

मुंबई महानगर प्रदेश विकास  
प्राधिकरण



## Mumbai Metropolitan Region Development Authority



## Problem of Urban Transportation in Metropolitan Region of Mumbai: Suggestions and Recommendations

February, 2021



**Mumbai Metropolitan Region  
Development Authority**



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in Metropolitan Region of Mumbai:  
Suggestions and Recommendations**



## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1-1</b>
1.1	BACKGROUND .....	1-1
1.2	CTS FOR MMR UPDATION STUDY BY MMRDA.....	1-3
1.3	CONTEXT FOR THE PRESENT STUDY.....	1-5
<b>2</b>	<b>TRAVEL CHARACTERISTICS – ISSUES &amp; PROBLEMS.....</b>	<b>2-1</b>
2.1	HISTORICAL TRENDS.....	2-1
2.2	HIS ANALYSIS.....	2-3
2.3	EXTERNAL TRAVEL.....	2-5
2.4	SUB-URBAN RAILWAYS .....	2-8
2.5	TRAVEL BY BUS.....	2-9
2.6	TRAVEL BY PARA TRANSIT MODES.....	2-10
2.7	TRAVEL BY PRIVATE VEHICLES.....	2-11
2.8	PEDESTRIAN MOVEMENT .....	2-11
2.9	AVERAGE JOURNEY SPEEDS .....	2-12
<b>3</b>	<b>MUMBAI METROPOLITAN REGION: EXISTING LANDUSE.....</b>	<b>3-1</b>
3.1	DISTRIBUTION OF DEVELOPED AREA IN MMR.....	3-4
3.2	LAND AVAILABLE FOR DEVELOPMENT WITHIN MMR.....	3-4
<b>4</b>	<b>ASSESSMENT OF MAJOR DEVELOPMENTS IN MMR .....</b>	<b>4-1</b>
4.1	INTRODUCTION .....	4-1
4.2	NAVI MUMBAI INTERNATIONAL AIRPORT (NMIA) .....	4-1
4.3	GROWTH CENTERS AND REGIONAL INDUSTRIAL AREAS .....	4-3
4.4	CHATRAPATI SHIVAJI MAHARAJ MEMORIAL STATUE .....	4-5
4.5	DR. BABASAHEB AMBEDKAR MEMORIAL .....	4-5
4.6	NAGPUR MUMBAI SUPER COMMUNICATION EXPRESSWAY.....	4-6
4.7	MUMBAI-AHMEDABAD BULLET TRAIN.....	4-8
4.8	DHARAVI REDEVELOPMENT PLAN .....	4-10
4.9	MASTER PLAN OF WADALA NOTIFIED AREA.....	4-11
4.10	MASTER PLANS FOR EXPANSION OF PORTS IN MMR .....	4-14
	4.10.1 Master Plan efforts for Development of Mumbai Port .....	4-14
	4.10.2 Ongoing and Planned Development in JNPT .....	4-16
4.11	NAVI MUMBAI AIRPORT INFLUENCE AREA (NAINA).....	4-18
<b>5</b>	<b>GROWTH SCENARIOS .....</b>	<b>5-1</b>
5.1	VISION FOR MMR.....	5-1
5.2	DRAFT REGIONAL PLAN (DRP) SCENARIO .....	5-1
5.3	CTSU SCENARIO.....	5-2
5.4	EMPLOYMENT FORECASTS AND ASSESSMENT AT CLUSTER LEVEL.....	5-3
<b>6</b>	<b>TRAVEL DEMAND ANALYSIS AND RECOMMENDED TRANSPORT INFRASTRUCTURE (2017-2041).....</b>	<b>6-1</b>
6.1	TRAVEL DEMAND ASSESSMENT .....	6-7
	6.1.1 Daily Mode Split and Mode Split Changes: Mumbai Metropolitan Region .....	6-8
6.2	ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR MMR FOR THE HORIZON YEAR 2021 (IMMEDIATE TERM) .....	6-10
	6.2.1 Transit Plan: Horizon Year 2021.....	6-10
	6.2.2 Traffic Management Measures for the horizon year 2021.....	6-12



6.2.3	Broad Cost Estimates for the horizon year 2021 .....	6-13
6.3	<b>ASSESSMENT OF TRANSPORT INFRASTRUCTURE WITHIN MMR UNDER 2026 HORIZON (SHORT TERM).....</b>	6-14
6.3.1	Transit and Highway Plans .....	6-14
6.3.2	Traffic Management Measures under the 2026 Horizon .....	6-18
6.3.3	Broad Cost Estimates under the 2026 horizon .....	6-18
6.4	<b>ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR THE MMR UNDER THE 2031 HORIZON (MIDTERM).....</b>	6-18
6.4.1	Transit and Highway Plans .....	6-18
6.4.2	Traffic Management Measures under the 2031 Horizon .....	6-23
6.4.3	Broad Cost Estimates for the horizon year 2031 .....	6-23
6.5	<b>ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR MMR UNDER THE 2041 HORIZON (LONG TERM) .....</b>	6-23
6.5.1	Transit and Highway Plans .....	6-23
6.5.2	Traffic Management Measures under the 2041 Horizon .....	6-29
6.5.3	Broad Cost Estimates for the horizon year 2041 .....	6-29
6.5.4	Broad Cost Estimates under various horizons until 2041 .....	6-29
7	<b>TERMINALS AND MULTI MODAL HUBS .....</b>	7-1
7.1	INTERCITY RAIL TERMINAL .....	7-1
7.2	INTER STATE/INTERCITY BUS TERMINALS.....	7-3
7.3	TRUCK TERMINALS.....	7-5
7.4	PASSENGER WATER TRANSPORT TERMINALS.....	7-8
7.5	MULTI MODAL HUBS.....	7-10
8	<b>RESOURCE MOBILISATION.....</b>	8-1
8.1	INVESTMENT NEEDS FOR 2041 .....	8-1
8.2	EXPENDITURE TRENDS OF MAJOR STAKEHOLDERS ON TRANSPORT INFRASTRUCTURE IN MMR .....	8-2
8.2.1	Expenditure Trends on Transport Infrastructure by MMRDA, CIDCO and MRVC .....	8-2
8.2.2	Expenditure Trends on Transport Infrastructure by ULBs .....	8-2
8.3	IDENTIFICATION OF FUNDING SOURCES AND STRATEGIES FOR URBAN TRANSPORT INFRASTRUCTURE IN MMR.....	8-6
8.3.1	Sources of Finance .....	8-7
9	<b>INSTITUTIONAL ARRANGEMENTS .....</b>	9-1
9.1	BACKGROUND .....	9-1
9.2	INSTITUTIONAL CHANGES AS PROPOSED IN THE PREVIOUS STUDIES .....	9-2
9.2.1	Need for Institutional Change .....	9-3
9.2.2	The Existing Institutional Framework in the MMR .....	9-3
9.2.3	Regional Transport Authority.....	9-6
9.2.4	The Organisation and Staffing of MMRDA.....	9-12
9.3	MOBILITY PLAN PROPOSED INSTITUTIONAL CHANGES FOR MCGM .....	9-16
9.3.1	Existing Institutional Setup of MCGM .....	9-16
9.3.2	Proposed Institutional Changes to MCGM Traffic Transport Department Organization Structure.....	9-18
9.3.3	Mobility Plan proposed Institutional Changes for Mumbai Traffic Police .....	9-21
9.4	METRO PROJECT IMPLEMENTATION UNIT .....	9-25
9.5	CTS FOR MMR UPDATION STUDY PROPOSED INSTITUTIONAL CHANGES FOR T&C DIVISION OF MMRDA .....	9-27



9.5.1	MMRDA's Initiatives.....	9-27
9.5.2	Role of T&C Division.....	9-28
9.5.3	Vision for T&C Division.....	9-32
9.6	<i>INSTITUTIONAL ARRANGEMENTS FOR PLANNING AND IMPLEMENTATION OF PROPOSED BRTS, INTER CITY/ INTER STATE BUS TERMINALS, TRUCK TERMINALS AND RAIL TERMINALS IN MMR</i> .....	9-36
9.7	<i>OPERATION &amp; MAINTENANCE OF NEW METRO LINES – NEED FOR INSTITUTIONAL ARRANGEMENTS</i> .....	9-36
10	<b>SUMMARY AND WAY FORWARD</b> .....	<b>10-1</b>
10.1	CTS FOR MMR UPDATION STUDY BY MMRDA.....	10-1
10.2	CONTEXT FOR THE PRESENT STUDY.....	10-1
10.3	VISION FOR MMR.....	10-2
10.4	SUMMARY ON TRAVEL DEMAND AND NETWORK ANALYSIS .....	10-2
10.5	SUMMARY ON INVESTMENT NEEDS AND RESOURCE MOBILISATION.....	10-4
10.6	POLICIES .....	10-7
10.7	WAY FORWARD.....	10-7



## List of Tables

Table 2-1: Bus Operational Attributes Operated by BEST, NMMT, TMT, KDMT, MBMT, VVMT and MSRTC .....	2-9
Table 2-2: IPT Vehicles (Auto and Taxi) on Road as on 31 <sup>st</sup> March of each year: MMR .....	2-10
Table 2-3: Growth of Motor Vehicles in MMR (On Road as on 31 <sup>st</sup> March, every year) .....	2-11
Table 3-1: DP status of ULBs/SPA Areas .....	3-1
Table 3-2: Existing Land-use of MMR, 2016 .....	3-2
Table 3-3: Classification of Land Availability in MMR .....	3-3
Table 4-1: Details of Proposed Growth Centres .....	4-3
Table 4-2 : Details of Proposed Regional Industrial Areas .....	4-3
Table 4-3: RoW in various sections of Nagpur-Mumbai Expressway .....	4-8
Table 4-4: Proposed Development Plan for Wadala Notified Area .....	4-12
Table 4-5: Projected Population in Wadala Notified Area .....	4-13
Table 4-6: Master Plan for the Development of Mumbai Port – Proposed Plans and Investments .....	4-15
Table 5-1: Cluster Level Population - Draft RP Scenario .....	5-2
Table 5-2: Cluster Level Population - CTSU Scenario .....	5-2
Table 5-3: Cluster Level Employment - Draft RP Scenario .....	5-4
Table 5-4: Cluster Level Employment –CTS Updation Scenario .....	5-4
Table 6-1: Passenger Travel Demand for MMR– Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.) .....	6-5
Table 6-2: Goods Travel Demand (in vehicle trips) for MMR – Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.) .....	6-5
Table 6-3: External Travel in vehicles (MMR – Outside of MMR and vice versa) - Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.) .....	6-5
Table 6-4: Planning Parameters for the Base and Horizon Years .....	6-7
Table 6-5: Daily Passenger Travel Demand within MMR– Horizon Period 2021-41, in million .....	6-7
Table 6-6: Goods Travel Demand (in vehicle trips) for MMR– Horizon Period 2021-41, Morning Peak Period (6:00 to 11:00 Hrs.) .....	6-8
Table 6-7: External Travel in PCUs (MMR to Outside of MMR and vice versa) – Horizon Period 2021-41, Morning Peak Period (6:00 to 11:00 Hrs.) .....	6-8
Table 6-8: Daily Mode Split, Mumbai Metropolitan Region .....	6-8
Table 6-9: Daily Mode Split, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CTS Updation Study (2017) .....	6-9
Table 6-10: Daily Travel Demand Growth, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CTS Updation Study (2017) .....	6-9
Table 6-11: Vehicles on road as on 31 <sup>st</sup> March of 2005 and 2017 in MMR .....	6-10
Table 6-12: Metro Corridors Proposed upto Horizon Year 2021 .....	6-10
Table 6-13: Suburban Corridors Proposed upto Horizon Year 2021 .....	6-10
Table 6-14: Proposed Locations of Flyover for the horizon year 2021 .....	6-12
Table 6-15: Proposed Locations for Elevated Roads for the horizon year 2021 .....	6-13
Table 6-16: Proposed RoBs for the horizon year 2021 .....	6-13
Table 6-17: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2021 (in Crores) .....	6-14
Table 6-18: Metro Corridors Proposed upto the Horizon Year 2026 .....	6-14
Table 6-19: Proposed Suburban Network upto Horizon Year 2026 .....	6-15
Table 6-20: Proposed Highway Network up to 2026 Horizon .....	6-15
Table 6-21: Summary of Preliminary Cost Estimates for Proposed Transport System Improvements until 2026 (in Crores) .....	6-18
Table 6-22: Metro Corridors Proposed up to the 2031 Horizon .....	6-19
Table 6-23: Suburban Corridors Proposed for the Horizon Year 2031 .....	6-19
Table 6-24: Proposed Highway Network under 2031 horizon .....	6-20
Table 6-25: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2031 (in Crores) .....	6-23
Table 6-26: Proposed Metro Corridors up to 2041 horizon .....	6-24



Table 6-27: Proposed Suburban Corridors up to 2041 horizon .....	6-24
Table 6-28: Suburban System Capacity Enhancement Measures up to 2041 horizon .....	6-25
Table 6-29: Highway Corridors Proposed until 2041 horizon .....	6-25
Table 6-30: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2041 (in Crores) .....	6-29
Table 6-31: Summary of Preliminary Broad Cost Estimates for the Traffic & Transport Infrastructure until 2041 (in INR Crores) .....	6-30
Table 6-32: Year-Wise Investment Needs on Transport Infrastructure for the Horizon Period upto 2041 .....	6-31
Table 7-1: Proposed Bus Terminals .....	7-3
Table 7-2: Proposed Truck Terminals .....	7-5
Table 8-1: Expenditure Trends on Transport Infrastructure by MMRDA, CIDCO and MRVC .....	8-2
Table 8-2: Total Expenditure by ULBs on Transport Infrastructure (2010-11 to 2017-18) .....	8-3
Table 8-3: Revenue share in expenditure on Transport Infrastructure (2010-11 to 2017-18) .....	8-4
Table 8-4: Capital share in expenditure on Transport Infrastructure (2010-11 to 2017-18) .....	8-5
Table 8-5: Major Sources of Funding and their Share (by 2041) for Transport Infrastructure in MMR .....	8-7
Table 8-6: Sources of Funding: Development Charge .....	8-9
Table 8-7: Sources of Funding: Land and Asset Monetisation .....	8-9
Table 8-8: Sources of Funding: Development Charge and Land & Asset Monetisation .....	8-10
Table 9-1: Existing and Proposed Enhancements of staff strength of Mumbai Traffic Police .....	9-22
Table 9-2: Executive Posts for O & M .....	9-37
Table 9-3: Executive Posts for System Wing of Metro PIU (Metro Line 2A and Line 7) .....	9-37
Table 10-1: Summary on Immediate-term, Short-term, Medium-term and Long-term Proposals within MMR .....	10-4
Table 10-2: Summary of Preliminary Broad Cost Estimates for Proposed Traffic & Transport Infrastructure for Horizon Period upto 2041 (in INR Crores) .....	10-5
Table 10-3: Major Sources of Funding and their Share (by 2041) for Transport Infrastructure in MMR .....	10-6
Table 10-4: Summary on Revenue Sources for O&M Shortfalls .....	10-6



## List of Figures

Figure 1-1: CTS for MMR Updation Study Process .....	1-4
Figure 2-1: Population Growth Trend and Decadal Growth of MMR (1971 to 2011) .....	2-1
Figure 2-2: Private vehicle Population of MMR, Veh./1000 persons .....	2-2
Figure 2-3: Mode share without NMT .....	2-4
Figure 2-4: Expenditure on Travel (INR per month): Variation by Income .....	2-4
Figure 2-5: Reported Average Household Income by Income Range .....	2-5
Figure 2-6: Traffic flow at Outer Cordon (In PCUs and Vehicles/Day) .....	2-5
Figure 2-7: Location wise Share of Total Daily Traffic at Outer Cordon .....	2-6
Figure 2-8: Average Traffic Composition at Outer Cordon .....	2-6
Figure 2-9: Travel Pattern of Passenger Vehicles – Outer Cordon Locations .....	2-7
Figure 2-10: Travel Pattern of Goods Vehicles – Outer Cordon Locations .....	2-7
Figure 3-1: Landuse Composition of MMR, 2016 .....	3-3
Figure 3-2: Jurisdiction wise built up area in MMR .....	3-3
Figure 3-3: ULB/SPA wise built-up in MMR .....	3-4
Figure 3-4: ULB/SPA wise Land Available for Development in MMR .....	3-5
Figure 3-5: Jurisdiction wise Land Available for Development in MMR .....	3-6
Figure 4-1: Connectivity to NMIA .....	4-2
Figure 4-2: Location of Proposed Growth Centres and Regional Industrial Areas in MMR .....	4-4
Figure 4-3: Shivaji Memorial Complex (Conceptual Image) .....	4-5
Figure 4-4: Dr. B.R. Ambedkar Memorial (Dadar), Concept Diagram .....	4-6
Figure 4-5: Proposed Nagpur- Mumbai Super Communication Expressway .....	4-7
Figure 4-6: Proposed alignment Mumbai-Ahmedabad Bullet train .....	4-10
Figure 4-7: Proposed Development Plan for Wadala Notified Area .....	4-12
Figure 4-8 : Ongoing Developments at JNPT .....	4-17
Figure 4-9: Network for dispersal of Traffic resulting from JNPT .....	4-18
Figure 4-10: Location of NAINA in MMR .....	4-20
Figure 6-1: Classified Traffic Volume Count Locations in MMR .....	6-2
Figure 6-2: TAZ System for MMR .....	6-3
Figure 6-3: Overview of Updation of Travel Demand Models - Updation of CTS for MMR Study .....	6-4
Figure 6-4: Travel Demand and Transport Network Analysis for the horizon period upto 2041 – “Bottom-up Approach” National Urban Transport Policy .....	6-6
Figure 6-5: Proposed Transit Network Plan for Year 2021 .....	6-11
Figure 6-6: Proposed Transit Network up to the Horizon year 2026 .....	6-16
Figure 6-7: Proposed Highway Network up to the Horizon year 2026 .....	6-17
Figure 6-8: Proposed Transit Network up to 2031 Horizon .....	6-21
Figure 6-9: Proposed Highway Network up to 2031 Horizon .....	6-22
Figure 6-10: Proposed Transit Network up to 2041 horizon .....	6-27
Figure 6-11: Proposed Highway Network up to 2041 horizon .....	6-28
Figure 7-1: Proposed Inter-City Rail terminals in MMR .....	7-3
Figure 7-2: Proposed Inter-State/Inter-City Bus Terminals in MMR .....	7-4
Figure 7-3: Proposed Truck terminals in MMR .....	7-7
Figure 7-4: Proposed Passengers Water Terminals in MMR .....	7-8
Figure 7-5: Combined Map of All Proposed Terminals .....	7-9
Figure 7-6: Identified Potential Location for Multi-Modal Hub .....	7-10
Figure 8-1: Expenditure of MMRDA, CIDCO and MRVC on Transport Infrastructure: 2010-2017 .....	8-2
Figure 8-2: Total Expenditure of Municipal Corporations on Transport Infrastructure (2010-11 to 2017-18) .....	8-3
Figure 8-3: Total Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18) .....	8-3
Figure 8-4: Revenue Expenditure of Municipal Corporation on Transport Infrastructure (2010-11 to 2017-18) .....	8-4
Figure 8-5: Revenue Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18) .....	8-5
Figure 8-6: Capital Expenditure of Municipal Corporation on Transport Infrastructure (2010-11 to 2017-18) .....	8-5
Figure 8-7: Capital Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18) .....	8-6



Figure 9-1: Traffic & Transport Infrastructure in MMR- Multiplicity of Organisations.....	9-2
Figure 9-2: Existing MMRDA Structure .....	9-8
Figure 9-3: Existing Authority Composition .....	9-9
Figure 9-4: Executive Committee and Relation to MMIF Committee .....	9-9
Figure 9-5: UMMTA Composition, Sub Committees and UMMTA Relation with Executive Committee.....	9-13
Figure 9-6: Proposed Organisation Structure for MMRDA.....	9-13
Figure 9-7: Strategic Policy, Financial Planning and Investment Division and Sub-Committee .....	9-14
Figure 9-8: Organisational Structure for Regional Transport Department.....	9-15
Figure 9-9: Organizational Structure for Special Planning Areas and New Town Division .....	9-16
Figure 9-10: Organizational Structure of MCGM.....	9-17
Figure 9-11: Organisational Structure of Traffic Department, MCGM .....	9-18
Figure 9-12: Proposed Organisational Structure for Traffic & Transportation Department, MCGM .....	9-19
Figure 9-13: Existing Institutional Setup of Mumbai Traffic Police.....	9-23
Figure 9-14: Proposed Institutional Setup of Mumbai Traffic Police.....	9-24
Figure 9-15: Organizational chart of Metro PIU .....	9-26
Figure 9-16: Existing Organisation Structure of MMRDA .....	9-30
Figure 9-17: Existing Institutional Setup of Transport & Communications Division of MMRDA .....	9-31
Figure 9-18: Proposed Institutional Setup of Transport & Communications Division of MMRDA .....	9-35
Figure 9-19: Organization chart of the proposed O & M Unit.....	9-38



## List of Abbreviations

AAI	Airports Authority of India
AFC	Automatic Fare Collection
AGLR	Andheri-Ghatkopar Link Road
AIIB	Asian Infrastructure Bank
AKBSNA	Ambernath Kulgaon Badlapur Surrounding Notified Area
AM	Ante Meridian
AMC	Additional Metropolitan Commissioner or Additional Municipal Commissioner
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
BRTS	Bus Rapid Transit System
BSNA	Bhiwandi Surrounding Notified Area
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
CRZ	Coastal Regulation Zone
CSIA	Chhatrapati Shivaji International Airport
CSMT	Chhatrapati Shivaji Maharaj Terminus (formerly known as Victoria Terminus)
CTS	Comprehensive Transport Study (known as TranSfoRM)
CTSU	Comprehensive Transportation Study Updation
DBFOT	Design Built Finance Operate and Transfer
DC	Development Charge
DCP	Deputy Commissioner of Police
DCR	Development Control Regulation
DDP	Draft Development Plan
DAKC	Dhirubhai Ambani Knowledge City
DMIC	Delhi Mumbai Industrial Corridor
DMC	Deputy Municipal Commissioner
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
EBL	Exclusive Bus Lanes
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 Multiple Unit
EPP	Evening Peak Period
FATC	Fully Adaptive Traffic Control
FHWA	Federal Highway Administration
FOB	Foot Over Bridge
FSI	Floor Space Index
GC	Growth Centre
GDDP	Gross District Domestic Product
GIS	Geographic Information System
GMLR	Goregaon Mulund Link Road
GMUA	Greater Mumbai Urban Agglomeration
Gol	Government of India
GoM	Government of Maharashtra
GPS	Global Positioning System
GR	Government Resolutions
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
IFSC	International Financial Services Centre
IIPA	Indian Institute of Public Administration
IMP	Integrated Mobility Plan
INCCAT	Individual Income Category
IPT	Intermediate Public Transport
IR	Indian Railways
IRC	Indian Roads Congress
IT	Information Technology
ITES	Information Technology Enabled Service
ITS	Intelligent Transport System
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 Bahadur 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
MoHUA	Ministry of Housing and Urban Affairs
MMB	Maharashtra Maritime Board
MMC	Multi Modal Corridor
MMIF	Mumbai Metropolitan Infrastructure Fund
MMR	Mumbai Metropolitan Region



MMRC	Mumbai Metro Rail Corporation
MMRDA	Mumbai Metropolitan Region Development Authority
MMTPA	Million Metric Tons Per Annum
MNL	Multi Nomial Logit
MoEF	Ministry of Environment and Forests
MoR	Ministry of Railways
MoUD	Ministry of Urban Development
MPC	Metropolitan Planning Committee
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
MSRTC	Maharashtra State Road Transport Corporation
MTHL	Mumbai Trans Harbor Link
MTNL	Mahanagar Telephone Nigam Limited
MTP	Mumbai Traffic Police
MTPA	Million Tons Per Annum
MTSU	Mumbai Transformation Support Unit (under AILSG)
MUIP	Mumbai Urban Infrastructure Project
MUTP	Mumbai Urban Transport Project
NAAQS	National Ambient Air Quality Standards
NAINA	Navi Mumbai Airport Influence Notified Area
NCPA	National Centre for Performing Arts
NDDP	Net District Domestic Products
NDP	Net Domestic Products
NEERI	National Environmental Engineering Research Institute
NGO	Non-Governmental Organization
NH	National Highway
NHAI	National Highways Authority of India
NHB	Non Home Based
NHSRC	National High Speed Rail Corporation
NMIA	Navi Mumbai International Airport
NMMC	Navi Mumbai Municipal Corporation
NMT	Non Motorised Transport
NMSEZ	Navi Mumbai Special Economic Zone
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
PIU	Project Implementation Unit
POL	Petroleum, Oil and Lubricant
PPL	Public Parking Lot
PPP	Public Private Partnership
PU	Polyurethane Coating
PUP	Pedestrian Underpass
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



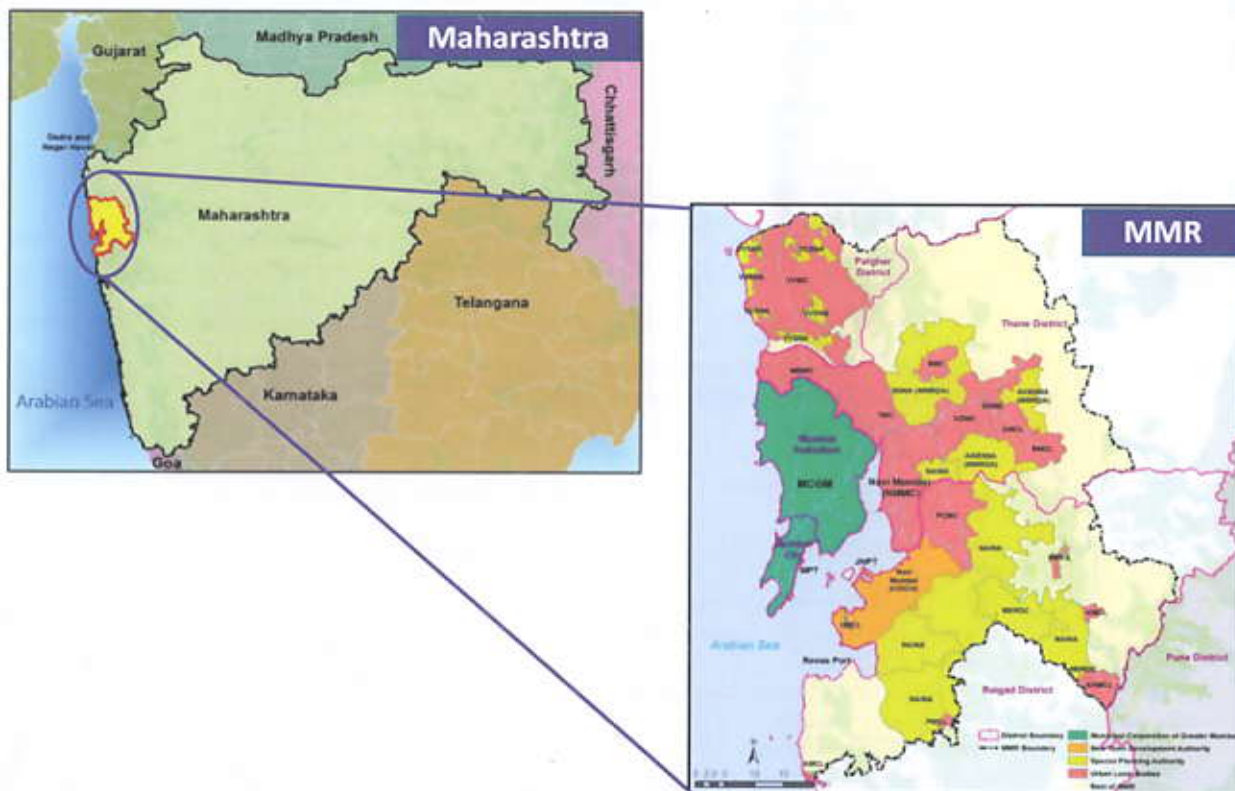
RoW	Right of Way
RP	Regional Plan
RSI	Road Side Interview
SATIS	Station Area Traffic Improvement Scheme
SCLR	Santa Cruz –Chembur Link Road
SEEPZ	Santacruz Electronics Export Processing Zone
SEZ	Special Economic Zone
SGNP	Sanjay Gandhi National Park
SH	State Highway
SI	Sub Inspector
SL	Screen Line
SPA	Special Planning Authority
SPM	Suspended Particulate Matter
SPV	Special Purpose Vehicle
SRD	Slum Redevelopment
TA	Technical Assistance
TAC	Technical Advisory Committee
TAZ	Traffic Analysis Zones
TBIB	Thane-Belapur Industrial Belt
TBM	Tunnel Boring Machine
TDM	Travel Demand Modelling
TDR	Transferable Development Rights
TDS	Total Dissolved Solids
TIA	Traffic Impact Assessment
TLFD	Trip Length Frequency Distribution
TOD	Transit Oriented Development
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 Metropolitan Transport Authority
URDPFI	Urban and Regional Development Plans Formulation and Implementation
USEPA	United States Environmental Protection Agency
UTF	Urban Transport Fund
UTP	Urban Transport Planning
VAG	Versova Andheri Ghatkopar
VMS	Variable Message Sign
VOC	Vehicle Operating Cost
VOT	Value of Time
VRS	Voluntary Retirement Schemes
VT	Victoria Terminus (now called as CSMT)
VUP	Vehicle Under Pass
VVCMC	Vasai Virar City Municipal Corporation
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

Mumbai Metropolitan Region (MMR) is one of the fastest growing metropolises in India. With a population of about 22.8 million based on 2011 censuses (estimated population of MMR was 24.6 million based on 2016 Draft Regional Plan Report), it is ranked as the sixth largest Metropolitan Region in the world. This accounts for approximately one-fifth of the Maharashtra state total population. Greater Mumbai is the mother city and represents a significant engine of growth for the whole region. It is worth noting that other areas in MMR viz. Thane, Navi Mumbai, Vasai-Virar and Mira Bhayander have also experienced major economic growth, and MMR has become the land of opportunities for many people in India. In regards to overall planning, economic and transportation perspective, almost the entire urbanized areas of the Region have been functioning as a single entity. Commuters usually travel across municipal jurisdictions for work, business, education, shopping, recreation, tourism and personal needs.



The region's primacy in the economic wellbeing of the country has been well appreciated. Achieving sustainable growth is pivotal towards accomplishing the larger developmental objectives, maintaining the quality of life, including steadily enhancing the vitality of the metropolis. The metropolis, like many other major cities of the world, has been experiencing significant deficiencies in the social and physical infrastructural supply, while governments have been making concerted efforts to address such deficiencies over time. These reinstating efforts need to be intensified and expedited, in order to overcome the backlog of the cumulative needs and to enhance MMR's contribution towards national development objectives.



Mumbai Metropolitan Region Development Authority (MMRDA) is a planning, development, coordinating and implementing agency established to ensure the balanced development combined with the sustainable growth of the MMR area. MMRDA's focus has ever been to make the MMR area a hub of economic activities through promoting infrastructure development and improve the quality of life. The Authority has also been instrumental in providing various infrastructure facilities in the region.

Given the growth dynamics and dimensions of transportation problems, and more importantly to plan and develop sustainable transportation systems under the long-term perspective, MMRDA had initiated a comprehensive transportation study for the MMR area since 2005, in technical consultation with and financial assistance of the World Bank. The study was named as **TRANSFORM** and was commenced under the Mumbai Urban Transport Project (MUTP) in 2005. The study was carried out during a three (3) year period i.e. from 2005 to 2008. The **TRANSFORM** study recommended appropriate transportation improvements to be implemented under various horizons until 2031. The recommended transportation improvements included highway network improvements, installation of metro network, inter-city bus routes, provisioning rail terminals, truck terminals and implementation of appropriate traffic management measures (i.e. construction of grade separated junctions, flyovers, Rail-over-Bridges (RoBs)/ Road-under-Bridges (RUBs), Pedestrian underpasses (PuP)/ Foot-over-Bridges (FOBs), and Area Traffic Control Systems, etc.). Project preparatory works for some of the transport corridors have been completed, while the efforts are on for some other corridors by various planning and executing organizations of MMR.

Economic growth and spatial developments are quite often governed by the quality and quantity of transport infrastructure provided. An inadequate transport facility generates problems of congestion, delays, and higher carbon footprint causing significant socio-economic costs to the society, while an unconstrained facility, although might not be economical, often supports the long-term spatial development strategies of settlements and regions. An optimal level of sustainable infrastructure provisioning is the key to planned development. Under this overall guiding principle, MMRDA aims to prepare an investment program for augmenting and upgrading the capacity of the transport infrastructure in MMR area adhering to the recommendations provided in the Comprehensive Transportation Study (CTS) for the MMR area.

During last decade, MMRDA and other stakeholders within the MMR area have initiated many transport infrastructure projects i.e. metro, monorail, highway, suburban rail projects. In continuation the MMRDA also intends to further enhance the transport network in MMR. Furthermore, during the last decade, post completion of CTS for MMR study, MMR has been widely experiencing major land area developments within the MMR jurisdiction. Therefore, a need is felt to update the CTS for MMR Study. Apparently, the triggers for updating the CTS Study are as follow:

- a) MMRDA has prepared development plans for twenty-seven (27) villages within the notified areas in and around Kalyan and fifty-one (51) villages surrounding Bhiwandi. This is one of the major triggers towards updating the CTS;
- b) There are land-use changes in and around Wadala resulting in re-zoning. An independent 'Master Plan' has been under preparation by MMRDA for Wadala Notified Area. The incorporation of such rezoning also triggers the updating of CTS;
- c) MCGM has been preparing a 'Revised Draft Development Plan' for the Greater Mumbai area, which requires incorporation in the existing CTS;



- d) CIDCO has prepared another Master Plan for Navi Mumbai Airport Influence Notified Area (NAINA), which also requires further incorporation in the CTS;
- e) Changing scenario of Special Economic Zones (SEZs) in MMR should also be integrated in the updated CTS;
- f) Cluster Development, Floor Space Index (FSI) Increase proposals also triggers updating of the CTS;
- g) MMRDA has prepared Draft Regional Plan(RP) for the period 2016-2036 and suggestions/ objections are in progress;
- h) Mumbai Port Trust's study on "Planning, Design, and Program Management Support for Master Planning and Infrastructure Design of the Mumbai Port Complex of MbPT" is in progress and needs incorporation in the CTS; and
- i) MMRDA and other stakeholders have carried out a number of planning studies on traffic and transport infrastructure. In course of the study some changes in the alignment of suburban, metro and highway corridors have been considered with respect to those that were suggested in the CTS for MMR study.



## 1.2 CTS FOR MMR UPDATION STUDY BY MMRDA

MMRDA appointed M/s LEA Associates South Asia Pvt. Ltd. in JV with LEA International Ltd., Canada as Consultants for updation of previous CTS for MMR Study 2005-08 i.e. **TRANSFORM** in 2017. The updation study has been called henceforth as **TRANSFORM-2**. The main objectives of the study are



to capture the travel pattern of MMR, to develop Urban Transportation Model as a planning tool, to evolve a long-term transportation strategy for MMR, and identify a phase-wise investment program in the transport system. The study aims to update the MMR long term strategy developed in 2017-20 and identify the practical and effective investment program upto 2041. The main emphasis of the study is to improve the traffic and transportation scenario in the whole MMR.

The Consultants for the study have submitted the Draft Final Report for MMRDA's review in December 2019. Process followed in CTS for MMR Updation study is presented in Figure 1-1. The Draft Final Report covers the following aspects:

- 1) Review of Earlier CTS Model and Assessment of Planning Parameters for 2017 based on Census 2011 and recent Economic Census;
- 2) Data Collection: Through Secondary Sources and Identify and Carryout Additional Primary Surveys;
- 3) Updating/ Modifying CTS Recommended Landuse Scenarios for MMR for various Horizon Years;
- 4) Assessment of Major Developments & Landuse Updation for the Base Year 2017;
- 5) Updating the CTS Model and Analysis using State-of-the-art Urban Transportation Planning Software;
- 6) Assessing/ Updating of Planning Parameters, Transport Network Updations for the Horizon Period up to 2021, 2031, and 2041 and Network Analysis;
- 7) Analysis & Evaluation of Travel Demand for Updated Landuse Scenario for Different Horizon periods 2021, 2031, and 2041;
- 8) Rephasing, Reprioritization & Cost Assessment of CTS Recommended Transport Infrastructure projects including all developments, for the horizon periods 2021, 2031, and 2041;
- 9) Preparation of Multi-Modal Integration Plan;
- 10) Preparation of TOD/TIA guidelines for MMR;
- 11) Fare Sensitivity Analysis of Public Transport Modes in MMR;
- 12) Skill and Technology Transfer; and
- 13) Stakeholder workshops.

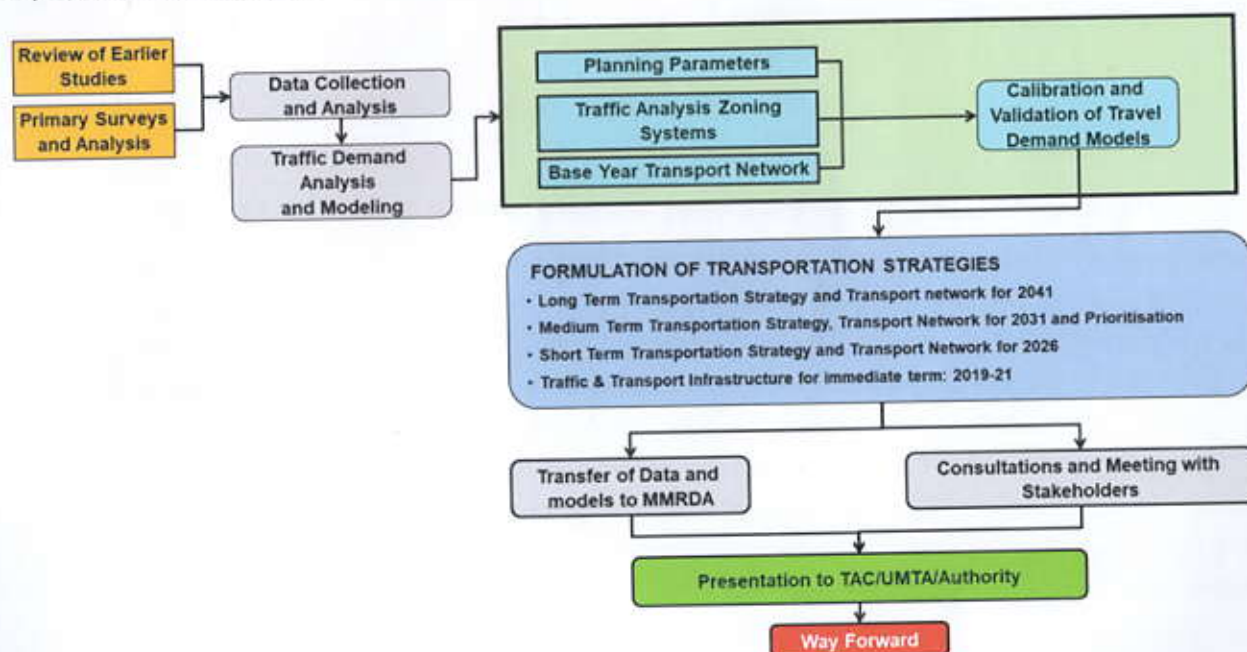


Figure 1-1: CTS for MMR Updation Study Process

MMRDA has sent the report to various stakeholders for their comments and suggestions and the Final Report will be prepared shortly. Once the stakeholders provide their views/ suggestions on the Draft Final Report, the consultants will submit a Final Report incorporating all suggestions/comments and we are expecting the same by end of March 2021.

### 1.3 CONTEXT FOR THE PRESENT STUDY

MMRDA received communication from Indian Institute of Public Administration (IIPA), Maharashtra Regional Branch (MRB) for taking up the Research Project: The Problems of Urban Transportation in Metropolitan area Mumbai by MMRDA covering the following:

- 1) Evaluate the existing infrastructure, governance mechanism and analyse the problems faced by the commuters residing in Mumbai metropolitan region;
- 2) Consider future growth of the region and environmental implications the integrated model plan to be developed for public transportation in the metropolitan area; and
- 3) Suggestions and recommendations including present status of transportation and future plan for integrated transport system.

MMRDA appointed M/s LEA Associates South Asia Pvt. Ltd. to review the secondary and primary data, reports submitted, transport network plans prepared for MMR as part of CTS for MMR Updation study in the context of the above requirements and prepare a report in October 2020 and Consultants submitted their report in February 2021.

This report provides an insight and overview of the existing traffic transport infrastructure, travel demand & transport network analysis for the base year, reflects the recommendations on improvements of the traffic & transport infrastructure for MMR under various horizons until the year of 2041, summaries the investment needs assessment, potential funding sources, suggests proposed institutional changes and discusses way forward.



## 2 TRAVEL CHARACTERISTICS– ISSUES & PROBLEMS

### 2.1 HISTORICAL TRENDS

The share of the urban population in India has been steadily increasing over the decades, which has currently reached almost 31.16 % of the total population. Similarly, the urban population share of Maharashtra indicates a steady increase in the urbanization from 31.2% during 1971 to 45.2% under the recent time, reflecting a steady growth of urban centers in Maharashtra. On the contrary the urban population within the MMR area has seen a decline from 46.0% during 1971 to 42.0% during 2011.

Population growth trend of MMR during the period of 1971 to 2011 along with decadal growth rate is presented in Figure 2-1. Decadal growth rate of population decreased from 3.63%, observed during 1971-81, to 1.64% during 2001-11. Similar to the MMR trend of urban population change, the Greater Mumbai population has declined from 76.9% during 1971 to 54.6% during 2011. This declination reflects a strong indication towards the growth of the other neighboring municipal corporations that are situated within the metropolitan boundary. The Work Force Participation Rate (WFPR) for urban and rural MMR is approximately 39.75% and 41.04%, respectively. Both the percentages are less than that of Maharashtra, which is approximately 42% and higher than the nationwide WPR, which is 39.1% (Census 2011).

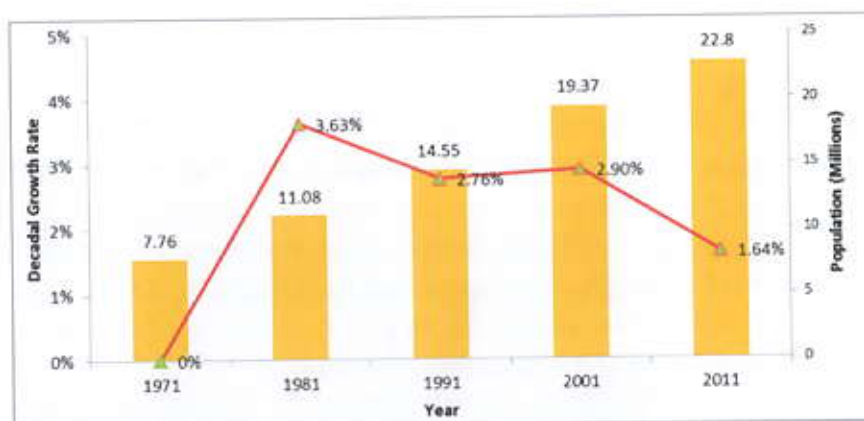


Figure 2-1: Population Growth Trend and Decadal Growth of MMR (1971 to 2011)

Motor vehicle statistics on road in MMR for the period 2001 to 2017 indicates that, the total vehicle volumes have increased from 1.84 million to 7.27 million, which is approximately 3.95 times (i.e. about 8.41% CAGR). During the same period, the total number of private vehicles i.e. two wheelers and cars have increased from 1.37 million to 6.16 million, which is approximately 4.49 times (about 9.23 % CAGR). Figure 2-2 illustrates the number of private vehicles/ 1000 population within the MMR area. The increase in private vehicles ownership/ 1000 population during the period 2001 to 2017 in MMR was from 71 to 248, which has been found to be alarming. The possible reasons for such upsurge could be the convenience of using private vehicles and easy financing to buy etc. The other possible reasons could be the excessive overcrowding of suburban public transit and also delays of potential transit project implementation i.e. installation of the suburban rail, metro rail and monorail.



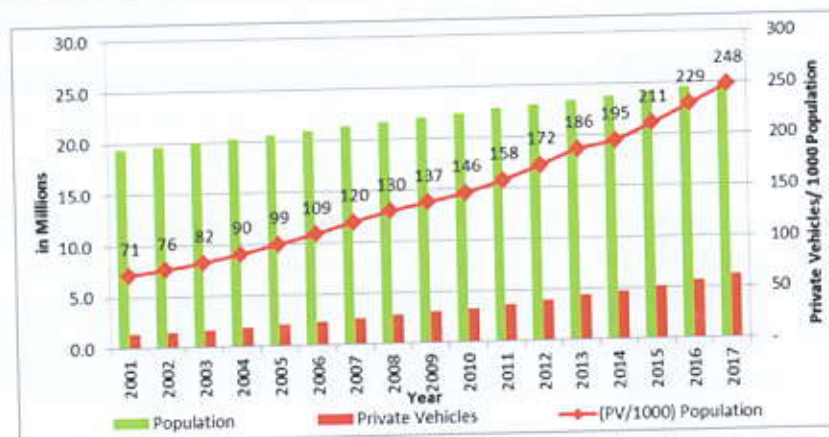


Figure 2-2: Private vehicle Population of MMR, Veh./1000 persons

The total numbers of IPT modes (Auto and Taxi) have increased from 0.26 million in 2001 to 0.53 million in 2017 which is approximately 1.97 times (about 4.10% CAGR).

MMR suburban railway is a mass transit system that carries more than 7.56 million people daily (Central Railway: 4.05 million and Western Railway 3.51 million based on statistical data of the period during 2015-16), which is considered as the lifeline of MMR.

Furthermore, travel by bus is also predominant practice in MMR. Daily travel by bus during the base year (2017) was about 3.80 million, which was approximately 20.3% of total passenger trip excluding walking trips. It is pertinent to note that bus operations act as a major feeder service to the sub-urban train. The bus trips carry approximately 4.2 million passengers/ day based on the ridership estimation included in the Updation of CTS for MMR Study. The CTS for MMR Study 2005-2008 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 rail and monorail. Bus transport share has been reduced from 26.3%, observed in 2005, to 20.3% in 2017. If all the proposed metro and suburban rail projects are implemented in MMR as recommended in the CTS for MMR Updation study, the bus transport share would decline from existing 20.3% (2017) to around 9.0% in the coming two decades despite of the cheaper travel cost and its flexibility of operations.

On-street parking is one of the major problems that reduces the overall capacity and results significant traffic congestions on the roadways within MMR. Generally, on-street parking facilities on major corridors and service roads are planned when the traffic flows are low and parking maneuver are not in conflict with the main traffic movement. Under higher traffic demand, the on-street parking reduces the available capacity and also conflicts with mainline traffic movement that results in congestion. Improper and insufficient provision of on-street parking also leads to encroachment on legal traffic flow. Furthermore, illogical maneuvering from the on-street parking lots creates unnecessary hazards to the high speed traffic and leads to accidents. Hence, in the context of increase in traffic flows on major corridors and increasing demand for parking, a trade-off of road space between on-street parking and traffic lanes needs 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

As part of the CTS for MMR study 2005-08, 'Home Interview Surveys'(HIS) were carried out on sample basis during the period 2005-06. Home Interview Survey (HIS) among other surveys is the most important survey for any 'Comprehensive Transportation Study' (CTS). Representative samples of dwelling units are selected and personal interviews are conducted to obtain travel characteristics for all members of the household by all modes of transportation on one full normal working day. Vast amount of information is collected on various aspects of family structure, socio-economic characteristics, location of work/study places, and information of travel attributes by all trips made on that day.

The number of households covered in MCGM area was about 36,000 (about 1.4% sample size), which was duly approved by MMRDA. The total number of households considered for HIS in MMR was about 66,000 households i.e. approximately 1.6% sample size. MCGM had initiated 'Comprehensive Mobility Plan' (CMP) for the Greater Mumbai area in Feb 2014 and HIS was carried out for a 6,000 sample size (5,000 sample size within MCGM and 1,000 sample size in rest of MMR). CIDCO had initiated Master plan for 'Navi Mumbai Airport Influence Notified Area' (NAINA) in 2014 where a sample of 10,000 HIS data was collected as part of the study. Furthermore, due to various consultancy services extended to MMRDA, CIDCO and MCGM towards carrying out the aforesaid studies, LASA/ LIL had the privilege of utilizing all available data points collected during those studies. As part of the present study, 5,000 household surveys were carried out adhering to the 'Terms of Reference' and the HIS database, created through all the above studies, was duly updated.

This HIS data is employed for analyzing existing travel patterns and behaviour, to help in the calibration of 'Travel Demand Models'. These models are then employed to estimate/ forecast the future travel demand. Thus transportation demand and supply conditions can be critically examined and upgradation/ new transportation facilities can be suggested with the help of the models and network analysis. Thus, household interviews are considered the most important and the best source of data on travel pattern and other socio-economic variable effecting travel in the study area.

It would be worth noting that if a multimodal trip comprises 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 done by walk/auto/taxi/car/two-wheeler-metro-walk/auto/taxi/bus/car/two-wheeler then the trip is classified as trip by metro. Generally, the observed trips by car, two-wheeler were mostly by single mode. The salient findings based on main mode trips are summarized below:

- The major transportation mode in MMR (about 47%) was noted to be the active modes i.e. walking/cycling for various trip purposes while the rest of the modes are train, bus, metro rail or auto rickshaws. A marginal (11.5%), use of private mode of transport is observed. Figure 2-3 illustrates various mode shares without the active modes;
- Local train (suburban trains) is the major mode of transportation amongst mechanized modes in MMR which transport about 43.2% commuters;
- Over 16.4% of the commuters use bus as their main mode of transportation and also a significant trips are made by Metro, rickshaws, cars and two wheelers as well; and
- Mode share by number of passenger trips is presented in Figure 2-3. It is important to mention that, while calculating the share of passengers using public transport (train, bus and metro), only main mode trips by train and bus were considered.



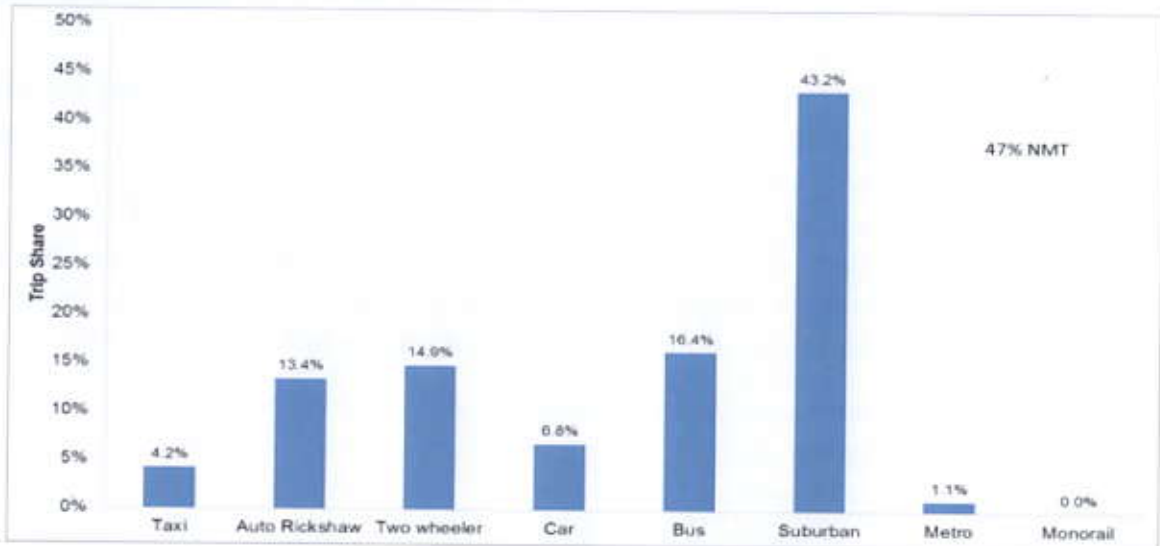


Figure 2-3: Mode share without NMT

The estimated trips made for internal travel during the morning peak period is about 10.59 million. Approximate number of motorized trips made/day is 5.62 million. On an average, a commuter in MMR spends about 8.4% of the individual income per month on transport. When average expenditure was plotted against total personal income, it could be inferred that travel expense rises with rising income. Figure 2-4 establishes important trends in expenditure on transport by commuters of MMR.

