mumbai. Categories and sub-categories created for capturing the existing land uses for the preparation of the Existing Landuse 2012 took cognizance of the mixed-use character, the predominance of offices and the various housing typologies present in the City. The Existing Landuse Map 2012, created using the GIS Base Map based on an Existing Land Use Survey, was a key first stage of the preparation of the DP 2014-34.

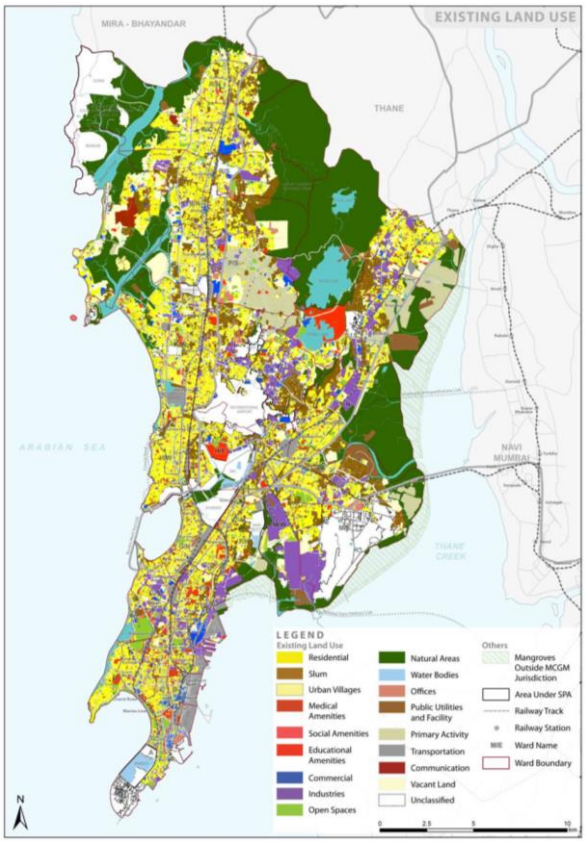
The total area under Greater Mumbai admeasures 458.28 sqkm. There are several pockets of mangroves, outside the MCGM limits, the area of which changes with the tide levels. These are not considered to be included in the MCGM boundary. Of the 458.28 sqkm, 43.23 sqkm is area under Special Planning Authorities (The State Government has appointed Special Planning Authorities (SPAs) for areas within the jurisdiction of the MCGM notified under Section 40 of the MR&TP Act. These include, the Back Bay Reclamation Area, Wadala Truck terminal Area, Bandra Kurla Complex, Oshiwara District Centre, Gorai Manori Tourism Zone, and Airport under the MMRDA; Dharavi Redevlopment Project under the Slum Rehabilitation Authority; and Marol Industrial Area, SEEPZ under MIDC). As provided in the MR&TP Act local authority ceases to be the "Planning Authority" in the notified areas. The revision of the Development Plan therefore excludes these notified areas from its scope. Thus, the jurisdiction of the MCGM as a Planning Authority comprises 415.05 sqkm and forms the area for which Development Plan for Greater Mumbai 2014-34 is being prepared.

Existing Land use distribution for Greater Mumbai (2012) is presented in Table 3-1 and shown in Figure 3-1. The analysis reveals that, only 65.3% (271.17 sqkm) of the Planning Area of Greater Mumbai is developed. While natural areas, vacant lands, plantation & salt pans constitute the remaining 34.7%. Of this developed area, 24.9% is occupied by Residential use, 5.4% by Industrial uses, 2.2% by Commercial uses and 0.9% by Offices. Amenities (Education, Medical, and Social Amenities) constitute 3.69%, open space 3.7% and Public Utilities & facilities 1.7%. Transport and Communication facilities constitute 12.8%. Together 21.9% of the developed area is under Amenities, Open Space, Public Utilities and Transport.

Table 3-1: Existing Land use Distribution for Greater Mumbai (2012)

Existing Landuse Categories (2012)	Area (ha)	% of Total Area
Residential	10,327.09	24.9%
Commercial	911.46	2.2%
Offices	360.96	0.9%
Industrial	2,242.88	5.4%
Open Spaces	1,537.78	3.7%
Education Amenities	853.81	2.1%
Medical Amenities	318.44	0.8%
Social Amenities	355.81	0.9%
Public Utilities and Facilities	693.43	1.7%
Transport & Communication Facilities	5,306.92	12.8%
Urban Villages	318.42	0.8%
Primary Activity (P1, P3, P4, P5, P6, P7)	939.22	2.3%
Unclassified	1,829.77	4.4%
Vacant Land (only under construction)	1,121.97	2.7%
Developed Area	**27,117.96**	**65.3%**
Natural Areas	11,303.82	27.2%
Vacant Land (Excluding under construction)	2,282.82	5.5%
Primary Activity (P2 and P8)	801.11	1.9%
Undeveloped Area	**14,387.75**	**34.7%**
Total Planning Area	**41,505.71**	**100.0%**
Area under Special Planning Authority	4,322.79	**9.4%**
Total Greater Mumbai area	**45,828.50**	

Source: Development Plan for Greater Mumbai 2014-2034, Report on Preparatory Studies



Source: Development Plan for Greater Mumbai 2014-2034, Report on Preparatory Studies

Figure 3-1: Existing Land use Map for Greater Mumbai (2012)

4. TRAVEL DEMAND ANALYSIS AND RECOMMENDED TRANSPORT INFRASTRUCTURE (2014–2034) TRAVEL DEMAND ANALYSIS PROCESS

Standard four stage travel demand modeling approach has been adopted in the study. Trip Generation, Trip Distribution, Mode-Split and Assignment models have been revalidated through primary and secondary surveys/ studies. Six purposes (Home Based Work Office, Home Based Work Industry, Home Based Work Others, Home Based Education, Home Based Others and Non Home Based) and seven modes (Sub-urban train, metro, bus, auto, taxi, car and two-wheeler) have been considered. MMR has been divided into 1030 Traffic Analysis Zones (TAZs) for travel demand analysis. Greater Mumbai constitutes 577 TAZs (Figure 4-1). The software used for travel demand modelling and network analysis is EMME (Equilibria Multimodal Multimodal Equilibium) which is used in more than 70 cities all over the world.

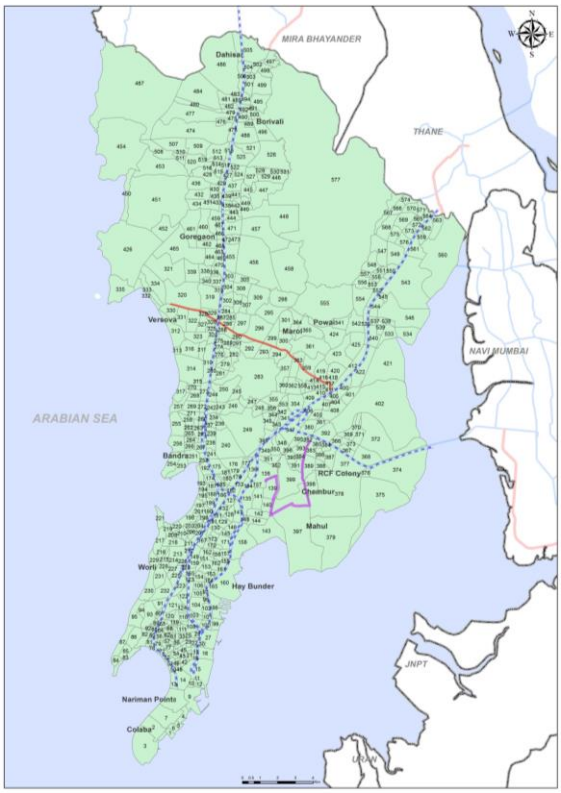


Figure 4-1: TAZ System for Greater Mumbai

Extensive primary traffic and transportation studies carried out under CTS for MMR during the period 2005-2007 and the following primary and secondary traffic and transportation surveys/data carried out in Greater Mumbai area during 2014 has been used in developing the database for travel demand analysis for the base year i.e. 2014.

a) Home Interview Surveys (HIS) – 6,000 sample (5,000 samples in Greater Mumbai and 1,000 samples in Rest of MMR).
b) Classified traffic volume count surveys at Outer Cordon locations for 24 hrs. (6 no.);
c) Origin-Destination surveys at Outer Cordon locations for 24 hrs. (6 no.);
d) Classified traffic volume count surveys across Screen lines for 24 hrs. (37 no.);
e) Road network inventory updations survey;
f) Speed & Delay study;
g) Classified turning volume count surveys for 16 hrs. (50 no.);
h) Pedestrian count surveys for 16 hrs. (25 no.); and
i) Parking surveys for 16 hrs. (25 no.).

In addition, collected secondary information on transport systems operating in Greater Mumbai. GIS based maps for the entire Greater Mumbai has been prepared. Based on these surveys, a database on household socio-economic and travel characteristics of the Greater Mumbai has been prepared for detailed travel demand modelling to study the future transport network requirements.

It is pertinent to mention here that, while developing the travel demand models for MMR in 2005-06, there was no metro and no mono rail corridors. Over a period of last 8 to 9 years' time, due to change in the socio-economic characteristics, system operating characteristics of existing public transport modes (bus and suburban train modes), operation of metro and monorail corridors, etc. Moreover, major road projects have been completed and opened for traffic (SCLR, eastern Freeway, Flyovers, etc.). These changes led to changes in the travel pattern, mode shares, etc. Hence, there is a need for updation of CTS for MMR study database and travel demand models wherever necessary. The process followed for estimation of travel demand for the base year 2014 and updation of travel demand models is shown in Figure 4-2. Major steps involved in the

development of these models are:

a) Assessment of internal travel demand using the HIS database and external travel demand using OD survey database for the year 2014;
b) Preparation of Base Year (2014) transport network for validation of travel demand matrices;
c) Validation of Base Year (2014) travel demand by comparing assigned and observed flows across outer cordon and screen line locations;
d) Estimating planning parameters for each TAZ for the base year 2014;
e) Revalidation and updation of mode choice models; and
f) Validated travel demand for the base year.

Summary of the mode wise travel demand (main mode only) estimated for the base year (2014) for morning peak period (6:00 to 11:00 hrs.) is presented in Table 4-1.

Table 4-1: Passenger Travel Demand for Greater Mumbai (Within MMR) in lakhs – Base Year 2014, Morning Peak Period (6:00 to 11:00 Hrs.)

Mode	Internal-Internal of MCGM	MCGM -Other Sub-regions of MMR	Other Sub-regions of MMR - MCGM	Total
Car	3.00	0.30	0.32	3.62
Two Wheeler	3.65	0.42	0.53	4.60
Auto Rickshaw	1.25	0.24	0.32	1.80
Taxi	1.57	0.18	0.31	2.07
Bus	8.26	0.84	1.79	10.89
Train	9.84	2.47	6.19	18.51
Metro/Mono	0.24	0.36	0.43	1.03
Total	**27.81**	**4.82**	**9.90**	**42.53**

Similar to the internal passenger travel (MMR area) assessment, goods vehicle travel (MMR area) assessment has been carried out for the year 2014. Summary of the vehicle type wise travel demand estimated for Greater Mumbai for morning peak period (6:00 to 11:00 hrs.) is presented in Table 4-2.

Table 4-2: Goods Travel Demand (in vehicle trips) for Greater Mumbai (Within MMR) – Base Year 2014, Morning Peak Period (6:00 to 11:00 Hrs.)

Mode	Internal-Internal of MCGM	MCGM - Other Sub-regions of MMR	Other Sub-regions of MMR - MCGM	Total
LCV	2,821	1,318	2,030	6,169
Trucks	6,564	3,052	4,704	14,321
Total	**9,385**	**4,370**	**6,734**	**20,489**

The external travel (Greater Mumbai to Outside of MMR and Outside of MMR to Greater Mumbai) for the year 2014, Morning Peak Period i.e. 6:00 to 11:00 hrs. is presented in Table 4-3. The travel interaction of Greater Mumbai outside MMR places is very less compared to the travel interaction of Greater Mumbai within MMR.

Table 4-3: External Travel in vehicles (Greater Mumbai – Outside of MMR and vice versa) - Base Year 2014, Morning Peak Period (6:00 to 11:00 Hrs.)

Mode	Vehicles Trips
Car	6,232
Two wheeler	2,166
Auto	481
Taxi	135
Bus	1,060
Goods	4,866

The overall travel demand analysis and network assessment process for the horizon period 2016-2034 is presented in Figure 4-3. This flow chart describes the application of travel demand models for various horizon years viz. 2034, 2024 and 2019 using the travel models. Major steps involved in the development of these models are:

a) Assessment of internal travel demand and external travel demand for the year 2014;
b) Preparation of Base Year (2014) road network for validation of travel demand matrices for Greater Mumbai;
c) Validation of Base Year (2014) travel demand by comparing assigned and observed flows across outer cordon and screen line locations;
d) Estimating planning parameters for each TAZ for different horizon years 2034, 2024 and 2019;
e) Forecasting internal travel demand for Greater Mumbai using the travel demand models developed in CTS for MMR study and assessment of external demand for Greater Mumbai using growth factor methods for different horizon years; and
f) Preparing EMME/4 software suit for travel demand and network analysis.

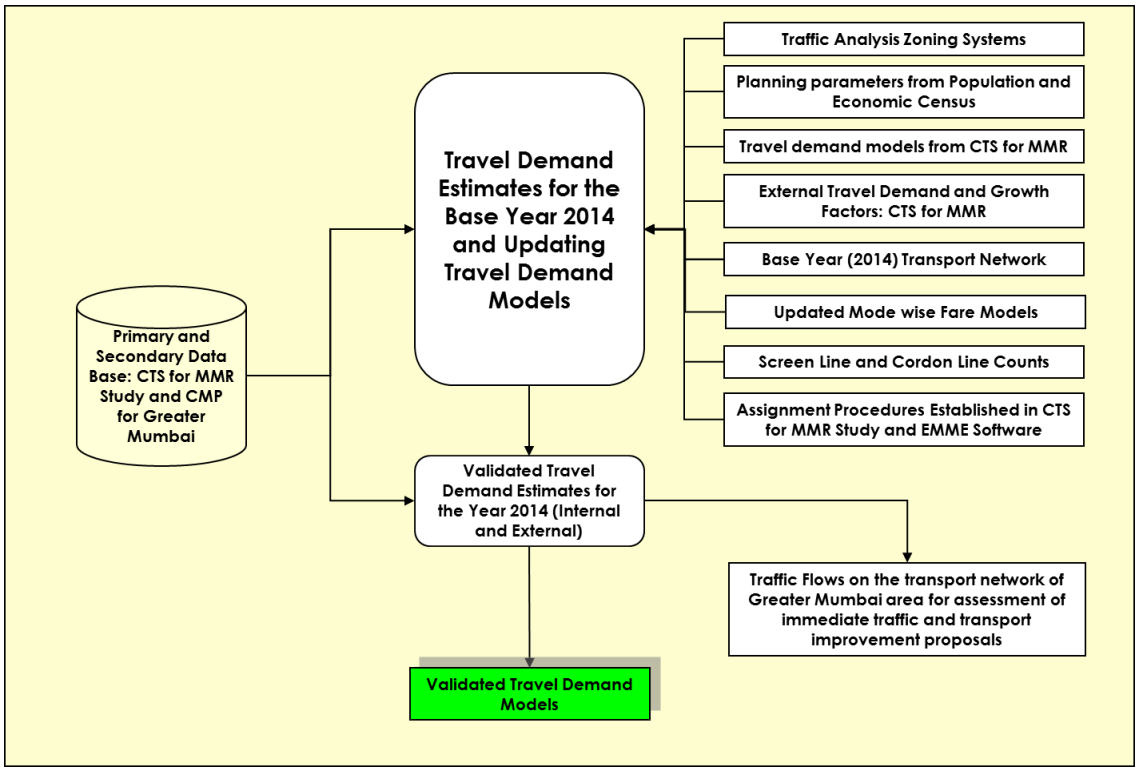


Figure 4-2: Overview of the Model Revalidation in CMP for Greater Mumbai Study

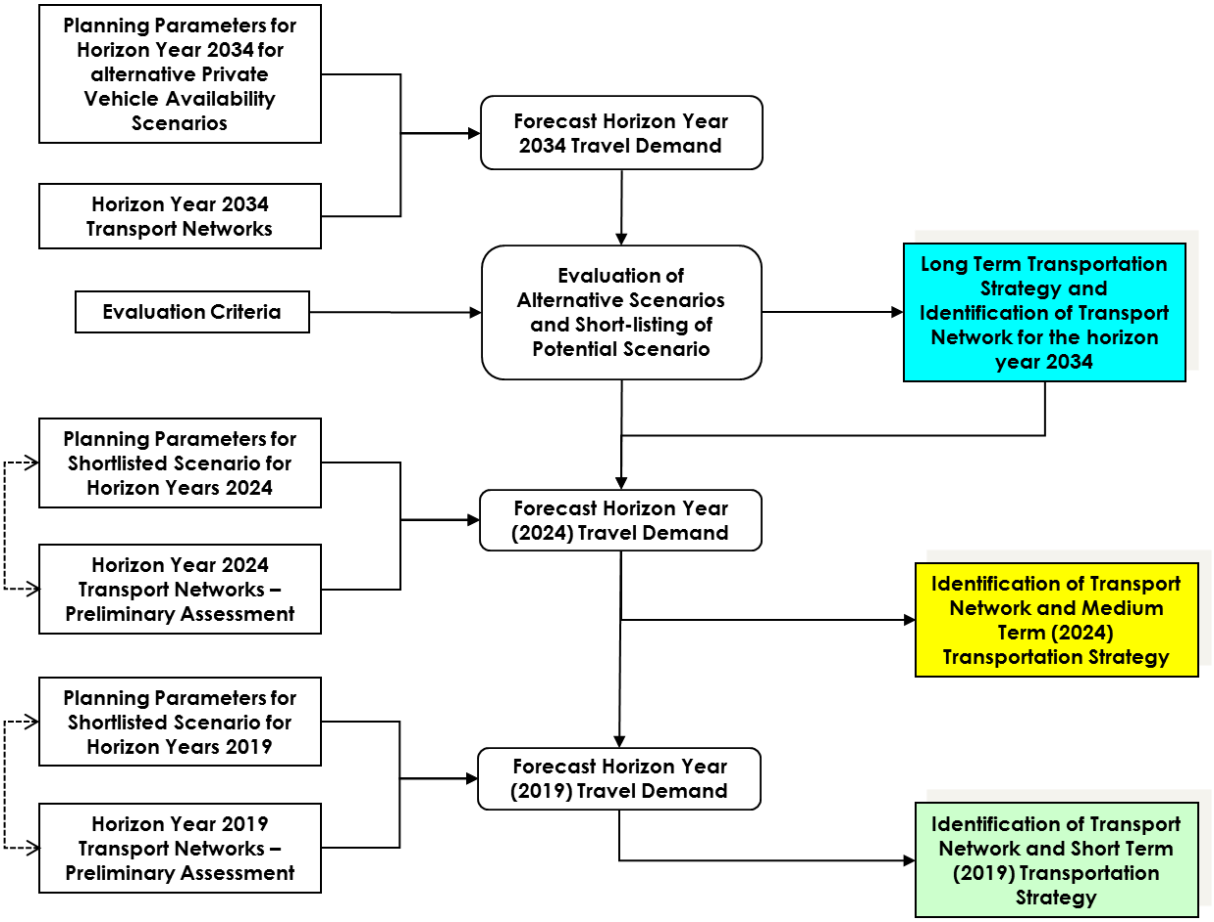


Figure 4-3: Travel Demand Analysis and Network Assessment Process

4.1 National Urban Transport Policy, 2005

The Government of India, recognizing the importance of sustainable flow of goods and people in urban areas in supporting the required level of economic activity has lead to drafting of a National Urban Transport Policy.

The policy proposes a much closer integration of land use and transport planning and also emphasizes greater use of public transport and non-motorized modes of travel since these modes occupy less road space and emit fewer pollutants compared to personal motor vehicles. The policy recognizes the importance of providing good parking facilities in urban areas and also the need to properly manage the freight traffic that gets generated. It offers central government's financial support for the required investments and also aims at building up capability for sound urban transport planning in the cities. It suggests a coordinated approach to urban transport planning and the need for creating greater awareness about the problems amongst city residents.

The Policy proposes that, while planning the transport networks, the following major aspects should be considered.

- **Transport to guide development:** Incorporating urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement;
- **Encourage public transport:** Encourage greater use of public transport enabling establishment of quality focused multi modal public transport systems that are well integrated for providing seamless travel across modes;
- **Provide equity:** Bringing about a more equitable allocation of road space with people rather than vehicles as its main focus; and
- **Integrate land use with transport:** Encouraging integrated land use and transportation planning so that the travel distances are minimized and access to livelihoods, education and other social needs is improved.

While evolving the required transport infrastructure for Greater Mumbai for the horizon period 2016-34 and to sustain the existing share of public transport share, the above stated policy guidelines of NUTP have been followed.

4.2 Travel Demand Assessment

Travel demand for the horizon period upto 2034 has been estimated using the travel demand models and various planning parameters.

Planning parameters assessed for the Greater Mumbai for base and horizon years are presented in Table 4-4. Travel demand for various horizon years has been estimated using the planning parameters assessed and travel demand models developed as part of CTS for MMR study. For assessment of transport for the horizon period 2014-2034 top-down approach has been followed starting from assessment of transport network requirement for the horizon 2034 followed by 2024 and 2019.

Table 4-4: Planning Parameters for the Base and Horizon Years

Parameters	2014	2019	2024	2034
Population (in million)	12.66	12.98	13.25	13.95
Workforce Participation Rates	0.40	0.43	0.44	0.46
Workers (in million)	5.11	5.53	5.87	6.35
Employment (in million)	5.91	6.72	7.13	8.04

Source: Consultant Estimates

Summary of the mode wise travel demand (main mode only) estimated for the horizon period 2014-2034 for morning peak period (6:00 to 11:00 hrs.) is presented in Table 4-5.

Table 4-5: Passenger Travel Demand for Greater Mumbai (Within MMR) in lakhs – Horizon Period 2019-34, Morning Peak Period (6:00 to 11:00 Hrs.)

Mode	Person Trips			
	2014	2019	2024	2034
Car	3.62	5.16	5.39	5.73
TW	4.60	4.05	4.24	4.50
Auto	1.80	2.30	1.31	1.41
Taxi	2.07	3.27	1.15	1.35
BUS	10.89	11.73	7.14	7.58
Suburban	18.51	22.10	21.93	25.34
Metro & Mono	1.03	1.41	1.55	2.052
Total	**42.53**	**50.02**	**56.65**	**66.43**

Similar to the internal passenger travel (MMR area) assessment, goods vehicle travel (MMR area) assessment has been carried out for the horizon period 2011-2031. Summary of the vehicle type wise travel demand estimated for Greater Mumbai for morning peak period (6:00 to 11:00 hrs.) is

presented in Table 4-6.

Table 4-6: Goods Travel Demand (in vehicle trips) for Greater Mumbai (Within MMR) – Horizon Period 2019-34, Morning Peak Period (6:00 to 11:00 Hrs.)

Vehicle Type	2014	2019	2024	2034
LCV	6,169	10,131	10,465	11,272
Trucks	14,321	23,504	24,291	26,179
Total	**20,489**	**33,635**	**34,756**	**37,451**

The external travel (Greater Mumbai to Outside of MMR and Outside of MMR to Greater Mumbai) for the horizon period 2014-2034, Morning Peak Period i.e. 6:00 to 11:00 hrs. is presented in Table 4-7. The travel interaction of Greater Mumbai with outside MMR places is very less compared to the travel interaction of Greater Mumbai within MMR.

Table 4-7: External Travel in PCUs (Greater Mumbai t0 Outside of MMR and vice versa) – Horizon Period 2019-34, Morning Peak Period (6:00 to 11:00 Hrs.)

Mode	2014	2019	2024	2034
Car	6,232	7,606	12,518	33,903
Two wheeler	2,166	2,644	4,351	11,784
Auto	481	587	966	2,616
Taxi	135	165	272	737
Bus	1,060	1,110	1,247	1,574
Goods	4,866	5,414	7,069	12,053

4.3 Daily Mode Split and Mode Split Changes: Greater Mumbai

Daily mode split for Greater Mumbai (main mode) has been assessed based on Morning Peak Period (6:00 to 11:00 AM) travel demand, updated HIS analysis, Screen line and outer cordon count data, secondary data on daily ridership data of public transport systems, etc. and the daily motorised mode split details are presented in Table 4-8. Public transport is dominant with 61.2% followed by private vehicle share with 26.4%.

Table 4-8: Daily Mode Split, Greater Mumbai

Mode	2014	2014
Car	1,639,439	11.6%
Two Wheeler	2,083,578	14.8%
Auto Rickshaw	816,940	5.8%
Taxi	938,670	6.6%
BUS	3,093,288	21.9%
Suburban	5,256,019	37.2%
Metro & Mono	293,148	2.1%
Total	**14,121,082**	**100.00%**
PV	3,723,017	26.4%
IPT	1,755,611	12.4%
PT	8,642,455	61.2%

A comparison of mode-split assessed for Greater Mumbai in 2005 (CTS for MMR Study) and 2014 (CMP for Greater Mumbai study) is presented in Table 4-9. It may be inferred that, major mode split changes have happened during the last decade. Public transport share has been decreased from 83% to 61.2% which is alarming. The major reasons for fall in public transport share is due to slow capacity enhancements to suburban rail system, delays in metro implementation, high private vehicle growth, increasing travel time of road based public transport system, etc. Growth of vehicle population i.e. vehicles on road as on 31st March of 2005 and 2014 for Greater Mumbai and CAGR details are presented in Table 4-10. It may be inferred that, Two wheelers have grown at CAGR of 8.3% and cars/ Jeeps have growth at 7.1%. Overall growth of vehicles in Greater Mumbai is at 6.8%.

Table 4-9: Daily Mode Split, Greater Mumbai Comparison: CTS for MMR Study (2005-08) and CMP for Greater Mumbai Study (2014-16)

Mode	Trips per day (2005)	%	Trips per day (2014)	%
Car	757,164	7.0%	1,639,439	11.6%
Two Wheeler	412,959	3.8%	2,083,578	14.8%
Auto Rickshaw	429,067	4.0%	816,940	5.8%
Taxi	230,290	2.1%	938,670	6.6%
BUS	3,541,967	32.9%	3,093,288	21.9%
Suburban	5,402,711	50.1%	5,256,019	37.2%
Metro & Mono			293,148	2.1%
Total	**10,774,158**	**100%**	**14,121,082**	**100%**
PV	1,170,123	10.9%	3,723,017	26.4%
IPT	659,357	6.1%	1,755,610	12.4%
PT	8,944,678	83.0%	8,642,455	61.2%

Table 4-10: Vehicles on road as on 31st March of 2005 and 2014 in Greater Mumbai

Vehicle Category	2005	2014	CAGR
Two Wheeler	647,892	1,329,461	8.3%
Cars	382,898	723,496	7.3%
Jeeps	22,354	29,882	3.3%
Stn. Wagons	3,868	3,848	-0.1%
Taxis	58,049	57,798	0.0%
Auto Rickshaw	104,104	109,170	0.5%
Stage Carriages	5,536	4,484	-2.3%
Contract Carriages	4,465	4,249	-0.5%
School Buses	853	2,518	12.8%
Private Service Vehicles	1,402	1,057	-3.1%
Ambulance	1,436	1,455	0.1%
Trucks and Lorries	14,930	7,561	-7.3%
Delivery Vans (4 Wheelers)	16,328	21,599	3.2%
Delivery Vans (3 Wheelers)	21,907	34,342	5.1%
Tractors	1,406	201	-19.4%
Trailers	986	92	-23.2%
Others	4,748	1,208	-14.1%
Tankers	1,778	385	-15.6%
Total	**1,294,940**	**2,332,806**	**6.8%**

4.3.1 Daily Mode Split and Mode Split Changes: Mumbai Metropolitan Region

It is pertinent to mention here that, focus of the CMP study is Greater Mumbai and hence primary surveys, travel demand analysis, etc. has been carried out accordingly. An attempt has been made for assessment of daily travel demand at MMR level using the HIS analysis data, CTS for MMR database, secondary data on population and employment assessed for the base year 2014, ridership details of public transport systems, etc. and the daily motorised mode split details are presented in Table 4-11. Public transport is dominant with 69.9.2% followed by private vehicle share with 21.6%.

Table 4-11: Daily Mode Split, Mumbai Metropolitan Region

Main Mode	2014 (CTS for Greater Mumbai)	
	Trips per day (Lakhs)	Motorised Mode Split
Metro & Mono	3.00	1.6%
Train	74.00	40.6%
Bus	50.36	27.7%
Rickshaw	12.41	6.8%
Taxi	3.06	1.7%
Two Wheeler	24.88	13.7%
Car	14.40	7.9%
Total	**182.11**	**100.0%**
PV (Car & TW)	39.28	21.6%
IPT (Auto & Taxi)	15.47	8.5%
PT (Train & Bus)	127.36	69.9%
Total	**182.11**	**100.0%**

A comparison of mode-split assessed for Greater Mumbai in 2005 (CTS for MMR Study) and 2014 (CMP for Greater Mumbai study) is presented in Table 4-12. It may be inferred that, major mode split changes have happened during the last decade. Public transport share has been decreased from 78.1% to 69.9% which is alarming. The major reasons for fall in public transport share is due to slow capacity enhancements to suburban rail system, delays in metro implementation, high private vehicle growth, increasing travel time of road based public transport system, etc.

Table 4-12: Daily Mode Split, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CMP for Greater Mumbai Study (2014-16)

Main Mode	2005 (CTS for MMR Study)*		2014 (CTS for Greater Mumbai)**	
	Trips per day (Lakhs)	Motorised Mode Split	Trips per day (Lakhs)	Motorised Mode Split
Metro & Mono			3.00	1.6%
Train	69.75	51.8%	74.00	40.6%
Bus	35.50	26.3%	50.36	27.7%
Rickshaw	10.50	7.8%	12.41	6.8%
Taxi	2.25	1.7%	3.06	1.7%
Two Wheeler	10.50	7.8%	24.88	13.7%
Car	6.25	4.6%	14.40	7.9%
Total	**134.75**	**100.0%**	**182.11**	**100.0%**
PV (Car & TW)	16.75	12.4%	39.28	21.6%
IPT (Auto & Taxi)	12.75	9.5%	15.47	8.5%
PT (Train & Bus)	105.25	78.1%	127.36	69.9%
Total	**134.75**	**100.0%**	**182.11**	**100.0%**

Daily travel demand growth in MMR assessed during 2005 and 2014 is presented in

Table 4-13. It may be inferred that, travel demand by public transport has grown at CAGR of 2.1%, IPT grown at 2.2% and private vehicle travel demand has grown at 9.9% which is highest. Growth of vehicle population i.e. vehicles on road as on 31st March of 2005 and 2014 for Greater Mumbai and CAGR details are presented in Table 4-14. It may be inferred that, Two wheelers have grown at CAGR of 10.1% and cars/ Jeeps have growth at 8.7%. Overall growth of vehicles in Greater Mumbai is at 8.7%.

