



Mira Bhayandar Municipal Corporation
मिरा भाईंदर महानगरपालिका

Oct 2014

Comprehensive Mobility Plan Mira Bhayandar



Final Report



Urban Mass Transit
Company Limited

Table of contents

Table of contents.....	ii
Table of Figures	vii
List of Tables	xi
Executive Summary	16
1. Introduction.....	26
1.1 Background.....	26
1.2 Comprehensive Mobility Plan	27
1.3 Need for CMP	28
1.3.1 Improving Mobility of People	28
1.3.2 Integrated Approach	29
1.4 Objectives of the Study	29
1.5 Scope of the Study	29
1.6 Structure of the report.....	30
2 Approach and Methodology.....	32
2.1 Approach	32
2.2 Methodology	33
2.2.1 Collection and review of existing secondary information	33
2.2.2 Collection of data through primary surveys	34
2.2.3 Analyze existing traffic/transport situation.....	35
2.2.4 Travel demand modeling	35
2.2.5 Develop urban mobility plan	35
3 City Profile	36
3.1 Study Area	36
3.2 Population Projection.....	37

3.3	Land Use	39
4	Existing Transport Scenario	42
4.1	Introduction	42
4.2	Secondary Data	42
4.2.1	<i>Comprehensive Transport Study for MMR Region</i>	<i>43</i>
4.2.2	<i>Public Transport Characteristics</i>	<i>43</i>
4.2.3	<i>Registered vehicles in Mira Bhayandar</i>	<i>47</i>
4.3	Primary Data Collection.....	48
4.3.1	<i>Household Characteristics</i>	<i>49</i>
4.3.2	<i>Pedestrian Characteristics</i>	<i>51</i>
	Intersection Locations	51
	Mid-Block Locations	53
4.3.3	<i>Classified Volume Count & RSI survey characteristics</i>	<i>53</i>
	Volume Count Survey at Mid Blocks	54
	Turning Movement Count Survey at Intersections	58
	Outer Cordon Classified Traffic Volume Count and Origin Destination Survey	62
4.3.4	<i>Parking Characteristics</i>	<i>67</i>
4.3.5	<i>Road Network Characteristics</i>	<i>72</i>
4.3.6	<i>Speed & Delay Characteristics</i>	<i>75</i>
4.3.7	<i>Railway Station Characteristics</i>	<i>78</i>
4.3.8	<i>Occupancy Table.....</i>	<i>83</i>
4.4	Summary of Data Analysis.....	83
4.5	Service Level Benchmark.....	87
4.6	Accidents	88
4.7	Conclusion	88
5	Travel Demand Assessment	89

5.1	Background.....	89
5.2	Model Structure	90
5.3	Study Area Zoning	90
5.4	Network Development	93
5.5	Base Year (2012) Travel Pattern.....	94
5.5.1	<i>TFlowFuzzy Matrix Correction</i>	<i>94</i>
5.5.2	<i>Base Year Calibration/Validation</i>	<i>95</i>
5.6	Base Year (2012) Traffic Characteristics.....	96
5.7	Travel Demand Model Calibration	99
5.7.1	<i>Trip Generation Calibration</i>	<i>100</i>
5.7.2	<i>Trip Distribution Calibration (Gravity Model)</i>	<i>102</i>
5.8	Travel Demand Forecasting.....	106
5.8.1	<i>Mobility Scenarios</i>	<i>107</i>
5.9	Traffic Forecast under Mobility Scenarios	110
6	Mobility Plan	112
6.1	Vision Statement	112
6.2	Mobility Pillars.....	113
6.3	Goals.....	114
6.4	Objectives.....	114
6.5	Mobility plan and its approach	116
6.5.1	<i>Integrated land use and transport Plan.....</i>	<i>117</i>
6.5.2	<i>Public transit strategy and Plan.....</i>	<i>123</i>
6.5.3	<i>Non-motorized transport Plan.....</i>	<i>138</i>
6.5.4	<i>Freight management Plan</i>	<i>140</i>
6.5.5	<i>Traffic engineering and management measures.....</i>	<i>141</i>
6.5.6	<i>Water Transport Plan</i>	<i>142</i>

6.5.7	<i>Parking Management Plan</i>	143
6.5.8	<i>Education & Enforcement</i>	145
7	Implementation Programme and Costing	146
7.1	Phasing Plan	146
7.2	Project Prioritisation	146
7.2.1	<i>Regional Development Cost</i>	150
7.3	Financing Options for Urban Transport Projects	150
7.3.1	<i>Public Private Partnership</i>	151
7.3.2	<i>Alternate Sources of Funding</i>	153
8	Institutional Framework.....	156
8.1	Introduction	156
8.2	Issues with the Present Institutional Set up.....	156
8.3	Proposed Institutional Framework.....	157
8.3.1	<i>Unified Metropolitan Transport Authority (UMTA)</i>	157
8.3.2	<i>City Level Unified Metropolitan Transport Authority</i>	158
8.3.3	<i>Broad Functions</i>	158
8.3.4	<i>Proposed Structure of UMTA</i>	159
8.3.5	<i>Composition of UMTA</i>	160
8.3.6	<i>Legal backing of UMTA</i>	161
8.3.7	<i>Manpower Requirement and Staffing Plan</i>	162
8.3.8	<i>Priorities of the coordinating agency</i>	162
9	Environmental and Social Impact Assessment	164
9.1	National Level Policy and Legal Framework.....	164
9.2	Screening and Identification of Impacts	164
9.3	Location Impacts	171
9.4	Construction Impacts	171

9.5	Operation Impacts.....	173
9.6	Social Impact	173
9.7	Strategies of Risk & Quality Management	173
9.7.1	<i>Risk mitigation process</i>	173
9.7.2	<i>Risk regarding availability of land</i>	175
9.7.3	<i>Risks in funding</i>	177
9.7.4	<i>Stakeholder consultation</i>	178
10	Outcomes	182
10.1	Level of Service.....	182
10.2	Improved Level of Service	182
10.3	Conclusion	183
11	Annexures	184
	Annexure A Intersection survey Results.....	184
	Annexure B Projected Population and Employment	204
	Annexure C Primary Survey Formats.....	207
11.1	Classified Traffic Volume Count Survey (Intersection, mid-block,outer cordon).....	207
11.2	Intersection Volume Count Survey Format.....	208
11.3	Road Side Interview Passengers at Outer Cordon Points Survey Format	209
11.4	Road Side Interview Goods at Outer Cordon Points Survey Format	210
11.5	Household Survey Format.....	211
11.6	Road Network Inventory Survey Format.....	213
11.7	Road Network Inventory Survey Format.....	214
11.8	Parking Survey Format	215
11.9	Railway Station Survey Format	216
11.10	Occupancy Survey Format.....	217
	Annexure D Proposal Maps under Mobility Plan	218

Table of Figures

Figure 1-1 Location of Mira Bhayandar	27
Figure 2-1 Methodology for preparation of Comprehensive Mobility Plan, Mira Bhayandar	33
Figure 3-1 Study Area with 79 ward boundaries	36
Figure 3-2 Study Area for Mira Bhayandar with Road Network	36
Figure 3-3 Population Growth Pattern in Mira Bhayandar.....	37
Figure 3-4 Ward Wise Population Density in Persons per Ha for the Year 2011.....	38
Figure 3-5 Existing Land Use for Mira Bhayandar.....	41
Figure 4-1 Bus Network coverage by different operators in MBMC	47
Figure 4-2 Distribution of Households by Household Size.....	49
Figure 4-3 Distribution of Household Incomes	50
Figure 4-4 Distribution of households by expenditure on transport.....	50
Figure 4-5 Pedestrian volume at Intersections.....	51
Figure 4-6 Volume of pedestrian across the road at intersection during peak hour	52
Figure 4-7 Mid block survey locations	55
Figure 4-8 Hourly Variations and Traffic Composition at Bagathi Vedant Road.....	56
Figure 4-9 Hourly Variations and Traffic Composition at Narmada Complex.....	57
Figure 4-10 Hourly Variations and Traffic Composition at Navghar Pada	57
Figure 4-11 Hourly Variations and Traffic Composition at Vinayak Mandal, Cabin Road	57
Figure 4-12 Hourly Variations and Traffic Composition at Uttan Road flyover	58
Figure 4-13 Hourly Variations and Composition at Sai Petrol Pump, Mira Bhayandar Road	58
Figure 4-14 Intersection Survey Locations.....	59
Figure 4-15 Outer Cordon Locations.....	63
Figure 4-16 IRB Toll Plaza.....	65

Figure 4-17 Ghodbandar Road.....	65
Figure 4-18 D Mart Mall.....	65
Figure 4-19 Dahisar Toll Naka	65
Figure 4-20 Duration of Parked vehicles at different locations	68
Figure 4-21 Composition of Parked Vehicles	69
Figure 4-22 Right of Way map for Mira Bhayandar	73
Figure 4-23 Traffic situation in Bhayandar East	74
Figure 4-24 Distribution of Road Length based on number of lanes.....	74
Figure 4-25 Availability of Median in Mira Bhayandar	75
Figure 4-26 Causes of Delay	77
Figure 4-27 Mira Road Station Entry & Exit Plan	78
Figure 4-28 Bhayandar Station Entry & Exit Plan.....	81
Figure 5-1 Four Stage Transport Model Structure	90
Figure 5-2 Traffic Analysis Zones for Mira Bhayandar	91
Figure 5-3 Mira Bhayandar Road Network	94
Figure 5-4 TFlowFuzzy Matrix Correction Methodology Flow Chart	95
Figure 5-5 Desire Line diagram for Internal Travel_Base Year	96
Figure 5-6 Desire Line diagram between Internal to External Zones Base Year.....	97
Figure 5-7 Desire Line diagram for External Travel_Base Year	97
Figure 5-8 Comparison of Observed and Estimated Trip Productions	101
Figure 5-9 Comparison of Observed and Estimated Trip Attractions.....	101
Figure 5-10 Observed and Calibrated Trip Length Distribution for Cycle.....	103
Figure 5-11 Observed and Calibrated Trip Length Distribution for Two Wheeler.....	103
Figure 5-12 Observed and Calibrated Trip Length Distribution for Auto Rickshaw.....	104
Figure 5-13 Observed and Calibrated Trip Length Distribution for Car	104
Figure 5-14 Observed and Calibrated Trip Length Distribution for Goods.....	105

Figure 5-15 Observed and Calibrated Trip Length Distribution for Bus.....	105
Figure 5-16 Observed and Calibrated Trip Length Distribution for all modes.....	106
Figure 5-17 Transport Network for Do Minimum Scenario for the year 2031	108
Figure 5-18 Transport Network for Road Network Improvement Scenario for the year 2031	109
Figure 5-19 Transport Network for PT Improvement Scenario for the year 2031	110
Figure 6-1 Sustainable Mobility Solutions	114
Figure 6-2 Integrated Land Use Transport Strategy.....	118
Figure 6-3 Proposed locations for Induced Growth Centres	119
Figure 6-4 Proposed Mobility Corridor	120
Figure 6-5 Summary of Proposed New Roads in Mira Bhayandar.....	122
Figure 6-6 Proposed Road Widening & Vehicular Flyovers	123
Figure 6-7 Public Transit Strategy for Mira Bhayandar.....	124
Figure 6-8 MRTS Proposals for Mira Bhayandar	126
Figure 6-9 Proposed location of transport hub	131
Figure 6-10: Feeder Bus Routes proposed in Mira Bhayandar	132
Figure 6-11: Location of Terminals and Depots	134
Figure 6-12 Proposed FOBs at various locations in Mira Bhayandar.....	139
Figure 6-13 Proposed Truck Terminal near Ghodbunder Gaon.....	141
Figure 6-14 Proposed Water Transport Terminals and Route.....	143
Figure 6-15 Proposed locations for Multi Level Parking lots	144
Figure 8-1 Departments and Organizations involved in Urban Affairs and Urban Transport	161
Figure 11-1 AM Peak hour Traffic Flow at Intersection 1-Jichakar Chwok.....	185
Figure 11-2 PM Peak hour Traffic Flow at Intersection 1-Jichakar Chwok	186
Figure 11-3 AM Peak hour Traffic Flow at Intersection 2-Golden Nest Junction	187
Figure 11-4 PM Peak hour Traffic Flow at Intersection 2-Golden Nest Junction.....	188
Figure 11-5 AM Peak hour Traffic Flow at Intersection 3-Kashimira Junction.....	189

Figure 11-6 PM Peak hour Traffic Flow at Intersection 3-Kashimira Junction.....	190
Figure 11-7 AM Peak hour Traffic Flow at Intersection 4-Uttan Road Junction	191
Figure 11-8 PM Peak hour Traffic Flow at Intersection 4-Uttan Road Junction	192
Figure 11-9 AM Peak hour Traffic Flow at Intersection 5-Mira Road Station East Junction	193
Figure 11-10 PM Peak hour Traffic Flow at Intersection 5-Mira Road Station East Junction.....	194
Figure 11-11 AM Peak hour Traffic Flow at Intersection 6-Surya Complex Junction	195
Figure 11-12 PM Peak hour Traffic Flow at Intersection 6-Surya Complex Junction.....	196
Figure 11-13 AM Peak hour Traffic Flow at Intersection 7-Bhayandar Station West Junction	197
Figure 11-14 PM Peak hour Traffic Flow at Intersection 7-Bhayandar Station West Junction	198
Figure 11-15 AM Peak hour Traffic Flow at Intersection 8-Delhi Darbar Junction	199
Figure 11-16 AM Peak hour Traffic Flow at Intersection 9-Kashi Gaon Junction	200
Figure 11-17 PM Peak hour Traffic Flow at Intersection 9-Kashi Gaon Junction.....	201
Figure 11-18 AM Peak hour Traffic Flow at Intersection 10-MIDC Road Junction	202
Figure 11-19 AM Peak hour Traffic Flow at Intersection 11-Penkarpada Road Junction.....	203

List of Tables

Table 3-1 Population growth rate	37
Table 3-2 Distribution of Land Use	39
Table 3-3 Landuse Distributions recommended by UDPFI Guidelines	40
Table 3-4 Proposed Landuse for the Year 2031	40
Table 4-1 MBMT bus route details.....	44
Table 4-2 Details of BEST bus routes operated in MBMC area.....	46
Table 4-3 Bus Route details of other operators in MBMC area.....	46
Table 4-4 Registered Vehicles in the Year 2010 for Mira Bhayandar Municipal Jurisdiction	47
Table 4-5: Primary Data Collection	48
Table 4-6: Pedestrian flow characteristics at intersections	52
Table 4-7: Pedestrian flow characteristics at mid-block.....	53
Table 4-8: PCU Conversion Values	54
Table 4-9: Mid Block Survey Locations	54
Table 4-10: Traffic intensity at mid-block	55
Table 4-11: Survey locations for Turning Movement Counts	59
Table 4-12: Traffic intensity Summay at all 11 intersections.....	60
Table 4-13: Outer Cordon Locations	62
Table 4-14: Summary of Cordon Count	63
Table 4-15: Trip Purpose of Passengers at Outer Cordon.....	66
Table 4-16: Trip Frequency of Goods Vehicles	67
Table 4-17: ECS Values Adopted for Various Vehicle Types	67
Table 4-18: Peak hour accumulation	70
Table 4-19: Available ROW	72

Table 4-20: Distribution of road length by number of lanes	73
Table 4-21: Distribution of road length by type of carriageway.....	75
Table 4-22: Availability of storm water drains on road network.....	75
Table 4-23: Distribution of Road Length by Journey Speed.....	76
Table 4-24: Distribution of Delay Time by delay points.....	77
Table 4-25 Summary of Entry & Exit Passengers for Mira Road Station	79
Table 4-26 Summary of Entry & Exit Passengers for Bhayandar Station.....	81
Table 4-27 Average Occupancy values in Mira Bhayandar.....	83
Table 4-28 V/C ratios of some of the major roads.....	87
Table 4-29 Service Level Benchmark	88
Table 4-30 Accident details of Thane (Rural) District	88
Table 5-1 TAZ wise Demographic Data	91
Table 5-2 GEH statistic for Mira Bhayandar.....	95
Table 5-3 Base Year Travel Characteristics	98
Table 5-4 Base Year Internal to Internal Travel mode shares.....	98
Table 5-5 Base Year Internal to External Travel mode shares	98
Table 5-6 Base Year access mode shares to Railway Stations	99
Table 5-7 Average V/C Ratios on few selected corridors for Base Year	99
Table 5-8 Calibrated Trip End Models.....	100
Table 5-9 Calibrated Gravity Model Parameters	102
Table 5-10 Projected Population and Employment.....	107
Table 5-11 Estimated Total Trips for Horizon Period.....	107
Table 5-12 Mode Shares for Internal Travel in 2031 for different Scenarios	111
Table 5-13 Mode Shares for Internal to External Travel in 2031 for different Scenarios.....	111
Table 5-14 Mode Shares for station access in 2031 for different Scenarios	111
Table 5-15: V/C Ratios on Selected Corridors for Different Scenarios in 2031.....	111

Table 6-1: Road widening proposals for Mira Bhayandar	123
Table 6-2 Proposed Service Frequency for MBMT Buses	126
Table 6-3 Feeder Bus Route Details	131
Table 6-4: list of Terminals and Depots	133
Table 6-5 Peak Pedestrian crossing count at different locations	138
Table 6-6 PV2 values at different locations	138
Table 7-1: Prioritization and Phasing of Projects	147
Table 7-2: Phase wise cost details	148
Table 7-3: Detailed costing of Projects in Phase I (2013-2016)	149
Table 7-4: Detailed costing of Projects in Phase II (2016-2021)	149
Table 7-5: Detailed costing of Projects in Phase III (2021-2031)	149
Table 7-6 Projects under Regional Development Cost	150
Table 9-1 Environmental Impacts of Important Projects.....	165
Table 9-2 : Various options for funding Urban Transport projects.....	177
Table 9-3 Project Impacts	180
Table 10-1: Scenario wise outcomes	182
Table 10-2: Overall LOS.....	183
Table 11-1 TAZ wise projected Population and Employment.....	204

List of Abbreviations

ATM	Automatic Teller Machine
BEST	BrihanMumbai Electric Supply & Transport
CDP	City Development Plan
CMP	Comprehensive Mobility Plan
CTTS	Comprehensive Traffic & Transportation Study
DPR	Detailed Project Report
ECS	Equivalent Car Space
FOB	Foot Over Bridge
GIS	Geographic Information System
GoI	Government of India
IPT	Intermediate Public Transport
IPT	Intermediate Public Transport
IRC	India Road Congress
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KMPL	Kilometers per Litre
LBS	Lal Bahadur Sastri
LCV	Light commercial vehicle
LoS	Level of Service
MAV	Multi Axle Vehicle
MBMC	Mira Bhayandar Municipal Corporation
MBMT	Mira Bhayandar Municipal Transport
MoUD	Ministry of Urban Development
MSRTC	Maharashtra State Road Transport Corporation
NH	National Highway
NH	National Highway
NHAI	National Highway Authority of India
NMT	Non-Motorised Transport
NUTP	National Urban Transport Project
OC	Outer Cordon

OD	Origin - Destination
PAP	Project Affected People
PCTR	Per Capita Trip Rate
PCU	Passenger Car Unit
PPP	Public Private Partnership
PT	Public Transport
PV	Private Vehicle
PWD	Public Works Department
RoW	Right of Way
R&R	Rehabilitation and Resettlement
SH	State Highway
STTIMP	Short Term Traffic Improvement & Management Plan
TDM	Transportation Demand Management
TMT	Thane Municipal Transport
TSM	Transport System Management
UDPFI	Urban Development Plans Formulation & Implementation
UMTC	Urban Mass Transit Company
V/C	Volume/ Capacity
WTT	Water Transport Terminal

Executive Summary

Introduction

During the last decade, the urban sprawl in Indian cities has extended far beyond the existing territorial jurisdiction of the city administration resulting in high usage of private modes. Despite substantial efforts, cities are facing difficulty in coping with increase of private vehicles along with improving personal mobility and freight movement.

Due to limited road width and scope of road widening, together with increase in number of private vehicles, traffic congestion and delays have become a common phenomenon. The situation becomes more acute during peak hours. Growth and development of commercial activities along both sides of the road and on-street parking of private vehicles by resident users, has further aggravated the situation. On the other hand, the pedestrians have become more vulnerable due to lack of proper pedestrian facilities. Thus, Mira Bhayandar requires a comprehensive vision document for urban mobility. This vision document should identify the transport infrastructure needs and requirements of for both base year and horizon year in conjunction with the other plans and schemes.

The Comprehensive Mobility Plan (CMP) for Mira Bhayandar emphasizes on movement of people and goods by both motorized and non-motorized mode of transport giving priority to public transport.

Mira Bhayandar City Characteristics

According to the development plan, out of the 79.4 Sq.Km municipal area, 73.12% of the total area is non developable and is covered by agriculture land, hills, salt pans, water bodies and vacant lands etc. The developable area is 26.88%, out of which 54.24% is under residential use and 16.6% is under transport and communication. The industry occupies 6.48% of the total area, 8.20% denotes organized open spaces, play fields etc. The population has increased from 1,75,400 persons in 1991 to 5,20,301 in 2001, recording a decadal growth rate of 197%. During the past few decades, the city's population has grown at a rapid pace. As per 2011 census, the population of Mira Bhayandar is 8.14 Lakhs.

The number of registered vehicles in 2010 under MBMC jurisdiction are 1,24,891 . Out of te total vehicles registered, two wheelers (58%) occupy the highest share followed by cars (22%). The registration of private vehicles is increasing day by day. Mira Bhayandar CMP has taken into account all these aspects, and following the NUTP guidelines, has given more emphasis on promoting public transport and non motorized transport.