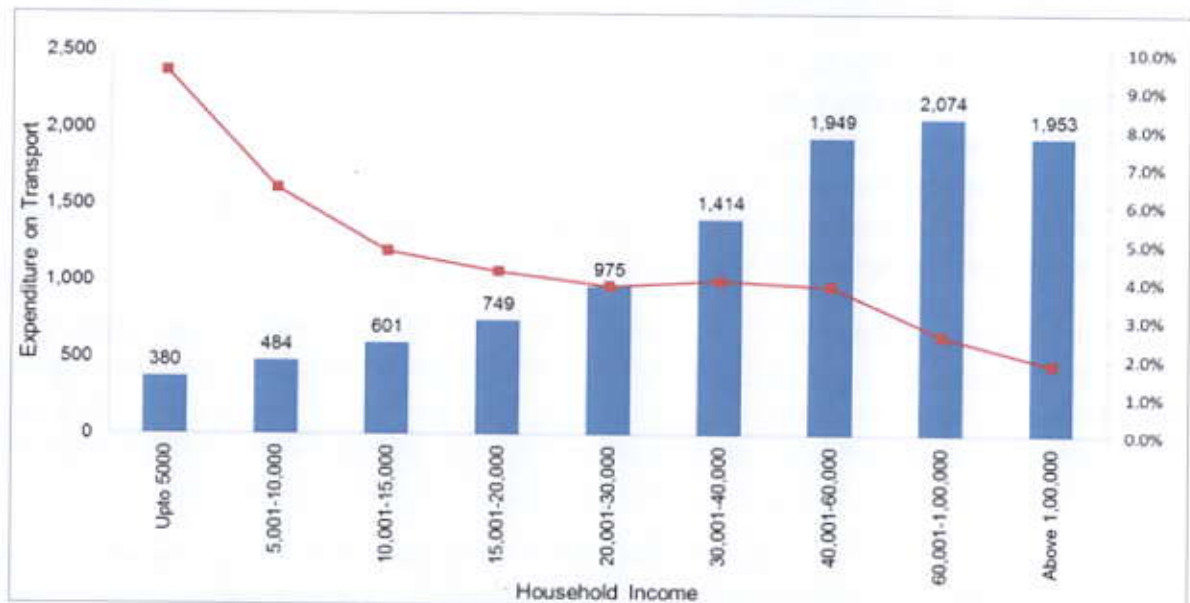


Figure 2-4: Expenditure on Travel (INR per month): Variation by Income

Reported household income with respect to income range, considering all types of housing, is illustrated 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 people changing location of jobs but not homes, even if that involves increased travel distance and time. The experience of developed economies is the phenomenon of changing jobs has been creating approximately 30% increase in travel even with no overall increase in employment. India has now been experiencing high volatility in the job market as organizations have aggressively been competing for qualified staff whereas retaining employees has been becoming a major business issue, and has been driving inflation pressures.



The observed experience in large cities as the city limits keep on expanding, the average person trip length gets longer, resulting in an increased travel time and length on the existing transportation networks.

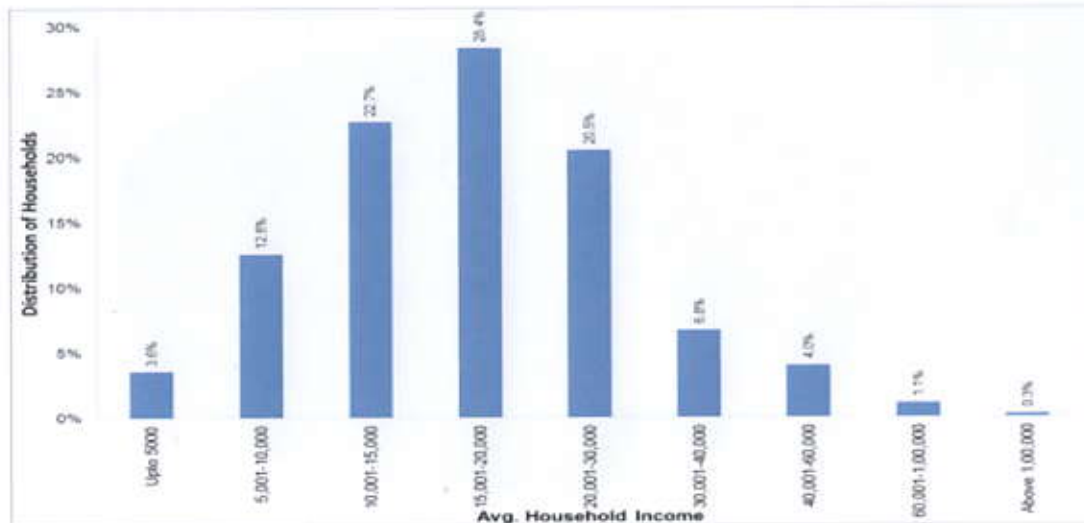


Figure 2-5: Reported Average Household Income by Income Range

## 2.3 EXTERNAL TRAVEL

External demands i.e. passenger and goods trips from the study area to outside the study area (internal to external), or 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 along corridors that connect the core study area with the extended study area. The directional split at all locations is balanced 50% traffic in each direction. Traffic flow observed at the outer cordon location is shown in Figure 2-6.

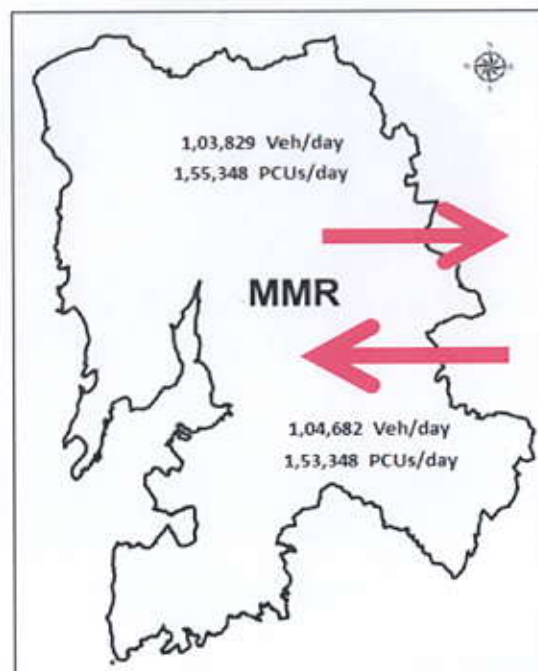


Figure 2-6: Traffic flow at Outer Cordon (In PCUs and Vehicles/Day)



The major traffic handling corridors are near Tansa River (OC-1) and Khalapur Toll Plaza (OC-8) that accommodate approximately 25.2% vehicle trips followed by 15% at Talawali near Kasna (OC-3) and 8.2% at Khopoli (OC-7). Figure 2-7 illustrates the "Percentage of Daily Traffic" based on various locations.

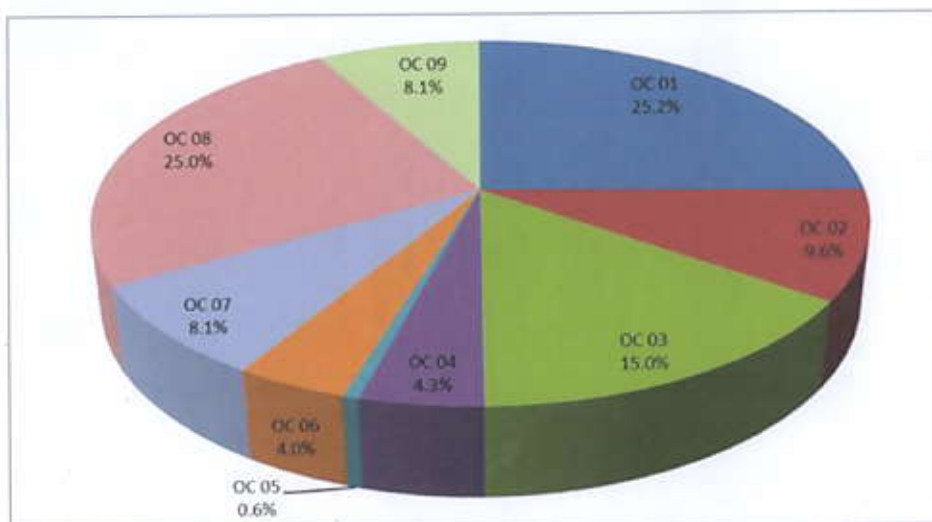


Figure 2-7: Location wise Share of Total Daily Traffic at Outer Cordon

The average traffic compositions observed at the outer cordon locations are shown in Figure 2-8. The percentages of cars/jeeps/vans and two wheelers within the total owned mode of transport were 36.9% and 24.3%, respectively. The percentages of IPT modes i.e. Autos and Taxi were 1.3% and 3.5%, respectively. The percentages of Buses and Light Commercial vehicles were found to be 3.7% and 14.7%, respectively. The percentages of trucks were noted to be 14.4%.

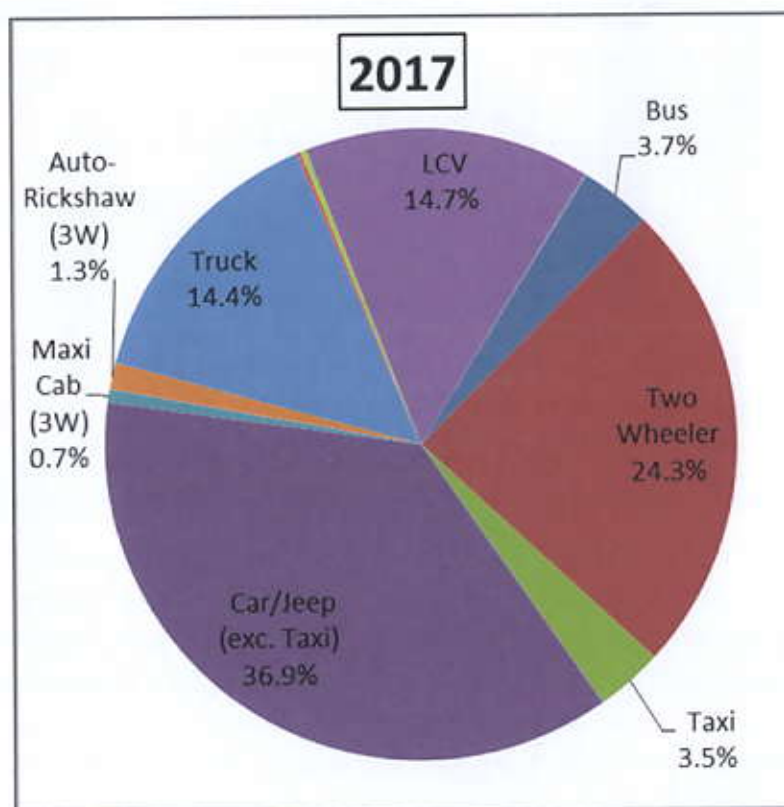


Figure 2-8: Average Traffic Composition at Outer Cordon



Travel pattern of passenger vehicles is shown in Figure 2-9. Out of the 1,39,385 passenger vehicles observed at the outer cordon locations, out of which 3,243 vehicles were through traffic, which represent approximately 2.3% of the total traffic.

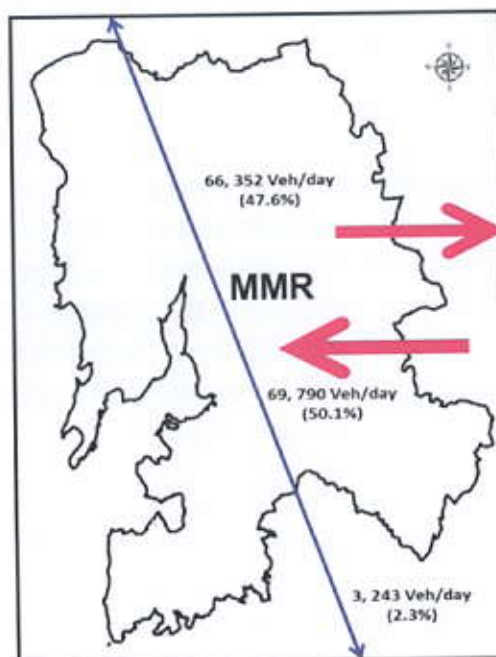


Figure 2-9: Travel Pattern of Passenger Vehicles – Outer Cordon Locations

Travel pattern of goods vehicles is shown in Figure 2-10. Out of the 60,626 goods vehicles observed at the outer cordon locations, approximately 7.9% of the trucks were through traffic.

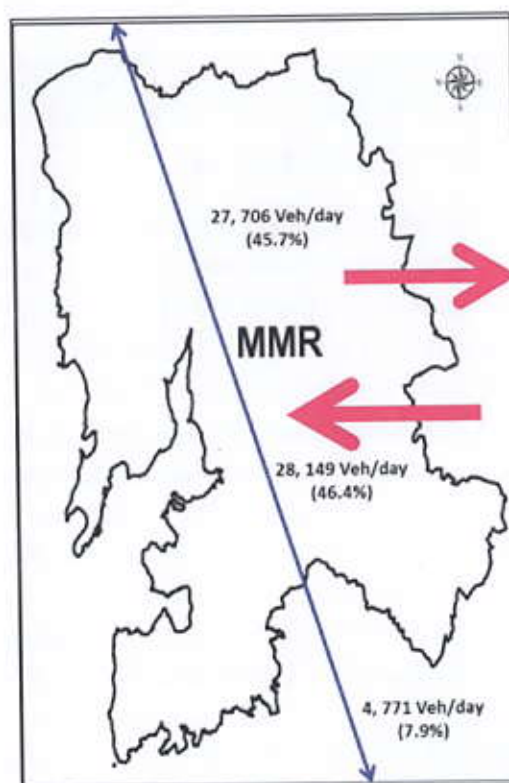


Figure 2-10: Travel Pattern of Goods Vehicles – Outer Cordon Locations



A comparison of traffic volume across OC locations, between the "TranSfoRM" study (2005-2008) and the "Updation of CTS for MMR study" (2017) indicates that, the compound annual growth rate (CAGR) is approximately 6.8 % considering vehicle volumes or 4.5% considering equivalent PCU volumes. Two Wheelers and LCV have registered highest growth rates of 11.7% & 7.5%, respectively. Cars have exhibited a growth rate of approximately 3.9%.

## 2.4 SUB-URBAN RAILWAYS

The history of transit in Mumbai and history of railways in India are tied together. The first train of India was flagged off from CSMT to Thane in 1853, the first suburban operation started between Virar and Back bay in 1867 (near Churchgate of today). Over the years, Mumbai Region has greatly benefited by having a very mature and efficient rail-based transit system that was 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 across the country, it has continued operating and maintaining the Mumbai Transit System, a non-core activity.

Mumbai region is connected by the Western Railway (WR) and the Central Railway (CR), two major branches of the Indian Rail. The Western line runs northwards from Churchgate terminus station in Island City, which exclusively serves the sub-urban passenger along the west coast. The Central Railway runs from CSMT, Mumbai (Chhatrapati Shivaji Maharaj Terminus) station, which is situated very close to Churchgate within the Island City, and serves a large part of the central and eastern areas of Mumbai. Central Railway also has a harbour line, which serves the Navi Mumbai area. It also helps passengers originating at the CSMT to go to the west coast. Within the Mumbai region both branches of the railways i.e. the WR and CR carry a combination of sub-urban, long distance and freight traffic trains.

The Western Railway operates a total two-way daily 863 sub-urban train trips (based on data available from 31st July 2017). The Central Railway operates a total two-way daily 800 sub-urban train trips. Harbour Railway operates a total two-way daily 566 sub-urban train trips. Trans Harbour Railway operates a total two-way daily 232 sub-urban train trips.

Commuters from various parts of MMR generally travel long distances by train for day-to-day activities including work, education, recreation and health facilities. It has been observed that the highest daily average passenger movement into Greater Mumbai is via the Central line, with a split of approximately 0.624 million inbound and 0.534 million outbound. The Western line carries approximately 0.25 million inbound and 0.21 million outbound passengers. The harbour line moves about 0.45 million inbound passengers and approximate 0.31 million outbound passenger. Rail passenger movements from Thane, Bhiwandi, Kalyan and Navi Mumbai to Greater Mumbai are observed to be the major commuter volumes. Rail passenger movement across Island City screen line indicates that, movement of 2.02 million passengers enter into the Island City and 2.07 million passengers exit from the Island City on a daily basis. However, the stations in the central parts of Greater Mumbai, such as Dadar, Mahim, Bandra, Andheri, Kurla and Ghatkopar record the highest footfall of passenger loadings. Most of these stations are also served by more than one railway line. While Dadar is served by the Western and Central Railway lines, Mahim, Bandra and Andheri are served by the Western and Harbour lines. Kurla is served by Central line and Harbour line. These stations act as interchanges among Western Rail/ Central Rail, Western Lines/ Harbour lines etc. The obvious effect and impact of such interchange is reflected on the surrounding Land uses and transportation demand in these areas. Higher passenger loadings in these



areas also indicate that, there is a shift in the employment opportunities and commercial activity towards north from the Island city to suburbs.

## 2.5 TRAVEL BY BUS

Suburban rail being the most dominant, bus travel is the next predominant mode of transportation in MMR. It was observed that an average of about 3.8 million commuters travelled by bus on a daily basis during the base year of 2017. The daily passenger trips by bus, therefore, represented about 20.3% of total passenger trips (without walk trips). It is pertinent to mention that bus serves as a major feeder to the suburban train. If accesses/ egresses are also included in the count, which is generally used by the bus operators, the total passenger trips were estimated to be about 4.21 millions/day based on the findings from the CTS for MMR Updation Study. CTS for MMR study projected that the modal share of the bus transport would face major threat due to growth of personal vehicles (car and two wheelers) and increase of rail based transport such as metro rail and monorail. If all the proposed metro projects could be implemented in MMR, the passenger share by bus transport would decline from existing 20.3% (2017) to around 9.0% within the coming two decades. However, the bus public transport being more flexible and of lesser operational cost the preference of bus travel would still remain comparatively higher.

The road based public transport system is mainly operated by municipal corporation undertakings like BEST, NMMT, TMT, KDMT, MBMT and VVMT etc. In addition, MSRTC (which provides services mainly for inter-city travel) also caters to the internal travel needs of MMR. Operational attributes of BEST, NMMT, TMT, KDMT, MBMT, VVMT and MSRTC are briefly summarized in Table 2-1.

**Table 2-1: Bus Operational Attributes Operated by BEST, NMMT, TMT, KDMT, MBMT, VVMT and MSRTC**

Undertaking	No of Buses	Bus Depot	No of bus stops	No of Routes	Total Route Length (km)	Daily Ridership (lakh)	Ridership per bus Route length-km
BEST	3,749	27	1,640	477	6,888	28.3	411
TMT	493	4	722	100	1,051	1.3	124
NMMT	467	3	436	70	1,820	2.7	148
KDMT	80		288	46	533	0.8	150
MBMT	47		263	28	323	0.3	93
VVMT	122	2	401	36	361	0.9	249
MSRTC	2,145	19	3,000	761	41,277	7.8	19
<b>Total</b>	<b>7,103</b>	<b>55</b>	<b>6,750</b>	<b>1,518</b>	<b>52,253</b>	<b>42.1</b>	<b>81</b>

Source: BEST, NMMT, TMT, KDMT, MBMT, VVMT, MSRTC and Basic Transport and Communication Statistics of MMR, 2016 by MMRDA

Daily passenger volumes that travel by Bus, as a primary mode, during the base year (2017) were about 3.81 million, which was approximately 20.3% of total passenger trips (Without walk trips).

In Greater Mumbai, Brihanmumbai Electric Supply and Transport Undertaking (BEST) is the largest public bus transport service provider. BEST possesses a fleet strength of 3, 749 during 2016-17 that operates daily and covers 480 routes during 2016-2017. The fleet strength during 2016-2017 had increased from 3,489 buses per day that were operated during 2015-2016. BEST operates services within Greater Mumbai, and to major destinations outside Greater Mumbai. BEST also operates ferry services between Manori and Malad. The observed one-way bus passenger trips originated daily from BEST have been noted to be steady during the last 20 years, which hovers about 40 lakhs to 45 lakhs passengers/day. As per 2013-2014 data there were a total of 3,753 buses on road per day and one-way passenger trips



originated daily was about 35.8 lakhs. During the last three years (2014-2015, 2015-2016 and 2016-2017), the bus ridership has estimated to bereduced to 33.5 lakhs/day, 28.9 lakhs/day and 28.3 lakhs/day, respectively.

## 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 accommodating the unstructured users travel demands. IPT performs as feeder services to the main mass transport system (both rail and road based mass transport) and provides access to predefined areas. The services provided by the IPT are intermittent in nature and this has complete flexibility to provide the last mile connectivity, which is determined by the passengers.

In MMR, IPT has been the competent mode for direct access; however it competes with major surface transport systems, and for short to medium trip lengths. Trip characteristics by these modes, due to their higher flexibility, are entirely different compared to the trips made by other motorized modes.

Based on the collected data, it has been estimated that taxis perform 10 trips a day on an average with an average trip length of 14.4 km. The proportion of taxis between owned and rented by the operators/drivers is approximately 40:60%. The three wheeler auto rickshaws perform about 16 trips a day with an average trip length of 7.2 km. The proportion of autos between owned and rented by the operators/drivers is 61:39%. IPT vehicle registration data in terms of vehicles on road as on 31<sup>st</sup> March of every year for the period 2001 to 2018 for MMR is summarized in Table 2-2:

**Table 2-2: IPT Vehicles (Auto and Taxi) on Road as on 31<sup>st</sup> March of each year: MMR**

Year	IPT Vehicles (Numbers)		
	Taxi	Auto	IPT
2001	70,027	197,820	267,847
2002	74,011	205,702	279,713
2003	68,638	207,993	276,631
2004	74,093	220,170	294,263
2005	80,722	227,336	308,058
2006	84,898	234,015	318,913
2007	88,306	238,515	326,821
2008	98,151	241,700	339,851
2009	101,405	250,172	351,577
2010	106,671	259,450	366,121
2011	100,445	261,346	361,791
2012	106,660	263,697	370,357
2013	109,611	266,823	376,434
2014	108,828	267,236	376,064
2015	117,293	288,568	405,861
2016	149,625	297,762	447,387
2017	196,613	333,512	530,125
2018	214,517	418,824	633,341

It can be inferred that IPT growth rate (CAGR) is approximately steady within the MMR area during 2001 to 2017, which is approximately 5.19%. The modest growth rate appears to be due to the growth of personal vehicles over the years. However, there is increase in Auto and Taxis from 2016, growth rate (CAGR) during these years were estimated at approximately 19.0%. The share of three-wheeler is increasing due to the 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 rail, monorail services and increase of personalized vehicles. The actual number of trips by IPT is expected to increase in the future within MMR.

## 2.7 TRAVEL BY PRIVATE VEHICLES

Daily commuter travel by private vehicle modes i.e. two wheelers and cars during the base year (2017) was about 2.26 million and 1.53 million, respectively, which were about 12.1% and 8.2% of total commuter trips (Without walk trips). Two wheelers have grown at a CAGR of 10.6%, Cars have grown at a CAGR of 8.3% and Private Vehicles, combining the two had grown at a CAGR of about 9.8%.

It has been estimated that at an average 2,080 private vehicles increase on a day-to-day basis in Mumbai District.

Table 2-3: Growth of Motor Vehicles in MMR(On Road as on 31<sup>st</sup> March, every year)

Year	Private Vehicles (Numbers)		
	Two-Wheeler	Car	Total
2001	865,008	508,811	1,373,819
2002	952,259	539,691	1,491,950
2003	1,066,878	581,148	1,648,026
2004	1,199,778	636,804	1,836,582
2005	1,349,006	703,476	2,052,482
2006	1,516,331	766,166	2,282,497
2007	1,713,041	840,373	2,553,414
2008	1,898,139	917,016	2,815,155
2009	2,052,152	981,532	3,033,684
2010	2,216,805	1,061,462	3,278,267
2011	2,435,831	1,158,481	3,594,312
2012	2,693,515	1,278,353	3,971,868
2013	2,983,841	1,392,414	4,376,255
2014	3,170,000	1,463,888	4,633,888
2015	3,511,812	1,584,119	5,095,931
2016	3,912,916	1,708,594	5,621,510
2017	4,335,616	1,828,786	6,164,402
2018	4,785,574	1,969,499	6,755,073

Source: RTO

## 2.8 PEDESTRIAN MOVEMENT

In MMR, 46.9% of the total trips are made by walk. 72.5% trips associated with school trips are also by walking. Workers of economically weaker sections, especially women and children, who often cannot afford motorized modes of transport, constitute a significant proportion of pedestrians. In addition, most of the last mile connectivity trips associated with public transport (60%) are walk trips. The walk trips are also considerable short in length. It has been estimated that the average time for 80% of walk trips either to workplaces or schools are lesser than 15 minutes. Presently, several conditions discourage pedestrian movement. These include inappropriate sidewalk provisions along the streets, 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; lack of designated hawking area especially around the railway stations; discontinuous footpaths and varying levels at every access and intersection. Moreover, the pedestrian footpaths and facilities are not equipped to serve universal accessibility for disabled people. Undesirable and unsafe pedestrian walk environments force commuters to switch to



other 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.

## 2.9 AVERAGE JOURNEY SPEEDS

Average Journey Speed is one of the important 'Measurement of Effectiveness' (MoEs), generally considered for assessing the unimpeded traffic flow or magnitude of traffic congestion. The purpose of the journey speed survey was to identify the bottlenecks, major reasons for delay, etc. Average delays are generally used to assess 'Measurement of Performance' (MoP) 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, roundabout or priority control). 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 of travel 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 2 runs in each direction (during the weekday morning and evening peak periods). Intersection delay for through vehicles was recorded at signalized intersections.

Approximate length of road considered for Journey Speed survey was about 2,476 km. The road on which the average journey speeds were less than 20 kmph were found to be either congested or the surface conditions were poor. The observed speeds on some of the major corridors in the study area indicate that, overall, the speeds decrease with the length of journey time and due to varying trend of traffic levels along various sections.

- a) Average journey speed was estimated to be 22.81 Kmph during the morning peak period and 22.70 Kmph during the evening peak periods; and
- b) The average journey speed of approximately 30 kmph during the peak periods were estimated on approximately 67% of the studied road network length.



### 3 MUMBAI METROPOLITAN REGION: EXISTING LANDUSE

The traffic demand in urban areas is generally a function of existing Land-use. Planners have observed that different land-use generate different volumes and characteristics of traffic. Hence, examining the existing land-use pattern and forecasting future land-use pattern are essential to estimate change in demand as one of the primary steps in the transport planning process. For the project of "Updation of Comprehensive Transportation Study for MMR", latest land-use data within the MMR area was necessary to comprehend the land-use characteristics. The Draft Regional Plan 2016-2036 reflected the existing land-use, updated for the horizon year of 2016, at the regional level and also at more disintegrated levels as well. The base year for the present study was 2017 and hence, the land-use considerations with respect to the developments that have occurred within the recent past were required to be incorporated. Also, MCGM and CIDCO had prepared their Development Plans for Greater Mumbai and NAINA, respectively, that was planned to be implemented during 2014. Further, land-use updates that were eminent from the Google imagery were considered. Site reconnaissance surveys were undertaken in order to assess the Existing Land-use under 2017 scenario, which was necessary for the CTS for MMR Updation Study. The process that was followed and analysis of the existing land-use under 2017 horizon is presented in this chapter. The following objectives were kept in mind, while a compilation of database for the base year 2017:

- To capture the existing macro/broad land-use of MMR during 2017;
- To quantify and evaluate the urban/ micro-level land-use from the proposed Development Plans of the various councils and corporations of MMR;
- To identify and analyze the changes in various land-use characters over a time period between 2005 and 2017 (based on available secondary data);
- To investigate the reasons for the spatial changes by correlating the land-use with other secondary data like physiography, accessibility, policies, and projects;
- To identify the potential for urbanization and development of various areas within MMR; and
- To predict the future trend of land-use change within MMR.

The present study has utilized the contents extracted from the following study reports:

- ▶ Draft Regional Plan 2016-36;
- ▶ Development Plan for Greater Mumbai 2014-34; and
- ▶ Master Plan for NAINA 2014-34.

Other relevant land-use data from various jurisdictions i.e. from City Corporations, Councils, and SPA areas was collected. The respective validities of each ULB were checked and their respective status is summarized in Table 3-1.

Table 3-1: DP status of ULBs/SPA Areas

Sl. No	ULB/SPA	Previous DP (Period)	Current DP Status
1.	Greater Mumbai	2014-2034	Existing Land-use available
2.	Thane	1999-2019	Preparation of Draft DP is scheduled from 2019
3.	Kalyan-Dombivali	1996-2016	2013 approved
4.	Vasai - Virar City	2007-2027	Recently approved (last E.P)
5.	Navi Mumbai	2018-2038*	Preparation of Draft DP for is in progress
6.	Mira-Bhayander	1997-2017*	Preparation/Revision of DP taking place



Sl. No	ULB/SPA	Previous DP (Period)	Current DP Status
7.	Bhiwandi-Nizampur	2001-2021	
8.	Ulhasnagar	2010-2035	
9.	Ambernath	1996-2016	No revision anticipated
10.	Kulgaon-Badlapur	1996-2016	
11.	Panvel	1990-2010* (Second Revision)	New DP for is in progress after Corporation was formed
12.	Khopoli	1992-2012	First Revision of Revised Development Plan (31st March 2003)
13.	Pen	1988-2008	
14.	Uran	1985-1995	
15.	Karjat	2006-2026* (Notification -25/04/2006)	
16.	Alibag	1982-2002	
17.	Matheran	1987-2007* (Notification-16/01/1987)	Part of RP 2016-36
18.	Navi Mumbai NT (56)	2018-2038	Preparation of Draft DP for is in progress
19.	NAINA & MSRDC (270)	2014-2034	Existing Land-use available (year 2014)
20.	Kalyan 27 Villages (26)	2008-2028	Recently Approved
21.	BSNA (61)	2008-2028	(2015 approved) Recently Approved
22.	AKBSNA (58)	1996-2016	(2005 approved) MMRDA - No revision
23.	VVSNA (24)	2007-2027	Recently approved (last E.P)
24.	Khopla (33)	2014-2034	Existing Land-use available (the year 2014)
25.	MMR	2016-2036	Existing Land-use available (the year 2016)

MMR area contains a mix of all land-use categories in varying proportions. The study area spreads around 4,311.75 sq.km area, which is dominated with the agricultural land in the regions outside the urban agglomerations. Some of the agriculture areas lie within the peri-urban areas, while most of it is seen in the rural areas.

The existing land-use pattern of the MMR area during 2017 reflects that the available developed land area totals about 638.64 sq.km, which is approximately 14.81% of the total area. Land Available for future development totals about 573.27 sq.km i.e. approximately 13.30%, and the non-developable land comes out to be around 3099.85 sq.km i.e. approximately 71.89%.

The land-use categories have been classified into finer levels under each of the above-mentioned categories. The existing land-use is classified into ten (10) different categories which are summarized in Table 3-2.

In MMR, existing Built-up area is about 16.17%. About one-third of the total land in MMR is used for Agricultural activities and the forests account for 19.3% of the total area. The area of waterbodies in MMR is approximately 4.18% of the total area, which sums up to 180.30 sq.km of the area.

Table 3-2: Existing Land-use of MMR, 2016

Land-use Categories	Area (sq.km)	%
Agriculture & Other Primary Activities	1263.30	29.30
Agriculture & Other Primary Activities (Saltpan)	44.08	1.02
Airport	6.15	0.14
Built-up	697.00	16.17
Coastal Features/Wetlands	267.03	6.19
Forest	833.08	19.32
Industry	88.02	2.04
Port / Jetty	6.13	0.14
Scrub/Grass/Waste Land	926.67	21.49
Water Bodies	180.30	4.18
Grand Total	4311.75	100.00

Table 3-3: Classification of Land Availability in MMR

Category	Area (sq.km)	%
Developed Land	638.64	14.81
Land available for development	573.27	13.30
Land not available for development	3099.85	71.89
<b>Grand Total</b>	<b>4311.75</b>	<b>100.00</b>

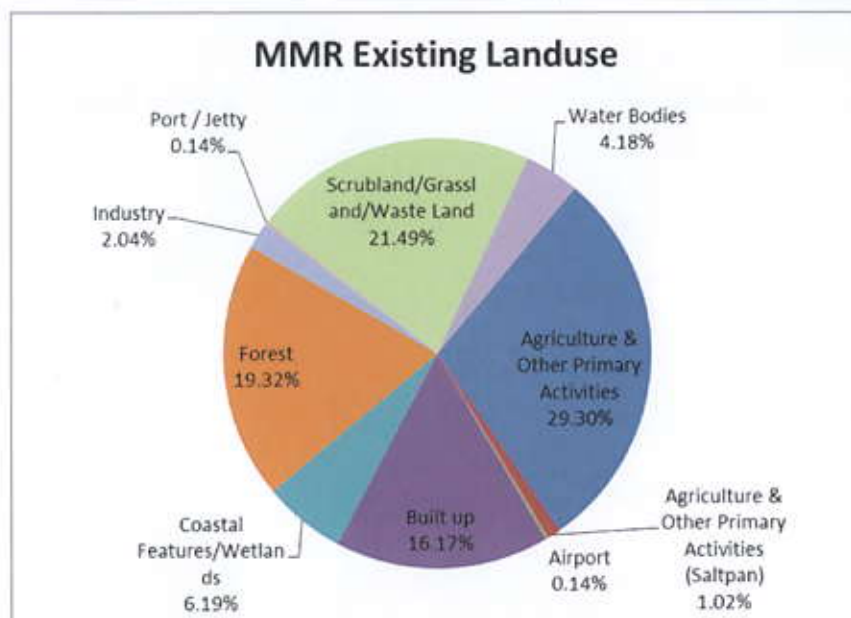


Figure 3-1: Landuse Composition of MMR, 2016

The Coastal Features/Wetlands that include mangroves and mud-flats cover about 6.19% of the available land area. The scrubland and grasslands have significant coverage areas that sum up to approximately 21.49% (926.67 sqkm).

The distribution of urban built-up in Area, land available for development and the existing land-use details of Rural MMR have also been identified in the report.

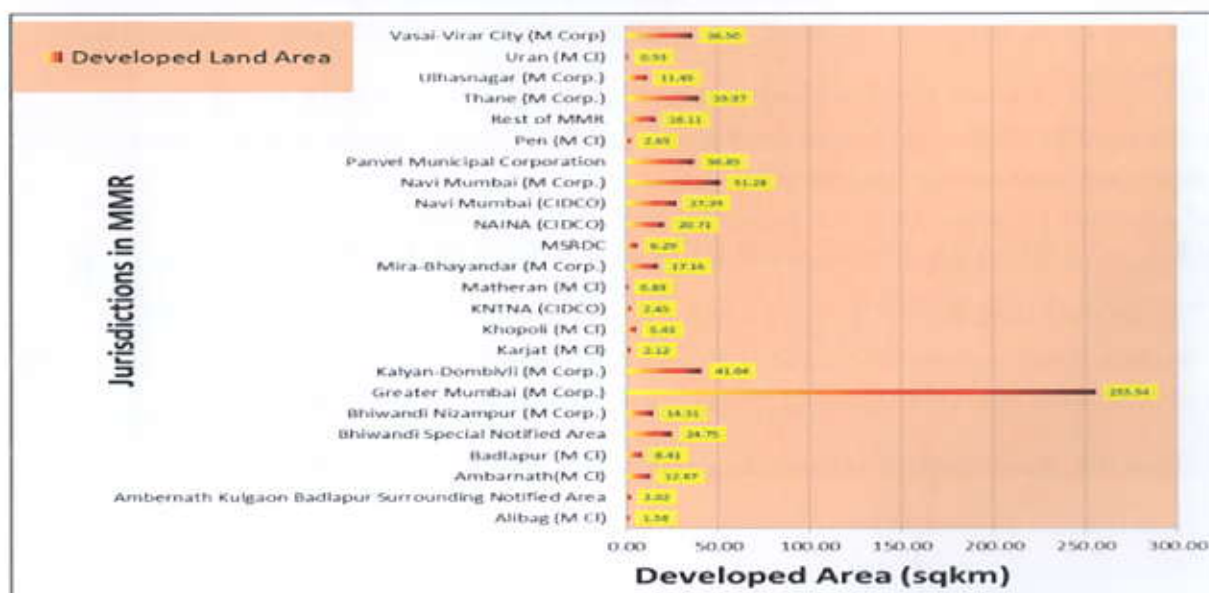


Figure 3-2: Jurisdiction wise built up area in MMR



### 3.1 DISTRIBUTION OF DEVELOPED AREA IN MMR

On analyzing the total built-up of MMR, it was observed that Greater Mumbai possesses a built-up area of 255.54 sq.km, which is approximately 40% of the total built-up area within the MMR jurisdiction. Following the MCGM jurisdiction, Navi Mumbai Municipal Corporation possesses about 51.28 sq.km built-up area, which is approximately 8.03% of the MMR built-up area().

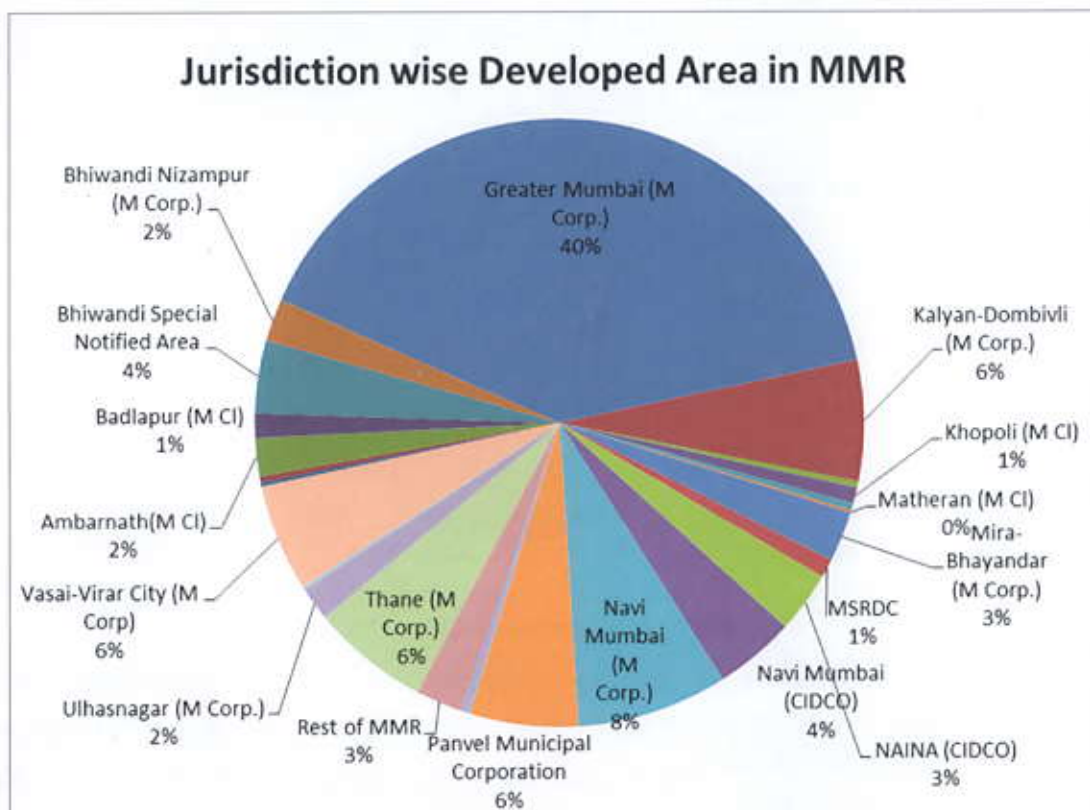


Figure 3-3: ULB/SPA wise built-up in MMR

Vasai-Virar, Thane, Kalyan-Dombivli and Panvel are some of the city corporations that accommodate a varying range between 5%-7% of the total developed area within each of the above-mentioned jurisdictions.

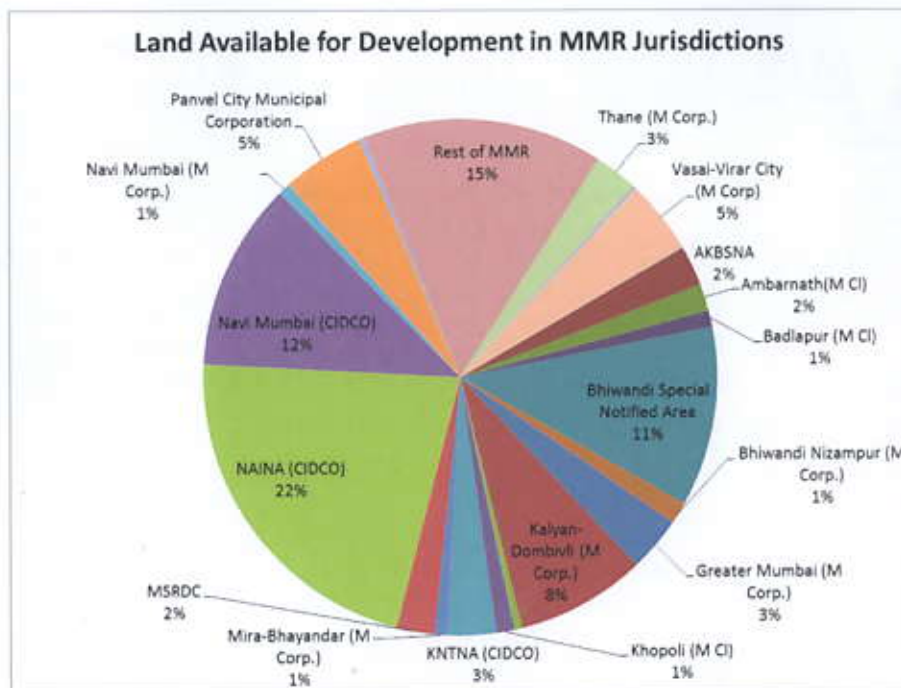
The detailed distribution of the developed areas is illustrated in Figure 3-3, where the major built-up areas within MMR situate within the ULBs..

### 3.2 LAND AVAILABLE FOR DEVELOPMENT WITHIN MMR

The total developable land available within the jurisdiction of the ULBs and the SPAs is considered in this analysis. It was seen that the majority of available developable land was within the jurisdiction of NAINA (CIDCO), which represents about 21.8% (125 sq. km) of the total area of MMR.

Figure 3-4 depicts the land available for development in various jurisdictions in MMR.





**Figure 3-4: ULB/SPA wise Land Available for Development in MMR**

The Rest of MMR area contains about 15.1% (86.7 sq.km) of MMR and further Navi Mumbai New Town (CIDCO) contains about 11.8% of the developable area (67.8 sq.km). It has been noted that comparatively more developable areas within the MMR are closer to the rural MMR area. It has also been noted that Vasai Virar areas have realized a sudden increase in the development rate potentially due to the introduction of the suburban rail services i.e. the Western Railway extension. The sprawled areas have become more attractive due to ease of commuting and also availability of better quality of life, while the living cost is comparatively cheaper. The better quality life at a cheaper cost with ease of commute, enhanced connectivity and accessibility has potentially resulted in sprawling of the city boundary within the MMR jurisdiction. It becomes obvious that transport network plays a vital role in the spatial distribution of the settlements, while the Greater Mumbai functions as an epicenter of all the employment-related activities within the MMR.

It transpires that further scope of land development in and around the green field area can take place complying national environmental policies subject to the enhancement and outreach of the transport network towards accommodating the future population. With the extensive transport network installation, as planned within the study area and establishing the new growth centers that have been proposed, it becomes evident that the land-use planning should play the key role. This study identifies unique approaches to determine the forecast detailed land-use distribution based on the proposed transport network, as recommended under various horizon years until 2041.

Figure 3-5 illustrates developable land available within various jurisdictions.



**Figure 3-5: Jurisdiction wise Land Available for Development in MMR**

Determination of the spatial distribution of land-use within MMR i.e. within the jurisdiction of the Municipal Corporations, Councils, and SPA Areas, was the next focus. The existing land-use distribution, classification of available land i.e. the existing built-up areas, developable and non-developable land availability within the respective jurisdictions has been elaborated in the latter part of the report.



## 4 ASSESSMENT OF MAJOR DEVELOPMENTS IN MMR

### 4.1 INTRODUCTION

During the decades MMR area has accommodated rapid and diverse changes in terms of physical developments. With the rapid urbanization across the country, it becomes clear that the metropolitan regions have pivotal roles to play in order to cater the increasing populations and employments. Various major developments have been happening within the MMR jurisdictions, and a lot of planning efforts have been done to accommodate the growing population and employment. Relevant information from various stakeholders have, therefore, been collected, reviewed and analyzed to prepare the background of preparing a comprehensive transport strategy. Generally, the collected data would be useful in calibrating and validating travel demand during the base year (2017), whereas the validated demand model shall be used to forecast the travel demand during various horizon periods until the long term horizon of 2041.

### 4.2 NAVI MUMBAI INTERNATIONAL AIRPORT (NMIA)

Airports being the nuclei of economic activities assume a significant role in the national and statewide economy. The quality of an airport infrastructure, which is a vital component of the overall transportation network, contributes directly to a country's international competitiveness and could influence the flow of foreign investment. Airports also represent as the window of the country to the rest of the world. The first impression of the nation comes from the state of the airports, which effectively serves as the symbol of national pride. The airport needs to be integrated with a professional transport network comprising rapid transit network and Highways/ Expressways, enabling seamless transfer to the desired nodes from the airport.

The proposed Airport (NMIA) is situated within the geographical area of Navi Mumbai, abutting National Highway 4B, and located near Panvel. The distance between the existing Chhatrapati Shivaji International Airport (CSIA) and NMIA will be approximately 35 Km. The site is presently accessible by the 4 lane National Highway NH4B from the east and by another 4 lanes major arterial Aamra Marg, from the west. The primary connectivity between Navi Mumbai and Mumbai is Sion-Panvel Highway. Sion-Panvel Highway has been widened recently, to ensure seamless and effective accessibility to the future travelers. Connectivity to the new airport shall also be available by the existing suburban rail that operates within the vicinity. The existing Mankhurd- Belapur- Panvel, and Thane – Panvel commuter rail corridor provides access to the airport from Khandeshwar Railway Station, and the Nerul-Uran Railway line, presently under development, will provide access to the new airport from Targhar Railway Station. The Metro Rail access to the new airport from Mumbai will be the Line 8 Metro i.e. the Airport Metro (CSIA-NMIA) that will be of an approximate length of 35km. The DPR for the extension of the Line 8 is under progress. The connectivity to NMIA is illustrated in Figure 4-1.





Figure 4-1: Connectivity to NMIA

The MMR area is significantly higher in comparison to other metropolises in the country, and it possesses a higher population density, as well. The census population in the MMR exceeded approximately 24 million in the Year of 2011. The population is likely to be in the order of 32.10 million by 2041. It is also expected that workforce participation rate with respect to the total population will go up and could reach 40%-45% by 2031, which would result in a major transformation of the economic base of the MMR. The existing airport (CSIA) accommodated about 29 Million Passengers Per Annum (MPPA) during 2010-2011. The air traffic during 2015 were projected to be 40 MPPA and during 2026 the same was forecasted to about 80 MPPA. CTS recommended the need of a second airport to accommodate the increasing demand. The 3<sup>rd</sup> party consultant that is responsible for preparation of the NMIA Master Plan has forecasted the demand of the annual passengers and cargo during the future horizons. The forecasted total passenger demands at the CSIA and NMIA were about 40 MPPA and 61.74 MPPA, respectively, during 2031- 2032.

Navi Mumbai, being closer to Mumbai, has attracted various industrial developments in specific pockets. These industries, in turn, have created a large number of employments. Many government and corporate offices have moved from Mumbai to Navi Mumbai area. The industrial units related to heavy engineering, textiles, chemical, pharmaceutical, petrochemical, electronics, paper, plastic, steel and food industries are generally established in Taloja Industrial Area. Thane-Belapur Industrial Belt (TBIB), which generally accommodates IT sector and SEZ, has also created many job opportunities in the region. The Navi Mumbai International Airport would also create a significant employment generation in the future. It is estimated that the airport will generate 1.42 lakh new employments directly, while there should be additional 2 lakh indirect jobs within the vicinity of the proposed Airport area. The Airport is expected to boost further industrial developments along the Mumbai-Pune-Ahmednagar corridor, the Mumbai-Nashik corridor and also in and around the Konkan belt, which could add to further traffic growth including the air traffic. The Airport is likely to attract an investment of around INR 60,000 crore in the MMR and the surrounding areas. Furthermore, enhanced cargo facilities at NMIA will open up additional opportunities for export of the State's agriculture and floriculture produce including other high-value products to the global market. It is expected that the proposed Airport will economize the time and cost



of the delivery of the export/import of the cargo including enhancing the efficiency of the same, while transported from the proposed Navi Mumbai Special Economic Zone.

### 4.3 GROWTH CENTERS AND REGIONAL INDUSTRIAL AREAS

In order to facilitate the employment creation in the tertiary sector, the Draft Regional Plan 2016-2036 has proposed new Growth Centres (GC's) at several locations that are currently connected to both the rail and road network. Upgradation of the existing rail networks including Panvel-Diva-Vasai, Panvel-Karjat-Khopoli, and Panvel-Roha have already been proposed to the suburban rail system. The three rail corridors already accommodate occasional shuttle services. An immediate upgradation of the first two corridors will create an opportunity for development of the growth centers to serve Vasai-Virar, Bhiwandi, Thane, Kalyan-Dombivali, and Panvel areas. There have been four locations that are proposed at Gass in Vasai-Virar, Kaman-Kharbav near Bhiwandi, Nilje in the KDMC within, MMRDA's SPA, Shedung within NAINA and SPA area within MSRDC; Details of the proposed Growth Centres within the MMR area are summarized in Table 4-1.

**Table 4-1: Details of Proposed Growth Centres**

Sl. No	Location	District	Village Name	Area (sq.km)
1	Vasai	Palghar	Nallasopara, VVMC	6.18
2	Kharbav, Bhiwandi	Thane	Kharbav, Malodi, Paye, Paygaon, Nagle, TMC	13.08
3	Nilje, Kalyan	Thane	Bhopar, Sandap, Hedutane, Gharivali, Usarghar, Katai, Nilje, Kole	10.83
4	Shedung, Panvel	Raigad	Ajiwali, Barwai, Bhingar, Bhingarwadu, Borle, Khanavale, Mohope, Poyanje, Sangde, Shedung	5.77
<b>Total Area</b>				<b>35.86</b>

The Growth Centres are envisaged as integrated complexes with opportunities for multifarious land-use developments including retail, office, research and development, education and recreational facilities and high density residential etc. It is proposed to prepare detailed plans for these areas after the RP is approved, which includes area allocations for institutional, research and other regional facilities, strategies for development and expanded Development Control Regulations.

In addition to the Growth Centres, seven large pockets of land, summarized in Table 4-2, are identified to accommodate further industrial developments. Virar is situated within VVCMC, Taloja within NAINA SPA, Khopoli within the SPA of MSRDC, Khopta within the SPA of CIDCO, areas adjacent to Bhiwandi municipal areas and SPA boundaries, and sites situated on both the sides of Amba river within the NAINA area and adjacent to the BSNA SPA boundaries. The locations of the growth centers and Industrial areas are illustrated in Figure 4-2.

**Table 4-2 : Details of Proposed Regional Industrial Areas**

Sl.No	Location	District	Village Name	Area (sq.km)
1	Bhiwandi-1	Thane	Angaon, Nivali, Supegaon	4.09
2	Bhiwandi-2	Thane	Sape, Vahuli, Borivali Tarf Sonale, Bhoirgaon, Kukase, Amane	5.43
3	Virar	Thane	Bhatpada, Kopri, Vasai-Virar Municipal Corporation	12.48
4	Taloje	Raigad	Chindharan, Mahodar, Kherane Kh., Nitalas, Vavanje	4.12
5	Khopoli	Raigad	Talawali, Anjrun, Ghodivali, Kandrol Tarf boreti, Kelavali, Khalapur, Mankivali, Navandhe, Wangani	8.39
6	Along Amba River	Raigad	Bahramwatak, Beneghat, Borwe, Khar Borli, Kolave, Masad Kh, Masad Bk, Masad Bell, Narvel, Sarebhag, Shirki, Shirki Chawl No.1, Wadkhal, Wave, Washi, Dherand, Mankule, Narangi, Shahabaj, Shahapur	32.90
7	Khopta	Raigad	Aware, Bandhpada, Dhasakhosi, Govthane, Jui, Kacherpada, Koprol, Pale, Pirkone, Sangpalekhar, Talbandkhar, Vindhane	10.85
<b>Total Area</b>				<b>78.26</b>



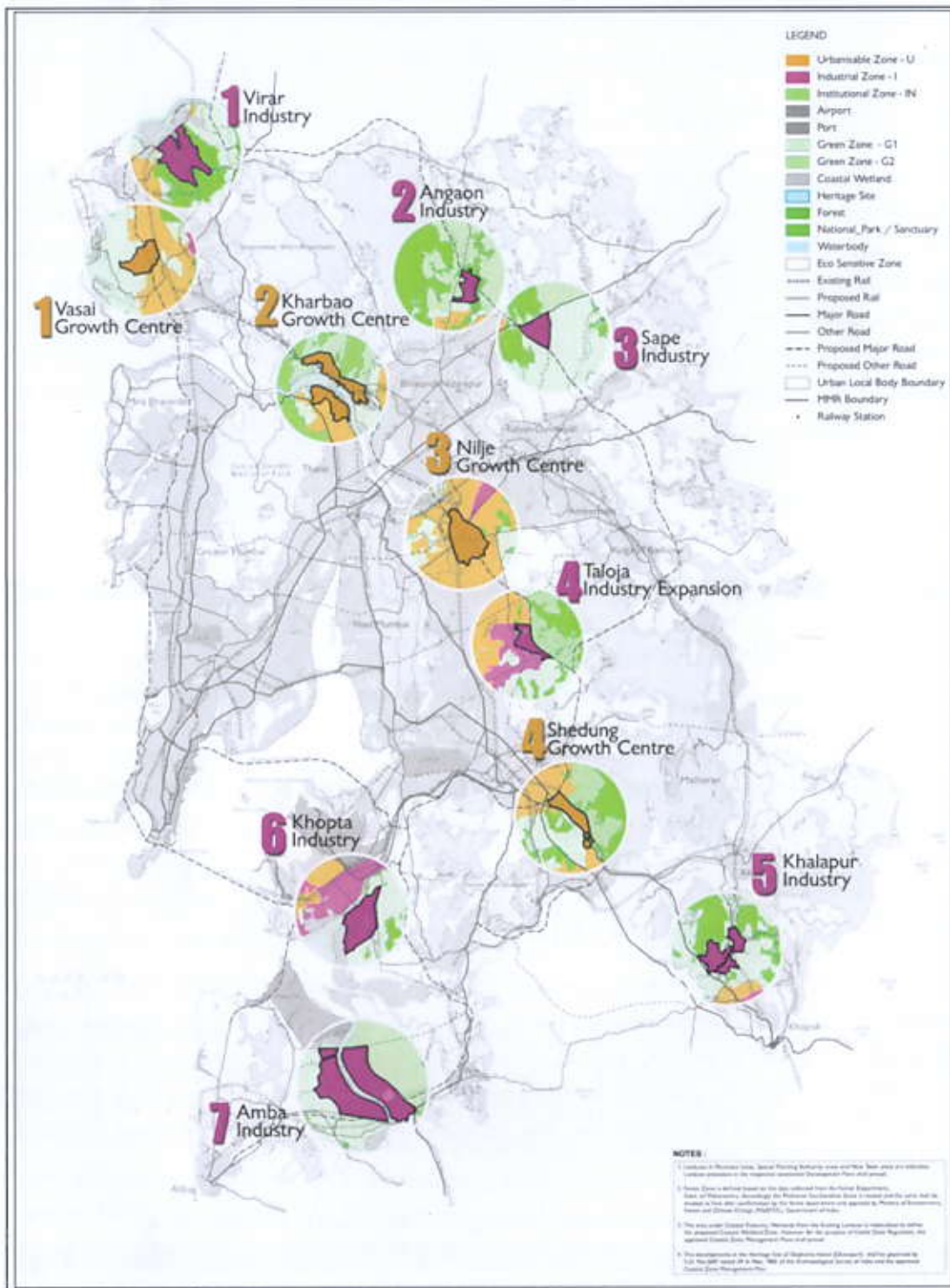


Figure 4-2: Location of Proposed Growth Centres and Regional Industrial Areas in MMR

1. Landuses in Municipal Areas, SPA Areas, and New Towns areas are indicative, Landuse provisions in the respective sanctioned Development Plans shall prevail;
2. Forest Zone is defined based on the data collected from the Forest Department, Govt. of Maharashtra. Accordingly, the Matheran Eco-Sensitive Zone is revised and the same shall be treated as final after confirmation by the forest department and approval by Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India;
3. The area under Coastal Features/Wetlands from the Existing Landuse is rationalized to define the proposed Coastal Wetland Zone. However, for the purpose of Coastal Zone Regulation, the approved Coastal Zone Management Plan shall prevail; and
4. The developments in the Heritage Site of Elephanta Island (Gharapuri) shall be governed by S.O.No.5681 dated 29th Nov. 1985 of the Archaeological Survey of India and the approved Coastal Zone Management Plan.