Table 4-13: Daily Travel Demand Growth, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CMP for Greater Mumbai Study (2014-16)

Main Mode	Trips per day in Lakhs, 2005 (CTS for MMR Study)	Trips per day in Lakhs, 2014 (CTS for Greater Mumbai)	CAGR during 2005 to 2014
Metro & Monorail		3.00	
Train	69.75	74.00	0.7%
Bus	35.50	50.36	4.0%
Rickshaw	10.50	12.41	1.9%
Taxi	2.25	3.06	3.5%
Two Wheeler	10.50	24.88	10.1%
Car	6.25	14.40	9.7%
PV (Car & TW)	16.75	39.28	9.9%
IPT (Auto & Taxi)	12.75	15.47	2.2%
PT (Train & Bus)	105.25	127.36	2.1%

Table 4-14: Vehicles on road as on 31st March of 2005 and 2014 in Greater Mumbai

Vehicle Category	2005	2014	CAGR
Two Wheeler	1,337,731	3,170,000	10.1%
Cars	613,944	1,364,834	9.3%
Jeeps	73,062	88,798	2.2%
Stn. Wagons	4,986	10,256	8.3%
Taxis	80,079	108,828	3.5%
Auto Rickshaw	226,112	267,236	1.9%
Stage Carriages	6,740	9,337	3.7%
Contract Carriages	10,633	18,993	6.7%
School Buses	1,298	4,778	15.6%
Private Service Vehicles	2,879	3,756	3.0%
Ambulance	2,275	4,249	7.2%
Trucks and Lorries	97,775	160,655	5.7%
Delivery Vans (4 Wheelers)	62,180	113,754	6.9%
Delivery Vans (3 Wheelers)	51,036	126,745	10.6%
Tractors	3,256	4,170	2.8%
Trailers	6,981	14,996	8.9%
Others	7,003	8,961	2.8%
Tankers	14,153	22,222	5.1%
Total	**2,602,123**	**5,502,568**	**8.7%**

4.4 Assessment of Transport Infrastructure for Greater Mumbai for the horizon year 2034 (Long Term)

4.4.1 Transit Plan: Horizon Year 2034

The analysis reveals that, the need of transport network/system for changes in travel characteristics of Greater Mumbai for the next two decades by proposing the Metro network of about 145 km (inclusive of 11 km length of VAG Metro corridors which is under operation) for the horizon year 2034. The list of Metro corridors is presented in Table 4-15.

Table 4-15: Metro Corridors Proposed for the Horizon Year 2034

S.No	Line Description	Length (km)
1.	Versova – Ghatkopar	11
2.	Dahisar (E)-Mankhurd	41
3.	Colaba - BKC – SEEPZ	34
4.	Andheri (E) - Dahisar (E)	16
5.	Wadala – Mulund	20
6.	Jogeswari (E) - Kanjurmarg (W)	9
7.	Andheri - Ghatkopar – Mankhurd	17
8.	Sewri - Prabadevi (part of MTHL)	4
Total		**152**

The list of suburban projects is as follows:

a) Completion of on-going MUTP II projects;
b) CST Panvel fast corridor;
c) Premium corridor between Andheri and Virar;
d) Premium Elevated Corridor between Kurla-Thane-Bhiwandi; and
e) CBTC on harbour line.

Suggested long term Transit Network plan for the year 2034 is shown in Figure 4-6.

4.4.2 EBLs: Horizon Year 2034

The following criteria are adopted for identification of potential Exclusive Bus Lanes (EBL) corridors in Greater Mumbai:

a) Exclusive Bus Lane (EBL) recommended by BEST;
b) Bus Passenger Demand > to 5,000 persons per hour both direction;
c) Road Corridors connecting major activity centres, nodes, new areas of growth/ redevelopments, etc.; and
d) Assessment of potential role of EBL based on Suburban and Metro corridors in terms of functioning as an access mode to some select pockets of MCGM.

While considering the above criteria, the road corridors satisfying right of way greater than 27.4m are considered, for accommodating the dedicated lane on either side of the corridor. After examination and further identification of EBL corridors for the horizon period 2034 has been prepared this is about 256 km based on travel demand analysis and multi-criteria approach. BEST is taking a pro-active view and action on the implementation of EBL projects. The list of projects, identified for implementation within next 20 years are presented in Table 4-16 and shown in Figure 4-5.

4.4.3 Road Network Plan: Horizon Year 2034

Suggested long term Road Network Plan for the year 2034 is shown in Figure 4-6. The proposed Road network consists of roads with widening links to the extent of about 708 km. The details of links/ roads to be widened by 2034 are shown in Figure 4-7. The proposed Road network also consists of newly proposed roads/ links (missing links) to the extent of about 219 km. the details of links/ roads to be added/ modified in Master Plans are shown in Figure 4-8.

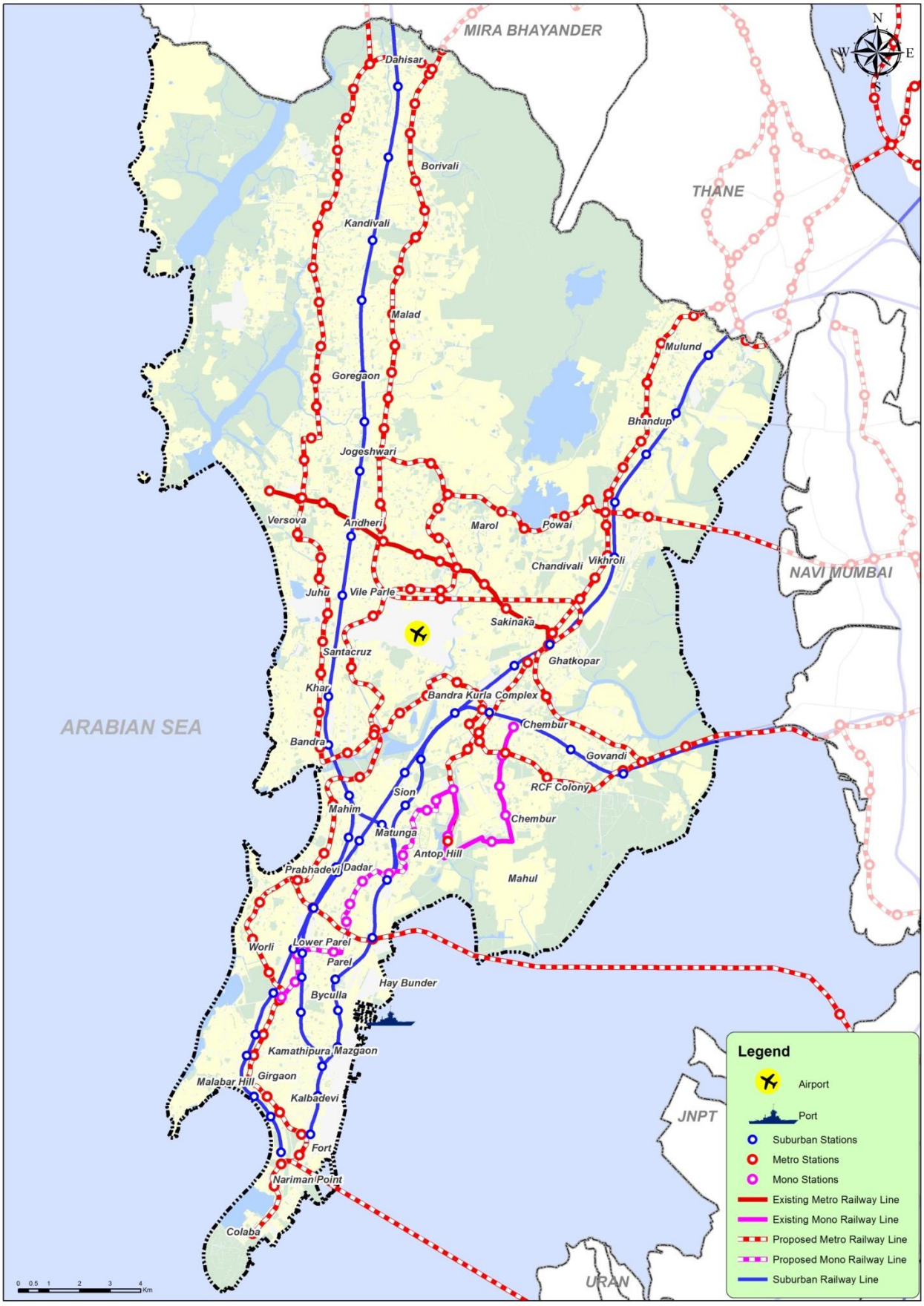


Figure 4-4: Suggested long Term Road Network Plan for Year 2034

Table 4-16: Recommended Exclusive Bus lane Corridors for 2034

Sl. No	Line Description	Length (km)
1.	Eastern Express Highway (Sion – Mulund)	19.2
2.	Jn of Lokhandwala to Jn of JVLR x WEH at Jogeshwari	3.9
3.	Western Express Highway (Bandra – Andheri Kurla Road)	7.6
4.	Swami Vivekananda Road_Vile Parle - Borivali Station	15.0
5.	Lalalajpathrai Marg_Haji ali Jn - Worli Naka	2.5
6.	Madam Cama Road_Mantralaya-CST	3.4
7.	Lady Jahangir Road_Eastern Freeway Via Bhakti Park-Shivaji Nagar Jn	10.6
8.	Sion - Goregaon Via Sakinaka, L&T powai	17.4
9.	LBS Marg_Phoenix Mall - Ghatkopar BEST Depot	4.2
10.	Senapati Bapat Marg	7.3
11.	SCLR- PL Lokhande Marg- Shivaji Nagar JN.	9.3
12.	DR. BR Ambedkar Road_CST - Sion	12.2
13.	Marine Drive	3.9
14.	Mahim Sion Link Road_Raheja Hospital - Sion	3.7
15.	Coastal Road	29.7
16.	Sion Bandra Link Road (kalanagar) - Suochana Setty Road (Sion Hospital)	2.8
17.	Colaba _ Maheshwari Udhyan via Rafi Ahmed khidwai Marg	14.1
18.	Suman Nagar Jn - Shivaji Chowk Via Dr.Choitram Gidwani Marg	3.2
19.	Sardar Vallabhai Patel Road	3.3
20.	Girgaon Chowpaty - Haji Ali - Jacob Circle	4.5
21.	Gokhale Raod (Dadar Police Station) -NM Joshi Marg	5.1
22.	TH Kataria Marg - Sion Via Hinduja Bus Stop, Naik Nagar	3.2
23.	Veer Savarkar Marg From Prabadevi - Behraum Baug	15.7
24.	Juhu Road From Santacruz To Seven Bunglow Metro Station Via JVPD	7.0
25.	Guru Hargovindji Marg - JVPD Via Gokhale Bridge	4.0
26.	Sahar Road - CSIA	4.0
27.	GMLR_Inorbit Mall Jn - Dindoshi Bus Depot	3.8
28.	Akurli Road_ Kandivali Station - BEST Bus Stand	2.9
29.	Malad Marve Road_From SV Road Jn - Madh-Marve Jn	5.2
30.	MG Road (From SV Road Jn) - New Link Jn (Malad Marve Road Jn)	3.7
31.	SV Road (Borivali (E) - WEH Jn)	3.4
32.	Bhandup Gaon (GMLR Jn) - Vikroli	5.5
33.	GMLR - Mulund Airoli Road	4.9
34.	IIT Market Gate Jn - Vaishali Nagar (Mulund)	7.6
Total		**257**

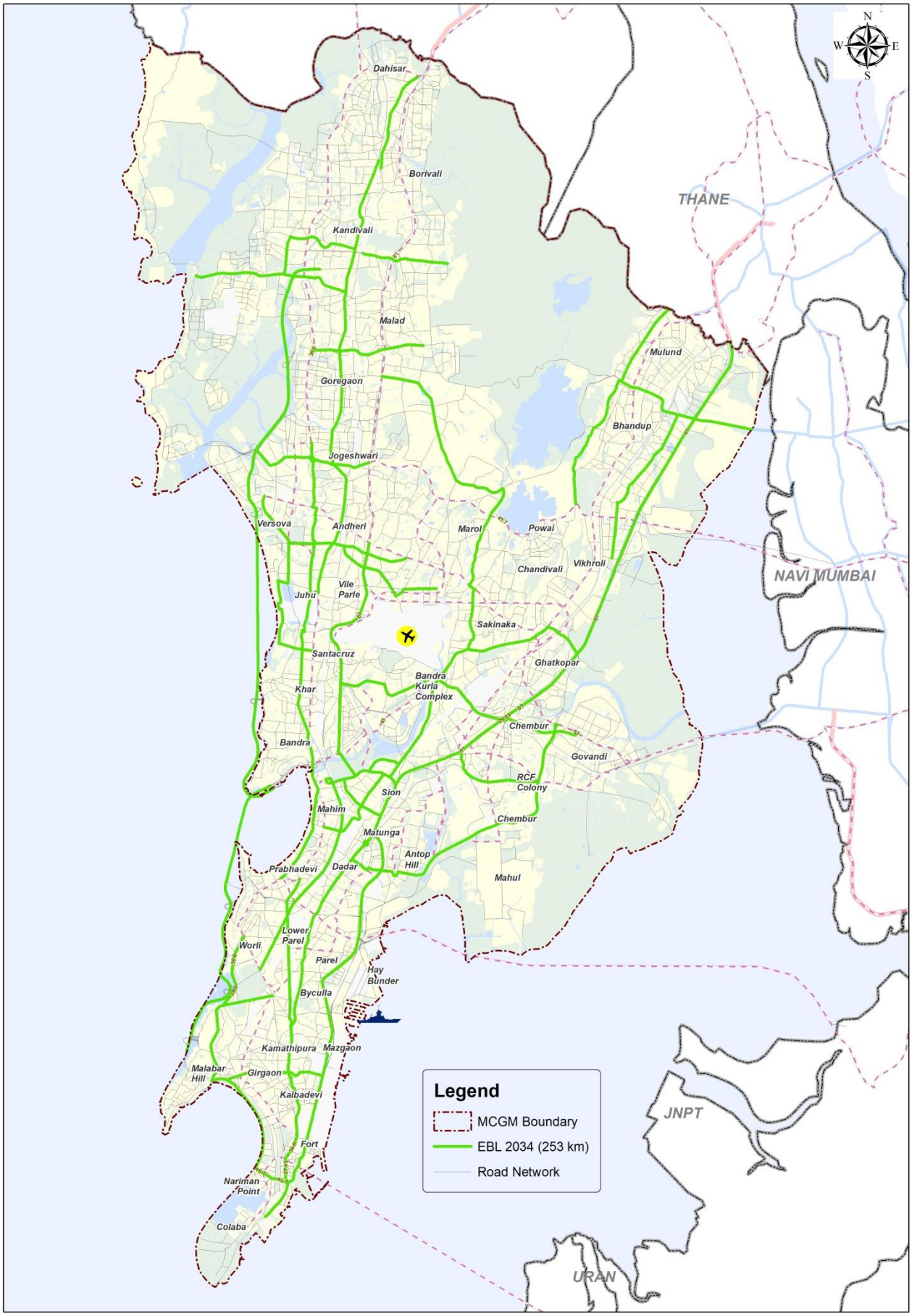


Figure 4-5: Recommended Exclusive Bus lane Corridors for 2034

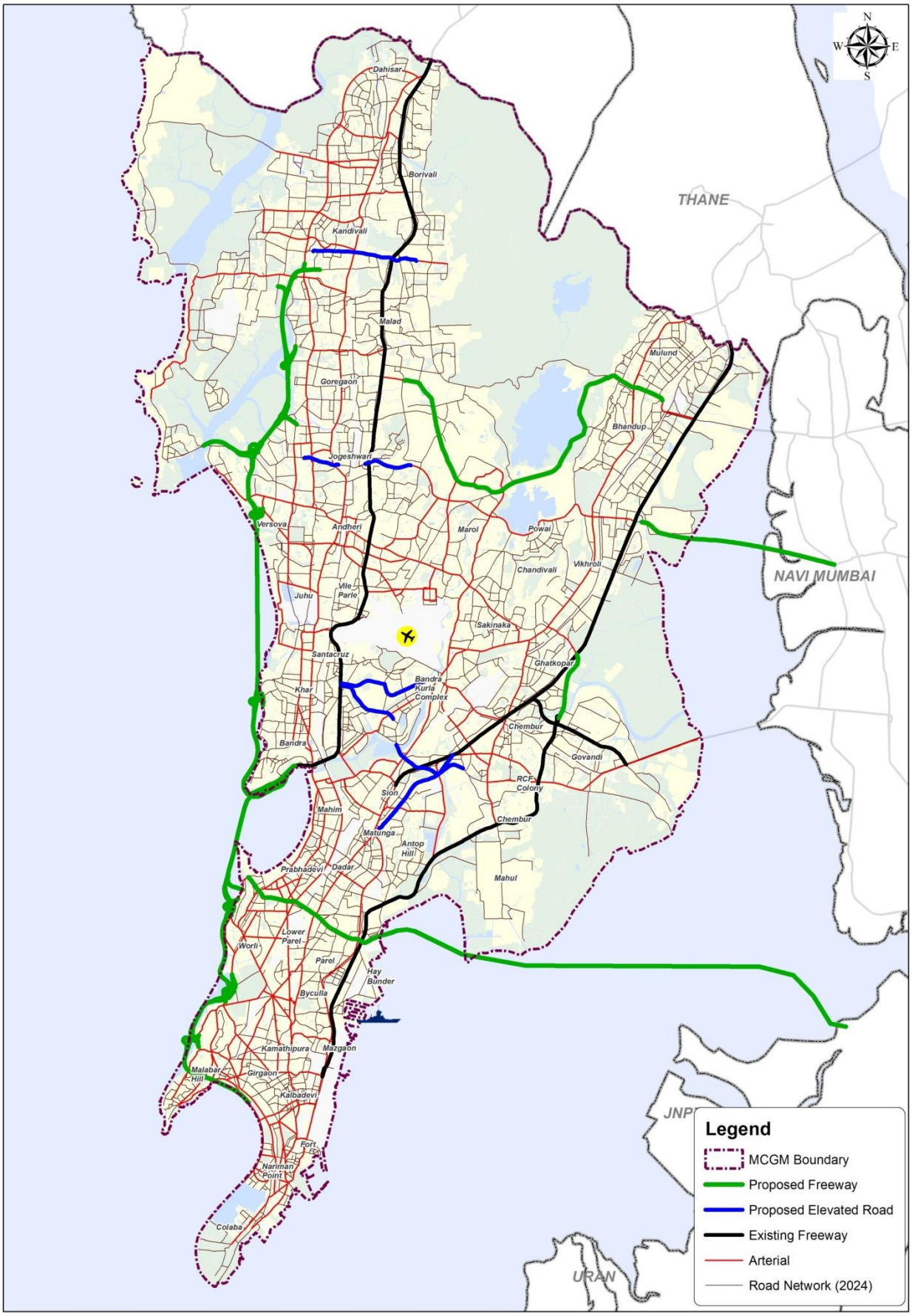


Figure 4-6: Suggested long Term Road Network Plan for Year 2034

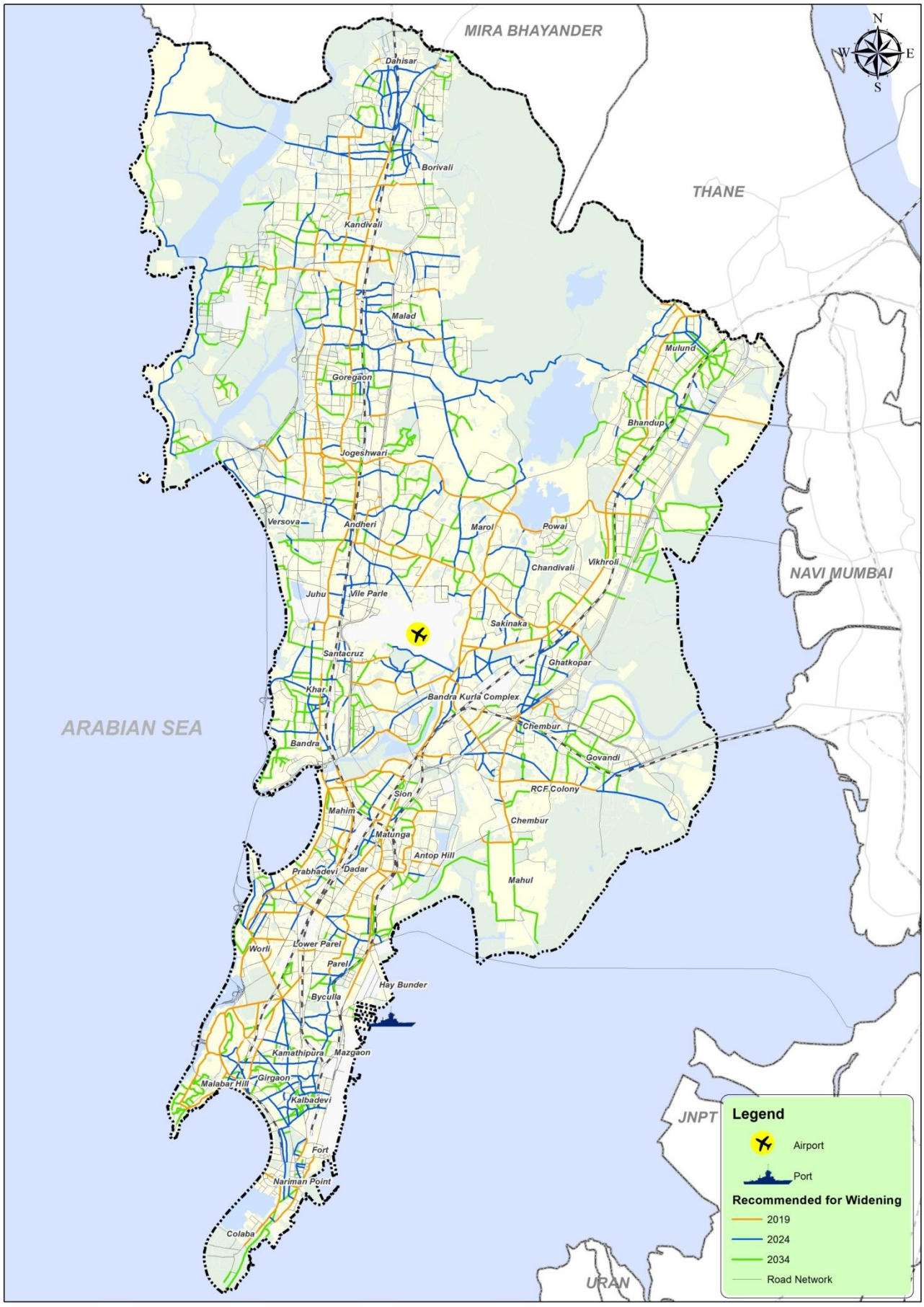


Figure 4-7: Recommended Widening Links for Greater Mumbai by 2034

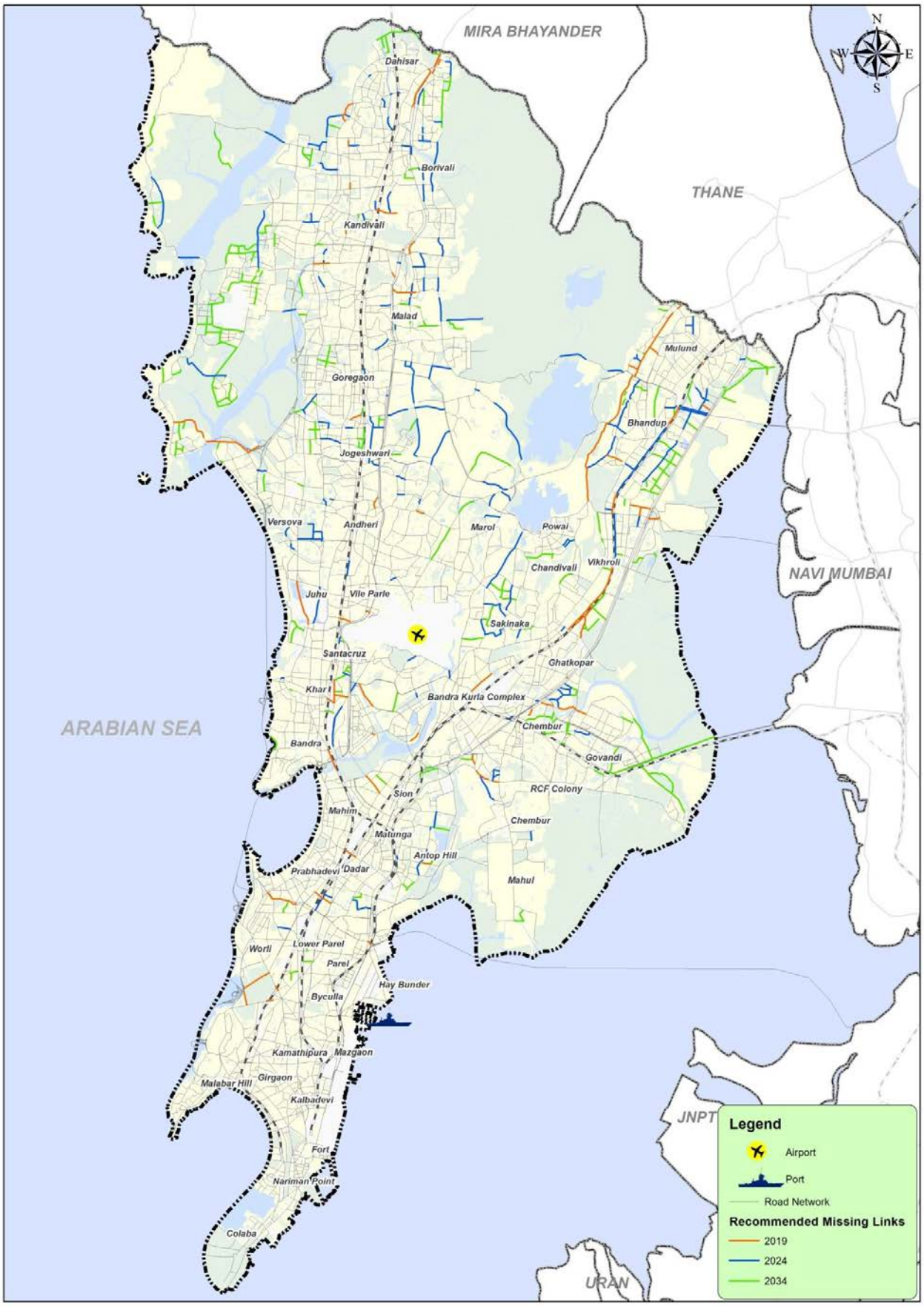


Figure 4-8: Recommended Missing Links for Greater Mumbai by 2034

4.4.4 Intercity Bus Terminals, Truck Terminals, Bus system and Traffic Management Measures for the horizon year 2034

Apart from Metro network and improvement/ development of road/ highways, the other transport infrastructure required is inter-city bus and truck terminals, bus system for intra-city operations and traffic management measures.

Inter-city bus terminals and truck terminals for the horizon period upto 2024 have been assessed based on the external travel demand forecasts. Four Inter-city bus terminals are proposed for the horizon year 2034 and the possible locations are,

1. LBS Marg, Mulund (Octroi Naka area)
2. WEH, Dahisar (Octroi Naka area)
3. EEH, Anand Nagar (Octroi Naka area)
4. Sion-Panvel Highway: Vashi (Octroi Naka area)

Two truck terminals are proposed for the horizon year 2034 and the possible locations are EEH, Anand Nagar (Octroi Naka area) and Airoli (Octroi Naka area).

Inter-city bus terminals and truck terminals are proposed in the existing Octroi areas with a view that, once Octroi is abolished, the existing octroi areas shall be used for the proposed inter-city bus terminals and truck terminals.

Summary of Locations Proposed for Inter-city Bus terminals and Truck Terminals in Greater Mumbai is presented in Table 4-17.

Proposed suburban stations for SATIS for the horizon year 2034 are presented in Table 4-18. Proposed locations for the flyovers, elevated roads and RoBs/ RuBs for the horizon year 2034 are presented in Table 4-19, Table 4-20 and Table 4-21 respectively.

Bus fleet requirements, bus terminal-cum depots for intra-city bus operations for the horizon period upto 2034 have been worked out based on the travel demand analysis carried out for the horizon years 2019, 2024 and 2034.

The proposed traffic engineering measures are limited to the arterial road network. In the short term, up to 2034, there is a need to undertake transportation projects that address specific existing deficiencies in order to provide some relief to the current congestion levels and safety concerns. These have been characterized as “Traffic Engineering Measures”. Based on the review of numerous background studies, reports and recommendations supplemented with further data compiled in the study, an initial assessment of traffic engineering measures has been compiled and the associated costs have been included the cost estimates. For other Traffic Management Measures (TMM) such as traffic signs & markings, bus bays & shelters, infrastructure for traffic police, etc., which could not be quantified in numbers, lump sum estimates have been assumed. It is recommended that, traffic engineering measures should be implemented well before 2034. Summary of the proposed inter-city bus terminals, bus system (intra-city) and Traffic Engineering Measures is presented in Table 4-22.