Challenges

Mira Bhayandar being one of the major urban areas with close proximity to Mumbai, is a prime residential location for many people working in Mumbai. The road connectivity to major tourist locations like Essel world, gorai is through Mira Bhayandar Road.. The major arterials are mira bhayandar road, silver park road, LBS marg, phatak road, cabin road & B.P Road. All roads leading to Mira Road & Bhayandar stations experience heavy traffic during peak hours. From both primary data and secondary data analysis following inferences have been drawn:

(a) Road Network – Mira Bhayandar Road is the only major arterial connecting other parts of MMR region with Mira Bhayandar. Additional roads are required to reduce the trip lengths and decongest the existing mira bhayandar road. Uttan road is the only road connecting East and West of Mira Bhayandar Railway Line. Additional roads are required to connect East and west areas of Mira Bhayandar Railway Line.

(b) Public transport - The growth of number of registered vehicles in Mira Bhayandar has resulted in high traffic volumes private vehicles on road in Mira Bhayandar. Besides, owing to the religious and tourism based significance of the city, increase in number of visitors/tourists using personal modes of vehicles has exploded the traffic into multiple proportions. There has been huge growth in the population and the use of bus public transport system. There is a need for expansion of the system to keep pace with the growing demand

Existing buses are parked on the road and without regular and adequate facilities for maintenance. The fleet is fairly new, with the average age of buses being less than 5 years. Currently maintenance and repair of buses is done on the roads or under a flyover. The lack of proper maintenance has resulted in lower KMPL and will reduce the life of the buses.



Due to absence of a bus depot, MBMC is unable to increase the fleet size. Additionally there is no facility for driver training.



There is very insufficient pedestrian and passenger infrastructure posing a safety issue for them. For example, on Western Express highway, close to Kashmir junction, people wait for buses on the roads. There is generally insufficient or no facilities like seating or toilets.

(c) Parking: Parking is another major issue of concern for Mira Bhayandar. Free parking without any demarcation is reducing the carriageway width on many roads leading to congestion. There is no multi level parking facility in Mira Bhayandar. Poor maintenance of parking spaces is observed at railway stations.

(d) Traffic and Travel: The effective carriageway capacity of roads is reducing with increasing traffic volume and increase in activity centers along the roads including encroachments impairing traffic movement and creating bottlenecks. The Outer cordon origin destination survey shows the share of through traffic is high which necessitates creation of additional bypass roads.

(e) Major bottleneck Points: Following are the major bottleneck points of Mira Bhayandar city

- Kashimira Junction
- Mira Road Railway Station East
- Bhayandar Railway Station East
- Bhayandar Railway Station West
- Golden Nest Junction
- Silver Park Junction
- LBS Marg Junction
- Station Road Junction
- Phatak Road
- Cabin Road
- B.P Road

(f) Pedestrians Facilities: Although walk is the predominant mode of transport in Mira Bhayandar, but the city lacks proper pedestrian facilities. Poor maintenance of existing foot paths is causing problems to pedestrians. The pedestrian crossing facility is also inadequate. Absence of road markings is also creating problems to pedestrians.

(g) Congestion: The roads connecting both Mira Road and Bhayandar Railway Stations see major congestion during peak hours. Mira Bhayandar road is the only major connecting road from Mumbai and Thane to Mira Bhayandar. 6 signals located on this stretch lead

to major delays on this road. Following table gives the v/c ratios on few road stretches of Mira Bhayandar. V/c ratio of more than 0.8 indicates that there is a need for improvement/management measures.

V/C ratios of some of the major roads

S.No	Road Name	Base Year v/c ratio
1	Cabin Road	0.62
2	Uttan Road_Flyover_GoldenNest	0.56
3	Phatak Road	0.94
4	Sant Tukaram Marg	0.61
5	Punam Garden Road	0.76
6	Uttan Road_Sadanand Nagar	0.73
7	Penkharpada Road	0.59
8	Cabin road	0.94
9	Shanti Vidya Nagari Road	0.90
10	Mari Gold Road	0.84

The present situation in Mira Bhayandar will only continue to worsen unless the Government authorities respond appropriately in this regard. In the absence of Government interference, by 2031, the share of public transport will go down leading to more congested road space attributed by higher use of private mode. Performance indicators were developed to arrive at goals to be achieved for the city of Mira Bhayandar. The goals have been defined with vision and objectives. The mobility strategies developed will aim at attaining these goals.

Mobility Plan and its approach

The Comprehensive Mobility Plan for Mira Bhayandar is developed with the following vision.

“To provide safe, efficient, and environmentally sustainable means of transportation system for improving mobility of people in Mira Bhayandar.”

Truly reflecting the status that the Mira Bhayandar city, it is proposed to have a sustainable, low carbon well networked integrated transportation system, by developing and sustaining quality transportation infrastructure with the help of an urban transport strategy. The strategy is envisioned to be in line with the current National Urban Transport Policy (NUTP),

- that will move people and goods safely, efficiently and securely.

- that will provide affordable mobility for people, goods and commerce (and maximize the benefit of transportation investments and facilitating implementation of priority projects of city and region wide significance over the short, medium and long term).
- that will improve quality of life (by providing a recognized and effective platform for integrating land use, transportation, and economic development that minimizes the need for travel, provides choices for modes that are safe and also socially, economically, financially and environmentally sustainable).

Urban mobility solutions cannot be evolved by a single source strategy, the mobility goals for Mira Bhayandar will need to be addressed through a multi-pronged approach. The following strategies are adopted to meet the various goals set for Mira Bhayandar:

- ✓ Integrated land use and transport strategy
- ✓ Public transit strategy
- ✓ Non-motorized transport strategy
- ✓ Freight management strategy
- ✓ Traffic engineering & management measures
- ✓ Water transport strategy
- ✓ Parking management strategy
- ✓ Education & enforcement

All the listed strategies are equally important and the order of listing does not imply priority. Each of the broad strategies includes sub- strategies of immense importance. The strategies when implemented through specific projects shall fulfill the goals and objectives of the CMP. The sections below discuss these strategies.

Based on the framework of the plan, travel demand model, and the strategy for achieving the vision under realistic scenario, the mobility plan has been prepared and various components and details of the same are given as under:

1. Land Use Transport**Integration Strategy**

- Induced Growth Centres
- Regional Connectivity
- Mobility Corridors
- Road Network

Improvement Plan**2. Public Transit Strategy**

- New MRTS Proposals
- Existing PT Improvement
- Feeder services
- Intermodal Integration

3. Non-Motorized Transport

- Pedestrian mobility plan

4. Freight Management

- Goods Vehicles management
- New Truck Terminals

5. Water Transport Strategy

- Water Transport Terminals
- Water Transport Routes & Infrastructure

6. Parking Management

- Regulation of on street Parking
- Public transport supportive parking strategy

Based on the above strategies, CMP Proposals have been identified.

Project Phasing and Prioritization

In accordance with NUTP and based on the detailed analysis, all the projects identified have been prioritized as follows:

1. Public Transport
2. Non-Motorized Transport

3. Travel Demand Management techniques
4. Parking facilities
5. Transport hubs
6. Terminal Facilities
7. New Roads
8. Road widening
9. Subways

The details of prioritization are given below.

S. No	Project Component	Phase		
		Short	Medium	Long
		2013-16	2017-21	2022-31
1	INTEGRATED LAND USE AND TRANSPORT PLAN	L	M	H
1. (a)	Development of Induced Growth Centers	L	M	H
1. (b)	New Road Links	L	L	H
1. (c)	Widening of Roads	L	L	H
1. (d)	Development of Flyovers	L	M	H
1. (e)	Mobility Corridors	H	H	H
2	PUBLIC TRANSPORT STRATEGY AND PLAN	M	H	H
2. (a)	MRTS Proposals	H	H	H
2. (b)	Increase in Service Frequency of City Bus Services	M	H	H
2. (c)	Development of Bus Shelters	M	H	H
2. (d)	Development of New Bus Routes	L	M	H
2. (e)	Development of Bus Infrastructure	H	H	H
2. (f)	Creation of Public Transport Hub	L	M	H
3	NON MOTORIZED TRANSPORT STRATEGY	H	H	H
3. (a)	Pedestrian Phase at all Signalized Intersections	H	H	H
3. (b)	Mechanized Foot Over Bridges	M	H	H
4	FRIEGHT MANAGEMENT STRATEGY	M	M	H
4. (a)	Goods Vehicle Management	H	H	H
4. (b)	Development of Truck Terminal	L	M	H
5	TRAFFIC ENGINEERING AND MANAGEMENT MEASURES	H	H	H

S. No	Project Component	Phase		
		Short	Medium	Long
		2013-16	2017-21	2022-31
5. (a)	Road Markings	H	H	H
5. (b)	Road Studs	H	H	H
5. (c)	Road Median	H	H	H
5. (d)	On Street Parking Management	H	H	H
5. (e)	Removal of Temporary Encroachment	H	H	H
5. (f)	Street Lighting	H	H	H
5. (g)	Provision of Bus Post & Bus Box	H	H	H
5. (h)	Oneway Schemes	H	H	H
5. (i)	Re Surfacing of Roads	H	H	H
5. (j)	Goemetric Design of Junctions	H	H	H
6	WATER TRANSPORT PLAN	L	L	M
6. (a)	Development of Water Transport Terminals	L	L	M
6. (b)	New Water Transport Routes	L	L	M
7	PARKING MANAGEMENT PLAN	M	H	H
7. (a)	Construction of Multi Level Parking Lots	M	H	H
7. (b)	Differential Parking Rates	L	M	H
8	EDUCATION AND ENFORCEMENT	H	H	H
8. (a)	Public Participation and awareness programme	H	H	H
8. (b)	Road Safety Programmes	H	H	H

The approximate capital cost, excluding land acquisition, for implementing the mobility plan is about Rs. 899 Crores.

The Phase wise costing details are given below.

Phases	Project Cost (Rs crores)
Phase I : Short Term Projects: 2013-2016	70
Phase II : Medium Term Projects: 2017-2021	360
Phase III : Long Term Projects: 2022-2031	463
Total	893

Conclusion and Next Steps

The CMP has identified a number of projects for implementation and has estimated block cost estimates and identified broadly projects amenable to PPP and potential alternative sources of finances. Various agencies as per the existing institutional set up have been identified for implementing these specific projects. Thus, it is proposed that as part of next steps post approval of the CMP by MBMC, various agencies identified for implementation of the projects under aegis of the proposed UMTA or a senior level Monitoring Committee should get Feasibility Reports/ DPRs prepared for individual projects, which inter-alia should cover the following aspects.

- (a) Technical and physical feasibility
- (b) Technical system specifications
- (c) Detailed engineering specifications
- (d) Detailed capital cost and O&M estimates
- (e) Potential revenues sources
- (f) Financial and economic viability
- (g) Project structuring and means of finance
- (h) Phasing and implementation plan

Thereafter, they should submit the DPR to MBMC and to various other agencies for funding; ADB, World Bank, JICA etc. to avail the funds or schemes for implementation.

1. Introduction

1.1 Background

Mira Bhayandar is one of the eleven sub regions of Mumbai Metropolitan Region. Located North of Greater Mumbai, administered by Mira Bhayandar Municipal Corporation (MBMC), rapidly developing Mira Bhayandar is surrounded by hills on the Eastern side, along with Arabian Sea guarding the west side of the city. The North side of the city is surrounded by Vasai (Bassin) Creek. Mira Bhayandar is a part of Thane district of Maharashtra and has an area of 79.4 sq.km and the entire municipal area is divided into 79 wards¹. MBMC is well connected by Mumbai & Vasai by Road and Western Railway. Mira Bhaayandar Municipal Corporation is developing as a residential and tourism hub. Due to constraints for growth in Island city of Mumbai aided by high accessibility provided by rail services and spatial and development policies pursued by the Government of Maharashtra, the number for economic activities have been rapidly increasing within Mira Bhayandar city.

On 12th June 1985, five gram panchayats namely Bhayandar, Kashi, Mira, Navghar and Ghodbunder were integrated to form Mira Bhayandar Municipal Council. In 1990 the Council got extended further by including four gram panchayats namely Chena, Varsova, Rai – Murdhe, Dongri – Uttan. Thus this corporation is made up of 9 gram panchayats depicted by the nine stars on Mira Bhayandar Logo.

Being a neighbouring city of Mumbai, the growth of the city has been tremendous. Still, the city has managed to retain independent identity with the continued role of small scale industries, farming, fishing, sand and salt cultivation in the economy of the region. Map showing the location of Mira Bhayandar in Maharashtra and in Mumbai Metropolitan Region (MMR) is presented in **Figure 1-1**.

¹ Census of India 2011 data

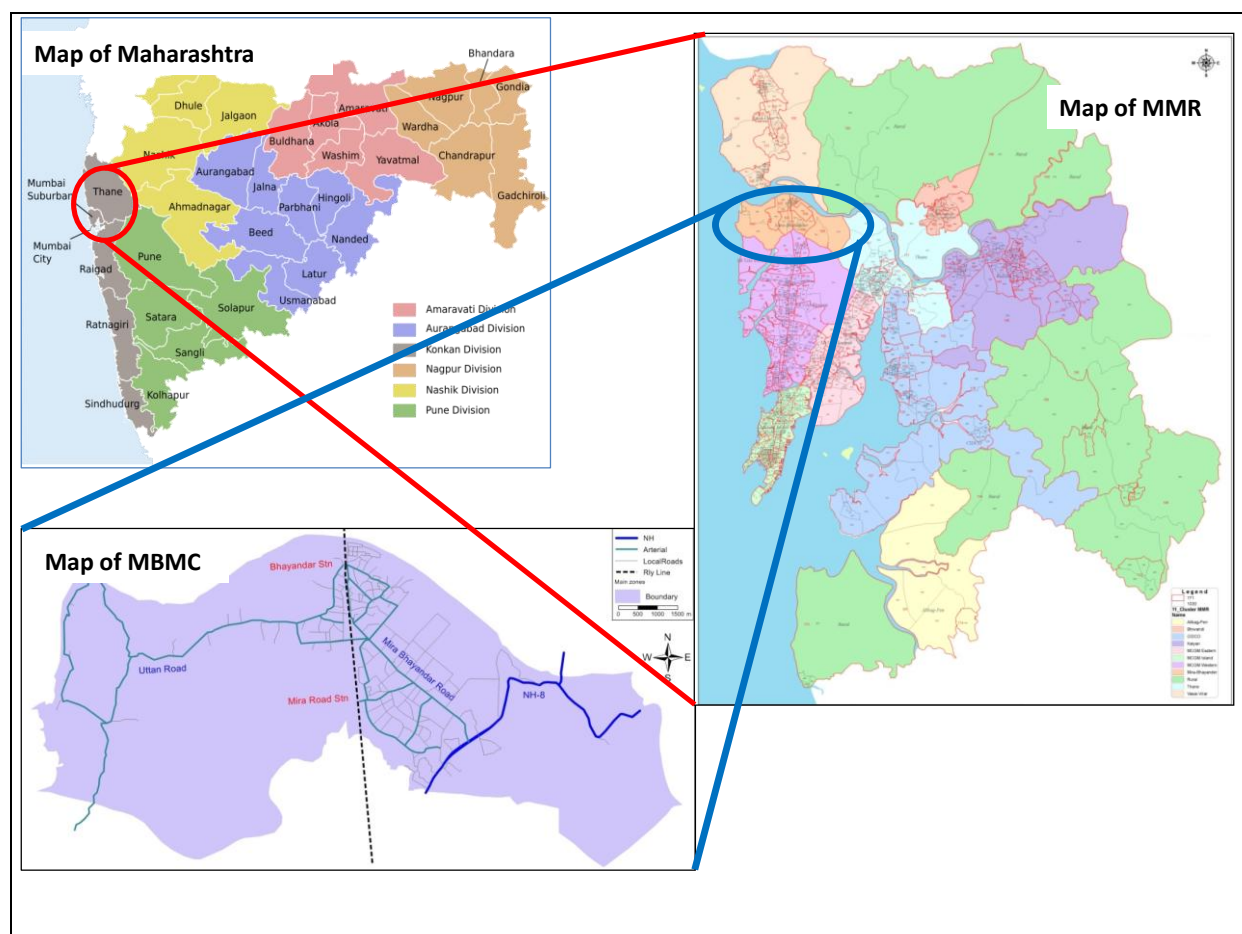


Figure 1-1 Location of Mira Bhayandar

1.2 Comprehensive Mobility Plan

As per the National Urban Transport Policy (NUTP), it is important to focus on personal mobility to achieve cost-effective and equitable urban transport measures within an appropriate and consistent methodology. Accordingly, the Ministry of Urban Development (MoUD), Government of India (GoI) encourages each city to prepare a Comprehensive Mobility Plan (CMP) as part of a long-term urban transport strategy for sustainable improvement in the mobility of people and goods, which is integrated with the land use plan. CMP should also highlight the projected mobility needs of the city as well as the manner in which such mobility needs are proposed to be met. As per MoUD, CMP would be a prerequisite for submission of Detailed Project Report (DPR) for JNNURM funding.

A Comprehensive Mobility Plan is a strategy document that defines the Mobility Vision of the city, which is in synchronization with the Master Plan, and details out strategies and actions for achieving the objectives for enhancing mobility of the people. The Comprehensive Mobility Plan will address traffic growth of all modes of transportation and suggest a direction for a sustainable multi-modal transport system for the city.

1.3 Need for CMP

The population of Mira Bhayandar, as per the 2011 census, is 8,14,655. The 2001 census population was 5,20,301. The population growth trends indicate that the city is growing fast paced with the growth rate for the decade 2001-11 is around 57%.

Basic trends that are evident in Mira Bhayandar, which determine transport demand (such as substantial increase in urban population, household incomes, and industrial and commercial activities) are the same as most of the fast growing cities in the country. These changes have placed heavy demands on urban transport systems, a demand that many Indian cities have been unable to meet.

These trends indicate the absolute necessity in preparing our cities for the transport needs of the immediate and perspective future. Comprehensive Mobility Plan (CMP) is a process taken up by the Urban Development Ministry as a step to negotiate these needs of a city.

The formulation of a CMP serves the following basic needs:

1.3.1 Improving Mobility of People

Urban growth and all its associated economic benefits bring with it an unprecedented stress on city's transportation and land use. The cities, once called the "cycle/ pedestrian cities", are now being commonly referred to as "motor-cycle/ automobile cities".

During the last decade, the urban sprawl in Indian cities has extended far beyond the existing territorial jurisdiction of the city administration. This is continuing to spill over into the fringe areas of the cities.

Accessibility per person is an important criterion to determine the mobility of a city. Accessibility to public transport and safe road infrastructure is an essential element in urban transport.

Substantial efforts are being made to improve urban mobility, but cities have been facing difficulty in coping with high rate of increase in the number of private and goods vehicles.

Thus, Comprehensive Mobility Plan (CMP) needs to be prepared which focuses on mobility of people rather than vehicles, and accordingly give priority to pedestrians, non-motorized transport (NMT), all modes of public transport and intermediate public transport (IPT). By integrating all modes of Transport and focusing on NMT, CMP will improve the mobility of people in Mira Bhayandar city.

1.3.2 Integrated Approach

Mira Bhayandar Municipal Corporation (MBMC) and other government agencies associated with the city have undertaken various programmes/studies on improving the transportation system in the city. Several road widening and network improvement proposals (including subway connecting Bhayandar East & West) are undertaken along with proposals for city bus service, parking projects etc. These programmes are sometimes isolated from each other, with each of them being planned to meet an objective set by the respective programme. There is a strong need for coordinated implementation strategy for these projects. It is wiser to first set goals for the city and establish strategies to meet these goals rather than implement isolated projects and hope that the net sum of these projects would meet required goals.

Hence CMP will integrate the various projects and programs by laying emphasis on improving the transportation system in the city and integrating it with the land use development of the city.

1.4 Objectives of the Study

The objective of the CMP is to develop specific actions in the form of short, medium and long term transportation improvement proposals that will achieve the transportation vision for the area.

1.5 Scope of the Study

- Define objectives of the Mobility Plan and delineate Planning Area and Horizon of the Mobility Plan.
- Demand-Supply gap analysis of transportation needs and related infrastructure over the planning horizon.

- Assessment of existing problems and issues for mobility of people and goods within the study area.
- Define Mobility Plan
- Preparation of a Mobility Plan Implementation Program involving stakeholder's consultation.

1.6 Structure of the report

The draft final report presentation was held at MBMC office on 06th March 2013. Feedback from stakeholders regarding the proposals was discussed in detail. Another Individual stakeholder meeting was conducted during 17th to 19th June 2013. This report is the Final Report where in all the relevant suggestions from stakeholders were considered and accordingly updated . This Final Report consists of ten chapters. The description of each chapter is as follows:

1. Chapter One, "Introduction" describes the need for CMP for Mira Bhayandar and the scope of work for the preparation of the Comprehensive Mobility Plan for the city.
2. Chapter Two discusses the "Approach and Methodology" adopted to prepare Comprehensive Mobility Plan for Mira Bhayandar.
3. Chapter Three highlights the profile of Mira Bhayandar city covering aspects such as connectivity, demography etc.
4. Chapter Four describes the "Existing Transportation Scenario" of the study area in terms of network, traffic and travel, parking, pedestrian and public transport characteristics based on both primary and secondary data.
5. Chapter Five "Travel Demand Assessment" describes the process of developing transportation model to forecast the future or horizon year travel demand. This chapter also describes the process of scenario building to arrive at feasible and sustainable mobility goal for Mira Bhayandar.
6. Chapter Six on "Mobility Plan Strategies and Projects" describes the various approaches for achieving mobility vision of the study area. This chapter include identification of number of intervention measures ranging from landuse-transport integration to NMT provisions for improving mobility of the study area based on data analysis and transportation model.