#### 4.4 CHATTRAPATI SHIVAJI MAHARAJ MEMORIAL STATUE

The Chattrapati Shivaji Maharaj Memorial, an equestrian statue of the great Maratha Fighter Shivaji of 192 m height, which will become a national monument, has been proposed at about 3 to 4 kilometers distance from the Marine Lines within the Arabian Sea. To attract tourists a hotel has also been proposed in the memorial complex. Conceptual image of the monument is illustrated in Figure 4-3.

The tallest statue project was commenced on 19<sup>th</sup> February 2015. An alternate idea of establishing the iconic equestrian statue on INS Vikrant ship was initially provided by the Baroda based architect Mr. Kolhatkar; however, an alternative plan was proposed to place the statue inside Mumbai's Arabian sea, subject to obtaining necessary clearances from the Coastal Regulation Zone (CRZ4) authorities. The project was proposed in 2005, approved by the State Government in 2011, and is supposed to be under construction soon. The proposed monument is supposed to become another tourist attraction in the South Mumbai area, which will result in considerable trip generation. The Shivaji memorial complex is proposed to consist of museum, gallery, amphitheater, marine aquarium and other attractions.

The Shivaji Memorial Statue will act as a major attraction, therefore, an efficient access system to the proposed monuments should be provided by the local authorities. An effective traffic network enhancement should also be undertaken to provide an efficient traffic circulation in and around the vicinity of the proposed location. It is anticipated that the completion of the construction of the memorial would occur in and around three (3) year time, while the expected tourist demand would be about 10,000 visitors/ day (an average of 1,000 vehicles/day). The proposed ferrying plan of tourists by the Passenger Water Transport (PWT) reveals four (4) jetties will operate, which are identified as 1. Radio Club, 2. NCPA, 3. Versova Beach and 4. Sagar Sangam.



Figure 4-3: Shivaji Memorial Complex (Conceptual Image)

#### 4.5 DR. BABASAHEB AMBEDKAR MEMORIAL

A 350-feet tall bronze statue of Dr. Baba Saheb Ambedkar will feature at the Ambedkar memorial, which is proposed to be set up at Indu Mill land in Mumbai (Ref Figure 4-4). The monument will be called the 'Statue of Equality', in order to reflect Dr. Babasaheb Ambedkar's contribution to the Indian society.



Dr. Babasaheb Ambedkar Memorial will also act as a special generator and will have an impact on the surrounding area.

**Foundation stone:** On 11 October 2015, the foundation stone of Memorial was laid by the Prime Minister of India Shri Narendra Modi. Work of memorial started in November 2015.

**Structure of memorial:** The memorial on the 12-acre land is estimated to cost INR 425 crore (US\$65 million). Its main attraction will be a 25,000 sq. ft stupa around a pond. The memorial will have a facility to park around 400 vehicles.

**Stupa:** The stupa would be the most expensive part at INR 110.95 crore (US\$17 million). Stupa will be of 40 meters (140 feet) height and a circumference diameter of 80 meters (110 feet) will have a ribbed ceiling thus resembling the Buddhist Chaityas. An eight-tier bronze canopy representing the Buddha's eight-fold path at the top of the stupa in a built-up area of 2,400 square meters with a lotus pond at the foot of the dome.

**Vipassana Hall:** A Vipassanā ("meditation") Hall is also proposed within the memorial, which will accommodate a seating capacity of 13,000 people.



Figure 4-4: Dr. B.R. Ambedkar Memorial (Dadar), Concept Diagram

In addition to these special generators, various planning and implementation authorities within MMR have conceived and implemented a number of transport infrastructure projects, planning efforts and project preparatory works for some of the major infrastructure projects are in progress. The following paragraph discusses a couple of them.

#### 4.6 NAGPUR MUMBAI SUPER COMMUNICATION EXPRESSWAY

Maharashtra state possesses approximately 720 km of coastline, which accommodates two major ports i.e. Mumbai Port and Jawaharlal Nehru Port, and some minor ports i.e. Dharamtar, Dighi, Jaigad etc. The Jawaharlal Nehru Port handles more than 60% of the "Container Cargo" that is generated in the country.



The major industrial establishments are located in Mumbai, Thane, Palghar, Raigad Districts within MMR, and in Pune-Pimpri Chinchwad Belt, Nashik and Aurangabad. The Eastern part of Maharashtra is the home of 90% of the mineral deposits in the State. It also has major Forest areas and contains many Cement and Steel industries. This region is responsible for approximately 60% of the total power demand within the State. The major city in the eastern part of Maharashtra is Nagpur, which is designated as the second capital of the State. It is the third largest city in the State. Currently, the travel time between Nagpur-Mumbai varies between 16 hours to 18 hours for passenger transportation. The goods transport from Nagpur and the easterly state boundary takes almost upto 36 hours to reach Jawaharlal Nehru Port. The additional freight time is on account of poor road connectivity and also the inability to handle heavy and multi-axle vehicles. To improve the travel time and comfort among these important cities Government of Maharashtra have decided to strengthen the transport network, which in turn will boost the economy of draught prone area of Vidarbha and Marathawada. Accordingly, Government of Maharashtra has decided to construct a Super Communication Expressway connecting Nagpur and Mumbai. An announcement to that effect was made by the Hon'ble Chief Minister in the Maharashtra Legislative Assembly on 31<sup>st</sup> July 2015.

The project starts from Hingna in Nagpur Revenue Division and ends at Vadpe on Bhivandi bypass, in the Konkan Revenue Division. The length of the proposed expressway is approximately 710 km. The expressway route will traverse through Hingna - Wardha - Pulgaon - Karanja Lad - Malegaon - Mehekar - Sindhakhedraja - Jalna - Karmad - Aurangabad - Daultabad - Lasur - Vaijapur - Shirdi - Sinnar - Ghoti - Kasara - Khardi - Kasegaon - Chinchawali - Vadpe. The total length will be 710 km), and the route is illustrated in Figure 4-5.

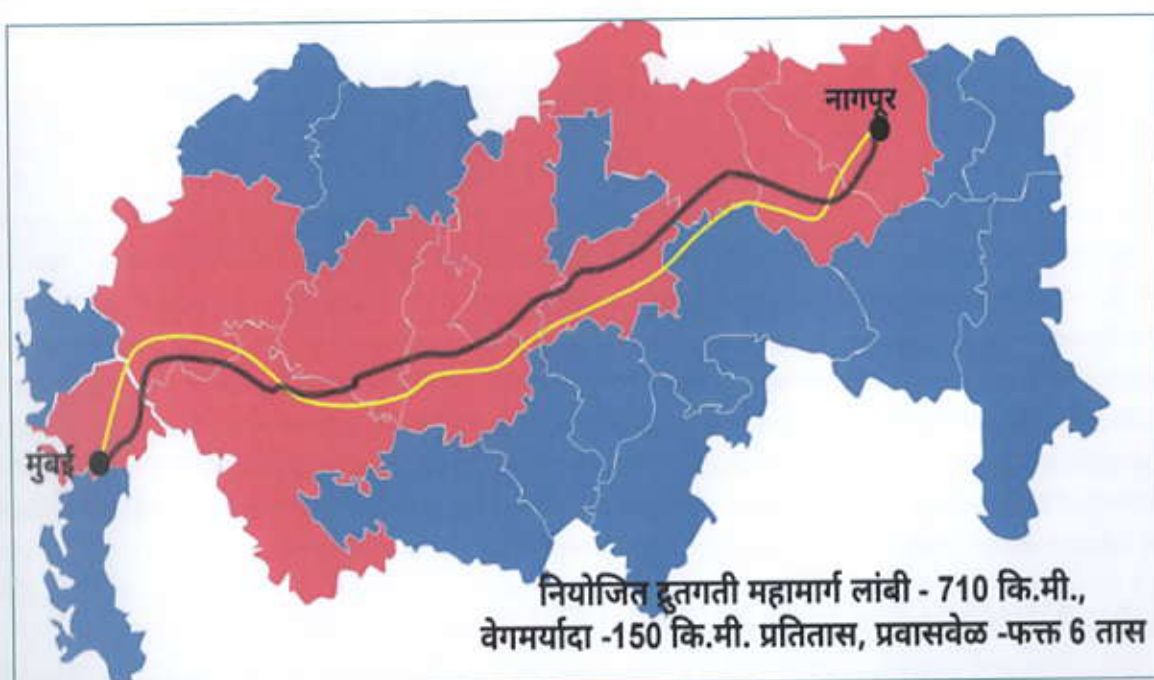


Figure 4-5: Proposed Nagpur- Mumbai Super Communication Expressway

The proposed features of Nagpur Mumbai Super Communication expressway are as follows:

- a) Total Length – 710 km (approx.) Greenfield Alignment;
- b) Design Speed – 150 km/hr;
- c) ROW : 120 m in areas without forest land & 90 m in areas that contain forest;



- d) Central Median: 15m;
- e) 6 lane (2X3) dual carriageway with 3m paved shoulder and 2m earthen shoulder;
- f) Underpasses for wild life / cattle crossing to be spaced adequately;
- g) Flyover/Interchange at major road crossings;
- h) VUP's & PUP will be provided at every village/ town and proposed alignment will avoid major town/ city;
- i) Solar Lighting;
- j) Emergency telephones @ every 5km;
- k) Food Plaza & restaurants, shops and wayside amenities will be planned. [The wayside amenities includes trauma centre, truck terminus, IT parks and];
- l) IT companies, educational institute, median plantation/landscaping, bus bays, tunnel lighting, bridge- beautification, street lighting and digitized signage;
- m) The expressway will have Free Wi-Fi access, traffic surveillance and enforcement and CCTV to monitor the project length; and
- n) Nodal development projects & utility services along the expressway.

The total cost of the project is estimated to be around 46,000 crores. The total length of the expressway is 710 Km. and the cost of civil works is estimated to be around INR 27,000 crore. The available widths of the RoW in different sections across various districts of Maharashtra are summarized in Table 4-3.

**Table 4-3: RoW in various sections of Nagpur-Mumbai Expressway**

Sl. No.	Package (Division)	Length(in km)	ROW
1.	Nagpur	89.41	80m in first 6.2 km and 120m in remaining length
2.	Amravati	257.88	120m
3.	Aurangabad	154.97	120m/90m in Forest
4.	Nashik	120.68	120m
5.	Konkan	77.98	120m/90m in Forest

Five DPR consultants were engaged to prepare the detailed design of the respective sections awarded, who have completed the detailed traffic surveys and analyses for their respective sections. The traffic data and analyses, prepared by the individual DPR Consultants had been reviewed and compiled in a traffic report capturing the entire alignment. The total traffic volumes during the base year, as reflected from the integrated analysis, varied between 20,000 to 32,000 PCUs at various toll plazas. Total numbers of toll booths proposed were twenty-four (24) between the two terminal points of the proposed expressway. The traffic growth rates established were based on elasticity approach, where in, a relationship is established between several crucial factors like Past Traffic Growth, Vehicle Registration & GDP growth. The traffic growth rate has been estimated to be within 6% to 8% for various vehicle categories during the short term or midterm scenarios, whereas a reduced growth rate varies within 3.5% to 6% towards the end of concession period. However, it may be noted, traffic ramp up is expected to take time and likely to stabilize over a period of 5 years post construction period.

#### 4.7 MUMBAI-AHMEDABAD BULLET TRAIN

The introduction of the Japanese Bullet train, a flagship program by the Prime Minister, will have several social and economic benefits. The work on the Mumbai-Ahmedabad corridor was supposed to begin by the end of 2017 and is expected to be operational by 2023. The construction was expected to commence from 2018 and complete by 2023. The construction was further preponed to 2017. The bullet train line is proposed to be built between Mumbai and Ahmedabad, two cities that are 505 km apart, with the help of Japanese "Shinkansen" technology. The bullet train, while operational will reduce the travel time



between the two cities to 2 hours and 7 minutes, reducing the same from 6 hours and 15 minutes, which is currently consumed by the Mumbai-Ahmedabad Shatabdi Express. The cost of the project is estimated to be INR 1.10 lakh crore. Proposed alignment of the Mumbai-Ahmedabad Bullet train is illustrated in Figure 4-6. Salient features of the bullet train project are as follows:

- a) Proposed halts will be Bandra Kurla Complex (BKC) - Thane-Virar-Boisar-Vapi-Billimora-Surat-Bharuch-Vadodara-Anand (Nadiad) - Ahmedabad-Sabarmati;
- b) Top speed of the bullet train- 350 kmph;
- c) Travel Time reduction to 2 hours in comparison to the existing 6-7 hours by Shatabdi Express;
- d) Mumbai-Ahmedabad rail corridor work, which was proposed to begin in the end of 2017;
- e) Mumbai-Ahmedabad Bullet train is expected to be operational during 2023;
- f) Fare – Likely to be 1.5 times the AC train fare; and
- g) 81% of funding will come by the way of a Japanese loan.

The project might not generate revenues from the fares, but it would have high potential of revenue making from the sale of goods inside the stations as well as from the advertisements and the business activities around the station areas. Introduction of such a system is supposed to lead to various land developments including high density residential, commercial, business and others along the corridor. The railway line will be underground in the Bandra Kurla Complex area in Mumbai, followed by a 21 km long underground tunnel, a seven (7) km section of which will traverse under the sea, which will further surface near Thane. Much of the section through Gujarat will be on an elevated right-of-way. There will be a total of twelve (12) stations along the entire route, while eight (8) of them will be in Gujarat. The stations will be closer to the existing railway stations in Ahmedabad, Vadodara and Sabarmati. The ground work is divided into two parts; one is for the construction of an exclusive training institute at Gandhinagar and the other is the complete civil work. For the civil works, except for tunneling and two critical areas- Ahmedabad and Vadodara- all are open to Indian contractors without any condition. Out of 508 km, around 450 km is open to Indian contractors. In electrical system, certain areas have been identified which will be done by the Japanese contractors only. Work on the tracks will be done by the Japanese contractors only, as the tracks will be ballastless and currently India doesn't have the technology. The proposed alignment of the bullet train corridor is shown in Figure 4-6.

The major reason behind the construction of this project is to boost the accessibility and faster mobility between the two major cities, which in turn is expected to spearhead the economy of this region. The ridership on the bullet train is expected to be higher due to the expedited travel time and the ease of accessibility on the train. Maharashtra government has also consented to provide necessary land in the Bandra Kurla Complex (BKC) to carry out the construction work. The MMRDA was earlier opposed to giving the land as they wanted the land for the proposed International Financial Services Centre (IFSC). Japan has offered an assistance of approximately INR 79,000 crore to be repaid during the next 50 years. Indian Railway has framed a SPV named as High-Speed Rail Corporation Limited (NHSRCL), with a paid-up capital of INR 500 crore for the project. Railways has already allotted INR 200 crore for the SPV and Maharashtra and Gujarat will have equity of 25% each, which the Railways will have 50% in the SPV.

National High-Speed Rail Corporation (NHSRC) appointed a general consultant in December 2016. The role of this consultant is to do the complete. NHSRC has been waiting for completion of the detailed design subject to which the loan agreement will be signed. The ground survey has been completed, while the next step is to undertake a detailed social impact assessment, for which necessary initiatives have already been taken.



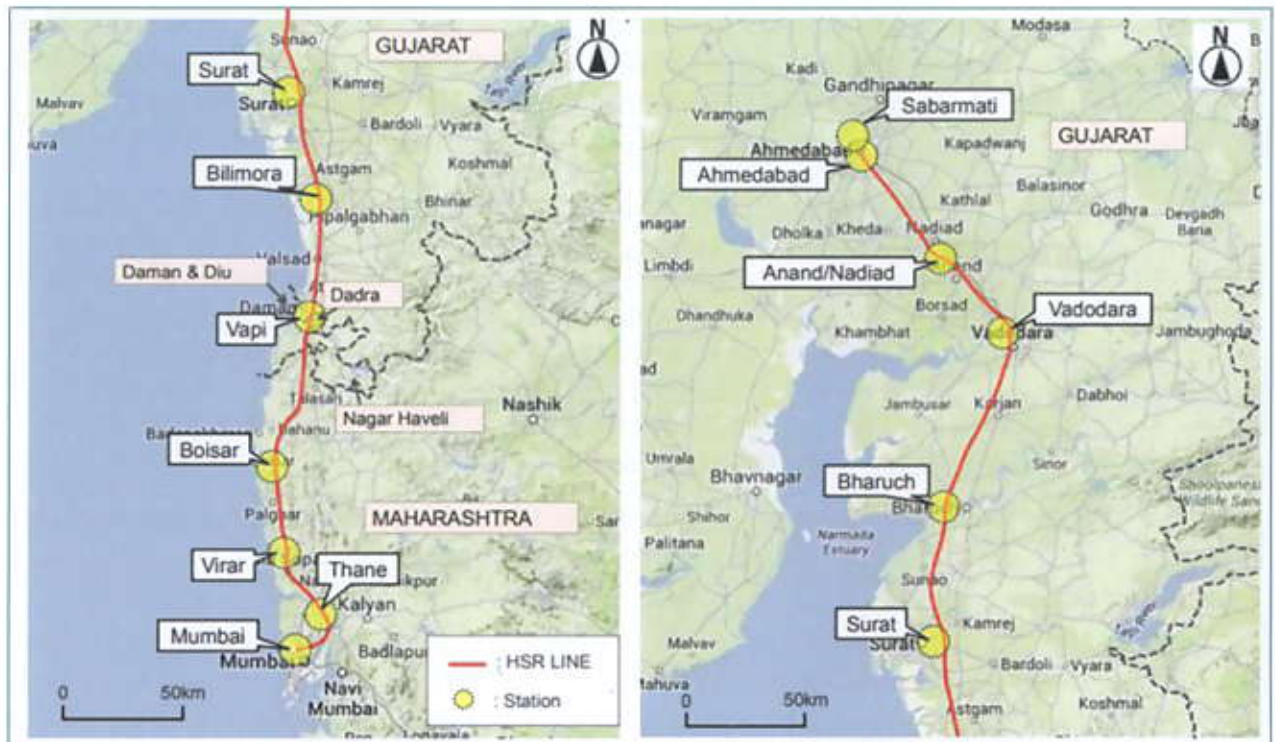


Figure 4-6: Proposed alignment Mumbai-Ahmedabad Bullet train

#### 4.8 DHARAVI REDEVELOPMENT PLAN

The Government of Maharashtra in the year 2003-2004 had decided to redevelop Dharavi as an integrated planned township. An action plan for implementation of Dharavi Redevelopment was developed and duly approved by its G.R. on 04.02.2004. It was decided that the development will be carried out utilizing the existing land as a resource to cross-subsidize the cost of the development. Slum Rehabilitation Scheme will be developed identifying unique land parcels, whereas the remaining land parcels will be developed by successful developers that will be procured through competitive bidding. The government also decided to notify the Dharavi area as undeveloped and appoint a Special Planning Authority for necessary planning and development of the entire area.

Government in Urban Development Department (UDD) accordingly notified the lands admeasuring about 178.30 Ha. The land was bounded by Sant Rohidas Marg (Sion-Bandra Link Road) to thenorth, Mithi River (Creek)/Mahim Creek to thenorthwest, the junction of Sant Rohidas Marg and L.B.S. Marg to thenortheast, Central Railway Tracks to the east, Western Railway Harbor Tracks to thesoutheast, west and southwest. The Dharavi Notified Area (DNA) appointed the Slum Rehabilitation Authority by notification no. TPB 4034/322/CR-56/04/UD-11, on 09.03.2005. The Slum Rehabilitation Authority was constituted under Section 3A of Maharashtra Slum Areas (I. C. & R.) Act 1971 and identified as the Special Planning Authority (SPA) of the Dharavi Development area under sub Section 1(b) of Section 40 of M.R. & T.P. Act 1966.

Similarly, Government in UDD notified another adjoining the lands, measuring about 62.05 ha bounded by the Boundary of 'H' Block of Bandra Kurla Complex (BKC) to the north and northeast, Refuse Transfer Station outside 'H' Block area to the east (vide planning proposal of BKC, sanctioned under notification No.BKR-1177/262/UD-5 dated 9th April 1979), L.B.S. Marg to the southeast, Sant Rohidas Marg to the



south, C.S. no. 665 (Piwala Bungalow) and the boundary of 'H' Block of BKC to the west. by including existing Rajeev Nagar as Dharavi Notified Area under its Notification No. TPB 4308/3499/CR-83/09/UD-11, dtd. 25.06.2009 and appointed SRA as the Special Planning Authority for the same under sub Section 1 (b) of a section of 40 of the M.R. & T.P. Act, 1966.

Dharavi are redevelopment would trigger a complete reassessment of the transportation and accessibility need. The subject parcel of land consisting of horizontal-low rise temporary housing is foreseen to be converted into a higher density high rise mixed use development. Presently, the metro rail (Line 3) is the only mode that will traverse through the Dharavi area. It is presumed that once redevelopment happens, there would be a scope for people to use the available mass transit, which will reduce individual vehicle trip, and could increase the ridership on mass transit facility. A detailed development study should be undertaken to develop a better understanding on the potential transportation impacts including social and environmental impacts. In addition to the metro rail, the transportation impact study might find necessity of induction of further transit services to enhance accessibility and last mile connectivity.

The state government has approved a fresh plan for Dharavi redevelopment. A Special Purpose Vehicle has been proposed to be set up with 80% private stake and 20% government contribution in order to implement the project. The project is supposed to provide concessions in stamp duty, state GST repayment and relaxation in regards to the floor space index (FSI) consideration. Under the new plan a parcel of land owned by Central Railways (90 acres), abutting Dharavi, will also be included as the part of the redevelopment project.

#### 4.9 MASTER PLAN OF WADALA NOTIFIED AREA

MMRDA is appointed as an SPA for the 'Wadala Notified Area'. The State Government has approved a planning proposal prepared by MMRDA for Wadala, while a global FSI of 4 has been approved for the subject development. Considering Mumbai's economic growth and the commercial potential of Wadala, this area (which also includes a multi-modal transport hub) is being envisaged as the future commercial hub of Mumbai, which will be similar to the Nariman Point or Bandra Kurla Complex areas.

A Truck Terminal Authority Act was enacted in 1992 to operate, control and manage various activities and movement of commercial vehicles presumed to occur in Truck Terminal areas. Finally, the State Government of Maharashtra vide its notification No. TPB-4305/CR-318/05, UD-11, dated December 3, 2005, designated the MMRDA as Special Planning Authority for this area. Necessary authority to MMRDA was provided adhering to the Maharashtra Regional & Town Planning (MR&TP) Act, 1966. The land area covered by the SPA is specified as 122.10 ha (and with an extended boundary of the adjacent land parcel, the total developmental area is supposed to be up to 156.52 ha).

The proposed development plan is illustrated in Figure 4-7. The land-use distribution details are summarized in Table 4-4. It can be inferred that, the overall land area is 156.52 ha, while a projected FSI of 2.75 is expected to be achievable to prepare the development plan. A population of approximately 3 lakh is forecasted to be within this SPA area.



Table 4-4: Proposed Development Plan for Wadala Notified Area

Sl. No.	Particulars	Proposed Land Area (ha)	Proposed Land Area Distribution (sqm)	Proposed Land Area Distribution (%)
1	Roads	41.85	418523.07	26.74
2	R.O.S	32.27	322712.54	20.62
3	Reserved Forest Zone	24.28	242830.00	15.51
4	Residential			
a.	Lodha New Cuffe Parade	10.10	101000.00	
b.	Mathadi Kamgar Housing	5.96	59600.00	
c.	Proposed Development	2.36	23643.99	
	Total	18.42	184243.99	11.77
5	Commercial*	10.46	104643.49	6.69
6	Mixed Use	4.75	47536.52	3.04
7	Social Amenities	1.88	18772.48	1.20
8	Public Utilities	3.40	34001.20	2.17
9	Multimodal Transportation**	18.44	184380.63	11.78
10	Petrol Pump Reservation	0.21	2061.70	0.13
11	Rawali Channel	0.82	8200.00	0.52

\* including 92,000 sqm Commercial BUA proposed in Lodha New Cuffe Parade

\*\* including FSI already consumed on Monorail Yard of 69,826.87 sqm @ FSI 1

Source: Wadala Notified Area, Mumbai (Stage V: Final Master Plan, May16, 2017, (R2)



Figure 4-7: Proposed Development Plan for Wadala Notified Area



As indicated in Table 4-5, the population projection in Wadala Notified Area would be approximately 3 lakh persons, including the floating population. Based on the projected FSI on the master plan, approximately 1.15 lakh employments will be generated once Wadala reaches its full development potential over the next thirty years. An additional 1.2 lakh jobs are predicted to be generated due to the mixed-use and transport infrastructure related developments.

Table 4-5: Projected Population in Wadala Notified Area

Sl. No.	Landuse	Projected FSI Area (sqm)	Population (nos)	Remarks
1	Commercial	11,51,015.14	1,15,101.51	Occupancy assumed at 10 sqm per person
2	Residential	2,77,923.19	15,881.33	Average unit size 70sqm & occupancy @ 4 persons per unit
3	Mixed use	549,688.07	54,968.81	Occupancy assumed at 10 sqm per person
4	Social and Cultural Facility	71,259.12	7125.91	
5	Multi-modal Transportation	7,52,746.07	75,2743.61	
6	Public Utilities		-	
7	R.O.S (Layout)		-	
8	R.O.S (Plot)		-	
9	<b>Total</b>	<b>28,02,631.59</b>	<b>2,69,007.64</b>	<b>Total Population (A)</b>
			26,900.76	Assuming 10% floating population (B)
			2,95,908	Overall Population (A+B)

Presently, the main access to the Wadala Notified Area is from 36 m wide Sewri-Chembur Road, which connects the Eastern Express Highway (EEH) and the Eastern Freeway. Sewri-Chembur Road carries a significant volume of through traffic. It is predicted that maximum project traffic would be generated during the morning peak, as the predominant land-use would be commercial. Considering the land use distribution with the commercial land use as dominant, it is evident that morning peak is going to be higher than evening peak as incoming morning peak towards offices/commercial establishments are going to be concentrated and heavy.

Based on the trips generated during the most likely scenario, volumes to capacity (V/C) analyses were performed for full occupancy scenario to ascertain the levels of service (LOS) on major roads. Junction capacity analysis was conducted for the existing intersections as per the Highway Capacity Manual, 2010. Acceptable levels of service are expected at junctions when the development will reach its full potential. It has been felt that certain locations will become congested under future traffic conditions and necessary traffic control measures might have to be adopted. Considering the nature of the project location and the surrounding development including installation of mass transit systems provisioning of grade separation might not be feasible.

A detailed transportation impact study will be warranted for detailed assessment of the performance measures of the proposed transportation network. However, at the inception the following recommendations are made at the Regional level in order to develop the environmental and transportation infrastructure of the region to support the high-density development at Wadala Notified Area over the next thirty years.

- Widening of the bridge along Sewri-Chembur road adjacent to the Anik BEST Depot;
- Develop a grade-separated interchange on the Eastern Freeway considering the traffic demand during by 2025 horizon along with a traffic signal-controlled ramp junction;



- c) Extension of the proposed Metro corridor from Wadala to Carnac Bunder, as was intended in the earlier plan considering the re-development of the Mumbai Port Trust Lands in the near future and the development at Wadala Notified Area;
- d) Development of the BKC Connector would enhance the connectivity between Wadala Notified Area and BKC; and
- e) A wetland delineation, integration, and management plan at the regional level would be required in order to enhance the wetlands within the Notified Area as well. Until the time the regional level inventory is made, the SPA and citizens groups can take this task up;

At a regional level, certain infrastructural improvements as mentioned above will require integration with the planned development at Wadala Notified Area to allow smooth functioning of this Business District, once completed.

#### 4.10 MASTER PLANS FOR EXPANSION OF PORTS IN MMR

Ports, the gateways to India's International trade, that handle over 90% of the foreign trade. There are 12 Major Ports & 187 Minor/Intermediate ports along the 7,517km long coastline of the country. The Indian government has a federal structure, and according to its constitution, maritime transport is to be administered by both the Central and the State governments. While the central government's shipping ministry administers the major ports, the minor and intermediate ports are administered by the relevant departments or ministries in the nine coastal states including Andhra Pradesh, Odisha, West Bengal, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra, and Gujarat. Day to day operations of the "Major Ports" are managed through respective autonomous "Port Trusts" (Except Kamarajar Port, located on the Coromandel Coast about 24 km north of Chennai Port, Chennai, the first port in India which is a public company).



Post liberalization, few private ports which operate at almost similar levels with "Major Ports" have still termed as "Minor Ports" and are operated by State (provincial) governments. The seaports are located in various states including Maharashtra, Gujarat, Odisha, Tamil Nadu, Daman and Diu, Andhra Pradesh, Andaman, and Nicobar Islands, Kerala, Karnataka, West Bengal, Lakshadweep, Puducherry, and Goa. According to the Ministry of Shipping, around 95% of India's trading by volume and 70% by value is done through maritime transport.

##### 4.10.1 Master Plan efforts for Development of Mumbai Port

The MMR has two of the twelve major ports in the country, which are Mumbai Port (MbPT) and Jawaharlal Nehru Port (JNPT). In addition, another port is being planned at a site known as Rewas. MbPT and JNPT are putting efforts into expanding the capacities and their Master Plan efforts, which are described in the following sections (Refer Table 4-6).



**Table 4-6: Master Plan for the Development of Mumbai Port – Proposed Plans and Investments**

Sl. No.	Name of the Project and its mode of financing (e.g. Govt. funding or PPP format)	Brief Description of the Project	Projected future Investment (INR in crore)
1.	Construction of two off-shore container terminal Mode of financing: PPP: INR 862 Cr. Govt. funding: INR 366 Cr.	The proposal comprises of construction of two offshore container berths for handling vessels of 6000 TEU capacity. On implementation of the scheme, Mumbai Port's cargo handling capacity will increase by approximately 10 million tonnes per annum.	1,228
2.	Redevelopment of 18 to 21 ID, Harbour Wall Berths Mode of financing: Govt. funding	The proposal is of upgrading the four harbor wall berths at Indira Dock to handle large and deep drafted vessels. On implementation of the scheme, Mumbai Port cargo handling capacity will increase by approximately 7.00 million tonnes per annum.	353
3.	Construction of 2nd berth for handling chemicals / specialized grade of POL off Pir Pau Pier Mode of financing: Govt. funding	This 2 <sup>nd</sup> berth construction is proposed to handle chemicals and specialized grades of POL. With this additional berth, Mumbai Port cargo handling capacity will increase by approximately 2.00 million tonnes per annum.	116
4.	New cruise terminal near Gateway of India - Phase I and II Mode of financing: PPP	This international standard cruise terminal construction near Gateway of India will cater to cruise ship services from Mumbai.	152
5.	5th oil berth at Jawahar Dweep - modern oil berth to handle larger oil tankers Mode of financing: Govt. funding	The proposal is to increase the crude oil handling capacity of Mumbai Port as a result of the 5th oil berth construction at Jawahar Dweep. On implementation of the scheme, the crude oil handling capacity will increase by approximately 15 MTPA	150
6.	Redevelopment of BPX and BPS berths Mode of financing: Govt. funding	The proposal is for redevelopment and Modernisation of BPX, BPS container berths to serve to deep drafted vessels.	150

MbPT recommended the followings:

- Offshore Container terminal: MbPT, through a global tendering process on design-build-finance-operate and transfer (DBFOT) basis for a concession period of 30 years, awarded Indira Container Terminal (ICT) Pvt. Ltd. to develop an offshore container terminal; ;
- Development of 2nd Chemical Jetty at Pir Pau;
- Additional crude oil jetty at Jawahar Dweep, JD 5;
- Bunkering Terminal at Jawahar Dweep; and
- Capital dredging of 5th Oil Berth.

In 2016, Ministry of Shipping/ India Ports Association engaged M/s McKinsey and M/s AECOM India Pvt. Ltd. for preparation of the Master Plan for Mumbai Port under Sagarmala Project. As part of the Master Plan, several projects had been identified, which is expected to be taken up in a phased manner simultaneous to the building-up in port traffic. The proposed phasing, capacity addition and the likely investments (INR 33.9 billion) are presented below:

**Projects to be completed by the Year 2020:**

- Handling of steel cargo at OCT, 4 MPTA, INR 100 crores (Port's funds)
- Development of Marina at Victoria and Princes Dock, INR 200 crores (PPP)
- Setting up of a Floating Storage & Regasification Unit (FSRU), 5.0 MPTA, INR 2,740 crores (PPP)
- Upgradation of the Cruise terminal at BPX, INR 54 crore (PPP)
- Dry Docking facility at Indira Dock, INR 50 crores (PPP)



**Projects to be completed by the Year 2025:**

- a) Extension of OCT berth by 300 m, 4.5 MPTA, INR 150 crores (PPP);
- b) Projects to be completed by the Year 2035; and
- c) Extension of OCT berth by another 600 m, 2.5 MPTA, INR 100 crores (PPP);

MbPT identified approximately 342 Hectare Land to harness the potential development. Out of 342 hectare, nearly 165 hectare land is immediately available for development. MbPT, therefore, intends to develop this 165 hectare as Mumbai Port Complex- I (MPC - I), and prepare a Conceptual Master Plan for the entire 342 hectare land. A detailed master plan for 165 hectare has been proposed to be prepared simultaneously. The project also includes detailed infrastructure design, urban and landscape design, marketing strategy, financial strategy, implementation strategy. MbPT has retained a consulting organization for preparation of the detailed master plan, which is currently under progress.

**4.10.2 Ongoing and Planned Development in JNPT**

Currently, the principal traffic in JN Port consists of containers and liquid bulk. With the fast-growing industrial development in the hinterland, the intention is to develop additional facilities for handling dry bulk, break bulk, project cargo and automobiles to facilitate handling of exports cargo. Port has taken up several steps to install the facilities to accommodate the increasing traffic. The ongoing developments constitute the followings and illustrated in Figure 4-8.

- a) Deepening and widening of main harbour channel and JN Port channel;
- b) NSICT-DPW's 330 m standalone container terminal;
- c) Construction of additional liquid cargo terminal;
- d) Widening of Highway sections to a 6 to 8 lanes with a 2 lane=2 way service roads on either side (NH-4B, SH54, and Aamara Marg linkages);
- e) Rail connectivity project – Western Dedicated Freight Corridor to connect JNPT with Northern hinterland;
- f) Multi-Modal Logistic Park and Dry Port;
- g) Centralised Parking Plaza;
- h) Development of PSA's 4th Container Terminal on DBFOT Basis; and
- i) Port-Based Multi Product SEZ.

Container traffic at JNPT is expected to increase up to around 9 million to 10 million TEUs by FY 2025, matching the planned capacity at the port. The growth of container traffic is forecasted as 18.3 million TEUs under 2035 (an optimistic forecast). The overall traffic under the horizon year 2025 and 2035 are forecasted to be 144 MMTPA and 254 MMTPA, respectively. Apart from this, there will be additional opportunity for coastal shipping of cement that can potentially be induced. There is a potential to coastal ship to transport about 5 MTPA of cement from Andhra Pradesh to Maharashtra via JNPT under 2025 scenario. This is a contingent on the development of central AP Port which will serve as the origin port for this movement.



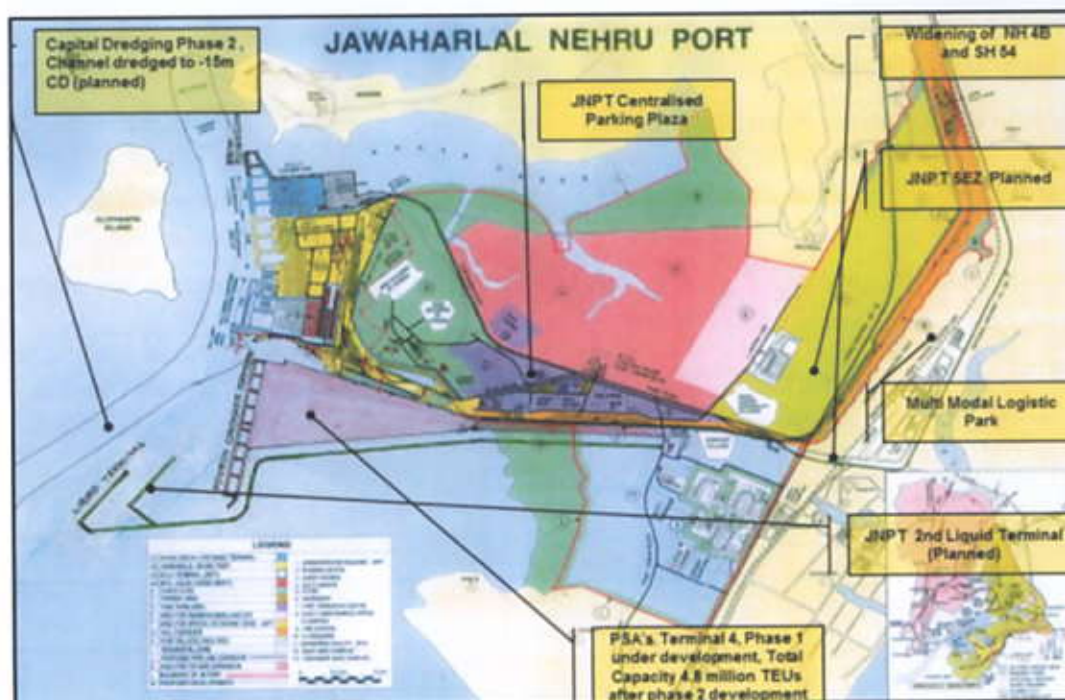


Figure 4-8 :Ongoing Developments at JNPT

As part of the Master Plan, several projects have been identified, which should be taken up in a time based manner considering full build-out conditions. The proposed phasing, capacity addition, and the likely investments are presented as follows:

#### **Ongoing projects**

- a) JNPT Container Terminal T4-Phase 1, 30 MPTA, INR 4,719 crores (PPP)

#### **Projects to be completed by 2020**

- a) Restructuring of JNPT Yard for Optimal Yard Utilisation, 3 MPTA – Estimated Project Cost – INR 200 crores (Port's funds);
- b) Construction of Flyover at Y Junction for Decongestion of Traffic Flows - Estimated Project Cost – INR 200 crores (Port's funds);
- c) Construction of Integrated Common Rail Yard, 3 MPTA - Estimated Cost – INR 200 crores (PPP);
- d) North Anchorage - Estimated Cost – INR 50 crores (Port's funds);
- e) Construction of Flyover at GTI Entry/ Exit Over the Rail Tracks to Common Rail Yard - Estimated Cost – INR 70 crores (Port's funds);
- f) Deepening and widening of JNPT and Mumbai Channel Phase 2, 24 MPTA - Estimated Cost – INR 2,029 crores (Port's funds);
- g) Reconfiguration and rehabilitation of port area for utilization of Coastal Berth for Liquid cargo, 2.5 MPTA - Estimated Cost – INR 20 crores (Port's funds);
- h) Construction of additional liquid bulk terminal-Phase 1, 3.8 MPTA - Estimated Cost – INR 570 crores (PPP);
- i) Construction of Central Truck Parking Terminal - Estimated Cost – INR 200 crores (Port's funds);
- j) Construction of Evacuation road for standalone Container terminal (330 m extension to DPW terminal) - Estimated Cost – INR 54 crores (Port's funds); and



- k) Provisioning of SEZ Phase EPC Contract for Infrastructure development - Estimated Cost – INR 468 crores (Port's funds).

**Projects to be completed by 2025**

- a) JNPT Container Terminal T4-Phase 2, 30 MTPA - Estimated Cost – INR 3,196 crores (PPP)

The Virar-Alibag Multi-Modal Corridor, Mumbai-Vadodara Spur in MMR and the existing and proposed alignments in the network would provide some effective diversion of traffic from JNPT as shown in Figure 4-9.

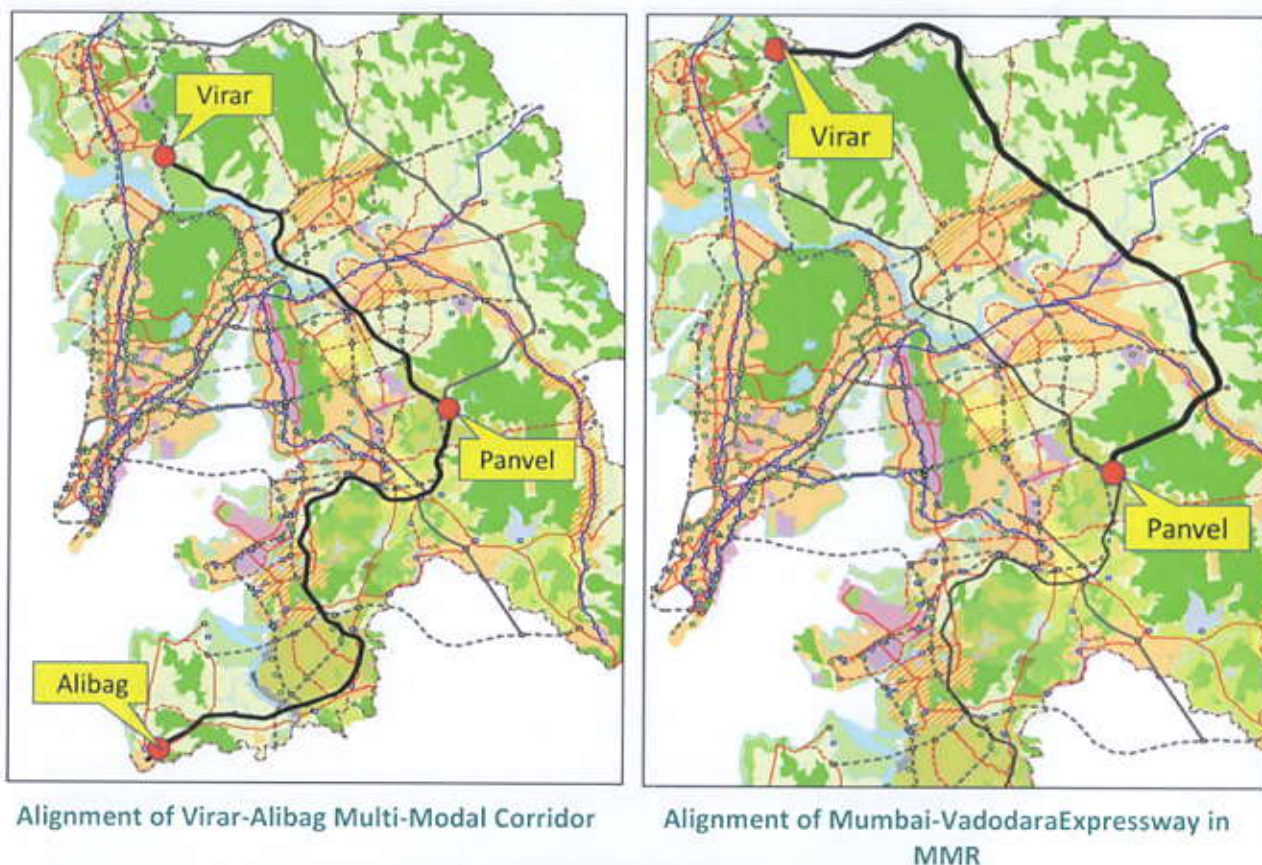


Figure 4-9: Network for dispersal of Traffic resulting from JNPT

#### 4.11 NAVI MUMBAI AIRPORT INFLUENCE AREA (NAINA)

CIDCO successfully sought approvals for the proposed International Airport in Navi Mumbai from Government of Maharashtra, Ministry of Civil Aviation and Ministry of Environment, Forest & Climate Change (MoEFCC), Government of India. While granting the Environmental and Coastal Regulations Zone (CRZ) clearances to the proposed Greenfield airport on November 2010, MoEFCC, Government of India, expressed concern about unplanned and haphazard development within 20 km of the Airport. In pursuance of these concerns, Government of Maharashtra identified the area around the proposed airport that was not under any urban governance mechanism (i.e. urban local body (ULB)/ special planning authority/ new town development authority etc.) and notified it as "Navi Mumbai Airport Influence Notified Area (NAINA)" and appointed CIDCO as the Special Planning Authority (SPA) January, 2013. NAINA comprised of 270 revenue villages from Uran, Panvel, Karjat, Khalapur, and Pen Talukas of



Raigad district and Thane Taluka of Thane district of Maharashtra. NAINA has an area of approximately 558 sqkm. Subsequently due to Notification of Matheran Eco-sensitive zone, by Ministry of Environment and Forests February 2003, two villages (Karambali Tarf Talaje and Sangatoli) which were part of NAINA earlier stood to be part of MESZ. Therefore, the total numbers of villages in NAINA reduced to 268. Further, by Government of Maharashtra corrigendum notification July 2015, Rode village was deleted and Nevali village was added in NAINA.

The process of preparation of Development Plan for NAINA has been completed and Existing Land Use map was prepared and submitted to Government of Maharashtra in November 2015. Meanwhile, Government of Maharashtra, September 2015, appointed MIDC (Maharashtra Industrial Development Corporation) as the Special Planning Authority (SPA) for eight villages in Khalapur Taluka. As per the said notification, three villages (namely Wangni, Kelavali and Kandroli Tarf Boreti) are fully under MIDC jurisdiction whereas five villages are partly in MIDC and NAINA. The fact that notification mentioned name of villages with series of survey numbers, it is assumed that the Gaothans engulfed within the list of survey numbers also fall under MIDC jurisdiction.

Later, Government of Maharashtra appointed MSRDC as SPA for 84 villages (67 villages from Khalapur Tehsil and 17 villages from Panvel Tehsil). As per the notification MSRDC was SPA for the area between Mumbai-Pune Expressway & Mumbai-Pune old Highway (NH4), and for the land within the two km south-west from Mumbai-Pune Expressway (excluding the area of Pune district and IDP in NAINA).

Due to above mentioned notification, the 11 villages of NAINA which had signed MOU in 'Make in India' week, were separated from NAINA and became part of MSRDC area. Due to initiatives and steps already taken for development of Khalapur Smart City (KSC), on request of CIDCO, Government of Maharashtra decided to remove these 11 villages from MSRDC jurisdiction. The revised list comprised of 71 villages. Out of these 71 Villages, 41 villages are from NAINA. After considering the areas excluded for MSRDC, MIDC and MESZ, NAINA now comprises of 224 villages with an area of 474 sqkm. NAINA Area is illustrated in Figure 4-10.

NAINA shares its boundary with Thane Municipal Corporation (TMC) and Ambarnath Kulgaon Badlapur Surrounding Notified Area (AKBSNA) in north, Matheran Ecosensitive Zone on east, Khopoli and Karjat Municipal Council, area under MSRDC as SPA, Pen Municipal Council on south and Dharmtar creek, Khopta New Town, Navi Mumbai New Town (CIDCO) and Navi Mumbai Municipal Corporation on west. In terms of geography, NAINA extends from Goteghar, Nitalas, Wangani Tarf Talaje and Maldunge villages in the North to Shirki Chawl, Wave, and Dhawate in the south west side and Shengaon, Mahad and Nimbode on the south-east. The east-west spread is about 30 km from Dighode to Varne. The region is a mix of flat and hilly areas with Kalundre, Kirki, Gadhi, Kalun, and Patal Ganga rivers passing through and other natural water bodies existing within the project area.



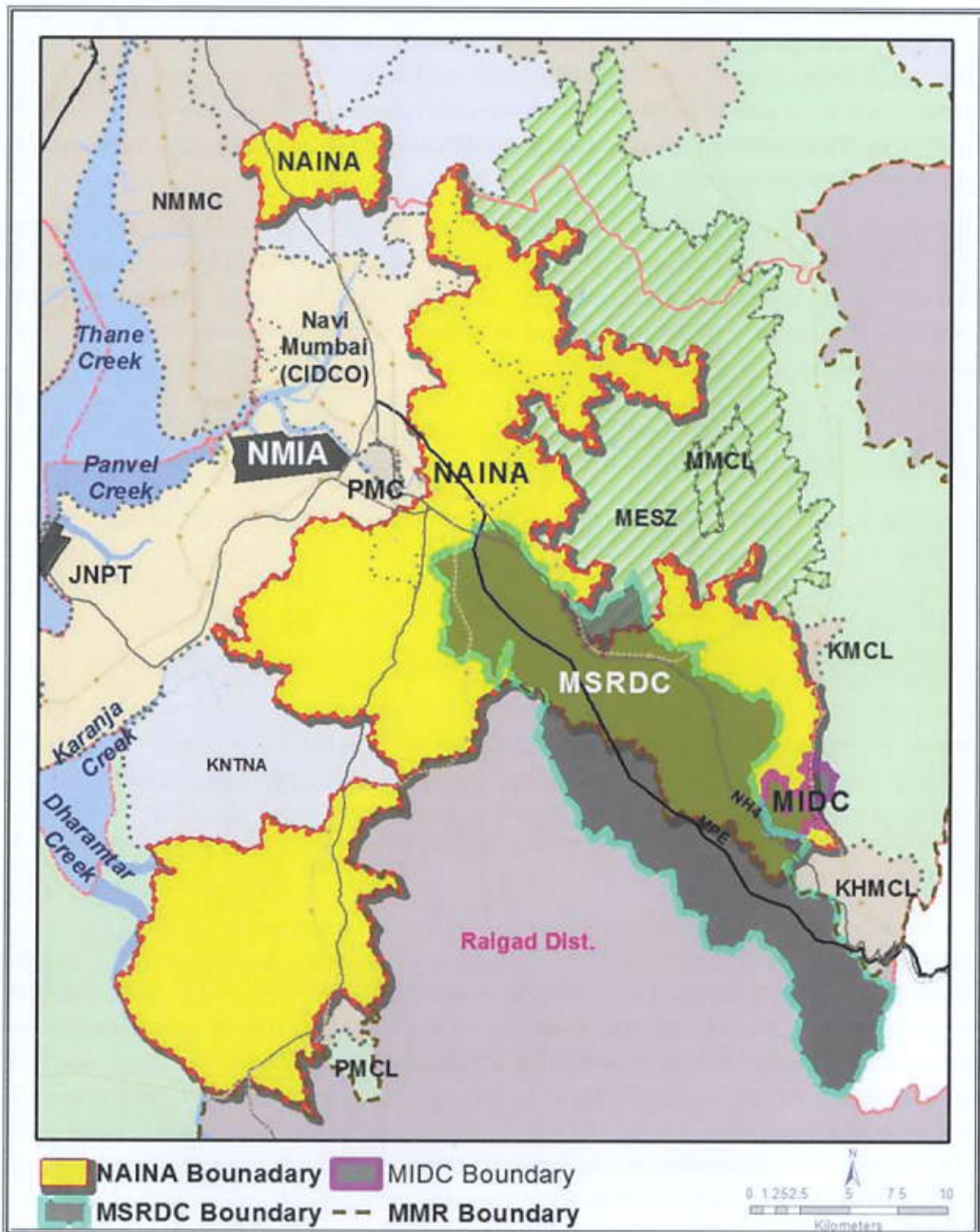


Figure 4-10: Location of NAINA in MMR



## 5 GROWTH SCENARIOS

The future growth of any region is uncertain. The estimate for population only based on time series analysis might not be valid for future in case of dynamic changes in the socio-economic parameters or change in environmental attributes. However, to overcome this shortage and uncertainty of the future growth scenario, various projection techniques have been developed to predict the more realistic future growth. Existing transportation systems are often examined to verify that the appropriate capacity requirements to accommodate any unforeseen random growth. It is presumed that the proposed transport infrastructure should be able to accommodate daily demand under the future forecast conditions. This study has assumed two alternative scenarios to suit the future transportation needs, which consider Scenario-1 i.e. population projection will adhere the principles assumed in the Draft Regional Plan, which is known as DRP Scenario; and Scenario-2 i.e. based on the anticipated development intensity, future transport infrastructure as proposed, some of which are already under implementation, and some planned investments, which is known as 'Comprehensive Transportation Study Update' (CTSU) Scenario. The detailed description of both the scenarios is presented in the following sections.