Table 4-17: Summary of Locations Proposed for Inter-city Bus terminals and Truck Terminals in Greater Mumbai

Aspect/ Location	WEH, Dahisar	LBS Marg, Mulund	EEH, Anand Nagar	Mulund-Airoli Link Road: Airoli	Sion-Panvel Highway: Mankhurd
Plot Area (ha)	**2.20**	**1.58**	**8.04**	**2.50**	**3.02**
Nearest railway Station	Dahisar	Mulund	Mulund	Mulund and Airoli	Mankhurd
Approximate Demand: Inter-city/ State Bus: No. of bus bays/ departures	• 26 bus bays • No. of Bus departures: 2080	• 31 bus bays • No. of Bus departures: 2480	• 33 bus bays • No. of Bus departures: 2640	• 15 bus bays • No. of Bus departures: 1200	• 33 bus bays • No. of Bus departures: 2640
Approximate Demand: Truck Parking Bays/ Parking turnover	• 90 bays • 1,080 trucks/day	• 75 bays • 900 trucks/day	• 170 bays • 2,040 trucks/day	• 25 bays • 300 trucks/day	• 80 bays • 960 trucks/day
Suitability for	Inter City /State Bus Terminal	Inter City /State Bus Terminal	Truck Terminal and Inter City/State Bus Terminal	Truck Terminal	Inter City /State Bus Terminal
Rationale/ Basis	CTS for MMR Study, 2005-08 and CMP for Greater Mumbai, 2014				
Area Required (ha)	3.00	3.00	13.00 ha (10.00 for TT + 3.00 for BT)	10.00	3.00
Feasibility of expanding the existing area	• Not Feasible	• Feasible by Changing the landuse from RG to Bus Terminal	• Feasible by Changing partially the landuse from BEST Housing and Municipal Housing to Truck Terminal/ Bus Terminal	• Feasible by Changing partially the landuse from NDZ or Chemical Godown to Truck Terminal	• Additional area is not required.
Comment	• Bus Terminal may be planned with the available area			• The demand for truck terminal in the beginning may be low. Hence, the existing available area i.e. 2.5 ha may be readily used for Truck Terminal to begin with.	• Bus Terminal may be planned within the available area.
No. of Trucks Bays/ Bus Bays	• 25 bus bays	• 35 bus bays	• 300 truck bays • 35 bus bays	• 300 truck bays (for 10 ha area) • 75 truck bays (for 2.5 ha area)	• 35 bus bays
Parking Turnover in Truck Terminals			• 3,600 trucks	• 3,600 trucks (for 10 ha area) • 900 trucks (for 2.5 ha area)	
No. of Bus departures	• 2,000	• 2,800	• 2,800		• 2,800

Table 4-18: Proposed Suburban Stations for SATIS for the horizon year 2034

Sl. No	Name of Suburban Station	Sl. No	Name of Suburban Station
1	Mumbai Central	19	Bhandup
2	Lower Parel	20	Mulund
3	Dadar	21	Wadala Road
4	Bandra	22	Mahalaxmi
5	Andheri	23	Elphiston Road
6	Borivali	24	Khar Road
7	Kurla	25	Santacruz
8	Chembur	26	Vile Parle
9	Charni Road	27	Jogeshwari
10	Grant Road	28	Kandivali
11	Matunga Road	29	Parel
12	Mahim Junction	30	Sion
13	Goregaon	31	Vidyavihar
14	Malad	32	Kanjur Marg
15	Dahisar	33	Nahur
16	Byculla	34	Govandi
17	Ghatkopar	35	Mankhurd
18	Vikhroli		

Table 4-19: Proposed Locations for Flyovers for the horizon year 2034

Sl. No.	Name
1.	Kalanagar Junction (Junction of BKC Main Road x Sion Dharavi Link Road)
2.	Chhedanagar Junction ((Junction of EEH x Ghatkopar Mankhurd Link Road)
3.	Junction of Ghatkopar Mankhurd Link Road x Shivaji Nagar Junction
4.	Junction of S V Road x GMLR
5.	Connectivity between WEH and Senapati Bapat Marg
6.	Connectivity between Senapati Bapat Marg and WEH
7.	Coastal Road Interchange : Connectivity from Coastal Road (traffic coming from North) to Back Road/ P Tandon Road, Jogeshwari
8.	Coastal Road Interchange : Connectivity from Back Road/ P Tandon Road, Jogeshwari to Coastal Road
9.	Coastal Road Interchange : Connectivity from Coastal Road (traffic coming from South) to Back Road/ P Tandon Road, Jogeshwari
10.	Junction of Sardar Vallabhbhai Road x Khetwadi Main Road
11.	Junction Of PD Mello Road X Carnac Bridge
12.	Junction of Sulochana Shetty Marg x 60 feet Road x Krishna Menon Road
13.	Junction of S V Road x Kora Kendra Road
14.	Connectivity between Sudhir Phadke ROB and WEH, Borivali
15.	Junction of Link Road x Andheri Link Road
16.	Junction of Rafi Ahmed Kidwai Marg X Jerabhai Wadia Marg (from North)
17.	Junction of JJ Road x Saboo Siddik Polytechnic Road
18.	Junction of Rafi Ahmed Khidwai Marg X Jerabhai Wadia Marg (from South)

Note: Project preparatory works for Sl. No. 1 and Sl. No. 2 flyovers are under progress by MMRDA

Table 4-20**: Proposed Locations for Elevated Roads for the horizon year 2034**

Sl. No	List of Proposed Elevated Roads
1.	Elevated Road connecting BKC, EEH and Sewri-Chembur Link Road (Wadala Truck Terminal Road) and Lal Dongar Road, East of RCF
2.	From WEH in Santacruz to Kapadia Bazar in BKC
3.	From WEH in Santacruz to Bharat Nagar in BKC
4.	Extension of JVLR South RoB on East side
5.	Extension of JVLR South RoB on West side
6.	From V N Purav Marg x EEH junction to Starting of Rafi Ahmed Kidwai Marg
7.	Over Mathurdas Road and Akurli Road
8.	Bridge over Thane Creek from Kanjurmarg to Koparkairane i.e. extension of JVLR

Note: Project preparatory works for Sl. No. 1, Sl No. 2 and Sl. No. 3 elevated roads are under progress by MMRDA

Table 4-21: Proposed Locations for RoBs/ RuBs for the horizon year 2034

Sl. No.	Name
1.	RoB over western railway line, north of Milan flyover
2.	RoB over western railway line, north of Goregaon station
3.	RoB, south of Dadar station connecting Mc Jawale Marg and MMGS Marg
4.	RoB over central railway line, south of Vikroli station
5.	RoB over western railway line, north of Elphinstone station
6.	RuB under central railway line, north of Vasanth Dada patil Marg (Between Vikroli and Ghatkopar stations)
7.	RoB over western railway line, south of Mahalakshmi station (connecting Keshvrao Khadye Marg and Anandilal P Marg)
8.	RoB, north of Dadar station connecting Bal Govind Das Marg and Lakshmi Nappu Road
9.	RoB over western railway line, north of Mahalakshmi station (connecting Dr E Moses Road and Sakpal Marg)
1.0	RuB under harbor line, south of Vidya Vihar station
11.	RuB under western railway line, south of Dahisar railway station
12.	RoB over harbor line, providing connectivity between Jerbhai Wadia Marg, Rafi Ahmed Kidwai Marg and internal roads of MbPT land
13.	RoB over central railway line connecting Ratanji Hirji Bhojraj Marg and R B Thakkar Marg, South of Mulund station
14.	RoB over harbor line, connecting Naigaon Road and L M Nadkarni Road
15.	RoB over central railway line, providing connectivity between LBS Marg and Swadeshi Mills Road
16.	RoB over western railway line, South of Khar Station
17.	RoB over harbor line, north of Guru Tejbhahadur Nagar station
18.	RoB over western railway line, north of Andheri
19.	RoB over harbor line, providing connectivity between Mathar Pakhadi Road and internal road of MbPT lands
20.	RoB over western railway line, north of Bandra terminus
21	RoB over central railway line, north of Kanjurmarg station
22	RoB over harbor railway line, providing connectivity between DS Baretto Road and internal roads of MbPT lands
23	RoB over western railway line, extension of Ganpatrao Kadam Marg
24	RoB over western railway line, south of Jogeshwari station
25	RoB over harbor line connecting Sakaram Lanjekar Marg and Messent Road
26	RuB under western railway line, north of Suncity RoB (between Vile Parle and Andheri stations)
27	RoB over harbor railway line, GSB seva Mandal, south of EEH
28	RoB over western line, north of Dahisar station

Table 4-22: Intercity Bus Terminals, Truck Terminals and Traffic Management Measures for Horizon Year 2034

Description	Unit	Number
Inter-city Bus Terminals*	No.	4
Truck Terminal*	No.	2
Bus fleet	No.	1,800
Bus Terminal-cum Depot for Intra-city Bus operations	No.	18
Intersection Improvements	No.	200
Installation of Traffic Signals	No.	48
Installation of ATC Compatible Traffic Signals	No.	247
SATIS (Outside the Railway premises)	No.	35
ROBs/RUBs	No.	28
Flyovers (2 no.)/ Elevated Roads (3 No.) already planned	No.	5
Flyovers (New)	No.	16
Elevated Roads (New)	No.	5
FOBs/ Subways	No.	100
Cycle Tracks along the existing roads	km	540
Road Safety measures	Lumpsum	
Other TMM (Traffic signs, Markings, etc.)	Lumpsum	
Infrastructure for Traffic Police	Ref. Table 4-42	

Table 4-23: Broad Cost Estimate Details on Infrastructure for Mumbai Traffic Police for Horizon Year 2034

Sl. No.	Item	Quantity	Unit	Estimated Total Cost (Rs. Crore) H65	%
1	Patrolling Vehicles: Jeeps	650	No.	65	3.6%
2	Patrolling Vehicles: TW	2250	No.	13.5	0.7%
3	Offices (Chowkies)	550	No.	22	1.2%
4	Traffic Wardens/ Guards	2495	No.	305	16.9%
5	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Small	1360	No.	680	37.8%
6	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Big	675	No.	675	37.5%
7	Facilities in Traffic Police Training Centre				0.0%
8	Speed Guns	70	No.	0.14	0.0%
9	ATC Traffic Control Centres in suburbs	2	No.	6	0.3%
10	Training to Traffic Police		Lump sum	10	0.6%
11	Traffic Park	1	No.	2	0.1%
12	Enforcement Automation (Mobile phones, Wireless printer, interceptors, etc.)		Lump sum	20	1.1%
13	Mumbai Traffic Police website improvements and maintenance		Lump sum	2	0.1%
Total				**1800**	**100%**

4.4.5 Broad Cost Estimates for the horizon year 2034

The cost of horizon period transport network, bus system and traffic management measures has been estimated based on the unit rates, compiled from the recent metro project reports, detailed feasibility studies, Consultants own experience on similar projects, etc. The details of broad cost estimate for the total horizon transport network (2034) by Metro System, Highway System are presented in Table 4-24. The total cost of horizon transport network for the horizon period upto 2034 is INR 1,67,583 Crores at 2014-15 prices. Approximate cost of transport network proposed under Metro system, Roads/Highway system, Suburban System and BRTS/ Exclusive Bus system is INR 72,700 Crores, INR 56,793 Crores, INR 17,434 Crores and INR 5,397 Crores respectively, with the individual share of total cost being 43.1%, 33.9%, 10.4% and 3.2% respectively. The share of traffic management measures and Monorail are 7.0% and 1.1%. Consultants have given due consideration on Road safety and Suburban commuter safety. Approximate cost provisions made for Road Safety and Trespass Control measures is about INR 900 crores and 760 crores for the horizon year upto 2034 respectively. The proposed trespass control measures include 100 FoBs with escalators for East-West connectivity across railway tracks (proposed at heavy to moderate trespass locations as well as provision for future within Greater Mumbai) to for general public.

Table 4-24: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2034 (in Crores)

Component	2016-2034	%
Roads/ Highway System	56,793	33.9
Traffic Management Measures	11,793	7.0
Bus System	1,241	0.7
BRTS/ EBL	5,397	3.2
Terminals	826	0.5
Metro System	72,200	43.1
Monorail	1,900	1.1
Suburban System	17,434	10.4
Total	**1,67,583**	**100.0%**

4.5 Assessment of Transport Infrastructure for Greater Mumbai for the horizon year 2024 (Medium Term)

4.5.1 Transit, EBL and Highway Plans

For intermediate year 2024, identified transit corridors are shown in Figure 4-9. The Metro corridors beyond 2019 for the intermediate year 2024 are presented in Table 4-25.

Table 4-25: Metro Corridors Proposed for the Horizon Year 2024

S.No	Line Description	Length (km)
1.	Dahisar (E)-Mankhurd	41
2.	Colaba - BKC - SEEPZ	34
3.	Andheri (E) - Dahisar (E)	16
4.	Jogeswari (E) – Kanjurmarg (W)	9
5.	Andheri - Ghatkopar – Mankhurd (via International Airport)	17
Total		**117**

From the recommended EBL for Greater Mumbai of 2034, the identification of network for 2024 is done

following the process as given under

- Dropping of EBL Corridors which form either Feeder or Main System to Metro corridors planned beyond 2024; and
- Dropping of those EBL Corridors which are planned as Feeder or Main lines to emerging Growth Centre and Greenfield opportunities planned beyond 2024.

The above is the process of elimination. Identification of corridors for 2024 is in conformity with overall Plan. EBL corridors have been identified for the horizon year 2024 which is about 153 km length. However, this includes the projects which have already been identified for implementation. The list of projects, identified for implementation within next 10 years, is identified as presented in Table 4-26 and shown in Figure 4-10.

Table 4-26: Recommended Exclusive Bus lane Corridors for 2024

S.No	Line Description	Length (km)
1.	Eastern Express Highway (Sion – Mulund)	19.2
2.	Jn of Lokhandwala to Jn of JVLR x WEH at Jogeshwari	3.9
3.	Western Express Highway (Bandra - Andheri Kurla Road)	7.6
4.	Swami Vivekananda Road_Vile Parle - Borivali Station	15.0
5.	Lala lajpath rai Marg_Haji ali Jn - Worli Naka	2.5
6.	Madam Cama Road_Mantralaya-CST	3.4
7.	Lady Jahangir Road_Eastern Freeway Via Bhakti Park-Shivaji Nagar Jn	10.6
8.	Sion - Goregaon Via Sakinaka, L&T Powai	17.4
9.	LBS Marg_Phoenix Mall - Ghatkopar BEST Depot	4.2
10.	Senapati Bapat Marg	7.3
11.	SCLR- PL Lokhande Marg- Shivaji Nagar JN	9.3
12.	DR. BR Ambedkar Road_CST – Sion	12.2
13.	Marine Drive	3.9
14.	Mahim Sion Link Road_Raheja Hospital – Sion	3.7
15.	Coastal Road	29.7
Total		**153**

For intermediate year 2024, recommended highway/ road network is shown in Figure 4-11. The proposed road network consists of widening of existing roads to the extent of about 466 km and new/ missing links to the extent of about 125 km. The details are shown in Figure 4-7 and Figure 4-8 respectively.

4.5.2 Intercity Bus Terminals, Truck Terminals, Bus system and Traffic Management Measures for the Horizon Year 2019

Apart from Metro network and improvement/ development of road/ highways, the other transport infrastructure required is inter-city bus and truck terminals, bus system for intra-city operations and traffic management measures.

Inter-city bus terminals and truck terminals for the horizon period upto 2024 have been assessed based on the external travel demand forecasts. Two Inter-city bus terminals are proposed for the horizon year 2024 and the possible locations are LBS Marg, Mulund (Octroi Naka area) and WEH, Dahisar (Octroi Naka area). Two truck terminals are proposed for the horizon year 2024 and the possible locations are EEH, Anand Nagar (Octroi Naka area) and Airoli (Octroi Naka area). Proposed suburban stations for SATIS for the horizon year 2024 are presented in Table 4-18. Proposed locations for the flyovers, elevated roads and RoBs/ RuBs for the horizon year 2024 are presented in Table 4-19, Table 4-29 and Table 4-21 respectively.

Table 4-27: Proposed Suburban Stations for SATIS for the horizon year 2024

Sl. No	Name of Suburban Station	Sl. No	Name of Suburban Station
1	Mumbai Central	12	Mahim Junction
2	Lower Parel	13	Goregaon
3	Dadar	14	Malad
4	Bandra	15	Dahisar
5	Andheri	16	Byculla
6	Borivali	17	Ghatkopar
7	Kurla	18	Vikhroli
8	Chembur	19	Bhandup
9	Charni Road	20	Mulund
10	Grant Road	21	Wadala Road
11	Matunga Road		

Table 4-28: Proposed Locations for Flyovers for the horizon year 2024

Sl. No.	Name
1.	Kalanagar Junction (Junction of BKC Main Road x Sion Dharavi Link Road)
2.	Chhedanagar Junction ((Junction of EEH x Ghatkopar Mankhurd Link Road)
3.	Junction of Ghatkopar Mankhurd Link Road xShivaji Nagar Junction
4.	Junction of S V Road x GMLR
5.	Connectivity between WEH and Senapati Bapat Marg
6.	Connectivity between Senapati Bapat Marg and WEH
7.	Coastal Road Interchange : Connectivity from Coastal Road (traffic coming from North) to Back Road/ P Thandon Road, Jogeshwari
8.	Coastal Road Interchange : Connectivity from Back Road/ P Thandon Road, Jogeshwari to Coastal Road
9.	Coastal Road Interchange : Connectivity from Coastal Road (traffic coming from South) to Back Road/ P Thandon Road, Jogeshwari
10.	Junction of Sardar Vallabhbhai Road x Khetwadi Main Road
11.	Junction Of PD Mello Road X Carnac Bridge
12.	Junction of Sulochana Shetty Marg x 60 feet Road x Krishna Menon Road
13.	Junction of S V Road x Kora Kendra Road
14.	Connectivity between Sudhir Phadke ROB and WEH, Borivali
15.	Junction of Link Road x Andheri Link Road
16.	Junction of Rafi Ahmed Khidwai Marg X Jeerabhai Wadia Marg (from North)
17.	Junction of JJ Road x Saboo Siddik Polytechnic Road
18.	Junction of Rafi Ahmed Khidwai Marg X Jeerabhai Wadia Marg (from South)

Note: Project preparatory works for Sl. No. 1 and Sl. No. 2 flyovers are under progress by MMRDA

Table 4-29: Proposed Locations for Elevated Roads for the horizon year 2024

Sl. No	List of Proposed Elevated Roads
1.	Elevated Road connecting BKC, EEH and Sewri-Chembur Link Road (Wadala Truck Terminal Road) and Lal Dongar Road, East of RCF
2.	From WEH in Santacruz to Kapadia Bazar in BKC
3.	From WEH in Santacruz to Barath Nagar in BKC
4.	Extension of JVLR South RoB on East side
5.	Extension of JVLR South RoB on West side
6.	From V N Purav Marg x EEH junction to Starting of Rafi Ahmed Kidwai Marg

Note: Project preparatory works for Sl. No. 1, Sl No. 2 and Sl. No. 3 elevated roads are under progress by MMRDA

Table 4-30: Proposed Locations for RoBs/ RuBs for the horizon year 2024

Sl. No.	Name
1.	RoB over western railway line, north of Milan flyover
2.	RoB over western railway line, north of Goregaon station
3.	RoB, south of Dadar station connecting Mc Jawale Marg and MMGS Marg
4.	RoB over central railway line, south of Vikroli station
5.	RoB over western railway line, north of Elphinstone station
6.	RuB under central railway line, north of Vasanth Dada patil Marg (Between Vikroli and Ghatkopar stations)
7.	RoB over western railway line, south of Mahalakshmi station (connecting Keshvrao Khyde Marg and Anandilal P Marg)
8.	RoB, north of Dadar station connecting Bal Gavond Das Marg and Lakshmi Nappu Road
9.	RoB over western railway line, north of Mahalakshmi station (connecting Dr E Moses Road and Sakpal Marg)
1.0	RuB under harbor line, south of Vidya Vihar station
11.	RuB under western railway line, south of Dahisar railway station
12.	RoB over harbor line, providing connectivity between Jerbhai Wadia Marg, Rafi Ahmed Kidwai Marg and internal roads of MbPT land
13.	RoB over central railway line connecting Ratanji Hirji Bhojraj Marg and R B Thakkar Marg, South of Mulund station
14.	RoB over harbor line, connecting Naigaon Road and L M Nadkarni Road
15.	RoB over central railway line, providing connectivity between LBS Marg and Swadeshi Mills Road
16.	RoB over western railway line, South of Khar Station
17.	RoB over harbor line, north of Guru Tehbhahadur nagar station
18.	RoB over western railway line, north of Andheri
19.	RoB over harbor line, providing connectivity between Mathar Pakhadi Road and internal road of MbPT lands
20.	RoB over western railway line, north of Bandra terminus

Bus fleet requirements, bus terminal-cum depots for intra-city bus operations for the horizon period upto 2024 have been worked out based on the travel demand analysis carried out for the horizon years 2019 and 2024.

The proposed traffic engineering measures are limited to the arterial road network. In the short term, up to 2024, there is a need to undertake transportation projects that address specific existing deficiencies in order to provide some relief to the current congestion levels and safety concerns. These have been characterized as “Traffic Engineering Measures”. Based on the review of numerous background studies, reports and recommendations supplemented with further data compiled in the study, an initial assessment of traffic engineering measures has been compiled and the associated costs have been included the cost estimates. For other Traffic Management Measures (TMM) such as traffic signs & markings, bus bays & shelters, infrastructure for traffic police, etc., which could not be quantified in numbers, lump sum estimates have been assumed. It is recommended that, traffic engineering measures should be implemented well before 2024. Summary of the proposed inter-city bus terminals, bus system (intra-city) and Traffic Engineering Measures is presented in Table 4-31.

Table 4-31: Intercity Bus Terminals, Truck Terminals and Traffic Management Measures for Horizon Year 2024

Description	Unit	Number
Inter-city Bus Terminals	No.	2
Truck Terminal	No.	2
Bus fleet	No.	800
Bus Terminal-cum Depot for Intra-city Bus operations	No.	8
Intersection Improvements	No.	80
Installation of Traffic Signals	No.	48
Installation of ATC Compatible Traffic Signals	No.	154
SATIS (Outside the Railway premises)	No.	21
ROBs/RUBs	No.	20
Flyovers (2 no.)/ Elevated Roads (3 No.) already planned	No.	5
Flyovers (New)	No.	16
Elevated Roads (New)	No.	3
FOBs/ Subways	No.	50
Cycle Tracks along the existing roads	Km	240
Road Safety measures		
Other TMM (Traffic signs, Markings, etc.)		
Infrastructure for Traffic Police		

Table 4-32: Broad Cost Estimate Details on Infrastructure for Mumbai Traffic Police for Horizon Year 2034

Sl. No.	Item	Quantity	Unit	Estimated Total Cost (Rs. Crore) H65	%
1	Patrolling Vehicles: Jeeps	250	No.	25	3.3%
2	Patrolling Vehicles: TW	750	No.	4.5	0.6%
3	Offices (Chowkies)	250	No.	10	1.3%
4	Traffic Wardens/ Guards	1365	No.	101	13.4%
5	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Small	595	No.	297.5	39.4%
6	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Big	295	No.	295	39.1%
7	Facilities in Traffic Police Training Centre	0			0.0%
8	Speed Guns	30	No.	0.06	0.0%
9	ATC Traffic Control Centres in suburbs	1	No.	3	0.4%
10	Training to Traffic Police		Lump sum	6	0.8%
11	Traffic Park	1	No.	2	0.3%
12	Enforcement Automation (Mobile phones, Wireless printer, interceptors, etc.)		Lump sum	10	1.3%
13	Mumbai Traffic Police website improvements and maintenance		Lump sum	0.5	0.1%
Total				**755**	**100%**

4.5.3 Broad Cost Estimates for the horizon year 2024

Broad cost estimates for the horizon year 2019 is presented in Table 4-33. The total cost of horizon transport network for the horizon period upto 2024 is INR 1,28,874 crores at 2014-15 prices. Approximate cost of transport network proposed under metro system, Roads/Highway system, Suburban System and Exclusive Bus

system are INR 55,580 Crores, INR 48,790 Crores, INR 11,016 Crores and INR 3,213 Crores respectively, with the individual share of total cost being 43.1%, 37.9%, 8.5% and 2.5% respectively. The share of traffic management measures and monorail are 5.7% and 1.5%.

Table 4-33: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2024 (in Crores)

Component	2016-2024	%
Roads/ Highway System	48,790	37.9%
Traffic Management Measures	7,332	5.7%
Bus System	552	0.4%
BRTS/ EBL	3,213	2.5%
Terminals	496	0.4%
Metro System	55,575	43.1%
Monorail	1,900	1.5%
Suburban System	11,016	8.5%
Total	**1,28,874**	**100.0%**

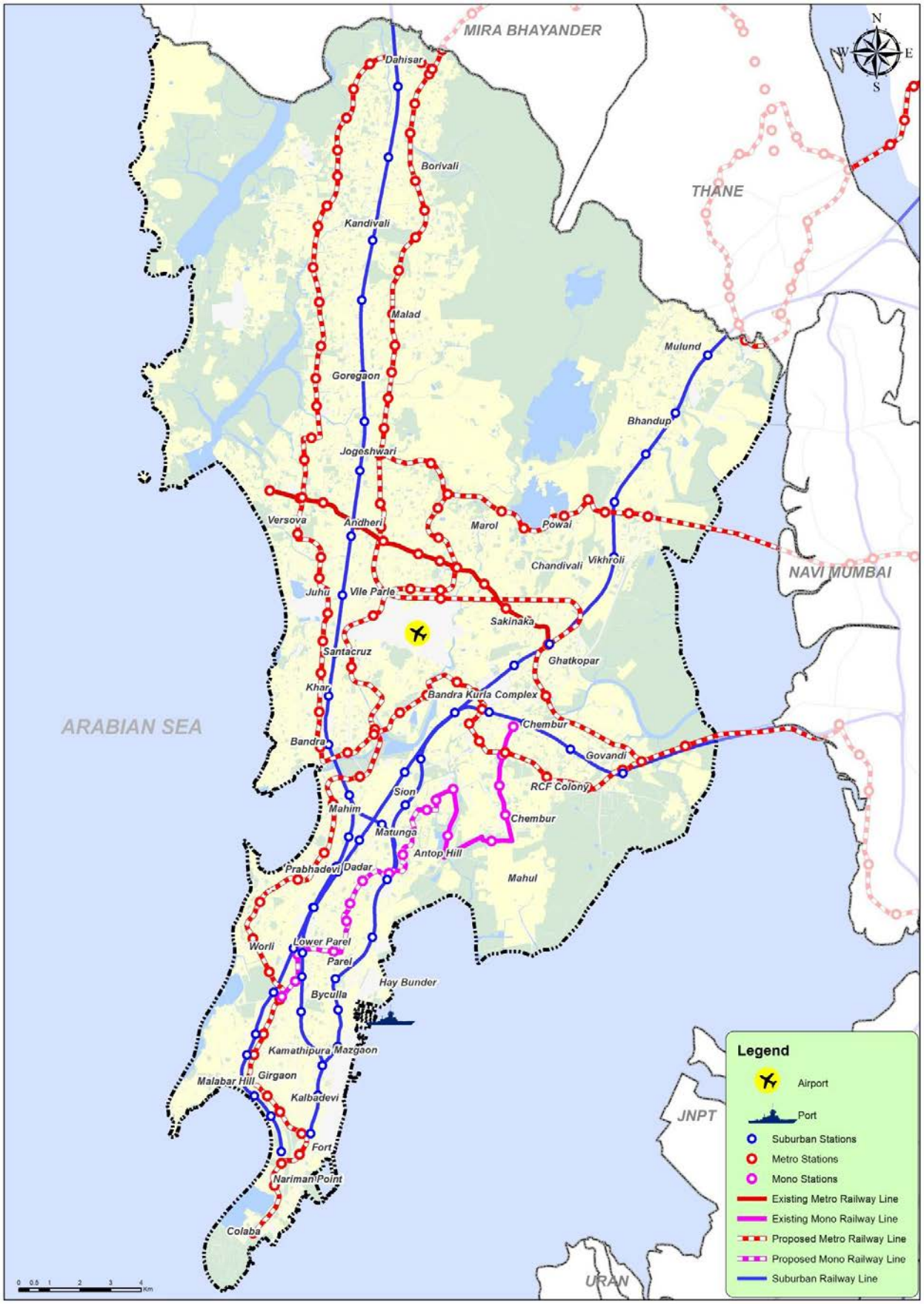


Figure 4-9: Recommended Transit Network for the Intermediate year 2024

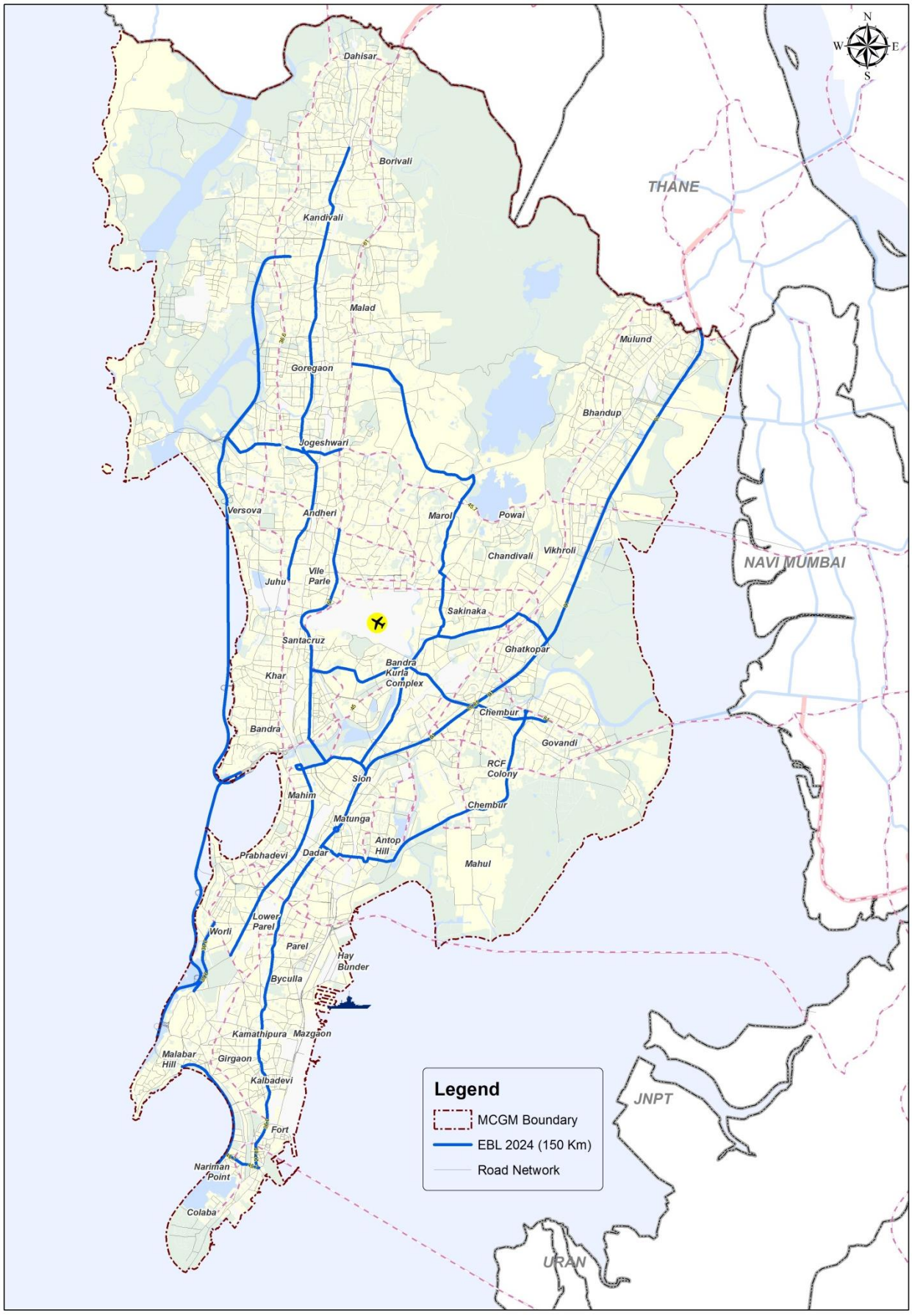


Figure 4-10: Recommended Exclusive Bus lane Corridors for 2024

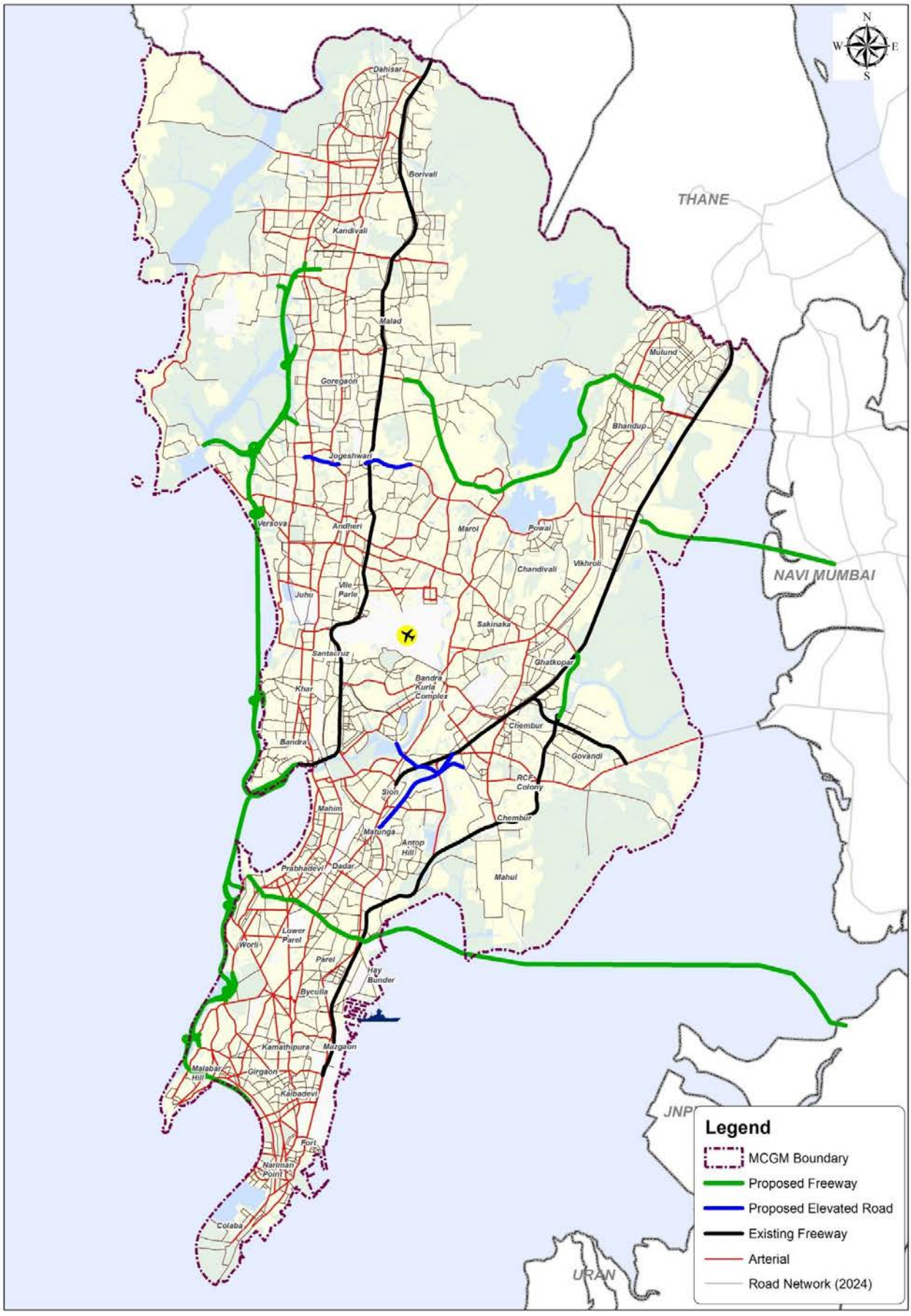


Figure 4-11: Recommended Highway Network for the Intermediate year 2024

4.6 Assessment of Transport Infrastructure for Greater Mumbai for the horizon year 2019 (Short Term)

4.6.1 Transit, EBL and Highway Plans

For intermediate year 2019, identified transit corridors are shown in Figure 4-12. Due to expected delay is implementation of metro corridors, the commencement of Dahisar- Mankhurd (line 2) and Colaba- Bandra-Kandjurmarg (line 3) will not be able to operate before 2019. Due to this only Wadala to Jacob Circle monorail corridor is considered as additional transit network beyond 2014 for the intermediate year 2019.