7. Chapter Seven “Implementation Programme and Costing” defines phases for implementing the projects identified in chapter six in terms of priority. This chapter also describes the cost estimates associated with implementation of each projects. The financing options to implement each of the projects are also described in this chapter.
8. Chapter Eight “Institutional Framework” describes the pros and cons of existing city and state level institutional structures responsible for managing and monitoring urban transport. This chapter recommends number of reform measures for improvement of existing city and state level institutional structures.
9. Chapter Nine “Environmental and Social Impact Assessment” describes the environmental and social impacts of projects identified.
10. Chapter Ten on “Outcomes” assessed the outcomes and accordingly justifies the projects suggested in terms of overall improvement in mobility situation.

The primary survey formats, population & employment projections are annexed with the report.

2 Approach and Methodology

2.1 Approach

The methodology for preparing CMP for Mira Bhayandar has been formulated after studying the need for preparing the CMP and is based on following aspects:

1. Demographic characteristics
2. Land use characteristics
3. Traffic & travel characteristics
4. Challenges and issues relating to mobility of residents of Mira Bhayandar
5. Suggestions and inputs of project stakeholders
6. Guidelines of National Urban Transport Policy

The methodology for preparation of CMP, Mira Bhayandar is shown in **Figure 2-1**. As per the JnNURM guidelines layout the broad scope for the Comprehensive Mobility Plan for a city. However, considering the distinct characteristics of each of the cities, there is a flexibility of adopting a city-specific approach towards strategizing a mobility vision and plan for the city.

Mira Bhayandar being an ancient city with a multi-varied activity base such as religious, business amongst others, an inclusive methodology to prepare a focused vision, goals and objectives based on recent and updated database is essential. The methodology includes primary and secondary data collection which was used to study the existing transportation system. Since secondary data was old, primary surveys, especially transport demand surveys such as volume counts, origin-destination survey, parking and pedestrian survey, household surveys became essential.

Analysis of this primary and secondary information, along with inputs from land use information, was used to develop transport demand model simulating the base year scenario. Based on the existing scenario, a mobility vision for Mira Bhayandar was developed with goals and specific objectives. Together with goals and objectives, and inputs from urban growth strategies, future growth and travel demand scenarios have been developed. A development strategy through project identification, costing and implementation framework has been worked out. Based on the vision and goals set out, the prioritization of projects was done.

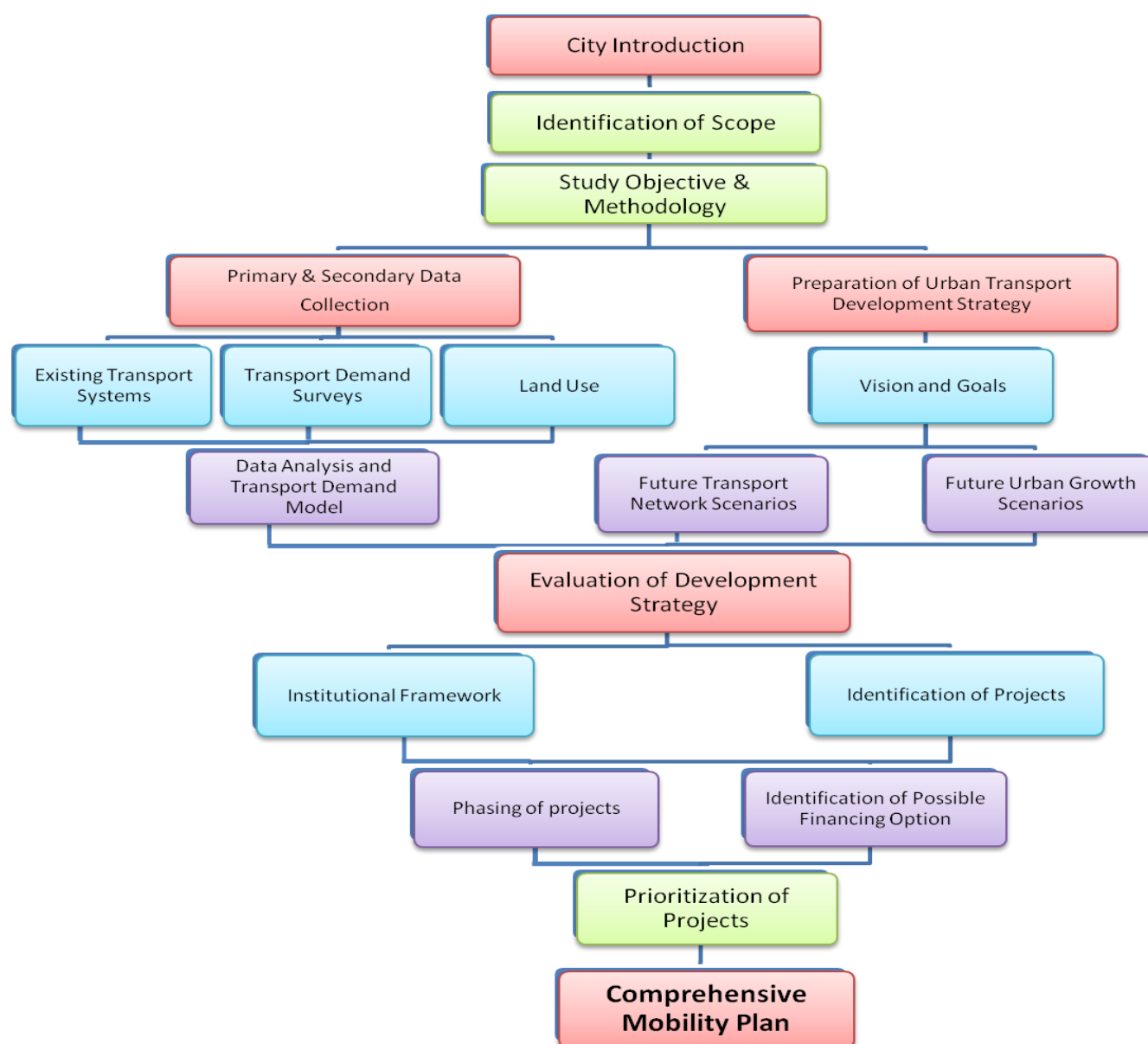


Figure 2-1 Methodology for preparation of Comprehensive Mobility Plan, Mira Bhayandar

2.2 Methodology

As given in **Figure 2-1**, the following steps explain the methodology undertaken for the study.

2.2.1 Collection and review of existing secondary information

UMTC, with assistance from all stakeholders has compiled and updated all available relevant information from various past studies carried out in the study area. During the

process, UMTC has identified the data gaps and additional data requirements and accordingly, UMTC has carried out number of primary surveys. Data on existing land use and land use plans have been collected and presented, through a detailed review of existing development plans, including the Master Plan and the City Development Plan (CDP). The secondary data as required for the development of study has been collected from various sources primarily from the government/planning organizations of the study area.

2.2.2 Collection of data through primary surveys

A number of primary surveys such as traffic survey, household survey and GIS mapping of the study area have been carried out by UMTC. An illustrative list of surveys conducted by UMTC is enlisted below:

- Road network inventory
- Speed & Delay survey
- Household survey
- Outer cordon classified traffic volume count
- Outer cordon origin-destination survey
- Turning traffic volume count at intersection
- Classified traffic volume count at mid block
- Pedestrian count at intersection
- Pedestrian count at mid blocks
- Railway terminal survey
- On-street parking survey
- Off street parking survey (12 Hrs.)

Primary survey formats are furnished in Annexure. The information collected from secondary source and primary surveys are used for assessment of existing travel pattern and for development of transportation model, validation and forecasting of future travel demand.

2.2.3 Analyze existing traffic/transport situation

Based on the information/data collected, a basic analysis of the transport and traffic situation was done, identifying characteristics and issues for the city, which includes analysis of existing urban transport situation and traffic characteristics.

2.2.4 Travel demand modeling

The purpose of travel demand modeling is to project future travel demand in order to estimate the likely consequences of several alternatives taken into consideration including the “Do- Something Alternative”.

The travel demand forecast has been done for different horizon years. The forecast has been done for different modes, in different alternative scenarios.

2.2.5 Develop urban mobility plan

The Urban Mobility Plan includes development of vision and goals, planning of medium and long range measures, along with cost estimates and prioritization of projects. To make the mobility plan a collaborative effort, detailed meetings, consultation were held to solicit the comments and concerns from the stakeholders and disseminate the findings of the draft final report. Input from the stakeholder meetings provided input to the development of the mobility plan on various aspects and issues of the transportation system.

3 City Profile

3.1 Study Area

The total area in Mira Bhayandar municipal limits is about 7941 Hectares². The municipal limit area which is divided into 79 wards is taken as the study area. The study area with ward boundaries is shown in **Figure 3-1** and the study area with road network is shown in **Figure 3-2**.

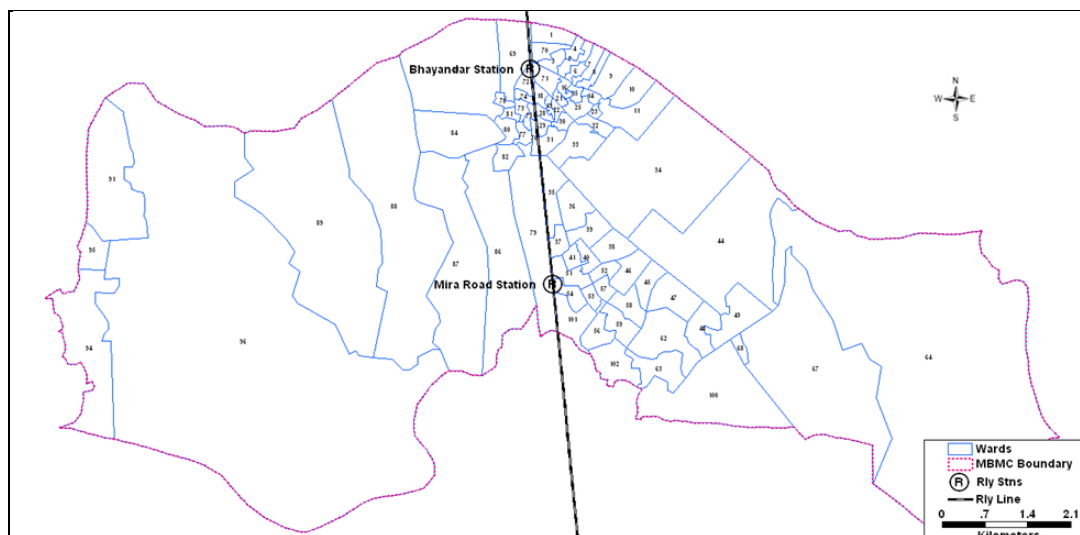


Figure 3-1 Study Area with 79 ward boundaries

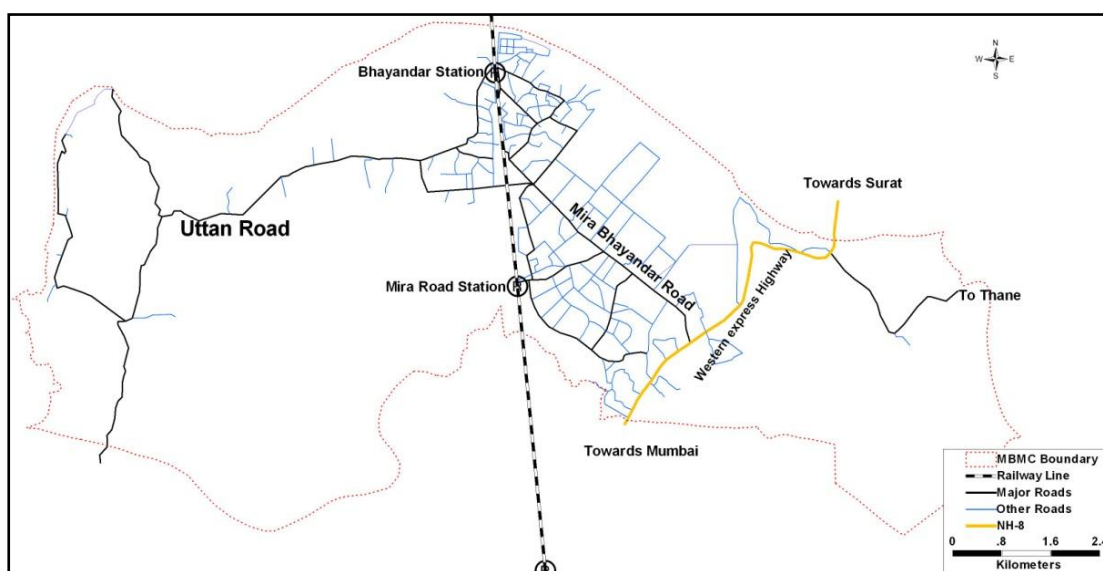


Figure 3-2 Study Area for Mira Bhayandar with Road Network

² The area is taken as per the final development plan published during the year 1997.

3.2 Population Projection

The population of Mira Bhayandar was 25,560 as per the 1961 census, which increased to 6.94 Lakhs in 2001 and further to 8.15 lakhs in 2011. The population growth trends indicate a sharp rise over the decades, with the growth rate for 2001-11 at around 57% which is very significant.

Table 3-1 and **Figure 3-3** show the population growth rates.

As per the City Development Plan, the population of MBMC is anticipated to increase at a very high rate and the population will be around 22 lakhs in 2031.

Table 3-1 Population growth rate

Year	Population	Growth Rate
1961	25,560	-
1971	33,022	29.19%
1981	67,192	103.48%
1991	1,75,400	161.04%
2001	5,20,301	196.69%
2011	8,14,655	56.57%
2021	15,55,331	90.90%
2031	22,09,008	42.00%

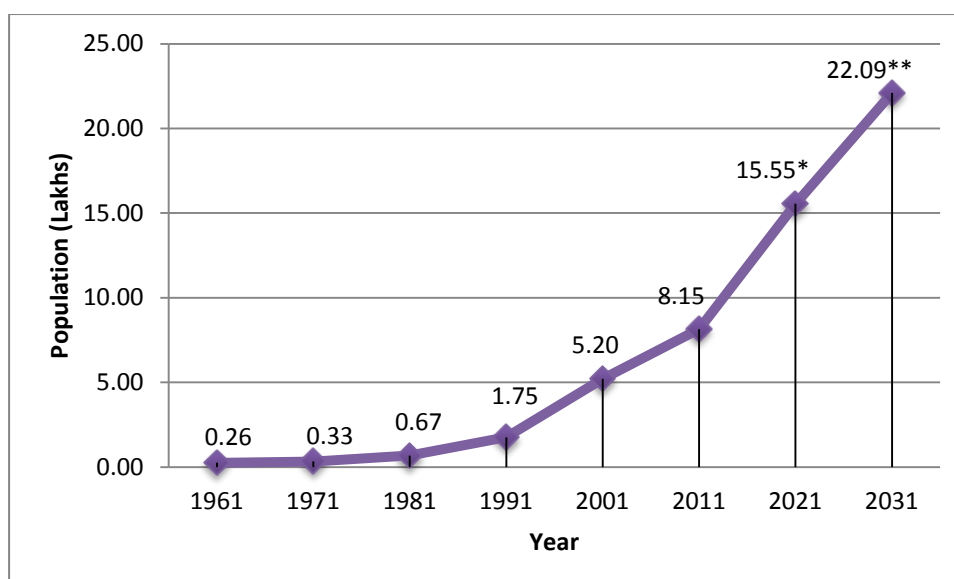


Figure 3-3 Population Growth Pattern in Mira Bhayandar

(*Projected by CMP, **Projected by CDP)

Residential area earmarked in the Development Plan (1157 Ha) can accommodate additional population by 5 lakhs.

There are several Salt Pans in Mira-Bhayander region comprising of 1394.33 Ha of land (City Sanitation Plan, March 2012). These Salt pans are shallow man made ponds designed to produce salt from sea water. The sea water is fed into large pans and water is drawn out through natural evaporation which allows the salt to be subsequently harvested.

Apart from the land earmarked for Residential use in DP Plan, Salt pan land also to be made available for development of houses to accommodate additional population (out of total 22 lakhs in 2031).

It is observed that the wards located on East and West side of Bhayandar station have high population densities ranging from 700 to 1800 persons per hectare. However, wards with villages Murdha, Rai, Morwa Gaon & Dogri have very low densities less than 100 persons per hectare. The ward wise population density for 79 wards of Mira Bhayandar is shown thematically in the **Figure 3-4** below. The average population density is found to be 102 Persons/Ha for the year 2011.

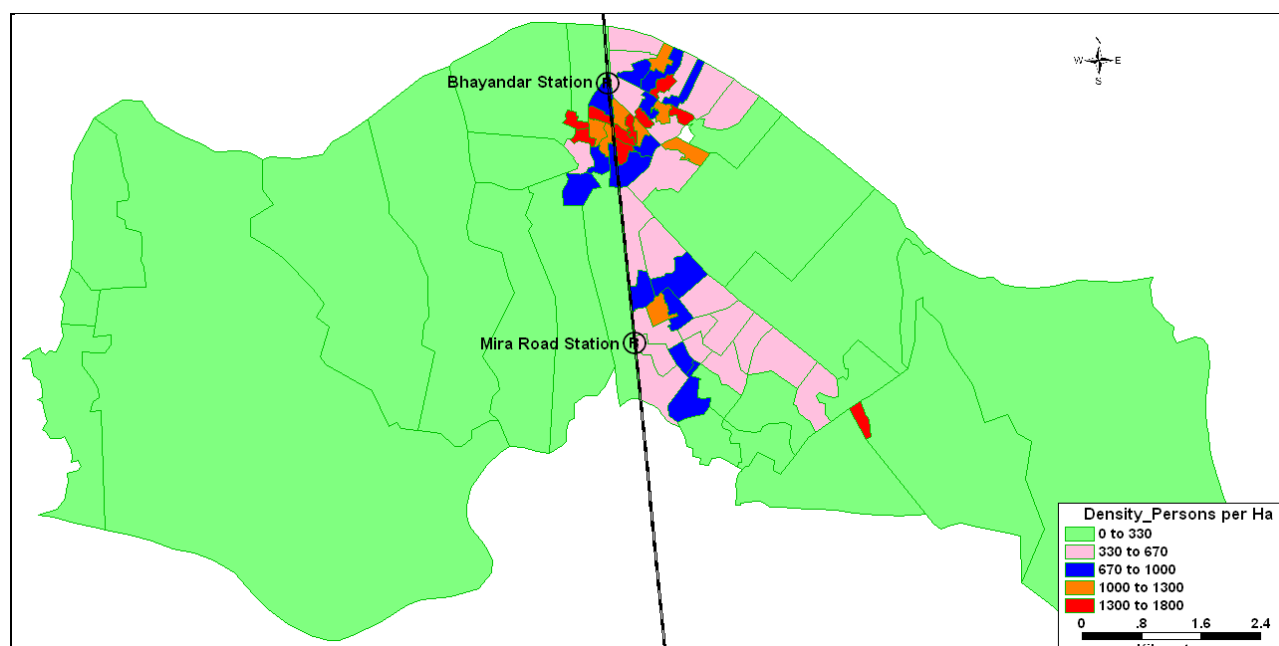


Figure 3-4 Ward Wise Population Density in Persons per Ha for the Year 2011

3.3 Land Use

According to the development plan, out of the 79.4 Sq.Km municipal area, 73.12% of the total area is non developable and is covered by agriculture land, hills, salt pans, water bodies and vacant lands etc. The developable area is 26.88%, out of which 54.24% is under residential use and 16.6% is under transport and communication. The industry occupies 6.48% of the total area, 8.20% denotes organized open spaces, play fields etc.

The distribution of land use is given below in **Table 3-2** and the corresponding figure is **Figure 3-5**.

Table 3-2 Distribution of Land Use

S.NO	Land Use Categories	As per Sanctioned Development Plan		
		Area (Ha.)	% Total	% Developed Area
1	Residential	1157.50	14.58	54.24
2	Mixed Usage	0	0	0
3	Industrial	138.29	1.74	6.48
4	Commercial	53.910	0.68	2.53
5	Roads	354.17	4.46	16.6
6	Public, Semi-Public Areas	251.49	3.17	11.78
7	Open Spaces	175.05	2.20	8.20
8	Burial and Cremation ground	3.70	0.05	0.17
9	Public Amenities	0	0	0
	Sub Total	2134.36	26.88	100%
10	Water Bodies	3350.48	42.20	
11	Marshy Land and Salt Pans	1390.33	17.51	
12	Forest and hills	1064.06	13.41	
13	Non developable Areas-Sub Total	5804.87	73.12	
	Total	7940.56	100%	

(Source: Development Plan for Mira Bhayandar)

The Land Use distributions recommended by Urban Development Plans Formulation & Implementation (UDPFI) guidelines for large cities (Population above 5 Lakhs) are presented in **Table 3-3**.

Table 3-3 Landuse Distributions recommended by UDPFI Guidelines

S.No	Land Use Category	% Area
1	Residential	40-45
2	Mixed	4-6
3	Commercial	2-4
4	Industrial	5-8
5	Public & Semi Public	8-10
6	Public Amenities	2
7	Road, Transport & Parking	18-20
8	Open Space, Agriculture & Water bodies	Balance
9	Total Developed Area	100

Table 3-4 shows the Land use proposed for the year 2031 as per CDP.