### 5.1 VISION FOR MMR

The Task Force, appointed by the Chief Minister following the Bombay First-McKinsey report "Mumbai Vision: Transforming Mumbai into a world-class city", adopted the vision of "Transforming Mumbai into a world class city with a vibrant economy and globally comparable quality of life for its citizens" to counter the declining economy and achieve true potential of growth. The earlier efforts of envisioning were having focus on Greater Mumbai. During CTS for MMR 2005-08 study and Business Plan for MMR study 2008, it was considered more appropriate to have a vision for the entire metropolis considering the growth and expansion of Mumbai beyond the municipal boundaries and the economic interdependence of the local jurisdictions. There is also a consensus that the vision statement prepared by the 2004 Task Force - ***"Transforming MMR into a world class metropolis with a vibrant economy and globally comparable quality of life for all its citizens"***, is considered appropriate by CTS for MMR 2005-08 and the same vision is followed in CTS for MMR Updation study. While planning for traffic & transport infrastructure for MMR for the period upto 2041, Vision 2041: Transforming Transportation in MMR formulated as follows:

**"Transforming MMR into a Sustainable Metropolis with enhanced accessibility, mobility, connectivity, safety, environment and quality of travel"**

### 5.2 DRAFT REGIONAL PLAN (DRP) SCENARIO

DRP Scenario is based on population projection made by MMRDA in the Draft Regional Plan 2036. Although the 2036 horizon has been considered in the Draft Regional Plan the study projects the population until 2041 horizon, which is identical to the long-term horizon, considered in the current study. The Draft Regional Plan forecasts projected population for all ULB's and urban area upto 2041. The ULB/ Urban areas have been regrouped into 19 clusters for the current study. This scenario is described as Draft RP scenario. The population projections for the nineteen clusters are summarized in Table 5-1.



Table 5-1: Cluster Level Population - Draft RP Scenario

CI No	Cluster Name	2017	2021	2026	2031	2041
1	Island City	2.90	2.89	2.71	2.44	1.95
2	Western Suburbs	5.75	5.84	5.68	5.59	5.13
3	Eastern Suburbs	3.99	4.05	3.95	3.88	3.56
4	Thane M.Corp	2.07	2.24	2.48	2.75	3.24
5	NMMC (NM-N)	1.44	1.70	2.02	2.39	3.20
6	KDMC,AKBSNA, UMC, KBMC,AMC	2.81	3.01	3.15	3.30	3.53
7	VVMC, VVSNA	1.70	2.04	2.46	2.98	4.11
8	Uran+NM-S	0.22	0.29	0.39	0.53	0.85
9	Pen, Naina Pt -2	0.13	0.13	0.14	0.14	0.14
10	BNMC, BSNA	1.07	1.16	1.22	1.29	1.44
11	MBMC	1.06	1.26	1.47	1.71	2.29
12	NAINA Pt -1 (near Panvel)	0.23	0.24	0.25	0.27	0.29
13	MSRDC	0.06	0.07	0.07	0.07	0.07
14	PMC+ NM-E	0.67	0.78	0.91	1.07	1.39
15	Khopda	0.06	0.06	0.06	0.07	0.08
16	Kharbao TAZ	0.02	0.02	0.04	0.04	0.10
17	Rest of MMR	0.24	0.27	0.28	0.29	0.29
18	Matheran, Karjat, Khopoli, Rural MMR	0.30	0.30	0.31	0.33	0.34
19	Alibag M.Cl, Rural MMR	0.16	0.16	0.17	0.17	0.18
<b>Total</b>		<b>24.88</b>	<b>26.52</b>	<b>27.76</b>	<b>29.32</b>	<b>32.17</b>

### 5.3 CTSU SCENARIO

In the previous CTS, various scenarios were evolved based on the relative growth of population and employment in the Greater Mumbai and rest of the MMR area. The scenarios, discussed and deliberated in CTS prepared during 2005 to 2008 were revisited based on the past trend observed since 2005 until 2017; anticipated developments; implemented transport infrastructure including the planned investments. This CTSU scenario considers the population projection in the Draft Regional Plan-2036, which has duly been altered at the cluster levels. Thus, the distribution has been adjusted based on the new inputs consisting of Government policies, current land-use, new developments, improved and planned transport infrastructure. This update was discussed and finalized based on various meetings with MMRDA officials, TAC Members and Stakeholders. The finalized projected population under the CTSU Scenario is summarized in Table 5-2.

Table 5-2: Cluster Level Population - CTSU Scenario

CI No	Cluster Name	2017	2021	2026	2031	2041
1	Island City	2.90	2.85	2.73	2.62	2.43
2	Western Suburbs	5.75	5.95	6.01	6.10	6.12
3	Eastern Suburbs	3.99	4.18	4.25	4.33	4.24
4	Thane M.Corp	2.07	2.39	2.56	2.75	3.21
5	NMMC (NM-N)	1.44	1.56	1.68	1.81	1.99
6	KDMC,AKBSNA, UMC, KBMC,AMC	2.81	3.08	3.23	3.41	3.53
7	VVMC, VVSNA	1.70	1.88	2.12	2.40	3.01
8	Uran+NM-S	0.22	0.37	0.50	0.68	1.15
9	Pen, Naina Pt -2	0.13	0.15	0.17	0.19	0.28
10	BNMC, BSNA	1.07	1.16	1.23	1.30	1.44
11	MBMC	1.06	1.09	1.20	1.34	1.55
12	NAINA Pt -1 (near Panvel)	0.23	0.25	0.28	0.30	0.49
13	MSRDC	0.06	0.06	0.07	0.08	0.17
14	PMC+ NM-E	0.67	0.78	0.91	1.06	1.21



CI No	Cluster Name	2017	2021	2026	2031	2041
15	Khopda	0.06	0.06	0.09	0.12	0.38
16	Kharbao TAZ	0.02	0.02	0.03	0.04	0.10
17	Rest of MMR	0.24	0.24	0.26	0.28	0.32
18	Matheran, Karjat, Khopoli, Rural MMR	0.30	0.30	0.32	0.34	0.39
19	Alibag M.Cl, Rural MMR	0.16	0.14	0.14	0.15	0.16
<b>Total</b>		<b>24.88</b>	<b>26.52</b>	<b>27.76</b>	<b>29.32</b>	<b>32.17</b>

#### 5.4 EMPLOYMENT FORECASTS AND ASSESSMENT AT CLUSTER LEVEL

Considering 100% containment level (work force equal to the employment) within the MMR area, employment levels during 2021, 2026, 2031 and 2041 were estimated. The incremental employment was added on the top of the total employment during the previous horizon year to estimate the total employment during the next horizon year. The incremental employment was then distributed among the identified clusters. As an example, employment during the 2031 horizon was considered based on the total employment during 2026 and the incremental employment during 2031. The incremental employment during 2026-2031 was calculated by subtracting the 2026 base year employment from 2031 employment of MMR and was distributed among the clusters. The employment was further classified as 'Basic' employment and 'Service' employment. Basic employment was the out-come of employment generated out of the planned inputs at the employment centers, as envisaged in the Regional plan/ the Development plan/ or in other relevant government policies. Service (Dependent) Employment was related to public services in various private and government employment centers.

Draft Regional Plan 2036 and Development Plans of ULB's in MMR identified the locations of upcoming employment centers. These locations were primarily the growth centers (Vasai, Kharbao, Nilje, Shedung), industrial areas (Virar, Bhivandi, Taloje, Khopoli, Khopta, Amba river etc), commercial hubs (Corporate Park Kharghar), upcoming airport area, JNPT expansion etc. Based on growth potential, as envisaged in the RP, the percentages of development under the horizon of 2021, 2026, 2031 and 2041, were considered to work out the potential employment. This, basic employment and population were used to work out service employments. Service employments and basic employments aggregate the total employments at cluster level. The following process was followed to assess the basic employments and service employments at individual cluster level under the Draft RP and CTSU scenarios, which detailed below:

- Basic employment is worked out by finding out the planned investment and land use.
- Service Employment was estimated as – Increase in employment at MMR level – Basic employment
- The service employment is distributed among clusters by giving 70% weightage to population and 30% weightage to Basic employment.

$$\text{Service Employment} = \text{ISC}_n = \left[ \left( \frac{\text{IPC}}{\text{TIP}} \right) * 0.7 * \text{TIS} \right] + \left[ \left( \frac{\text{IBC}}{\text{TIB}} \right) * 0.3 * \text{TIS} \right]$$

ISC<sub>n</sub> : Incremental Service Employment in Cluster 'n';

IPC : Incremental Cluster Population ;

TIP : Total MMR Incremental Population;

IBC: Incremental Basic Employment at Cluster;

TIB: Total MMR Incremental Basic Employment;

TIS: Total MMR Incremental Service Employment;



- d) The employment at cluster level = Service employment (distributed as explained above) + Basic employment(if falling in the cluster)

Cluster level forecasted employments under Draft RP Scenario and CTS Update Scenario during 2041 are summarized in Table 5-3 and Table 5-4, respectively.

**Table 5-3: Cluster Level Employment - Draft RP Scenario**

CI No	Cluster Name	2017	2021	2026	2031	2041
1	Island City	2.66	2.73	2.70	2.67	2.71
2	Western Suburbs	2.60	2.70	2.76	2.81	2.83
3	Eastern Suburbs	1.58	1.65	1.61	1.59	1.50
4	Thane M. Corp	0.52	0.59	0.69	0.76	0.90
5	NMMC (NM-N)	0.61	0.73	0.85	0.95	1.17
6	KDMC,AKBSNA, UMC, KBMC,AMC	0.70	0.79	0.90	0.97	1.10
7	VVMC, VVSNA	0.26	0.39	0.55	0.69	1.03
8	Uran+NM-S	0.05	0.08	0.16	0.39	0.74
9	Pen, Naina Pt -2	0.04	0.04	0.04	0.05	0.07
10	BNMC, BSNA	0.55	0.60	0.63	0.65	0.69
11	MBMC	0.21	0.29	0.37	0.43	0.60
12	NAINA Pt -1 (near Panvel)	0.05	0.06	0.07	0.13	0.22
13	MSRDC	0.02	0.02	0.03	0.05	0.08
14	PMC+ NM-E	0.16	0.21	0.29	0.40	0.60
15	Khopla	0.01	0.01	0.04	0.08	0.14
16	Kharbao TAZ	0.01	0.01	0.04	0.06	0.14
17	Rest of MMR	0.07	0.09	0.09	0.13	0.16
18	Matheran, Karjat, Khopoli, Rural MMR	0.08	0.08	0.09	0.12	0.14
19	Alibag M.Cl, Rural MMR	0.05	0.06	0.06	0.07	0.08
<b>Total</b>		<b>10.24</b>	<b>11.13</b>	<b>11.97</b>	<b>12.99</b>	<b>14.91</b>

**Table 5-4: Cluster Level Employment –CTS Updation Scenario**

CI No	Cluster Name	2017	2021	2026	2031	2041
1	Island City	2.66	2.71	2.71	2.72	2.85
2	Western Suburbs	2.60	2.75	2.89	2.99	3.14
3	Eastern Suburbs	1.58	1.70	1.72	1.74	1.72
4	Thane M. Corp	0.52	0.65	0.72	0.77	0.89
5	NMMC (NM-N)	0.61	0.67	0.72	0.75	0.80
6	KDMC,AKBSNA, UMC, KBMC,AMC	0.70	0.82	0.93	1.01	1.11
7	VVMC, VVSNA	0.26	0.33	0.42	0.50	0.69
8	Uran+NM-S	0.05	0.11	0.20	0.44	0.83
9	Pen, Naina Pt -2	0.04	0.05	0.06	0.07	0.11
10	BNMC, BSNA	0.55	0.60	0.63	0.65	0.69
11	MBMC	0.21	0.22	0.27	0.30	0.36
12	NAINA Pt -1 (near Panvel)	0.05	0.06	0.08	0.14	0.27
13	MSRDC	0.02	0.01	0.03	0.05	0.11
14	PMC+ NM-E	0.16	0.21	0.29	0.39	0.55
15	Khopla	0.01	0.02	0.04	0.10	0.23
16	Kharbao TAZ	0.01	0.01	0.04	0.06	0.14
17	Rest of MMR	0.07	0.07	0.09	0.12	0.17
18	Matheran, Karjat, Khopoli, Rural MMR	0.08	0.08	0.10	0.12	0.16
19	Alibag M.Cl, Rural MMR	0.05	0.05	0.05	0.06	0.08
<b>Total</b>		<b>10.24</b>	<b>11.13</b>	<b>11.97</b>	<b>12.99</b>	<b>14.91</b>

The forecast of population and employment for both the scenarios i.e. Draft RP Scenario and CTSU Scenario had been important inputs towards developing travel demand assessment and transport network analysis under various horizons including 2041. The planned transit network had also been included based on the proposed year of implementations.



## 6 TRAVEL DEMAND ANALYSIS AND RECOMMENDED TRANSPORT INFRASTRUCTURE (2017-2041)

Standard four stage travel demand modeling approach has been adopted in undertaking the travel demand analysis in order to forecast the travel demand, modal splits, and traffic assignment on road network including ridership estimates on various transit lines. The four-stage modeling consisting of 'Trip Generation', 'Trip Distribution', 'Mode-Split' and 'Trip Assignment'. 4-stage models were developed during CTS 2005-2008 Study, which had been revalidated utilizing various databases developed based on primary and secondary surveys/studies. Travel demand was assessed considering primarily six trip 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 (Suburban train, metro rail/ mono rail, bus, auto, taxi, car and two-wheeler). Further, MMR area has been divided into 1,810 'Traffic Analysis Zones' (TAZs) to complete the travel demand analysis (Ref

Figure 6-2).EMME (Equilibria Multimodal Multimodal Equilibrium) Version 4.0, a Canadian software package, was used for the travel demand modelling and network analysis, which was used in more than 70 cities across the world.

Primary traffic and transportation surveys carried out as a part of the subject study during the period 2017-2018. The outcomes of the primary survey results have been used in developing the database. Secondary data, extracted from other sources were integrated in the database, which were utilized to develop the travel demand analysis for the base year of 2017. Primary data were collected through the following tasks

- a) Home Interview Surveys (HIS) – 5,000 samples: CTS Updation study, 6000 samples from CMP for greater Mumbai and 10000 samples from NAINA Master plan for CIDCO.
- b) Classified traffic volume count and OD surveys at Outer Cordon locations for 24 hrs. (9 no.);
- c) Classified traffic volume count and OD surveys at Sub Region Cordon locations for 24 hrs. (20 no.);
- d) Classified traffic volume count surveys at Inner Cordon locations for 24 hrs. (33 no.);
- e) Origin-Destination surveys at Inner Cordon locations for 24 hrs. (4 no.);
- f) Classified traffic volume count surveys across Screen line points for 24 hrs. (3 no.);
- g) Classified traffic volume count surveys at Mid-block Location for 24 hrs. (11 no.);
- h) Classified traffic volume count surveys at Level Crossing Locations for 24 hrs. (3 no.);
- i) Road network inventory updation survey (2,500Km);
- j) Speed & Delay study(2,475 Km);
- k) Revealed and Stated Preference surveys (2,000 samples); and
- l) Workplace based surveys (5,000)

The classified traffic volume count locations across MMR as presented in Figure 6-1



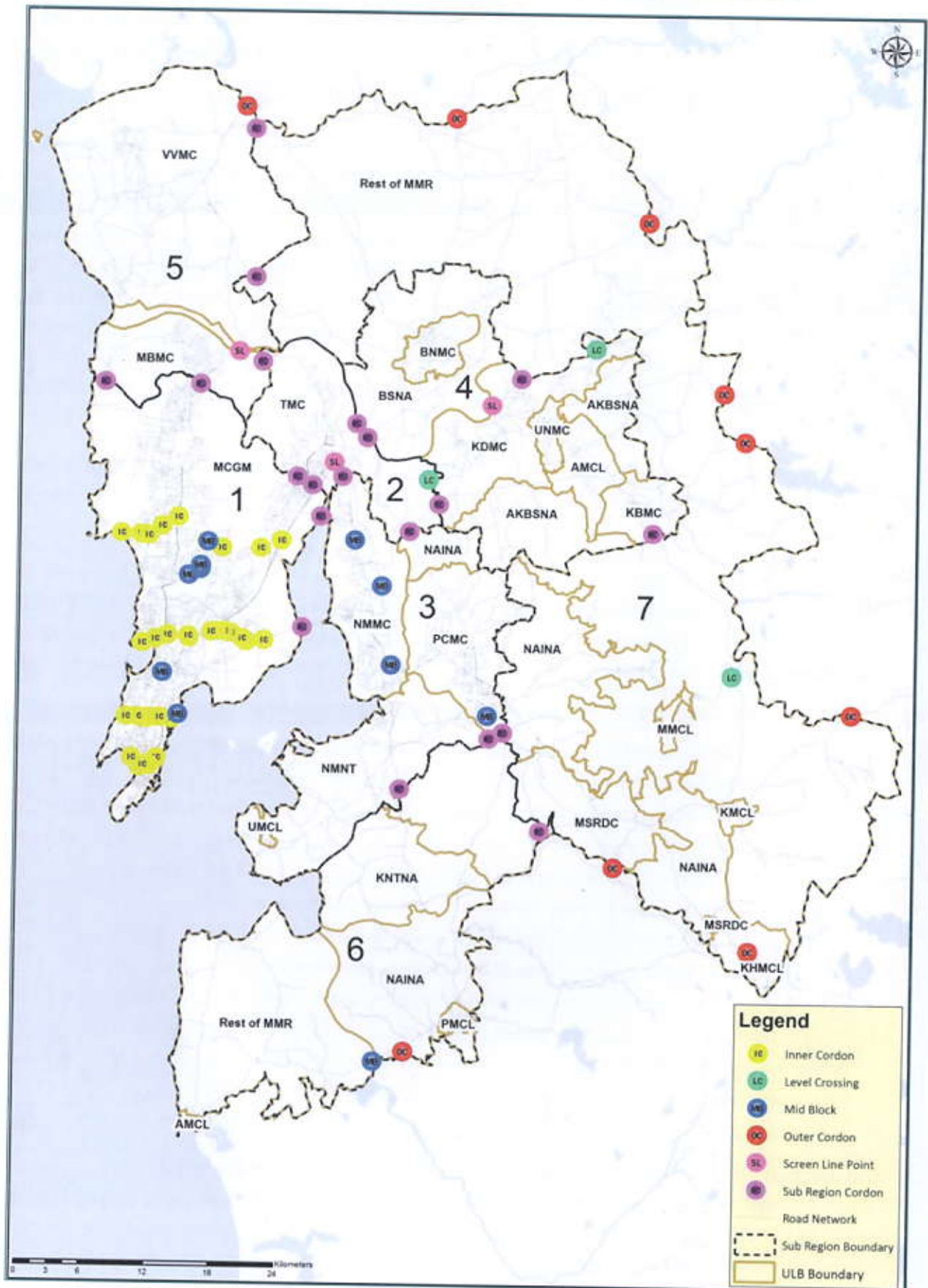
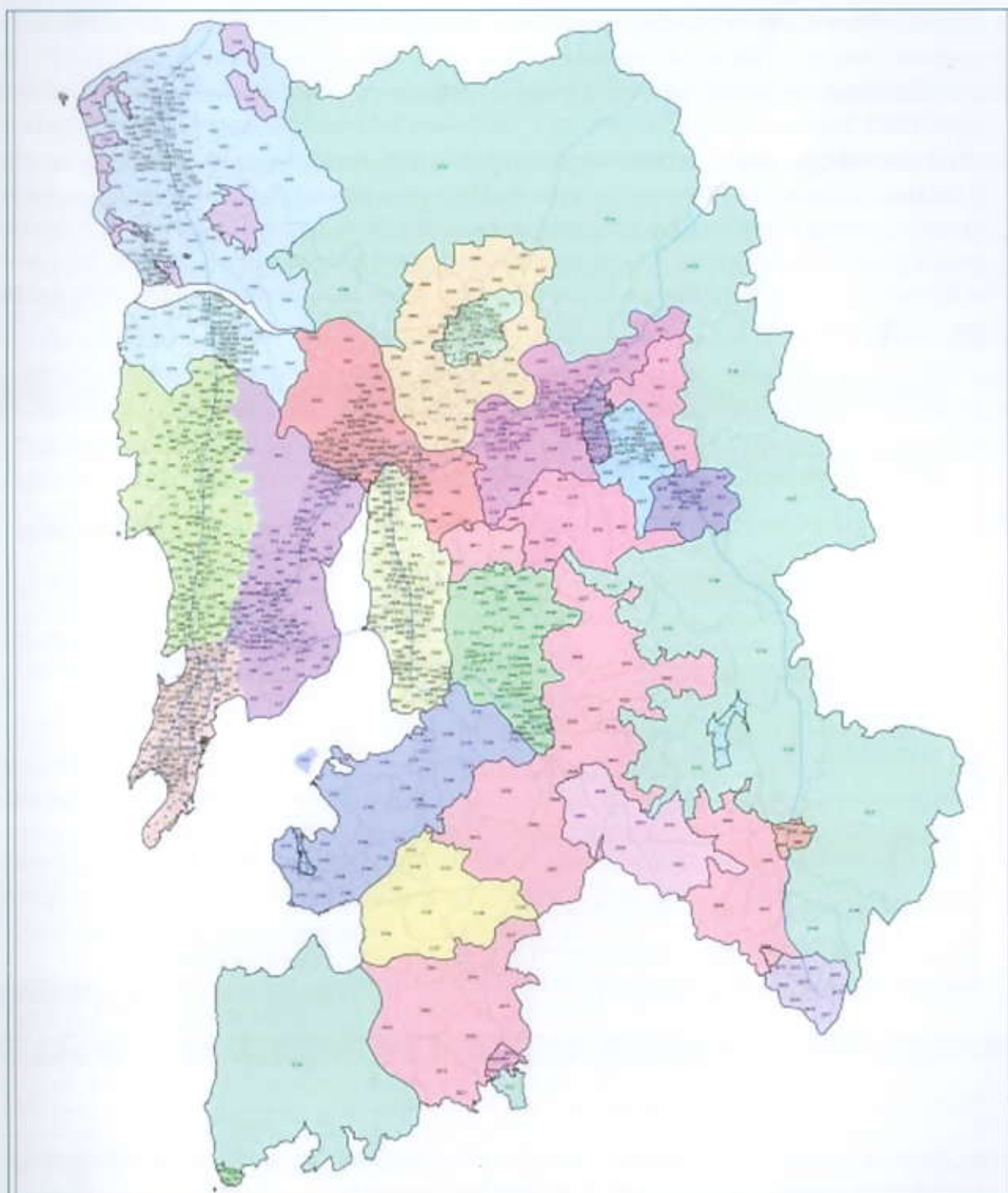


Figure 6-1: Classified Traffic Volume Count Locations in MMR





**Figure 6-2: TAZ System for MMR**

In addition to the above, available relevant secondary data had also been collected. Further, GIS based maps for the entire MMR had been prepared including existing land-use, existing transport network and individual ULB boundaries. A unique database on household socio-economic and travel characteristics based on the household surveys across the MMR had been prepared to develop the travel demand modelling.

It is pertinent to mention here that, while developing the travel demand models for MMR during preparing the CTS in 2005-2006, there was no metro and monorail corridors in operation. However, over



a period of last 8 year to 9 years, metro/monorail corridors have been actively operating. There are significant changes in the socio-economic characteristics, operating system characteristics of the public transport systems including major road improvements, which have been completed and opened for traffic (SCLR, Eastern Freeway, Flyovers, etc.). There were suburban rail capacity augmentations under MUTP, works for which were substantially completed, as well. These improvements had inflicted changes in the travel pattern, mode shares, etc. across the MMR area. Hence, CTS model updating was necessary including updating of the database and travel matrices. The following process towards estimation of the base year (2017) travel demand was adopted including model calibration and validation. The flow chart in the Figure 6-3 below illustrates the detailed tasks completed towards accomplishing the objectives of the CTS Updating.

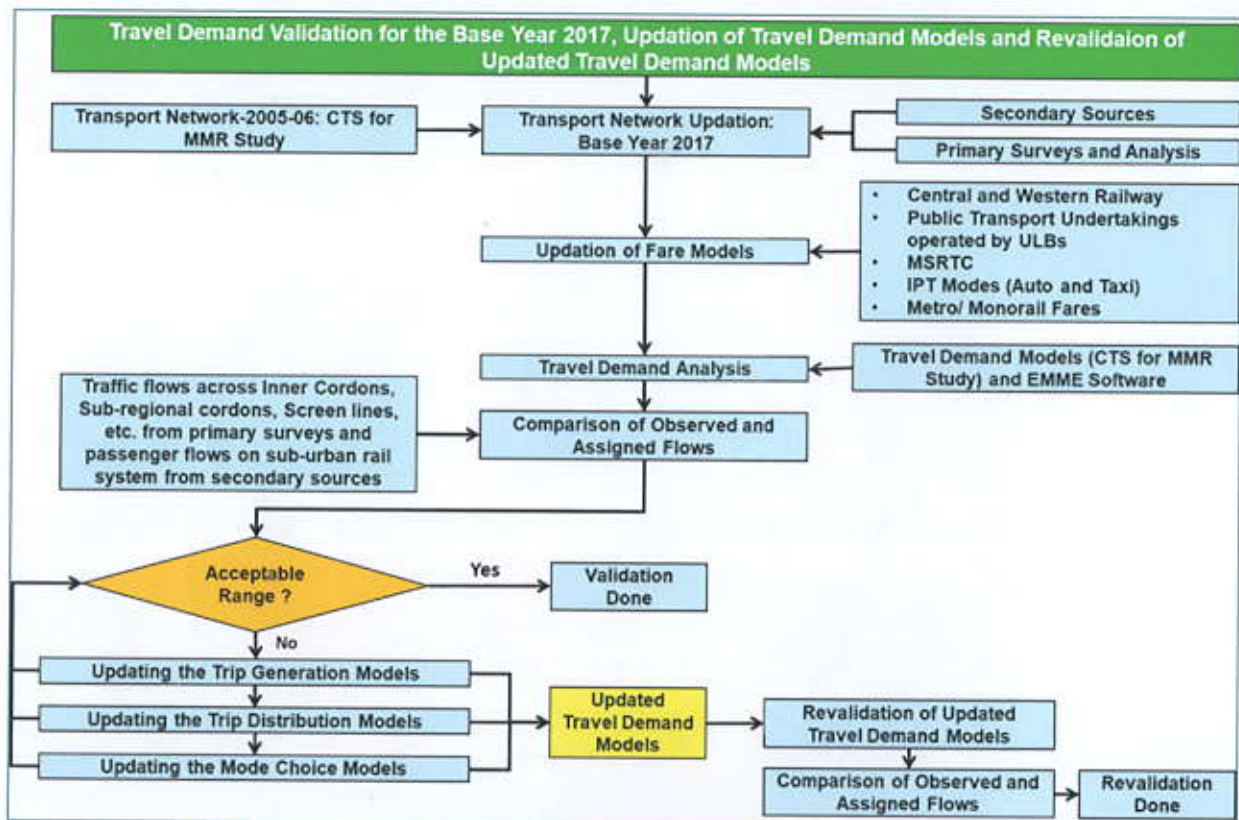


Figure 6-3: Overview of Updation of Travel Demand Models - Updation of CTS for MMR Study

Major steps involved in the development of these models are:

- Transport network updation based on CTS model developed for earlier study, subsequent study outcomes and integrating the operating public transport systems;
- Updating the fare collection models based on the secondary data collected from Central and Western Railways, Bus transit operated by various public transport undertakings, three-wheelers (auto-rickshaw) and Taxi;
- Updating of VOT and VOC using HIS analysis, Revealed and Stated Preference Surveys and Secondary Data;
- The travel demand models developed during the original CTS for MMR during 2005-2008 were used to develop the travel demand analyses for the base year 2017, based on various purposes and transport modes. Necessary calibrations and validations were completed comparing the assigned



traffic and observed traffic including passenger flows across the screen lines. The acceptable margin of error was within a range between 15% and 20%. In case the variation of assigned volumes were more than the actual demand or targeted convergence was not achieved the equations of four-stage modelling were updated.

- e) Generally, it is expected that, the error could be higher primarily due to the ten-year-old travel demand models, which requires a sequential update i.e. updating the trip generation equations, trip distributions, and mode choice. The observed flows and assignment flows across the screen lines had also been verified. If the errors were within acceptable range, the model was assumed to be properly validated.
- f) The calibration process continued further until a convergence between the observed and assigned traffic volumes and passenger flows across screen lines were noted, where the deviations were within the acceptable range. Summary of the mode wise travel demand (main mode only) estimated for the base year (2017) during morning peak period (6:00 to 11:00 hrs.) from the validated model is summarized in Table 6-1.

**Table 6-1: Passenger Travel Demand for MMR– Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.)**

Mode	Total (In Lakhs)	%
Car	3,88,699	6.9%
Two-Wheeler	6,24,932	11.1%
Auto Rickshaw	2,78,650	4.9%
Taxi	3,48,990	6.2%
Bus	10,08,417	17.9%
Train	28,84,431	51.1%
Metro/Mono	1,13,786	2.0%
<b>Total</b>	<b>56,47,906</b>	

Similar to the internal passenger travel (MMR area) assessment, assessments of the internal goods vehicle travel (MMR area) had been carried out for the base year 2017. Summary of the vehicular travel demand based on varying categories, estimated during the morning peak period (6:00 to 11:00 hrs.) is summarized in Table 6-2.

**Table 6-2: Goods Travel Demand (in vehicle trips) for MMR – Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.)**

Mode	Total
LCV	7,138
Trucks	18,394
<b>Total</b>	<b>25,532</b>

The 2017 external travel volumes, consisting of the “Internal to External” (MMR to outside of MMR) the “External to –Internal” (Outside of MMR to MMR) and the “External-External” (Outside of MMR to Outside of MMR) during the Morning Peak Period (6:00 to 11:00 hrs.) are summarized in Table 6-3.

**Table 6-3: External Travel in vehicles (MMR – Outside of MMR and vice versa) - Base Year 2017, Morning Peak Period (6:00 to 11:00 Hrs.)**

Mode	Vehicles Trips
Car	20,054
Two-wheeler	14,191
Auto	580
Taxi	2,443
Bus	1,822
Goods	13,340



The overall Travel Demand and Transport Network Analysis under various horizon periods until 2041 – “Bottom-up Approach” have been illustrated in Figure 6-4. This flow chart describes the application of updated travel demand models to assess traffic flow on the considered transport network under various horizon years i.e. 2021, 2026, 2031 and 2041. Major steps involved in the development of these models were:

- Assessment of planning parameters at Cluster level and TAZ level considering land-use and transport network parameters for horizon years 2021, 2026, 2031 and 2041;
- Forecasting internal passenger and goods travel demand using the updated travel demand models and assessment of external demand using growth factor methods for different horizon years; and
- Preparing EMME/4 software suit for estimating travel demand and network analysis following a “Bottom-up” approach i.e. assessment of traffic network for the horizon year 2021, followed by 2026, 2031 and 2041, respectively.

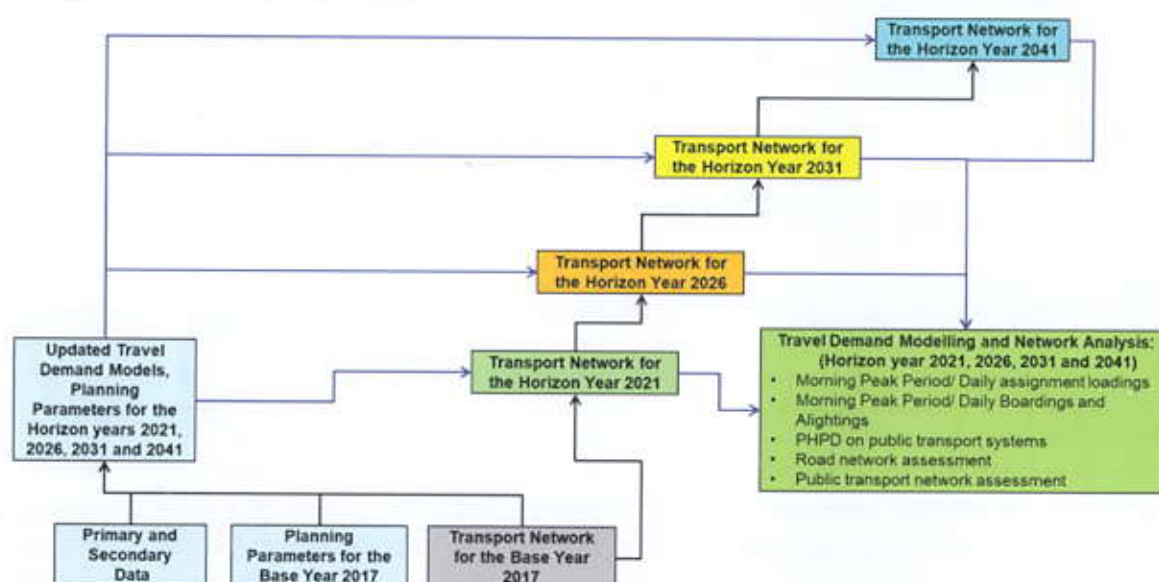


Figure 6-4: Travel Demand and Transport Network Analysis for the horizon period upto 2041 – “Bottom-up Approach” National Urban Transport Policy

The Government of India recognizes the importance of sustainable flow of goods and people in urban areas towards supporting the required level of economic activity. National Urban Transport Policy had, therefore, been framed by the Government of India to encourage sustainable development.

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. The policy recognizes the importance of providing good parking facilities in urban areas and also the need to properly manage the freight traffic. It offers central government’s financial support to fulfil the required investments and also aims at capacity building for efficient and sound urban transport planning to be developed for the Indian cities. It suggests that 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, during the urban planning stage rather than being a post facto thought;



- ▶ **Encourage public transport:** Encourage greater use of public transport ensuring quality and efficient multi modal public transport operations, well integrated with the surface transport system for providing seamless transfer across modes;
- ▶ **Provide equity:** Bringing about a more equitable and continuous allocation of road space to active transportation in comparison to the vehicular spaces; 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 optimized.

While assessing the required transport infrastructure for MMR under various horizons during 2021-2041 and ensuring sustenance of the existing public transport share, the NUTP policy guidelines had been followed.

## 6.1 TRAVEL DEMAND ASSESSMENT

Travel demand for the horizon period upto 2041 had been estimated using relevant travel demand models that were developed based on various planning parameters. Planning parameters assessed for the MMR are during the base years and various horizon years are summarized in Table 6-4. Travel demands during various horizon years had been estimated utilizing the planning parameters. Updated travel demand models were developed as part of Updating of CTS study. A bottom-up approach was followed to assess the transportation assignments during various horizons under the period of 2021 to 2041. Further assessment had been completed to identify the necessary transport network requirement under 2021 horizon including the short term (2026) horizon, midterm (2031) and far term (2041) horizons.

Table 6-4: Planning Parameters for the Base and Horizon Years

Parameters	2021	2026	2031	2041
Population (in million)	26.52	27.76	29.32	32.17
Workforce Participation Rates (%)	42	43	44	46
Employment (in million)	11.13	11.97	12.99	14.91

Source: Consultant Estimates

Summary of the daily travel demand based on main modes only, estimated for the horizon period upto 2041 is presented in Table 6-5. Bus being feeder system for metro and suburban, daily ridership of bus system would be about 2 to 2.5 times the main mode travel demand. Similarly, metro acts as feeder to suburban system, daily ridership of metro system would be about 1.1 to 1.5 times the main mode travel demand.

Table 6-5: Daily Passenger Travel Demand within MMR– Horizon Period 2021-41, in million

Vehicle Type	2017	2021	2026	2031	2041
Car	1.59	1.60	1.69	1.58	1.79
Two-wheeler	2.34	2.36	2.52	2.25	2.55
Auto	0.95	1.02	1.08	0.91	0.97
Taxi	1.63	1.66	1.53	1.23	1.20
Bus	3.75	1.82	1.99	1.68	1.80
Suburban	8.11	6.85	6.99	6.01	7.02
Metro & Mono	0.41	4.34	5.13	8.39	9.58
Total	18.78	19.64	20.93	22.04	24.91

Similar to the internal passenger travel assessment within MMR area, assessment of goods vehicle travel within MMR area had also been carried out under the period starting from horizon 2021 through to



2041. Summary of the vehicle type and travel demand estimated by various goods vehicular modewithin the MMR during morning peak period (6:00 AM to 11:00 AM) is summarized inTable 6-6.

**Table 6-6: Goods Travel Demand (in vehicle trips) for MMR– Horizon Period 2021-41, Morning Peak Period (6:00 to 11:00 Hrs.)**

Vehicle Type	2017	2021	2026	2031	2041
LCV	7,138	8,416	10,340	12,704	19,176
Trucks	18,394	19,879	21,905	24,137	29,308
Total	25,532	28,295	32,245	36,841	48,484

The external travel volumes by various modes during the morning peak period i.e. 6:00 AM to 11:00 AM undervarious horizon periodsuntil 2041 are presented inTable 6-7.

**Table 6-7: External Travel in PCUs (MMR to Outside of MMR and vice versa) – Horizon Period 2021-41, Morning Peak Period (6:00 to 11:00 Hrs.)**

Mode	2017	2021	2026	2031	2041
Car	20,085	23,831	29,520	37,104	57,590
Two-wheeler	14,190	16,846	20,785	25,798	39,147
Auto	781	946	1,181	1,493	2,297
Taxi	2,038	2,450	3,059	3,860	6,020
Bus	1,986	2,276	2,725	3,328	4,902
Goods	13,346	17,540	24,093	32,280	47,995

#### 6.1.1 Daily Mode Split and Mode Split Changes: Mumbai Metropolitan Region

Assessment of daily travel demand under the base year 2017had been completed based on the HIS data and analysis results, original CTS database, secondary data related to ridership details in various public transport systems, etc. The daily mode split details of the motorized vehicles are summarized in Table 6-8.

It has been noted that, public transport represents the dominant passenger travel share, which was 65.3%, while that by the private vehicle was estimated as 20.9%.

**Table 6-8: Daily Mode Split, Mumbai Metropolitan Region**

Main Mode	2017 (CTS Updation)	
	Trips per day (millions)	Motorized Mode Split
Metro & Mono	0.41	2.2%
Train	8.11	43.2%
Bus	3.75	20.0%
Rickshaw	0.95	5.1%
Taxi	1.63	8.7%
Two-Wheeler	2.34	12.5%
Car	1.59	8.5%
<b>Total</b>	<b>18.78</b>	<b>100%</b>
PV (Car & TW)	3.93	20.9%
IPT (Auto & Taxi)	2.58	13.7%
PT (Train & Bus)	12.27	65.3%
<b>Total</b>	<b>18.78</b>	<b>100%</b>

A comparison of mode-split within MMR, estimated in 2005 (CTS for MMR Study) and that in 2017 (Update of CTS for MMR) is summarized in Table 6-9. It may be inferred that, major mode split changes happened during the last decade, while public transport share had been decreased from 78.1% to 65.3%, which is alarming. The major reasons for reduction in the public transport share was potentially due to



lack of pace in periodical capacity augmentations to suburban rail system, delays in metro rail installation, higher private vehicle growth, increased travel time by the surface transport system, etc.

**Table 6-9: Daily Mode Split, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CTS Updation Study (2017)**

Main Mode	2005 (CTS for MMR Study)*		CTS Updation Study (2017)	
	Trips per day (Millions)	Motorized Mode Split	Trips per day (Millions)	Motorized Mode Split
Metro & Mono			0.41	2.2%
Train	6.97	51.8%	8.11	43.2%
Bus	3.55	26.3%	3.75	20.0%
Rickshaw	1.05	7.8%	0.95	5.1%
Taxi	0.22	1.7%	1.63	8.7%
Two-Wheeler	1.05	7.8%	2.34	12.5%
Car	0.62	4.6%	1.59	8.5%
<b>Total</b>	<b>13.47</b>	<b>100.0%</b>	<b>18.78</b>	<b>100%</b>
PV (Car & TW)	1.67	12.4%	3.93	20.9%
IPT (Auto & Taxi)	1.27	9.5%	2.58	13.7%
PT (Train & Bus)	10.52	78.1%	12.27	65.3%
<b>Total</b>	<b>13.475</b>	<b>100.0%</b>	<b>18.78</b>	<b>100%</b>

Daily travel demand growth within MMR that was assessed in 2005 and 2017 is summarized in Table 6-10. It has been noted that passenger travel demand by public transport has grown at CAGR of 1.29%, while that by IPT had grown at a CAGR of 6.08% and that by the private vehicle had grown at a CAGR of 7.39%, which reflected that passenger travel by private transport had the highest growth. Growth rates of various vehicle populations in terms of CAGR comparing the vehicles on road as on 31<sup>st</sup> March of 2005 and that in 2017 within the MMR are presented in Table 6-11. It may be inferred that; Two-wheelers have grown at a CAGR of 6.91% and that for the cars/ Jeeps was at 8.16%. Overall growth of vehicles in terms of CAGR within MMR was estimated as 8.85%.

**Table 6-10: Daily Travel Demand Growth, Mumbai Metropolitan Region Comparison: CTS for MMR Study (2005-08) and CTS Updation Study (2017)**

Main Mode	Trips per day in Millions, 2005 (CTS for MMR Study)	Trips per day in Millions, 2017CTS Updation Study	CAGR during 2005 to 2017
Metro & Monorail		0.41	
Train	6.97	8.11	1.27%
Bus	3.55	3.75	0.46%
Rickshaw	1.05	0.95	-0.83%
Taxi	0.22	1.63	18.16%
Two-Wheeler	1.05	2.34	6.91%
Car	0.62	1.59	8.16%
PV (Car & TW)	1.67	3.93	7.39%
IPT (Auto & Taxi)	1.27	2.58	6.08%
PT (Train & Bus)	10.52	12.27	1.29%



Table 6-11: Vehicles on road as on 31<sup>st</sup> March of 2005 and 2017 in MMR

Vehicle Category	2005	2017	CAGR
Two-Wheeler	13,49,006	43,35,616	10.22%
Cars	6,23,572	17,18,801	8.82%
Jeeps	74,918	99,621	2.40%
Stn. Wagons	4,986	10,364	6.29%
Taxis	80,722	1,96,613	7.70%
Auto Rickshaw	2,27,336	3,33,512	3.25%
Stage Carriages	6,757	10,149	3.45%
Contract Carriages	11,343	24,191	6.51%
School Buses	1,298	7,948	16.30%
Private Service Vehicles	2,976	4,901	4.24%
Ambulance	2,306	5,063	6.77%
Trucks and Lorries	1,01,217	1,91,032	5.44%
Delivery Vans (4 Wheelers)	62,904	1,47,197	7.34%
Delivery Vans (3 Wheelers)	51,390	1,39,455	8.67%
Tractors	3,256	4,874	3.42%
Trailers	7,010	15,262	6.70%
Others	7,003	10,797	3.67%
Tankers	1,41,153	22,937	4.11%
<b>Total</b>	<b>26,32,153</b>	<b>72,78,333</b>	<b>8.85%</b>

## 6.2 ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR MMR FOR THE HORIZON YEAR 2021 (IMMEDIATE TERM)

### 6.2.1 Transit Plan: Horizon Year 2021

The analysis reveals that, the immediate improvement need for effective transport network/system is to promote public transport (PT) system within/ across MMR area through adding more PT facilities. Therefore, more metro network i.e., about additional 60 km for the horizon year 2021 (based on the committed projects by various stakeholders that are expected to be in operation by 2021). The list of metro corridors for the horizon year 2021 is presented in Table 6-12.

Table 6-12: Metro Corridors Proposed upto Horizon Year 2021

ID	Corridor Name	Length (Km)
M-2A	Dahisar - DN Nagar	18.6
M-3 A	Bandra-SEEPZ	11.9
M-7	Dahisar (E) - Andheri (E)	16.5
M-15	Belapur – Taloja- Pendhar	11.1
M-16	Pendhar to MIDC	2.0

The list of suburban corridors proposed for the year 2021 is as enlisted in Table 6-13.

Table 6-13: Suburban Corridors Proposed upto Horizon Year 2021

ID	Corridor Name	Length (Km)
S-1	Seawoods to Uran	24.2
S-2	Airoli -Kalwa	4.7

Proposed Transit Network plan for the horizon year 2021 is illustrated in Figure 6-5.



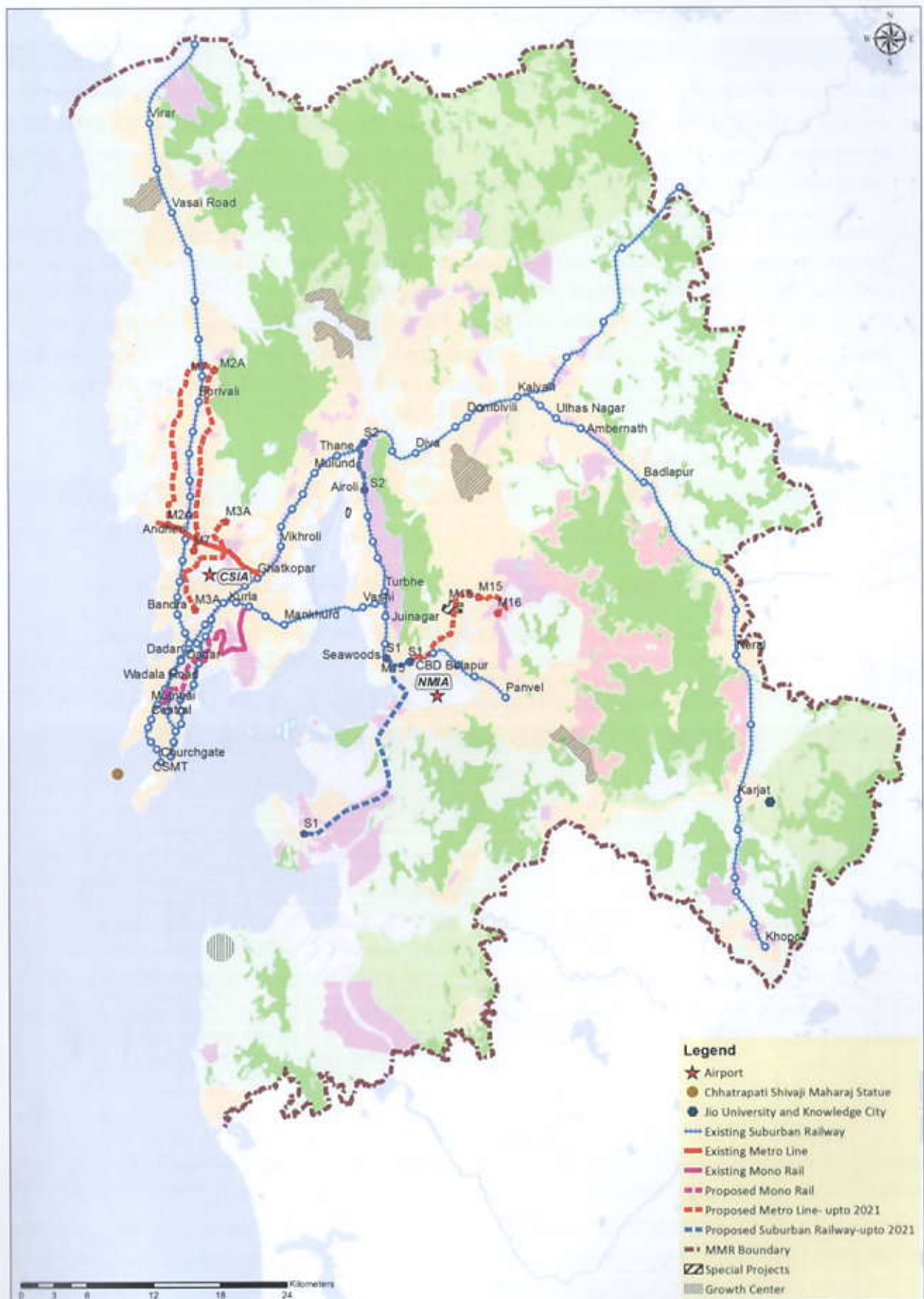


Figure 6-5: Proposed Transit Network Plan for Year 2021



### 6.2.2 Traffic Management Measures for the horizon year 2021

The need to manage the vehicular traffic under the immediate term could be fulfilled through installation of various grade separation e.g. flyovers, elevated roads and RoBs/RuBs until the 2021 horizon at the proposed locations Table 6-14, Table 6-15 and Table 6-16 summarize the potential grade separation at respective locations. It is worth noting that detailed traffic assessments should be undertaken prior to any specific decision makings.

The proposed traffic engineering measures are limited to the arterial road network. Under the immediate term, up to 2021, some specific capacity augmentation measures should be implemented, which would address some existing deficiencies and might provide some relief to the levels of service. These have been termed as "Immediate Action Plan". Based on the review of numerous background studies, reports and recommendations, supplemented with further data and compiled during the study undertakings, of the following preliminary measures had been developed, a preliminary cost estimate of the individual improvements has also been included in the report.

**Table 6-14: Proposed Locations of Flyover for the horizon year 2021**

SL.No	ID	Name	Length (km)
1	F-1	Kasarvadavali Flyover	0.49
2	F-2	Chatrapati Shivaji maharaj Marg (4 lanes Flyover from Pleasant Park to Silver Park Signal)	0.64
3	F-3	Chatrapati Shivaji maharaj Marg (4 lanes Flyover from Shivar Garden to SK Stone Signal)	0.76
4	F-4	Chatrapati Shivaji maharaj Marg (4 lanes Flyover from Golden Nest Circle to Deepak Hospital)	0.74
5	F-5	Thane Belapur Road (Savita Chemical Flyover)	0.72
6	F-6	Shilphata Mahape Road (SH-40) with four lane flyover at L&T Junction and Service Road	0.67
7	F-7	Thane Belapur (Talavali Naka)	1.61
8	F-8	Bhiwandi Kalyan Road (Rajiv Gandhi Chowk to Saibaba Temple)	3.03
9	F-9	Mumbai Nashik Expressway (Ranjoli Flyover)	0.84
10	F-10	Mumbai Nashik Expressway (Mankoli Flyover)	1.13
11	F-11	Ghodnunder Road (Bhainderpada)	0.38
12	F-12	Ghodnunder Road (Anand Nagar)	0.51
13	F-13	Junction of Eastern Express Highway and GMLR	0.77
14	F-14	Junction of SV Road and Kora Kendra Road	0.54
15	F-15	Junction of SV road and GMLR	0.75
16	F-16	Frere Road Flyover	0.50
17	F-17	Junction of JJ Road and SabooSiddhi Polytechnic	0.52
18	F-18	Ghatkopart Mankhurd Junction Shivaji Nagar Road	2.05
19	F-19	Connector between Bandra Kurla Complex G Block and Eastern Express Highway including ROB at the level crossing on V.N. Purav Marg near chunabhatti Station	1.68
20	F-20	Mahatama Gandhi Road	0.54
21	F-21	LBS Marg near Meenatai Thackrey Chowk	0.42
22	F-22	Meena Tai Thackrey Chowk	0.61
23	F-23	JVLR Near Lakeside Promenade	0.40
24	F-24	SH54	0.67
25	F-25	LBS Marg	0.75
26	F-26	Ghatkopar Mankhurd Link Road to Eastern Express Highway	1.02
27	F-27	LBS Marg	0.33
28	F-28	AGLR Flyover	0.82
29	F-29	Mumbra by-pass flyover	4.77



**Table 6-15: Proposed Locations for Elevated Roads for the horizon year 2021**

Sl.No	ID	Name	Length (km)
1	E-1	Bapne-Naigaon-Agashi Rd	0.21
2	E-2	Naigaon-Juchandra Road	0.67
3	E-3	Umelman-Naigaon Station Road	0.25
4	E-4	SCLR (BKC to Kapadia Nagar)	1.26
5	E-5	SCLR Elevated Road (Vakola Junction to Asian Heart Hospital) 4 Lane	1.25
6	E-6	Connector bet WEH and Senapati Bapat Road	0.41
7	E-7	Connector bet WEH and Senapati Bapat Road	0.44
8	E-8	Kalwa Naka	0.86
9	E-9	Uran Road	0.72
10	E-10	Umelman-Naigaon Station Road	0.41
11	E-11	SCLR Near Kapdi Nagar	0.70
12	E-12	Connector Between Bharat nagar Road and BKC Road	0.29
13	E-13	Bharat Nagar Rd to BKC Rd	0.40
14	E-14	SCLR Elevated Road (Vakola Junction to Asian Heart Hospital) 4 Lane	0.45
15	E-15	Connector Between Bharat nagar Road and SCLR	0.32
16	E-16	Connector Between Bharat nagar Road and SCLR	0.73
17	E-17	Connector Between Bharat nagar Road and SCLR	0.41
18	E-18	Western Express Highway	0.64
19	E-19	SCLR	0.24
20	E-20	SCLR Elevated Road near Nityanand Hotel	0.30
21	E-21	SCLR Elevated Road near D Surve Chowk	0.27
22	E-22	SCLR Elevated Road (Vakola Junction to Asian Heart Hospital)	0.25
23	E-23	SCLR near Directorate of Maharashtra Fire Services	1.16
24	E-24	SCLR near Napha Bus Stop	0.53
25	E-25	SCLR near Maha Auto	0.15

**Table 6-16: Proposed RoBs for the horizon year 2021**

SL.No	ID	Name	Length (km)
1	R-1	Vikroli Station ROB	0.42
2	R-2	South ROB at Mahalaxmi Station	0.52
3	R-3	Rail Over Bridge at Kopari, Thane	0.48
4	R-4	JVLR South ROB	1.39
5	R-5	JVLR North ROB	0.62
6	R-6	Alibag Khapoli road to Mumbai Goa Road	3.46
7	R-7	ROB at Titwala Ambiwili Junction	0.48
8	R-8	Kopri Bridge ROB	0.21

In addition to the above, additional bus fleet requirements, additional bus terminal-cum-depots for intra-city bus operations for the horizon period upto 2041 have also been estimated based on the travel demand analysis covering the period of 2021 to 2041, and recommendations were provided for various horizons i.e. 2021, 2026, 2031 and 2041.