EBL corridors have been identified for the horizon year 2019 which is about 74 km length, which has been identified by the BEST and is in the process of implementation. The list of projects, identified for implementation within next 3 years, is identified as presented in Table 4-34 and shown Figure 4-13.

Table 4-34: Recommended Exclusive Bus lane Corridors for 2019

S.No	Line Description	Length (km)
1.	Eastern Express Highway (Sion – Mulund)	19.2
2.	Jogeshwari Vikroli Link Road (JVLR)	10.7
3.	Ghatkopar Mankhhurd Link Road (GMLR)	4.0
4.	Western Express Highway (Bandra – Dahisar)	25.9
5.	Bandra Kurla Complex Road	3.8
6.	Swami Vivekananda Road (Oshiwara Depot - Mith chowky)	5.0
7.	Lalalajpathrai Marg (Haji Ali - Worli Naka)	2.5
8.	Madam Cama Road_ Matralaya – CST	3.4
Total		**74.4**

For intermediate year 2019, recommended highway/ road network is shown in Figure 4-14. The proposed Road network consists of widening of existing roads to the extent of about 197 km and new/ missing links to the extent of about 47 km. The details are shown in Figure 4-7 and Figure 4-8 respectively.

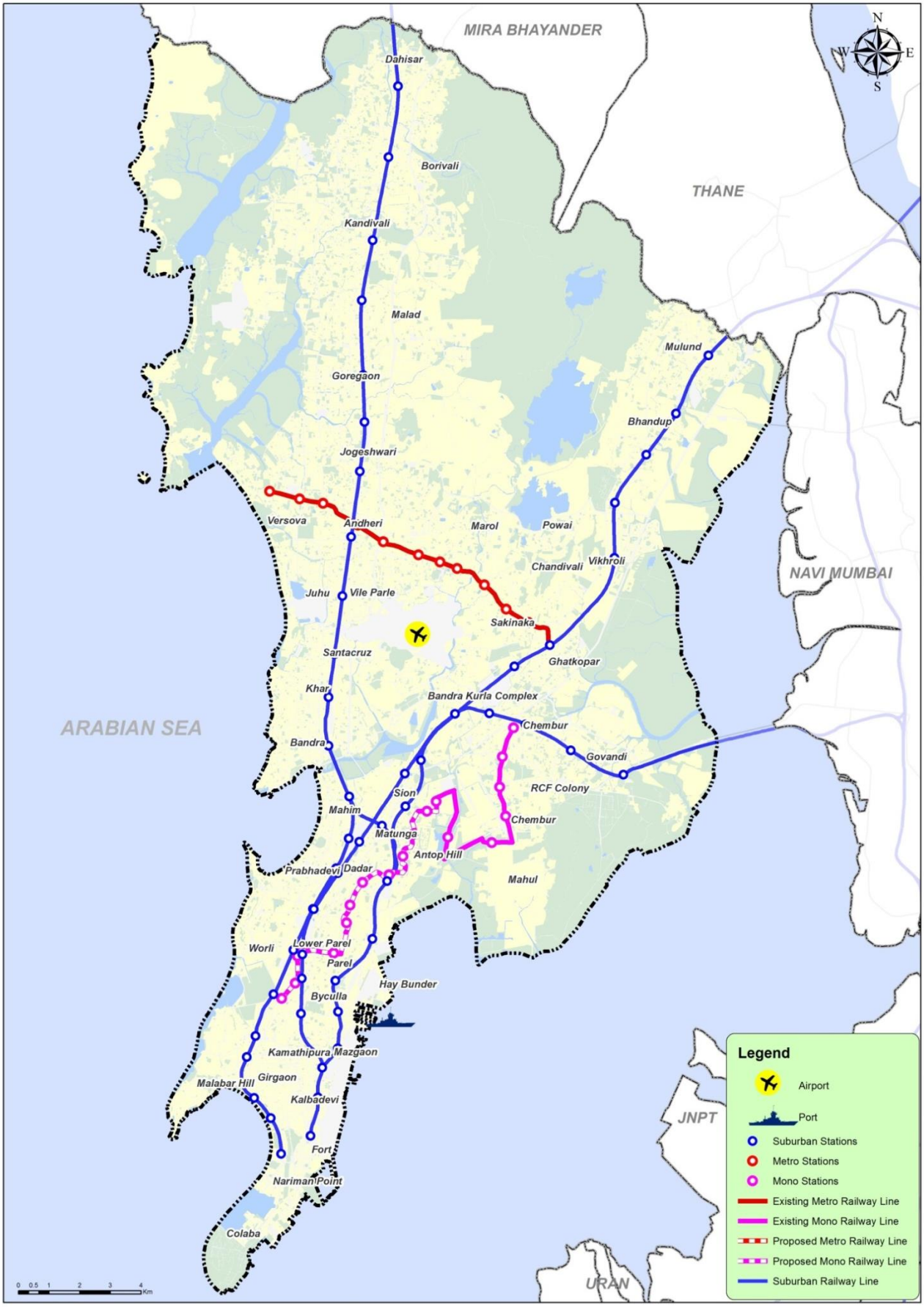


Figure 4-12: Recommended Transit Network for the Intermediate year 2019

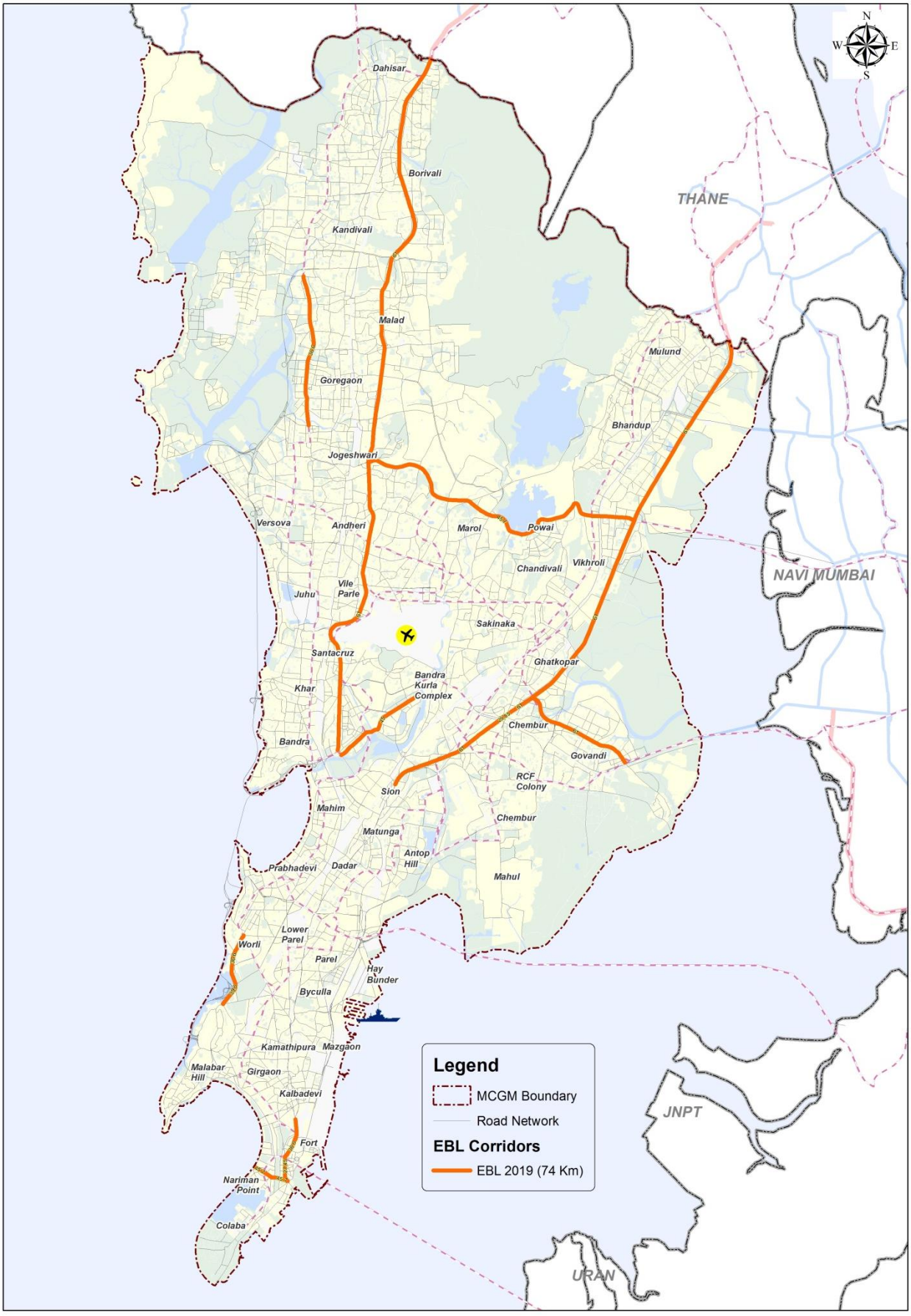


Figure 4-13: Recommended Exclusive Bus lane Corridors for 2019

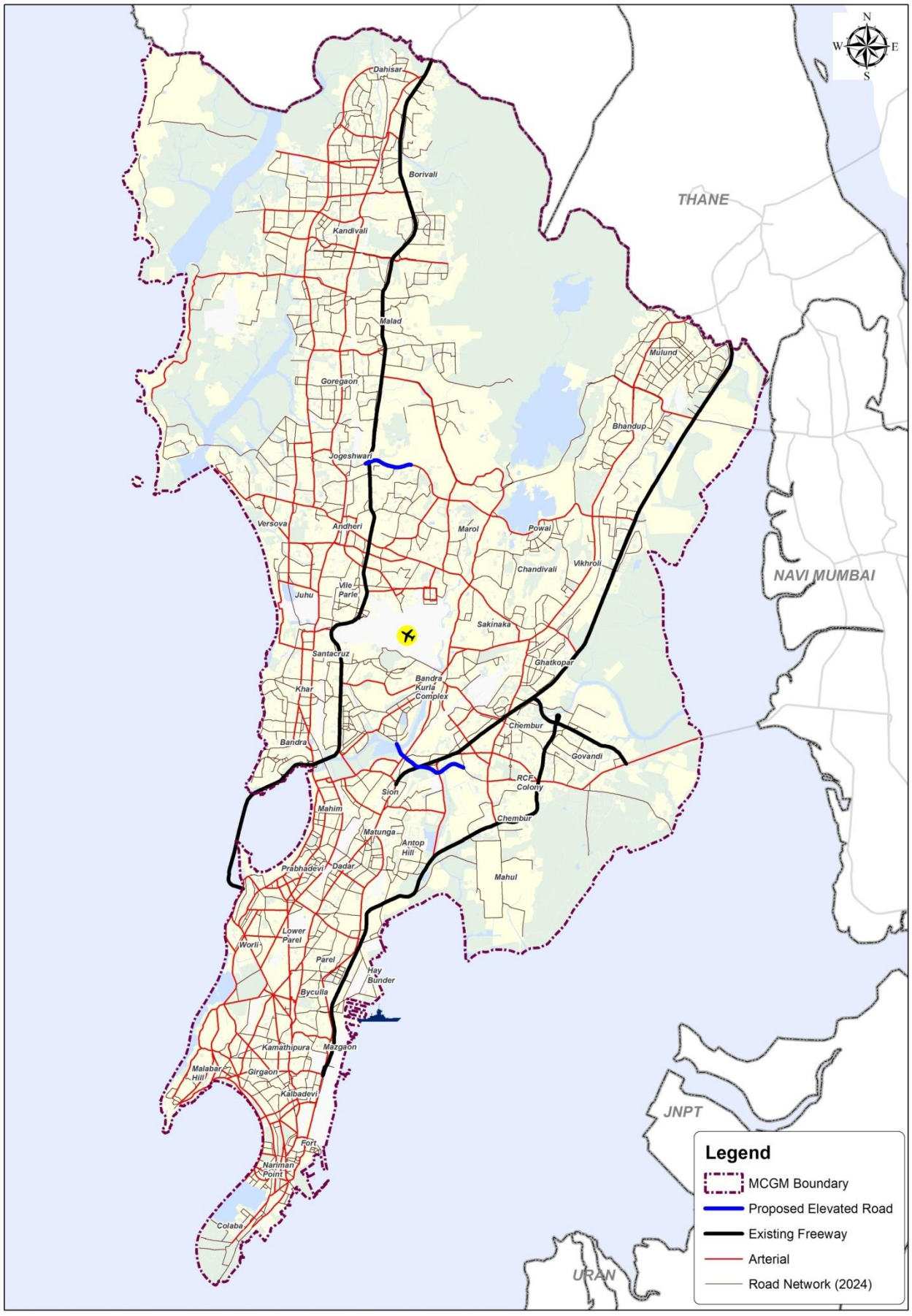


Figure 4-14: Recommended Highway Network for the Intermediate year 2019

4.6.2 Intercity Bus Terminals, Truck Terminals, Bus system and Traffic Management Measures for the Horizon Year 2019

Apart from Metro network and improvement/ development of road/ highways, the other transport infrastructure required is inter-city bus and truck terminals, bus system for intra-city operations and traffic management measures.

Inter-city bus terminals and truck terminals for the horizon period upto 2019 have been assessed based on the external travel demand forecasts. One Inter-city bus terminal and one truck terminal is proposed for the horizon year 2019. The possible locations for inter-city bus terminal and truck terminal are LBS, Mulund (Octroi Naka area) and EEH, Anand Nagar (Octroi Naka area) respectively. Proposed suburban stations for SATIS for the horizon year 2024 are presented in Table 4-35. Proposed locations for the flyovers, elevated roads and RoBs/ RuBs for the horizon year 2024 are presented in Table 4-36, Table 4-37 and Table 4-38 respectively.

Table 4-35: Proposed Suburban Stations for SATIS for the horizon year 2019

Sl. No	Name of Suburban Station
1	Mumbai Central
2	Lower Parel
3	Dadar
4	Bandra
5	Andheri
6	Borivali
7	Kurla
8	Chembur

Table 4-36: Proposed Locations for Flyovers for the horizon year 2019

Sl. No.	Name
1.	Kalanagar Junction (Junction of BKC Main Road x Sion Dharavi Link Road)
2.	Chhedanagar Junction ((Junction of EEH x Ghatkopar Mankhurd Link Road)
3.	Junction of Ghatkopar Mankhurd Link Road x Shivaji Nagar Junction
4.	Junction of S V Road x GMLR
5.	Connectivity between WEH and Senapati Bapat Marg
6.	Connectivity between Senapati Bapat Marg and WEH

Note: Project preparatory works for Sl. No. 1 and Sl. No. 2 flyovers are under progress by MMRDA

Table 4-37: Proposed Locations for Elevated Roads for the horizon year 2019

Sl. No	List of Proposed Elevated Roads
1.	Elevated Road connecting BKC, EEH and Sewri-Chembur Link Road (Wadala Truck Terminal Road) and Lal Dongar Road, East of RCF
2.	From WEH in Santacruz to Kapadia Bazar in BKC
3.	From WEH in Santacruz to Barath Nagar in BKC
4.	Extension of JVLR South RoB on East side

Note: Project preparatory works for Sl. No. 1, Sl No. 2 and Sl. No. 3 elevated roads are under progress by MMRDA

Table 4-38: Proposed Locations for RoBs/ RuBs for the horizon year 2019

Sl. No.	Name
1.	RoB over western railway line, north of Milan flyover
2.	RoB over western railway line, north of Goregaon station
3.	RoB, south of Dadar station connecting Mc Jawale Marg and MMGS Marg
4.	RoB over central railway line, south of Vikroli station

Sl. No.	Name
5.	RoB over western railway line, north of Elphinstone station
6.	RuB under central railway line, north of Vasanth Dada patil Marg (Between Vikroli and Ghatkopar stations)
7.	RoB over western railway line, south of Mahalakshmi station (connecting Keshvrao Khyde Marg and Anandilal P Marg)
8.	RoB, north of Dadar station connecting Bal Gavond Das Marg and Lakshmi Nappu Road
9.	RoB over western railway line, north of Mahalakshmi station (connecting Dr E Moses Road and Sakpal Marg)
10.	RuB under harbor line, south of Vidya Vihar station

Bus fleet requirements, bus terminal-cum depots for intra-city bus operations for the horizon period upto 2019 have been worked out based on the travel demand analysis carried out for the horizon years 2019.

The proposed traffic engineering measures are limited to the arterial road network. In the short term, up to 2019, there is a need to undertake transportation projects that address specific existing deficiencies in order to provide some relief to the current congestion levels and safety concerns. These have been characterized as "Traffic Engineering Measures". Based on the review of numerous background studies, reports and recommendations supplemented with further data compiled in the study, an initial assessment of traffic engineering measures has been compiled and the associated costs have been included the cost estimates. For other Traffic Management Measures (TMM) such as traffic signs & markings, bus bays & shelters, infrastructure for traffic police, etc., which could not be quantified in numbers, lump sum estimates have been assumed. It is recommended that, traffic engineering measures should be implemented well before 2019. Summary of the proposed inter-city bus terminals, bus system (intra-city) and Traffic Engineering Measures is presented in Table 4-39.

Table 4-39: Intercity Bus Terminals, Truck Terminals and Traffic Management Measures for Horizon Year 2019

Description	Unit	Number
Inter-city Bus Terminals	No.	1
Truck Terminal	No.	1
Bus fleet	No.	300
Bus Terminal-cum Depot for Intra-city Bus operations	No.	3
Intersection Improvements	No.	30
Installation of Traffic Signals	No.	48
Installation of ATC Compatible Traffic Signals	No.	47
SATIS (Outside the Railway premises)	No.	8
ROBs/RUBs	No.	10
Flyovers (2 no.)/ Elevated Roads (3 No.) already planned	No.	5
Flyovers (New)	No.	4
Elevated Roads (New)	No.	2
FOBs/ Subways	No.	25
Cycle Tracks along the existing roads	km	90
Road Safety measures	Lumpsum	
Other TMM (Traffic signs, Markings, etc.)	Lumpsum	
Infrastructure for Traffic Police	Ref. Table 4-42	

Table 4-40: Broad Cost Estimate Details on Infrastructure for Mumbai Traffic Police

Sl. No.	Item	2016-19				2020-24				2025-34				By 2019	By 2024	By 2034	By 2019	By 2024	By 2034
		Quantity	Unit	Unit Cost in Rs. Crores	Estimated Total Cost (Rs. Crore) H65	Quantity	Unit	Unit Cost in Rs. Crores	Estimated Total Cost (Rs. Crore) H65	Quantity	Unit	Unit Cost in Rs. Crores	Estimated Total Cost (Rs. Crore) H65						
1	Patrolling Vehicles: Jeeps	50	No.	0.1	5	200	No.	0.1	20	400	No.	0.1	40	5	25	65	1.7%	3.3%	3.6%
2	Patrolling Vehicles: TW	250	No.	0.006	1.5	500	No.	0.006	3	1500	No.	0.006	9	1.5	4.5	13.5	0.5%	0.6%	0.7%
3	Offices (Chowkies)	100	No.	0.04	4	150	No.	0.04	6	300	No.	0.04	12	4	10	22	1.3%	1.3%	1.2%
4	Traffic Wardens/ Guards	600	No.	0.054	32	765	No.	0.09	69	1130	No.	0.18	203.4	32	101	305	10.8%	13.4%	16.9%
5	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Small	240	No.	0.5	120	355	No.	0.5	177.5	765	No.	0.5	382.5	120	297.5	680	40.0%	39.4%	37.8%
6	Towing Vehicles for enforcement of on-street parking surrounding the PPLs: Big	120	No.	1.0	120	175	No.	1	175	380	No.	1	380	120	295	675	40.0%	39.1%	37.5%
7	Facilities in Traffic Police Training Centre													5			1.7%	0.0%	0.0%
8	Speed Guns	10	No.	0.002	0.02	20	No.	0.002	0.04	40	No.	0.002	0.08	0.02	0.06	0.14	0.0%	0.0%	0.0%
9	ATC Traffic Control Centres in suburbs					1	No.	3	3	1	No.	3	3	0	3	6	0.0%	0.4%	0.3%
10	Training to Traffic Police													4	6	10	1.3%	0.8%	0.6%
11	Traffic Park	1	No.	2	2									2	2	2	0.7%	0.3%	0.1%
12	Enforcement Automation (Mobile phones, Wireless printer, intercepters, etc.)													6	10	20	2.0%	1.3%	1.1%
13	Mumbai Traffic Police website improvements and maintenance													0.25	0.5	2	0.1%	0.1%	0.1%
														300	755	1800	100%	100%	100%

4.6.3 Broad Cost Estimates for the horizon year 2019

Broad cost estimates for the horizon year 2019 is presented in Table 4-41. The total cost of horizon transport network for the horizon period upto 2019 is INR 38,528 crores at 2014-15 prices. Approximate cost of transport network proposed under Roads/Highway system, metro, Exclusive Bus system and Suburban System is INR 4,851 Crores, INR 25,000 crores, INR 1,562 Crores and INR 938 Crores respectively, with the individual share of total cost being 12.6%, 64.9%, 4.1% and 2.4% respectively. The share of traffic management measures and monorail are 9.9% and 4.9%. It is pertinent to mention here that, for implementation of Colaba-Bandra-SEEPZ metro corridor, JICA is providing funding and monorail Phase II i.e. Wadala to Jacob Circle is in advanced stage of completion.

Table 4-41: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2019 (in Crores)

Component	2016-2019	%
Roads/ Highway System	4,851	12.6%
Traffic Management Measures	3,821	9.9%
Bus System	207	0.5%
BRTS/ EBL	1,562	4.1%
Terminals	248	0.6%
Metro	25,000	64.9%
Monorail	1,900	4.9%
Suburban System	938	2.4%
Total	**38,528**	**100.0%**

4.7 Proposed Short & Medium Transportation Strategies and Policies

Based on secondary and primary data, travel demand and transport network analysis has been carried out and the assed traffic and transportation infrastructure for the horizon year 2034 and for medium and short term, the details are presented in above sections. The focus of medium & short term transportation strategy is mainly on the following:

a) Enhancing the capacity of the public transport system by enhancing public transport systems (Suburban, Metro, bus system extensions/ expansions and development of EBL/ BRTS);
b) Strengthening and widening of existing roads and development of missing links;
c) Traffic management measures;
d) To provide appropriate budgets to address the growing needs for traffic and right-of-way management through traffic engineering and enforcement measures.

The proposed development of new transport corridors and terminals and traffic management measures under medium and short term transportation strategy are addressed through the following measures:

Development of Transport Corridors and Terminals

a) Capacity enhancement and development of additional suburban rail corridors, metro expansion, bus system expansion, development of EBL/ BRTS in accordance with recommended 2024 and 2019 plans;
b) Strengthening of roads and removal of right-of-way encroachments to fully utilize the traffic carrying capacity of regionally significant roads and provide safe and unrestricted public footpaths;
c) Strengthening and widening of roads to meet traffic requirements;
d) Improve overall network continuity by removing bottlenecks or constructing a missing links in the system;
e) NMT facility improvement plans; and
f) Providing new bus and truck terminals for intercity transport.

Traffic Management Measures

a) Intersection improvements and traffic signal installations;
b) ATC expansion for effective use of traffic signals;
c) Grade separation of major intersections where at-grade improvements would be inadequate;
d) At-grade and grade separated pedestrian facilities particularly in the vicinity of rail/metro stations and transport terminals;
e) Provision of protected raised footpath facilities on either side existing major road corridors and implementation of proposed NMT policy;
f) Full grade separated railway crossings for vehicular traffic (ROBs/ RUBs);
g) Grade separated crossings for pedestrian traffic (FOBs/ Subways) to minimize pedestrian trespassing across rail corridors or at high intensity pedestrian corridors and major roads;
h) Demand management measures (parking controls) to secure maximum social value from network use;
i) Parking policy for Greater Mumbai; and
j) Improving the enforcement efficiency and incident management capability.

Station Area Traffic Improvement Schemes/ Measures

a) Improving the access to the Suburban railway stations;
b) Enhancing the parking facilities;
c) Providing pedestrian walkways; and
d) Improving the pedestrian circulation and free-flow within and around the station area by providing additional FOBs.

Summary of traffic & transportation issues, proposed and policies are presented in Table 4-42.

Table 4-42: Traffic and Transportation Issues, proposed strategies and traffic & transportation measures

Issues	Strategies	Proposed traffic & transportation measures
Congested intersections and Uncontrolled intersections	• Increasing the capacity of intersections	a) Intersection improvements b) Installation of traffic signals c) Installation of ATC compatible signals d) Grade separation facilities (Flyovers/ elevated roads)
Pedestrian footpaths and crossing, absence of cycle tracks and facilities	• NMT First Policy (Ref. Annexure 9-2)	a) Footpath improvements b) Development of adequate footpath facilities c) Mid-block at-grade pedestrian crossings (uncontrolled/ controlled) d) FOBs/ Subways/ Skywalks e) Provision of parking facilities for cycles f) Development of safe cycle tracks in select areas and promotion of “Cycle hire schemes”
On-street parking	• Parking policy (Ref. Annexure 9-3)	a) Development of off-street parking facilities (PPLs) b) Implementation of parking policy
Congested station areas	• Station Area Traffic Improvement Scheme (SATIS) (Ref. Annexure 9-4 on preliminary conceptual proposals)	a) Enhancing commuter movement facilities within the station areas b) Grade separated pedestrian facilities c) Removal of encroachments d) Development of footpath facilities e) Restriction of hawking activity in the station areas f) Provision of parking facilities for cycles g) Provision of Bus bays near the landing points of FOBs/Skywalks
Congested roads	• Capacity enhancements	a) Strengthening and widening of roads h) Development of missing links/ new links i) Congestion pricing
Growing private vehicle use (Two wheeler and car)	• Traffic/ travel demand management measures	a) Regulate parking with higher parking charges b) Even/ Odd plan/ rule for four wheeler passenger vehicles c) Congestion pricing d) Impose restriction on new private vehicle (Two wheeler and car) registrations
Limited railway crossings	• Enhancing East-West connectivity	a) RoBs/ RUBs
Decreasing	• Promotion of public transport	a) Development of Exclusive Bus Lanes (EBL)/ Bus Rapid Transit System (BRTS) b) Provision of Fare Integration with other public transport modes

ridership on bus system		c) Bus route information at all major bus stops, suburban and metro stations
Overcrowding on suburban system	• Promotion of public transport	a) Operation of 12/ 15 coach rakes b) Operation of 12 coach rakes on Harbour line c) Increasing frequency d) Doubling/ Quadrupling of railway lines e) Extension of harbor line from Goregaon to Borivali f) Development of premium corridors (Andheri and Virar, Kurla- Thane-Bhiwandi, CST Panvel Fast corridor)
Decreasing public transport share	• Promotion of public transport	a) Suburban system capacity enhancements b) Development of metro corridors c) Development of EBL/ BRTS d) Feeder services to Mass transit corridors
Environmental pollution	•	a) Promote car pooling b) Regulate parking with higher parking charges c) Even/ Odd plan/ rule for four wheeler passenger vehicles d) Congestion pricing e) Impose restriction on new private vehicle (Two wheeler and car) registrations f) Vehicle technologies with emission norms advancement
Road accidents	• Road safety initiatives	a) Mass media campaigns with a focus on attitude towards driving b) Schools to give kids Road Safety lessons c) Increasing police enforcement of laws to reduce drinking and driving d) Increasing police enforcement of laws to use of seat- belts e) Non usage of Mobiles by pedestrians while crossing at-grade f) ITS application in enforcement of traffic laws g) Comfortable Side Walks and Grade separated crossing facilities h) Traffic Calming Measures: Speed Table/ Raised crossings i) Safe Bicycle Tracks – School/ College areas
Independent fares – Suburban train, Bus, Metro, Monorail	• Integrated fare policy	

5. ECONOMIC ANALYSIS

Selection of appropriate Long Term Transportation Strategy and firming up Short and Medium Term Investment Plans are important and integral part of the present study. Towards this, undertaking the economic analysis of the shortlisted alternative proposals and/or scenario as modelled in and considered in the study are important to arrive at rational decision from society's perspective. The Do Minimum scenario (considers committed projects) is compared with Shortlisted Network (N1VA50).