Table 3-4 Proposed Landuse for the Year 2031

S No.	Use	Area in Ha	Percentage
1	Residential	1762.56	50
2	Mixed	70.50	2
3	Commercial	70.50	2
4	Industrial	138.29	4
5	Public & Semi public	282.00	8
6	Public Amenities	70.50	2
7	Road, Transport & Parking	634.52	18
8	Open Space, Agriculture & Water	493.51	14
	Total Developable Area	3525.12	
	Non-Developable Area	4415.44	
	Total	7940.56	100

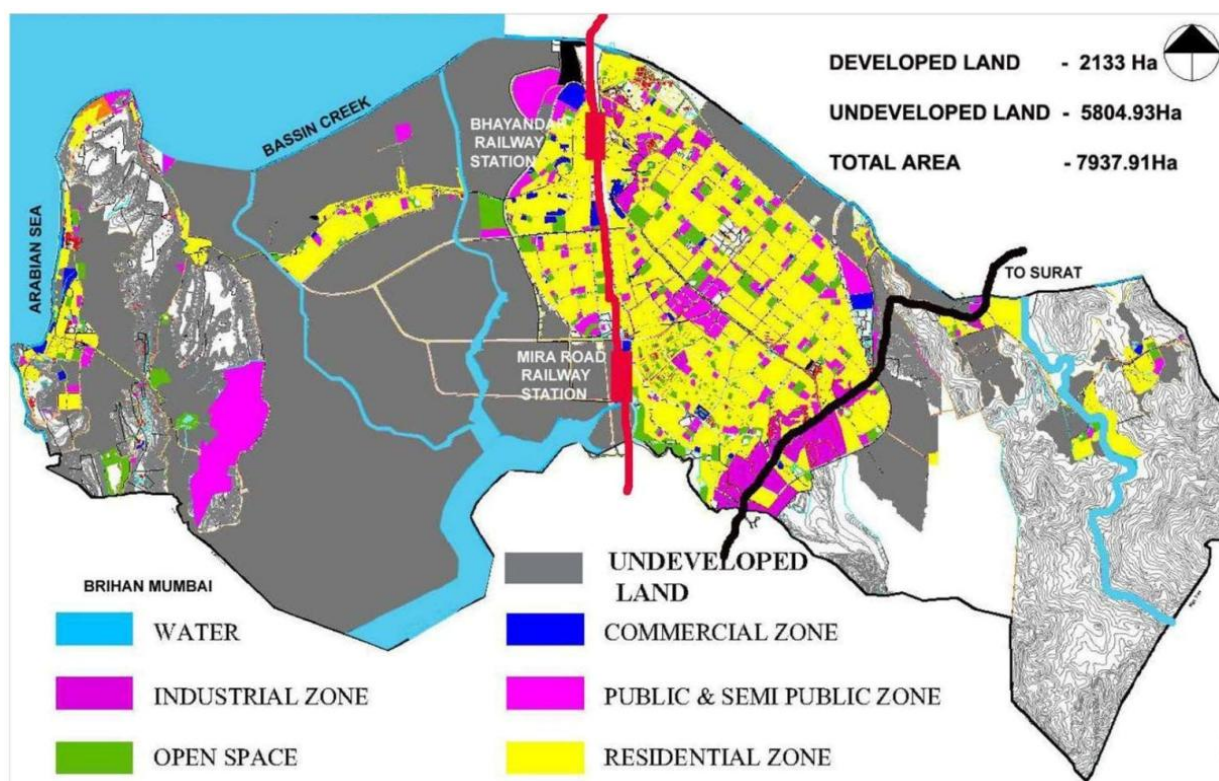


Figure 3-5 Existing Land Use for Mira Bhayandar

4 Existing Transport Scenario

4.1 Introduction

Assessment of traffic characteristics within an urban area is an essential pre-requisite to appreciate the problems with respect to traffic movement and to understand the need for organizing the same in an efficient and economical manner. Traffic characteristics help in appreciating the spatial and temporal features of travel within the area, relationship of traffic intensity with network capacity and the prevailing level of service obtained on various corridors of the network in the study area. This appreciation and understanding is essential for identifying the present conditions and constraints for formulating suitable policies and strategies, selecting relevant systems, and designing individual components of the system.

Apart from collection, compilation and analysis of secondary data, in order to appreciate an in-depth and comprehensive traffic and transport system and to understand mobility pattern of Mira Bhayandar, a number of primary surveys (survey format details in Annexure) were conducted within the study area such as classified traffic volume count at outer cordons and junctions, origin destination survey at outer cordon, household survey, parking survey, pedestrian survey, speed & delay survey etc. Based on secondary data and primary data, the analysis and inferences of existing transportation scenario of Mira Bhayandar are depicted herein.

4.2 Secondary Data

Officials from UMTC have visited Mira Bhayandar and met many officials from Mira Bhayandar Municipal Corporation and other departments. Information regarding the existing situation and proposed plans has been collected in the form of documents as well as inputs in the form of discussions and suggestions. A list of secondary data collected and their analysis is listed below.

- City Development Plan
- Comprehensive Transport Study for Mumbai Metropolitan Region
- Development Plan
- Registered Vehicles in a city
- Bus Route and Fare Collection details of MBMC
- Existing list of wards and related demographic data

It has been understood that the Government agencies in Mumbai like MMRDA, Indian Railways & MBMC have planned for traffic improvement in various ways. Most of these projects are related to new MRTS system, improvement of existing sub urban railway system and tourism related schemes. In terms of traffic management, UMTC has submitted a detailed report to MBMC on 01st September 2012 (Final Report of STTIMP) which will be instrumental in facilitating the traffic flow and improving the safety of road users.

4.2.1 Comprehensive Transport Study for MMR Region

CTS study is one of the major studies conducted for Mumbai Metropolitan Region in the field of Traffic & Transportation in the recent years (2005). With Horizon year as 2031, a set of comprehensive proposals are recommended in the study. Few MRTS proposals (eg. Metro corridor from Dahisar to virar) recommended in CTS which are relevant to Mira Bhayandar are honored in CMP Mira Bhayandar.

4.2.2 Public Transport Characteristics

Apart from the sub urban railway, existing city bus services operated by MBMT, BEST, TMT, MSRTC & NMMT provides a major means of transport within and outside mira bhayandar municipal corporation area.

Mira Bhayander Municipal Transport Undertaking (MBMTU) started its operations in 2005 and presently operates about 60 buses in the city. The buses are operated by M/s. Kestral Infrastructure Pvt. Ltd. There are 50 standard buses of 900mm floor height & 10 mini buses. The operator M/s. Kestral Infrastructure Pvt. Ltd. was given an upfront fee equivalent to the city's share of investment and pays a daily route authorization fee of Rs. 1 per kilometer per bus subject to a minimum of Rs. 180 per bus per day. In turn, the buses are given to the operator for its entire useful life of 10 years. The operator also holds the rights for collection of revenue generated from advertisement on these buses and at bus shelters in MBMC areas. The route wise information for MBMT buses is given in **Table 4-1**. There are 27 routes that are being operated covering most of the areas under MBMC jurisdiction.

MBMC had submitted a draft DPR on Bus funding under JnNURM in 2009. In the first phase, the Central government sanctioned funds for 50 buses of standard size 900 mm floor heights with cost of Rs.11 crores.

Table 4-1 MBMT bus route details.

S.No	Route NO	From To	Route Length (KM)	Oneway Run Time (min)	Existing Fleet	Existing Head way[In Min]
1	1	Bhayandar st.(W) to Chowk	14.2	45	6	30
2	2	Bhayandar st.(W) to Uttan Naka	10.3	30	6	15
3	3	Bhayandar st.(W) to Manori Tar	19.3	50	1	110
4	4	Bhayandar st.(W) to Essel World	16.1	50	2	50
5	5	Bhayander Station [W] to Maxus Mall	5.9	30	2	40
6	6	Uttan Naka to Manori Tar	11.6	35	3	30
7	7	Bhayandar st.(W) to Vaesova Bridge / Kajupada	11.4	40	1	45
8	8	Uttan Naka to Gorai Tar	9.7	30	1	70
9	10	Bhayandar st.(W) to Thane St. (E) Kopari) Via W.E.H Majiwada	34.5	90	7	60
10	11	Bhayandar st.(E) to Magathane Depo via M.T.N.L. Surshti. Dahisar Cheeknaka.	13.2	60	1	60
11	12	Bhayandar st.(E) to Magathane Depo Via Nayanagar Mira Road St.(E) Dahisar Chek Naka 9.00Borivali (E)	13.1	60	1	60
12	13	Versova Brige to Magathane Depo Via hatkesh	12.7	60	1	60

13	14	Bhayandar st.(E) to Magathane Depo Via kashimira borivali St (E)	13.5	60	6	20
14	15	Mira Road St.(E) to Rasmi Comp.via. s.k.ston Bevaly park cine max	4.1	18	5	7
15	17	Bhayander st to Western Park	8.6	45	1	90
16	18	Western Park to Jogeshwari [West]	19.8	90	1	60
17	19	Bhayander Station [E] to penkar pada	8.8	30	1	40
18	20	Bhayander Station [W] to Morva	5.5	20	1	25
19	21	Mira Road Station [E] to Ramdev Park Via Rasaz Theater Bharati Park Shivar Garden	3.1	15	3	8
20	22	Mira Road Station [E] to Shanti Vidhya Nagari Via Jain Mandir Vijay Park Silver Park	4.4	20	4	11
21	23	Bhayander Station [E] Vai Ghoddev Naka Indralok Mira Road Station [E] Royal College	15	60	2	20
22	24	Mira Road Station [E] to Western Park	5.7	20	2	20
23	27	Bhayander Station [W] to Bhivandi via majivada	46.9	120	1	120
24	30	Bhayander Station [W] to Shirsadh Phata	36.5	90	1	90
25	28	MIRAROAD ST. TO IDEAL PARK	2.2	30	1	60
26	29	MIRAROAD TO THANE KOPARI	30.2	75	1	120
27	33	BHAY STN (W) TO ULLASNAGAR	61.2	120	1	240

BEST operates 18 bus routes out of which few originate and others pass through MBMC region.

Table 4-2 gives the details of the BEST bus routes operating in MBMC area

Table 4-2 Details of BEST bus routes operated in MBMC area

S.No	Bus Route No	Route Description	Existing Headway(min)
1	701	Kandivali Bus Stn (E) circular via Mira Road Stn (E)	35
2	702	Magathane Depot to Ghodbundar Village	20
3	703	Samata Nagar (Kandivali) circular via Mira Road Stn (E)	12
4	705	Dindoshi Bus Station to Western Park	7
5	706	Marol Depot to Bhayandar Station East	15
6	707	Oshiwara Depot to Bhayandar Station East	25
7	708	Damunagar Bus Station (Circular) via Inderlok	20
8	709	Magathane Depot to Bhayandar Station East	35
9	710	Jai Maharashtra Nagar to Bhayandar Station West	25
10	718	Dindoshi Bus Station to Bhayandar Station East	10
11	720	P.Thakre Nagar Bus Station to Bhayandar Station East	30
12	A70	Mumbai Central Depot to Mira Road Station East	50
13	AS458	Mulund Depot to Majiwada	25
14	AS700	Magathane Depot to Golden Chemicals	30
15	AS707	Santacruz Depot to Laxmi Industrial Estate	25
16	C61	Mulund Depot to Mira Road Station East	25
17	C71	Mahim Bus Station to Mira Road Station East	17
18	C72	Sion to Bhayandar Station East	25

Other Bus operators like NMMT, MSRTC, TMT also operate few buses in MBMC area. **Table 4-3** gives the details of these bus routes operated in MBMC area.

Table 4-3 Bus Route details of other operators in MBMC area

S.No	Bus Route No	Operator	Route Description	Existing Headway (min)
1	57	TMT	Thane Railway Station East to Mira Road Railway Station East	30
2	58	TMT	Lokamanya Tilak Nagar to Mira Road Railway Station East	12

S.No	Bus Route No	Operator	Route Description	Existing Headway (min)
3	AC 65	TMT	Thane Railway Station East to Borivali Railway Station East	25
4	70	NMMT	Vashi Bus Depot to Mira Road Station East	20
5	--	MSRTC	Bhayandar Station West to Thane Railway Station East	15
6	--	MSRTC	Oshiwara Depot to Bhayandar Station East	30

The road network coverage of different bus operators in MBMC is shown in **Figure 4-1**.

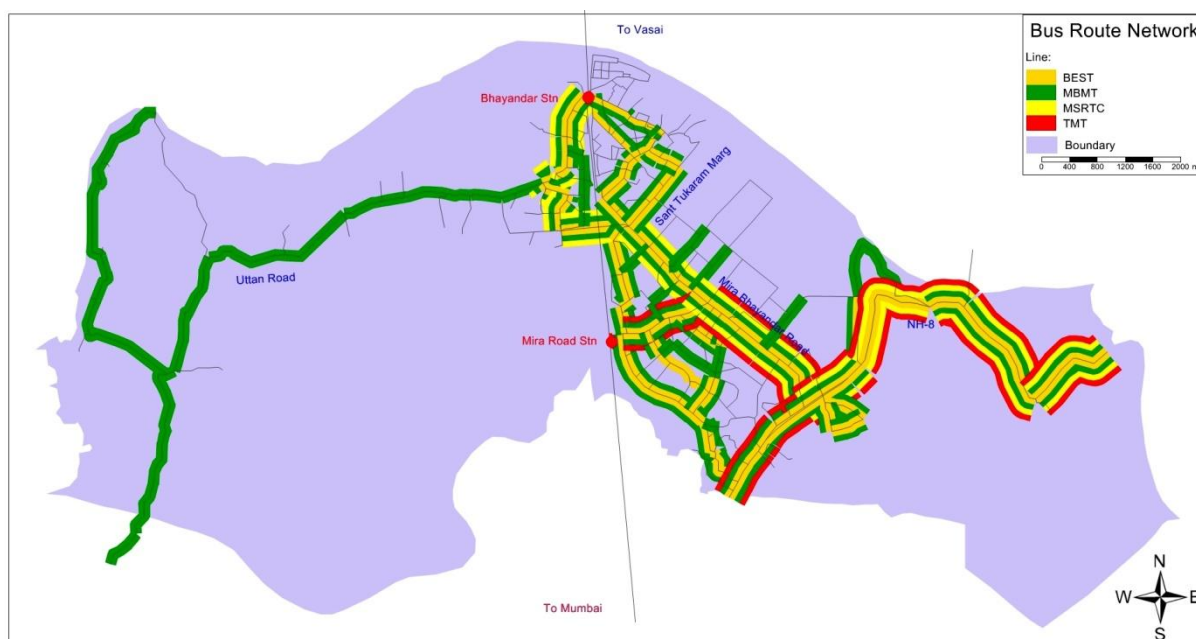


Figure 4-1 Bus Network coverage by different operators in MBMC

4.2.3 Registered vehicles in Mira Bhayandar

Table 4-4 shows the total number of registered motor vehicles in Mira Bhayandar during the year 2010. As per the data, Two wheelers occupy the maximum share (58%) followed by cars (22%) of the total traffic. Apart from the vehicles given below, 60 buses are registered under MBMT. An average of 8.4% of growth was observed in Thane district from 2009 to 2010 as per the statistics of RTO, Thane.

Table 4-4 Registered Vehicles in the Year 2010 for Mira Bhayandar Municipal Jurisdiction

S.No	Vehicle Category	Total No. of Vehicles	Percentage of Total Vehicles
1	Motor Cycle	65851	52.73%

S.No	Vehicle Category	Total No. of Vehicles	Percentage of Total Vehicles
2	Scooter	6553	5.25%
3	Moped	374	0.30%
4	Car	27128	21.72%
5	Jeep	676	0.54%
6	Taxi tourist cab	2076	1.66%
7	Auto Rickshaw	6320	5.06%
8	Container Carriage	430	0.34%
9	Ambulance	26	0.02%
10	Trucks & Lorries	2262	1.81%
11	Tankers	2326	1.86%
12	Delivar Van(4 wheeler)	4350	3.48%
13	Delivar Van(3 wheeler)	6270	5.02%
14	Tractor Trailers	249	0.20%
Total		124891	100.00%

4.3 Primary Data Collection

In any transport planning exercise, data collection is equivalent to foundation on which rests the super structure. **Table 4-5** presents the list of primary surveys that were undertaken to develop/update the traffic and transportation data for the study:

Table 4-5: Primary Data Collection

Sr No.	Items	No. Of Locations/ Samples
1	Household	1882 samples
2	Pedestrian Crossing Count Surveys (On Mid Block)	1 location
3	Pedestrian Crossing Count Surveys (at intersections block)	4 locations
4	Turning Movement Count at Intersections (16 Hrs)	11 locations
5	Classified Traffic Count at Outer cordon (24 Hrs.)	4 locations
6	Classified Traffic Count at Mid-block (16 Hrs)	6 locations
7	Railway Station Interview Survey	2 locations
8	Road Side Interview Surveys at outer cordon (24 Hrs.)	4 locations
9	On Street Parking Surveys (12 Hrs.) (500m Road stretch)	12 locations
10	Road Network Inventory	117 km

Sr No.	Items	No. Of Locations/ Samples
11	Speed and Delay	117 km
12	Bus Stop Surveys	10 locations
13	Occupancy Surveys	3 locations

4.3.1 Household Characteristics

4.3.1.1 Distribution of household by size

The average household size is 4 in Mira Bhayandar. **Figure 4-2** indicates that 40% of the households have less than 3 members, while 45% of household have 3 to 5 members. There are only 3% households with more than 7 household size.

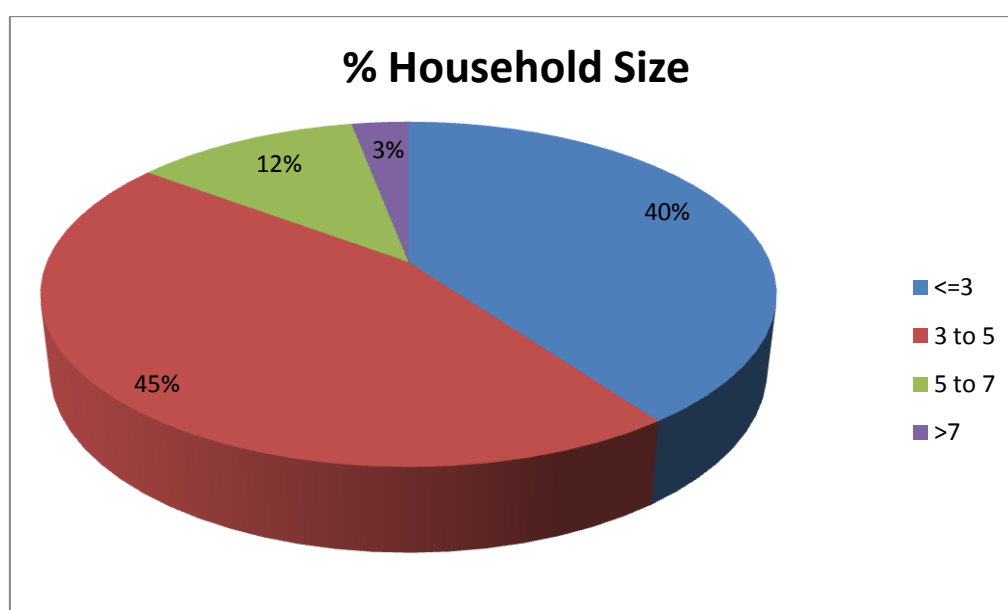


Figure 4-2 Distribution of Households by Household Size

4.3.1.2 Distribution of household according to their household income

The average household income is Rs. 19,437 per month. Distribution of household according to monthly income ranges is shown in **Figure 4-3**. It is observed that nearly 32% of household have monthly income upto Rs. 10,000 and about 29% have income between Rs. 10,001 – 20,000 per month. The percentage of household having monthly income above Rs. 50,000 is about 4% only.

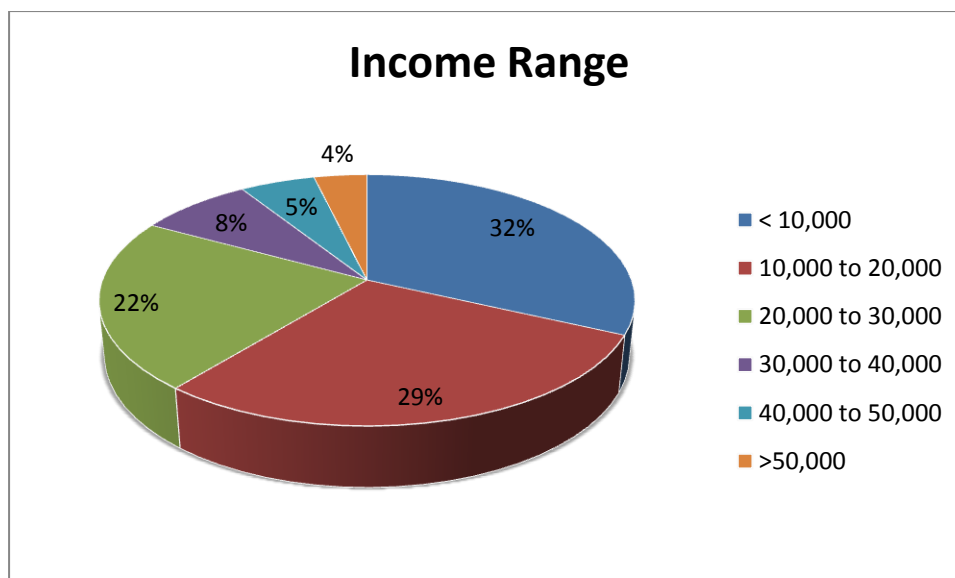


Figure 4-3 Distribution of Household Incomes

4.3.1.3 Expenditure on transport

The average monthly expenditure on transport by household is Rs. 1,200/-which is approximately 6% of total household income. Distribution of households by expenditure on transport is shown in **Figure 4-4**.