### 6.2.3 Broad Cost Estimates for the horizon year 2021

The cost of the proposed transport network improvements under various horizons had been estimated based on the unit rates compiled from the recent past studies including some recent experiences on similar projects etc. The summary of costs for various transportation improvements under 2021 horizon are presented in Table 6-17. The total cost of improvements upto 2021 horizon is estimated to be INR 68,581 Crores based on 2017-2018 prices. The apparent costs of transport network proposed for enhancement of Suburban System, Metro system would be INR 7,290 (10.6% of the total) and INR 26,787



Crores (39.1% of the total), respectively, whereas the cost of necessary Traffic Management Measure installations would be INR 11,085 Crores (16.2% of the total), while rest of the estimated costs would be towards installation of bus rapid transit (BRTS)/ exclusive bus lane (EBL), general Bus System, Highway System and terminals etc. Due consideration on necessary Road safety enhancements had also been considered and some provisions, to the tune of approximately about INR 150 crores, were made to be implemented until 2021.

**Table 6-17: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2021 (in Crores)**

Component	2019-2021	%
Metro System	26,787	39.1%
Suburban System	7,290	10.6%
BRTS/ EBL	264	0.4%
Bus System	815	1.2%
Highway System	20,550	30.0%
Terminals	1,790	2.6%
Traffic Management Measures	11,085	16.2%
<b>Total</b>	<b>68,581</b>	<b>100%</b>

### 6.3 ASSESSMENT OF TRANSPORT INFRASTRUCTURE WITHIN MMR UNDER 2026 HORIZON (SHORT TERM)

#### 6.3.1 Transit and Highway Plans

The transport network recommended to be implemented until horizon year 2026 constitutes of improvements recommended to be implemented under 2021 horizon and that to be implemented until 2026 to the transportation network. The recommended improvements also include the corridors that are under the ongoing planning or project preparatory works, initiated by various stakeholders in the MMR. The travel demand assignment has considered all such projects that are under planning and those transit services, which operate well below the flow capacity and minimum PHPDT requirements are not met. The identified Metro corridors for horizon year 2026 are shown in Figure 6-6. The Proposed length for Metro network under the 2026 horizon is presumed to be around 325 km.

**Table 6-18: Metro Corridors Proposed upto the Horizon Year 2026**

ID	Corridor Name	Length (Km)
M-2A	Dahisar - DN Nagar	18.6
M-3 A	Bandra-SEEPZ	11.9
M-7	Dahisar (E) - Andheri (E)	16.5
M-15	Belapur – Taloja- Pendhar	11.1
M-16	Pendhar to MIDC	2
M-2B	D.N. Nagar - Mandale	23.6
M-2B Ext	Mandale to Mankhurd Octroi Naka	2.1
M-3B	Colaba-Bandra	21.3
M-4	Wadala -Kasarvadvali-Gaimukh	35
M-5	Thane-Bhiwandi-Kalyan	24.9
M-6	Swami Samarth Nagar - Vikhroli	14.5
M-7A	Andheri East To CSIA Airport	3.2
M-8	Airport Metro (CSIA – NMIA)	35
M-9	Dahisar (E) - Mira Bhayandar	10.3



ID	Corridor Name	Length (Km)
M-12	Kalyan - Taloja	20.7
M-14	Kanjurmarg-Badlapur	38
M-17	MIDC- Khandeshwar	7.2
M-18	Thane Ring Metro	28.7

A similar methodology, as above, was adopted for metro system and was applied for the suburban system and Highway network. The recommended suburban rail transport network under 2026 horizon is illustrated in Figure 6-6. The proposed Suburban network under the 2026 horizon will be around 172 Km as summarized in Table 6-19.

**Table 6-19: Proposed Suburban Network upto Horizon Year 2026**

ID	Corridor Name	Length (Km)
S-1	Seawoods to Uran	24.2
S-2	Airoli -Kalwa	4.7
S-3	Panvel To Karjat	28.5
S-4	Diva Vasai Road	41.5
S-5	Diva Panvel	25.6
S-6	CSMT to Panvel Fast Corridor	47.8

The higher order highway/ road network recommended under the 2026 horizon that would possess Right of Way width equal to or greater than 45.0 m is illustrated in Figure 6-7. The proposed higher order road network under the horizon year 2026 should be around 485 km as summarized in Table 6-20.

**Table 6-20: Proposed Highway Network upto 2026 Horizon**

ID	Name	Length (km)
H1	Elevated Link (Sewri-Worli Sea Link)	5.0
H2	MTHL	23.0
H3	Multimodal Corridor (Virar to Alibag)	127.3
H4	Radial 3 (Mumbai Nashik Exp. NH3)	40.7
H5	Radial-4 (Nahur-Airoli-Nilaje-Badlapur)	35.2
H6	Radial-5 (Turbhe-Taloja-Ustane)	17.1
H7	Mumbai-Vadodara Spur in MMR	84.8
H8	Thane-Ghodbunder	4.4
H9	Western Sea Link North Extn (Bandra-Versova)	12.3
H10	Coastal Road to Ambivili (MMC)	17.6
H11	Goregaon Mulund Link Road	16.1
H12	Khopoli to Pen	31.9
H13	CIDCO Coastal Road	10.0
H14	Mankhurd to NMIA	18.4
H15	Kalyan Ring Road	30.9
H16	Thane Creek Road	11.0





Figure 6-6: Proposed Transit Network up to the Horizon year 2026





Figure 6-7: Proposed Highway Network up to the Horizon year 2026



### 6.3.2 Traffic Management Measures under the 2026 Horizon

The Traffic management improvements under short term measures should be in addition to those proposed under the 2021 horizon i.e. immediate term measures. They were recommended based on road network inventory survey, upcoming infrastructure, proposed transport network and proposed land-use developments like growth centres/ industrial areas etc. The recommendations included intersection improvements, junction control improvements e.g. installation of traffic signals, installation of rail-over-bridges (RoBs)/ RuBs, flyovers, elevated roads, sidewalk improvements, FoBs/ Subways/ Skywalks, installation bike lanes/ cycle tracks, relocation of bus stops, station area traffic improvement system (SATIS), which would be in and around the major railway stations or interchange locations, various road safety measures, traffic signs & markings, basic civic infrastructure for traffic police, etc.

### 6.3.3 Broad Cost Estimates under the 2026 horizon

The broad cost estimates wasdone based on unit rate based on rates extracted from the ongoing construction contracts in the MMR and also the item rates extracted from others. The projected cost estimates until 2026 horizon was prepared on the base cost assumed for the 2021 horizon. The forecasted costs for various transport infrastructure development is summarized in Table 6-21. The total cost of the recommended transport infrastructure improvementsuntil the 2026 horizon period was estimated to be INR 2,93,283 Crores based on 2017-2018 item rates. The cost estimates of the proposed transport network improvementsfor the Metro system, Suburban, were forecasted to be INR 140,908 Crores (48.0%), INR 57,081 (19.5%) Crores, respectively; whereas the cost estimates for the Highway system and Traffic Management Measures were forecasted as INR 67,463 Crores (23.0%) and INR 18,210 Crores (6.2%), respectively. An approximate cost provision was made for enhancing the Road Safety situation was assumed as about INR 500 crores until the 2026 horizon.

**Table 6-21: Summary of Preliminary Cost Estimates for Proposed Transport System Improvementsuntil 2026 (in Crores)**

Component	2019-2026	%
Metro System	1,40,908	48.0%
Suburban System	57,081	19.5%
BRTS/ EBL	3,300	1.1%
Bus System	2,236	0.8%
Highway System	67,463	23.0%
Terminals	4,085	1.4%
Traffic Management Measures	18,210	6.2%
<b>Total</b>	<b>2,93,283</b>	<b>100.0%</b>

## 6.4 ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR THE MMR UNDER THE 2031 HORIZON (MIDTERM)

### 6.4.1 Transit and Highway Plans

Periodical transport system improvement requirements beyond the 2026 horizon were also assessed befitting to midterm (2031) and long term (2041) horizons based on the forecast travel demand assignments, developed for the respective horizons. The identified metro corridors warranted until 2031 horizon areshown in Figure 6-8.The cumulative total length of metro corridors proposed until 2031 shall



be 426 Km, which includes the existing and proposed corridors through to 2026 horizon. The detailed break-up for the proposed metro corridors summarized in Table 6-22.

**Table 6-22: Metro Corridors Proposed up to the 2031 Horizon**

ID	Corridor Name	Length (km)
M-2A	Dahisar - DN Nagar	18.6
M-3 A	Bandra-SEEPZ	11.9
M-7	Dahisar (E) - Andheri (E)	16.5
M-15	Belapur – Taloja- Pendhar	11.1
M-16	Pendhar to MIDC	2
M-2B	D.N. Nagar - Mandale	23.6
M-2B Ext	Mandale to Mankhurd Octroi Naka	2.1
M-3B	Colaba-Bandra	21.3
M-4	Wadala -Kasarvadvali-Gaimukh	35
M-5	Thane-Bhiwandi-Kalyan	24.9
M-6	Swami Samarth Nagar - Vikhroli	14.5
M-7A	Andheri East To CSIA Airport	3.2
M-8	Airport Metro (CSIA – NMIA)	35
M-9	Dahisar (E) - Mira Bhayandar	10.3
M-12	Kalyan - Taloja	20.7
M-14	Kanjurmarg-Badlapur	38
M-17	MIDC- Khandeshwar	7.2
M-18	Thane Ring Metro	28.7
M-10	Gaimukh to Shivaji Chowk (Mira Road)	9.2
M-11 (M 4 Ext)	Wadala-CSMT	12.7
M-13	Shivaji Chowk (Mira Road) -Virar	23
M-19	Prabhadevi-Sewri-Jambhulpada (MTHL)	26.5
M-20	Khandeshwar to NMIA	3.7
M-21	MTHL Spur to NMIA	5.0
M-22	Thane to Juinagar	20.6

Figure 6-8 illustrates the recommended improvements in the Highway network and the Suburban Railway system until 2031. The proposed Suburban network until 2031 horizon shall be around 172 Km, which is summarized in Table 6-23.

**Table 6-23: Suburban Corridors Proposed for the Horizon Year 2031**

ID	Corridor Name	Length (km)
S-1	Seawoods to Uran	24.2
S-2	Airoli -Kalwa	4.7
S-3	Panvel To Karjat	28.5
S-4	Diva Vasai Road	41.5
S-5	Diva Panvel	25.6
S-6	CSMT to Panvel Fast Corridor	47.8

The higher order highway/ road network i.e. the proposed Right of Way equal to or greater than 45.0 m, recommended for implementation until 2031 is illustrated in Figure 6-9. The proposed higher order road network for the horizon year 2031 will be around 608 km as enlisted in Table 6-24.



Table 6-24: Proposed Highway Network under 2031 horizon

ID	Name	Length (km)
H1	Elevated Link (Sewri-Worli Sea Link)	5.0
H2	MTHL	23.0
H3	Multimodal Corridor (Virar to Alibag)	127.3
H4	Radial 3 (Mumbai Nashik Exp. NH3)	40.7
H5	Radial-4 (Nahur-Airoli-Nilaje-Badlapur)	35.2
H6	Radial-5(Turbhe-Taloja-Ustane)	17.1
H7	Mumbai-Vadodara Spur in MMR	84.8
H8	Thane-Ghodbunder	4.4
H9	Western Sea Link North Extn (Bandra-Versova)	12.3
H10	Coastal Road to Ambivili (MMC)	17.6
H11	Goregaon Mulund Link Road	16.1
H12	Khopoli to Pen	31.9
H13	CIDCO Coastal Road	10.0
H14	Mankhurd to NMIA	18.4
H15	Kalyan Ring Road	30.9
H16	Thane Creek Road	11.0
H17	Eastern Freeway:Indian Oil Nagar to Ghatkopar	2.5
H18	Kanjurmarg - Koparkairane Creek Bridge	7.7
H19	Western Sea Link South Extn (Worli-Marine Lines)	10.4
H20	Coastal Road (Thane to Sanpada)	20.2
H21	Spine Corridor in NAINA	43.1
H22	Coastal Road-Marve to Ghodbunder	29.7
H23	Western Sea Link North Extn (Versova-Kandivali)	9.6





Figure 6-8: Proposed Transit Network upto 2031 Horizon



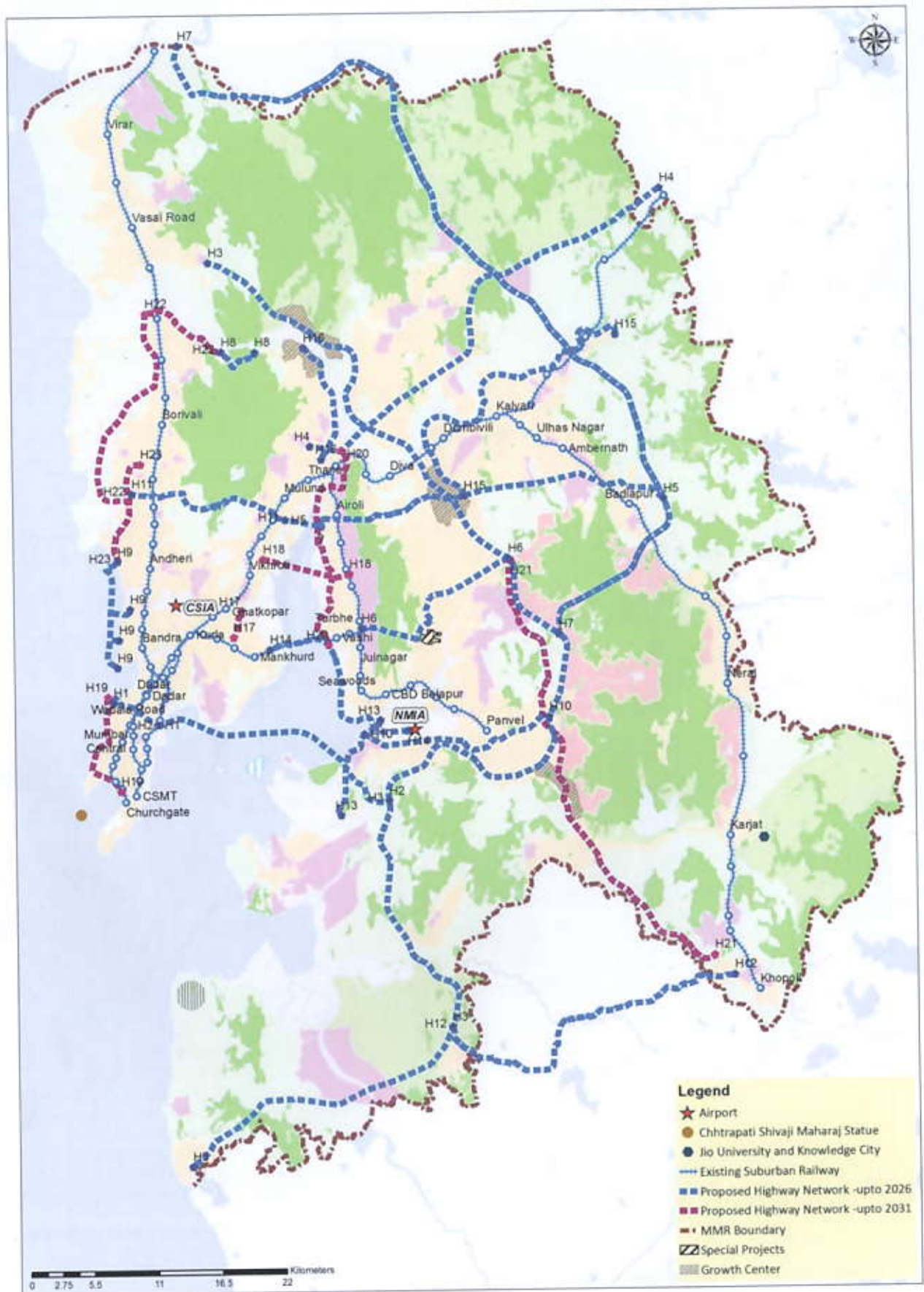


Figure 6-9: Proposed Highway Network upto 2031 Horizon



#### 6.4.2 Traffic Management Measures under the 2031 Horizon

The additional 'Traffic Management Measures' shall be the top up on that recommended to be implemented under midterm, immediate term and short term horizons. The recommendations include intersection improvements, installation of traffic signals, provisioning of Road Over Bridges (RoBs) or road under bridges(RuBs), flyovers, elevated roads, active transportation facilities including sidewalk improvements FoBs/ Subways/ Skywalks, cycle tracks etc. Other improvements included relocation of bus stops, station area traffic improvements (SATIS)outside railway premises, enhancement of road safety measures, traffic signs and markings, accommodation of traffic police on road etc.

#### 6.4.3 Broad Cost Estimates for the horizon year 2031

The broad cost estimates is done based on unit rate based on rates extracted from the ongoing construction contracts in the MMR and also the item rates extracted from others. The projected cost estimates until 2031 horizon was prepared on the base cost assumed for the 2026 horizon. The forecasted costs for various transport infrastructure development is summarized in Table 6-25. The total cost of the transport network improvementbefitting to the 2031 horizon would be INR 4, 17,682 Crores based on the 2017-2018 prices. The cost estimates of transport network in terms of installation of Metro system would be approximately INR 1,92,017 Crores (46.0%),approximately INR 70,810 crores(17.0%) for expansion of Suburban railways, INR 113,643 crores(27.2%) for enhancement of Highway system and approximately INR 26,194 Crores (6.3%) to improve Traffic Management Measures. Road safety enhancements under the horizon year 2031 had also been considered duly, and a lump sum cost of approximately INR 1,000 crores had been provisioned until 2031 horizon, whereas another amount of INR 200 crores had been considered to implement Trespass Control measures.

**Table 6-25: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2031 (in Crores)**

Component	2019-2031	%
Metro System	1,92,017	46.0%
Suburban System	70,810	17.0%
BRTS/ EBL	4,802	1.1%
Bus System	4,059	1.0%
Highway System	1,13,643	27.2%
Terminals	6,157	1.5%
Traffic Management Measures	26,194	6.3%
<b>Total</b>	<b>4,17,682</b>	<b>100.0%</b>

### 6.5 ASSESSMENT OF TRANSPORT INFRASTRUCTURE FOR MMR UNDER THE 2041 HORIZON (LONG TERM)

#### 6.5.1 Transit and Highway Plans

The objective of installation of public transport system was to facilitate easier access from the neighboring residential and commercial areas within the MMRDA region. The intent was to increase the public transport share from 65% during 2017 to 75% during 2041. The target of increasing the transit share could be achieved subsequent to implementation of the recommended transport network. The identified metro corridors warranted to be implemented under horizon year 2041 are shown in Figure



6-10. The total length of corridors proposed to be operational under 2041 should be approximately 467 km as summarized in Table 6-26.

**Table 6-26: Proposed Metro Corridors up to 2041 horizon**

Line	Name	Length (km)
M-2A	Dahisar - DN Nagar	18.6
M-3 A	Bandra-SEEPZ	11.9
M-7	Dahisar (E) - Andheri (E)	16.5
M-15	Belapur - Taloja- Pendhar	11.1
M-16	Pendhar to MIDC	2
M-2B	D.N. Nagar - Mandale	23.6
M-2B Ext	Mandale to Mankhurd Octroi Naka	2.1
M-3B	Colaba-Bandra	21.3
M-4	Wadala -Kasarvadvali-Gaimukh	35
M-5	Thane-Bhiwandi-Kalyan	24.9
M-6	Swami Samarth Nagar - Vikhroli	14.5
M-7A	Andheri East To CSIA Airport	3.2
M-8	Airport Metro (CSIA - NMIA)	35
M-9	Dahisar (E) - Mira Bhayandar	10.3
M-12	Kalyan - Taloja	20.7
M-14	Kanjurmarg-Badlapur	38
M-17	MIDC- Khandeshwar	7.2
M-18	Thane Ring Metro	28.7
M-10	Gaimukh to Shivaji Chowk (Mira Road)	9.2
M-11 (M 4 Ext)	Wadala-CSMT	12.7
M-13	Shivaji Chowk (Mira Road) - Virar	23
M-19	Prabhadevi-Sewri-Jambhulpada (MTHL)	26.5
M-20	Khandeshwar to NMIA	3.7
M-21	MTHL Spur to NMIA	5.0
M-22	Thane to Juinagar	20.6
M-23	Kasarvadavali - Ambarnath	41.4

The recommended length of the suburban rail transport network to be provisioned by 2041 horizon is summarized in Figure 6-10. The Suburban rail network that is recommended to be provisioned by 2031 will be approximately 232 Km. Table 6-27 summarizes the prospective suburban rail corridors and their respective lengths to be constructed by 2041. Table 6-28 summarizes the costs of capacity enhancements of the suburban system including cost of tracks and other appurtenances.

**Table 6-27: Proposed Suburban Corridors up to 2041 horizon**

ID	Corridor Name	Length (Km)
S-1	Seawoods to Uran	24.2
S-2	Airoli-Kalwa	4.7
S-3	Panvel To Karjat	28.5
S-4	Diva Vasai Road	41.5
S-5	Diva Panvel	25.6
S-6	CSMT to Panvel Fast Corridor	47.8
S-7	Chowk To Jite	25.1
S-8	Panvel To Apte	15.3
S-9	Panvel To Ranjanpada	19.1



Table 6-28: Suburban System Capacity Enhancement Measures up to 2041 horizon

Sl. No	Name of Project	Unit	Quantity	Amount in INR Crore			
				By 2021	2022-2026	2027-2031	2032-2041
1	Extension of Harbour Line between Goregaon-Borivali	km	7.27	99	646		
2	5th & 6th line between Borivali-Virar	km	26	229	1,735		
3	4th line between Kalyan- Asangaon	km	32.38	336	1,284		
4	3rd & 4th line between Kalyan-Badlapur	km	16.6	276	1,111		
5	Kalyan Yard - Segregation of Long distance and Suburban Traffic			158	630		
6	a) CBTC on Harbour Line			253	1,013		
7	b) CBTC on CSMT-Kalyan on Central Railway			39	1,932		
8	c) CBTC on CCG-VR on Western Railway			43	2,115		
9	Station Improvement	No	19	396	437		
10	Procurement of Rolling Stock	No	210	1,613	14,515		
11	Maintenance facilities for Rolling Stock	LS		205	1,845		
12	Stabling Lines	Nos	97	49	437		
13	Augmentation of Power Supply Arrangement	LS		62	555		
14	Technical Assistance	LS		25	225		
15	3rd & 4th line from Virar to Vaitarna	km	30			1,501	
16	3rd & 4th line from Badlapur to Karjat	km	30			1,501	
17	Station Improvement	No	25			365	730
18	Procurement of Rolling Stock	No	300			7,680	15,360
19	Maintenance facilities for Rolling Stock	No				1,000	2,000
20	Stabling Lines	LS	200			333	667
21	Augmentation of Power Supply Arrangement	LS				100	600
22	Technical Assistance	LS				50	300
23	Station Area Traffic Improvement Schemes (SATIS)	No	75			2,500	5,000
24	Tresspass Control	LS				200	500

The higher order highway/ road network improvements with 'Right of Way' equal to or greater than 45.0 m, recommended under the 2041 horizon is shown in Figure 6-11. The higher order road network proposed until 2041 horizon would consist approximately 742 km of roadway length as summarized in Table 6-29.

Table 6-29: Highway Corridors Proposed until 2041 horizon

ID	Name	Length (km)
H1	Elevated Link (Sewri-Worli Sea Link)	5.0
H2	MTHL	23.0
H3	Multimodal Corridor (Virar to Alibag)	127.3
H4	Radial 3 (Mumbai Nashik Exp. NH3)	40.7
H5	Radial-4 (Nahur-Airoli-Nilaje-Badlapur)	35.2
H6	Radial-5(Turbhe-Taloja-Ustane)	17.1
H7	Mumbai-Vadodara Spur in MMR	84.8
H8	Thane-Ghodbunder	4.4
H9	Western Sea Link North Extn (Bandra-Versova)	12.3
H10	Coastal Road to Ambivili (MMC)	17.6
H11	Goregaon Mulund Link Road	16.1
H12	Khopoli to Pen	31.9
H13	CIDCO Coastal Road	10.0
H14	Mankhurd to NMIA	18.4



ID	Name	Length (km)
H15	Kalyan Ring Road	30.9
H16	Thane Creek Road	11.0
H17	Eastern Freeway: Indian Oil Nagar to Ghatkopar	2.5
H18	Kanjurmarg - Koparkairane Creek Bridge	7.7
H19	Western Sea Link South Extn (Worli-Marine Lines)	10.4
H20	Coastal Road (Thane to Sanpada)	20.2
H21	Spine Corridor in NAINA	43.1
H22	Coastal Road-Marve to Ghodbunder	29.7
H23	Western Sea Link North Extn (Versova-Kandivali)	9.6
H24	Radial-1 (NH-8)	28.4
H25	Radial-2 (Part of NH-3) Ghodbunder to Vadape	20.5
H26	Belapur to MMC (Taloja MIDC)	17.2
H27	Vichumbe( Panvel) To MMC	11.4
H28	Samruddhi Corridor	19.0
H29	Dahisar-Virar	36.8





Figure 6-10: Proposed Transit Network up to 2041 horizon





Figure 6-11: Proposed Highway Network upto 2041 horizon



### 6.5.2 Traffic Management Measures under the 2041 Horizon

The additional 'Traffic Management Measures' under 2041 horizon shall be the top up on that recommended to be implemented under midterm, immediate term and short term horizons. The recommendations include intersection improvements, installation of traffic signals, provisioning of Road Over Bridges (RoBs) or road under bridges (RuBs), flyovers, elevated roads, active transportation facilities including sidewalk improvements FoBs/ Subways/ Skywalks, cycle tracks etc. Other improvements included relocation of bus stops, station area traffic improvements (SATIS) outside railway premises, enhancement of road safety measures, traffic signs and markings, accommodation of traffic police on road etc.

### 6.5.3 Broad Cost Estimates for the horizon year 2041

The broad cost estimates is done based on unit rate based on rates extracted from the ongoing construction contracts in the MMR and also the item rates extracted from others. The projected cost estimates until 2041 horizon was prepared on the base cost assumed for the 2031 horizon. The forecasted costs for various transport infrastructure development is summarized in Table 6-30. The total cost of the transport network for the horizon period until 2041 is INR 4,93,312 Crores based on 2017-2018 prices. The cost estimates of transport network in terms of installation of Metro system would be approximately INR 2,05,690 Crores (41.7%), approximately INR 1,01,085 crores (20.5%) for expansion of Suburban railways, INR 1,23,774 crores (25.1%) for enhancement of Highway system and approximately INR 42,363 Crores (8.6%) to improve Traffic Management Measures.. Road safety enhancements under the horizon year 2031 had also been considered duly, and a lump sum cost of approximately INR 3,000 crores had been provisioned until 2041 horizon, whereas another amount of INR 700 crores had been considered to implement Trespass Control measures.

**Table 6-30: Summary of Preliminary Broad Cost Estimates for Proposed Transport Networks for Horizon year 2041 (in Crores)**

Component	2019-2041	%
Metro System	2,05,690	41.7%
Suburban System	1,01,085	20.5%
BRTS/ EBL	5,250	1.1%
Bus System	6,500	1.3%
Highway System	1,23,774	25.1%
Terminals	8,650	1.8%
Traffic Management Measures	42,363	8.6%
<b>Total</b>	<b>4,93,312</b>	<b>100.0%</b>

### 6.5.4 Broad Cost Estimates under various horizons until 2041

Table 6-31 summarizes the preliminary costs of various transport system improvements based on various years of implementation. The share of necessary investment to improve the existing transport infrastructure under various horizons including immediate-term (2019-21), short-term (2022-26), medium-term (2027-31) and long-term (2031-41) within the MMR jurisdiction would be approximately 13.9%, 45.5%, 25.2% and 15.3% respectively.



**Table 6-31: Summary of Preliminary Broad Cost Estimates for the Traffic & Transport Infrastructure until 2041 (in INR Crores)**

System	Until 2021 (Immediate-term)		2022-2026 (Short-term)		2027-2031 (Medium-term)		2032-2041 (Long-term)		Total	
	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)
Metro System	60	26,787	265	1,14,121	101	51,109	41	13,673	467	2,05,690
Suburban System	29	7,290	143	49,791	0	13,729	60	30,275	232	1,01,085
BRTS/ EBL	22	264	249	3,036	123	1,502	37	448	431	5,250
Bus System		815		1,421		1,823		2,440		6,500
Highway System	174	20,550	468	46,913	282	46,181	217	10,131	1141	1,23,774
Terminals		1,790		2,295		2,072		2,493		8,650
Traffic Management Measures		11,085		7,124		7,985		16,169		42,363
<b>Total</b>		<b>68,581</b>		<b>2,24,701</b>		<b>1,24,400</b>		<b>75,629</b>		<b>4,93,312</b>

Year-wise investment needs on transport infrastructure for the horizon period upto 2041 is presented in Table 6-32. It is pertinent to mention here that, the total investment needs considering inflation @ 4% per annum for the horizon period upto 2041 would be 6.81 lakh crores.



Table 6-32: Year-Wise Investment Needs on Transport Infrastructure for the Horizon Period up to 2041

Phase	Components	Estimated Total (Rs. Crores)	Phase Wise Cost (Rs. Crores) @ 2017 18 prices	%	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	Total
Immediate Term Proposals (2019- 2021)	Metro/ LRT System	26,787			8,929	8,929	8,929																					26,787
	Suburban System	7,290			2,430	2,430	2,430																					7,290
	BRTS/ EBL System	264			88	88	88																					264
	Bus System	815			272	272	272																					815
	Highway System	20,550			6,850	6,850	6,850																					20,550
Short Term Proposals (2022- 2026)	Terminals	1,790			597	597	597																					1,790
	Traffic Management Measures	11,085			3,695	3,695	3,695																					11,085
	Metro/ LRT System	1,14,121						22,824	22,824	22,824	22,824	22,824																1,14,121
	Suburban System	49,791						9,958	9,958	9,958	9,958	9,958																49,791
	BRTS/ EBL System	3,036						607	607	607	607	607																3,036
Medium Term Proposals (2027- 2031)	Bus System	1,421						284	284	284	284	284																1,421
	Highway System	46,913						9,383	9,383	9,383	9,383	9,383																46,913
	Terminals	2,295						459	459	459	459	459																2,295
	Traffic Management Measures	7,124						1,425	1,425	1,425	1,425	1,425																7,124
	Metro/ LRT System	51,109											10,222	10,222	10,222	10,222	10,222											51,109
Long Term Proposals (2032- 2041)	Suburban System	13,729											2,746	2,746	2,746	2,746	2,746											13,729
	BRTS/ EBL System	1,502											300	300	300	300	300											1,502
	Bus System	1,823											365	365	365	365	365											1,823
	Highway System	46,181											9,236	9,236	9,236	9,236	9,236											46,181
	Terminals	2,072											414	414	414	414	414											2,072
	Traffic Management Measures	7,985											1,597	1,597	1,597	1,597	1,597											7,985
	Metro/ LRT System	13,673																1,367	1,367	1,367	1,367	1,367	1,367	1,367	1,367	1,367	1,367	13,673
	Suburban System	30,275																3,027	3,027	3,027	3,027	3,027	3,027	3,027	3,027	3,027	3,027	30,275
	BRTS/ EBL System	448																45	45	45	45	45	45	45	45	45	45	448
	Bus System	2,440																244	244	244	244	244	244	244	244	244	244	2,440
	Highway System	10,131																1,013	1,013	1,013	1,013	1,013	1,013	1,013	1,013	1,013	1,013	10,131
	Terminals	2,493																249	249	249	249	249	249	249	249	249	249	2,493
	Traffic Management Measures	16,169																1,617	1,617	1,617	1,617	1,617	1,617	1,617	1,617	1,617	1,617	16,169
	Total	4,93,312			22,860	22,860	22,860	44,940	44,940	44,940	44,940	44,940	44,940	24,880	24,880	24,880	24,880	24,880	12,593	12,593	12,593	12,593	12,593	12,593	12,593	12,593	12,593	4,93,312
Total with inflation @ 4%		6,80,782			22,860	23,775	24,726	50,552	52,574	54,677	56,864	59,138	34,050	35,412	36,828	38,302	39,834	12,593	13,097	13,620	14,165	14,732	15,321	15,934	16,571	17,234	17,924	6,80,782



## 7 TERMINALS AND MULTI MODAL HUBS

*Orderly planning for the expansion and potential location of Inter-city Rail Terminals, Inter-city Bus terminals, Truck Terminals and Airports, is an important objective in transport systems planning for any metropolitan region. Based on the detailed data analysis obtained from primary surveys/secondary source, relevant to external travel by rail&road, goods vehicle and groundside air passenger movements, various new transport terminals have been proposed. The potential for travel by passenger water transport from east and west coasts of Mumbai and across other major creeks within MMR had also been reviewed and the potential terminals had been identified. However, it should be worth noting that marine transportation will not have a material effect on travel demands by traditional wheel modes. In case of planning any terminals for air travel and inter-city rail trip, the Central Government should initiate necessary measures.*

### 7.1 INTERCITY RAIL TERMINAL

The increase in population and employment opportunities and consequent development activities in the MMR will increase the demand of inter-city passenger travel by regional rail system. However; there exists a considerable competition among the railways, regional bus operators and low cost airlines to capture the same travel market. There are some uncertainties to forecast how this will evolve during the next 10 years. To accommodate future demand it is certain that there will be necessity of expansion of existing terminals and addition of new terminals within the newly developing areas of the region. Estimation of future requirement of rail-terminal facilities needs estimation of trip-ends at these terminal locations under the various horizon periods.

The existing inter-city rail passenger terminals and halt stations along Western Railway in the MMR area are Mumbai Central, Bandra Terminus (Terminal Stations), Dadar, Andheri, Borivali, Vasai Road and Virar (intermediate stations). Similarly, along Central Railway, Chhatrapati Shivaji Terminus, Lokamanya Tilak Terminus, Dadar are the terminal stations, while Thane and Kalyan are intermediate stations.

Under 2017 i.e. the base year, a total of 79.4 million rail passenger trips were noted. The anticipated growth in inter-city rail passenger trips to/from the study area should justify both the expansion of existing terminal facilities and additional terminal facilities integrated with expanded suburban train and metro networks.

Based on the proposed transport network (roadways, railways and metro) under the horizon year 2041, proposed international airport in Navi Mumbai, preliminary locations of the inter-city bus terminals and truck terminals, five new Inter-City rail terminals are proposed. The new inter-city rail terminals are identified at **Vasai Road, Jite, Panvel, Kalyan and Bhiwandi** and the potential terminal locations are presented in Figure 7-1. The study recommendations also include improving the existing terminals and stations to handle the additional rail based travel demand.



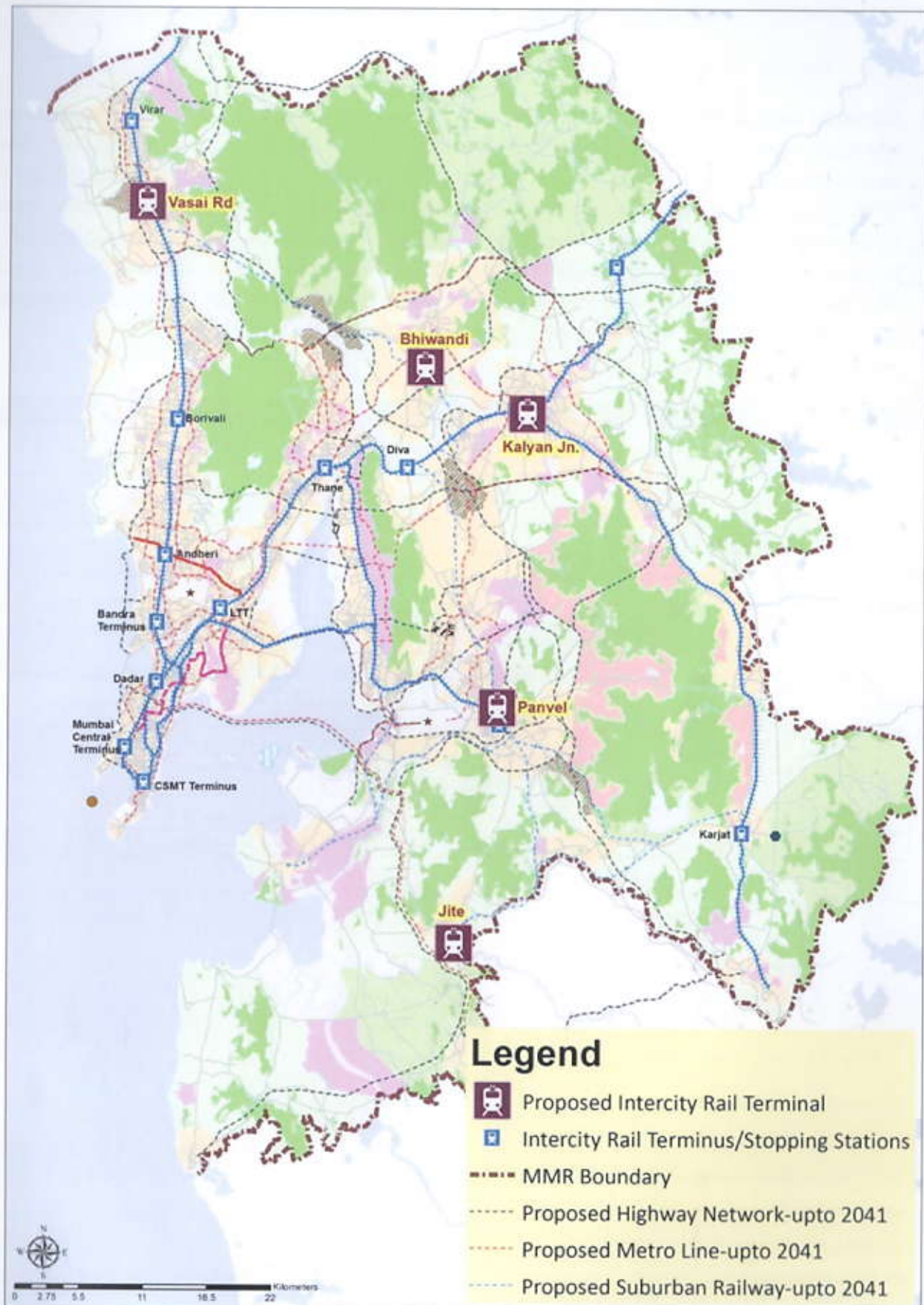




Figure 7-1: Proposed Inter-City Rail terminals in MMR

## 7.2 INTER STATE/INTERCITY BUS TERMINALS

The urban bus transportation within the MMRDA region accommodates a significant of travel demand, whereas the bus transport systems are operated by the respective municipal corporations through various bus operators i.e. BEST, TMT etc. Long distance and inter regional travel demands by bus in the MMR are met by State Road Transportation Corporations i.e. MSRTC and private bus operators. External travel demands at outer cordon location are analyzed to identify the need of provisioning of bus terminals. As a result of the analysis and feedback from stakeholders' consultation<sup>17</sup> Intercity/ Interstate terminals have been proposed, which should be installed by the 2041 horizon. The locations of proposed terminals are shown in Figure 7-2 and listed in Table 7-1.

Table 7-1: Proposed Bus Terminals

Sl.No	Location	Type	Year
1.	Kalamboli	Inter State Bus Terminal	2021
2.	Mankhurd	Inter City Bus Terminal	2021
3.	Dahisar	Inter City Bus Terminal	2021
4.	Thane	Inter City Bus Terminal	2021
5.	Kalyan (Shahad)	Inter City Bus Terminal	2026
6.	Bhayander	Inter City Bus Terminal	2026
7.	Nalasopara	Inter City Bus Terminal	2026
8.	Wadala	Inter State Bus Terminal	2026
9.	MBMC Fountain	Inter State Bus Terminal	2031
10.	Badlapur	Inter City Bus Terminal	2031
11.	Nerul	Inter City Bus Terminal	2031
12.	Kalyan (Katai)	Inter State Bus Terminal	2041
13.	Bhiwandi	Inter City Bus Terminal	2041
14.	Karjat	Inter City Bus Terminal	2041
15.	Jite	Inter City Bus Terminal	2041
16.	Alibag	Inter City Bus Terminal	2041
17.	Virar Chandansar	Inter City Bus Terminal	2041





Figure 7-2: Proposed Inter-State/Inter-City Bus Terminals in MMR



### 7.3 TRUCKTERMINALS

An efficient goods transport movement system is critical to the economy of huge urban area such as the MMR. Mumbai has a significant role as the most important trading gateway to India through its two major ports. The region is also well connected by rail and road to the rest of the country. Moreover, the MMR is home to a number of industrial growth centers, which generate considerable goods-traffic movement. The economic and physical characteristics of goods transportation, parking, loading and unloading etc. leads to special and often complex issues in accommodating truck maneuvering. The flow of goods into and out of large 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 deliveries often remain unaltered. The loading, unloading and other activities by the goods vehicles very often block traffic lanes and lead to traffic congestions within the urban area. In addition to this, increase in urban sprawl over a period of time the commodity demand increases with time. However, in many developed economies, large trucks often have to meet critical just in time deliveries because the truck or container, is an effective part of a production line between a manufacturer and an assembler. The need to have confidence on delivery schedules and timely securing goods have led the trucking industry becoming more dominated by larger companies. India has not reached this point and may never arrive there unless there is a major restructuring of the retail industry. Smaller goods vehicle owners are notoriously difficult to regulate. The economy of goods distribution in urban areas is often border line and owners are reluctant to incur truck terminal charges when street parking is free and often close to home.

Based on external travel demand at outer cordon locations/sub regional cordon points, URDPFI guidelines, conceptual transport network and land-use proposals prepared for MMR, five (5) major truck terminals and fourteen (14) mini truck terminals in various geographic locations of the study area had been recommended. These locations should be planned to possess sufficient ground area, contain facilities, and afford higher accessibility. The areas should adhere to proper land use breakup as mentioned in URDPFI guidelines. The proposed locations are listed in

Table 7-2 and shown in Figure 7-3.

**Table 7-2: Proposed Truck Terminals**

Sl. No	Location	Type	Year
1.	Kasheli	Mini Truck Terminals	2021
2.	Kalamboli	Mini Truck Terminals	2021
3.	APMC	Mini Truck Terminals	2021
4.	Mulund-Airoli	Mini Truck Terminals	2021
5.	JNPT	Mini Truck Terminals	2021
6.	Cotton Green	Mini Truck Terminals	2026
7.	Mira Road	Mini Truck Terminals	2026
8.	Virar (Along NH-8)	Major Truck Terminal	2026
9.	Vadape	Mini Truck Terminals	2026
10.	Badlapur	Mini Truck Terminals	2026
11.	Murbad (Along NH-222)	Major Truck Terminal	2031
12.	Talawali (Along NH-3)	Major Truck Terminal	2031
13.	Pen (Along NH-66)	Major Truck Terminal	2031
14.	Shilphata	Mini Truck Terminals	2031
15.	Gaimukh	Mini Truck Terminals	2031
16.	Khalapur	Mini Truck Terminals	2031
17.	Dan Phata (Along Mumbai Pune Exp.)	Major Truck Terminal	2041
18.	Kharegaon	Mini Truck Terminals	2041



19.	Usatane	Mini Truck Terminals	2041
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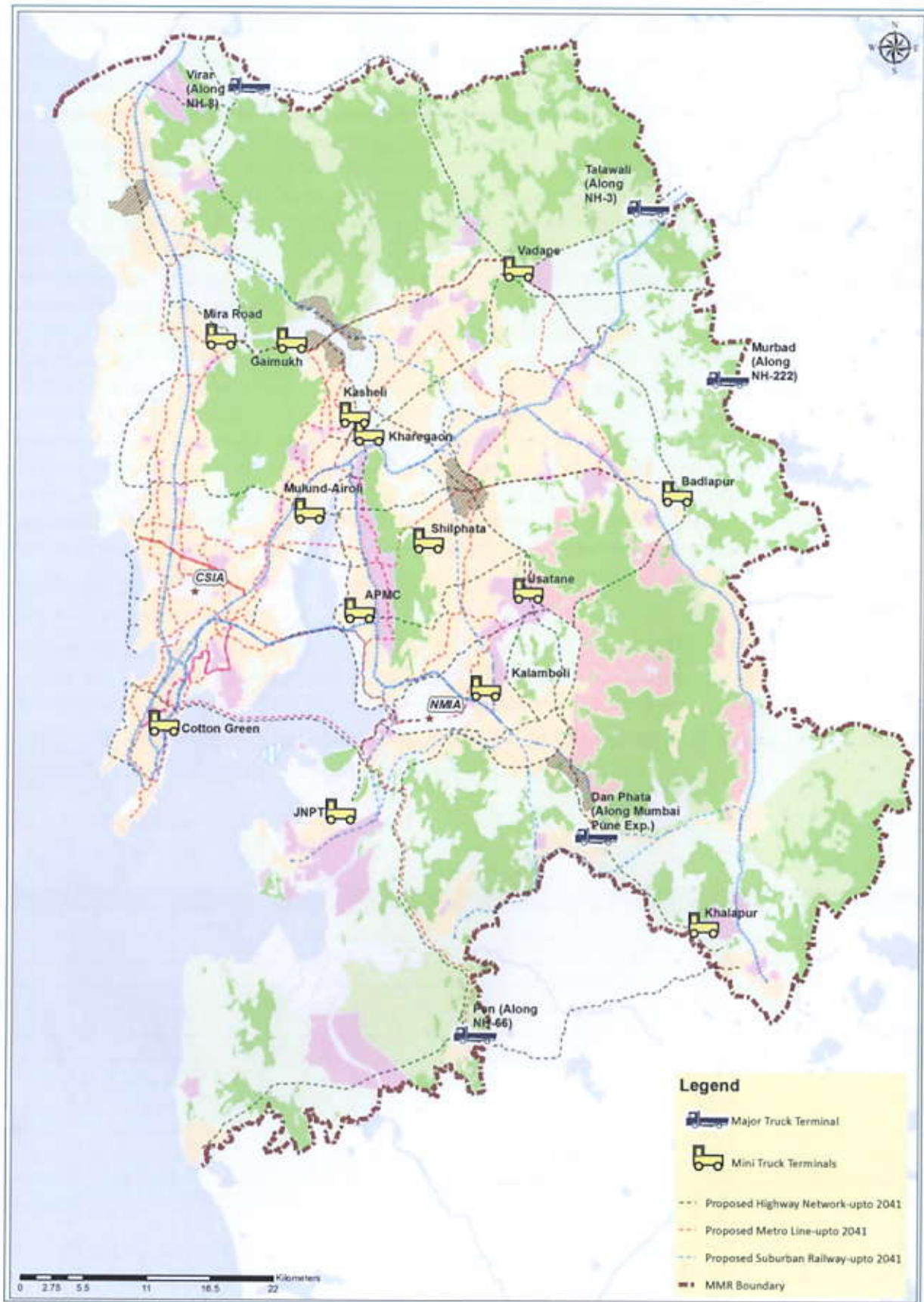


Figure 7-3: Proposed Truck terminals in MMR



## 7.4 PASSENGERWATER TRANSPORT TERMINALS

The passenger water transport terminals have been proposed based on review of the secondary data received from various stakeholders and review of past studies. The proposed terminals are identified as illustrated in Figure 7-4.

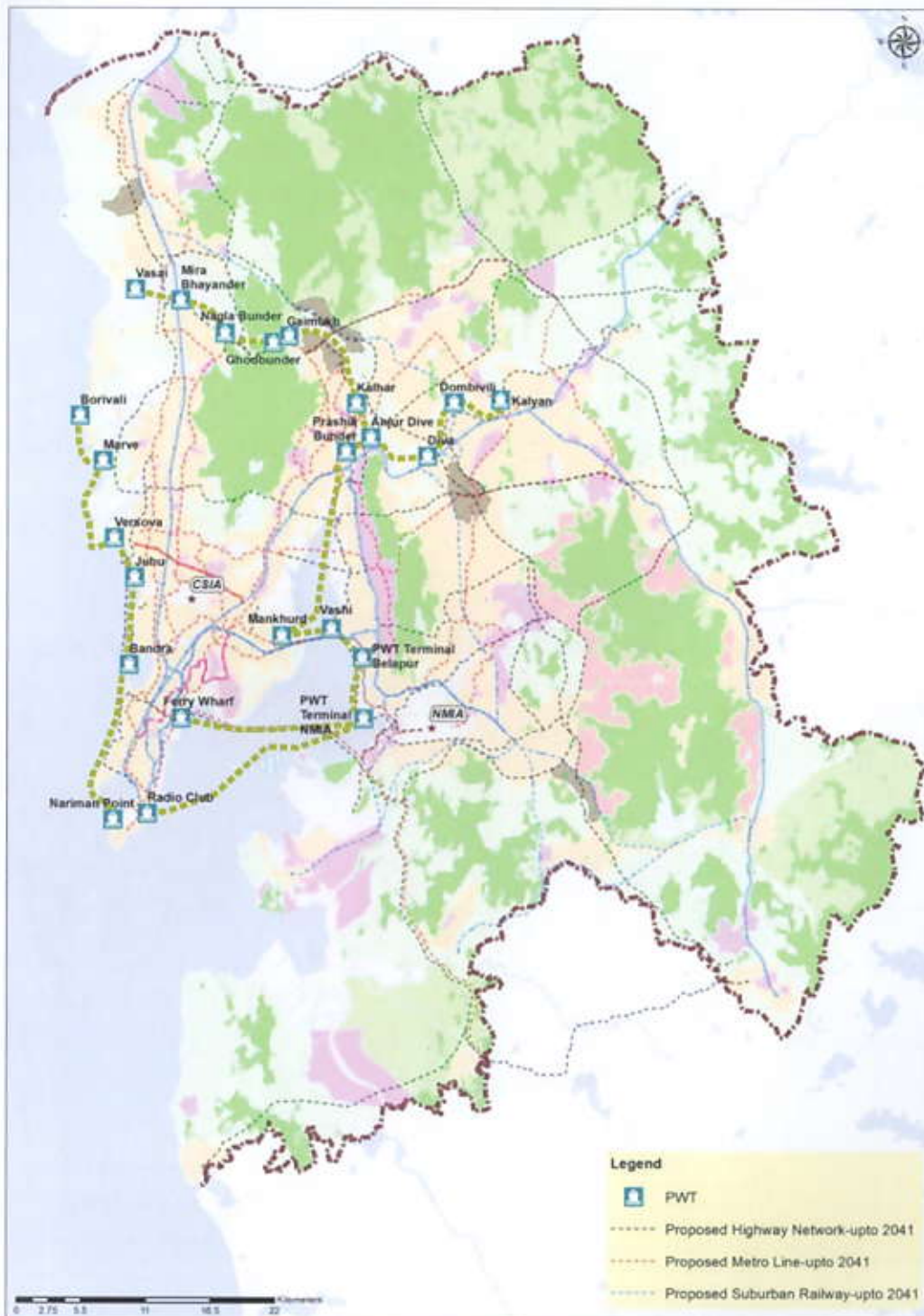


Figure 7-4: Proposed Passengers Water Terminals in MMR

The Figure 7-5 shows all the proposed terminals upto 2041.