The approach for economic analysis is shown in Figure 5-1. The project benefits are assessed by comparing the 'do minimum' and 'with project' scenario. The benefits which have been assessed are as follows:

a) The savings in vehicle operating cost and maintenance cost due to better and more efficient transport network in place, which also facilitates modal shift; and
b) Saving in travel time due to reduced congestion and better speeds.

These benefits are assessed for three time periods – 2019, 2024 and 2034. While undertaking the economic analysis, which follows a discounted cash-flow method, the in between benefits have been interpolated.

Once the benefits are estimated, the capital investment along with the annual investment made towards routine and periodic maintenance is compared to arrive at the following indicators:

a) Economic Internal Rate of Return (EIRR)
b) Net Present Value (NPV)

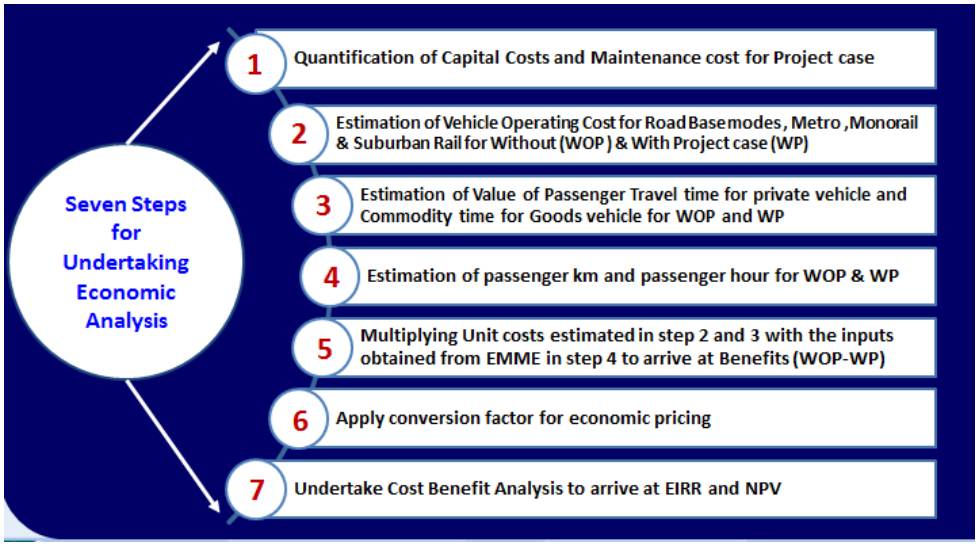


Figure 5-1: Approach to Economic Analysis

5.1 Assessment of Costs

The cost of improvement/new construction for road based and rail based projects – both capital cost as well as maintenance cost for three plan time periods viz 2019, 2024 and 2034 have been assessed and considered for analysis. They are:

a) Roads/ Highway System;
b) Traffic Management Measures;
c) Bus system (Bus fleet, bus depots & workshops and terminals for intra-city);
d) BRTS/EBL;
e) Monorail system;
f) Metro System;
g) Suburban System; and

h) Terminals (Inter-city bus and truck terminals)

5.1.1 Project Cost

The cost of the proposed traffic and Transportation infrastructure for the long term i.e. horizon year 2034 and medium and short term i.e. for the horizon year 2024 and 2019 respectively are presented in the previous chapters. A summary of the cost is presented in Table 5-1. A factor of 0.9 has been used for converting the financial cost to economic cost.

Table 5-1: Construction Cost of Project (INR millions @ 2015 prices) for the horizon years 2019, 2024 and 2034

Sl No.	Period	Financial Cost	Cumulative Financial Cost	Cumulative Economic Cost
1.	2016-2019[1]	366,275	366,275	329,648
2.	2020-2024[2]	903,460	1,269,735	1,142,762
3.	2025-2034[3]	387,097	1,656,832	1,491,149

5.1.2 Operation and Maintenance Cost

The maintenance cost of the road and rail based infrastructure, both routine and periodic, has been considered. Routine Maintenance: 0.2% of the construction cost per year and Periodic Maintenance: 1.25% of the construction cost every seventh year.

5.2 Assessment of Tangible Benefits

5.2.1 Estimation of Project Cost: Vehicle Operating Cost and Value of Time Cost

A. Estimation of VOC

Road based Modes (Two wheeler, Car, Auto, Taxi and Bus)

The quantification of VOC is done in the following way:

***Vehicle operating Cost for Road Based Modes** (Rs) = unit VOC (by speed, VDF type and mode) (in Rs /veh km) × vehicle km (obtained from EMME) (by speed, VDF type and mode).*

The unit costs of VOCs have been taken from CTS MMR Study undertaken in the year 2009-10. The same has been updated to 2015 prices.

Sub urban Rail based System

The estimation of operating cost for Rail based modes has been estimated in the following way:

***Operating Cost for Rail Based Modes - Monorail, Metro and Sub urban Rail** (Rs) = unit Operation cost (in Rs*

[1] The project implementation period is 4 years, and the proposed traffic and transportation infrastructure is progressively available by 2019.

[2] The project implementation period is 5 years, and the proposed traffic and transportation infrastructure is progressively available by 2024.

[3] The project implementation period is 10 years, and the proposed traffic and transportation infrastructure is progressively available by 2034.

/passenger km) × passenger km (obtained from EMME)

The unit cost of operation and maintenance of the suburban rail has been estimated as INR. 0.10 per passenger-km at economic prices in the CTS MMR study (2009-10). The same has been updated to 2015 prices and thereby forming an input to our analysis. A value of INR 0.176 per passenger-km has thus been adopted.

Metro and Monorail system

From the CTS MMR study (2009-10), a financial value of INR 1.12 per passenger km has been assumed, which is equivalent to INR 1.00 in economic terms. For our study a value of INR 1.76 per passenger-km @ 2015 prices has been adopted.

B. Estimation of VOT

The following VOT values are used in assessment of benefits due to savings in travel time.

Table 5-2: Adopted VOT values (INR /passenger hour @ 2015 prices)

Year	CAR	TWO	AUTO	TAXI	BUS	Suburban	Metro
2019	125	83	35	40	44	67	63
2024	121	81	35	39	44	67	65
2034	116	81	33	37	44	65	65

The value of travel time for all modes has been estimated in the following way:

Value of Travel Time for all modes *(Rs) = unit VOT (in Rs /passenger hour) × passenger hour (obtained from EMME).*

5.3 Results of Economic Analysis – Base Case

The economic evaluation is undertaken for a period of 20 and 30 years respectively. The output of the analysis is in the form of Economic Internal Rate of Return (EIRR) and Net Present Value (NPV) at 12% rate of discount. The results of the analysis are presented in Table 5-3.

Table 5-3: Results of Economic Analysis – Base Case

EIRR (%)		NPV (Rs million)	
20 yrs	**30 yrs**	**20 yrs**	**30 yrs**
17.81%	19.53%	262,886	469,513

5.4 Results of Economic Analysis – Sensitivity Analysis

Any investment is subject to risks and uncertainties. All risks culminate into either increase in project cost, reduction in benefits or both put together. In order to cover the above stated risks, a detailed sensitivity analysis, with respect to the sensitive parameters, has been undertaken. The various sensitivity scenarios considered are as follows:

a) Sensitivity 1: Increase in base cost by 20% ;

b) Sensitivity 2: Reduction in base benefits by 20%; and

c) Sensitivity 3: Increase in Base Costs by 20% and Reduction in Base Benefits by 20%.

The results of the sensitivity analysis have been presented in Table 5-4.

Table 5-4: Results of Economic Analysis – Sensitivity Case

Sensitivity case	EIRR (%)		NPV (Rs millions)	
	20 yrs	30 yrs	20 yrs	30 yrs
Sensitivity 1	14.43%	16.65%	122,407	328,608
Sensitivity 2	15.75%	17.75%	161,776	345,356
Sensitivity 3	12.44%	15.00%	21,296	204,451

The results indicate that the selected network is viable in the scenario of 20% increase in project cost coupled with 20% reduction in network benefit for the case of 20 years analysis period as well as 30 years analysis period.

However, it needs to be emphasized here that the benefits considered in the above analysis are all direct benefits. The other benefits which have not been monetised are:

a) Increase in Land Value; and

b) The aspect of safety ("Accident benefits").

However, it has been considered appropriate to highlight some of the indirect benefits, as given below:

a) Comfort due to reduced road stress;

b) Better accessibility to facilities in the influence area;

c) Increased business opportunities;

d) Overall increased mobility;

e) Facilitating better planning and up-gradation of influence area; and

f) Improving the image of the city.

5.5 Conclusion

The proposed transport network plans for the horizon years 2019, 2024 and 2034 *are* ***desirable from the society's point of view.*** The networks as a whole are found to be economically viable with positive net present values and EIRR greater than 12%. Hence, based on the above results, the project is recommended for immediate implementation.

6. COST ESTIMATES AND PLAN FINANCING OPTIONS

6.1 Cost Estimates

Broad cost estimates for the proposed traffic & transportation infrastructure for Greater Mumbai under short (20016-19), medium (2020-24) and long term (2025-34) is presented in Table 6-1. It can be inferred that, the share of overall investment required under short, medium and long term is 23.0%, 53.9% and 23.1% respectively. It is pertinent to mention hare that organisation like MCGM, MMRDA, MRVC, etc. are actively planning/ executing major transportation projects which may not be available for public by 2019 and they are expected to be available during 2019-24. Planning and project preparatory works for most of the planned metro corridors are actively in progress by MMRDA and their timely implementation is very much crucial. Hence, huge investments would be required under medium term.

Table 6-1: Summary of Broad Cost Estimates: Proposed Traffic & Transport Infrastructure under Short, Medium and Long Term

Period	Rs. Crores @ 2014-15 prices	%	Cumulative Cost Rs. Crores	Cumulative %
Short Term Proposals (2016-2019)	38,528	23.0%	38,528	23.0%
Medium Term Proposals (2020-2024)	90,346	53.9%	128,874	76.9%
Long Term Proposals (2025-2034)	38,710	23.1%	1,67,583	100.0%
Total	**1,67,583**	**100.0%**		

Summary of Broad Cost Estimates: Proposed Traffic & Transport Infrastructure for the period upto 2034 is presented in Table 6-3 and shown in Figure 6-1. It can be inferred that, major investments would be required for development of public transport systems i.e. metro system (43.08%), suburban system (10.40%), Bus system & BRTS/ EBLs (3.96%), Monorail (1.13%) which is 58.6% and the share of road system development, traffic management measures and terminals is 41.4%.

Table 6-2: Summary of Broad Cost Estimates: Proposed Traffic & Transport Infrastructure for the period upto 2034

Components	Amount (Rs. Crores)	Share (%)
Intersection improvements	400	0.24%
Installation of Traffic Signals	7	0.00%
Installation of ATC Compatible Traffic Signals	62	0.04%
SATIS (Outside the Railway premises)	1,750	1.04%
ROBs/RUBs	1,850	1.10%
Flyovers/ Elevated Roads (already planned)	1,371	0.82%
Flyovers (New)	784	0.47%
Elevated Roads (New)	840	0.50%
FOBs/ Subways	1,400	0.84%
Cycle Tracks (length in Kms)	178	0.11%
Road Safety measures	900	0.54%
Other TMM (Traffic signs, Markings, etc.)	450	0.27%
Infrastructure for Traffic Police	1,800	1.07%
Strengthening & Widening of existing roads and Missing Links	56,793	33.89%
Bus System	1,241	0.74%
BRTS/ EBL	5,397	3.22%
Terminals	826	0.49%
Metro System	72,200	43.08%
Monorail	1,900	1.13%
Suburban System	17,434	10.40%
Total	**1,67,583**	**100.0%**

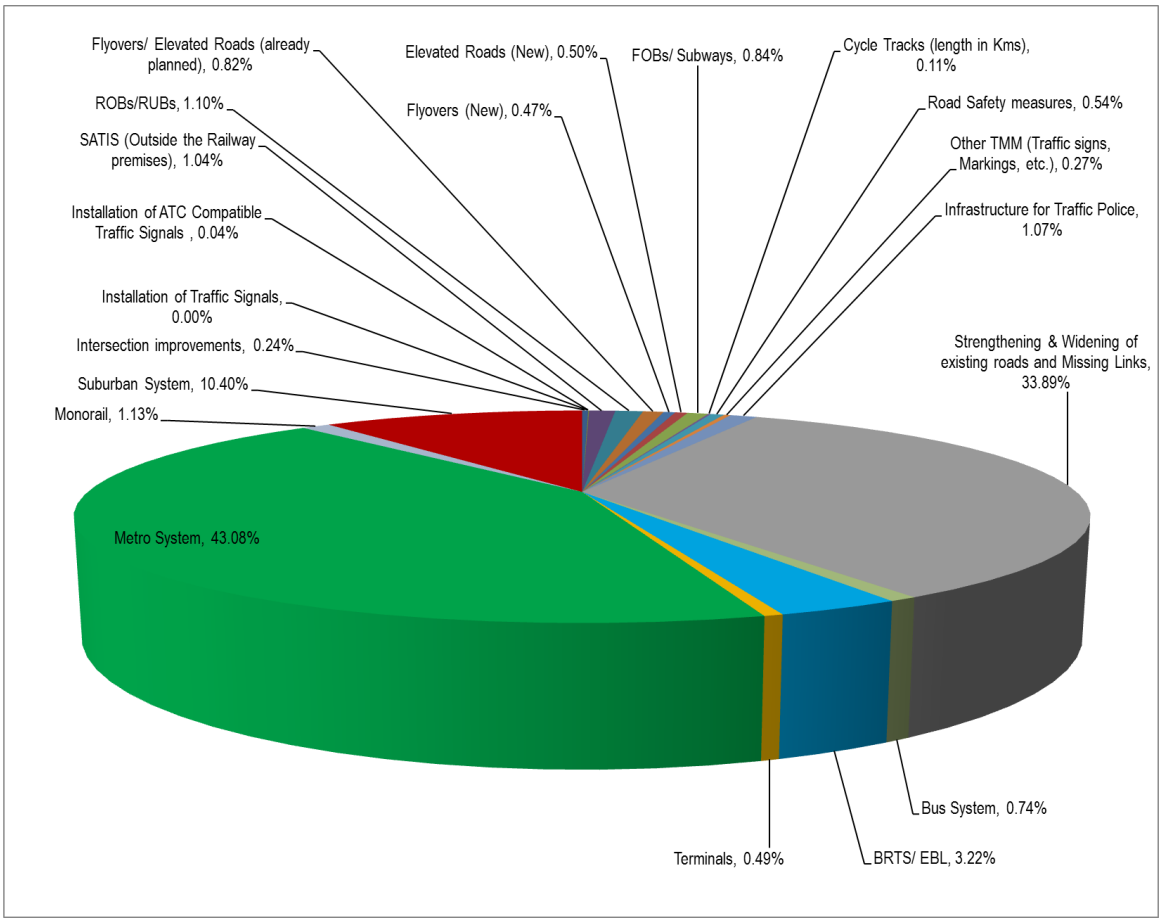


Figure 6-1: Component wise share of proposed Traffic & Transport Infrastructure for the period upto 2034

Detailed traffic & transport infrastructure investment needs of Greater Mumbai under Short, Medium and Long Term is presented in Table 6-3. As explained above, various planning and execution authorities of MMR and in specific MCGM needs to continue the project preparatory works, focus more on realisation of existing sources of revenue, etc. for timely delivery of traffic & transport infrastructure. Greater Mumbai has very limited alternative routes for road based traffic modes and construction of metro corridors would require traffic diversion during their construction. Hence, road widening and development of missing links, grade separation facilities would be equally important.

Table 6-3: Traffic & Transport Infrastructure Investment Needs of Greater Mumbai under Short, Medium and Long Term

Phase	Components	Quantity	Details	Unit	Unit Cost in Rs. Crores	Estimated Total Cost (Rs. Crore) H65	Phase Wise Cost (Rs. Crores) @ 2014-15 prices	%	Proposed Organisation/ Organisations for Planning and Implementation
Short Term Proposals (2016-2019)	Intersection improvements	30.00		No.	2.00	60.00	38,528	23.0%	MCGM
	Installation of Traffic Signals	48.00		No.	0.15	7.20			MCGM
	Installation of ATC Compatible Traffic Signals	47.00		No.	0.25	11.75			MCGM
	SATIS (Outside the Railway premises)	8.00		No.	50.00	400.00			MCGM
	ROBs/RUBs	10.00		No.	66.08	660.80			IR/ MRVC/ GoM
	Flyovers/ Elevated Roads (already planned)	5.00		No.	0.00	1371.00			MCGM/ MMRDA
	Flyovers (New)	4.00		No.	49.00	196.00			MCGM/ MMRDA
	Elevated Roads (New)	1.00		No.	210.00	210.00			MCGM/ MMRDA
	FOBs/ Subways	25.00		No.	14.00	350.00			MCGM
	Cycle Tracks (length in Kms)	90.00		Kms	0.33	29.74			MCGM
	Road Safety measures				Lumpsum	150.00			MCGM
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	75.00			MCGM
	Infrastructure for Traffic Police				Lumpsum	300.00			Traffic Police/ MCGM
	Strengthening & Widening of existing roads and Missing Links					4850.73			MCGM
	Bus System					206.87			BEST
	BRTS/ EBL					1562.40			BEST/ MCGM
	Terminals					247.80			MCGM
	Metro System					25000.00			MMRDA
	Monorail					1900.00			MMRDA
	Suburban System					938.25			MRVC
Medium Term Proposals (2020-2024)	Intersection improvements	50.00		No.	2.00	100.00	90,346	53.9%	MCGM
	Installation of Traffic Signals	0.00		No.	0.15	0.00			MCGM
	Installation of ATC Compatible Traffic Signals	107.00		No.	0.25	26.75			MCGM
	SATIS (Outside the Railway premises)	13.00		No.	50.00	650.00			MCGM
	ROBs/RUBs	10.00		No.	66.08	660.80			IR/ MRVC/ GoM
	Flyovers/ Elevated Roads (already planned)	0.00		No.	0.00	0.00			MCGM/ MMRDA
	Flyovers (New)	12.00		No.	49.00	588.00			MCGM/ MMRDA
	Elevated Roads (New)	2.00		No.	105.00	210.00			MCGM/ MMRDA
	FOBs/ Subways	25.00		No.	14.00	350.00			MCGM
	Cycle Tracks (length in Kms)	150.00		Kms	0.33	49.56			MCGM
	Road Safety measures				Lumpsum	250.00			MCGM
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	125.00			MCGM
	Infrastructure for Traffic Police				Lumpsum	500.00			Traffic Police/ MCGM
	Strengthening & Widening of existing roads and Missing Links					43939.67			MCGM
	Bus System					344.78			BEST
	BRTS/ EBL					1650.60			BEST/ MCGM
	Terminals					247.80			MCGM
	Metro System					30575			MMRDA
	Monorail					0.00			MMRDA
	Suburban System					10078.04			MRVC
Long Term Proposals (2025-2034)	Intersection improvements	120.00		No.	2.00	240.00	38,710	23.1%	MCGM
	Installation of Traffic Signals	0.00		Kms	0.15	0.00			MCGM
	Installation of ATC Compatible Traffic Signals	93.00		Kms	0.25	23.25			MCGM
	SATIS (Outside the Railway premises)	14.00		Kms	50.00	700.00			MCGM
	ROBs/RUBs	8.00		No.	66.08	528.64			IR/ MRVC/ GoM
	Flyovers/ Elevated Roads (already planned)	0.00		Kms	0.00	0.00			MCGM/ MMRDA
	Flyovers (New)	0.00		Kms	49.00	0.00			MCGM/ MMRDA
	Elevated Roads (New)	2.00		No.	210.00	420.00			MCGM/ MMRDA
	FOBs/ Subways	50.00		No.	14.00	700.00			MCGM
	Cycle Tracks (length in Kms)	300.00		Kms	0.33	99.12			MCGM
	Road Safety measures				Lumpsum	500.00			MCGM
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	250.00			MCGM
	Infrastructure for Traffic Police				Lumpsum	1000.00			Traffic Police/ MCGM
	Strengthening & Widening of existing roads and Missing Links					8002.19			MCGM
	Bus System					689.56			BEST
	BRTS/ EBL					2184.00			BEST/ MCGM
	Terminals					330.40			MCGM
	Metro System					16625.00			MMRDA
	Monorail					0.00			MMRDA
	Suburban System					6417.50			IR/ MRVC/ GoM
Total						167,583	167,583	100%	

6.2 Funding Sources/Options

Based on the recommendations of Working Group on Urban Transport for 12th Five Year Plan and experience gained on working in urban infrastructure of major Indian cities, the sources of funding have been assessed and the details are presented in Table 6-4 and shown in Figure 6-2 for Traffic & Transport infrastructure. It is observed that for urban transport infrastructure related projects envisaged by 2034, about 18.7% of the funding will be from the central government, and about 0.2% through private investment in the form of public private partnerships (PPP). The balance i.e. about 81.1%, will have to be raised by the MCGM/ MMRDA/ BEST/ Traffic Police/ IR/ MRVC/ State Government from own resources and by taking debt from various institutions.

Table 6-4: Major Sources of Funding and their Share (by 2034) for Transport Infrastructure

Source of Funding	Amount (INR crores)	% of Total
Government of India	31,236	18.7%
MCGM/ Development Authorities/ State Government	1,04,355	62.3%
PPP	413	0.2%
Debt from Multilateral/Bilateral/Domestic Institutions	31,579	18.8%
	1,67,583	**100%**

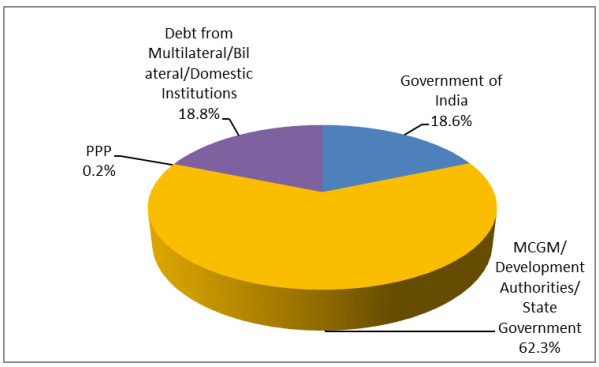


Figure 6-2: Major Sources of Funding and their Share (by 2034) for Transport Infrastructure

6.3 Preliminary Implementation Schedule

Preliminary implementation schedule along with annual investments required is presented in Table 6-5. This schedule has been prepared based on travel demand and network analysis carried out for long term, medium and short term. The intent of this schedule is to provide an initial assessment of a possible phasing scenario for the different projects over the next 18 to 20 years within the short, medium and long term time horizons.

Approximates annual funding requirement for delivery of proposed traffic & transport infrastructure in Greater Mumbai is shown in Figure 6-3. It can be seen that, the annual funding requirement during the period 2016 to 2019 is about INR 12,800 crores per annum, during 2020 t0 2023 is about INR 18,100 crores per annum and during 2025 to 2033 is about INR 3,900 crores per annum. Overall, during 2016 to 2034, the annual funding requirement is about INR 9,300 crores per annum. These assessments are made as per the travel demand assessments and consequent traffic & transport infrastructure needs. Major project planned during 2016 to 2019 is Colaba-Bandra-SEEPZ metro corridor for which funding is already available from JICA.

Past experiences in implementation major transport infrastructure projects in MMR and specific in Greater Mumbai indicates that, there would be general delays due to various reasons like coordination, land acquisition, removal of encroachments, funding, etc. Assuming similar delays in future as well, the proposed traffic & transport infrastructure for the horizon year 2024 may be delivered during the period 2025-34. Thus, the average annual funding requirement would get even out (approximately INR 8,600 crores per annum).

Table 6-5: Preliminary Implementation Schedule

Phase	Components	Quantity	Details	Unit	Unit Cost in Rs. Crores	Estimated Total Cost (Rs. Crore) H65	Phase Wise Cost (Rs. Crores) @ 2014-15 prices	%	Proposed Organisation/ Organisations for Planning and Implementation	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total	
Short Term Proposals (2016-2019)	Intersection improvements	30.00		No.	2.00	60.00	38,528	23.0%	MCGM	20.0	20.0	20.0																	60.0	38,528
	Installation of Traffic Signals	48.00		No.	0.15	7.20			MCGM	2.4	2.4	2.4																	7.2	
	Installation of ATC Compatible Traffic Signals	47.00		No.	0.25	11.75			MCGM	3.9	3.9	3.9																	11.8	
	SATIS (Outside the Railway premises)	8.00		No.	50.00	400.00			MCGM	133.3	133.3	133.3																	400.0	
	ROBs/RUBs	10.00		No.	66.08	660.80			IR/ MRVC/ GoM	220.3	220.3	220.3																	660.8	
	Flyovers/ Elevated Roads (already planned)	5.00		No.	0.00	1371.00			MCGM/ MMRDA	457	457	457																	1371.0	
	Flyovers (New)	4.00		No.	49.00	196.00			MCGM/ MMRDA	65.3	65.3	65.3																	196.0	
	Elevated Roads (New)	1.00		No.	210.00	210.00			MCGM/ MMRDA	70.0	70.0	70.0																	210.0	
	FOBs/ Subways	25.00		No.	14.00	350.00			MCGM	116.7	116.7	116.7																	350.0	
	Cycle Tracks (length in Kms)	90.00		Kms	0.33	29.74			MCGM	9.9	9.9	9.9																	29.7	
	Road Safety measures				Lumpsum	150.00			MCGM	50	50	50																	150.0	
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	75.00			MCGM	25	25	25																	75.0	
	Infrastructure for Traffic Police				Lumpsum	300.00			Traffic Police/ MCGM	100	100	100																	300.0	
	Strengthening & Widening of existing roads and Missing Links					4850.73			MCGM	1617	1617	1617																	4850.7	
	Bus System					206.87			BEST	69	69	69																	206.9	
	BRTS/ EBL					1562.40			BEST/ MCGM	521	521	521																	1562.4	
	Terminals					247.80			MCGM	83	83	83																	247.8	
	Metro System					25000.00			MMRDA	8333.3	8333.3	8333.3																	25000.0	
	Monorail					1900.00			MMRDA	633	633	633																	1900.0	
	Suburban System					938.25			MRVC	313	313	313																	938.3	
Medium Term Proposals (2020-2024)	Intersection improvements	50.00		No.	2.00	100.00	90,346	53.9%	MCGM				20	20	20	20	20												100.0	90,346
	Installation of Traffic Signals	0.00		No.	0.15	0.00			MCGM				0	0	0	0	0												0.0	
	Installation of ATC Compatible Traffic Signals	107.00		No.	0.25	26.75			MCGM				5.35	5.35	5.35	5.35	5.35												26.8	
	SATIS (Outside the Railway premises)	13.00		No.	50.00	650.00			MCGM				130.00	130.00	130.00	130.00	130.00												650.0	
	ROBs/RUBs	10.00		No.	66.08	660.80			IR/ MRVC/ GoM				132.16	132.16	132.16	132.16	132.16												660.8	
	Flyovers/ Elevated Roads (already planned)	0.00		No.	0.00	0.00			MCGM/ MMRDA				0.00	0.00	0.00	0.00	0.00												0.0	
	Flyovers (New)	12.00		No.	49.00	588.00			MCGM/ MMRDA				118	118	118	118	118												588.0	
	Elevated Roads (New)	2.00		No.	105.00	210.00			MCGM/ MMRDA				42	42	42	42	42												210.0	
	FOBs/ Subways	25.00		No.	14.00	350.00			MCGM				70	70	70	70	70												350.0	
	Cycle Tracks (length in Kms)	150.00		Kms	0.33	49.56			MCGM				9.91	9.91	9.91	9.91	9.91												49.6	
	Road Safety measures				Lumpsum	250.00			MCGM				50	50	50	50	50												250.0	
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	125.00			MCGM				25	25	25	25	25												125.0	
	Infrastructure for Traffic Police				Lumpsum	500.00			Traffic Police/ MCGM				100	100	100	100	100												500.0	
	Strengthening & Widening of existing roads and Missing Links					43939.67			MCGM				8788	8788	8788	8788	8788												43939.7	
	Bus System					344.78			BEST				69	69	69	69	69												344.8	
	BRTS/ EBL					1650.60			BEST/ MCGM				330	330	330	330	330												1650.6	
	Terminals					247.80			MCGM				50	50	50	50	50												247.8	
	Metro System					30575			MMRDA				6115	6115	6115	6115	6115												30575.0	
	Monorail					0.00			MMRDA				0	0	0	0	0												0.0	
	Suburban System					10078.04			MRVC				2016	2016	2016	2016	2016												10078.0	
Long Term Proposals (2025-2034)	Intersection improvements	120.00		No.	2.00	240.00	38,710	23.1%	MCGM									24	24	24	24	24	24	24	24	24	24		240.0	38,710
	Installation of Traffic Signals	0.00		Kms	0.15	0.00			MCGM									0	0	0	0	0	0	0	0	0	0		0.0	
	Installation of ATC Compatible Traffic Signals	93.00		Kms	0.25	23.25			MCGM									2	2	2	2	2	2	2	2	2	2		23.3	
	SATIS (Outside the Railway premises)	14.00		Kms	50.00	700.00			MCGM									70	70	70	70	70	70	70	70	70	70		700.0	
	ROBs/RUBs	8.00		No.	66.08	528.64			IR/ MRVC/ GoM									53	53	53	53	53	53	53	53	53	53		528.6	
	Flyovers/ Elevated Roads (already planned)	0.00		Kms	0.00	0.00			MCGM/ MMRDA									0	0	0	0	0	0	0	0	0	0		0.0	
	Flyovers (New)	0.00		Kms	49.00	0.00			MCGM/ MMRDA									0	0	0	0	0	0	0	0	0	0		0.0	
	Elevated Roads (New)	2.00		No.	210.00	420.00			MCGM/ MMRDA									42	42	42	42	42	42	42	42	42	42		420.0	
	FOBs/ Subways	50.00		No.	14.00	700.00			MCGM									70	70	70	70	70	70	70	70	70	70		700.0	
	Cycle Tracks (length in Kms)	300.00		Kms	0.33	99.12			MCGM									10	10	10	10	10	10	10	10	10	10		99.1	
	Road Safety measures				Lumpsum	500.00			MCGM									50	50	50	50	50	50	50	50	50	50		500.0	
	Other TMM (Traffic signs, Markings, etc.)				Lumpsum	250.00			MCGM									25	25	25	25	25	25	25	25	25	25		250.0	
	Infrastructure for Traffic Police				Lumpsum	1000.00			Traffic Police/ MCGM									100	100	100	100	100	100	100	100	100	100		1000.0	
	Strengthening & Widening of existing roads and Missing Links					8002.19			MCGM									800	800	800	800	800	800	800	800	800	800		8002.2	
	Bus System					689.56			BEST									69	69	69	69	69	69	69	69	69	69		689.6	
	BRTS/ EBL					2184.00			BEST/ MCGM									218	218	218	218	218	218	218	218	218	218		2184.0	
	Terminals					330.40			MCGM									33	33	33	33	33	33	33	33	33	33		330.4	
	Metro System					16625.00			MMRDA									1663	1663	1663	1663	1663	1663	1663	1663	1663	1663		16625.0	
	Monorail					0.00			MMRDA									0	0	0	0	0	0	0	0	0	0		0.0	
	Suburban System					6417.50			IR/ MRVC/ GoM									642	642	642	642	642	642	642	642	642	642		6417.5	
Total						**167,583**	**167,583**	**100%**		**12,843**	**12,843**	**12,843**	**18,069**	**18,069**	**18,069**	**18,069**	**18,069**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**3,871**	**0**	**167,583**	**167,583**

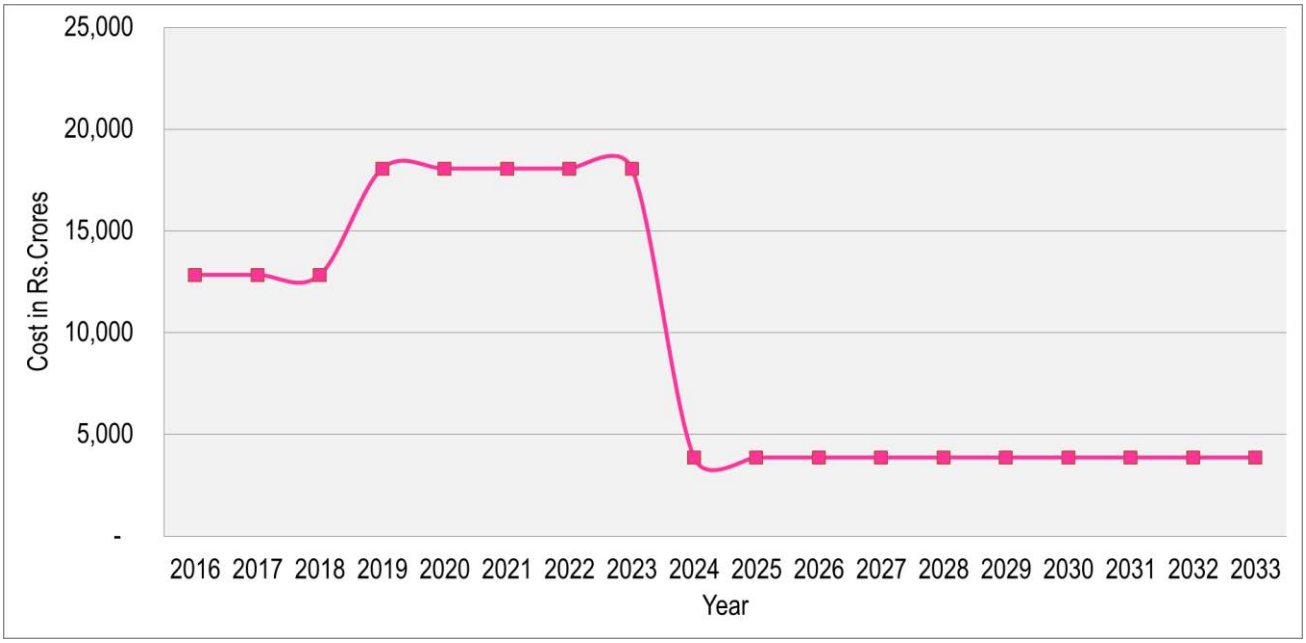


Figure 6-3: Approximates annual funding requirement for delivery of proposed traffic & transport infrastructure in Greater Mumbai

7. INSTITUTIONAL ARRANGEMENTS

For effective and timely implementation of the proposed traffic & transport infrastructure, the existing institutional arrangements are highly inadequate and there is a need for institutional strengthening at regional level as well as ULB level. The suggested institutional arrangements at regional level (previous studies) and local level i.e. within Municipal Corporation of Greater Mumbai are presented in this Chapter.