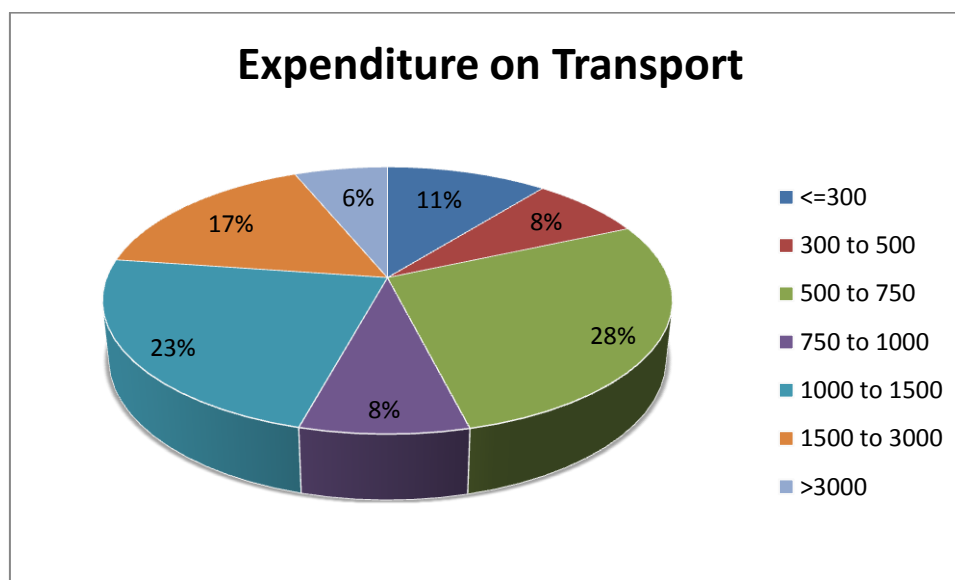


Figure 4-4 Distribution of households by expenditure on transport

4.3.2 Pedestrian Characteristics

The objective of the pedestrian survey is to identify locations for safe pedestrian crossing and to estimate the demand for pedestrian infrastructure.

Pedestrian count surveys were conducted at locations where heavy pedestrian movement is observed in the reconnaissance survey. The following pedestrian volume count surveys were conducted at identified critical locations within the study area:

- Classified pedestrian volume count survey at mid block including occupancy (1 location)
- Classified pedestrian volume count survey at major intersections (4 Intersections)

Intersection Locations

Classified pedestrian volume count surveys have been conducted at 4 intersections for 16-hour period (0600hrs to 2200hrs) on a typical fair weather working day. The total pedestrian traffic at the major intersections varies from 12,372 at Silver park Junction to 30,564 at Golden Nest Junction.

Summary of the total passenger count details at each of these Intersections is presented in **Figure 4-5**.

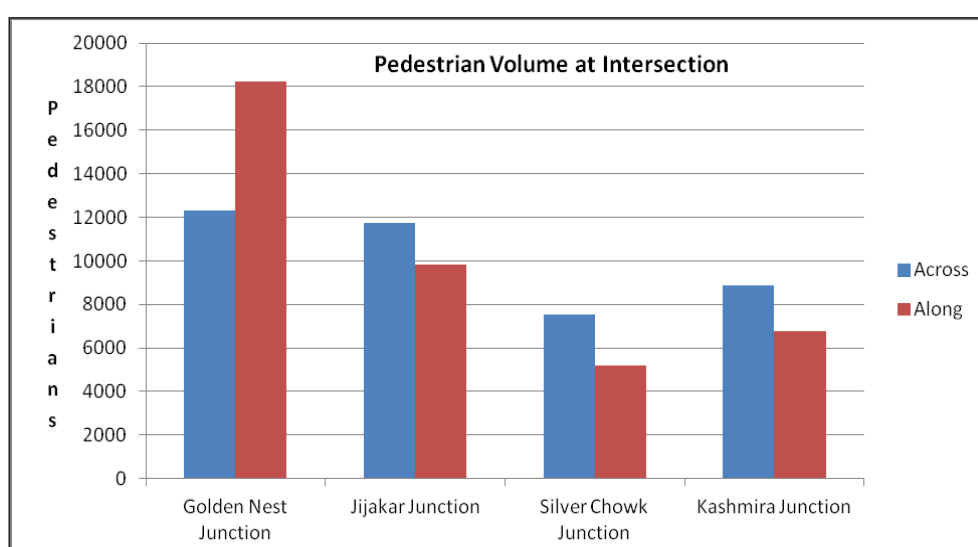


Figure 4-5 Pedestrian volume at Intersections

Peak hour pedestrian count data is presented in **Figure 4-6**.

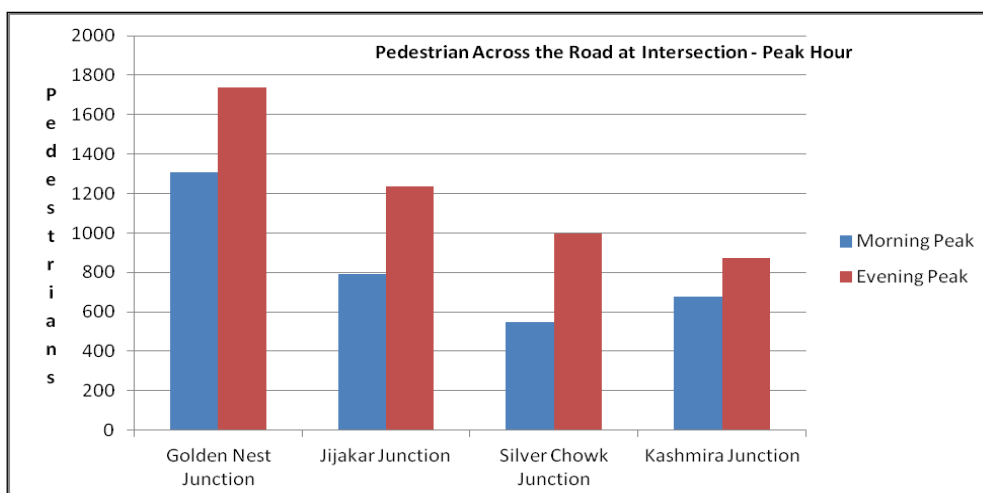


Figure 4-6 Volume of pedestrian across the road at intersection during peak hour

Pedestrian flow characteristics at surveyed intersections are presented in **Table 4-6**.

Table 4-6: Pedestrian flow characteristics at intersections

Sr No	Name of Location	16 hours			Morning Peak				Evening Peak			
		Across	Along	Total	Time	Across	Along	Total	Time	Across	Along	Total
1	Golden Nest Junction	12314	18250	30564	07:45 – 08:45	1306	900	2206	16:30 – 17:30	1736	1086	2823
2	Jijakar Junction	11734	9851	21585	08:00 – 09:00	790	678	1468	17:45 – 18:45	1236	1069	2305
3	Silver Chowk Junction	7554	5178	12732	08:30 – 09:30	548	320	868	16:00 – 17:00	998	837	1835
4	Kashmir Junction	8890	6768	15658	08:00 – 09:00	677	494	1171	17:15 – 18:15	871	692	1563

Mid-Block Locations

Table 4-7 presents pedestrian flow characteristics at surveyed mid-block location at Mira Road Station. Total pedestrians observed in morning peak were 299 and in the evening peak were 322 pedestrians.

Table 4-7: Pedestrian flow characteristics at mid-block

Name of Location	16 hours			Morning Peak				Evening Peak			
	Along	Across	Total	Time	Along	Across	Total	Time	Along	Across	Total
Mira Road Station (near Jijapur)	3279	1917	5196	10:00-11:00	183	116	299	17:00-18:00	207	115	322

4.3.3 Classified Volume Count & RSI survey characteristics

The traffic volume of motor vehicles in a city is the primary data requirement for planning and designing of transport infrastructure. Classified traffic volume counts were hence carried out at various critical locations in the city to estimate the volume and type of traffic. Traffic volume counts were used to perform TFlow Fuzzy matrix correction and for validation of the urban travel demand model.

The following are the three types of traffic volume count surveys conducted at identified critical locations within the study area:

- Classified traffic volume count survey at mid blocks (6 locations)
- Turning Movement count survey at major intersections (11 Intersections)
- Classified traffic volume count and Origin Destination survey at Outer Cordon points (4 locations)

The analysis of traffic volumes requires the conversion of the mode specific volume to common units called Passenger Car Units (PCU). The volume and capacity on any link or corridor is calculated in PCUs.

The PCU conversion factors adopted for the study is presented in **Table 4-8**.

Table 4-8: PCU Conversion Values

Sr. No.	Mode	PCU Value
1	Car/ Jeep/Van	1
2	2-Wheeler	0.5
3	Bicycle	0.5
4	Cycle Rickshaw	1.5
5	Auto/Tempo	1
6	Mini Buses	1.5
7	Buses	3
8	Truck	3
9	LCV	1.5
10	M-Axle Trucks	4.5
11	Tractor	4
12	Hand Cart/ Animal Drawn	4.5

(Source: IRC SP-41)

Volume Count Survey at Mid Blocks

Traffic volume counts were done at various points on the mid blocks of identified roads. Manual traffic counts have been carried out for 16 hrs (Morning 6 am to 10 pm) on a typical working day at all identified locations. At each identified station, both directional counts were carried out by vehicle type. i.e. cars, jeeps, vans, buses, trucks, MAVs, LCV's tractors, motorized two wheelers, three wheelers, and slow moving vehicles.

The results were used to validate the base year travel demand model. The mid block survey locations are listed in **Table 4-9** and **Figure 4-7** shows mid block locations.

Table 4-9: Mid Block Survey Locations

Sr. No.	Code	Description
1	MB5	Bhakthi Vedanta Road
2	MB7	Narmada Complex, Cabin Road
3	MB9	Navghar Road
4	MB10	Vinayak Mandal on Station Road
5	MB1	Uttan Road Flyover
6	MB2	Sai Petrol Pump, Mira Bhayandar Road



Figure 4-7 Mid block survey locations

The traffic counts, both in terms of numbers of vehicles and passenger car units (PCUs) have been computed for the total daily (16 hour) traffic at various mid-block locations. The morning peak hour volume varies from 387 PCUs (392 vehicles) at Navghar Pada to 2493 PCUs (2548 vehicles) at Sai Petrol Pump on Mira Bhayandar Road and evening peak hour volume varies from 439 PCUs (481 vehicles) at Navghar Pada to 2091 PCUs (2087 vehicles) at Sai Petrol Pump on Mira Bhayandar Road. It is observed that the daily traffic at different locations varies from 5492 PCUs (5876 Vehicle) at Navghar Pada to 29,947 PCUs (29,741 Vehicle) at Sai petrol pump on Mira Bhayandar Road. Traffic intensity at mid-block locations is presented in **Table 4-10**.

Table 4-10: Traffic intensity at mid-block

Sr. No	Location	16 hours		Morning peak hour			Evening peak hour		
		PCU	Veh	Time	PCU	Veh	Time	PCU	Veh
1	Bhakthi Vedanta Road	6812	7118	08.00-09.00	599	639	16.15-17.15	543	608
2	Narmada Complex,	9523	1100	09.45-	627	715	18.00-	804	935

Sr. No	Location	16 hours		Morning peak hour			Evening peak hour		
		PCU	Veh	Time	PCU	Veh	Time	PCU	Veh
	Cabin Road		0	10.45			19.00		
3	Navghar Road	5492	5876	08.15-09.15	387	392	17.00-18.00	439	481
4	Vinayak Mandal on Station Road	7640	7719	09.30-10.30	535	539	17.30-18.30	491	506
5	Uttan Road Flyover	21490	21574	06.00-07.00	1367	1413	17.00-18.00	1862	1843
6	Sai Petrol Pump, Mira Bhayandar Road	29947	29741	07.15-08.15	2493	2548	17.15-18.15	2091	2087

Different modes of traffic occupy different amount of spaces and have varied infrastructure needs. The traffic volume counts were done for all modes to study the modal composition at various points in the city. The variation in traffic at different times of the day was analyzed and presented. The detailed mode wise analysis of various locations is as follows:

a. **Bhakthi Vedanta Rd:** Hourly variation and traffic composition is presented in **Figure 4-8**.

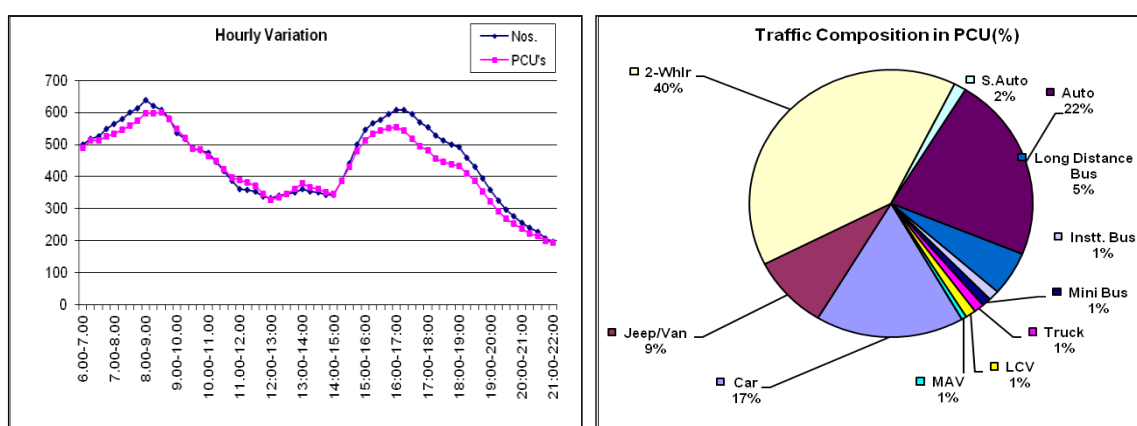


Figure 4-8 Hourly Variations and Traffic Composition at Bagathi Vedant Road

b. Narmada Complex: Hourly variation & composition are presented in **Figure 4-9**.

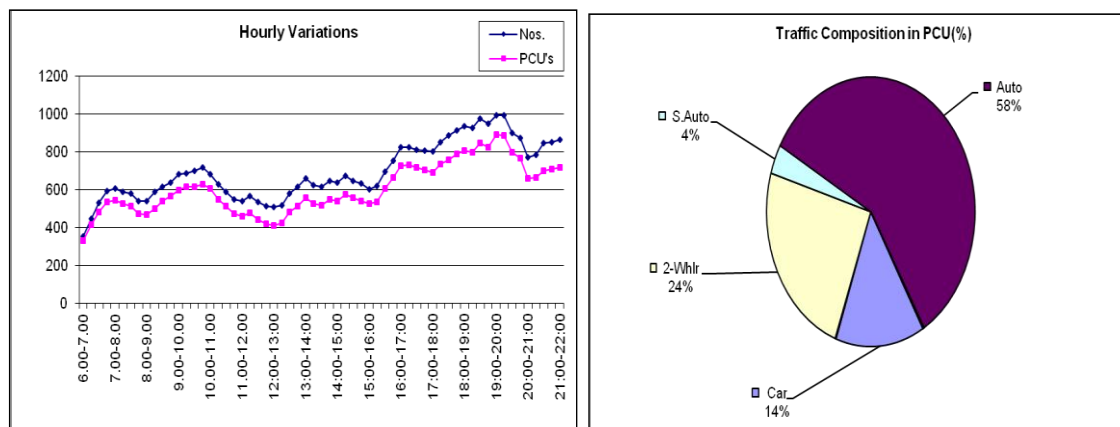


Figure 4-9 Hourly Variations and Traffic Composition at Narmada Complex

c. Navghar Road: Hourly variation of traffic and composition are presented in **Figure 4-10**.

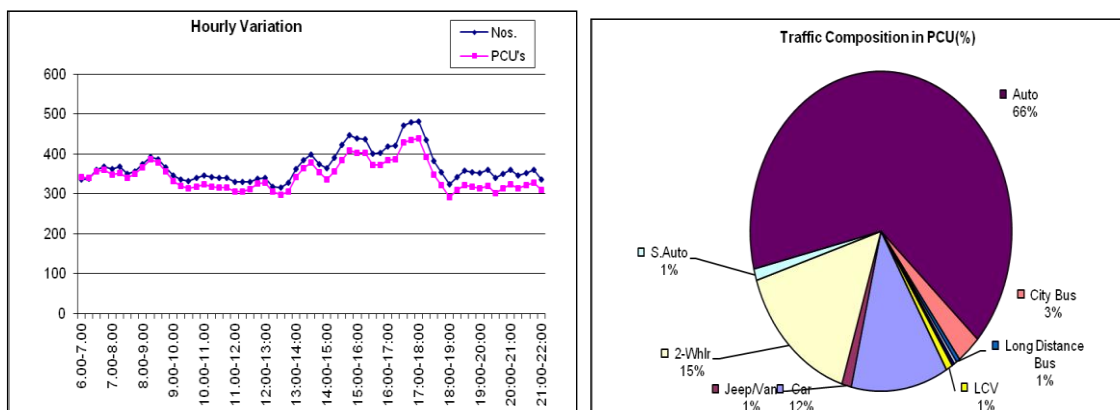


Figure 4-10 Hourly Variations and Traffic Composition at Navghar Pada

d. Vinayak Mandal: Hourly variation and traffic composition are presented in **Figure 4-11**

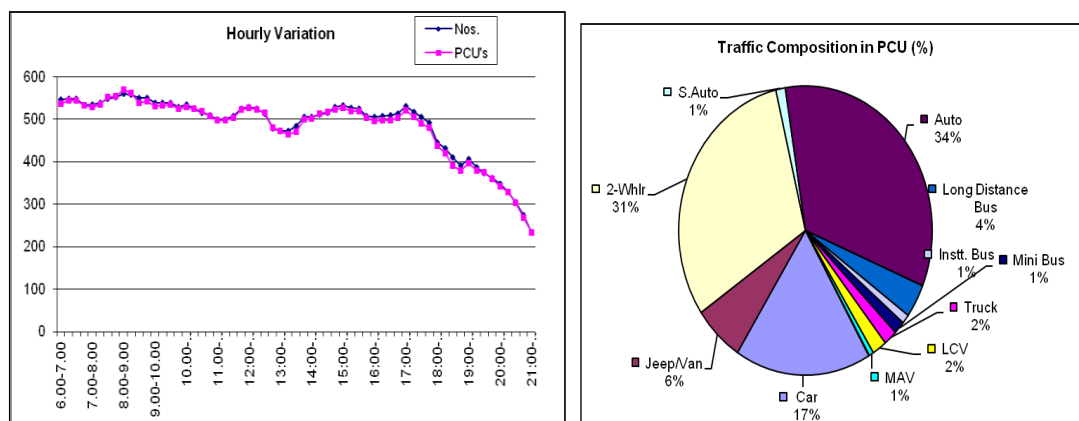


Figure 4-11 Hourly Variations and Traffic Composition at Vinayak Mandal, Cabin Road

e. **Uttan Road flyover:** Hourly variation & traffic composition are presented in **Figure 4-12**.

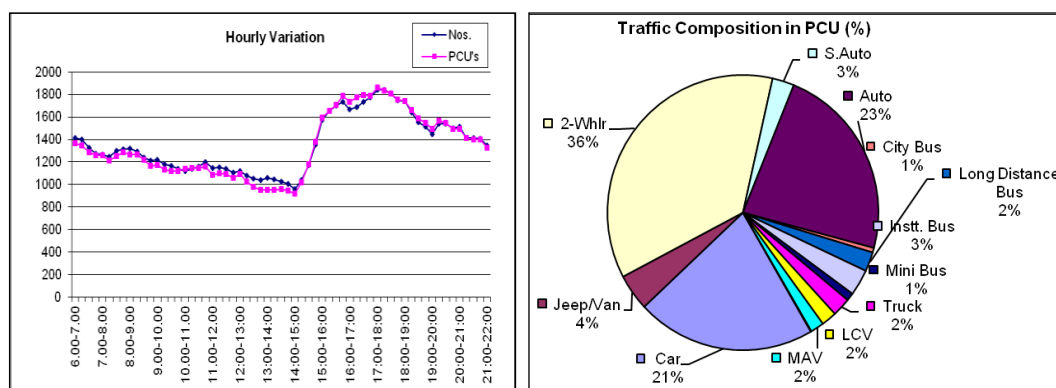


Figure 4-12 Hourly Variations and Traffic Composition at Uttan Road flyover

f. **SaiPetrolPump,:** Hourly variation & traffic composition are presented in **Figure 4-13**.