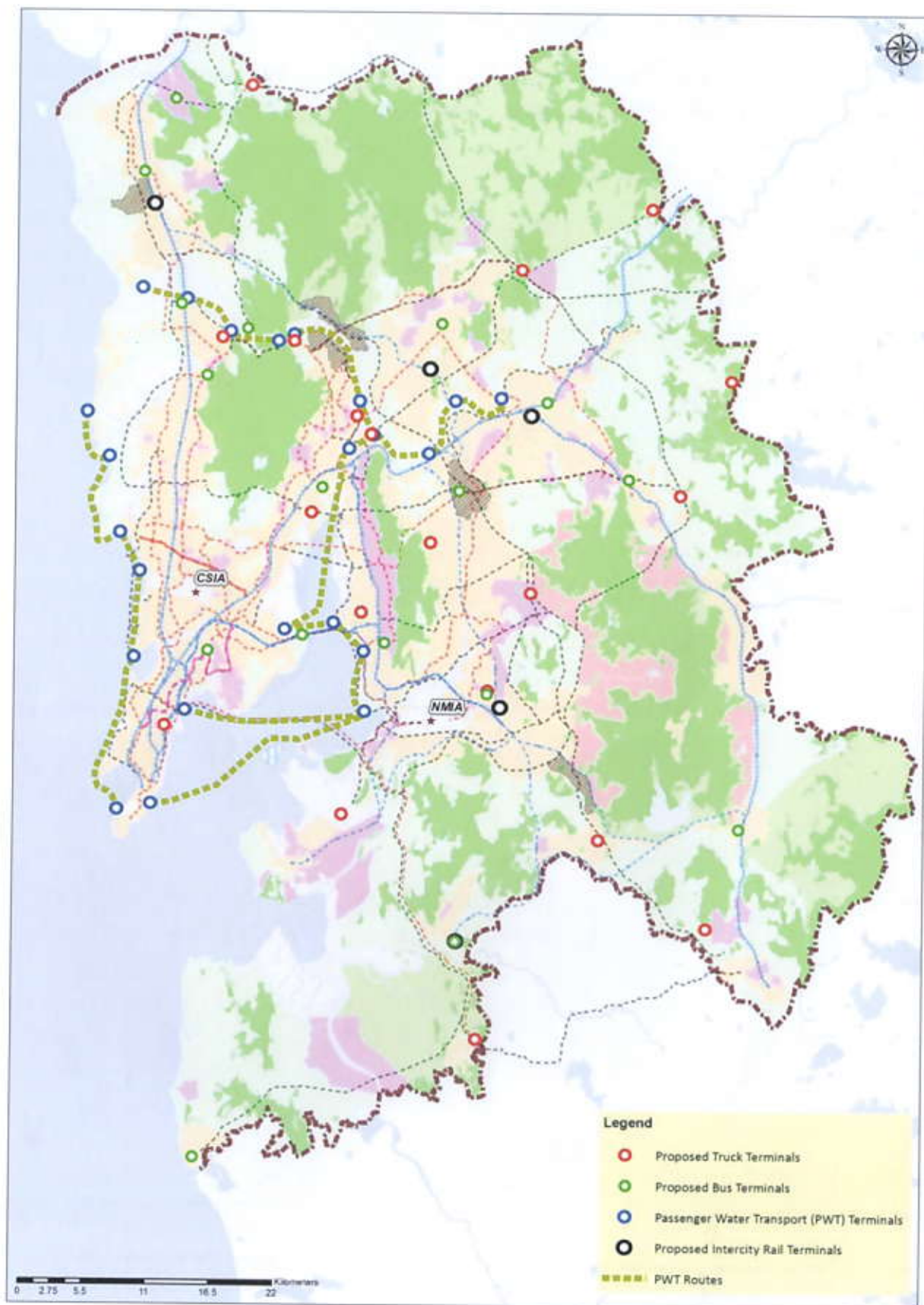


Figure 7-5: Combined Map of All Proposed Terminals



## 7.5 MULTI MODAL HUBS

Multi Modal Hub in any region or urban area plays vital role in holistic development. It triggers development in a much-planned manner. Also, it provides easy shift in different modes of transport which keeps the journey linked. The CTS report is based on a transit first policy and hence these actions that encourage the use of public Transport support this policy. Six potential nodes i.e. Thane, Vasai Road, Kalyan, Panvel, Dushmi and Sewri have been identified based on the proposed network of horizon year 2041 and proposed inter-city passenger terminals. These nodes have great potential to contribute in regional and urban development. Positioning of these nodes in MMR is also parallel to support RP strategy to have polycentric development in region.

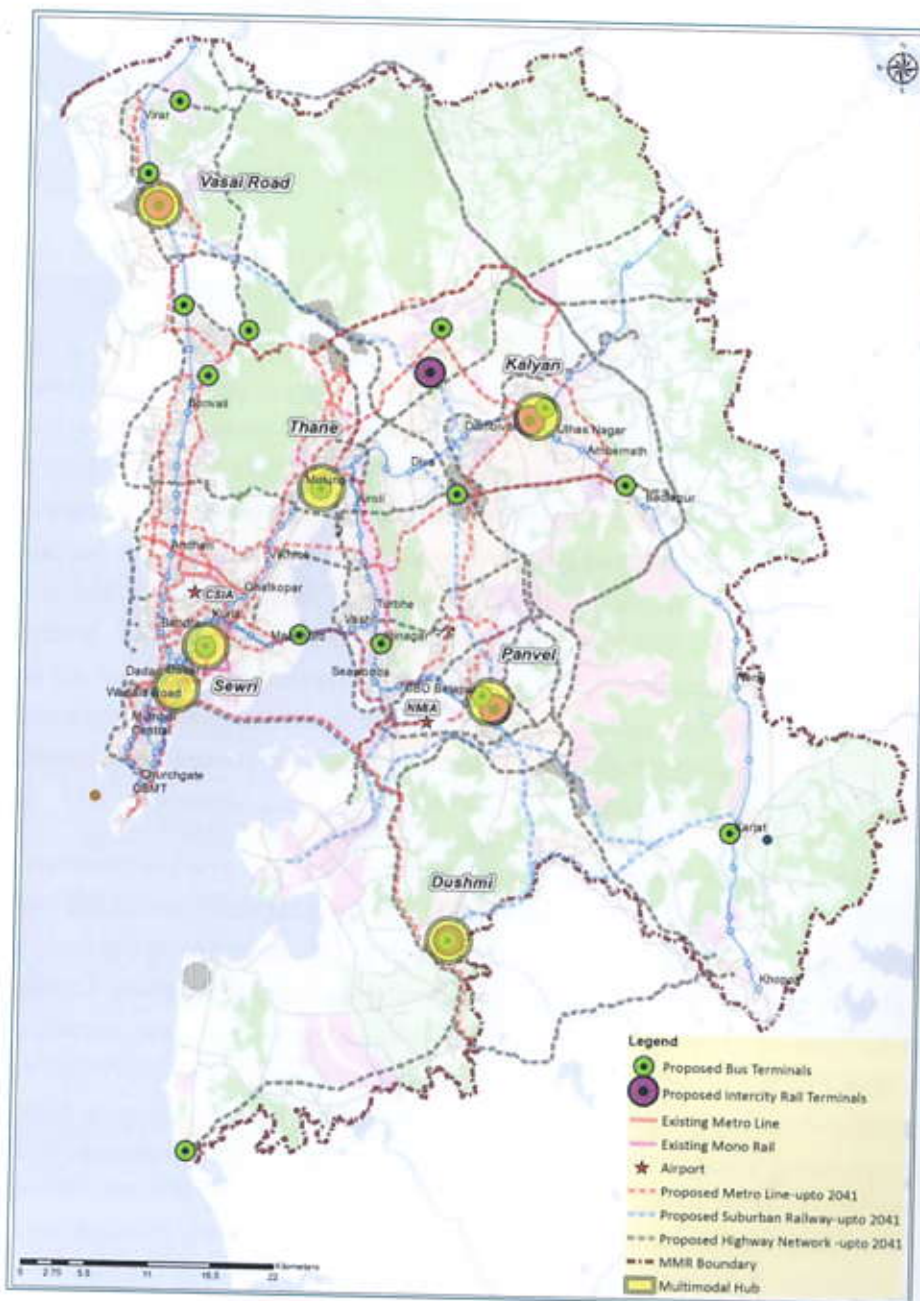


Figure 7-6: Identified Potential Location for Multi-Modal Hub



## 8 RESOURCE MOBILISATION

The strategic location of MMR in Maharashtra makes it a prominent centre of overall economic development of the state. In the past, MMRDA, MSRDC, MRVC, CIDCO, ULBs, PWD, NHAI, etc. have strived in providing equitable infrastructure facilities in the region. MMRDA and other stakeholders have a massive task of implementing the recommendations on traffic & transport infrastructure, as developed in the Updated CTS study. MMR will require affording a large expenditure on the construction of infrastructure for all urban services, including water supply systems, electricity, drainage and sewerage system. However, the major part of their investment should be dedicated towards improving transport infrastructure. MMRDA recognizes that the implementation of some recommendations from the latest CTS study is a complex task, given the scale of deficiencies that exist in the region; and therefore a strategic approach is required to be adopted to ensure on time implementation of projects. A well-structured and strong resource mobilization plan, analyzing all aspects of the project benefit and downsides, towards financing the required investment shall be needed in order to implementation of the study recommendations.

### 8.1 INVESTMENT NEEDS FOR 2041

Holistic development of a region involves various sectors of infrastructure to be brought up. It becomes equally important to prioritize investment in projects and infrastructure sectors. According to current status of CTS 2005 proposals many projects have been started. Many projects are under construction, whereas many new projects have been initiated during last few years. Updation of CTS for MMR study also included updating of previous proposals and addition of new proposals. **According to the proposals made for improving traffic & transport infrastructure services in MMR for the horizon period upto 2041 is about INR 4.93 lakh crores @ 2017-2018 prices. Average per annum investment needs on transport infrastructure is about INR 21,000 crore. By including other infrastructure i.e. water supply, sewerage, drainage, solid waste management, etc. (additional investment needs of other infrastructure in regards to overall infrastructure will be about 15% of the total) the overall infrastructure cost would be about INR 5.8 lakh crores @ 2017-2018 prices. Average per annum investment needs on overall infrastructure is about INR 25,000 crore.**

In many large cities, preparation of capital works plans for next 10 years is common. However, in MMR all the involved authorities and ULBs produce only annual budgetary provisions, which lack long term vision towards capital investments of projects. Therefore, it becomes mandatory to produce Capital investment plan by every 10 year period to implement the proposed program. Capital works plan should be referred to hold on annual capital expenses for upcoming ten year period. A further financial challenge is posed by the urban infrastructure, which involves large and expensive projects that involve multi-year implementation programs. Multi-year spanning projects require a commitment of annual funding for upcoming years, which warrants a well-planned robust multiyear rolling plan to ensure funding availability towards timely project implementation.



## 8.2 EXPENDITURE TRENDS OF MAJOR STAKEHOLDERS ON TRANSPORT INFRASTRUCTURE IN MMR

MMR consists of different levels of authorities like ULBs, MMRDA, CIDCO, MRVC, MSRDC, etc. involved at different level to contribute in infrastructure development in the region. Every authority has its own budgetary provision, its funding sources and future investment plans. It becomes very important to analyze all these investment details to analyze the past investment trends to assure reliability in future and in order to plan for future contribution from all the stakeholders.

### 8.2.1 Expenditure Trends on Transport Infrastructure by MMRDA, CIDCO and MRVC

Among all authorities mentioned in Table 8-1 MMRDA and CIDCO are involved with various infrastructure service deliveries, whereas MRVC, MSRDC dealing only with transportation sector their total expenditure in MMR is dedicatedly for expenditure on transport infrastructure. Analyzing the average annual share of past expenditures made, it can be inferred that comparatively larger shares belong to MMRDA followed by CIDCO.

Table 8-1: Expenditure Trends on Transport Infrastructure by MMRDA, CIDCO and MRVC

Authority	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18 (Revised)	Average in CR
MMRDA	3,224	2,949	2,491	2,385	2,368	1,939	2,947	5,222	2,941
CIDCO	1,586	1,435	1,293	1,642	2,561	2,239	2,618	3,467	2,105
MRVC	552	629	467	558	832	1,619	1,640	687	873
MSRDC	849	823	752	756	-	860	811	-	809
Total	6,211	5,836	5,002	5,341	5,762	6,657	8,016	9,377	6,727

MMRDA and CIDCO are substantially spending on transport infrastructure. MRVC's expenditure is totally on planning and execution of suburban rail infrastructure in MMR.

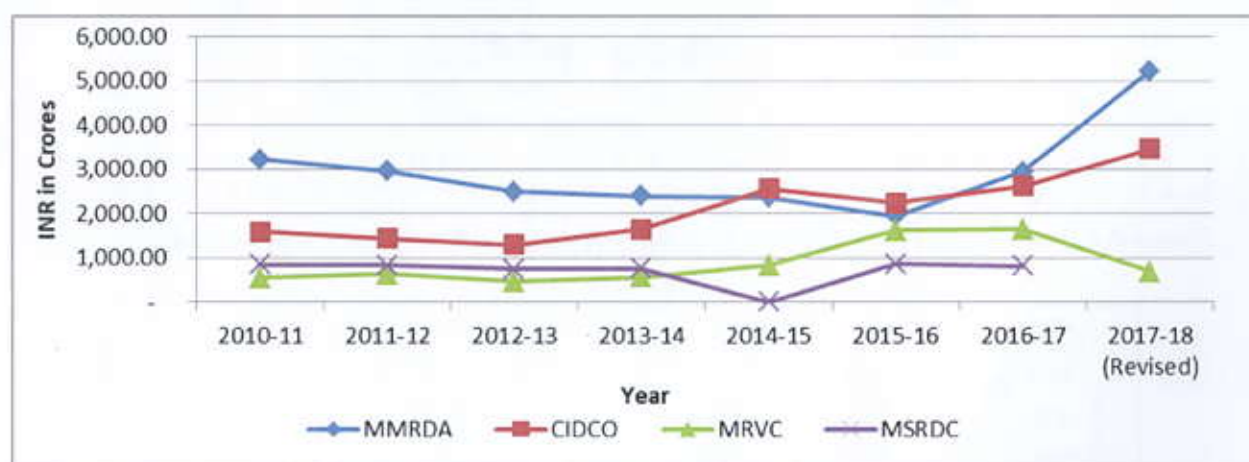


Figure 8-1: Expenditure of MMRDA, CIDCO and MRVC on Transport Infrastructure: 2010-2017

### 8.2.2 Expenditure Trends on Transport Infrastructure by ULBs

Transport Infrastructure has a very broad scope for development. Study shows among all other infrastructure development, Transport infrastructure holds maximum weightage of expenditure i.e. up to 80. Expenditure pattern in past will be helpful to make approximate financial investment provision within capacity up to horizon year.



### 8.2.2.1 Total expenditure by ULBs on Transport Infrastructure

ULB wise average expenditure on transport infrastructure is enlisted in Table 8-2 and presented in Figure 8-2 and Figure 8-3. Average annual expenditure at MMR level is INR 3,152 crores.

Table 8-2: Total Expenditure by ULBs on Transport Infrastructure (2010-11 to 2017-18)

Sl. No.	ULBs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18 (Revised)	ULB wise Average
1	MCGM	1,109.2	1,594.8	1,656.1	3,028.3	2,764.7	1,406.5	2,149.1	4,145.0	2,231.7
2	TMC	105.7	253.8	277.7	171.2	214.1	227.5	216.0	314.6	222.6
3	KDMC	20.9	46.6	72.8	89.3	183.1	159.3	330.3	434.7	167.1
4	VVMC	34.9	82.2	163.8	175.0	182.7	132.2	7.8	22.3	100.1
5	NMMC	174.9	190.7	241.7	376.5	419.5	154.8	344.1	319.7	277.7
6	MBMC	9.4	13.8	10.5	25.0	66.5	86.2	73.2	92.5	47.1
7	BNMC	3.0	3.3	4.1	1.8	4.7	13.3	9.6	6.8	5.8
8	UNMC	15.7	14.7	18.7	20.5	16.4	25.4	38.8	24.6	21.8
9	PCMC	1.5	2.9	2.8	5.0	7.1	14.8	20.6	117.1	21.5
10	AMC	-	0.0	10.7	10.6	50.1	56.7	40.5	37.0	25.7
11	KBMC	16.4	43.3	40.6	24.5	10.0	8.4	13.5	23.1	22.5
12	Khopoli MCI	1.4	0.7	7.5	10.8	10.2	9.3	7.9	13.3	7.6
13	Karjat MCI	0.5	1.0	1.0	1.0	1.2	0.3	0.7	3.8	1.2
14	Total Annual	1,493.5	2,247.8	2,507.9	3,939.5	3,930.3	2,294.7	3,252.0	5,554.4	3,152

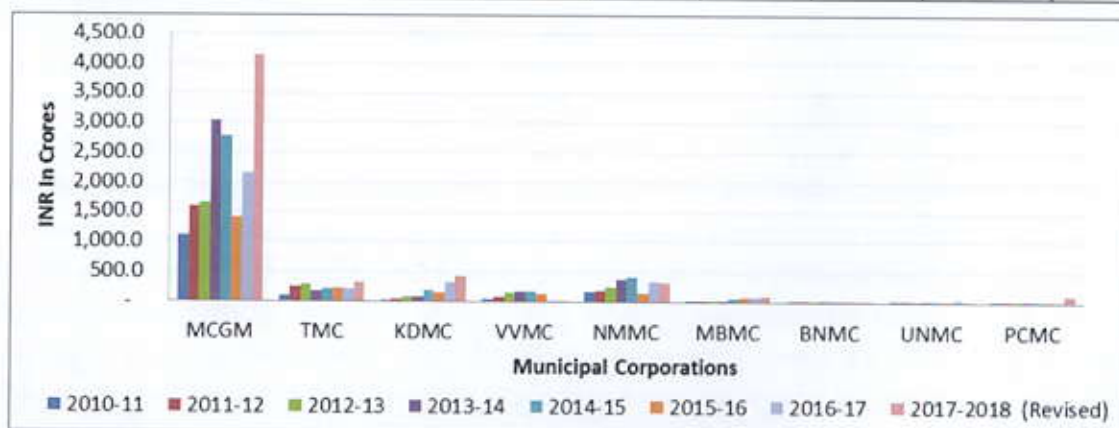


Figure 8-2: Total Expenditure of Municipal Corporations on Transport Infrastructure (2010-11 to 2017-18)

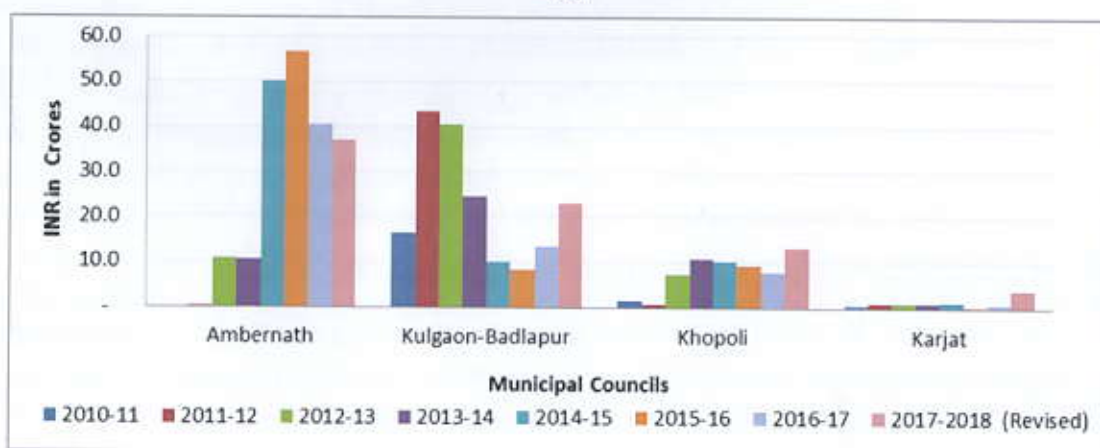


Figure 8-3: Total Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18)



### 8.2.2.2 Revenue and Capital expenditure on Transport Infrastructure

Revenue share in expenditure on Transport Infrastructure of ULBs is presented in Table 8-3 and shown in Figure 8-4 (Municipal Corporations) and Figure 8-5 (Municipal Councils). Among the total expenditure on transport infrastructure Revenue expenditure holds a share of 19% and Capital expenditure is 81%. From Table 8-3 it can be inferred that MCGM has topped the list followed with NMMC and VVMC.

Table 8-3: Revenue share in expenditure on Transport Infrastructure (2010-11 to 2017-18)

Sl. no	ULBs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-2018 (Revised)	ULB wise Average
1	MCGM	670.5	753.4	885.5	891.8	871.2	857.9	649.3	874.7	806.8
2	TMC	22.4	31.5	54.0	40.7	65.2	74.4	24.8	32.1	43.1
3	KDMC	12.8	40.8	42.0	26.0	30.8	30.8	43.5	47.1	34.2
4	VVMC	19.2	32.4	65.4	67.6	111.3	125.0	-	-	52.6
5	NMMC	74.3	77.3	139.6	109.3	114.6	86.1	129.4	98.5	103.6
6	MBMC	4.0	11.1	10.5	11.3	48.2	57.5	48.8	45.2	29.6
7	BNMC	1.3	1.5	-	-	1.9	7.3	8.8	5.0	3.2
8	UNMC	10.4	7.2	10.1	8.4	10.9	15.4	17.2	18.9	12.3
9	PCMC	1.3	1.7	1.7	1.3	0.6	9.9	4.6	9.1	3.8
10	AMC	-	0.0	0.0	0.0	3.0	3.3	3.4	4.9	1.8
11	KBMC	-	8.2	17.6	11.5	0.6	0.8	1.3	2.3	5.3
12	Khopoli MCI	0.4	0.5	7.4	9.8	9.5	8.6	7.8	11.3	6.9
13	Karjat MCI	0.5	1.0	1.0	1.0	1.2	0.3	0.7	3.8	1.2
14	Total Annual	817	967	1,235	1,179	1,269	1,277	939	1,153	1,104

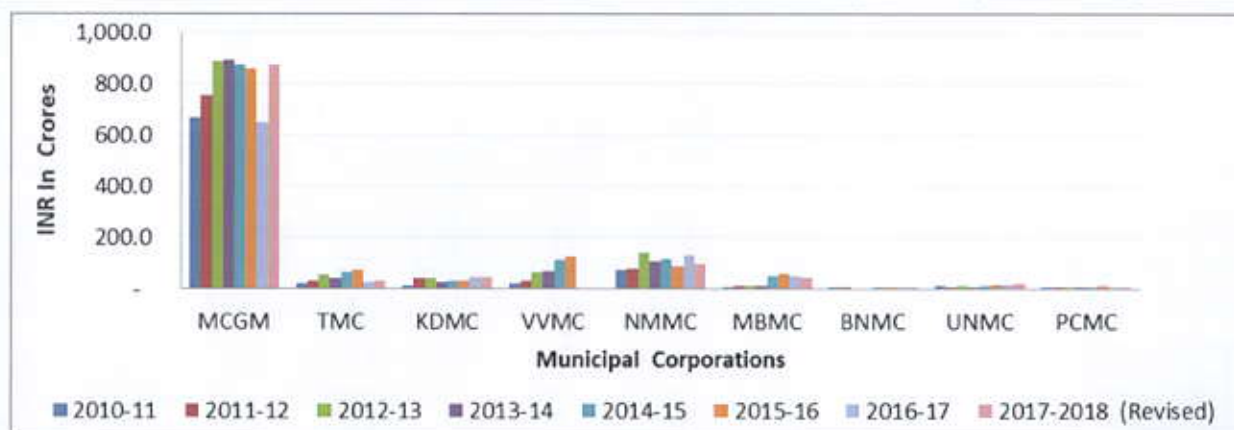


Figure 8-4: Revenue Expenditure of Municipal Corporation on Transport Infrastructure (2010-11 to 2017-18)



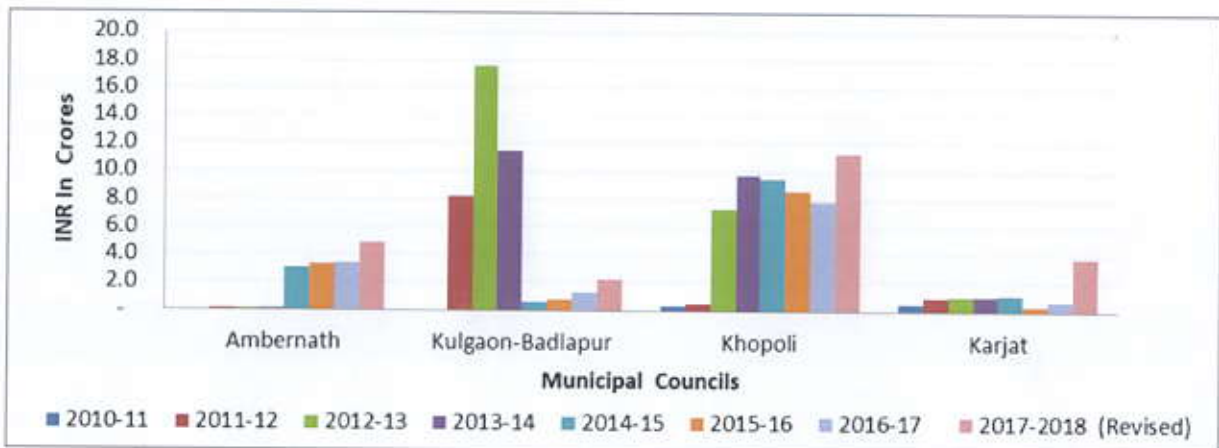


Figure 8-5: Revenue Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18)

Capital share in expenditure on Transport Infrastructure of ULBs is presented in Table 8-4 and shown in Figure 8-6 (Municipal Corporations) and Figure 8-7 (Municipal Councils). It can be inferred that MCGM has topped the list followed with NMMC and TMC.

Table 8-4: Capital share in expenditure on Transport Infrastructure (2010-11 to 2017-18)

Sl. no	ULBs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18 (Revised)	ULB wise Average
1	MCGM	438.7	841.4	770.6	2136.5	1893.5	548.5	1499.8	3270.3	1,424.9
2	TMC	67.0	195.3	192.4	98.2	112.2	110.1	166.9	257.1	149.9
3	KDMC	8.1	5.7	30.8	63.3	150.9	128.5	286.5	387.2	132.6
4	VVMC	15.7	49.8	98.4	107.4	71.4	7.2	7.8	22.3	47.5
5	NMMC	101.4	113.3	102.1	267.2	304.9	68.6	214.8	221.2	174.2
6	MBMC	5.4	2.6	0.0	13.6	18.3	28.8	24.4	47.4	17.6
7	BNMC	5.6	4.8	4.1	1.8	2.8	6.0	0.8	1.8	3.5
8	UNMC	5.3	7.6	8.6	12.1	5.5	10.0	21.7	5.7	9.6
9	PCMC	0.3	1.2	1.1	3.7	6.4	4.9	16.0	108.0	17.7
10	AMC	0.0	0.0	10.7	10.6	47.1	53.4	37.1	32.2	23.9
11	KBMC	16.4	35.2	23.0	13.0	9.4	7.6	12.2	20.8	17.2
12	Khopoli MCI	1.0	0.2	0.1	1.1	0.7	0.7	0.0	2.0	0.7
13	Karjat MCI	0.0	0.0	0.0	0.4	0.0	0.0	1.6	3.2	0.7
14	Total Annual	665	1,257	1,242	2,729	2,623	974	2,290	4,379	2,020

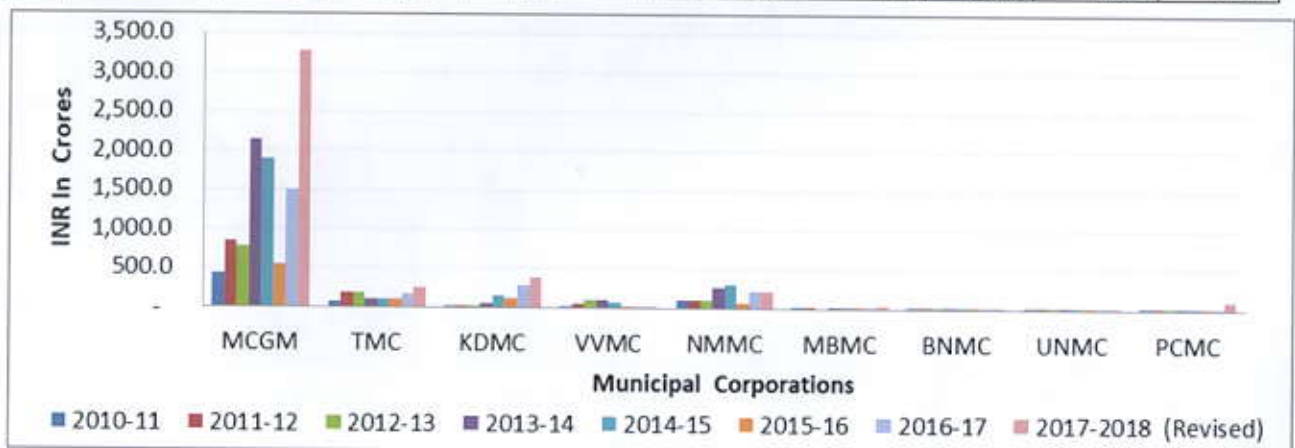


Figure 8-6: Capital Expenditure of Municipal Corporation on Transport Infrastructure (2010-11 to 2017-18)



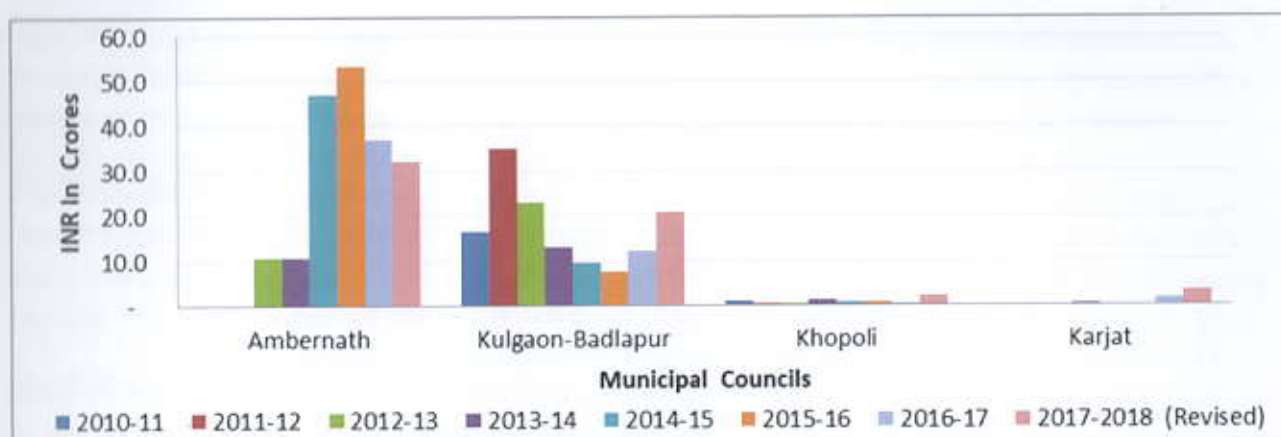


Figure 8-7: Capital Expenditure of Municipal Council on Transport Infrastructure (2010-11 to 2017-18)

*It is pertinent to mention here that, all the ULBs expenditure on transport infrastructure in MMR is related to maintenance of existing roads, street furniture maintenance, widening of existing roads, development of new roads etc. Regional level authorities like MMRDA, CIDCO, MRVC, MSRDC, etc. are planning and implementing major highway, metro, suburban corridors within MMR. There is a need for sharing responsibilities in planning, resource contribution, execution, etc. among major agencies to enhance construction of major highway, metro and suburban railway corridors etc. It becomes evident that the ULBs and regional authorities needs to raise the resources collectively and make use of the same for delivery of overall transport infrastructure in MMR.*

### 8.3 IDENTIFICATION OF FUNDING SOURCES AND STRATEGIES FOR URBAN TRANSPORT INFRASTRUCTURE IN MMR

The range of expenditure on transport infrastructure by all the ULBs, MMRDA, CIDCO, etc. is 8,000 crores to 9,000 Crores, as observed during the period 2010-2011 to 2017-2018. All the major stakeholders of MMRDA need to plan for delivering transport infrastructure of about INR 21,000 crore per annum. Including other infrastructure (water supply, sewerage, drainage, solid waste management, etc.), this figure would go up to INR 25,000 crores per annum. Thus, the available funding sources for the major organizations of MMR would be grossly inadequate. In order to cater to the future urban infrastructure needs of MMR, there will be a need for alternative sources of funding to ensure sustainable urban growth. Based on literature review of national and international experiences on alternative funding sources for urban infrastructure, recommendations of the High Powered Expert Committee, Working Groups on Urban Transport for 12<sup>th</sup> Five Year Plan, High Level Committee on Financing Infrastructure, MMRDA and other major stakeholder's past experience etc., the following funding sources and strategies could be considered:

- A dedicated Urban Transport Fund need to be set up at city/ region level through sources like Betterment levy, Land Value Tax, Enhanced Property Tax or grant of development rights, employment tax, congestion, parking charges reflecting a true value of Land, traffic challans etc. At city level, some of the ULBs have created UTF and MMRDA is putting efforts on creation of UTF at regional level;
- Revenue sharing based on value capture principles with the State and Central government as well as the private sector to fund and finance urban infrastructure where transportation is a major sector



and large component. The investments in transportation infrastructure would lead to increase in economic activities, new employment generation and increased property values. These would translate to higher incomes and demand for goods and services which would lead to higher tax revenues for central and state governments and opportunities for the private sector. The central government through MoHUA is seriously considering viability and mechanisms of monetizing such value creation and using it to fund infrastructure projects particularly in the context of its smart cities mission;

- c) Encouraging Public Private Investment (PPP) in urban infrastructure projects;
- d) Generating income from own land resources by rents/lease to corporates;
- e) Development Charge (DC) on new development and redevelopment within MMR which would be the most reliable and equitable way of raising money for regional infrastructure. This was one of the recommendations of CTS for MMR study 2005-08. Government of Maharashtra amended the MR&TP Act in 2010 and allowed the ULBs to charge the DC at 2.5% of the property value as per ready reckoner. Recently, Government of Maharashtra further increased the DC to 5% of the property value as per ready reckoner; and
- f) Raising money from public and capital markets via Bonds for long term projects with reliable revenue generation capacity.

### 8.3.1 Sources of Finance

Based on the recommendations of Working Group on Urban Transport for 12<sup>th</sup> Five Year Plan, and experience gained from working in urban infrastructure of major Indian cities by MMRDA and other major stakeholders, the sources of funding are assessed and the details are represented in Table 8-5. It is observed that for urban transport infrastructure related projects envisaged by 2041, about 19.2% of the funding is needed from the central government, about 13.3% from the State Government, 10.5% from Regional authorities, about 35.5% from the ULBs / Others. About, 9.1% of the investment needs are expected through private investment in the form of public private partnerships (PPP). Very limited share is expected from the property development i.e. about 0.1%. The balance i.e. about 12.4%, will have to be raised by taking debt from various multilateral/ domestic funding institutions. The analysis indicates that, the own burden of ULBs/SPA/ Regional authorities/ State Govt. would be about 69% (INR 3.40 lakh crore) which includes their own contribution and repayment of loans.

Table 8-5: Major Sources of Funding and their Share (by 2041) for Transport Infrastructure in MMR

Source of Funding	Amount (Rs. Crores)	% of Total
Gol/ IR Grant or Share	94,538	19.2%
State Govt	65,385	13.3%
MMRDA	51,553	10.5%
ULBs/ SPAs/ CIDCO/ MSRDC/ MSRTC/ Others	175,031	35.5%
PPP	45,038	9.1%
Loan from Multilateral/Domestic Agencies-Repayment by Gol	15,163	3.1%
Loan from Multilateral/Domestic Agencies-Repayment by GoM/ Regional Authority	46,016	9.3%
Property Development	587	0.1%
<b>Total</b>	<b>493,312</b>	<b>100%</b>

#### Funding from Central Government:

The funding from the Central government can be in different forms like Viability Gap Funding, Grants etc. Central Government can fund projects by providing grants through programs like the AMRUT, Smart



city, etc. These are scheme for bringing improvement in urban infrastructure and urban governance. It provides financial assistance in the form of grants to ULBs and para-statal state agencies such as MMRDA, CIDCO, MRVC, MSRDC, etc. for implementation of projects.

**Funding by State Government:**

About 13.3% of the total investment will have to be raised/ generated by the State Government. Considering the repayment of debt from Multilateral/Bilateral /Domestic Institutions (3.1%), this would increase to 16.4% (INR 0.85 lakh crores).

**Funding by MMRDA:**

About 10.5% (INR 51,553 crores) of the total investment will have to be raised by MMRDA.

**Funding by ULBs/ SPAs/ Others:**

About 35.5% of the total investment will have to be raised/ generated by the ULBs/ SPAs/ Others (INR 1.75 lakh crores).

Apart from the creation of transport infrastructure, ULBs and regional authorities are entrusted with meeting other financial obligations as well. Hence as mentioned above, a continuous revenue stream will have to be established. Based on a detailed study of the sources of revenue for ULBs and regional authorities, it is envisioned that the investment needs for the creation and maintenance of transport infrastructure can be met by levy of development charges based on the value of the development. This methodology allows market dynamics to play a greater role in the resource generation. Based on the project population and employment in MMR for the horizon year, preliminary estimates of the potential revenue that could be generated through the levy of Development Charges by ULBs and Regional authorities have been worked out.

**Funding from Private Sector:**

It is to be noted that proportion of investment can be anticipated to vary considerably depending on not only on market conditions but also on ability of other government bodies to join hands with MMRDA.

**Funding through Debt:**

Projects can also be funded through debt. It is estimated that all the stakeholders of MMR would have to raise about 12.4% of the total investment on urban transport through debt from domestic or international funding agencies like The World Bank, ADB, Japan International Cooperation Agency (JICA), Asian Infrastructure Bank (AIIB) or any commercial bank. The debt, will however, have to be supported by the Government of India & Government of Maharashtra and all the stakeholders of MMR will have to service and repay any such debt. The population of MMR is likely to increase from 24.88 million in the base year (2017) to about 32.2 million by 2041 and the employment is likely to increase from about 10.24 million to about 14.91 million during the same period. Development charges have been worked out separately for the residential as well as non-residential development – both new development and redevelopment of existing spaces.

According to the proposals made for improving traffic & transport infrastructure services in MMR for the horizon period upto 2041 is about INR 4.93 lakh crores @ 2017-18 prices (Ref. Table 10 2). Average per annum investment needs on transport infrastructure is about INR 21,000 crore. By including other



infrastructure i.e. water supply, sewerage, drainage, solid waste management, etc. (investment needs of other infrastructure in overall infrastructure is about 15%) the overall infrastructure cost would be about INR 5.81 lakh crores @ 2017-18 prices. Average per annum investment needs on overall infrastructure is about INR 25,000 crore.

Based on the investment needs on transport infrastructure prepared for MMR, a total investment of INR 4.93 lakh crores will be required for Urban Transport for the horizon period up to 2041. Including other infrastructure, the overall urban infrastructure investment requirement is INR 5.81 lakh crores. The amount required that is to be borne by the ULBs/Regional Authorities/ State Government is about INR 3.97 lakh crores (INR 3.40 lakh crores for transport infrastructure + INR 0.59 lakh crores other infrastructure).

*Revenue assessed from Development Charge as per the prevailing rates for the period 2021 to 2041 is about INR 0.85 lakh crore and with increase by 50% of the prevailing rates for the period 2021 to 2041 is about INR 1.27 lakh crore. Considering the overall scenario in real estate market, urban infrastructure investment need, uncertainties of revenue from other sources, the development charges required to be levied shall be Residential: 7.5%; Commercial: 15% and Industrial: 11.25% which means increasing the current/ existing Development Charges by 50%.*

Table 8-6: Sources of Funding: Development Charge

DC Percentage Levied	2021-26	2027-31	2032-41	Total DC
Residential: 5%; Commercial: 10% and Industrial: 7.5%	21,660	21,392	41,644	84,696
Residential: 7.5%; Commercial: 15% and Industrial: 11.25%	32,490	32,088	62,466	127,044

### 8.3.1.1 Assessment of Revenue from Land & Asset Monetisation

MMRDA owns pockets of land in MMR which can be considered as an asset. This can be disposed of at any point of time to fulfill financial gap. Sale of land owned by MMRDA has always been the major source of revenue generation to fund MMRDA's contribution to infrastructure construction to the date. In the last decade due to initiation and implementation of many new infrastructure projects which were already in the pipeline, some land from MMRDA's resources was sold out to contribute in coming investments. Also, some new pockets within MMR were allotted by state government. The revised land asset in 2017 and its potential to generate revenue according to current market prices are shown in Table 8-7. Apart from these, Draft Regional Plan 2016-36 identified 4 new growth centers and 7 industrial areas in Greenfield areas of MMR. Revenue assessed from land and assets monetisation is presented in Table 8-7. Estimated revenue potential from the vacant lands owned by MMRDA (In BKC, Wadala, etc.) is about INR 0.94 lakh crore. It is estimated that, revenue generated from the government owned vacant lands in the proposed growth centres/ areas in greenfield areas and vacant lands available with the ULBs/ SPAs in their jurisdiction is about INR 1.4 lakh crore and 0.5 lakh crore respectively. Thus, the total revenue potential from the land and asset monetisation by various stakeholders of MMR is about INR 2.84 lakh crore.

Table 8-7: Sources of Funding: Land and Asset Monetisation

Sl. No.	Project	Revenue potential (INR Crores) @ 2017-18 prices
---------	---------	---



1.	Bandra-Kurla Complex	58,869
2.	Wadala	32,200
3.	Varsova Car Depot	1,309
4.	Kandivli (Khatau-Magathane)	1,556
5.	Taloja (SWM)	16.5
6.	Bhiwandi (SWM)	24
7.	Growth Centres/ Areas (by MMRDA/ CIDCO)	1,40,000
8.	Land monetisation by ULBs/ MSRDC	50,000
<b>Total</b>		<b>2,83,975</b>

Approximate revenue potential from the increased development charge and land & asset monetisation is about INR 4.11 lakh crore and the details are summarized in Table 8-8.

**Table 8-8: Sources of Funding: Development Charge and Land & Asset Monetisation**

Revenue Source	Amount in INR Crore	
	Existing Development Charges: Residential: 5%; Commercial: 10% and Industrial: 7.5%	Proposed Development Charges: Residential: 7.5%; Commercial: 15% and Industrial: 11.25%
Revenue from Development Charges	84,700	1,27,000
Revenue from Land and Asset Monetisation	2,84,000	2,84,000
<b>Total</b>	<b>3,68,700</b>	<b>4,11,100</b>

*Note: Revenue is considered from 2021 onwards till 2041. Stakeholder's total financial burden is investment need that is to be raised for infrastructure development i.e. INR 3.98 lakh crores. It is inclusive of transport infra with the share of 85% and other infrastructure services with the share of 15%.*

The overall revenue generated from the increased Development Charge and land & asset monetisation by various stakeholders is about INR 4.11 lakh crores which matches the requirement of 3.98 lakh crores. The analysis indicates that, all the stakeholders have to follow multi-pronged approach to raise the resources for successful planning and timely implementation of infrastructure in MMR.



## 9 INSTITUTIONAL ARRANGEMENTS

*The existing institutional arrangements are highly inadequate to ensure effective and timely implementation of the proposed traffic & transport infrastructure enhancement and improvements, and therefore, there is a need for institutional strengthening at the Regional level as well as ULB level. The suggested institutional arrangements at Regional level and local levels i.e. of the Municipal Corporations are presented hereafter.*

### 9.1 BACKGROUND

As per CTS for MMR study (2005-2008) carried out by MMRDA, more than 10.5 million people (78% of the total commuters) travel daily by Public Transport, which constitute approximately 52% of person travel by Rail and about 26% person travel by Bus during 2005 within the MMR area. Based on the findings from the CMP for Greater Mumbai study, carried out by MCGM, it was identified that more than 12.7 million people (70% of the total) travel daily by Public Transport, which comprises 40.6% modal share by Rail, 27.7% modal share by Bus and approximately 1.6% modal share by Metro & Monorail (2014) in MMR. Existing suburban system has been under extreme pressure and role of the bus system has mostly been limited to provide feeder services to Suburban railways. Due to overcrowding on suburban system and crowding in an unsafe manner, 9 to 10 fatalities per day have been occurring on Mumbai suburban system on an average, which is alarming. Due to geographical constraints there is a limited scope to expand existing road and rail network capacity. Many pockets in the Island City and Suburbs are not served by rail network. A suburban train compartment possesses a maximum capacity of about 2,400 persons (Standing + seating together); however in a day-to-day event a suburban train compartment carries more than 5,000 persons. Based on the data obtained from the primary surveys, which were carried out during CTS for MMR study (on-board boarding and alighting survey), it was noted that the highest average commuter density was approximately nine (9) persons/ sq. m. It is worth noting that the average standing density is about 12 persons/ sq. m. and passenger density within the section between the doors of a unique rail compartment is 16 persons/ sq. m. Due to inadequate capacity of Mass Transit System that are operated within the MMR area with respect to rising demand, the share of public transport has declined from 88% to 78% during the period 1994 to 2005 (Source: CTS for MMR 2005-2008 study) and the ridership has further been reduced to 70% by 2014 (Source: CMP for Greater Mumbai 2014-2016).

MMR is a complex urban region that houses nine municipal corporations and eight municipal councils. The transport systems are operated by various national, state and local operators across the region. Thus, in MMR there are multiple organizations responsible for various transportation matters (Ref. Figure 1). The demand-supply gaps in local transport infrastructure and regional transport infrastructure are huge, which warrant supply of considerable capacity to meet the future requirements. The ULBs need to focus their efforts on improvement of local transport infrastructure within their jurisdictions and manages operation of the road based public transport system within and around the respective ULB areas. It is felt that there is a need for regional level authority to deliver the necessary Regional transport infrastructure within the MMR area.



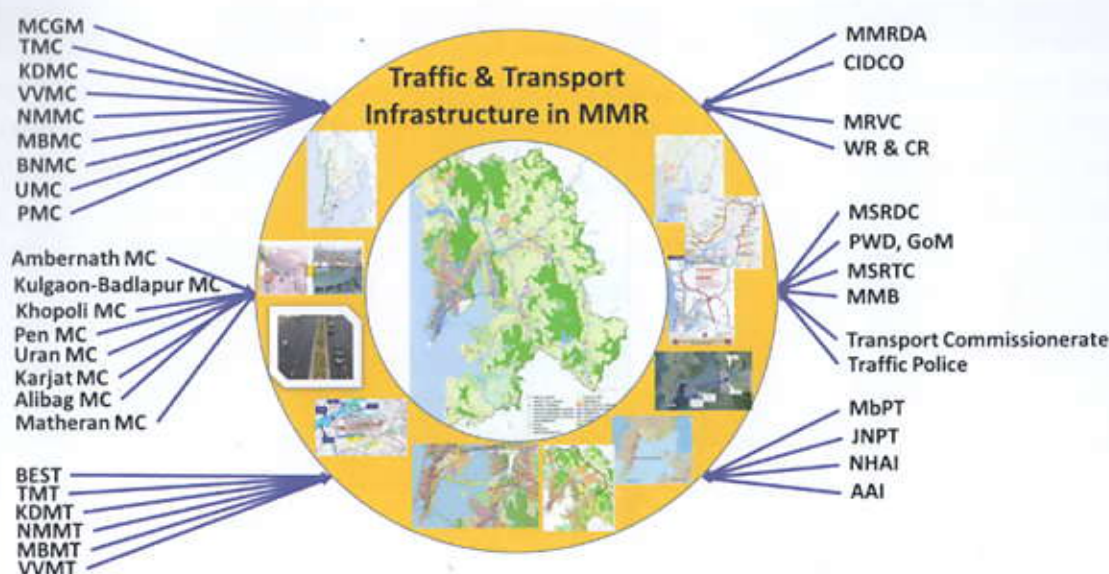


Figure 9-1: Traffic & Transport Infrastructure in MMR- Multiplicity of Organisations

With the goal of creating a transport infrastructure befitting to the current and future demands of the Mumbai region, MMRDA has carried out the many planning studies during various periods (some studies have already been completed while others are under progress). Subsequent to the study findings MMRDA had initiated number of transportation projects to improve the traffic operating conditions and, improve the passenger comfort in rail and road based public transport systems.

## 9.2 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 requirement of a significant transportation investment program based on the study recommendations. A need was also felt to significantly enhance the institutional capacities through reorganization to ensure efficient implementation of the necessary transport system improvement projects. A Business Plan for MMR was, therefore, prepared considering an investment plan for enhancement of transport infrastructure across all sectors. The Business Plan identified that the organization structure in MMR is quite complex. Having such complex institutional setup the existing organizational structure does not address certain functions such as planning for various attributes including economic growth, water resources, development of Greenfield areas, inter-municipal solid waste disposal etc. Furthermore, hand holding of smaller ULBs and resource mobilization for metropolitan infrastructure are also not adequately covered within the existing MMRDA structure. Therefore, in order to address these gaps, institutional restructuring towards improved planning management, capacity building, legal reforms etc. are required. Keeping in view the Business Plan proposals and the CTS proposals, Technical Assistance study (2009-11), suggested the institutional reforms towards restructuring of MMRDA and its metropolitan administration wing. This section summarizes the **TRANSFORM** and Business Plan recommendations with respect to institutional arrangements. The section also describes the historical developments since that time, the existing arrangements and concludes on the future direction reflecting necessary changes for incorporation.



### 9.2.1 Need for Institutional Change

The **TRANSFORM** study reflects that, the MMR faces the major challenge of delivering necessary transportation services across the region, which warrants massive capital investments. Preparation of such investment plan through addressing complex multi-faceted issues, implementation of the recommended improvements on a periodical basis including periodical resource mobilization is needed for improvement of the transportation system infrastructure. All this warrants appropriate organizational changes, which are required to improve the capacity of the MMR to deliver this program.

Institutional arrangements in other jurisdictions including various cities and regions across the world were examined. It appears that an appropriate form of Regional Government is warranted, which would be responsible and capable of building and running urban transportation services across the MMR area. This recommendation has not been addressed so far. It appears that an approach towards strengthening the current structure has been evolving, with MMRDA taking on a larger role in leading the process on behalf of the State Government.

### 9.2.2 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 listed in Box 8-1.



### BOX 8-1: Organisations and their Responsibilities

#### A. Key Responsibility and Jurisdiction Road and related infrastructure in respective municipalities/councils

##### Municipal Corporations

- |                          |                                      |
|--------------------------|--------------------------------------|
| 1. Greater Mumbai (MCGM) | 6. Navi Mumbai                       |
| 2. Kalyan Dombivli       | 7. Mira Bhayandar                    |
| 3. Ulhasnagar            | 8. Vasai-Virar                       |
| 4. Bhiwandi-Nizampur     | 9. Panvel City Municipal Corporation |
| 5. Thane                 |                                      |

##### Municipal Councils

- |              |             |
|--------------|-------------|
| 1. Ambernath | 6. Alibag   |
| 2. Badlapur  | 7. Uran     |
| 3. Khopoli   | 8. Matheran |
| 4. Pen       |             |
| 5. Karjat    |             |

#### B. Bus services mainly in respective municipalities

1. Brihanmumbai Electric Supply and Transport (BEST)
2. Thane Municipal Transport (TMT)
3. Navi Mumbai Municipal Transport (NMMT)
4. Kalyan Dombivli Municipal Transport (KDMT)
5. Mira Bhayandar Municipal Transport (MBMT)
6. Ulhasnagar Municipal Transport (UMT)

#### C. State Government

##### 1. Mumbai Metropolitan Region Development Authority (MMRDA)

Planning and coordinating authority for MMR

##### 2. City and Industrial Development Corporation (CIDCO)

Development of Navi Mumbai and Special Planning Authority for Vasai Virar Sub region.

##### 3. Public Works Department (PWD)

Construction and maintenance of roads, bridges, public buildings in the State

##### 4. Maharashtra State Road Development Corporation (MSRDC)

Improvement of existing and new construction of roads, highways, expressways and select water transport services in the State.

##### 5. Maharashtra State Road Transport Corporation (MSRTC)

Provision of inter-city bus service in Maharashtra State as well as neighboring states

##### 6. Traffic Police (TP)

Traffic enforcement in Greater Mumbai

##### 7. Transport Commissionerate (TC)

Grant licenses, issue permits, and collect various transport related taxes, fees and cess in the State

##### 8. Public Works Department (PWD)

Undertakes development of State Highways, MDRs, ODRs, Village Roads, Maintenance of National Highways

##### 9. Maharashtra Maritime Board (MMB)

Undertakes development of marine fronts, cargo jetties, ferry wharfs, terminals and inland waterways in State other than major ports.

#### D Central Government

##### 1. Central Railways (CR)

Operation of inter-city railway services and part of Mumbai's suburban rail system (CSMT-Karjat-Khopoli)

##### 2. Western Railways (WR)

Operation of inter-city railway services and part of Mumbai's suburban rail system (Churchgate-Virar-Dahanu)

##### 3. Mumbai Port Trust (MbPT)

Providing sea transport for cargo and port facilities for country's trade and commerce.

##### 4. Jawaharlal Nehru Port Trust (JNPT)

Providing port infrastructure and terminal facilities for bulk container traffic.

##### 5. Airport Authority of India (AAI)

Providing facilities for passenger and cargo air travel to and fro Mumbai for domestic and international traffic.

#### E Central and State Governments

##### 1. Mumbai Railway Vikas Corporation (MRVC)

Undertaking coordinated planning and implementation of Mumbai suburban rail infrastructure projects.

##### 2. 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 of numerous public agencies and corporate bodies. The State Government of Maharashtra is generally responsible urban development and implementation, operation and maintenance of urban transport system 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 under control of India Railways (IR). The allocation of resources for rail services is subject to the approval of the Planning Commission of the Government of India (GoI). The suburban rail services are run by two zonal railways i.e. Western Railway (WR) and Central Railway (CR), who operate within the MMR area as independent agencies without significant service integration. "Mumbai Railway Vikas Corporation" (MRVC) is established to implement projects that are included in the Mumbai Urban Transport Project (MUTP) and in coordination with the CR, WR and other agencies. MRVC operates under joint control of Indian Railways and the State Government of Maharashtra.

Metro and Monorail planning in the MMR is mainly carried out by MMRDA. However, the City and Industrial Development Corporation (CIDCO) has prepared plan for metro rail provisioning within their planning area and have undertaken construction of Belapur to Khandeshwar metro line, which is 23.40 km long and consists 20 metro stations. CIDCO is responsible for planning and development of the Navi Mumbai area.

Generally State Road construction and maintenance is the responsibility of the State Public Works Department (PWD), whereas the urban roads or local roads are the responsibility of the local authorities. Construction of some 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), however MCGM does not have necessary technical resources to meet the increasing demand of such important task. Similarly, planning and implementation of traffic management schemes in other municipal corporations and council jurisdictions is the responsibility of the respective corporations/ councils; however the municipal administrations also lack necessary resources for successful implementation of them.

The bus services within the jurisdiction of the City of Mumbai are provided exclusively by a division of the municipal administration, in the trade name of the Brihan Mumbai Electric Supply and Transport (BEST). 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). The other part of the surface transportation i.e. marine transportation is planned and developed by the Maharashtra Maritime Board (MMB).