7.1 Institutional Changes as proposed in the previous studies

The TRANSFORM study (TRANsportation Study for the Region Mumbai, also called CTS for MMR study carried out during 2005-08 by MMRDA) identified a significant program of transportation investment and made recommendations on the institutional arrangements necessary to implement these. Subsequent to that a Business Plan for MMR was prepared that considered an investment plan for infrastructure across all sectors. The Business Plan stated that the Governance structure in MMR is quite complex. Having such complex institutional setup certain functions such as planning for economic growth, planning and development of water resources, planning and development of Greenfield areas, inter-municipal solid waste disposal, hand holding of smaller ULBs and resource mobilisation for metropolitan infrastructure are not adequately addressed. Therefore, in order to address these governance issues institutional restructuring improved planning management practices, capacity building and legal reforms are required. Keeping in view the Business Plan proposals and the CTS proposals, Technical Assistance study (2009-11), suggested the institutional reforms for restructuring MMRDA and its metropolitan governance. This section summarises the TRANSFORM and Business Plan recommendations with respect to institutional arrangements, then describes the developments since that time and the current arrangements and concludes with the direction of future changes.

7.1.1 CTS AND BUSINESS PLAN EMPHASISE THE NEED FOR INSTITUTIONAL CHANGE

The TRANSFORM study showed that, the MMR faces the major challenge of delivering the region-wide service of transportation and that this will involve the need to make massive capital investments. Implementation of this investment plan involves complex multi-faceted issues and it is evident that the resource mobilization is needed for transportation alone and changes are required to improve the capacity of the MMR to deliver this program.

Institutional arrangements in other jurisdictions (world-wide) were examined and in the long term it was thought that, it could be desirable to consider some form of Regional Government with a strong mandate for building and running region wide urban services. This recommendation has not been addressed and what is evolving is an approach of strengthening the current working arrangements, with MMRDA taking on a larger role in leading the process on behalf of the State Government.

7.1.2 THE EXISTING INSTITUTIONAL FRAMEWORK IN THE MMR

There are more than 35 agencies involved in transport sector in MMR. They are directly or indirectly related to supply and management of the transport infrastructure. These organizations and their responsibilities are given in Box 7-1.

BOX 7-1: *Organisations and their Responsibilities*

Key Responsibility and Jurisdiction Road and related infrastructure in respective municipalities/councils	
Municipal Corporations	
Greater Mumbai (MCGM)	Thane
Kalyan Dombivali	Navi Mumbai
Ulhasnagar	Mira Bhayandar
Bhiwandi-Nizampur	Vasai-Virar
Municipal Councils	
Ambernath	Alibag
Badlapur	Panvel
Khopoli	Uran
Pen	Matheran
Karjat	
Bus services mainly in respective municipalities	
Brihanmumbai Electric Supply and Transport (BEST)	
Thane Municipal Transport (TMT)	
Navi Mumbai Municipal Transport (NMMT)	
Kalyan Dombivali Municipal Transport (KDMT)	
Mira Bhayandar Municipal Transport (MBMT)	
Ulhasnagar Municipal Transport (UMT)	
State Government	
Mumbai Metropolitan Region Development Authority (MMRDA)	
Planning and coordinating authority for MMR	
City and Industrial Development Corporation (CIDCO)	
Development of Navi Mumbai and Special Planning Authority for Vasai Virar Sub region.	
Public Works Department (PWD)	
Construction and maintenance of roads, bridges, public buildings in the State	
Maharashtra State Road Development Corporation (MSRDC)	
Improvement of existing and new construction of roads, highways, expressways and select water transport services in the State.	
Maharashtra State Road Transport Corporation (MSRTC)	
Provision of inter-city bus service in Maharashtra State as well as neighboring states	
Traffic Police (TP)	
Traffic enforcement in Greater Mumbai	
Transport Commissionerate (TC)	
Grant licenses, issue permits, and collect various transport related taxes, fees and cess in the State	
Public Works Department (PWD)	
Undertakes development of State Highways, MDRs, ODRs, Village Roads, Maintenance of National Highways	
Maharashtra Maritime Board (MMB)	
Undertakes development of marine fronts, cargo jetties, ferry wharfs, terminals and inland waterways in State other than major ports.	
Central Government	
Central Railways (CR)	
Operation of inter-city railway services and part of Mumbai's suburban rail system (CST-Karjat-Khopoli)	
Western Railways (WR)	
Operation of inter-city railway services and part of Mumbai's suburban rail system (Churchgate-Virar-Dahanu)	
Mumbai Port Trust (MbPT)	
Providing sea transport for cargo and port facilities for country's trade and commerce.	
Jawaharlal Nehru Port Trust (JNPT)	
Providing port infrastructure and terminal facilities for bulk container traffic.	
Airport Authority of India (AAI)	
Providing facilities for passenger and cargo air travel to and fro Mumbai for domestic and international traffic.	
Central and State Governments	
Mumbai Railway Vikas Corporation (MRVC)	
Undertaking coordinated planning and implementation of Mumbai suburban rail infrastructure projects.	
Mumbai Metro Rail Corporation (MMRC)	
Mumbai Metro Rail Corporation Limited (MMRC) is the nodal agency responsible for the implementation of Mumbai Metro Line–3 (MML-3, Colaba-Bandra-SEEPZ metro corridor) project. It has been constituted as a JV of the Govt. of India(GOI) and the Government of Maharashtra(GOM) on 50:50 sharing basis.	

The existing transport planning and management structure in the MMR comprises, as seen box above, numerous public agencies and corporate bodies. Responsibility for the general direction of urban development and urban transport is with the State through Mumbai Metropolitan Region Development Authority (MMRDA),

a regional agency under the State Urban Development Department (UDD).

The planning and provision of suburban rail services is with India Railways (IR). The allocation of resources for rail services is subject to the approval of the Planning Commission of GoI. The suburban rail services are run by two zonal railways, Western Railway (WR) and Central Railway (CR), who operate within the MMR as independent agencies without significant service integration. Mumbai Railway Vikas Corporation (MRVC) is established to implement projects included in Mumbai Urban Transport Project (MUTP) and to co-ordinate with CR, WR and other agencies. MRVC is jointly owned by Indian Railways and the State.

Metro and Monorail planning in MMR is mainly by MMRDA. However, CIDCO has prepared metro plan within their planning area and undertaken construction of Belapur to Khandeshwar metro line (Length, 23.40 km line consists of 20 metro stations).

Road planning, construction and maintenance is the responsibility of the State Public Works Department (PWD) and other local authorities. Construction of certain flyovers was undertaken by Maharashtra State Road Development Corporation (MSRDC). The planning and implementation of traffic management schemes is a responsibility of Municipal Corporation of Greater Mumbai (MCGM) in Greater Mumbai, but it has little technical capacity for this increasingly important task. Similarly, planning and implementation of traffic management schemes in other municipal corporations and council areas is taken care by respective corporations/ councils.

The bus services within the City of Mumbai are provided exclusively by a municipal company, the bus division of the Brihan Mumbai Electric Supply and Transport (BEST). Municipal bus services are also provided by Thane Municipal Transport (TMT), Kalyan-Dombivali Municipal Transport (KDMT), Navi Mumbai Municipal Transport (NMMT), Mira-Bhayander Municipal Transport (MBMT), Ulhasnagar Municipal Transport (UMT) and Maharashtra State Road Transport Corporation (MSRTC).

Maharashtra Maritime Board (MMB) is responsible for planning and development of water transport. City and Industrial Development Corporation (CIDCO) is responsible for planning and development of Navi Mumbai.

Funding arrangements for urban transport infrastructure and services in MMR are split between a number of national, state and local government agencies. No single agency has the clearly mandated role or responsibility for preparing affordable, integrated investment and operations budgets to meet travel demands and policy objectives. Overall levels of investment have been lagging demand, while maintenance expenditure is well below what is needed.

The key lessons from the past experiences include the absence of long term sustainable resource mobilization mechanism and funding strategy.

The current decision making process involves extensive consultations and thus has become a long drawn and cumbersome process. The consequence is the complexity and insufficient coordination between sectors and modes.

Infrastructure project implementation has experienced considerable delays, which is the result of poor definition of roles and responsibilities and weak inter-agency coordination. An important lesson about delay in implementation is that it results not only on account of paucity of funds but also for other reasons including the prolonged acquisition of land, R&R, environmental objections, inability to adjust user charges and tariffs on time, lack of comprehensive project assessments of need and justification and financial viability, lack of accountability for raising financial resources, inadequate capacity and skill sets available in procurement of works, goods and services, and absence of utility mapping. The root cause for many of these is the lack of one implementing authority with a clear mandate.

The issues can be summarised as follows:

(a) Multiplicity of agencies with overlapping responsibilities makes decision making and action difficult;
(b) The need to coordinate the roles of central, state and Local Government agencies without a clear mechanism for doing this makes major financial decisions difficult;
(c) There is a lack of coordination between land use development decisions and transportation investment decisions;
(d) Functional responsibility unrelated to available resources as a result key investment decisions not made;
(e) There is a shortage of staff with adequate skills in transport planning/ execution/ operational organizations, financial decision making in most organizations; and
(f) MMRDA's is seen by many as having the leadership role with respect to regional infrastructure improvement and investment but is not appropriately positioned or resourced within the agencies to realize the expectations placed upon it.

An effective institutional framework is of critical importance to successful transport systems. Because of the many external and internal interdependencies, MMR's transport does not fit easily into existing institutions and requires substantial co-ordination between the concerned agencies.

It therefore becomes imperative that effective inter-agency co-ordination is achieved at national, regional and municipal/local government agencies levels. Progress towards this attainment requires investment over a long time frame. Currently MMRDA's role is evolving but needs to be developed further.

TRANSFORM had set the direction for institutional change but at the time it was recognised that change would take time. The institutional arrangements in MMR are evolving and this section outlines the changes that are occurring.

7.1.3 REGIONAL TRANSPORT AUTHORITY

The Vision, Mission and Priorities for a regional transport authority is as follows.

7.1.3.1 Vision for a Regional Authority

The Authority to be mandated to achieve a transportation future where people and goods move in a way that promotes a healthy economy, an improved environment and quality of life for generations to come.

7.1.3.2 Mission for the Authority

The Authority to plan, finance, implement and champion an integrated transportation system that moves people and goods safely and efficiently supporting MMR growth strategy, air quality objectives and economic development.

7.1.3.3 Priorities of the Coordinating Authority

The Authority to believe that the only way it can achieve its transportation vision is by applying the following core values to everything it does.

(a) ***Safety:*** It will plan and deliver a transportation system that promotes health, safety and security of the public;
(b) ***Fiscal Responsibility:*** The Authority to invest the public funds wisely to ensure that the system is sustainable in the long term and the Authority to make every effort to attract financial partners;
(c) ***Accountability:*** The Authority is to account for its achievements, shortcomings, challenges to the public, stakeholders and partners;
(d) ***Communication and Consultation:*** The Authority is to listen to and actively seek the ideas of the public, partners and stakeholders. It is to provide clear and concise information in timely manner.
(e) ***Customer Service:*** The Authority to understand its customers and increase their satisfaction with the services they receive;
(f) ***Integrity:*** The Authority to conduct itself ethically, respectfully and honestly as stewards of the MMR transportation system; and

(g) ***Teamwork and Partnership:*** The Authority to work together as partners to achieve a sustainable transportation network that meets the concern and future needs of the MMR.

7.1.3.4 Governance of MMRDA

The existing administrative structure of MMRDA is shown in Figure 7-1. The complexity of this organisation reflects the complexity of the activities occurring within the Region.

To understand the mandate of MMRDA, it is necessary to examine how the governance of the organisation is structured and this is shown in Figure 7-2. The governance structure shown in this chart illustrates the importance of consultation across a large number of organisations but it also illustrates the challenges of making decisions in a timely way as is necessary to build an effective transportation system.

MMIF has been proposed as part of TA project to ensure that funds are available to build necessary regional infrastructure as envisaged in the studies such as Comprehensive Transport Study and Business Plan. The Fund will be dedicated to finance, either alone or in partnership infrastructure for which MMRDA is responsible. The proposed MMIF should be governed by a separate body – A MMI Fund Committee within MMRDA – which is independent of project initiating and implementing divisions of MMRDA. This approach is adopted because managing the investment decisions in a timely way is critical to building the infrastructure also. These decisions are major in scope and there needs to be a focus within MMRDA for expertise that can support good investment and business decisions concerning the large amounts of money involved. Figure 7-3 shows the existing Executive Committee composition and how the Mumbai Infrastructure Fund Committee relates to it.

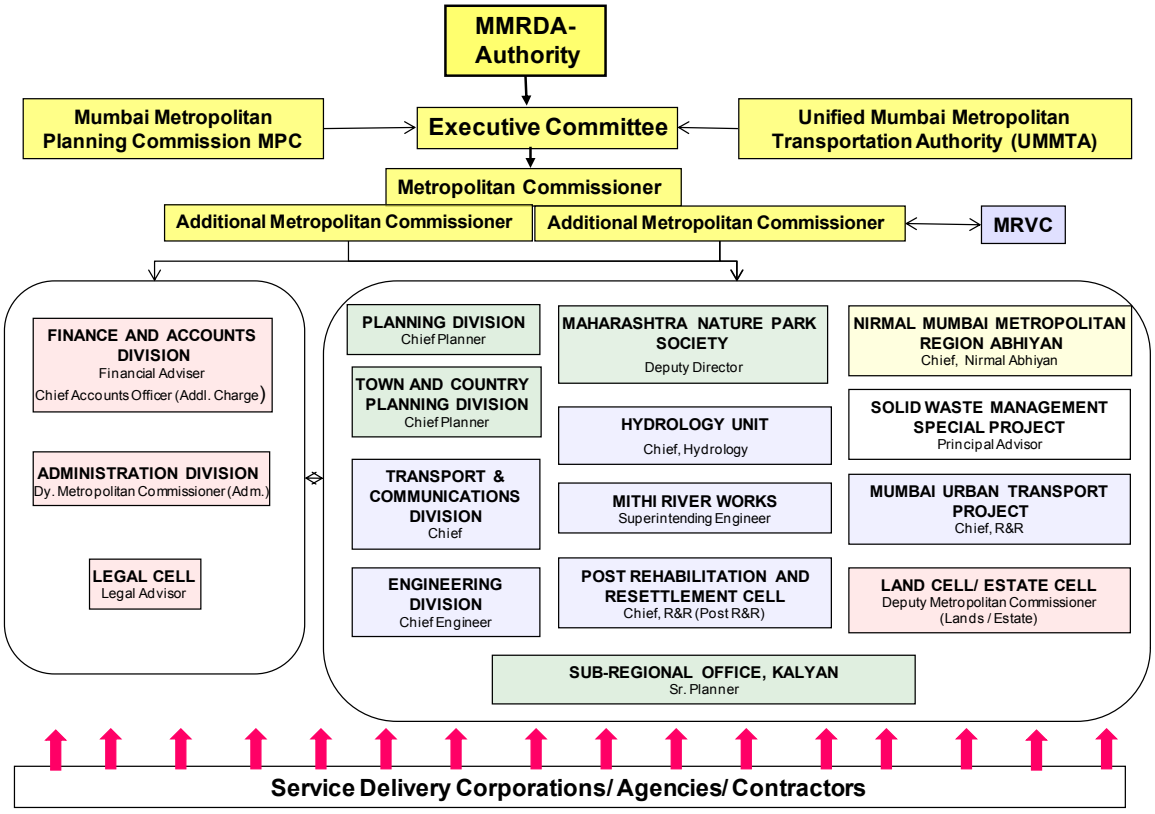


Figure 7-1: Existing MMRDA Structure

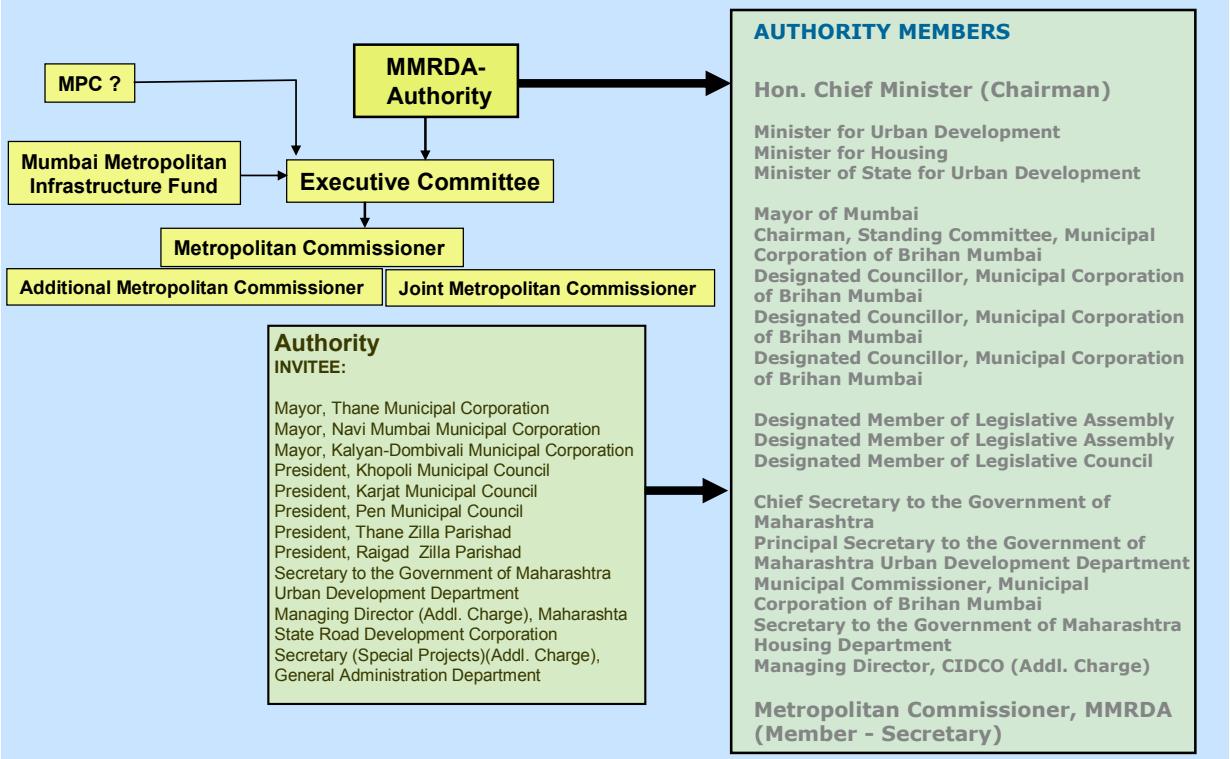


Figure 7-2: Existing Authority Composition

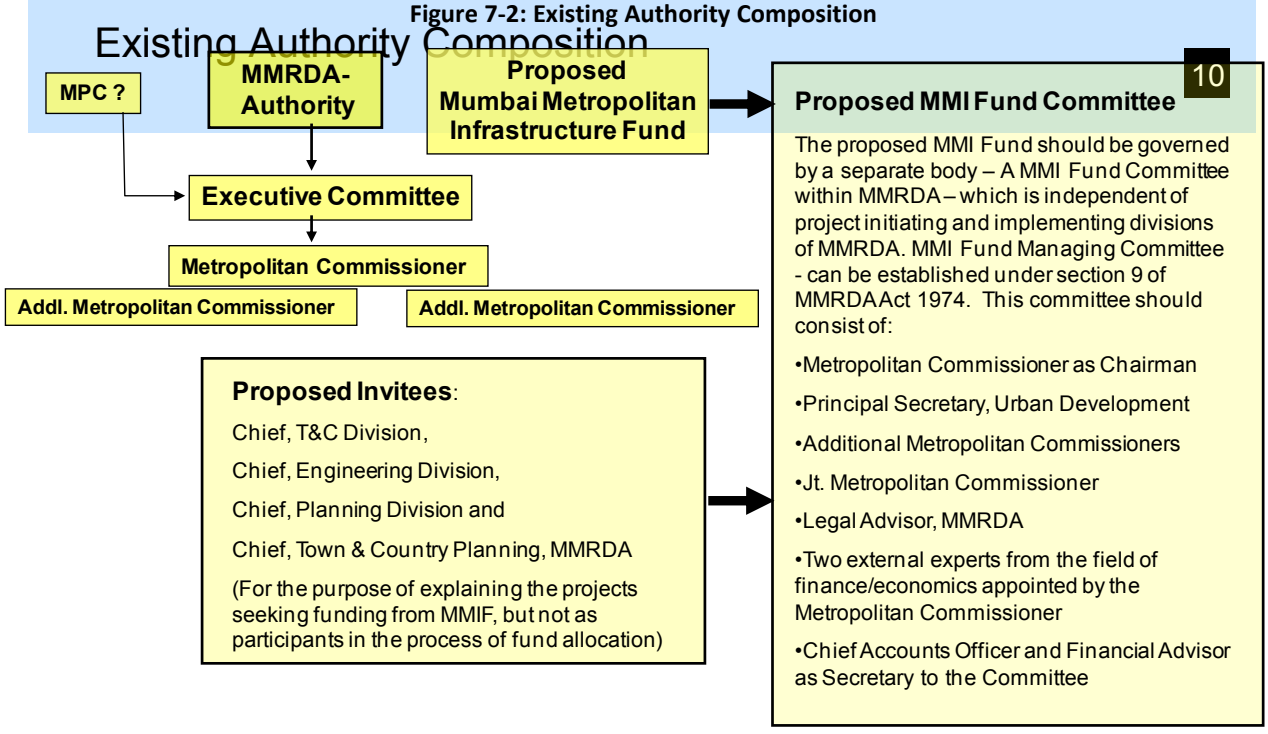


Figure 7-3: Executive Committee and Relation to MMIF Committee

National Urban Transport Policy (NUTP), 2006 envisages setting up of Unified Metropolitan Transport Authority (UMTA) in all million plus cities (census 2001), to facilitate coordinated planning and implementation of urban transport programmes and projects and an integrated management of the urban transport systems, as the current structure of Governance for the transport sector is not equipped to deal with problems of urban transport (Multiplicity of organizations, Lack of Integration and Coordination, Inefficient Transport system, Impact on the nature of travel due to rapid urbanization in the Region, etc.)

Government of Maharashtra in Home, Department by its resolution dated 12th February, 2008 established the

Unified Mumbai Metropolitan Transport Authority (UMMTA) with the following objectives, functions and role of MMRDA.

- **Objectives:**
  - UMMTA will act as a regional coordinating Authority in the area of Transport;
  - Take decisions on matter that would impinge on transport in the region and oversee that no steps are initiated by any agencies /local bodies that detract from the overall efficiency of the prescribed regional transport plan; and
  - As the empowered coordination Authority overall policy in regards to Transport, Modal priorities, Infrastructure priorities, financial allocation and operational coordination.
- **Functions:**
  - Comprehensive transport plan for MMR;
  - Integration of regional and city land use plans with transport plan of MMR;
  - Inter modal priorities and integration;
  - Infrastructure priorities and integration;
  - The allocation of individual infrastructure execution to implementing agencies;
  - Bus Rapid Transit System (BRTS);
  - Funding mechanism and fund allocation;
  - Implementation modalities including PPP;
  - To bring unanimity among various concerned agencies;
  - Transport studies and information systems; and
  - Other work assigned by Metropolitan Planning Committee (MPC).
- **Role of MMRDA:**
  - MMRDA is expected to provide staff, technical staff and expenses of UMMTA.

Government Regulation (GR) envisaged to setup eight committees viz. Strategic Planning Committee, Finance Committee, Traffic Engineering Committee, Traffic Operation & Management Committee, Regulation, Safety and Environment Committee, Terminals and Parking Committee and Legal Committee with specific focus in transport sector. Some of the committees have been formed. GR also envisages that UMMTA subsequently be provided statutory backing through appropriate legislation. UMMTA with active support from MMRDA is putting efforts to discharge its mandated functions and currently working on obtaining the statutory backing through appropriate legislation.

Multiple organizations and agencies deal with the Mumbai metropolitan transport system. To study, appraise the suggestion and proposals from these organisations and agencies and to recommend for approval to UMMTA and to assist UMMTA in expediting its functions, a "**Core Committee"** under the chairmanship of Principal Secretary, Urban Development Department has been formed vide GR in UDD, date 04th January, 2010. The specific scope of the Core Committee as follows:

a) Implement CTS recommendations in a phased manner;
b) Creation of Traffic & Transportation department/ division in ULBs;
c) Setup Dedicated Infrastructure Fund;
d) Implement Seamless Travel in MMR;
e) Security in Public Transport Systems; and
f) Other important issues with respect to efficient transport system in Mumbai Metropolitan Region (MMR).

The committee met regularly and initiated and the following actions have been taken so far.

a) Completed DPR studies for metro corridors: 120 km through MMRDA;

b) Taken up detailed Feasibility Study for Virar-Alibag Multi-Modal Corridor: 145 km (by MMRDA);
c) Technical Assistance project for implementation of CTS recommendations has been initiated in October, 2009;
d) Sources for Dedicated Infrastructure Fund i.e. Mumbai Metropolitan Infrastructure Fund (MMIF) have been identified and legal amendments in MRTP Act and MMRDA Act required for implementation of Development Charges in MMR have been sent to UDD, GoM;
e) Process for PWT on east coast for Ro-Ro facility initiated;
f) Directed ULBs to incorporate the CTS transport plans including truck terminal respective DP with necessary amendments/modifications;
g) ULBs have been advised to take approvals from competent authorities and create Traffic & Transportation department/division;
h) Initiated the process for seamless travel and appointment of consultants through MMRDA;
i) Initiated the process for examining various issues pertaining to the security in the public transport system; and
j) All concerned agencies like NHAI, MRVC and MSRDC have been advised to carry out the preparation of DPRs for the projects under their jurisdiction as per the CTS Plan.

UMMTA committee meeting was held on 8th February, 2011 under the chairmanship of Chief Secretary. The following core committee recommendations have been endorsed by the committee.

a) Provide Legal Framework for UMMTA;
b) Incorporation of CTS Transport Plans and reservation of proposed Right of Way (RoW) 80 to 100 m in the Regional Plan and Development Plans (Modifications to the existing DPs/ incorporation in DP revision);
c) Creation of Traffic & Transportation Division in ULBs;
d) Legal amendments proposed in MR&TP and MMRDA Acts for collection of Development Charge;
e) Creation of MMIF within MMRDA and provide suitable legal framework;
f) To ensure integrated planning/ development in MMR and direct to all ULBs and other organizations for submission of major transport infrastructure project proposals for appraisal / endorsement by UMMTA;
g) Direct the concerned organizations for preparation of DPR studies for prioritized transportation projects;
h) To accord priority to the transport connectivity to the strategic locations (regional and local airport connectivity for Mumbai and Navi Mumbai International Airports), faster dispersal of traffic during disasters (MTHL), etc.;
i) Strengthening of MMRDA which is technical and administrative secretarial of UMMTA i.e. MMRDA for assisting UMMTA and/or to appoint consultants for any policy legal/financial reforms needed for the integrated planning and development of infrastructure as decided by the Core Committee;
j) Abolition of sub-committees and amend the GR; and
k) Periodical Review of CTS plans.