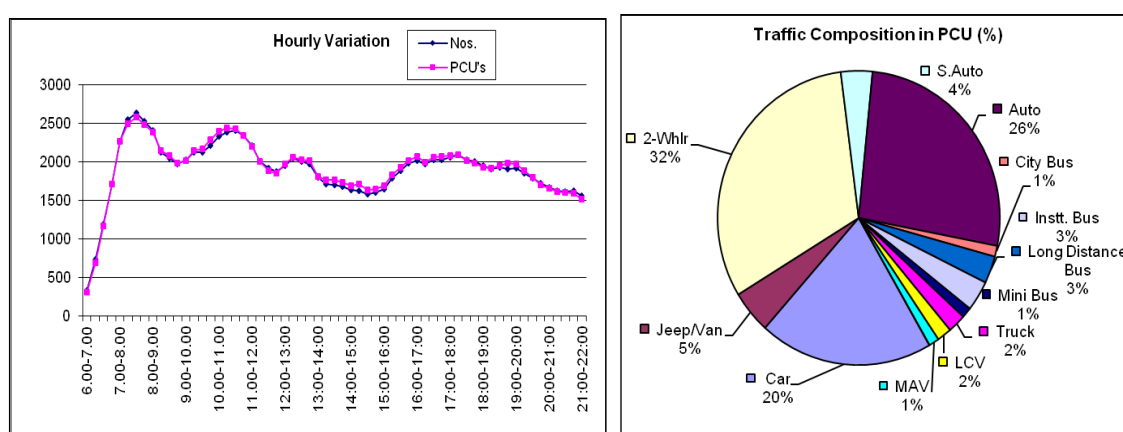


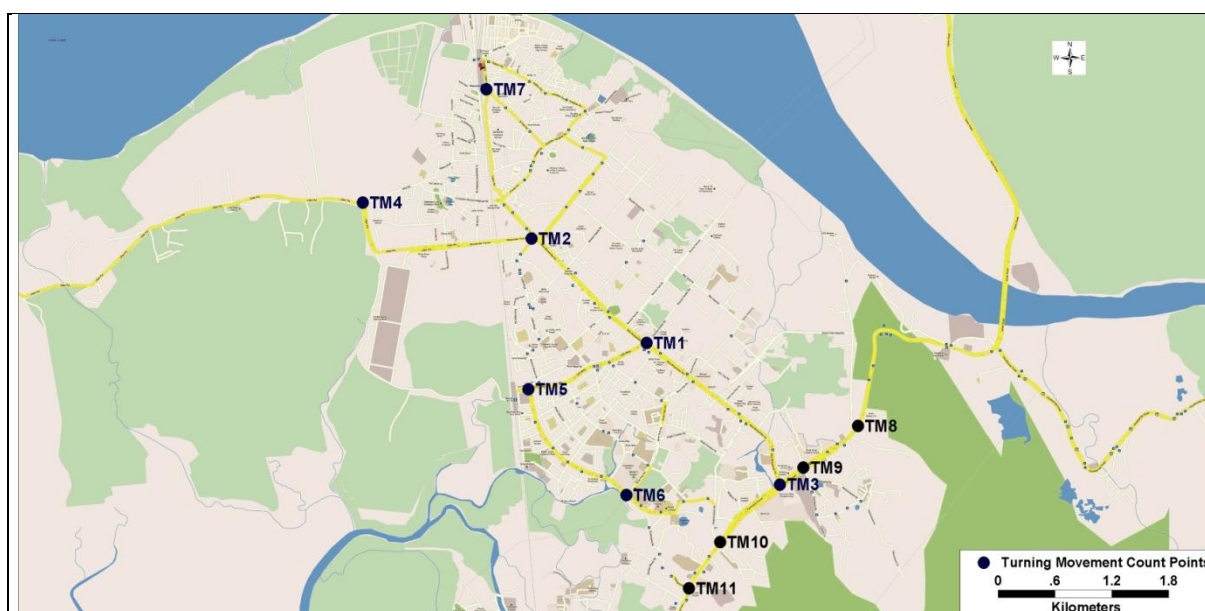
Figure 4-13 Hourly Variations and Composition at Sai Petrol Pump, Mira Bhayandar Road

Turning Movement Count Survey at Intersections

Surveys were conducted at critical intersections identified within the study area. The intersection data helped in identifying the traffic issues at the intersections, critical movements, etc. Counting of vehicles classified by mode was done at the selected locations for 16 hours (06:00 to 22:00) on a typical fair weather working day. The turning data was used to validate the turn volumes obtained from travel demand model. The locations where the surveys were conducted are tabulated in **Table 4-11** and shown in **Figure 4-14**.

Table 4-11: Survey locations for Turning Movement Counts

Sr No.	Code	Description
1	IS-1	Jichakar Chowk (4 Arm Intersection)
2	IS-2	Golden Nest Junction (5 Arm Intersection)
3	IS-3	Kashimira Junction (3 Arm Intersection with flyover above)
4	IS-4	Uttan Road Junction (3 Arm Junction)
5	IS-5	Mira Road Station East Junction (4 Arm Intersection)
6	IS-6	Surya Complex Junction on Bhakti Vedanta Road (3 Arm Intersection)
7	IS-7	Bhayandar Stn West Junction (3 Arm Intersection)
8	IS-8	Delhi Darbar Inn Junction on NH-8 (3 Arm Intersection)
9	IS-9	Kashi Gaon Junction (4 Arm Junction)
10	IS-10	MIDC Road Junction on NH-8 (3 Arm Intersection)
11	IS-11	Penkarpada Road Junction on NH-8 (3 Arm Intersection)

**Figure 4-14 Intersection Survey Locations**

The traffic data collected from the field was scrutinized and processed to get the required outputs. The traffic counts both in terms of numbers of vehicles and passenger car units (PCUs) have been computed for the total daily (16 hour) traffic at various intersections. It is observed that the traffic at different locations varies significantly from Junction to Junction. Traffic intensity at intersections during morning and evening peak hours is presented from **Figure 11-1 to Figure 11-19** while the summary table is presented in **Table 4-12**.

Table 4-12: Traffic intensity Summay at all 11 intersections

Sr. No.	Location Code	16 hours (06:00 to 22:00)		Morning peak hour			Evening peak hour		
		PCU	Vehicle	Time	PCU	Vehicles	Time	PCU	Vehicle
1	IS-1	110070	118301	10:30-11:30	6249	6593	19:00-20:00	10104	10985
2	IS-2	90278	96574	10:15-11:15	6270	6649	18:00-19:00	7403	7810
3	IS-3	71825	63254	09:30-10:30	4443	3854	19:00-20:00	5650	5274
4	IS-4	13873	13729	10:15-11:15	1213	1172	19:00-20:00	902	901
5	IS-5	27770	30293	10:30-11:30	1538	1751	19:30-20:30	2763	3018
6	IS-6	18472	21169	10:15-11:15	1126	1325	17:30-18:30	1352	1556
7	IS-7	8539	10107	09:30-10:30	528	623	17:30-18:30	637	734
8	IS-9	19165	21169	10:00-11:00	1649	1484	17:30-18:30	842	789
Sr. No.	Location Code	8 hours (06:00 to 14:00)		Morning peak hour					
		PCU	Vehicle	Time	PCU	Vehicle			
9	IS-8	3918	2718	10:30-11:30	729	475			
10	IS-10	6986	7651	08:45-09:45	1055	1085			
11	IS-11	5744	5590	09:30-10:30	897	868			

Traffic Flow in Morning and Evening Peak Hour

The morning and evening peak hour traffic flow diagrams of each surveyed intersections are given above.

1. **Jichkar Chowk (IS-1):** It is a 4 arm roundabout having no pedestrian crosswalk. Traffic flow in peak hours at this junction is shown in **Figure 11-1** and **Figure 11-2**. Traffic flow is highest in the evening peak hour (10104 pcu), that signifies the need of intersection improvement as a total volume of 3000 vehicle per hour entering from all the legs of the intersection.
2. **Golden Nest Junction (IS-2):** It is a signalized 5 arm intersection without proper pedestrian crosswalk markings. Traffic flow in peak hours at Golden Nest Jn is shown in **Figure 11-3** and **Figure 11-4**.
3. **Kashimira Jn (IS-3):** It is a signalized 3 arm intersection with a flyover above connecting Dahisar and virar. Traffic flow in peak hours at Kashimira Jn is shown in **Figure 11-5** and **Figure 11-6**.
4. **Uttan Road Jn (IS-4):** It is an unsignalised 3 arm intersection with no pedestrian crosswalk. This road is used to travel to Essel world. Traffic flow in peak hours at Uttan Road Jn is shown in **Figure 11-7** and **Figure 11-8**. Traffic flow is highest in the morning peak hour (1213 pcu).
5. **Mira Road Stn East Jn (IS-5):** It is a 4 arm intersection. Traffic flow in peak hours at Uttan Road Jn is shown in **Figure 11-9** and **Figure 11-10**. Traffic flow is highest in the morning peak hour (2763 pcu).
6. **Surya Complex Jn (IS-6):** It is a 3 arm unsignalized intersection on Bhakti Vedanta swami Road. Traffic flow in peak hours at Surya Complex Jn is shown in **Figure 11-11** and **Figure 11-12**.
7. **Bhayandar Station West (IS-7):** It is a 3 arm unsignalised intersection with no pedestrian crosswalk. Traffic flow in peak hours is shown in **Figure 11-13** and **Figure 11-14**.
8. **Delhi Darbar Inn Jn (IS-8):** It is a 3 arm unsignalised intersection with no pedestrian crosswalk. Significant amount of traffic is entering Mira Bhayandar from NH-8. A total of

729 PCU is the observed during morning peak hour to & fro from Mira Bhayandar to NH8.

- 9. Kashi Gaon Jn (IS-9):** It is a 4 arm unsignalised intersection with no pedestrian crosswalk. Significant amount of traffic is entering Kashi Gaon & Market area from NH-8. Without considering the through traffic on NH-8, the turning traffic to and from Mira Bhayandar was surveyed.
- 10. MIDC Road Jn (IS-10):** It is a 3 arm unsignalised intersection with no pedestrian crosswalk. Significant amount of traffic is entering Mira Bhayandar from NH-8. A total of 1055 PCU is the observed morning peak hour to & fro from Mira Bhayandar.
- 11. Penkarpada Road Jn (IS-11):** It is a 3 arm unsignalised intersection with no pedestrian crosswalk. Significant amount of traffic is entering Mira Bhayandar from NH-8. A total of 897 PCU is the observed morning peak hour to & fro from Mira Bhayandar.

Outer Cordon Classified Traffic Volume Count and Origin Destination Survey

Interviews were carried out on a sample basis on a typical working day by stopping the vehicles with the help of police. The information collected includes origin and destination of trip, occupancy, trip purpose and frequency. This survey was carried out for 24 hours along with the classified traffic counts in following locations. The locations where outer cordon surveys were conducted are tabulated in **Table 4-13** and shown in **Figure 4-15**.

Table 4-13: Outer Cordon Locations

Sr No.	Code	Description
1	OC1	Near IRB Toll Plaza
2	OC2	Ghodbandar Road
3	OC3	Near to DMart Mall
4	OC4	Near Dahisar Toll Plaza

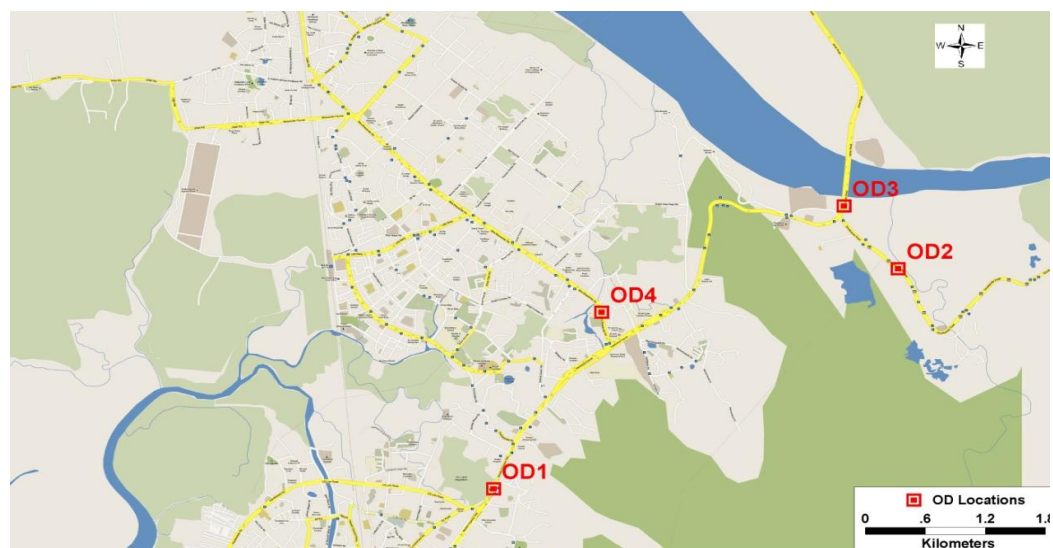


Figure 4-15 Outer Cordon Locations

Summary of the volume count in terms of number of vehicles and PCU for 24 hours are presented in **Table 4-14**.

Table 4-14: Summary of Cordon Count

Location Code	Location Name	Direction Name	PCUs (24 hours)	Morning Peak		Evening Peak	
				Time (hours)	PCU	Time (hours)	Evening Peak PCU
OC1	Near IRB Toll Plaza	Direction 1: Thane to Ghodbander	20697	09.30	3061	18.00	3494
		Direction 2: Godbandher to Thane	28533	10.30		19.00	
OC2	Ghodbandar Road	Direction 1: Ahmedabad to Mumbai	32625	08.45	3824	18.15	3387
		Direction 2: Mumbai to Ahmedabad	33246	09.45		19.15	

Location Code	Location Name	Direction Name	PCUs (24 hours)	Morning Peak		Evening Peak	
				Time (hours)	PCU	Time (hours)	Evening Peak PCU
OC3	Near to DMart Mall	Direction 1: Bhayandar to Kashmira Flyover	12886	10.45 –	1961	17.45 –	1895
		Direction 2: Kashmira Flyover to Bhayandar	14060	11.45		18.45	
OC4	Near Dahisar Toll Plaza	Direction 1: Ahmedabad to Dahisar	46379	10.00 –	5613	17.00 –	3993
		Direction 2: Dahisar to Ahmedabad	45912	11.00		18.00	

On an average, about 29326 vehicles enter/ exit Mira Bhayandar from all the four cordon points. The total daily traffic was about 2.34 lakh PCU. Maximum vehicles enter/exit through Dahisar Toll Plaza.

Traffic Composition: Composition of Traffic plying at the outer Cordon locations has been done by converting the vehicles into PCUs and is presented in **Figure 4-16 to Figure 4-19**.

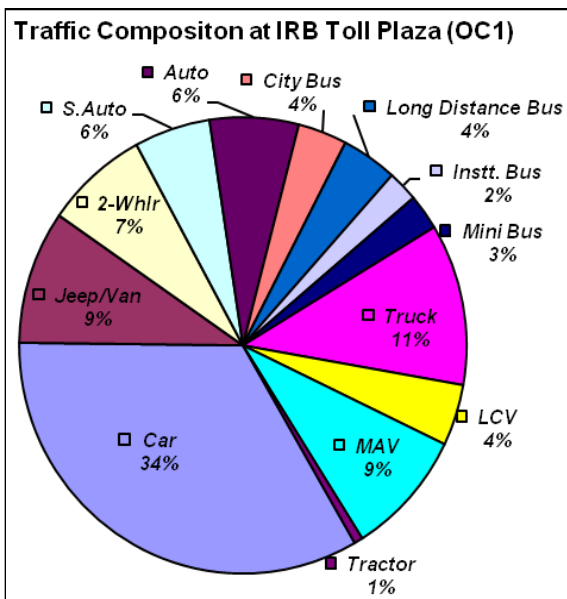


Figure 4-16 IRB Toll Plaza

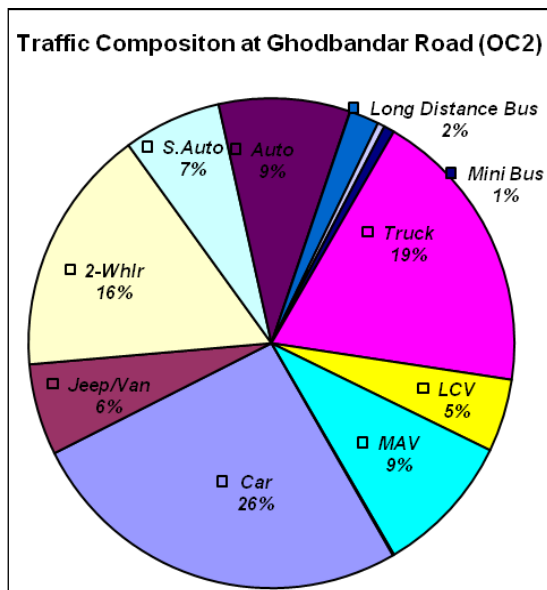


Figure 4-17 Ghodbandar Road

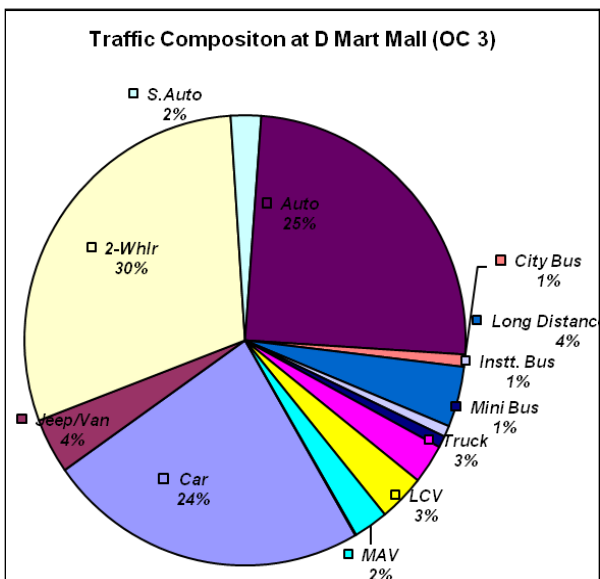


Figure 4-18 D Mart Mall

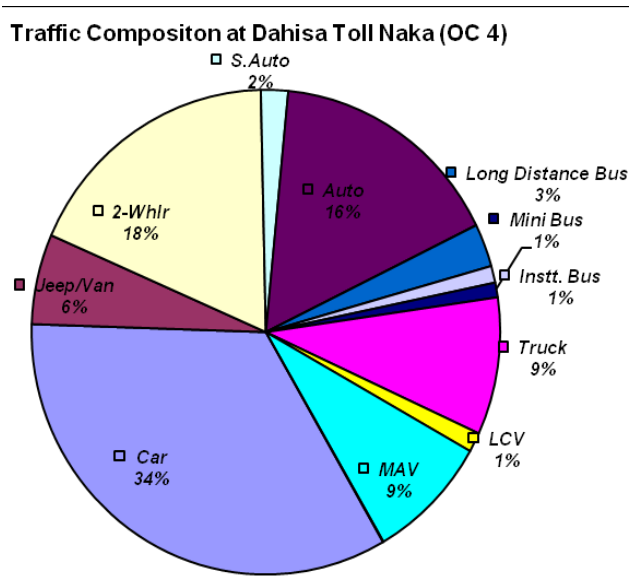


Figure 4-19 Dahisar Toll Naka

The Outer cordon traffic counts reveal that high amount of car traffic enter and exit the city through Dahisar, Ghodbandar and IRB Toll plaza which indicates relatively short distance trips being made through this road. A typical traffic character is seen in the rest of the locations where the Goods vehicles forms a major share of traffic with Ghaodbandar Road having 33%, Dahisar Toll Plaza and IRB Toll Plaza is having 20% and 24% goods traffic respectively.

Trip Purpose of passenger OD: Most of the trips made to and from the city are for the purpose of employment as Mira Bhayandar being one of the largest suburbs of Mumbai. After employment, the next important reason for travel to and from Mira Bhayandar is for social purpose. **Table 4-15** shows the share of trips by purpose.

Table 4-15: Trip Purpose of Passengers at Outer Cordon

Purpose	Work	Education	Business	Tourism	Social	Other	Total
OC 1	1237	313	186	218	1030	228	3212
OC 2	1217	348	312	172	906	243	3198
OC 3	356	108	75	121	294	32	992
OC 4	1107	149	165	119	599	78	2217
Total	3917	918	738	630	2829	581	9619
Percentage	40.72	9.54	7.67	6.55	29.41	6.04	100.00

Trip Frequency of Passenger and Goods OD: Highest number of passenger trips (42%) observed at the outer cordon points were daily trips, as majority of the trips to and from the Mumbai city are for official purposes.

In case of goods traffic, maximum trips (50%) are made daily or every alternate day and the rest of the goods trips are made with more than a week interval. **Table 4-16** shows the trip frequency of goods vehicles.

Table 4-16: Trip Frequency of Goods Vehicles

	Car	TW	Taxi	Goods
Frequency	(%age)	(%age)	(%age)	(%age)
Daily	26.17	55.85	44.56	32.63
Alternate day	19.30	15.27	12.26	18.68
Weekly	7.65	6.07	4.94	19.46
Monthly	17.72	8.06	9.24	20.94
Occasionally	29.16	14.75	29.00	8.28
Total	100.00	100.00	100.00	100.00

4.3.4 Parking Characteristics

Parking surveys have been conducted for a period of 12 hrs continuously. Survey data was analyzed and the findings such as accumulation of vehicles and duration of parking were worked out.

The Equivalent Car Spaces (ECS) adopted for different vehicle types for the analysis are given in **Table 4-17**.

Table 4-17: ECS Values Adopted for Various Vehicle Types

S. No.	Vehicle Category	ECS
1	Car	1.0
2	Two Wheelers	0.2
3	Bus	2.5
4	Trucks	2.5
5	LCV	1.75
6	Auto Rickshaw	0.5
7	Cycle	0.1

Duration of parking: There is no significant variation in terms of duration of parked vehicles among the locations surveyed. More than 70% of vehicles are parked for less than 2 hours except at Bailey Road location. The duration of vehicles parked at all the survey locations is shown in **Figure 4-20**.

Composition of parked Vehicles: The composition of vehicles parked at all the locations is shown in **Figure 4-21**. Car shared the majority of the total vehicles parked, which is 49% of the total vehicles followed by two wheeler share of 37%.