Funding arrangements for urban transport infrastructure and services in MMR are divided among various national, state and local government agencies. No single agency has the clear mandate on their role or responsibility for preparing affordable, integrated investment and operations budgets to meet travel



demands and policy objectives. It has been observed that overall levels of investment have been lagging demand, while maintenance expenditures are well below than 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 stakeholder consultations and therefore, has proven to be a long drawn and cumbersome process. The consequence of such long process is generation of additional complexity and insufficient coordination among various stakeholders.

Infrastructure project implementation has experienced considerable delays, as a result of poor definition of roles and responsibilities and weak coordination among various agencies. An important lesson about implementation delay results in paucity of funds and prolong the land acquisition process including obtaining necessary clearances from R&R, environmental department. The prolonged delay also results in manifold including user charges and tariffs, financial viability, accumulating financial and physical resources etc. The root cause of all such problems appears to be absence of an unique implementing authority that possesses a clear mandate.

The issues can be summarized as follows:

- (a) Multiplicity of agencies with overlapping responsibilities makes the decision making and follow-up action difficult;
- (b) The need of coordination among the roles of central, state and Local Government agencies without a clear established mechanism makes major financial decisions difficult;
- (c) There is a lack of coordination between land use development decisions and transportation investment decisions;
- (d) There is a shortage of staff with adequate skills in project planning and implementation including organizational and financial decision making; and
- (e) MMRDA appears to possess the leadership role with respect to regional infrastructure improvement and investment; however it is not appropriately positioned or resourced to meet the expectations placed upon it.

An effective institutional framework is of critical importance towards installation of successful transport systems. Because of the many external and internal interdependencies, the existing MMR organization does not fit easily while the responsible institutions require substantial co-ordination among the concerned agencies.

It therefore becomes imperative that effective inter-agency coordination is achieved at national, regional and municipal/local government levels. Progress towards this attainment requires investment over a long time frame. Currently MMRDA's role has been evolving; however further improvements and restructuring would be necessary.

**TRANSFORM** has set the direction towards the necessary institutional change however, it is recognized that implementation of such changes would take time. The institutional arrangements in MMR have been evolving and this section outlines the changes that are occurring.

### 9.2.3 Regional Transport Authority

The Vision, Mission and Priorities for a regional transport authority are detailed below:



#### 9.2.3.1 Vision for a Regional Authority

The Authority shall be mandated to achieve a future transport system, where people and goods move in a way that is sustainable and promotes a healthy economy, an improved environment and quality of life.

#### 9.2.3.2 Mission for the Authority

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

#### 9.2.3.3 Priorities of the Coordinating Authority

The Authority should believe that the only way it can achieve the transportation vision will be by applying the following core values to every action and task that it undertakes:

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

#### 9.2.3.4 Governance of MMRDA

The existing administrative structure of MMRDA is shown in

Figure 9-2. The complexity of this organization reflects the complexity of the activities that occur within the Region.

To understand the mandate of MMRDA, it is necessary to examine how the governance of the organisation is currently structured, which has been illustrated in Figure 9-3. The governance structure reflects the importance of consultation with a large number of organizations including reflecting the challenges of making decisions in a timely manner 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 Comprehensive Transport Study and Business Plan etc. The Funds for applicable infrastructure under MMRDA jurisdiction will be dedicated to finance to take up the implementation either alone or in partnership with other agencies. The proposed MMIF should be governed by a separate body MMI. The MMI Fund Committee within MMRDA, should be independent of



project initiating and implementing divisions of MMRDA. This approach is adopted to ensure managing the investment decisions in a timely manner, which is critical to building the transport system infrastructure. These decisions are major in scope and MMRDA should be focused on obtaining the expertise that can support good investment and business decisions. Figure 9-4 shows the existing Executive Committee composition and how the Mumbai Infrastructure Fund Committee relates to it.

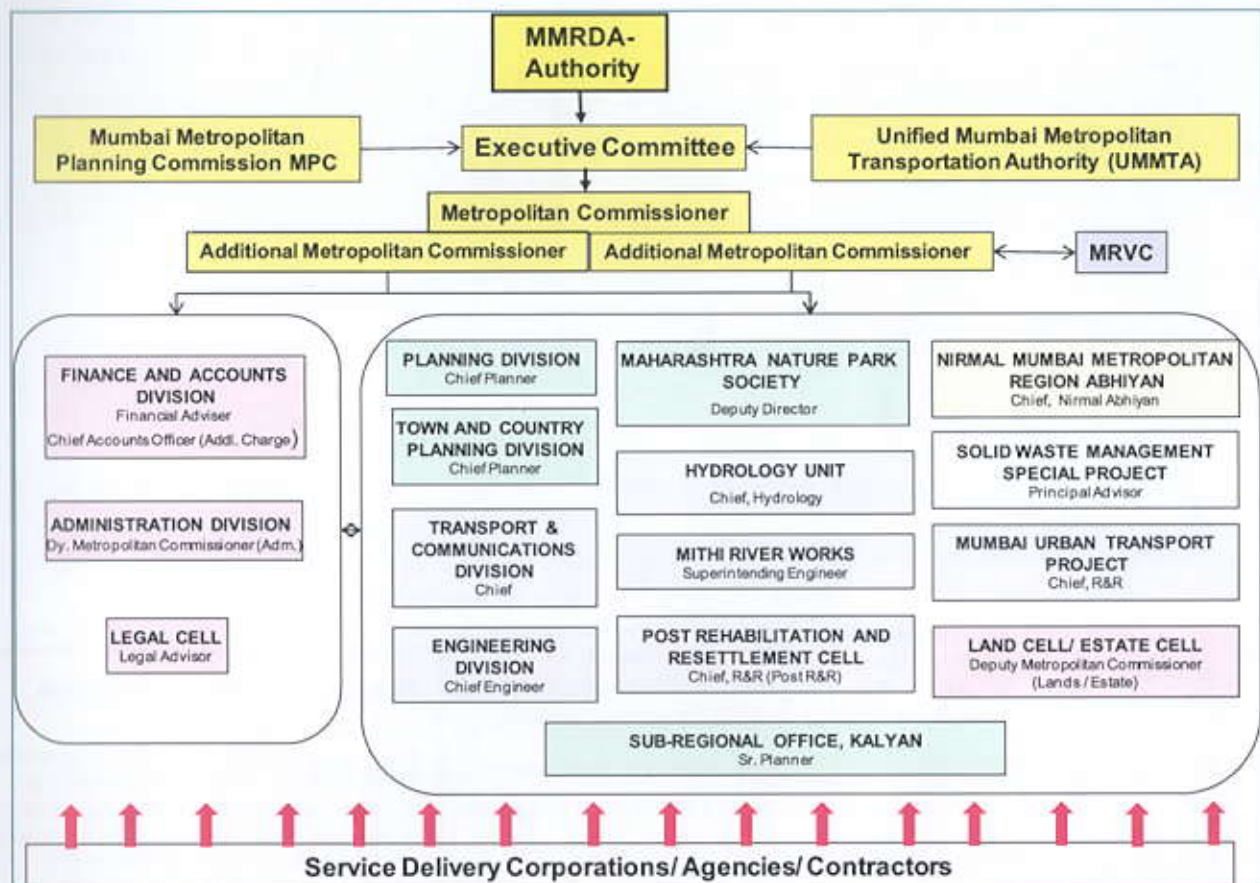


Figure 9-2: Existing MMRDA Structure



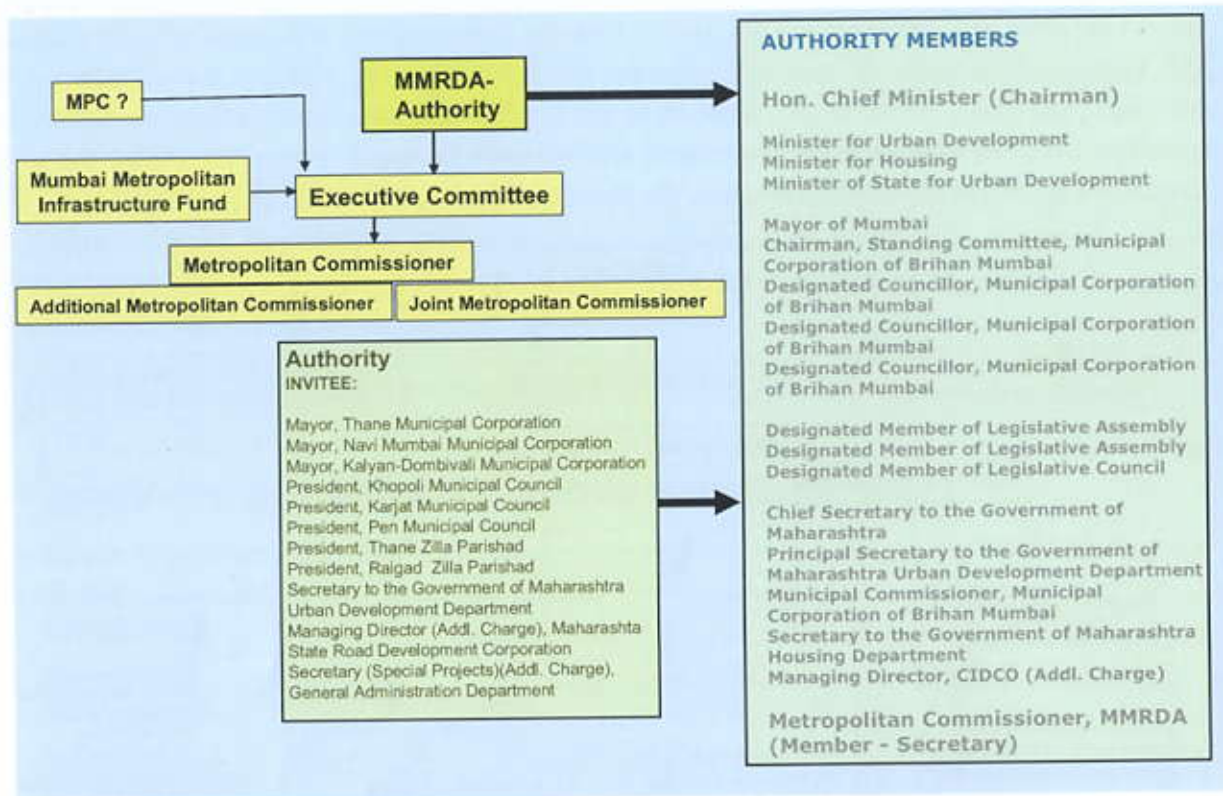


Figure 9-3: Existing Authority Composition

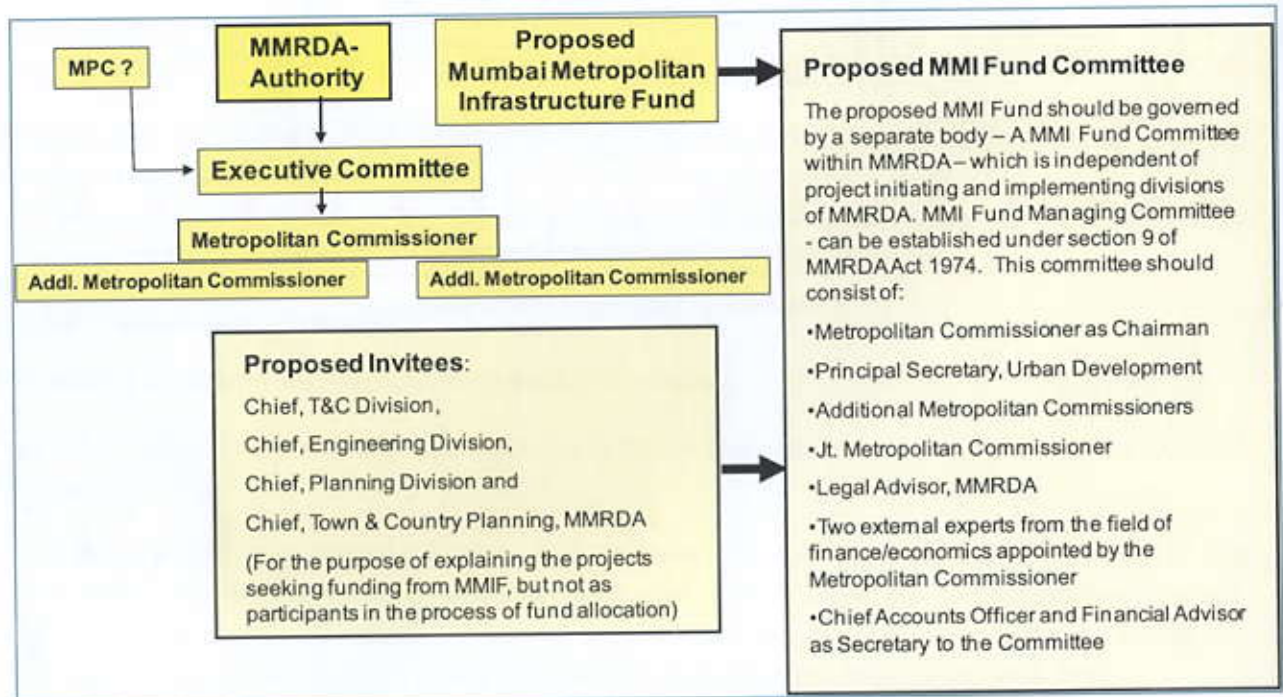


Figure 9-4: Executive Committee and Relation to MMIF Committee

National Urban Transport Policy (NUTP), 2006 envisages setting up of an Unified Metropolitan Transport Authority (UMTA) in all cities that possess more than million plus population (census 2001), to facilitate coordinated planning and implementation of urban transport programs and projects. Furthermore, an integrated management of the urban transport systems was also advised, as the current structure of



Transportation Sector Governance is not equipped to deal with problems of urban transport due to multiplicity of organizations, lack of integration and coordination etc.)

Home, Department of the Government of Maharashtra by its resolution dated 12<sup>th</sup> 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 implementation of transport system enhancements in the region and monitor that no steps are initiated by any agencies /local bodies that detract from the overall efficiency of the approved regional transport plan; and
- As the empowered coordination Authority, will ensure adhering to developed overall policy in regards to Transport, Modal priorities, Infrastructure priorities, financial allocation and operational coordination.

- **Functions:**

- Prepare comprehensive transport plan for MMR;
- Ensure integration of regional and city land use plans with transport plan of MMR;
- Develop inter modal priorities and integration;
- Identify infrastructure priorities and integration;
- Allocate individual infrastructure execution to implementing agencies;
- Install Bus Rapid Transit System (BRTS);
- Prepare funding mechanism and fund allocation;
- Implement modalities including PPP initiatives;
- Bring unanimity among various concerned agencies;
- Undertake transport studies and update information systems; and
- Carry-on other work assigned by Metropolitan Planning Committee (MPC).

- **Role of MMRDA:**

- MMRDA is expected to provide staff, technical skills and expenses to (Unified Mumbai Metropolitan Transport Authority) UMMTA.

Government Resolutions (GR) envisaged setting up 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 on the 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 has been putting efforts to discharge its mandated functions and currently working on obtaining the statutory backing through appropriate legislations.

Multiple organizations and agencies deal with the Mumbai metropolitan transport system. , A “**Core Committee**” under the chairmanship of Principal Secretary, Urban Development Department has been formed vide GR in UDD, date 04<sup>th</sup> January, 2010 to study and appraise the proposals from the dealing organizations, recommend accepted proposals for approval by UMMTA, and assist UMMTA in discharging its functions. The specific scope of the Core Committee covers the followings:



- a) Implement CTS recommendations in a phased manner;
- b) Create Traffic & Transportation department/ division in ULBs;
- c) Setup Dedicated Infrastructure Fund;
- d) Implement Seamless Travel in MMR;
- e) Implement security in Public Transport Systems; and
- f) Deal with other important issues ensuring efficient transport system in Mumbai Metropolitan Region (MMR).

The committee meets regularly and as a result of the regular meetings 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, that was initiated in October, 2009 ;
- d) Identified sources for Dedicated Infrastructure Fund i.e. Mumbai Metropolitan Infrastructure Fund (MMIF) and initiated legal amendments in MRTP Act and MMRDA Act that were required for implementation of Development Charges in MMR. The amended acts have been sent to UDD, GoM for approval;
- e) Initiated 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) Advised ULBs 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) Advised various agencies including NHAI, MRVC and MSRDC to carry out the preparation of DPRs for the projects under their jurisdiction as per the CTS Plan.

UMMTA committee meeting was held on 8<sup>th</sup> 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 9-5.

The GoI (MoUD) has initiated efforts to establish Unified Metropolitan Transport Authority (UMTA) and Urban Transport Funds (UTF). The MoUD has recently proposed processes and mechanisms to implement both UMTA and UTF on a statutory basis. UMMTA with the assistance from MMRDA is in the process of appointing Consultants for preparation of UMTA bill for MMR.

#### 9.2.4 The Organisation and Staffing of MMRDA

The level of investment through MMRDA on regional urban infrastructure is going to increase many folds in the immediate future. The increase in the number of projects that MMRDA will assess, plan, finance, and implement will require a large increase in the staff resources. However, the projects themselves are increasing in complexity, which requires a larger number of staff and a broader range of skills together. The proposed organizational structure is shown in Figure 9-6.

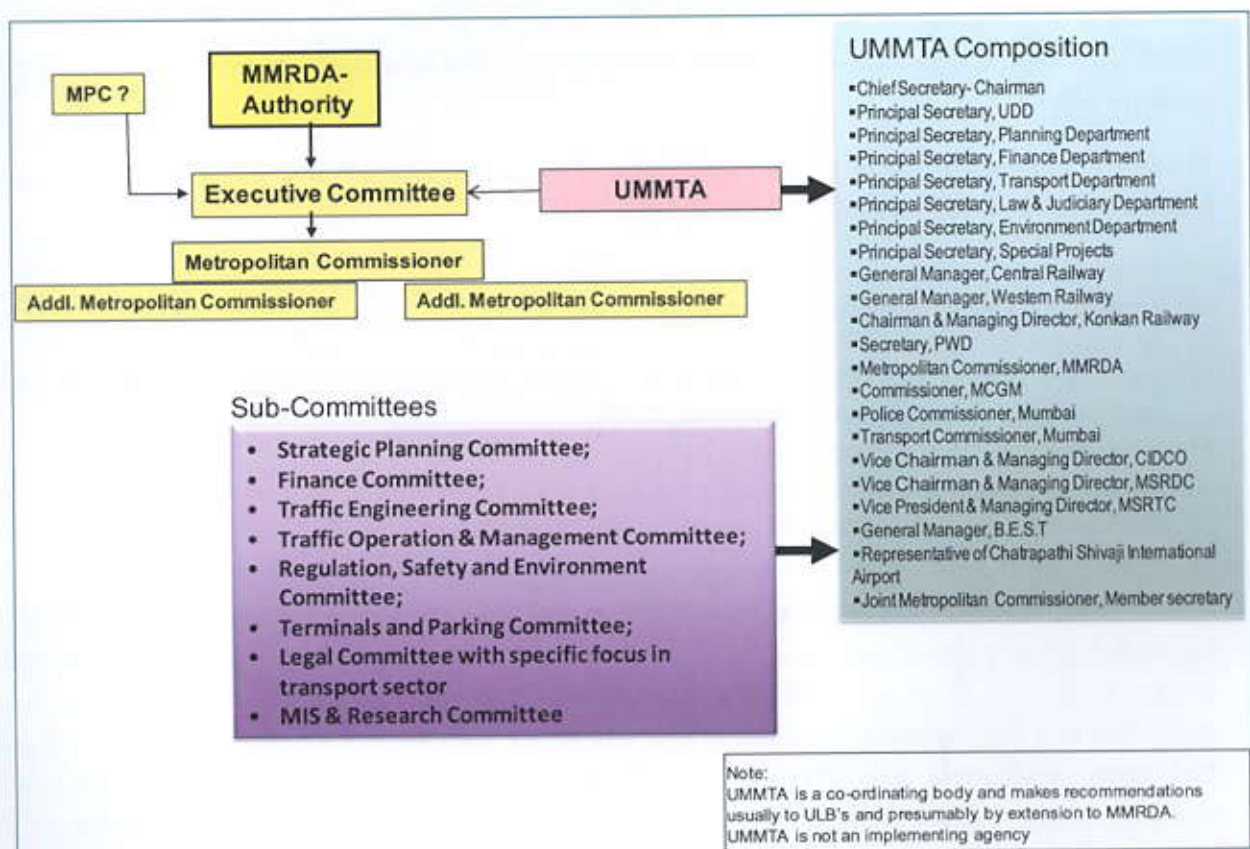




Figure 9-5: UMMTA Composition, Sub Committees and UMMTA Relation with Executive Committee

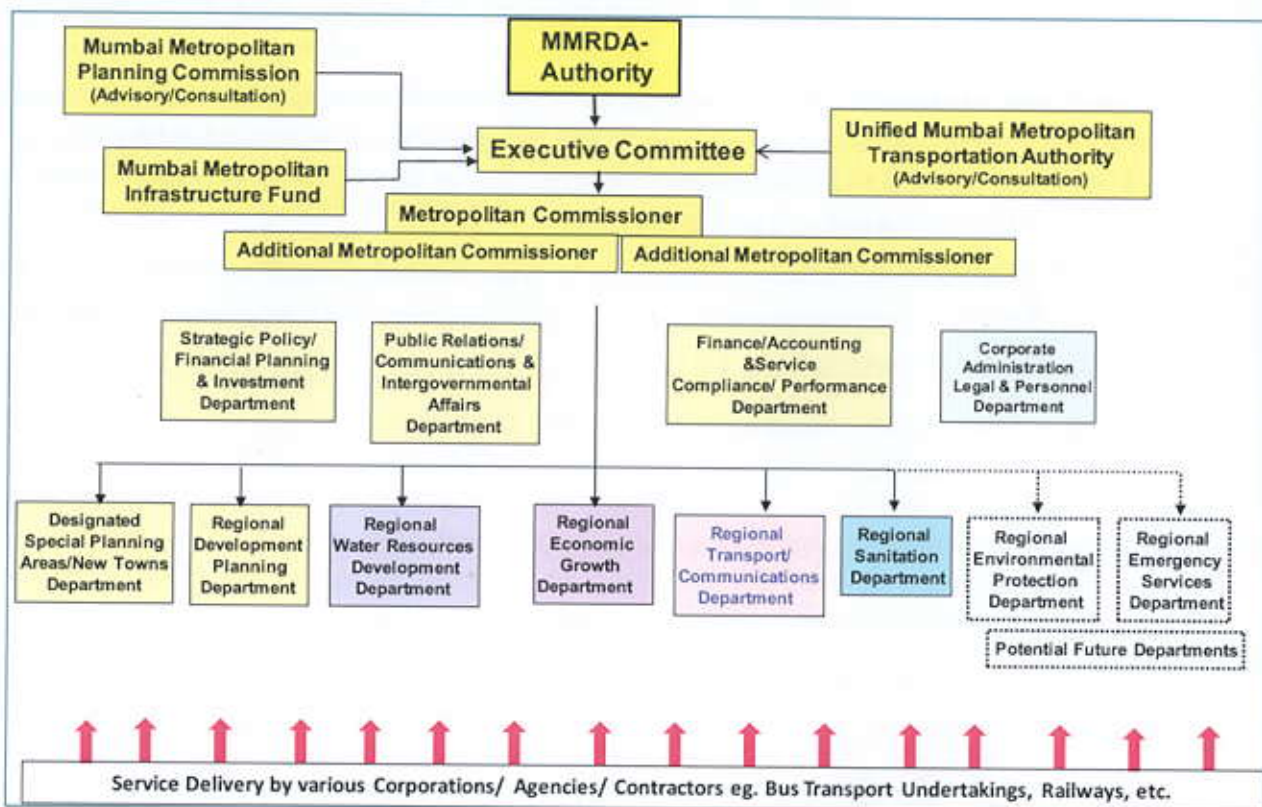


Figure 9-6: Proposed Organisation Structure for MMRDA

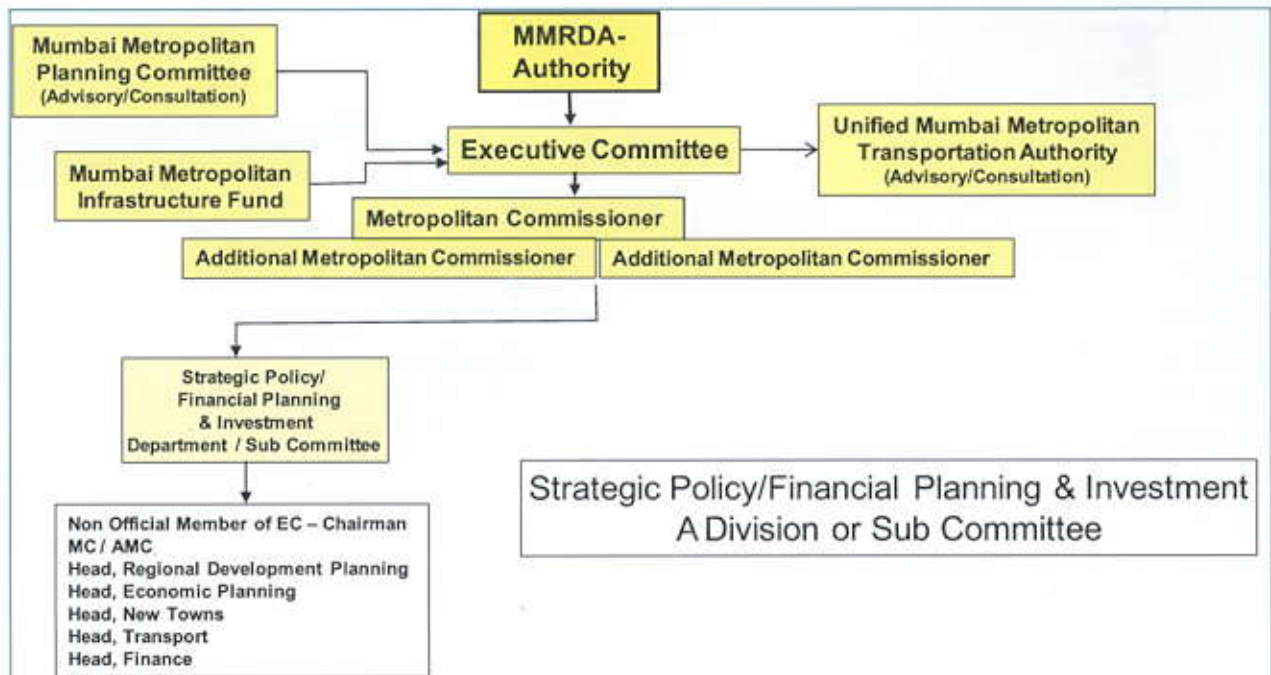
An important change to the existing organization structure of MMRDA is induction of a new division called "Strategic Policy/Financial Planning and Investment". The positioning of the Department is shown in Figure 9-7.

The role of this division will be to take the vision and the strategy for MMRDA and mobilize resources to translate the Vision into a reality. The process will involve:

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

A further expansion in the MMRDA's capability is planned through adding staff in new cells in the Regional Transport Department as shown in Figure 9-8. It is proposed that the three new cells will be created to address areas where MMRDA capacity needs will be improved. These cells will deal with Relocation and Resettlement, Land Acquisition and Utility Relocation. Each of the activities is a major task while establishing unique Right of Way (RoW) within an urban area. A specialist cell towards implementation of all this will provide the expertise and accelerate the implementation process.





**Figure 9-7: Strategic Policy, Financial Planning and Investment Division and Sub-Committee**

A further new group will also be required to respond to MMRDA's activities in leading the development of the Growth Centres and the Settlement Areas. It is proposed that a division should be created in the name of Special Planning Areas and New Towns Department, who would be responsible to lead the activity. Figure 9-6 illustrates the details of the proposed division, and integration with the existing organization structure is shown in Figure 9-9.



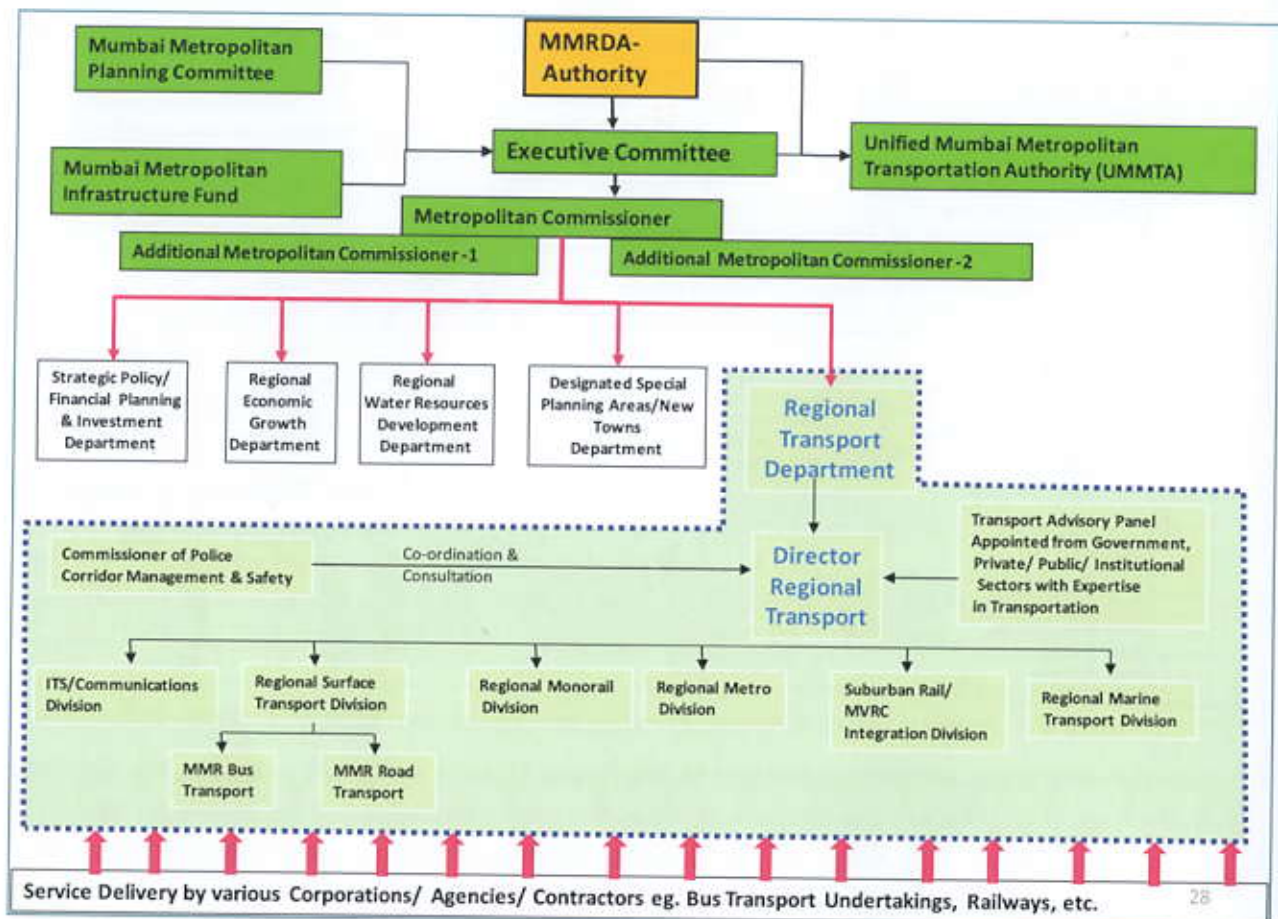


Figure 9-8: Organisational Structure for Regional Transport Department

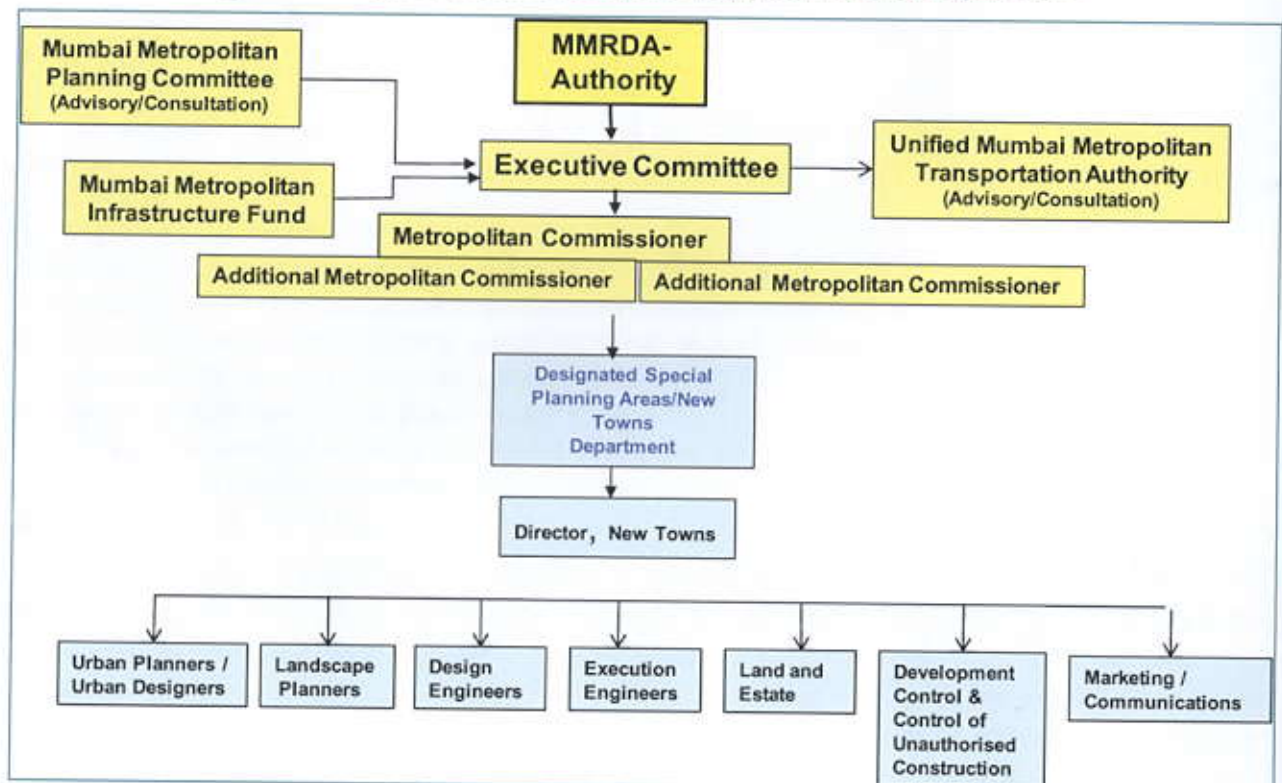




Figure 9-9: Organizational Structure for Special Planning Areas and New Town Division

### 9.3 MOBILITY PLAN PROPOSED INSTITUTIONAL CHANGES FOR MCGM

#### 9.3.1 Existing Institutional Setup of MCGM

Greater Mumbai is administered by the Municipal Corporation of Greater Mumbai (MCGM). The Municipal Corporation officials and policy makers form Standing Committee, Improvement Committee, BEST Committee, Education Committee, Wards Committee, Mayor. The Municipal Commissioner (MC) and General Manager, BEST head the Municipal Corporation and the Bombay Electric Supply and Bus Transportation. Municipal administration of MCGM is shown in Figure 9-10. 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 to discharge his functions. Additional Municipal Commissioners (AMCs) are appointed by Government of Maharashtra under BMC Act section 54. AMC functions as commissioner for individual departments, which are deputed to him by Municipal Commissioner. At present there are four Additional Municipal Commissioners in the MCGM. All executive powers are vested with the MC, who is an Indian Administrative Service (IAS) cadre, 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 and implementation 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. There is one Chief Engineer that looks after Development Plan preparation. Under each AMC, there are Joint MCs/ Deputy MCs to assist the AMCs in discharging 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.



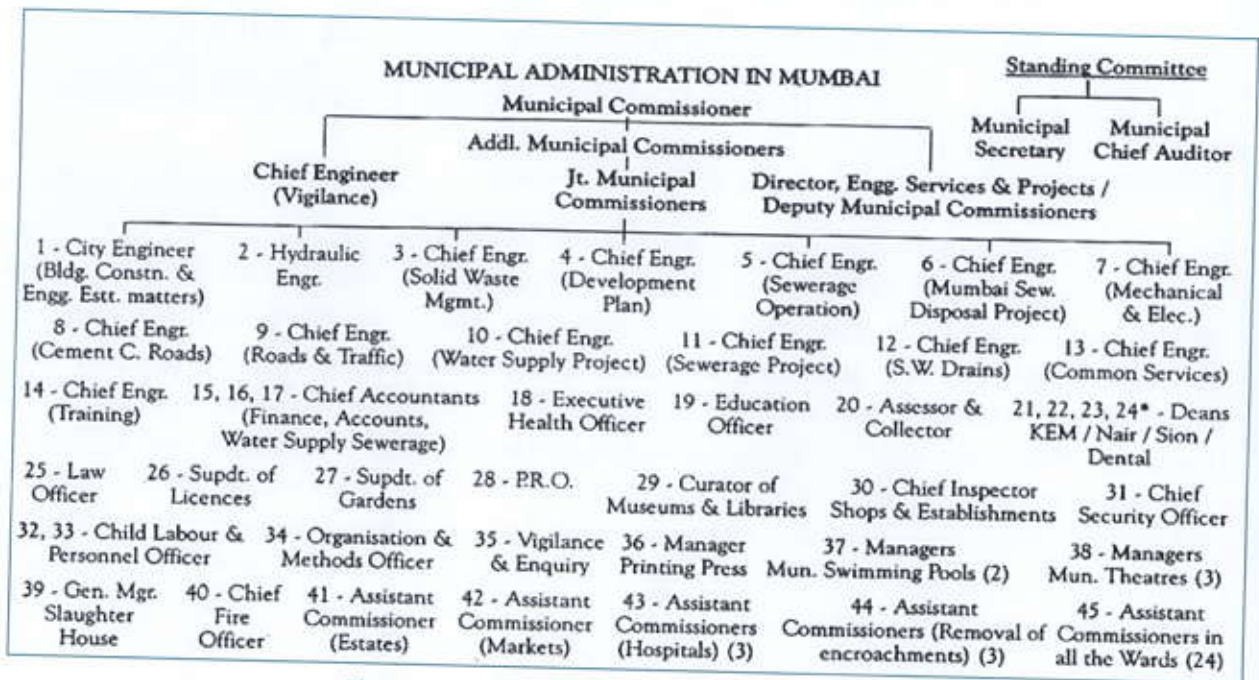


Figure 9-10: Organizational Structure of MCGM

**Functions of MCGM:** The functions of MCGM broadly relate to public health engineering (Water supply, sewerage, sanitation), regulatory functions (prescribing and enforcing Building regulations, encroachments on public land, Birth and Death registrations, etc.). The municipal functions also include provisioning of Street lighting, civic infrastructure works, and various 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 and the administrative Chief of the MCGM. Brief description of some of the major departments, which are relevant for traffic engineering, road safety and transportation planning are described as follow:

**Development Plan and Building Proposals Department:** This department is headed by the Chief Engineer. The Chief Engineer reports to the Director (Engineering Services & Projects), while the Director reports to the –Municipal Commissioner. Chief Engineer is assisted by four Dy. Chief Engineers (DP, Island City, Western and Eastern suburbs). Main functions of the department consist of implementation of Development Plan, accord approvals to Building/Development Plan or Proposal municipal by-laws, land acquisition, road improvements, implementation of slum redevelopment scheme (SRD), granting 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 9-11. The traffic department is headed by the Chief Engineer, Roads & Traffic. Chief Engineer reports to Addl. Municipal Commissioner (Eastern Suburbs), who in turn reports to the 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. The duties also include scrutiny of parking facilities within the development premises/ properties,



coordination with traffic police, BEST and other stakeholders, implementing traffic management measures, road opening activity, permitting etc.

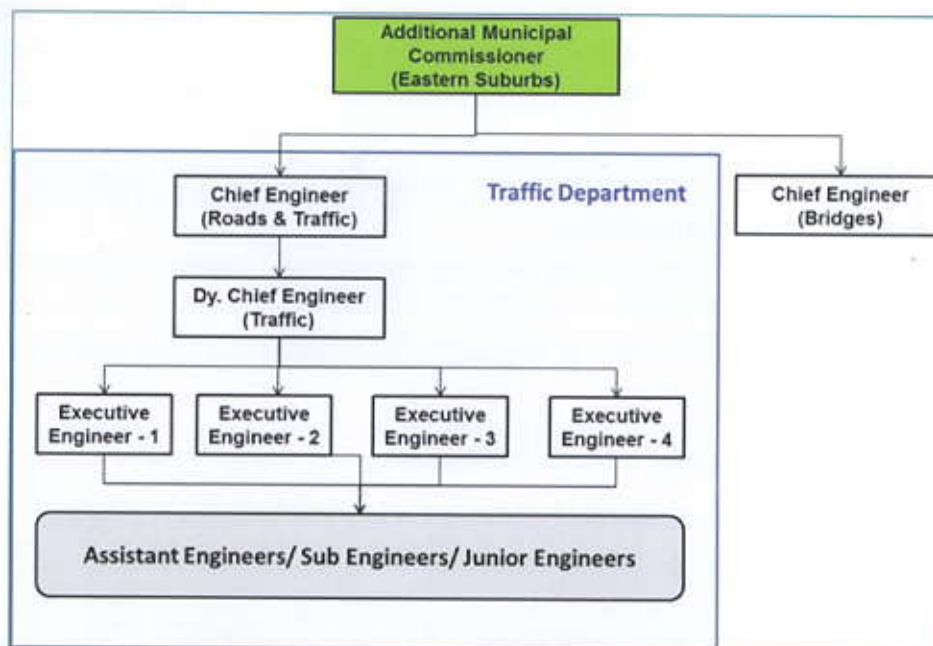


Figure 9-11: Organisational Structure of Traffic Department, MCGM

**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.

### 9.3.2 Proposed Institutional Changes to MCGM Traffic Transport Department Organization Structure

A gap study had been carried out to understand the existing gaps in regards to the institutional capacity of the Traffic and Transport Department within the MCGM. The issues are summarized in BOX 8-2.

#### Box 9-2: Issues and Concerns

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

In order to address the existing gaps, the following institutional changes are proposed:



- Renaming of existing Traffic Department as "Traffic & Transportation Department", supported by "Traffic Advisory Panel" and relevant stakeholders to coordinate local activities. This would facilitate effective coordination with the regional level, state level and central level authorities;
- Skill upgradation in various subject areas e.g. traffic engineering, road safety, transportation planning, highway engineering, GIS, etc., through necessary trainings from reputed professional organizations;
- Strengthening of technical resources by recruiting experienced Traffic and Transportation Engineering/ Planning post graduates;
- Creation of "Parking Cell" for effective planning, coordination, operation of on-street and off-street parking facilities; and
- Enhancing the strength of Traffic & Transportation Department with additional staff at various levels.

Proposed institutional changes for "*Traffic & Transportation Department*" are shown in Figure 9-12.

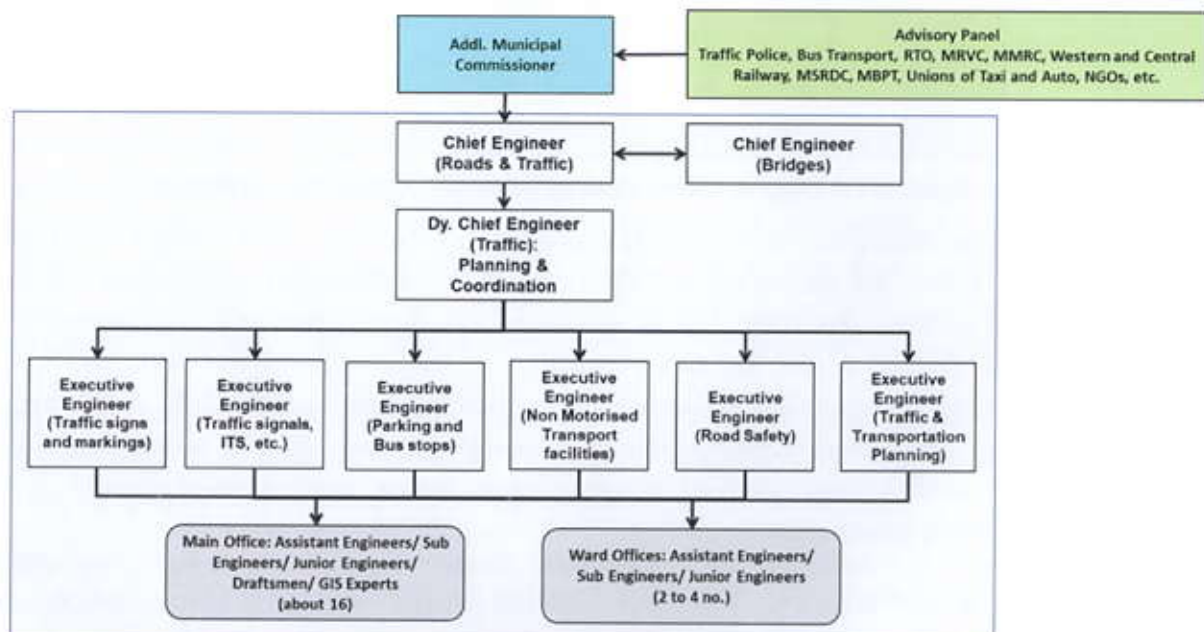


Figure 9-12: Proposed Organisational Structure for Traffic & Transportation Department, MCGM

Proposed functions of the Executive Engineers are presented as follows:

**Executive Engineer (Traffic signs and markings):**

- Maintenance of traffic signs, installation of new traffic signs, pavement markings, etc.; and
- Mapping of the locations of traffic signs in GIS and updating.

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

- Maintenance of traffic signals including traffic signal controller, ATC;
- Identification of intersections for junction improvements, installation of new junction controls including priority control, roundabout control or traffic signal control etc. planning, designing and implementation;



- c) Identification of locations for installation of Variable Message Signs (VMS) in coordination with Traffic Police and execution;
- d) Coordination with Traffic Police towards ensuring traffic enforcement ;
- e) Mapping and updating the locations of traffic signals in GIS;
- f) Conducting and managing traffic count using automatic counters (ex. TURTLE machines); and
- g) Develop and implement 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-Motorized 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) Record and maintain Road accident data base (including detailed description, various attributes of accident, mapping of accident location in GIS) in coordination with Traffic Police. A format of road accident recording is enclosed, which could be used by the Road Safety Department for developing a detailed accident record database;
- b) From time to time, locate hotspots on various roads that are accident prone, and identify potential accident blackspots;
- c) Carryout road safety studies and accident investigations at various hotspots, accident blackspots, develop mitigation measures to address the potential reasons of the road accidents;
- d) Develop necessary designs in support of blackspot eradication in consultation with the Traffic Police Department and implement the same time to time;
- e) Develop traffic calming measures at high pedestrian locations, and develop school zones to plan and implement special road safety measures;
- f) Coordinate with other departments of MCGM (Education, Health and Public Relations) and traffic police in implementation of road safety measures;
- g) Organize Road Safety Week/ actively participate in the initiatives organised by 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.

**9.3.3 Mobility Plan proposed Institutional Changes for Mumbai Traffic Police**

Traffic congestion, transportation issues in Greater Mumbai are very complex. The potential reasons are high densities of population and employment, limited land for transport infrastructure development, linear city and narrow street networks etc. In addition to various legal attributes, informal roadside hawking activity, parking, encroachments create a lot of impediments in traffic operation. 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 listed in BOX 9-3:

**Box 9-3: 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 9-13. 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 9-1; 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 9-1: Existing and Proposed Enhancements of staff strength of Mumbai Traffic Police**

Designation/ Rank	2017	By 2021	By 2031	By 2041
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
<b>Total</b>	<b>3,518</b>	<b>4,611</b>	<b>5,885</b>	<b>8,711</b>

Proposed institutional changes for MTP are shown in Figure 9-14.



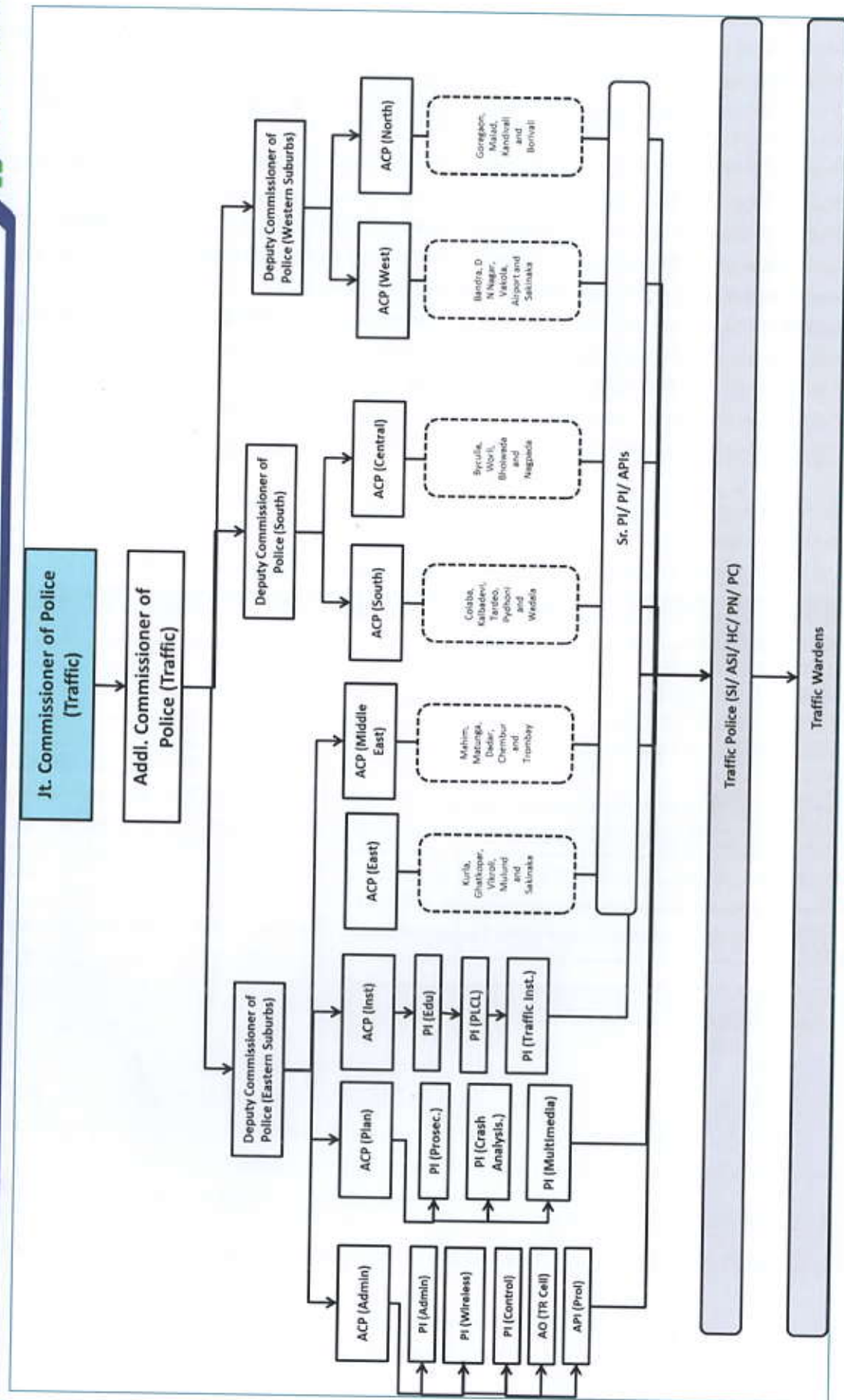
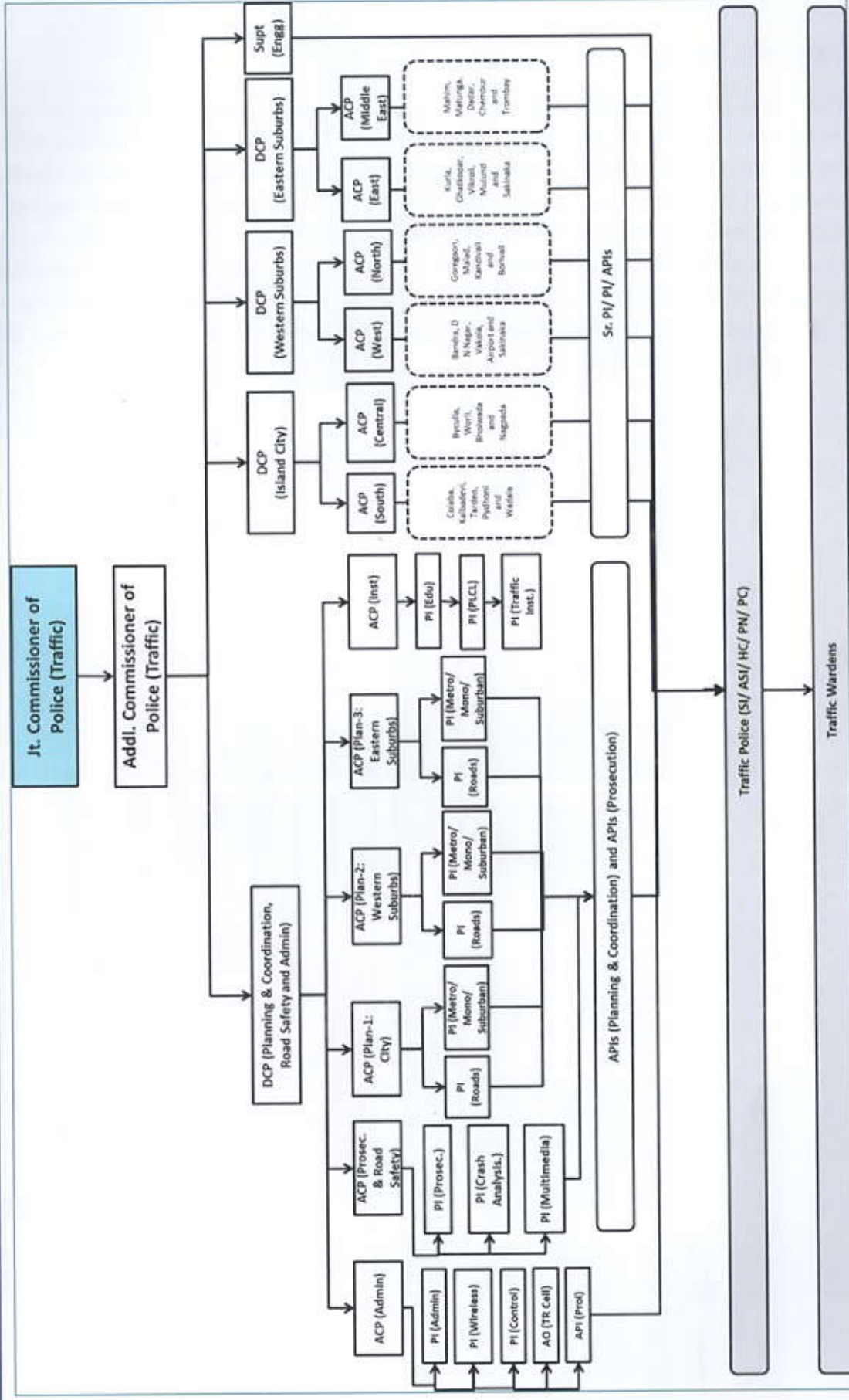


Figure 9-13: Existing Institutional Setup of Mumbai Traffic Police







#### 9.4 METRO PROJECT IMPLEMENTATION UNIT

Government of Maharashtra, MoUD and MMRDA had created Mumbai Metro Rail Corporation (MMRC) for delivery of Line 3: Colaba-Bandra-SEEPZ metro corridor. Further Metro Project Implementation Unit (PIU) was also created within MMRDA to speed-up the metro network implementation in MMR. Project Implementation Unit (PIU) is setup to implement the Metro corridors in a time bound manner and to coordinate with various Central and State authorities, and multilateral funding agencies. The PIU has several units covering various disciplines including Civil, Systems, Signaling and Telecommunication (S&T), Automatic Fare Collection (AFC), Land Acquisition, R&R, Administrative, Town Planning, PR and Finance. This department is headed by the AMC and CEO of Metro PIU. Organizational chart of Metro PIU is represented in Figure 9-15.