UMMTA will continue to exist and play a necessary coordinating role. The relationship of UMMTA to the Executive Committee is shown in Figure 7-4.

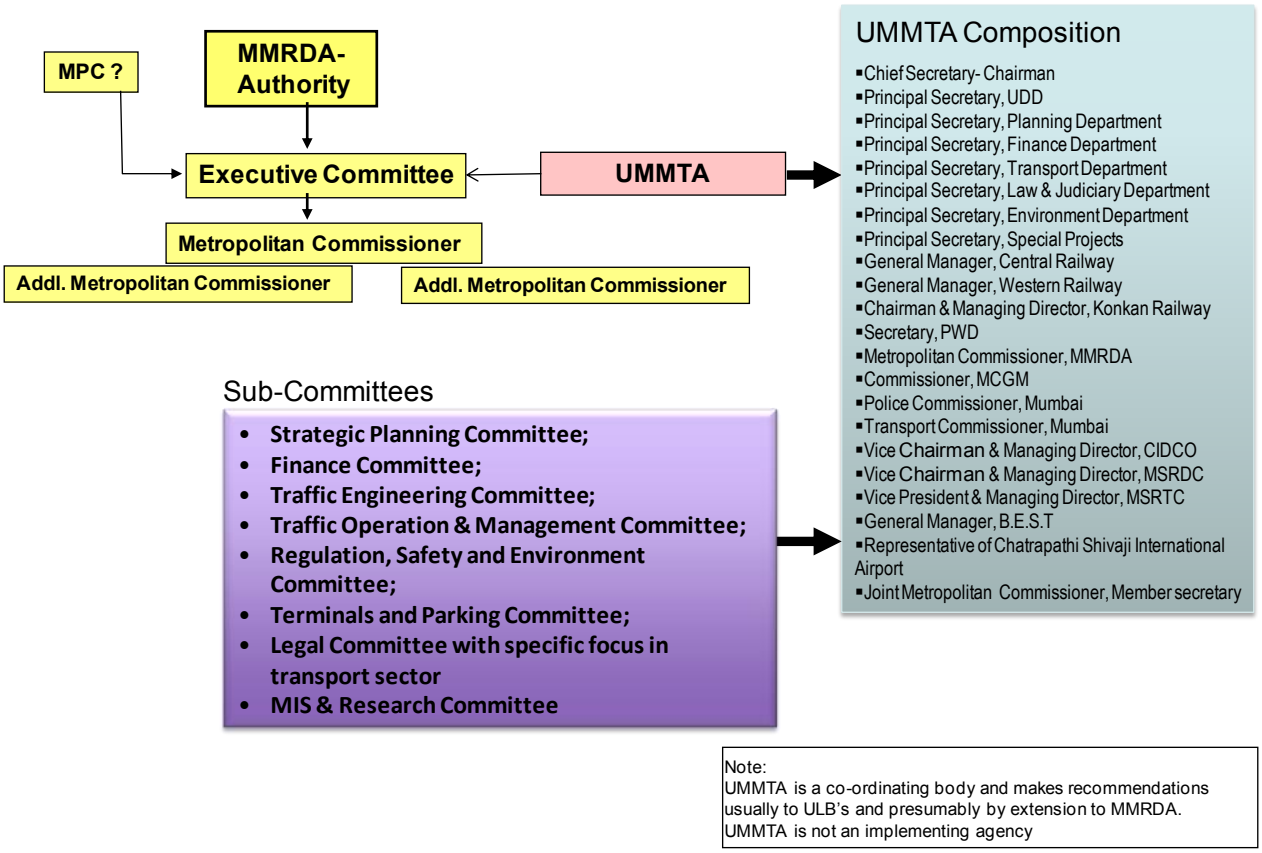


Figure 7-4: UMMTA Composition, Sub Committees and UMMTA Relation with Executive Committee

The GoI (MoUD) has initiated efforts to establish UMTA and Urban Transport Funds (UTF) and recently proposed processes and mechanisms to implement both UMTA's and UTF's on a statutory basis which was a significant shortcoming of the original advisory and coordinating intent of the UMTA. Draft. UMMTA with the assistance from MMRDA is in the process of appointment of Consultants for preparation of UMTA bill for MMR.

7.1.4 THE ORGANISATION AND STAFFING OF MMRDA

The level of investment in regional urban infrastructure to be made through MMRDA is going to increase many times in the immediate future. The increase in the number of projects that MMRDA will have to assess, plan, finance, implement and manage will alone require a large increase in the complement of staff. However, the projects themselves are increasing in complexity and this requires not only a larger number of staff but also a broader range of skills. These skills will have to be organised into groups that relate and work effectively together, a proposed organisational structure is shown in Figure 7-5.

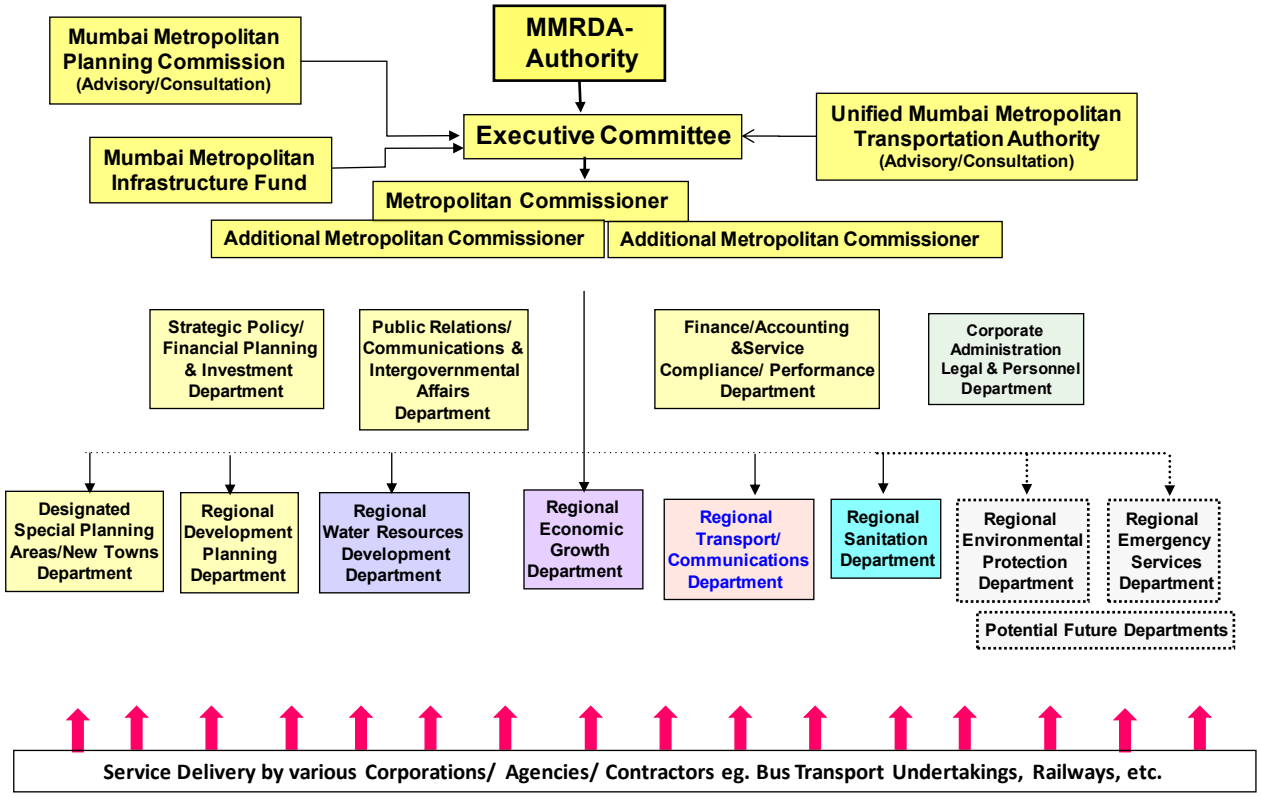


Figure 7-5: Proposed Organisation Structure for MMRDA

An important change to the existing structure of MMRDA is the introduction of a new division called "Strategic Policy/Financial Planning and Investment". The positioning of the Department is shown in Figure 7-6.

The role of this division will be to take the vision and the strategy for MMRDA and mobilise the resources to translate it into a reality this will involve:

a) Preparing economic forecasts;
b) Preparing a 5 year rolling capital investment plan;
c) Assessing individual projects and financial implementation plans for each;
d) Securing financing through PPPs, grants from senior governments, managing revenue flows from, user charges, land sales and development levies;
e) Managing the Infrastructure Development Fund;
f) Managing secured funds and managing the accounting and reporting for these funds;
g) Managing the financial aspects of the procurement process; and
h) Negotiating PPP contracts.

A further expansion of the MMRDA capability will occur by adding staff in new cells in the Regional Transport Department as shown in Figure 7-7.

It is proposed that the three new cells will be created to address areas where MMRDA capacity needs to be expanded. These cells will deal with Relocation and Resettlement, Land Acquisition and Utility Relocation. Each of these is a major task when establishing transportation rights of way within an urban area and creating a specialist cells for these purposes will concentrate the expertise and accelerate the process.

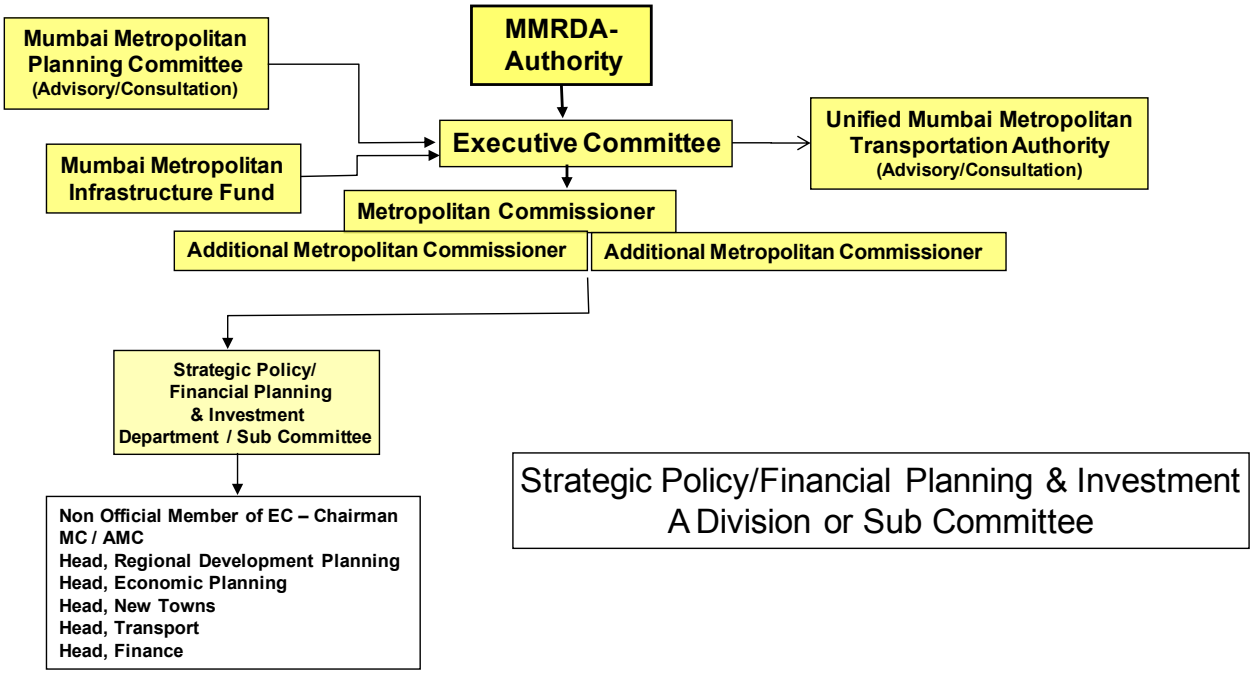


Figure 7-6: Strategic Policy, Financial Planning and Investment Division and Sub-Committee

A further new group will also be required to respond to the MMRDA's activities in leading the development of the Growth Centre's and the Settlement Areas to address this it is proposed that a division be created called the Special Planning Areas and New Towns Department. How this division is integrated with others is shown in Figure 7-5 and the details of how the division should be structure is shown in Figure 7-8.

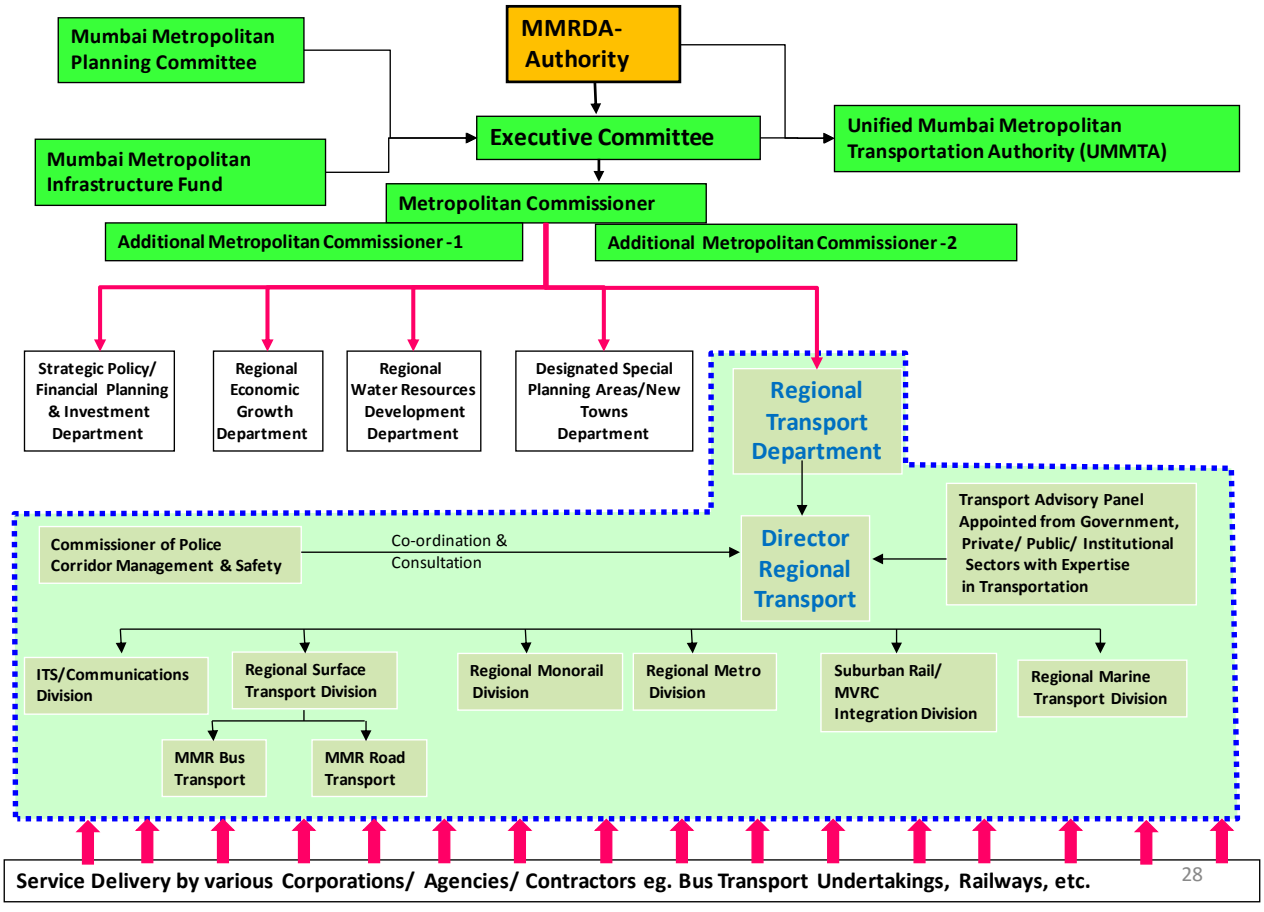


Figure 7-7: Organisational Structure for Regional Transport Department

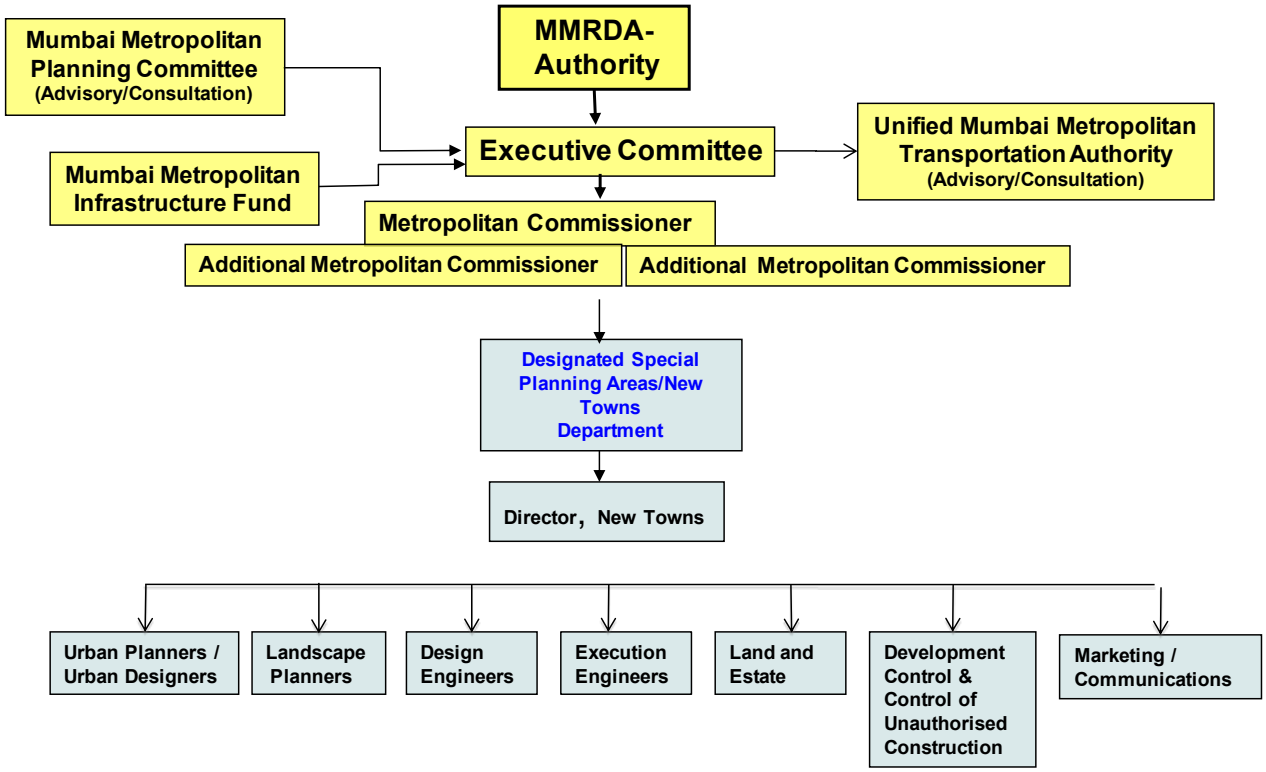


Figure 7-8: Organisational Structure for Special Planning Areas and New Town Division

7.2 Mobility Plan Proposed Institutional Changes for MCGM

7.2.1 Existing Institutional Setup of MCGM

Greater Mumbai is administered by the Municipal Corporation of Greater Mumbai (MCGM). The Municipal Authorities area, Corporation, Standing Committee, Improvement Committee, BEST Committee, Education Committee, Wards Committee, Mayor, Municipal Commissioner (MC) and General Manager, BEST. Municipal administration of MCGM is shown in Figure 7-9. The MC is the Chief Executive Officer and head of the executive arm of the Municipal Corporation. He is assisted by Additional Municipal Commissioners, Deputy Municipal Commissioners, Assistant Commissioners and various heads of Department in discharge of his functions. Additional Municipal Commissioners are appointed by Government of Maharashtra under BMC Act section 54. He functions as commissioner for departments which are deputed to him by Municipal Commissioner. At present there are four Additional Municipal Commissioners. All executive powers are vested in the MC who is an Indian Administrative Service (IAS) officer appointed by the state government. Although the Municipal Corporation is the legislative body that lays down policies for the governance of the city, it is the MC who is responsible for the execution of the policies. The MC and AMCs are appointed for a fixed term as defined by state statute. The powers of the MC are those provided by statute and those delegated by the Corporation or the Standing Committee. Under MC, there are four Additional Municipal Commissioners (AMCs), one on Projects and the rest three are for Island City, Western suburbs and Eastern suburbs and one Chief Engineer looking after Development Plan preparation. Under each AMC, there are Jt. MCs/ DMCs to assist the AMCs in delivery of functions. Below the Jt. MC/ DMC, there are teams of Chief Engineer/ Dy. Chief Engineer/ Executive Engineer/ Asst. Engineer/ Sub Engineer of various disciplines like Roads & Traffic, Bridges, Development Plan, Water Supply, Sewerage, Storm Water Drains, Common services, etc.) for further coordination and delivery of municipal functions.

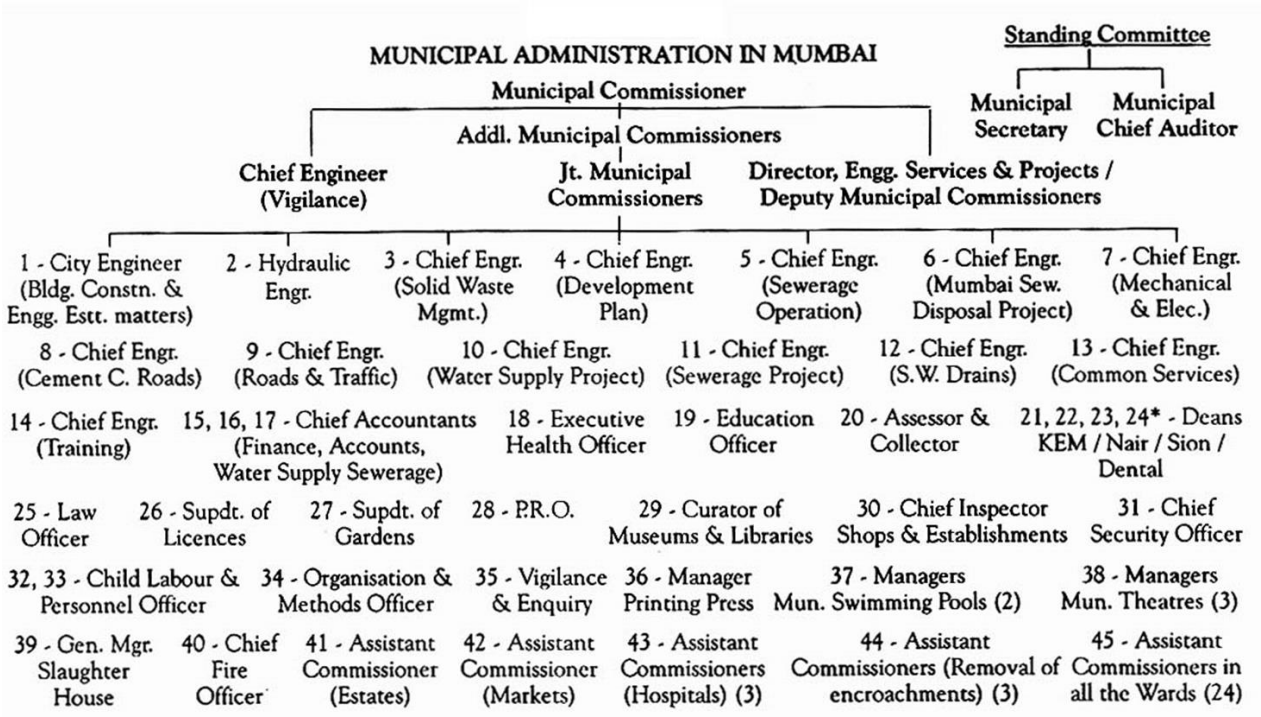


Figure 7-9: Organisational Structure of MCGM

Functions of MCGM: The functions of MCGM broadly relate to public health (Water supply, sewerage, sanitation), welfare, regulatory functions (prescribing and enforcing Building regulations, encroachments on public land, Birth registration and Death certificate, etc.), public safety (Fire protection, Street lighting, etc.), public infrastructure works (construction and maintenance of inner city roads, etc.), and development functions (Town planning, development of commercial markets, planning for Economic development and Social justice, urban poverty alleviation programs and promotion of cultural, educational and aesthetic aspects).

Mayor's Office: The Mayor of Mumbai is the first citizen of the city. This person is the chief of the MCGM, but the role is largely ceremonial as the real powers are vested in the Municipal Commissioner. The Mayor is usually chosen through indirect election by the councillors from among themselves for a term of two and half years. The Mayor also plays a functional role in deliberating over the discussions in the Corporation.

Brief description of some of the major departments which are relevant for traffic engineering, road safety and transportation planning are described as follows:

Development Plan and Building Proposals Department: This department is headed by the Chief Engineer. The line of reporting above Chief Engineer is Director (Engineering Services & Projects) and Municipal Commissioner. Chief Engineer is assisted by four Dy. Chief Engineers (DP, Island City, Western and Eastern suburbs). Main functions of the department are, implement Development Plan, give approvals to Building/Development Plan or Proposal as per sanctioned Development Control Rules, Acquisition of Reservation, Roads Widening as per Development Plan, implement Slum Redevelopment Scheme (SRD) for Slums, Grant of Transferable Development Rights. (TDR), Development of Reservation as per sanctioned Development Plan, Development of Reservation by Public Private Participation, etc.

Traffic Department: Organisation structure of Traffic Department is shown in Figure 7-10. The traffic department is headed by the Chief Engineer, Roads & Traffic. The line of reporting above Chief Engineer is Addl. Municipal Commissioner (Eastern Suburbs) and Municipal Commissioner. The Dy. Chief Engineer, Traffic is responsible for the daily functioning of the Traffic Department. Functions of the department are, provision of traffic control measures, traffic signs, street lights, parking facilities, etc., scrutiny of parking facilities within the development premises/ properties, coordination with traffic police, BEST, etc. on traffic management measures,

coordination of digging activity, etc.

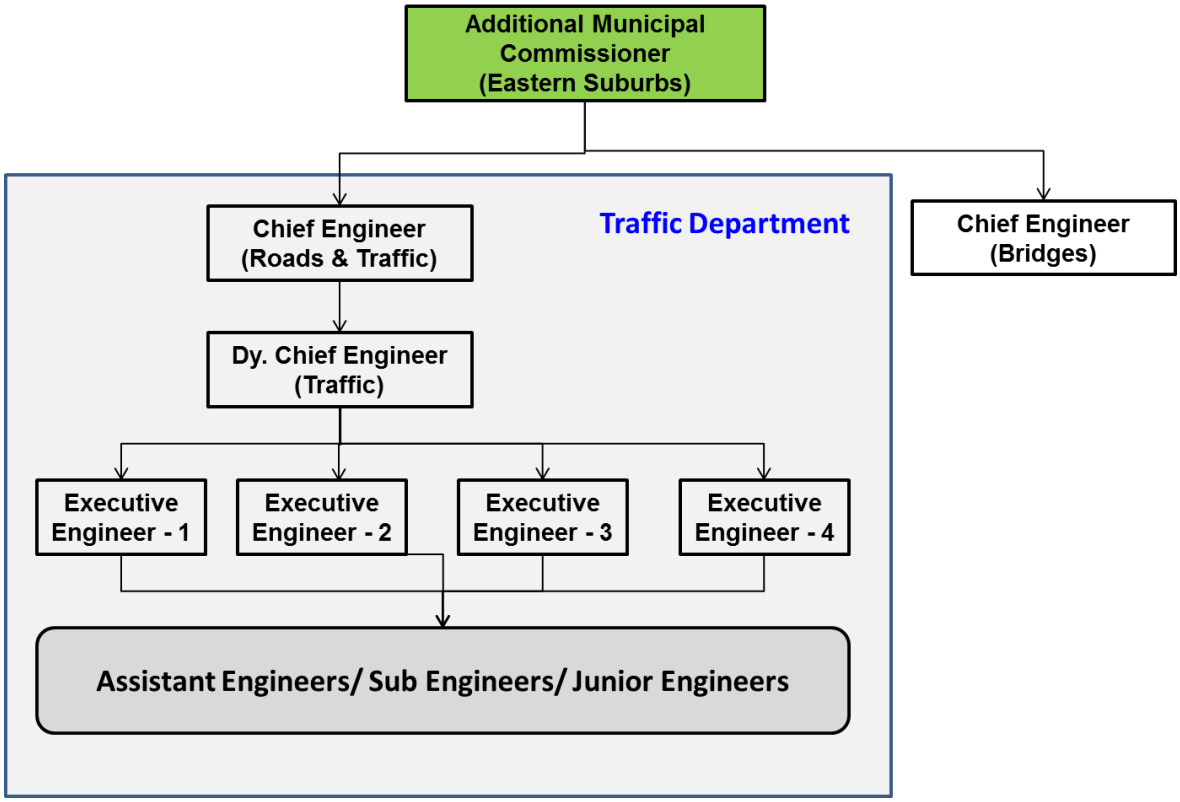


Figure 7-10: Organisational Structure of Traffic Department, MCGM

Public Health Department: This department is headed by the Executive Health Officer. The Additional Executive Health Officer and deputy Health Officers report to the Executive Health Officer. The Medical Officer of Health manages the department at each ward. The services offered by this department are, registration of births and deaths, regulation of places for the disposal of the dead, family welfare services, control of communicable diseases, immunization, international health certificates, food sanitation and the prevention of food adulteration, control of trades likely to pose a health hazard, insect and pest control, registration of private nursing homes, medical relief through hospitals, ambulance and health services, etc.

7.2.2 Mobility Plan proposed Institutional Changes for MCGM

As explained above, there exist Traffic Department for planning traffic (traffic signs, pavement markings, on-street and off-street parking facilities, traffic signals, etc.) and transport infrastructure (roads) within the Greater Mumbai municipal limits. The issues of concerns are presented at *BOX 13-2*, as regards institutional strengthening.