Peak hour accumulation at all parking locations is presented in **Table 4-18**. It is observed that peak hour accumulation varies for 38 ECS at Shree Om Chowk to 118 ECS at Kashmira Junction.

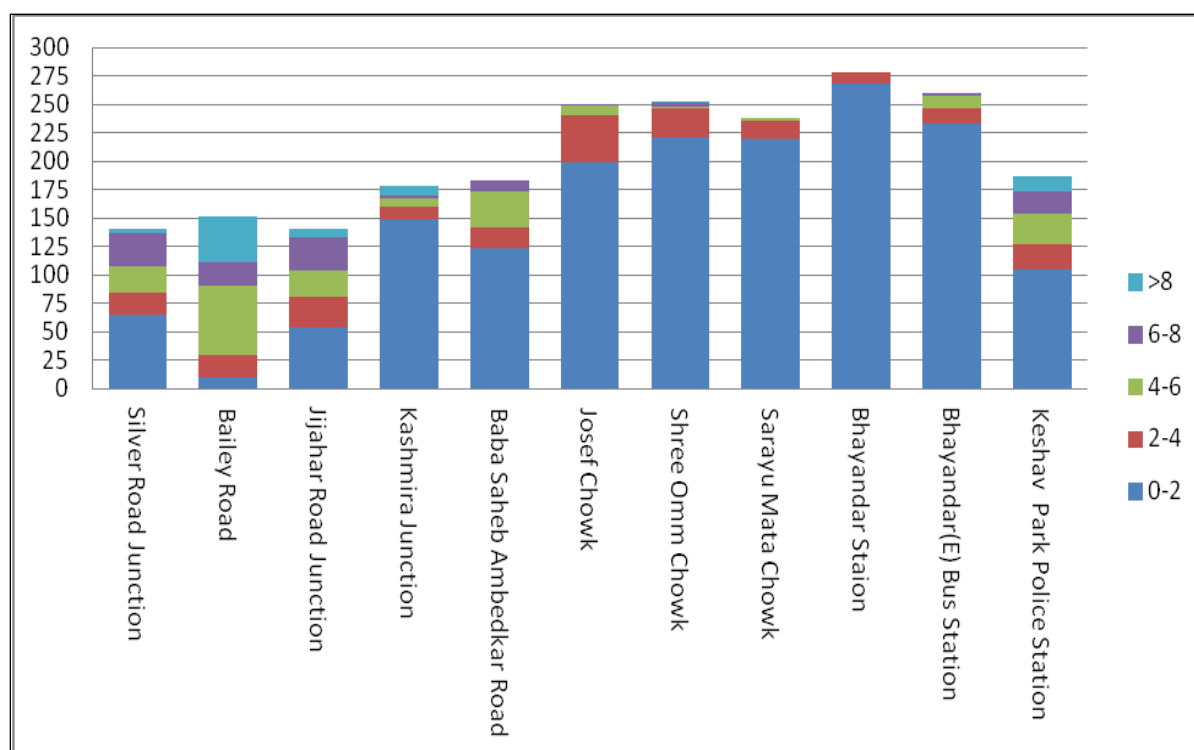


Figure 4-20 Duration of Parked vehicles at different locations

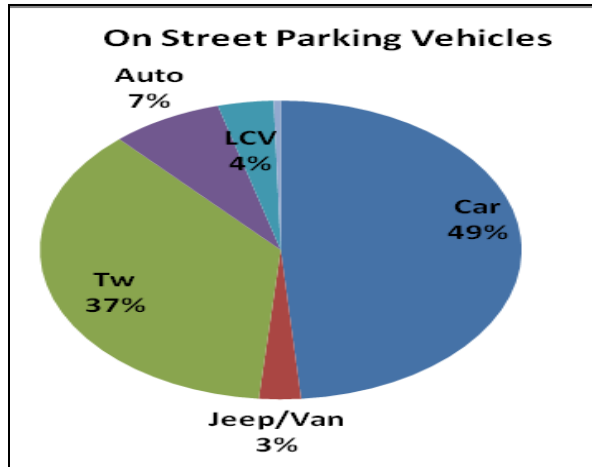


Figure 4-21 Composition of Parked Vehicles

Table 4-18: Peak hour accumulation

Sr No	Location	Parking Type	Peak Accumulation								Peak Accumulation Equivalent Car spaces (ECS)
			Peak Time	Car	2-Wh	Auto	LCV	Bus	Truck	MAV	
1	Silver Road Junction	On	1600-1700	48	0	27	0	0	0	0	54.75
2	Bailey Road	On	0800-0900	45	0	33	0	0	0	0	53.25
3	Jijahar Road Junction	On	1400-1500	43	10	20	0	0	0	0	58.00
4	Kashmira Junction	On	1800-1900	45	1	0	0	24	0	0	118.00
5	Baba Saheb Ambedkar Road	On	1300-1400	57	3	12	0	0	0	0	63.00
6	Josef Chowk	On	0600-0700	43	1	34	9	0	0	0	61.50
7	Shree Omm Chowk	On	0700-0800	16	0	44	2	3	0	0	38.00
8	Sarayu Mata Chowk	On	0700-0800	53	2	24	0	1	0	0	64.00

Sr No	Location	Parking Type	Peak Accumulation								Peak Accumulation Equivalent Car spaces (ECS)
			Peak Time	Car	2-Wh	Auto	LCV	Bus	Truck	MAV	
9	Bhayandar Staion	On	0900-1000	25	3	38	24	0	0	4	73.50
10	Bhayandar(E) Bus Station	On	1000-1100	11	4	53	19	4	0	0	59.25
11	Keshav Park Police Station	On	2000-2100	30	0	30	10	0	0	0	47.50

4.3.5 Road Network Characteristics

The appreciation of road network characteristics is important to assess existing capacity level of the roads, level of service offered, identify the constraints and assess the potential for improvement/ up gradation of the road network to cater to the existing and projected demands of traffic.

Road network inventory has been aimed at developing the network database with the existing features of roadway sections covering the study area. Detailed road inventory has been done on all major roads covering a total of 117 kms.

The road network inventory data has been analysed in terms of parameters like type of pavement, Right of Way (RoW), carriageway, road classification, service lane availability, on-street parking, drainage facilities, footpath, street light facilities, road markings and road signage.

Right of Way: Majority of roads in the study area have Right of Way less than 20m (84%) and 9% of roads have ROW greater than 30m as shown in **Table 4-19**. The corresponding figure is shown in **Figure 4-22**.

Table 4-19: Available ROW

S.No	Right of Way (m)	% of Road Length
1	<=10	53%
2	10 to 20	31%
3	20 to 30	8%
4	30 to 40	8%
5	> 40	1%

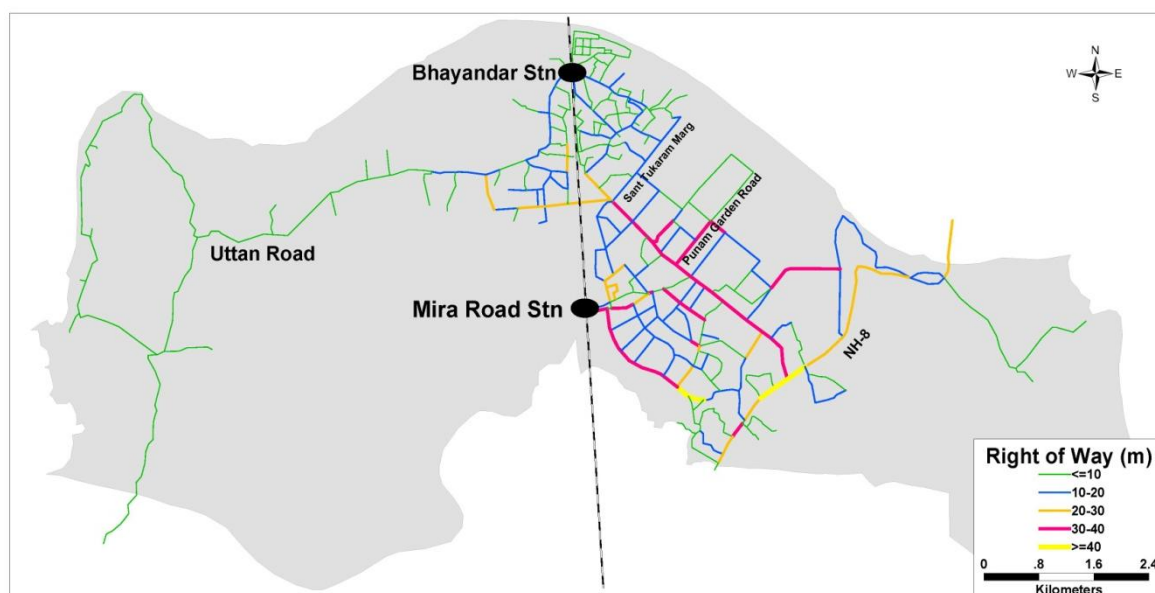


Figure 4-22 Right of Way map for Mira Bhayandar

Carriageway Width: The distribution of road length by carriageway width shows that nearly 92 percent of the road network has 5 or more lanes, which reflects on the good availability of carriage way in Mira Bhayandar and also 51 percent of the network having 3 to 4 lanes width shows good planning and potential for traffic flow improvement. The distribution of road length by carriageway width is presented in **Table 4-20**.

Table 4-20: Distribution of road length by number of lanes

Sr. No.	Total No. of Lanes (Both Sides)	Percentage of Road Length
1	< = 2 lanes	60%
2	2-4 Lanes	22%
3	4-6 Lanes	6%
4	6-8 Lanes	9%
5	>8 Lanes	3%

In most of the commercial areas in Bhayandar East, the actual width of carriageway is reduced due to encroachment by shopkeepers, street vendors and on street parking, which increases traffic congestion, as shown in **Figure 4-23**. The road length distribution is shown pictorially in **Figure 4-24**.



Figure 4-23 Traffic situation in Bhayandar East

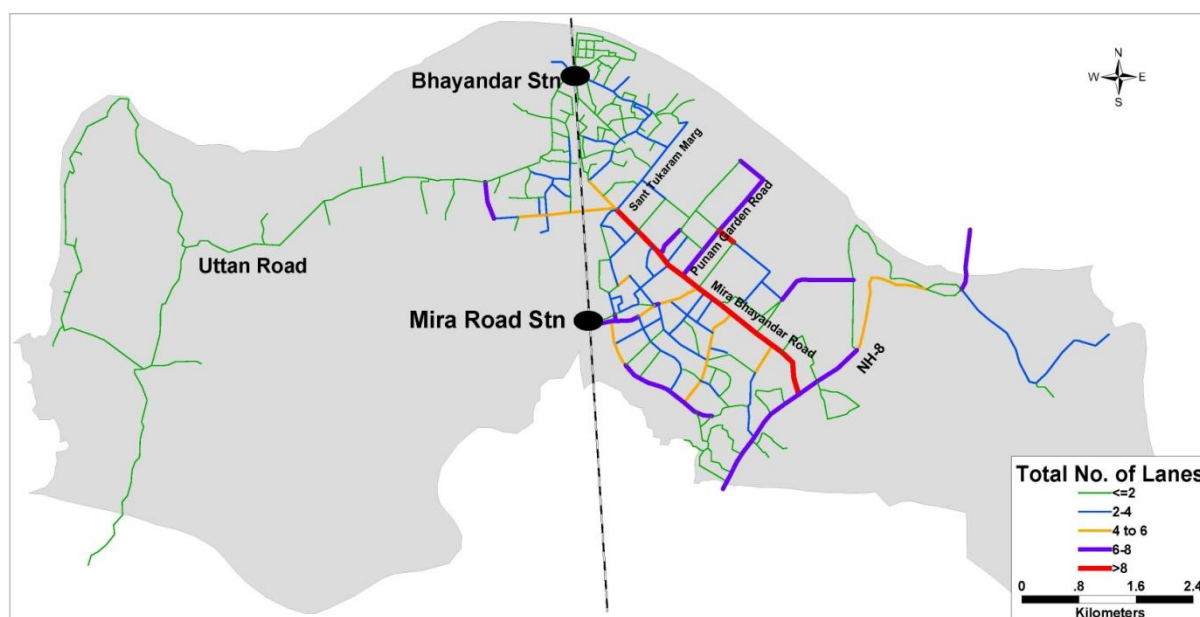


Figure 4-24 Distribution of Road Length based on number of lanes

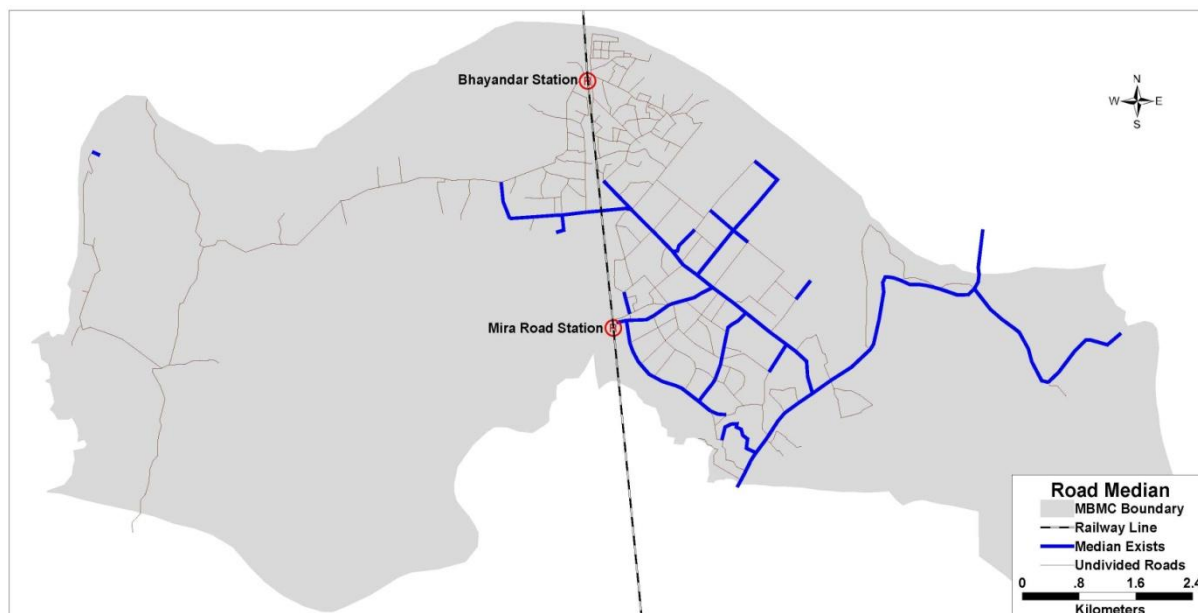
Availability of median: About 25 percent of the road length in the city has divided carriageway and further the balance roads needs attention in view of inadequate safety measures. The distribution of road length with availability of median is presented in **Table 4-21** and **Figure 4-25**.

As shown in the adjacent diagram both zebra crossing and median are intruded by car parking.



Table 4-21: Distribution of road length by type of carriageway

Sr. No.	Type of carriageway	Percentage of Road Length
1	Divided	23
2	Undivided	77

**Figure 4-25 Availability of Median in Mira Bhayandar**

Availability of Drainage: Storm Water Drainage plays an important role in maintaining the quality of road surface. It is observed that about 81% of roads do not have storm water drains, and 12% of roads have storm water drain but they are open drains, as shown in **Table 4-22**.

Table 4-22: Availability of storm water drains on road network

Drainage		Percentage of Road Length
Availability	Open	12.12
	Closed	6.87
Non Availability		81.01

4.3.6 Speed & Delay Characteristics

The principle objective of speed & delay survey was to find out the journey speed, running speed and delay of traffic flow of a road or entire road network system.

This survey was carried out on peak hours as well as non peak hours on a network of 137 kms within the city of Mira Bhayandar. Collection of delay information on different road stretches and at intersections/level crossings in the study area was also done.

The survey has been conducted using moving car observer method. The enumerators travelled along the stream by noting down the time of stop of the vehicle on the road stretches, at intersections and the reasons for the delay. The major roads which were covered are Mira Bhayandar Road, Golden Nest Road, Station Road, Jesal Park Road and Navghar. Distribution of road length by journey speed is shown in **Table 4-23**. It is observed that most of the roads have speeds ranging from 20 to 40 KMPH.

Table 4-23: Distribution of Road Length by Journey Speed

Journey Speed (Km/hr.)	Corridor Road Length (In Km.)			
	Peak Period	Percentage	Off-Peak Period	Percentage
<=10	1.87	1.36	0	0.00
11--20	4.32	3.15	1.87	1.36
21--30	63.145	46.01	51.512	37.53
31--40	67.019	48.83	78.762	57.38
>40	0.9	0.66	5.11	3.72
TOTAL	137.254	100.00	137.254	100.00

It is observed that about 78% of delays in peak hours are for less than 30 seconds and 6 % are between 31 – 60 seconds. **Table 4-24** presents the distribution of delay by delay points for peak and off-peak period.

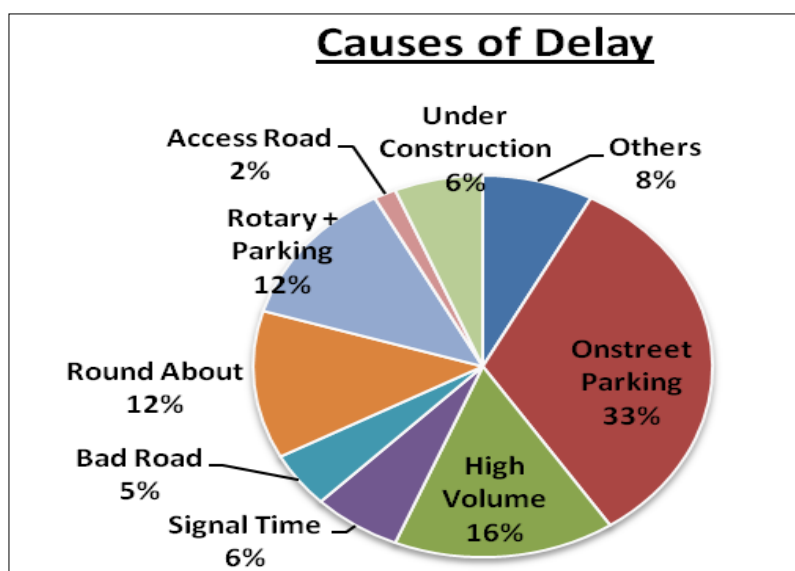


Figure 4-26 Causes of Delay

Table 4-24: Distribution of Delay Time by delay points

Delay Time (in seconds)	Peak Period		Off-Peak	
	Number of Points	Percentage	Number of Points	Percentage
<=30	61	88.41	23	85.19
31--60	4	5.80	1	3.70
61--120	4	5.80	1	3.70
121--180	0	0.00	2	7.41
> 180	0	0.00	0	0.00
TOTAL	69	100.00	27	100.00

Cause of Delay

The cause of delay from the survey analysis is shown in **Figure 4-26**. It clearly indicates that the major cause of delay is on-street parking and standing/stopping of vehicles on road. High traffic volume in peak hour is also one of the causes, but it is typical of any peak hour character.

4.3.7 Railway Station Characteristics

Passenger count and Interview surveys were conducted at existing two railway stations Mira Road and Bhayandar for 16 hrs (06:00 hrs to 22:00 hrs). **Figure 4-27** shows the key plan for entry and exit of passengers in Mira Road Station.

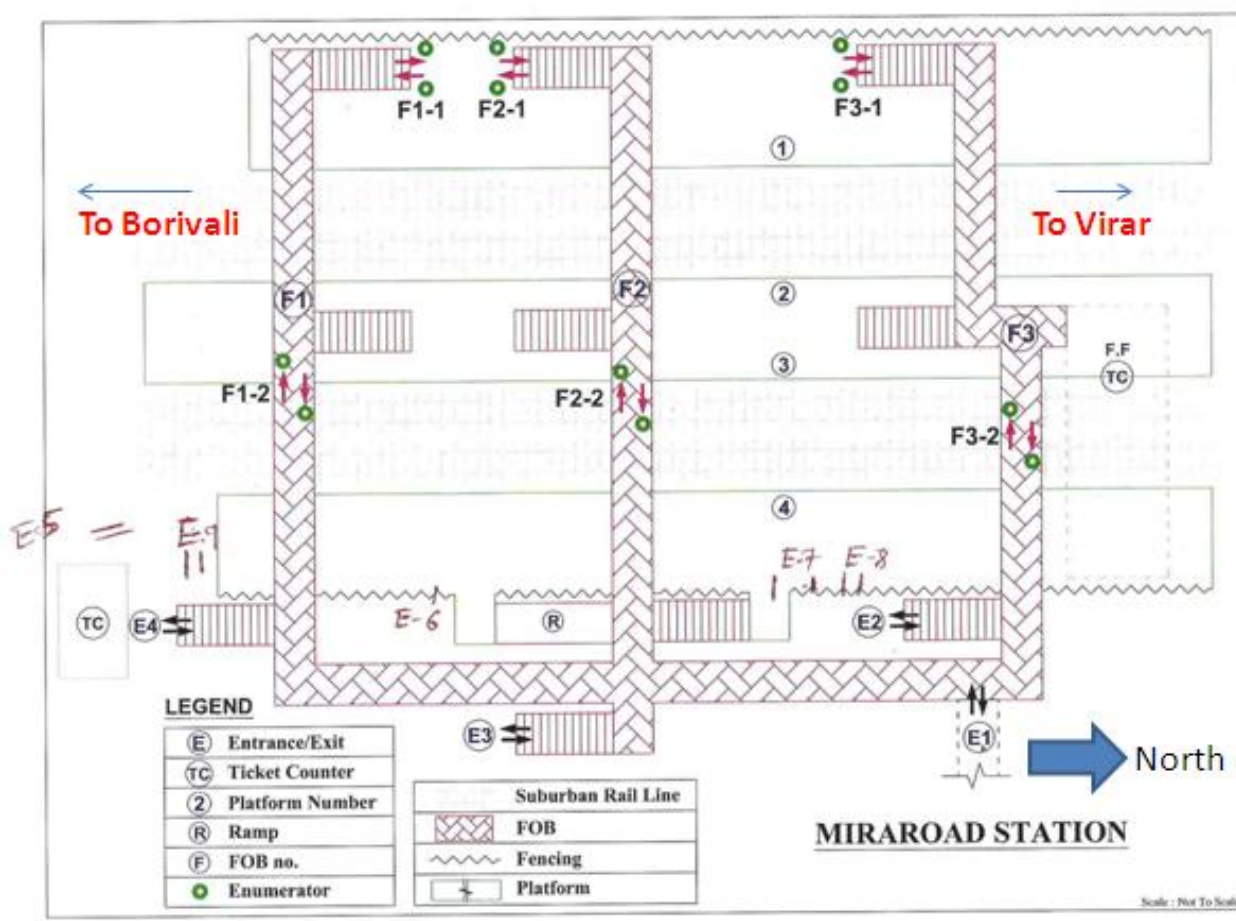


Figure 4-27 Mira Road Station Entry & Exit Plan

The counting of all entry and exit passengers was done meticulously at all entry/exit points. **Table 4-25** shows the summary of passengers entering and exiting Mira road station. It is observed that more than 8000 passengers enter Mira road station during the morning peak hour 08:45 to 09:45 and similarly in the evening peak period 18:00 hrs to 20:00 hrs more than 16000 passengers exit from Mira road station. A total of more than 96,000 passengers enter and exit Mira Road station.