## 9.5 CTS FOR MMR UPDATION STUDY PROPOSED INSTITUTIONAL CHANGES FOR T&C DIVISION OF MMRDA

### 9.5.1 MMRDA's Initiatives

The Government of Maharashtra has undertaken the implementation of Mumbai Urban Transport Project (MUTP) with the loan assistance of World Bank. The MMRDA has been designated as the Project Coordinating and Monitoring Authority for the Project. The Project includes improvements to suburban rail system, development of East-West road links, resettlement and rehabilitation of about 22,000 project affected families, Traffic Management, Procurement of passenger and environment friendly buses, transportation planning and investment program for the next 20-25 years. Further MMRDA initiated MUIP and extended MUIP with more focus on road infrastructure in Greater Mumbai and rest of MMR.

As part of the technical assistance under the World Bank Program, a Comprehensive Transportation Study (CTS) for Mumbai Metropolitan Region (MMR) known as **TRANSFORM** was carried out by LEA International Ltd., Canada in association with Lea Associates South Asia (LASA) during the period 2005-2008. To cater for the travel demand for the horizon period upto 2031 the following improvements were recommended:

- a) 450 km of metro rail service (24 corridors);
- b) 241 km of sub-urban (10 corridors);
- c) 1740 km length of highway/road network had been proposed. The length of higher order access controlled freeway system comprising 24 corridors was about 540 km. The length of upgradation of existing arterial roads including SHs and MDRs within the MMR was about 780 km and the length of new roads/ missing links was about 420 km;
- d) The proposed terminal facilities for the horizon period up to 2031 are thirteen (13) Inter State Bus Terminals: Six(6) Inter City Rail Terminals; Five(5) Major Truck Terminals; Ten (10) Mini Truck Terminals; and thirteen (13) Passenger Water Transport Terminals;
- e) The overall cost of the proposed transport infrastructure facilities was about INR 2.07 lakh crores based on 2005-2006 prices; and
- f) **TRANSFORM** assessed that the MMR faces the challenge of delivering efficient transportation services across the region due to significant paucity of funds. Considering this, alternative sources for funding the necessary improvement projects were explored and potential institutional arrangements were presented.

MMRDA had bestowed high importance to the recommendations of CTS and Business Plan. MMRDA had put forward the legal support for UMTA as recommended in National Urban Transport Policy (NUTP) guidelines by Ministry of Urban Development (MoUD). MMRDA had initiated study on setting up of Urban Transport Fund for MMR and the study is in advanced stage nearing completion. The study outcome identifies various sources of revenue generation like Premium FSI, Cess on Stamp Duty, Development Charge, Professional Tax, Commercial Development, City Level Parking, Motor Vehicle Tax, etc. The Estimated overall revenue from all these sources for the period upto 2034 was estimated to about 1.75 lakh crores. MMRDA have received Cabinet approval to implement Premium FSI, Cess on Stamp Duty, Development Charge, Commercial Development and Advertisement & Parking.



### 9.5.2 Role of T&C Division

*Transport & Communication division of MMRDA is completely responsible for planning and coordination of traffic & transport infrastructure in MMR which include the following:*

- a) Suburban railway system (under MUDP);
- b) MUDP: Area Traffic Control System;
- c) Metro Master Plan and DPR studies;
- d) SATIS: Metro and Monorail stations;
- e) Monitoring of Versova-Andheri-Ghatkopar metro corridor as a concession authority;
- f) Construction, O&M aspects of Chembur-Wadala-Sant Gadge Maharaj Chowk monorail corridor;
- g) Dedicated Bus Lanes (Kalanagar-MTNL);
- h) Major road network of regional significance;
- i) Passenger Water Transport;
- j) Integrated Ticketing System;
- k) Intelligent Transport System (ITS);
- l) Creation of Urban Transport Infrastructure Fund;
- m) Preparation of Traffic Diversion Plans during construction of metro/ mono rail corridors/ other infrastructure;
- n) Multi-modal Integration Plans;
- o) Transit Oriented Development;
- p) CTS for MMR updation study;
- q) ISBT updation study;
- r) Urban Ropeway;
- s) NaMTTRI; and
- t) Technical Secretariat to UMTA.

*It is pertinent to mention here that, lots of efforts had been made during the last decade by various stakeholders and a number project preparatory works were been carried out.* On Institutional Change, CTS and TA studies have recommended alternative restructuring options of the regional transportation authority. Meanwhile, Home Department, vide Government Resolution No. MVR 0807/ CR-400/Pa Ri 2 dated 12 February 2008, established Unified Mumbai Metropolitan Authority (UMMTA). In this resolution it was clarified that in due course UMMTA will be accorded supporting statutory framework. The Government, therefore, considered expediting supporting statutory framework for UMMTA. Currently, MMRDA is functioning as a Technical Secretariat to UMMTA. MMRDA drafted a Bill on statutory framework for UMMTA during 2011.

*With time, MMRDA's role in planning and implementation of regional transport infrastructure in MMR had been increasing, which warrants revamping the Transport & Communications Division of MMRDA. MMRDA's functions and responsibilities have been drastically changed with time. Initially, MMRDA was a basic planning and coordination division to handle development activities in MMR; however, in due course they were assigned the responsibilities of execution of major regional transport network in the region as well as managing major local road roads in Greater Mumbai and Rest of the Region. MMRDA reinvented itself with time through incrementally enhancing the institutional capabilities and expertise to deliver its functions and responsibilities. Some of the institutional measures*



triggered creating additional cells/ divisions, expanding the Engineering Division, Project Implementation Unit for Metro, additional administrative officers, impart training & technical expertise time to time, etc.

*Transport & Communications Division had undertaken a major role in planning of regional traffic & transport infrastructure (road/ highway system, metro/monorail system, suburban rail system) in MMR. They have completed the project preparatory works for all the CTS study, recommended transport infrastructure. Furthermore, T&C Division has been functioning as a Technical Secretariat to UMMTA. UMMTA is vested with a number of transport related functions. T&C division staffs have been struggling fulfilling some of these functions due to lack of staff. It has been suffering from some delays in achieving some of the targets that were resulted from actions/ decisions taken by Core Committee/ Main Committee. During the last decade, major ULBs of MMR (Greater Mumbai, Thane, Kalyan-Dombivali, etc.) had carried out Mobility Plans, modified volumes of which were incorporated in the CTS recommendations. These ULBs are also active in implementation of the traffic & transport infrastructure in their jurisdictions. ULBs continuously approach MMRDA for help on planning and implementation of projects, even on securing funding. Currently, the T&C Division does not possess adequate resources towards timely implementation of the regional scale highway and metro corridors, since these involved lots of coordination efforts. It is pertinent to mention here that, CTS for MMR, Business Plan and TA studies proposed new sources of revenue like Development Charges, creation of Mumbai Metropolitan Infrastructure Fund (MMIF). Realization of revenue from the new sources would need considerable efforts in drafting the amendments required in the present acts, formulating new policies, etc.*

Existing organisation structure of MMRDA and institutional setup of T&C division are presented in Figure 8-16 and Figure 8-17, respectively. Currently T&C division is headed with Chief Engineer supported by two Additional Chief Engineers, one each for Transportation Planning and Metro Rail/ Monorail/ UMMTA. The CE and ACEs are supported by Sr. Transportation Engineers/ Engineers, Superintendent Engineer, Dy. Engineers/ Planners, etc. Further senior officials are assisted by Advisors, OSDs, etc. Overall technical and administrative staff strength is about 31 and 11 respectively (total 42) against the sanctioned technical and administrative staff of 66 and 16 respectively (total 82).



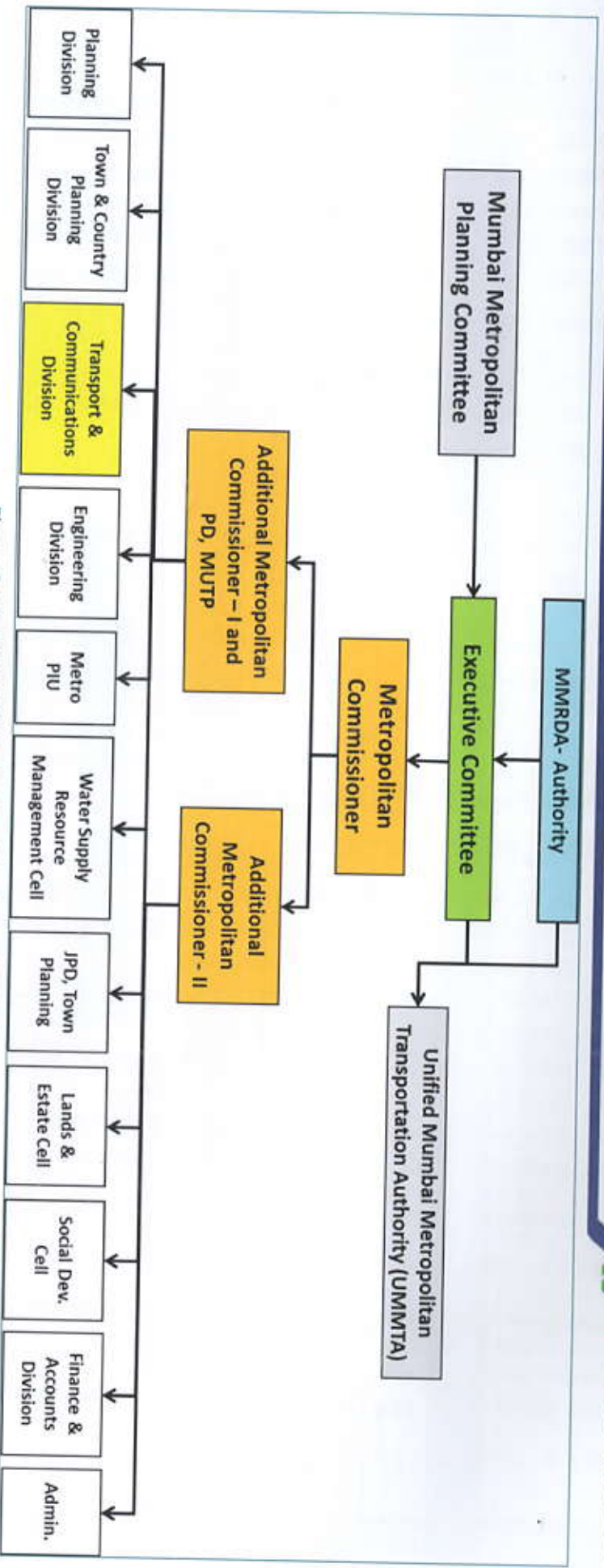


Figure 9-16: Existing Organisation Structure of MMRDA



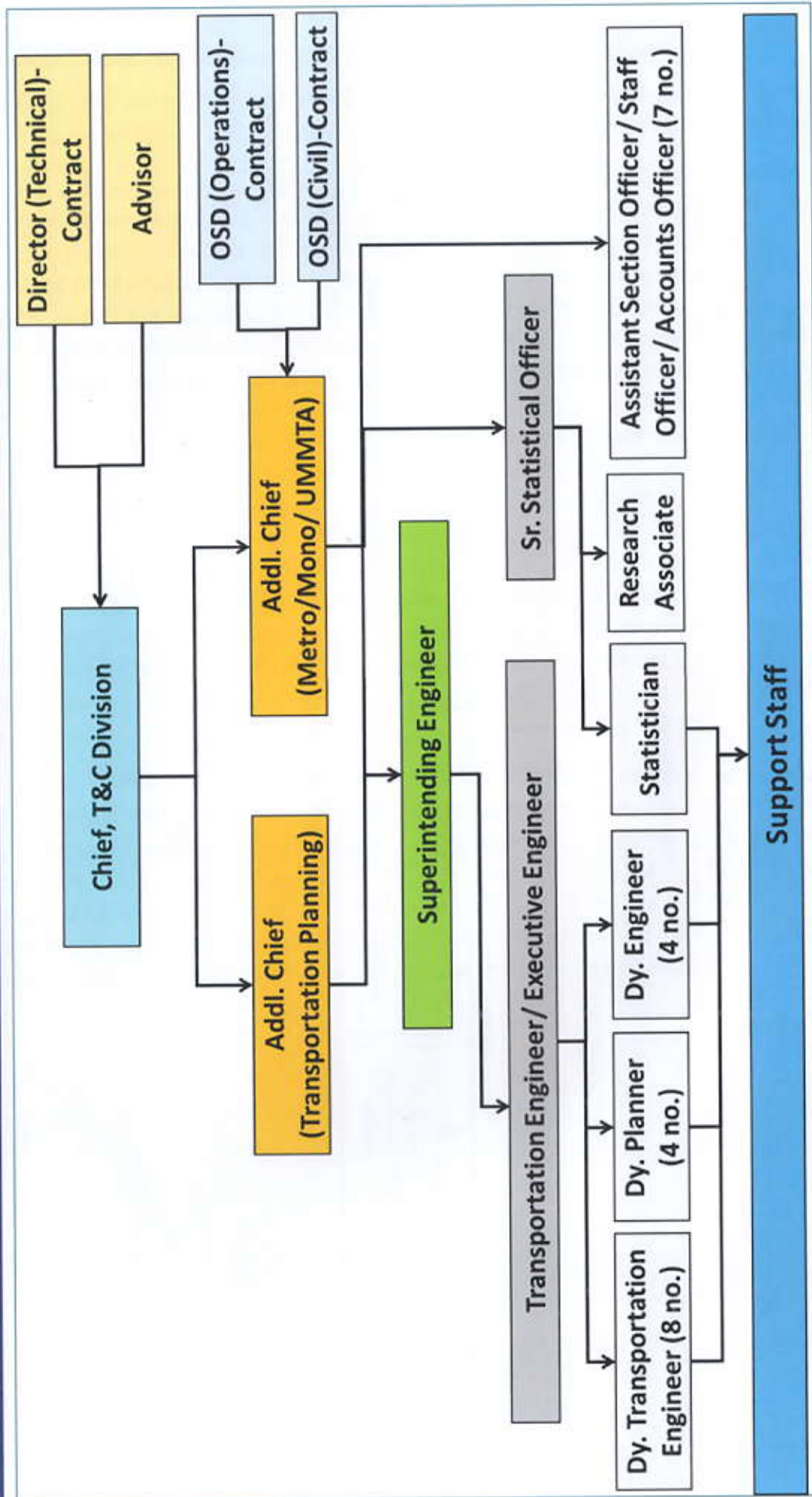


Figure 9-17: Existing Institutional Setup of Transport & Communications Division of MMRDA



### 9.5.3 Vision for T&C Division

*The Vision of the T&C Division is to plan, coordinate, raise resources from additional sources and deliver traffic & transport infrastructure in MMR.*

The above said vision of T&C Vision is further elaborated as follows:

#### 9.5.3.1 Metro/ Monorail Planning and Implementation

The following works shall be effectively handled with additional staff:

- a) Preparation of O&M strategies for Metro projects;
- b) Solar energy studies for Metro corridor and Depots;
- c) SATIS schemes: Planning and Implementation;
- d) Multi-modal Integration and Commercial Development with BEST depots;
- e) Traffic simulation;
- f) Commercial development at metro depots;
- g) Exploring joint development of AAI lands;
- h) Transit Oriented Development (TOD) along Metro and Monorail corridors; and
- i) Safety & Security in Public Transport-Setting up of Mass Rapid Transit Police.

#### 9.5.3.2 Transportation Planning

The following works shall be effectively handled with additional staff:

- a) Growth centres/ Smart City Transport related issues;
- b) Development of multi-modal hubs;
- c) Intelligent Transport System Master Plan preparation and implementation;
- d) Regional transport information centres;
- e) Development of ISBT at Wadala;
- f) Truck terminals in MMR;
- g) Studies on Non Motorised Transport;
- h) Pedestrian Master Plans;
- i) Extension of Dedicated Bus Lanes;
- j) Road Safety Audit for MMR; and
- k) Technical Assistance to other Government agencies for preparation of DPRs for Metro projects, SATIS plans, Traffic Diversion Plans, etc.

#### 9.5.3.3 Development of Consultancy Wing

Currently, project preparatory works (Feasibility Study/ DPR study) for metro corridors are entrusted to DMRC. T&C division generally provides inputs on metro-line alignment details including station locations, ridership forecast, and inputs for economic and financial etc. . Once the T&C division is strengthened as suggested above, feasibility study/ DPR study shall be carried out in-house by T&C Division. With time, the services of the T&C division can be extended to other ULBs in MMR and other cities/ regions in Maharashtra. For this purpose, dedicated team of professionals should be formulated which may be called as **"Consultancy Wing"**.



#### 9.5.3.4 Resource Mobilisation

The investment needs for delivery of the recommended infrastructure projects, as outcomes of various studies, including the traffic & transport infrastructure within MMR jurisdiction is huge. As per CTS, there is a need for exploring additional revenue sources through implementation of Development Charge, Impact Fee, etc. Huge efforts would be required in realization of revenues from new sources. Dedicated team of professionals with urban planning, real estate, legal expertise would be required. T&C division shall be strengthened with these professionals.

#### 9.5.3.5 Proposed Staff

Proposed institutional setup for T&C division with additional resources is shown in Figure 9-18.

- a) Director, T&C Division;
- b) Chief, Transportation Planning, Regional Surface Transport, ITS
- c) Chief, Project Planning & Coordination (Metrorail/Monorail/Suburban/PWT/ UMMTA)
- d) Chief, Metro/ Monorail Operations
- e) Chief, Resource Mobilisation
- f) Additional Chief, MMR Road Transport
- g) Additional Chief, MMR Bus Transport and ITS
- h) Additional Chief, Metro/ Mono/ Suburban
- i) Additional Chief, PWT and UMMTA
- j) Additional Chief, Metro/ Monorail Operations
- k) Advisor: Legal
- l) OSDs: Civil, Metro Operations, Monorail Operations (3 to 4)
- m) Advisors/ Specialists: Project Preparatory Works (3 to 4)
- n) Railway Engineer (2 nos.)
- o) Signal & Telecom Engineer
- p) Sr. Transportation Planner (2 nos.)
- q) Sr. Transportation Engineer (2 nos.)
- r) Sr. Urban Planner
- s) Executive Engineers (10 nos.)
- t) Real Estate Experts (2 nos.)
- u) Dy. Transportation Engineers (16 nos.)
- v) Dy. Planners (8 nos.)
- w) Dy. Engineers (8 nos.)
- x) GIS Expert
- y) Statistician/ Research Associate/ Assistant Section Officer/ Staff Officer/ Accounts Officer (20 nos.)

With the above institutional change, the overall expected staff of T&C division will be about 100. The proposed additions/ expansions shall be achieved in a phased manner during a 5-year period. To begin with, there is a need for expanding the T&C division with Sr. Transportation Planners/ Sr. Transportation Engineers/ Executive Engineers/ Dy. Transportation Engineers and later other senior positions. It is proposed to go for recruitment for the following positions and number professionals for the Financial Year 2018-19.

- a) Filling of vacant posts i.e. 44 (technical 37 and administration 7)



- b) Sr. Transportation Planners (3 nos.)
- c) Sr. Transportation Engineers (3 nos.)
- d) Executive Engineers (4 nos.)
- e) Dy. Transportation Engineers (5 nos.)

The other immediate administration requirements of T&C Division are as follows:

- a) Space for Staff;
- b) Committee Room and Record Room;
- c) High speed internet and WiFi;
- d) New Computers;
- e) Training and purchase of state-of-the-art transportation and metro planning software
- f) Training in metro planning and implementation on rotation

#### **9.5.3.6 Remuneration Policy**

It is pertinent to mention here that, the professionals that would be required for "Consultancy Wing", "Metro/ Monorail Operations Wing", should be through engaging third party consultants. The working professionals of the consultants could be hired directly on a permanent basis after a gestation period of three years or so. This can be achieved only paying appropriate remunerations, which are comparable to those provided in the private sector.





## 9.6 INSTITUTIONAL ARRANGEMENTS FOR PLANNING AND IMPLEMENTATION OF PROPOSED BRTS, INTER CITY/ INTER STATE BUS TERMINALS, TRUCK TERMINALS AND RAIL TERMINALS IN MMR

Growing population and employment including growing economic activity in the region needs well planned connectivity including inter-city passenger travel and inter-city goods vehicles. CTS for MMR study assessed expansion of some of the terminals and new terminals in the region. Considering various transport system planning, implementation and operation aspects some "Special Purpose Vehicles" (SPVs) are proposed for the proposed BRTS implementation, Inter City/ Inter State Bus Terminals, Truck Terminals and Rail Terminals installation in the MMR. The SPV arrangements are proposed.

- a) SPV Stakeholders for BRTS: ULB/ SPA + Transport Undertaking/ MSRTC
- b) SPV Stakeholders for Inter City/ Inter State Bus Terminals: ULB/ SPA + MSRTC
- c) SPV Stakeholders for Rail Terminals: IR + ULB/ SPA + Transport Undertaking/ MSRTC
- d) SPV Stakeholders for Truck Terminals: ULB/ SPA

## 9.7 OPERATION & MAINTENANCE OF NEW METRO LINES – NEED FOR INSTITUTIONAL ARRANGEMENTS

In Mumbai, Line 2 A and line 7 (out of multiple lines under execution) are planned to be completed in 2019. About 220 km of metro corridors are at various stages of implementation and it is expected that majority of the metro corridors would come into operation by 2026. This calls for the authority to set up an independent O & M organization in MMRDA to initiate its functioning, prior to commissioning of metro services. In India, only Delhi has such a big network of metro lines (317km, 231 stations) and they have developed their independent O & M unit. The O & M unit should be operational at least 12 to 18 months prior to the commissioning date of metro line in order to complete preparatory tasks of staff recruitment, statutory training, association in testing, conducting prototype approval etc. Train Operators are required to be on board one year in advance. To handle O & M of metro lines being executed in Mumbai, a separate O & M company under MMRDA is proposed for creation to be named as 'Mumbai Metro Operation Corporation Ltd.' and will be incorporated as an independent company under MMRDA.

MMRDA made a review of O&M models of different Metros in India/abroad. Considering size of metro network, developed in Mumbai, Hybrid O&M Model should be the most suitable model for metro lines in Mumbai. Under this model, core functions will be performed in-house and non-core functions will be outsourced following the similar approach that has been adopted by DMRC/BMRCL/KMRL etc.. Unlike DMRC, metro rail operation might be outsourced by MMRDA. Multi-skill training should be imparted to Station controller to handle emergencies in order to safeguard interests of MMRDA. Complete outsourcing of the entire O&M work to a single agency would have its challenges and inherent risk of metro operations. The metro operation, becoming entirely dependent on the function of the contracting institution, shall involve major risks of the complete inoperativeness/ shutdown of the system in case of the failure of the contractor's performance or withdrawal from discharging necessary duties. Therefore, a hybrid model combining of direct MMRDA staff and contractor's staff should ensure a stable, cost effective and efficient functioning of the robust system.



In addition to creation of new O&M unit, a proposal for manpower creation has been prepared for Line 2A & 7 based on Hybrid O & M Model. Different metros have different staff creation yardsticks for O & M works varying from 31 to 40 staff per Route Kilometer (RKM). To optimize the O&M cost, it has been decided by MMRDA to adopt yardstick, consisting of 25 staff per RKM, which will be the lowest among similar metro projects in India. Accordingly, staff strength for O & M for Line 7 and 2A has been worked out as 1053. Besides, there would be requirement of 30 executives. Thus there will be total requirement of 1083 posts under the new O&M unit. Apart from O & M work, system unit requires 23 extra posts to be created in Metro PIU to meet shortfall in existing cadre so as to manage System works for line 2A and Line 7. Thus, there is proposal for creation of total 1,106 posts i.e. 1,083 for O&M unit and 23 for Metro PIU. Proposed Posts and number of executive staff is enlisted in Table 9-2 and Table 9-3. The proposed organization chart of O&M unit is represented in Table 9-2.

The above proposals are presented in 146<sup>th</sup> meeting of the Authority held on 21<sup>st</sup> November 2018 and the same are accepted and resolution has been passed. With time, other metro lines which are under construction and further planned to be executed will come into operation soon and need further strengthened with additional staff with time.

**Table 9-2: Executive Posts for O & M**

Sl. No.	Executive Posts for O & M	No. of Posts
1.	General manager ( O&M)	1
2.	General manager (HR)	1
3.	DGM (Opn.)	1
4.	DGM ( RS)	1
5.	DGM ( PST)	1
6.	DGM (E & M)	1
7.	DGM (S & T)	1
8.	DGM ( Civil)	1
9.	DGM (Finance & Marketing)	1
10.	Manager (Comm.)	1
11.	Manager (Security)	1
12.	Manager (Safety)	1
13.	Manager (HR)	1
14.	Manager (Stores)	1
15.	Asst. Manager (Station Opn.)	2
16.	Asst. Manager (OCC)	1
17.	Asst. Manager (RS)	2
18.	Asst. Manager (PST)	2
19.	Asst. Manager (E & M)	2
20.	Asst. Manager (S & T)	3
21.	Asst. Manager (P / Way)	2
22.	Asst. Manager (Finance & Mkt.)	1
	<b>Total Posts</b>	<b>30</b>

**Table 9-3: Executive Posts for System Wing of Metro PIU (Metro Line 2A and Line 7)**

Sl. No.	Executive Posts for System Wing of Metro PIU	No. of Posts
1.	Chief Engineer (Electrical)	1
2.	XEN (Electrical)	4
3.	DE-I (Electrical)	6
4.	JE (Electrical)	12
	<b>Total Posts</b>	<b>23</b>



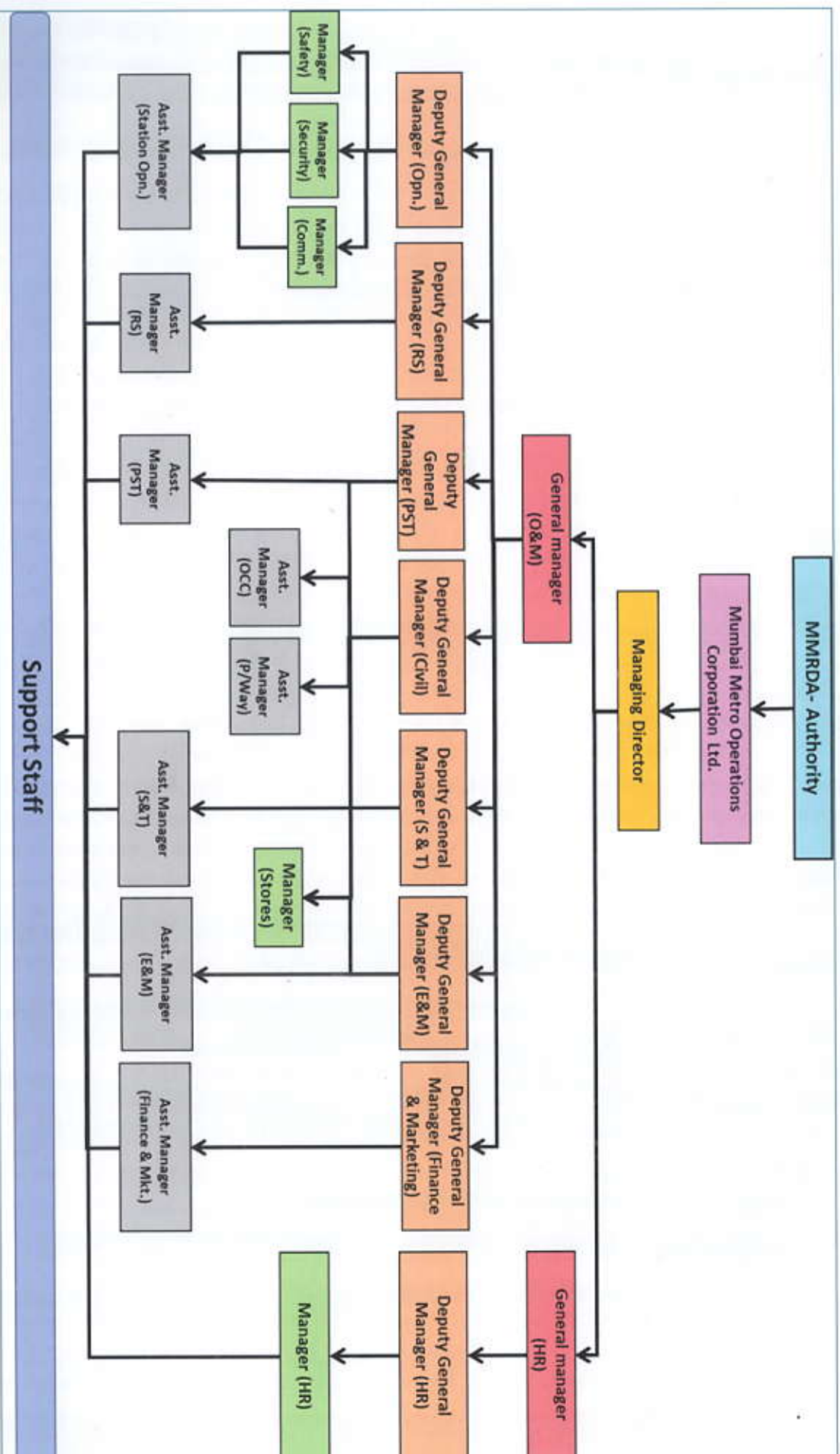


Figure 9-19: Organization chart of the proposed O & M Unit

## 10 SUMMARY AND WAY FORWARD

### 10.1 CTS FOR MMR UPDATION STUDY BY MMRDA

MMRDA appointed M/s LEA Associates South Asia Pvt. Ltd. in JV with LEA International Ltd., Canada as Consultants for updation of previous CTS for MMR Study 2005-08 i.e. **TRANSFORM** in 2017. The updation study has been called henceforth as **TRANSFORM-2**. The main objectives of the study are to capture the travel pattern of MMR, to develop Urban Transportation Model as a planning tool, to evolve a long-term transportation strategy for MMR, and identify a phase-wise investment program in the transport system. The study aims to update the MMR long term strategy developed in 2017-20 and identify the practical and effective investment program upto 2041. The main emphasis of the study is to improve the traffic and transportation scenario in the whole MMR.

The Consultants for the study have submitted the Draft Final Report for MMRDA's review in December 2019. The Draft Final Report covers the following aspects:

- 14) Review of Earlier CTS Model and Assessment of Planning Parameters for 2017 based on Census 2011 and recent Economic Census;
- 15) Data Collection: Through Secondary Sources and Identify and Carryout Additional Primary Surveys;
- 16) Updating/ Modifying CTS Recommended Landuse Scenarios for MMR for various Horizon Years;
- 17) Assessment of Major Developments & Landuse Updation for the Base Year 2017;
- 18) Updating the CTS Model and Analysis using State-of-the-art Urban Transportation Planning Software;
- 19) Assessing/ Updating of Planning Parameters, Transport Network Updations for the Horizon Period upto 2021, 2031, and 2041 and Network Analysis;
- 20) Analysis & Evaluation of Travel Demand for Updated Landuse Scenario for Different Horizon periods 2021, 2031, and 2041;
- 21) Rephasing, Reprioritization & Cost Assessment of CTS Recommended Transport Infrastructure projects including all developments, for the horizon periods 2021, 2031, and 2041;
- 22) Preparation of Multi-Modal Integration Plan;
- 23) Preparation of TOD/TIA guidelines for MMR;
- 24) Fare Sensitivity Analysis of Public Transport Modes in MMR;
- 25) Skill and Technology Transfer; and
- 26) Stakeholder workshops.

MMRDA has sent the report to various stakeholders for their comments and suggestions and the Final Report will be prepared shortly. Once the stakeholders provide their views/ suggestions on the Draft Final Report, the consultants will submit a Final Report incorporating all suggestions/comments and we are expecting the same by end of March 2021.

### 10.2 CONTEXT FOR THE PRESENT STUDY

MMRDA received communication from Indian Institute of Public Administration (IIPA), Maharashtra Regional Branch (MRB) for taking up the Research Project: The Problems of Urban Transportation in Metropolitan area Mumbai by MMRDA covering the following;



- 4) Evaluate the existing infrastructure, governance mechanism and analyse the problems faced by the commuters residing in Mumbai metropolitan region;
- 5) Consider future growth of the region and environmental implications the integrated model plan to be developed for public transportation in the metropolitan area; and
- 6) Suggestions and recommendations including present status of transportation and future plan for integrated transport system.

MMRDA appointed M/s LEA Associates South Asia Pvt. Ltd. to review the secondary and primary data, reports submitted, transport network plans prepared for MMR as part of CTS for MMR Updation study in the context of the above requirements and prepare a report in October 2020 and Consultants submitted their report in February 2021.

### 10.3 VISION FOR MMR

The Task Force, appointed by the Chief Minister following the Bombay First-McKinsey report "Mumbai Vision: Transforming Mumbai into a world-class city", adopted the vision of "Transforming Mumbai into a world class city with a vibrant economy and globally comparable quality of life for its citizens" to counter the declining economy and achieve true potential of growth. The earlier efforts of envisioning were having focus on Greater Mumbai. During CTS for MMR 2005-08 study and Business Plan for MMR study 2008, it was considered more appropriate to have a vision for the entire metropolis considering the growth and expansion of Mumbai beyond the municipal boundaries and the economic interdependence of the local jurisdictions. There is also a consensus that the vision statement prepared by the 2004 Task Force - **"Transforming MMR into a world class metropolis with a vibrant economy and globally comparable quality of life for all its citizens"**, is considered appropriate by CTS for MMR 2005-08 and the same vision is followed in CTS for MMR Updation study. While planning for traffic & transport infrastructure for MMR for the period upto 2041, Vision 2041: Transforming Transportation in MMR formulated as follows:

**"Transforming MMR into a Sustainable Metropolis with enhanced accessibility, mobility, connectivity, safety, environment and quality of travel"**

### 10.4 SUMMARY ON TRAVEL DEMAND AND NETWORK ANALYSIS

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

- a) Population of MMR (2017): 24.88 million; Employment (2017): 10.24 million;
- b) Area of MMR: 4,355 sqkm;
- c) Forecasted population for the horizon year 2021, 2026, 2031 and 2041 is 26.52 million, 27.76 million, 29.32 million and 32.17 million respectively. Forecasted employment for the horizon year 2021, 2026, 2031 and 2041 is 11.13 million, 11.97 million, 12.99 million and 14.91 million respectively;
- d) Primary Surveys (Home Interview Surveys (HIS) – 5,000 sample; Traffic volume count surveys at Outer Cordon: 24 hrs. (9 no.); Origin-Destination surveys at Outer Cordon locations: 24 hrs. (9 no.); Traffic volume count surveys at Sub regional cordon: 24 hrs. (20 no.); Origin-Destination surveys at Sub regional cordon: 24 hrs. (20 no.); Classified traffic volume count surveys at Inner Cordon locations for 24 hrs. (33 no.); Origin-Destination surveys at Inner Cordon locations for 24 hrs. (4 no.); Classified traffic volume count surveys across Screen line points for 24 hrs. (3 no.); Classified traffic volume count surveys at Mid-block Location for 24 hrs. (11 no.); Classified traffic volume count surveys at



Level Crossing Locations for 24 hrs. (3 no.); Road network inventory updation survey (2500km); Speed & Delay study (2475km); Revealed and Stated Preference surveys (2000 samples); and Workplace based surveys (5000)

- e) HIS Analysis: Average Household Income: Rs. 19,592 per month; Average Income of the Worker/ Earner: Rs.12,977 per month; Mode Split: NMT: 47% and Motorised: 53%; Motorised Mode Split: Public Transport: 61.0%; IPT: 17.6% and PV: 21.7%; Average expenses on transport per month per person: Rs. 1,094/- ; Per Capita Trip Rate (PCTR) per day including walk trips: 1.41; Per Capita Trip Rate (PCTR) per day Motorised trips: 0.75; Peak periods: 7:00 to 11 hrs. and 16:00 to 23:00 hrs.;
- f) Other Surveys: Total traffic entering and leaving MMR: 2.08 lakh vehicles; At Outer Cordon, traffic growth observed is 6.8% (CAGR during 2005-17); % of road network having journey speed < 30 kmph: 67%; Average delay of 11sec/km;
- g) Vehicle growth in MMR: No. of vehicles on road as on 31<sup>st</sup> March of 2017: 72.78 lakhs; No. of Cars and Two wheelers (private vehicles) on road as on 31<sup>st</sup> March of 2017: 18.28 lakhs and 43.35 lakhs respectively (Total: 61.64 lakhs, 85% of the total vehicles); 2001 to 2017 data indicates that, Two wheelers have grown at 10.22% Compound Annual Growth Rate (CAGR), Cars have grown at 8.82% CAGR and Private Vehicles growth is 9.23% CAGR; Average number of private vehicles added on to roads per day : 2080;
- h) MMR: Motorised mode split during morning peak period (6:00 to 11:00 hrs.) after validation of travel demand for the base year (2017): Public transport (Suburban, bus, metro and monorail): 71.1%; IPT (Auto and Taxi): 11.1% and Private Vehicles (Two-wheeler and Car): 17.8%. Daily Motorised mode split for the base year (2017): Public transport (Suburban, bus, metro and monorail): 65.0%; IPT (Auto and Taxi): 14.7% and Private Vehicles (Two-wheeler and Car): 20.3%.

The recommended transport network plans for the horizon year 2041 i.e. Highway Network, Transit Network, have been summarized below. Some of the salient features of the proposed immediate-term, short-term and medium-term plans and their extent by 2041 under long-term along with proposed institutional change are described below:

- a) The length of additional metro network for the horizon year 2021, 2026 and 2031 is 60 km, 325 km and 426 km cumulative respectively, which further expands to 467 km by 2041. The metro lines considered are of twin track i.e. one track per direction;
- b) The length of additional Suburban network for the horizon year 2021, 2026 and 2041 is 29 km, 172 km and 232 km cumulative respectively;
- 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 2021, 2026 and 2031 are 174 km, 642 and 924 km cumulative respectively. The 2041 network is further required to be developed and augmented by another 217 km by 2041 to be extending up to 1,141 km. In terms of lane-km, road network supply increase for the horizon years 2021, 2026, 2031 and 2041 would be 970 lane-km, 4,445 lane-km, 6,583 lane-km and 7,987 lane-km respectively;
- d) Inter-City/ Inter-State Bus Terminals and truck terminals have been proposed for the horizon period upto 2041;
- e) Institutional arrangements/changes are proposed for effective planning and implementation of traffic & transport infrastructure in MMR (enhancing the strength and expertise of Transport & Communication Department, changes in remuneration policy, etc. of MMRDA, establishment of traffic department in all the ULBs of MMR, etc.)
- f) SPVs are proposed for effective implementation of proposed BRTS, Inter-city/ Inter-state bus terminals, Inter-city rail terminals and truck terminals;
- g) Institutional arrangement for UMMTA and legislative support for the same is proposed;



**Table 10-1: Summary on Immediate-term, Short-term, Medium-term and Long-term Proposals within MMR**

Sr. No	Parameter	By 2021	By 2026	By 2031	By 2041
1.	Population, million*	26.52(1.6%)	27.76 (1.2%)	29.32 (1.2%)	32.17 (1.1%)
2.	Employment, million*	11.13 (2.1%)	11.97 (1.7%)	12.99 (1.7%)	14.91 (1.6%)
3.	Daily Travel demand(million person trips) *	20.62	21.92	23.67	26.99
4.	Length of additional Road network (Km)	174	642	924	1,141
5.	Length of additional Road network (Lane-Km)	970	4,445	6,583	7,987
6.	Length of Suburban Rail network (km)**	29	172	172	232
7.	Length of Metro Rail network (km)	60	325	426	467
8.	Length of Mono Rail network (km)	20	20	20	20
9.	Length of EBL/ BRTS (km)	75	150	250	350
10.	Average Network Speed (kmph)	25.29	25.93	30.11	35.93
11.	Public Transport (%) Daily	66.7%	68.8%	71.3%	74.8%
12.	ATCS (No. of traffic signals)	200	500	700	1,000
13.	Traffic Signals (No.)	186	200	300	500
14.	SATIS- Outside the Railway premises (No. of suburban stations)	15	30	45	75
15.	Flyovers (No.)	26	40	50	75
16.	Elevated Roads (No.)	7	9	11	15
17.	RoB's/RuB's (No.)	10	20	30	50
18.	Inter-State Bus Terminals (No.)	1	2	3	4
19.	Inter-City Bus Terminals (No.)	3	6	8	13
20.	Inter-City Rail Terminals (No.)	2	3	4	5
21.	Major Truck Terminal (No.)		1	4	5
22.	Mini Truck Terminal (No.)	5	9	12	14
23.	Passenger Water Terminals (No.)		10	14	25
24.	Bus fleet (No.)	745	1,978	3,615	5,760
25.	Bus Terminal-cum Depot for Intra-city Bus operations	7	20	36	58
26.	Intersection Improvements (No.)	100	350	600	1,100
27.	FOBs (No.)	23	50	100	200
28.	Subways (No.)	26	50	100	200
29.	Skywalks (No.)	20	30	50	75
30.	Cycle Tracks along the existing roads (km)	175	250	500	1,000

\* Figures in brackets show increase over base year (2017); \*\* additional sub-urban rail network proposed

## 10.5 SUMMARY ON INVESTMENT NEEDS AND RESOURCE MOBILISATION

MMRDA, CIDCO, MRVC, MSRDC, ULBs and other stakeholders have a massive task of implementing the CTS for MMR updation study recommendations on traffic & transport infrastructure in MMR. MMR will require a large expenditure on the construction of infrastructure for all urban services, such as water supply, electricity, drainage and sewerage system but the major part of their investment will have to be dedicated for transport infrastructure. MMRDA recognizes that the implementation of some recommendations of the Updation of CTS for MMR study is a complex task, given the scale of deficiencies that exist in the region. For that matter to have better and on time implementation schedule of projects a strategic approach is required to be followed. A well-structured and strong resource mobilization plan analyzing all aspects of the project benefit and downsides, to finance the required scale of investment is needed for CTS for MMR Updation study provided recommendations.

Holistic development of a region involves various sectors of infrastructure to be brought up. It becomes equally important to prioritize investment in projects and infrastructure sectors. According to current status of CTS 2005 proposals many projects have been started, many are under construction phase, also many new projects have been initiated in last few years. Updation of CTS for MMR study also included updation of previous proposals and addition of new proposals. **According to the proposals made for improving traffic & transport infrastructure services in MMR for the horizon period upto 2041 is about INR 4.93 lakh crores @ 2017-18 prices (Ref. Table 10-2). Average per annum investment needs on**



transport infrastructure is about **INR 21,000 crore**. By including other infrastructure i.e. water supply, sewerage, drainage, solid waste management, etc. (investment needs of other infrastructure in overall infrastructure is about 15%) the overall infrastructure cost would be about INR 5.81 lakh crores @ 2017-18 prices. Average per annum investment needs on overall infrastructure is about INR 25,000 crore.

Table 10-2: Summary of Preliminary Broad Cost Estimates for Proposed Traffic & Transport Infrastructure for Horizon Period upto 2041 (in INR Crores)

System	Upto 2021 (Immediate term)		2022-26 (Short-term)		2027-31 (Medium-term)		2032-41 (Long-term)		Total	
	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)	Length (km)	Cost (INR crores)
Metro System	60	26,787	265	1,14,121	101	51,109	41	13,673	473	2,05,690
Suburban System	29	7,290	143	49,791	0	13,729	60	30,275	232	1,01,085
BRTS/ EBL	22	264	249	3,036	123	1,502	37	448	431	5,250
Bus System		815		1,421		1,823		2,440		6,500
Highway System	174	20,550	468	46,913	282	46,181	217	10,131	1141	1,23,774
Terminals		1,790		2,295		2,072		2,493		8,650
Traffic Management Measures		11,085		7,124		7,985		16,169		42,363
<b>Total</b>		<b>68,581</b>		<b>2,24,701</b>		<b>1,24,400</b>		<b>75,629</b>		<b>4,93,312</b>

The range of expenditure on transport infrastructure by all the ULBs, MMRDA, CIDCO, etc. is 8,000 to 9,000 Crores as observed during the period 2010-11 to 2017-18. *It is pertinent to mention here that, all the ULBs expenditure on transport infrastructure in MMR is related to maintenance of existing roads, street furniture maintenance, widening of existing roads, development of new roads as per the Development Plans, etc. Regional level authorities like MMRDA, CIDCO, MRVC, MSRDC, etc. are planning and implementing major highway, metro, suburban corridors in MMR. With time there is a need for sharing of responsibilities in planning, resource contribution, execution, etc. of major highway, metro and suburban railway corridors is expected and it is very much needed as regional authorities alone can't take complete responsibilities. Of course, the ULBs and regional authorities need to raise the resources collectively and make use of the same for delivery of overall transport infrastructure in MMR.*

Based on the recommendations of Working Group on Urban Transport for 12<sup>th</sup> Five Year Plan and experience gained on working in urban infrastructure of major Indian cities, MMRDA and other major stakeholder's past experience in raising the resources, etc., the sources of funding are assessed and the details are presented in Table 10-3. It is observed that for urban transport infrastructure related projects envisaged by 2041, about 19.2% of the funding is needed from the central government, about 13.3% from the State Government, 10.5 % from Regional authorities, about 35.5% from the ULBs / Others. About, 9.1% of the investment needs are expected through private investment in the form of public private partnerships (PPP). Very limited share is expected from the property development i.e. about 0.1%. The balance i.e. about 12.4%, will have to be raised by taking debt from various multilateral/ domestic funding institutions. The analysis indicates that, the own burden of ULBs/SPA/ Regional authorities/ State Govt. would be about 69% (INR 3.40 lakh crore) which includes their own contribution and repayment of loans.



Revenue assessed from Development Charge as per the prevailing rates for the period 2021 to 2041 is about INR 0.85 lakh crore and with increase by 50% of the prevailing rates for the period 2021 to 2041 is about INR 1.27 lakh crore. Considering the overall scenario in real estate market, urban infrastructure investment need, uncertainties of revenue from other sources, the development charges required to be levied shall be Residential: 7.5%; Commercial: 15% and Industrial: 11.25% which means increasing the current/ existing Development Charges by 50%.

The overall revenue generated from the increased Development Charge and land & asset monetisation by various stakeholders is about INR 4.11 lakh crores which matches the requirement of 3.98 lakh crores. The analysis indicates that, all the stakeholders have to follow multi-pronged approach to raise the resources for successful planning and timely implementation of infrastructure in MMR.

The analysis indicates that, all the ULBs and Regional Authorities have to follow multi-pronged approach to raise the resources for successful planning and timely implementation of infrastructure in MMR. Also to safeguard ourselves in future all the resources must be mobilized properly.

**Table 10-3: Major Sources of Funding and their Share (by 2041) for Transport Infrastructure in MMR**

Source of Funding	Amount (Rs. Crores)	% of Total
Gol/ IR Grant or Share	94,538	19.2%
State Govt	65,385	13.3%
MMRDA	51,553	10.5%
ULBs/ SPAs/ CIDCO/ MSRDC/ MSRTC/ Others	175,031	35.5%
PPP	45,038	9.1%
Loan from Multilateral/Domestic Agencies-Repayment by Gol	15,163	3.1%
Loan from Multilateral/Domestic Agencies-Repayment by GoM/ Regional Authority	46,016	9.3%
Property Development	587	0.1%
<b>Total</b>	<b>493,312</b>	<b>100%</b>

Summary on revenue sources for O&M shortfalls is presented in Table 10-4. Detailed description is presented in Annexure 3-3. It can be inferred that, the overall potential from various sources identified for O& M shortfalls is about INR 1.03 lakh crores to 1.21 lakh crores for the period 2021 to 2041 and per annum would range from INR 4,980 crores to 6,070 crores.

**Table 10-4: Summary on Revenue Sources for O&M Shortfalls**

Sl. No.	Revenue sources	Assumptions	Amount in INR crore		
			2021-31	2032-41	Total
1	Cess on Property	5%	3,300	8,800	12,100
2	Cess on Fuel	Option 1: 2%	1,600	1,500	3,100
		Option 2: 3%	2,400	2,200	4,600
3	One-time cess on the purchase of new vehicles	2%	1,600	1,100	2,700
4	Fee on the annual renewal of a vehicle licenses	Option 1: Two wheelers INR 500, Cars INR 2,000 and Trucks INR 3,000	11,400	13,600	25,000
		Option 2: Two wheelers INR 1,000, Cars INR 3,000 and Trucks INR 3,000	19,000	22,800	41,800
5	Employment/ Payroll Tax	According to CRISIL assumptions	10,300	20,100	30,400
6	Pay & Park	As per Calculation	11,100	12,400	23,500
7	Sale of Advertisement Charges	According to CRISIL assumptions	1,300	3,100	4,400
8	Station Area Development	As per Calculation	560	990	1,550



Sl. No.	Revenue sources	Assumptions	Amount in INR crore		
			2021-31	2032-41	Total
9	Utilisation of ROW (Annual)	As per Calculation	190	210	400
Total I: Sl. No. 1, 2 Option 1, 3, 4 Option 1, 5, 6, 7, 8 and 9			41,350	61,800	103,150
		Per annum	4,140	6,180	5,160
Total II: Sl. No. 1, 2 Option 1, 3, 4 Option 1, 5, 6, 7, 8 and 9			49,750	71,700	121,450
		Per annum	4,980	7,170	6,070

## 10.6 POLICIES

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

- Policies to promote Transit Oriented Development (TOD);**
- Policies to have a controlled growth using proposed Traffic Impact Assessment (TIA) Guidelines; and**
- Parking policy and NMT Policy.**

## 10.7 WAY FORWARD

The action plan for implementation of transport plan would begin by considering; approving and adopting the CTS for MMR Updation study recommendations on traffic and transport infrastructure for MMR. The action plan (Box 10-1) as follows:

### BOX 10-1: THE ACTION PLAN

- Prepare Techno-Economic and Financial Feasibility Studies/ DPR studies for the transit (metro/ suburban/ BRT/ LRT/ ART) and major highway corridors;*
- Prepare Techno-Economic and Financial Feasibility Studies/ DPR studies for the terminals (bus, rail, truck, etc.);*
- Incorporation of the recommended transport system by ULBs/ SPAs/ Development Authority in their respective Development Plans/ Master Plans;*
- Implement measures to protect long term transportation corridors (protection of Right of Way);*
- Secure encroachment removal along major transportation corridors and restore capacities to safely and effectively move people and vehicles;*
- Implementation of proposed institutional changes in Traffic Department of MCGM and other major ULBs of MMR, Mumbai Traffic Police and T&C Division of MMRDA;*
- Creation of SPVs for planning and implementation of proposed DBL/BRTS, ICBT/ ISBT, ICRT, Truck terminals in MMR;*
- Review and updating of transport investment plans and priorities every 5 years;*
- Implement policies to promote Transit Oriented Development;*
- Implement policies to have a controlled growth using proposed Traffic Impact Assessment (TIA) Guidelines;*
- Introduce Travel Demand Management measures and implement NMT measures;*
- Implementation of Integrated Fare Structure and common ticketing among public transport systems;*
- Identification of vacant lands and land monetisation by all the ULBs and regional authorities to pool the resource for urban infrastructure; and*
- Timely amendments in MR&TP Act for enhancing the Development Charges and securing the revenues to achieve the targeted revenues.*