Box 7-2: Issues and Concerns

a) Lack of expertise in Traffic & Transportation Planning/ Engineering field;
b) Difficulty in coordinating with Central, State and Local Government agencies;
c) Difficulties encountered within departments;
d) Functional responsibility unrelated to available resources;
e) Rarely the transport planning/ execution/ operational organizations are staffed with the professionals required to accomplish the given objectives;
f) Inadequate trained staff resulting in inability to deal with the problems they encounter; and
g) *Inadequate computer and communication facilities.*

The following institutional changes are proposed:

a) Renaming of existing Traffic Department as "Traffic & Transportation Department", supported by "Traffic Advisory Panel" with stake holders to coordinate local activities. This would facilitate in effective coordination

with regional level, state level and central level authorities;

b) Skill & Technology transfer (traffic engineering, road safety, transportation planning, highway engineering, GIS, etc.) through professional organizations;
c) Strengthening of Traffic & Transportation Department by recruiting post graduates with academic qualifications and experience in Transportation Planning, Transportation Engineering and Highway Engineering;
d) Creation of "Parking Cell" for effective planning, coordination, operation of on-street and off-street parking facilities; and
e) Enhancing the strength of Traffic & Transportation Department with additional staff at various levels.

Proposed institutional changes for "***Traffic & Transportation Department"*** are shown in Figure 7-11.

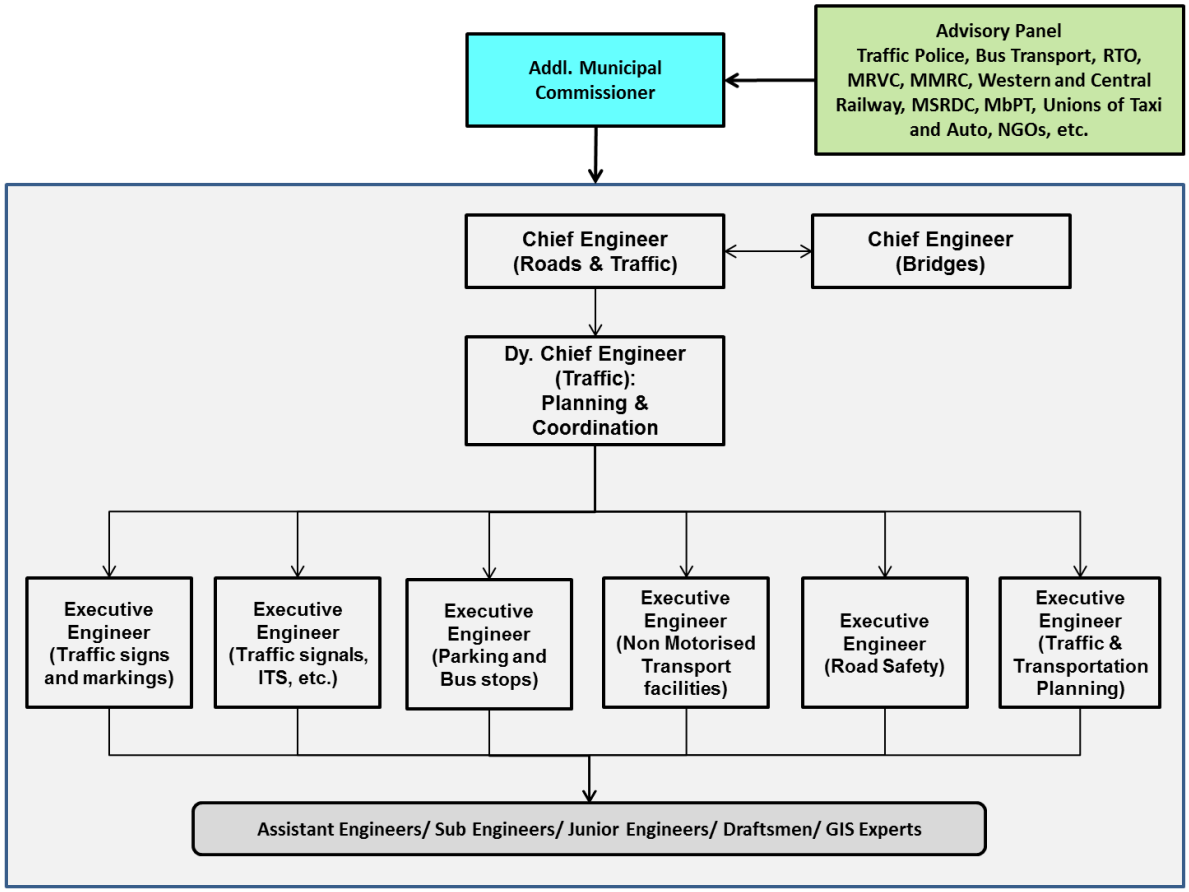


Figure 7-11: Proposed Organisational Structure for Traffic & Transportation Department, MCGM

Proposed functions of the Executive Engineers who will be in-charge of various identified traffic and transportation policies, strategies and plans are presented as follows:

Executive Engineer (Traffic signs and markings):

a) Maintenance of traffic signs, installation of new traffic signs, pavement markings, etc.; and
b) Mapping of the locations of traffic signs in GIS and updation.

Executive Engineer (Traffic signals, ITS, etc.):

a) Maintenance of traffic signals including ATC;
b) Identification of intersections for junction improvements, installation of new traffic signals, etc. and execution;
c) Identification of locations for installation of Variable Message Signs (VMS) in coordination with

Traffic Police and execution;

d) Coordination with Traffic Police for effective implementation of traffic regulations;
e) Mapping of the locations of traffic signals in GIS and updation;
f) Traffic count using automatic counters (ex. TURTLE machines); and
g) Develop and execute Incident Management System in coordination with Traffic Police.

Executive Engineer (Parking and Bus stops):

a) Parking policy related works;
b) Assessment of parking demand, planning for off-street parking facilities;
c) Scrutiny of off-street parking proposals (ex. PPLs) in coordination with Traffic Police, State Government;
d) Demarcation of sections of the roads, areas within 500 m radius from the PPL for prohibition of on-street parking;
e) Coordination with Traffic Police on enforcement of on-street parking regulations; and
f) Bus stop locations/ bus bays/ bus shelter designs in coordination with BEST.

Executive Engineer (Non Motorised Transport facilities):

a) NMT First policy related works;
b) Removal of encroachments on footpaths in coordination with other departments of MCGM;
c) Identify sections of the roads where footpaths improvements needs to be carried out;
d) Planning for at-grade (uncontrolled/ controlled) and grade separated pedestrian facilities (FoB/ Subway/ Skywalk);
e) Planning for safe cycle tracks, cycle parking, etc.; and
f) Initiate “Cycle Hire Schemes” through NGOs/ Private organisations.

Executive Engineer (Road Safety):

a) Coordination with other departments of MCGM (Education, Health and Public Relations) and traffic police in implementation of road safety measures;
b) Organisation of Road Safety Week/ actively participate in the initiates organised by Traffic Police;
c) Identification of locations for speed breakers and their execution in coordination with Traffic Police;
d) Road accident data base (including mapping in GIS) in coordination with Traffic Police;

Executive Engineer (Traffic & Transportation Planning):

a) Development and maintenance of traffic data base;
b) Continuous updation of GIS database of traffic & transportation infrastructure (road network, one-ways, bus routes, metro, monorail, suburban rail corridors, traffic signals, flyovers/ RoBs/ RUBs, elevated roads, etc.);
c) Coordination with other departments and organisations for effective implementation of CMP proposed policies, strategies and plans on traffic and transportation infrastructure;
d) Carry out project preparatory works (Pre-feasibility, Feasibility, Detailed Project Report, etc. for implementation of traffic and transport infrastructure) in coordination with other relevant departments of MCGM and organisations MMR/ State Government;
e) Preparation of Capital Investment Plans (CIP) and annual budgets for the Traffic & Transportation Department; and

f) Identify training programs on various aspects related to traffic engineering, transportation planning and highway engineering and ensure that, the expertise of the technical staff of the department is enhanced with time.

With time, the functions and responsibilities of the Traffic & Transportation Department of MCGM are expected to increase. Hence, Mobility Plan recommends implementation of the proposed institutional changes at the earliest.

7.2.3 Mobility Plan proposed Institutional Changes for Mumbai Traffic Police

Traffic congestion, transportation issues in Greater Mumbai are very complex as the population and employment densities are very high in many areas of Greater Mumbai, limited land for development and providing adequate transport infrastructure, linear city and narrow street networks, informal hawking activity near the suburban railway stations and major activity centres, etc. MCGM and Mumbai Traffic Police (MTP) regularly monitor traffic management and regulations enforcement on major roads of Greater Mumbai with a traffic police force of about 3,500 traffic police officers/ constables. In addition, Mumbai Traffic Police employs Traffic Wardens who work voluntarily. The issues and concerns of MTP are given at *BOX 7-3*, as regards institutional strengthening.

Box 7-3: Issues and Concerns of MTP

a) Lack of staff for effective traffic control and management, parking regulations, etc.;
b) Difficulty in coordinating with MCGM and other organisations;
c) Lack of monetary resources for traffic police infrastructure;
d) Functional responsibility unrelated to available resources;
e) Inadequate trained staff resulting in inability to deal with the problems they encounter; and
f) *Inadequate computer and communication facilities.*

Existing institutional setup of MTP are shown in Figure 7-12. The following institutional changes are proposed:

a) Enhancing the strength of Mumbai Traffic Police with additional staff at various levels for effective coordination with other organisations for effective traffic control and management, implementation of enforcement measures, planning of traffic diversion schemes during implementation of road widening, development of missing links, during construction of metro/ suburban corridors, etc.
   - One additional position at DCP level: DCP (Planning & Coordination, Road Safety and Administration);
   - Three positions at ACP level for planning & coordination in place of single ACP for planning: ACP (Plan-1: City), ACP (Plan-2: Western Suburbs), ACP (Plan-3: Eastern Suburbs);
   - One additional ACP for Prosecution & Road Safety i.e. ACP (Prosecution & Road Safety)
   - Superintendent Engineer (one position) for effective coordination with MCGM for implementation of traffic infrastructure in Greater Mumbai;
   - Additional Sr. Police Inspectors for Planning & Coordination, Prosecution, Traffic management and regulation (5 By 2019; 11 by 2024 and 24 by 2034);
   - Additional PI, API, PSI, etc. as per Table 7-1; and
   - One Superintendent Engineer with Electrical/ Computer Science background to plan, coordination and oversee the implementation of traffic signals, IT based enforcement measures, etc.

b) Skill & Technology transfer (traffic engineering, road safety, GIS, website management, etc.) through

professional organizations.

Table 7-1: Existing and Proposed Enhancements of staff strength of Mumbai Traffic Police

Designation/ Rank	2015	By 2019	By 2024	By 2034
Joint Commissioner Police	1	1	1	1
Additional Commissioner Police	1	1	1	1
Deputy Commissioner Police	3	4	4	4
Assistant Commissioner Police	9	11	11	11
Senior Police Inspector	17	22	28	41
Police Inspector	32	42	54	80
Assistant Police Inspector	33	43	55	81
Police Sub Inspector	152	199	254	376
Assistant Sub Inspector	144	189	241	357
Police Hawaldar	763	1,000	1,276	1,889
Police Naik	785	1,029	1,313	1,944
Police Constable	1,482	1,943	2,480	3,671
Representative	110	144	184	272
Total	**3,518**	**4,611**	**5,885**	**8,711**

Proposed institutional changes for MTP are shown in Figure 7-13.

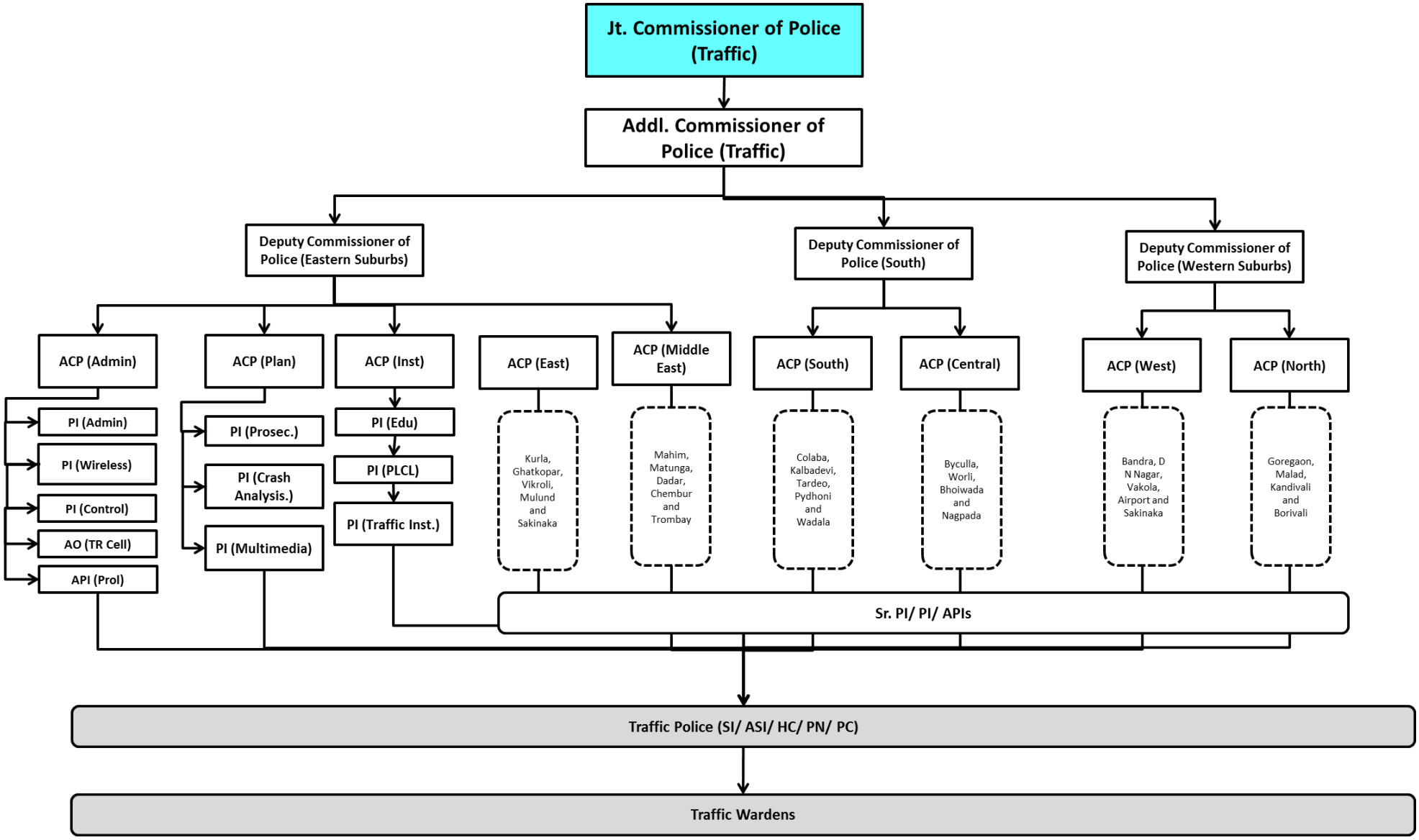


Figure 7-12: Existing Institutional Setup of Mumbai Traffic Police

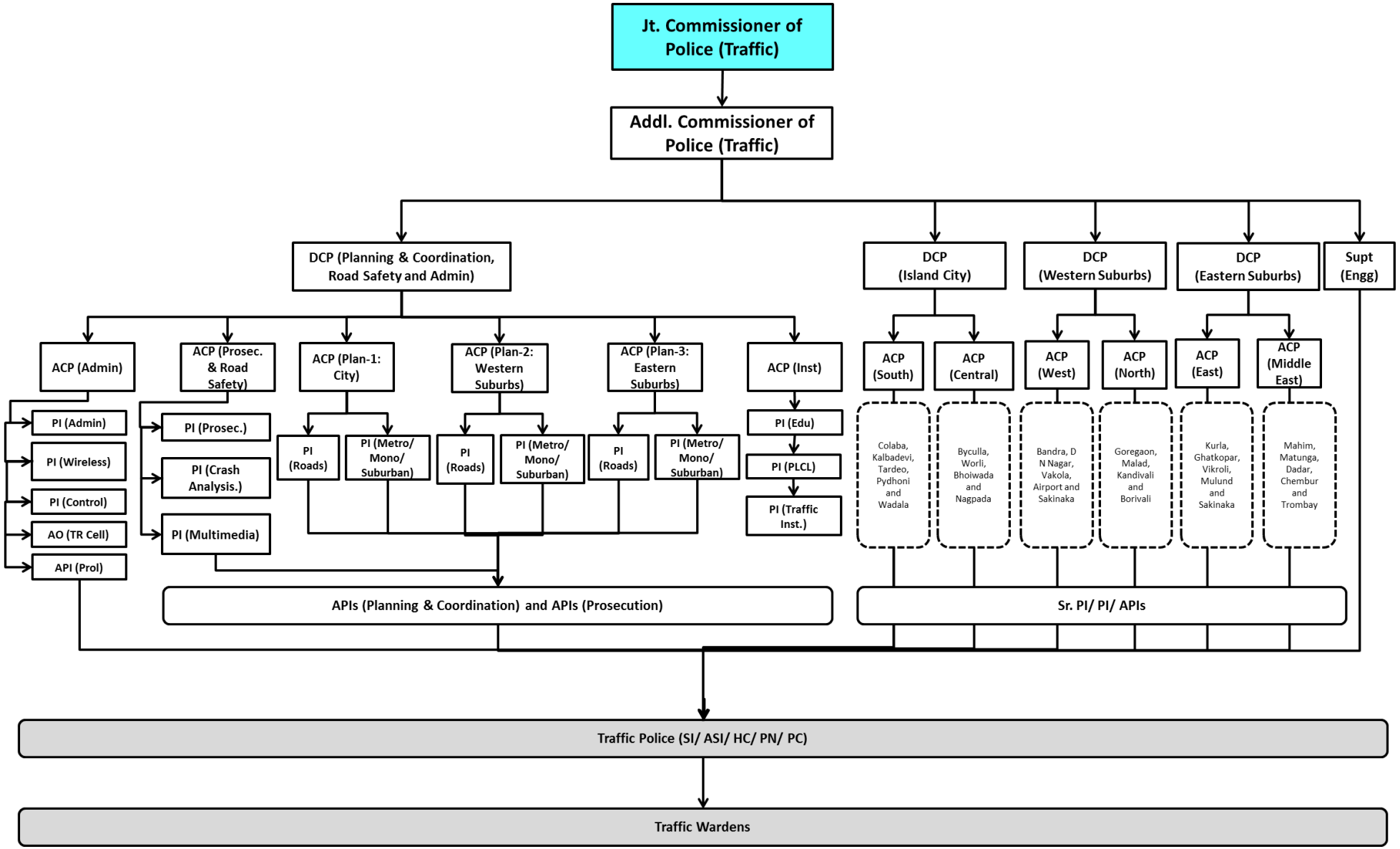


Figure 7-13: Proposed Institutional Setup of Mumbai Traffic Police

8. SUMMARY AND WAY FORWARD

8.1 Summary

Summary on primary and secondary data analysis and travel demand and network analysis is as follows:

a) *Population of Greater Mumbai (2014): 12.7 million (52.7% of MMR); Employment (2014): 5.9 million (61.5% of MMR);*
b) *Area of Greater Mumbai: 458 sqkm (10.5% of MMR);*
c) *Forecasted population for the horizon year 2019, 2024 and 2034 is 13 million, 13.3 million and 13.9 million respectively. Forecasted employment for the horizon year 2019, 2024 and 2034 is 6.7 million, 7.1 million and 8.0 million respectively;*
d) *Primary Surveys (Home Interview Surveys (HIS) – 6,000 sample; Traffic volume count surveys at Outer Cordon: 24 hrs. (6 no.); Origin-Destination surveys at Outer Cordon locations: 24 hrs. (6 no.); Traffic volume count surveys across Screen lines: 24 hrs. (37 no.); Road network inventory updations survey; Speed & Delay study; Classified turning volume count surveys for 16 hrs. (50 no.); Pedestrian count surveys for 16 hrs. (25 no.); and Parking surveys for 16 hrs. (25 no.);*
e) *HIS Analysis: Average Household Income: Rs. 20,000 per month; Average Income of the Worker/ Earner: 11,400 per month; Mode Split: NMT: 46% and Motorised: 54%; Motorised Mode Split: Public Transport: 67.0%; IPT: 16.1% and PV: 16.9%; Average expenses on transport per month per person: Rs. 1,220/- ; Per Capita Trip Rate (PCTR) per day including walk trips: 1.7; Per Capita Trip Rate (PCTR) per day Motorised trips: 0.9; Peak periods: 6:00 to 11 hrs and 17:00 to 22:00 hrs.;*
f) *Other Surveys: Total traffic entering and leaving Mumbai: 5.64 lakh vehicles; At Outer Cordon, traffic growth observed is 6.5% (CAGR during 2005-14); % of road network having journey speed < 20 kmph: 57%; Average Parking Demand/ Supply: 2.32;*
g) *Vehicle growth in Greater Mumbai: No. of vehicles on road as on 31st March of 2015: 25.46 lakhs; No. of Cars and Two wheelers (private vehicles) on road as on 31st March of 2015: 8.2 lakhs and 14.5 lakhs respectively (Total: 22.7 lakhs, 89% of the total vehicles); 2001 to 2015 data indicates that, Two wheelers have grown at 8.9% Compound Annual Growth Rate (CAGR), Cars have grown at 6.4% CAGR and Private Vehicles growth is 7.9% CAGR; Average number of private vehicles added on to roads per day : 700;*
h) *Greater Mumbai: Motorised mode split during morning peak period (6:00 to 11:00 hrs.) after validation of travel demand for the base year (2014): Public transport (Suburban, bus, metro and monorail): 71.6%; IPT (Auto and Taxi): 9.1% and Private Vehicles (Two wheeler and Car): 19.3%. Daily Motorised mode split for the base year (2014): Public transport (Suburban, bus, metro and monorail): 61.2%; IPT (Auto and Taxi): 12.4% and Private Vehicles (Two wheeler and Car): 26.4%; and*
i) *Mumbai Metropolitan Region (MMR): Daily Motorised mode split for the base year (2014): Public transport (Suburban, bus, metro and monorail): 69.9%; IPT (Auto and Taxi): 8.5% and Private Vehicles (Two wheeler and Car): 21.6%.*

The recommended transport network plans for the horizon year 2034 i.e. Highway Network, Transit Network, Widening Links, Missing links and Exclusive Bus lane Network have been shown in Figure 8-12 to Figure 8-16 respectively. Some of the salient features of the proposed short and medium term plans and their extent by 2034 are described below:

a) *The length of metro network for the horizon year 2019 and 2024 is 11 km and 117 km respectively (inclusive of existing line 1 metro corridor), which further expands to 152 km by 2034. Since MMRDA, MMRC etc. are actively planning/ executing major transportation projects which may not be available for public by 2019 and due to that majority of the new metro network corridors are required by 2024. The metro lines considered are of twin track i.e. one track per direction;*
b) *Implementation of suburban network i.e. MUTP II projects as well as CTS – Panvel fast corridor, Premium corridor between Andheri – Virar, Premium Elevated Corridor between Kurla - Thane – Bhiwandi, CBTC on harbor line, trespass control measures, SATIS, rolling stock, etc. are recommended. An approx. investment needed for these is assessed to be INR 1,058 crores (2016-2019), INR 11,276 crores (2016-2024) and INR 17,934 crores (2016-2034);*
c) *The highway network, which includes higher order transport network (fully access controlled), arterial and sub arterials corridors with RoW greater than 18m for the horizon year 2019 and 2024 are 1,242 km and 1,500 km cumulative respectively. The 2024 network is further required to be developed and augmented by another 190 km by 2034 to be extending over 1,688 km;*
d) *Along some of these corridors, Exclusive Bus Lanes (EBL)/ BRTS have been proposed for the horizon years where the travel demands on parallel metro corridors were insufficient to justify investments in a metro line for the time horizons being considered. The approximate length of EBL network proposed by 2019, 2024 and 2034 is 74 km, 153 km and 257 km cumulative respectively;*
e) *Inter-State bus terminals, inter-city/ intra-regional bus stations and truck terminals have been proposed as part of transport plan for the horizon years 2019: INR 248 cores, 2024: INR 496 cores and 2034: INR 826 cores cumulative costs;*
f) *Road safety measures, traffic management measures are being recommended. These measures include intersection improvements, flyovers/ interchanges/ elevated roads, pedestrian facilities (FOBs and Subways), ROBs/ RUBs, footpath improvements, traffic signal installation/ Area Traffic Control Systems, traffic signs and marking, infrastructure for traffic police, Station Area Traffic Improvement Schemes (SATIS) outside the suburban station areas, etc. An approx. investment needed for these is assessed to be INR 3,821 crores (2019), INR 7,332 crores (2024) and INR 11,793 crores (2034);*
g) *Along the entire higher order road/highway network and on proposed new and upgraded arterial/sub arterial roads it is*

recommended to have footpath facilities on either side with guard rails (typically of to 2.0 m width). This is for safe movement of pedestrians. The cost for footpaths is included in the roadway costs;

h) *Safety measures within the existing suburban railway stations like FOBs with escalators (24 no. by 2019; 52 by 2024 and 100 by 2034) for non-rail commuters, provision of guard rails between the tracks to avoid crossing of tracks by rail commuters, etc. have been proposed. Budget provisions for these improvements are INR 760 crores;*

i) *NMT Policy and Parking Policy for Greater Mumbai are prepared;*

j) *Implementation of integrated fare structure and Common Ticketing among existing public transport systems has been recommended;*

k) *The total cost of transport network for the horizon year 2019, 2024 and 2034 is INR 0.39, INR 1.29 and INR 1.68 lakh crores cumulative respectively @ 2014-15 prices;*

l) *The proposed transport network plans for the horizon years 2019, 2024 and 2034 as a whole are found to be economically viable with positive net present values and EIRR greater than 12% (EIRR for the case of 20 years analysis period as well as 30 years analysis period is 12.44% and 15.0% respectively for scenario of 20% increase in project cost coupled with 20% reduction in network benefit;*

m) *The total infrastructure investment is proposed to be funded by 18.7% by Government of India, 18.8% by Debt from Multilateral/Bilateral/Domestic Institutions, 62.3% by Government own funds (MCGM/ Development Authorities/ State Government) and 0.2% by private investment in PPP format.*

n) *Summary on short (2016-19), medium term (2020-2024) and long term (2025-34) proposals is presented in Table 8-1 . Broad shares on investment needs with respect to stakeholders is presented in Table 8-2. The share of MCGM is about INR 69,000 crores i.e. about 41% of the total cost of traffic & transport infrastructure; and*

o) *Institutional arrangements/changes are proposed for effective planning of infrastructure in MCGM, such as renaming of existing Traffic Department as "Traffic & Transportation Department", enhancing the strength and expertise of Traffic & Transportation Department, creation of "Parking Cell", etc. Institutional changes also proposed for Mumbai Traffic Police for effective coordination with other stakeholders, enhancement of strength and expertise of traffic police, etc.*

Table 8-1: Summary on Short, Medium and Long term Proposals within Greater Mumbai

Sr. No	Parameter	2014	By 2019	By 2024	By 2034
1.	Population, million*	12.7	13.0 (2.4%)	13.3 (4.7%)	13.9 (9.4%)
2.	Employment, million*	5.9	6.7 (8.1%)	7.1 (14.5%)	8.0 (29.0%)
3.	Travel demand,(million person trips) *	4.3	5.0 (17.6%)	5.7 (33.6%)	6.6 (53.5%)
4.	Length of major Road network (Km)**	1,186	1,242 (4.7%)	1,500 (26%)	1,688 (42%)
5.	Length of major Road network (Lane-Km)	4,470	5,493(23%)	6,573 (47%)	7,340 (64%)
6.	Missing Link (km)		41	125	220
7.	Widening of Roads (km)		197	466	710
8.	Length of Suburban Rail network (km)***	93	93	93	93
9.	Length of Metro Rail network (km)	11	11	117	152
10.	Length of Mono Rail network (km)	9	20	20	20
11.	Length of EBL/ BRTS (km)		74	153	257
12.	Average Network Speed (kmph)	20	23	38	37
13.	Greater Mumbai: Public Transport (%) Morning Peak Period (6 to 11 hrs.)	71.6%	70.5%	79.9%	73.9%
14.	Greater Mumbai: Public Transport (%) Daily	61.2%	59.9%	71.4%	64.0%
15.	ATCS (No. of traffic signals)	262	309	416	509
16.	Traffic Signals (No.)		48		
17.	SATIS (No. of suburban stations)		8	21	35
18.	Flyovers (No.)		6	18	18
19.	Elevated Roads (No.)		4	6	8
20.	RoB's/RuB's (No.)		10	20	28
21.	Inter-city Bus Terminals (No.)		1	2	4
22.	Truck Terminal (No.)		1	2	2
23.	Bus fleet (No.)		300	800	1800
24.	Bus Terminal-cum Depot for Intra-city Bus operations		3	8	18
25.	Intersection Improvements (No.)		30	80	200
26.	FOBs/ Subways (No.)		25	50	100
27.	Cycle Tracks along the existing roads (km)		90	240	540

* Figures in brackets show increase over base year (2014); ** Network Considered for CMP Study and *** Length of suburban network is considered for the horizon years is kept same as that of 2014 as additional corridors are coming in the same RoW

Table 8-2: Summary on Short, Medium and Long term Investment Needs and Percentage share with respect to Stakeholders

Phase	MCGM	MMRDA	BEST	Traffic Police	IR/ MRVC/ GoM	Total
Short Term Proposals (2016-2019)	7,962	28,474	597	225	1,269	38,528
Medium Term Proposals (2020-2024)	47,831	30,974	757	375	10,408	90,346
Long Term Proposals (2025-2034)	13,207	16,835	1,236	750	6,682	38,710
Total	**69,001**	**76,283**	**2,590**	**1,350**	**18,359**	**167,583**
Short Term Proposals (2016-2019)	20.7%	73.9%	1.6%	0.6%	3.3%	100.0%
Medium Term Proposals (2020-2024)	52.9%	34.3%	0.8%	0.4%	11.5%	100.0%
Long Term Proposals (2025-2034)	34.1%	43.5%	3.2%	1.9%	17.3%	100.0%
Total	**41.2%**	**45.5%**	**1.5%**	**0.8%**	**11.0%**	**100.0%**

8.2 Policies

Early action on some policies and acts which play crucial role in achieving successful implementation of the CMP as some of the policies need to be discussed debated and implemented. The major policy changes proposed under *CMP are as follows:*

a) NMT Policy;
b) Parking Policy; and
c) Policies to promote Transit Oriented Development (TOD).

8.3 Way Forward

The action plan for implementation of transport plan would begin by considering; approving and adopting the CMP study recommendations on traffic and transport infrastructure for Greater Mumbai. The action plan (Box 8-1) as follows:

BOX 8-1: THE ACTION PLAN

a) Prepare DPRs;
b) Introduce Travel Demand Management measures and implement NMT measures (Parking policy and NMT Policy);
c) Secure encroachment removal along major transportation corridors and restore capacities to safely and effectively move people and vehicles;
d) Implementation of proposed institutional changes in Traffic Department of MCGM and Mumbai Traffic Police;
e) Implement measures to protect long term transportation corridors (protection of Right of Way);
f) Review and updating of transport investment plans and priorities every 5 years;
g) Implement policies to promote Transit Oriented Development; and
h) Implementation of Integrated Fare Structure and common ticketing among public transport systems.