Table 4-25 Summary of Entry & Exit Passengers for Mira Road Station

Time	Number of Passengers Entered	Number of Passengers Exited
6.00 to 6.15	229	234
6.15 to 6.30	312	344
6.30 to 6.45	360	387
6.45 to 7.00	406	351
7.00 to 7.15	411	462
7.15 to 7.30	526	487
7.30 to 7.45	761	642
7.45 to 8.00	900	820
8.00 to 8.15	1533	1365
8.15 to 8.30	1757	1309
8.30 to 8.45	1717	1427
8.45 to 9.00	2026	1702
9.00 to 9.15	2064	1541
9.15 to 9.30	2137	1624
9.30 to 9.45	2149	1775
9.45 to 10.00	2071	1609
10.00 to 10.15	1877	1891
10.15 to 10.30	1960	1578
10.30 to 10.45	1914	1744
10.45 to 11.00	1967	1388
11.00 to 11.15	1930	1444
11.15 to 11.30	1993	1341
11.30 to 11.45	1950	1574
11.45 to 12.00	1805	1546
12.00 to 12.15	1921	1666
12.15 to 12.30	1857	1979
12.30 to 12.45	1848	1556
12.45 to 13.00	1613	1515
13.00 to 13.15	1466	1400
13.15 to 13.30	1328	1491
13.30 to 13.45	1369	1354
13.45 to 14.00	1352	1437
14.00 to 14.15	1256	1306
14.15 to 14.30	1565	1157
14.30 to 14.45	1657	1369
14.45 to 15.00	1666	2020
15.00 to 15.15	1648	1580
15.15 to 15.30	1766	1234
15.30 to 15.45	1775	1905
15.45 to 16.00	1602	1270

Time	Number of Passengers Entered	Number of Passengers Exited
16.00 to 16.15	1581	1447
16.15 to 16.30	1487	1384
16.30 to 16.45	1492	1583
16.45 to 17.00	1570	1692
17.00 to 17.15	1913	1772
17.15 to 17.30	1975	1779
17.30 to 17.45	2119	1808
17.45 to 18.00	1948	1630
18.00 to 18.15	1995	1726
18.15 to 18.30	2070	2284
18.30 to 18.45	1974	2161
18.45 to 19.00	2058	2262
19.00 to 19.15	2398	2387
19.15 to 19.30	1973	2363
19.30 to 19.45	1642	2108
19.45 to 20.00	1304	2423
20.00 to 20.15	1576	1929
20.15 to 20.30	1662	1775
20.30 to 20.45	1238	1723
20.45 to 21.00	1090	1701
21.00 to 21.15	1154	1433
21.15 to 21.30	1040	1475
21.30 to 21.45	853	1352
21.45 to 22.00	814	1207
Total	99370	96228

Figure 4-28 shows the key plan for entry and exit of passengers in Bhayandar Station. **Table 4-26** shows the summary of passengers entering and exiting Bhayandar station. It is observed that more than 8000 passengers enter Bhayandar station during the morning peak hour 08:45 to 09:45 and similarly in the evening peak hour 18:45 hrs to 19:45 hrs more than 12000 passengers exit from Bhayandar station. A total of more than 1 lakh passengers enter and exit Bhayandar Station.

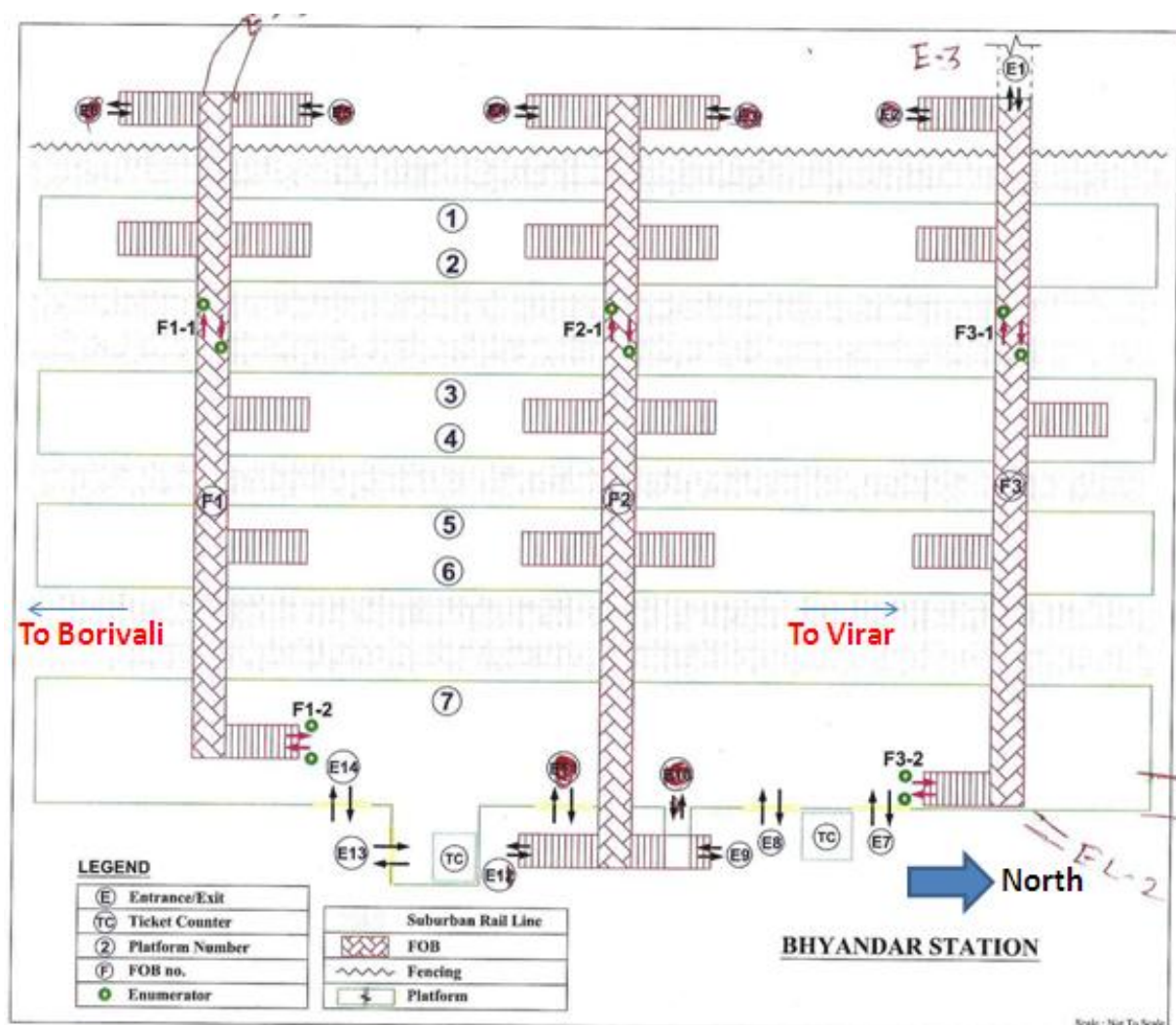


Figure 4-28 Bhayandar Station Entry & Exit Plan

Table 4-26 Summary of Entry & Exit Passengers for Bhayandar Station

Time	Number of Passengers Entered	Number of Passengers Exited
6.00 to 6.15	404	373
6.15 to 6.30	599	389
6.30 to 6.45	747	493
6.45 to 7.00	922	613
7.00 to 7.15	915	686
7.15 to 7.30	959	857
7.30 to 7.45	1075	927
7.45 to 8.00	1053	980
8.00 to 8.15	1614	1580
8.15 to 8.30	1887	1866
8.30 to 8.45	1740	2253
8.45 to 9.00	2227	2090
9.00 to 9.15	2034	2005

Time	Number of Passengers Entered	Number of Passengers Exited
9.15 to 9.30	1870	1932
9.30 to 9.45	2126	2091
9.45 to 10.00	2279	1941
10.00 to 10.15	1969	1752
10.15 to 10.30	1915	1886
10.30 to 10.45	1985	2226
10.45 to 11.00	1815	1810
11.00 to 11.15	1590	1647
11.15 to 11.30	1940	1911
11.30 to 11.45	2129	2507
11.45 to 12.00	2215	1687
12.00 to 12.15	2064	1525
12.15 to 12.30	2103	1562
12.30 to 12.45	1650	1498
12.45 to 13.00	1424	1708
13.00 to 13.15	1406	1624
13.15 to 13.30	1376	1510
13.30 to 13.45	2048	1623
13.45 to 14.00	1588	1455
14.00 to 14.15	1847	1355
14.15 to 14.30	1352	1346
14.30 to 14.45	1705	1430
14.45 to 15.00	1315	1471
15.00 to 15.15	1799	1372
15.15 to 15.30	1479	1166
15.30 to 15.45	1870	1447
15.45 to 16.00	1794	1299
16.00 to 16.15	1445	1461
16.15 to 16.30	1868	1294
16.30 to 16.45	1488	1484
16.45 to 17.00	1766	1579
17.00 to 17.15	1466	1497
17.15 to 17.30	1536	1651
17.30 to 17.45	1590	2053
17.45 to 18.00	1694	1987
18.00 to 18.15	1263	1733
18.15 to 18.30	1488	2754
18.30 to 18.45	1369	2433
18.45 to 19.00	1442	3340
19.00 to 19.15	1401	3154
19.15 to 19.30	1659	2955
19.30 to 19.45	1423	3066
19.45 to 20.00	1418	3189
20.00 to 20.15	1375	2580

Time	Number of Passengers Entered	Number of Passengers Exited
20.15 to 20.30	1386	2851
20.30 to 20.45	1560	3013
20.45 to 21.00	1593	2062
21.00 to 21.15	1615	2287
21.15 to 21.30	1485	2070
21.30 to 21.45	1561	1718
21.45 to 22.00	1682	1946
Total	101402	114050

The rail passenger statistics for Mumbai Metropolitan Region is provided in the Basic Transport & Communication Statistics published by MMRDA (January 2011). Based on these statistics, it is assessed that on an average each season pass holder makes 1.77 trips daily across the western Railway during the year 2009-10.

Applying the same percentage for Mira Road and Bhayandar Stations, approximately 56,034 pass holders performed daily 99,370 trips through Mira Road Station and 64,312 pass holders performed 1,14,050 trips through Bhayandar Station.

4.3.8 Occupancy Table

Table 4-27 shows the average occupancy values for different modes in Mira Bhayandar.

Table 4-27 Average Occupancy values in Mira Bhayandar

Mode	Average Occupancy
Cycle	1.00
Two Wheeler	1.59
Three Wheeler	2.24
Four Wheeler	2.68

4.4 Summary of Data Analysis

Mira Bhayandar being one of the major urban areas with close proximity to Mumbai, is a prime residential location for many people working in Mumbai. The road connectivity to major tourist locations like Essel world, gorai is through Mira Bhayandar Road.. The major arterials are mira bhayandar road, silver park road, LBS marg, phatak road, cabin road & B.P Road. All roads leading to Mira Road & Bhayandar stations experience heavy traffic during peak hours. From both primary data and secondary data analysis following inferences have been drawn:

- (h) Road Network** – Mira Bhayandar Road is the only major arterial connecting other parts of MMR region with Mira Bhayandar. Additional roads are required to reduce the trip lengths and decongest the existing mira bhayandar road. Uttan road is the only road connecting East and West of Mira Bhayandar Railway Line. Additional roads are required to connect East and west areas of Mira Bhayandar Railway Line.
- (i) Public transport** - The growth of number of registered vehicles in Mira Bhayandar has resulted in high traffic volumes private vehicles on road in Mira Bhayandar. Besides, owing to the religious and tourism based significance of the city, increase in number of visitors/tourists using personal modes of vehicles has exploded the traffic into multiple proportions. There has been huge growth in the population and the use of bus public transport system. There is a need for expansion of the system to keep pace with the growing demand

Existing buses are parked on the road and without regular and adequate facilities for maintenance. The fleet is fairly new, with the average age of buses being less than 5 years. Currently maintenance and repair of buses is done on the roads or under a flyover. The lack of proper maintenance has resulted in lower KMPL and will reduce the life of the buses.



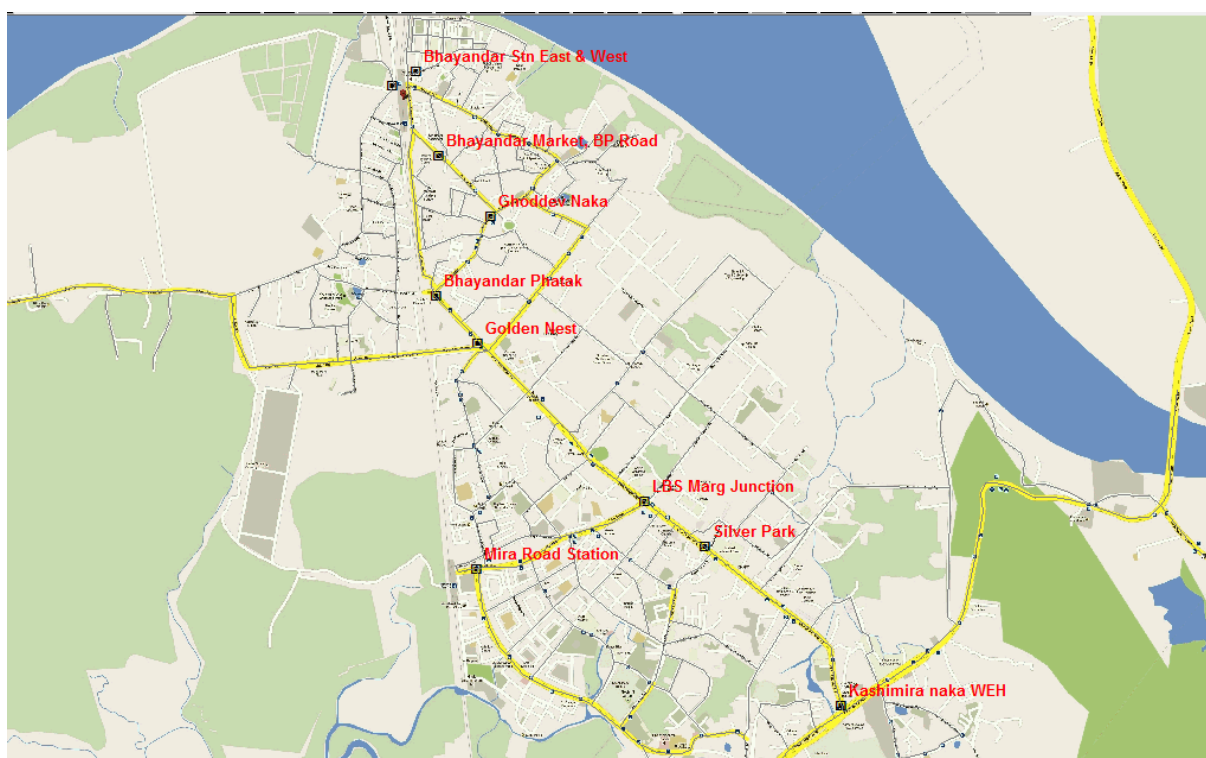
Due to absence of a bus depot, MBMC is unable to increase the fleet size. Additionally there is no facility for driver training.



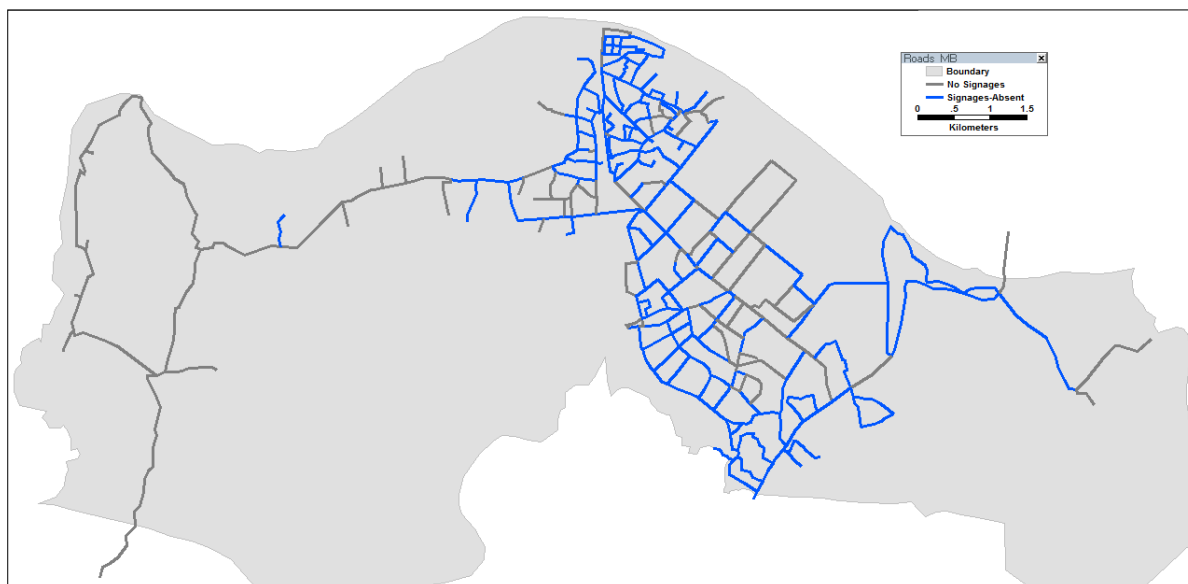
There is very insufficient pedestrian and passenger infrastructure posing a safety issue for them. For example, on Western Express highway, close to Kashimira junction, people wait for buses on the roads. There is generally insufficient or no facilities like seating or toilets.

- (j) Parking:** Parking is another major issue of concern for Mira Bhayandar. Free parking without any demarcation is reducing the carriageway width on many roads leading to congestion. There is no multi level parking facility in Mira Bhayandar. Poor maintenance of parking spaces is observed at railway stations.
- (k) Traffic and Travel:** The effective carriageway capacity of roads is reducing with increasing traffic volume and increase in activity centers along the roads including encroachments impairing traffic movement and creating bottlenecks. The Outer cordon origin destination survey shows the share of through traffic is high which necessitates creation of additional bypass roads.
- (l) Major bottleneck Points:** Following are the major bottleneck points of Mira Bhayandar city
- Kashimira Junction
 - Mira Road Railway Station East

- Bhayandar Railway Station East
- Bhayandar Railway Station West
- Golden Nest Junction
- Silver Park Junction
- LBS Marg Junction
- Station Road Junction
- Phatak Road
- Cabin Road
- B.P Road



(m) Pedestrians Facilities: Although walk is the predominant mode of transport in Mira Bhayandar, but the city lacks proper pedestrian facilities. Poor maintenance of existing foot paths is causing problems to pedestrians. The pedestrian crossing facility is also inadequate. Absence of road markings & signages is also creating problems to pedestrians. The following figure show the existing condition of signages in Mira Bhayandar. The detailed proposals of short term in nature related to improve pedestrian infrastructure are given as a part of "Short Term Traffic Improvement & Management Plan" submitted to MBMC on 1st Sept 2012.



(n) Congestion: The roads connecting both Mira Road and Bhayandar Railway Stations see major congestion during peak hours. Mira Bhayandar road is the only major connecting road from Mumbai and Thane to Mira Bhayandar. 6 signals located on this stretch lead to major delays on this road. **Table 4-28** gives the v/c ratios on few road stretches of Mira Bhayandar. V/c ratio of more than 0.8 indicates that there is a need for improvement/management measures.

Table 4-28 V/C ratios of some of the major roads

S.No	Road Name	Base Year v/c ratio
1	Cabin Road	0.62
2	Uttan Road_Flyover_GoldenNest	0.56
3	Phatak Road	0.94
4	Sant Tukaram Marg	0.61
5	Punam Garden Road	0.76
6	Uttan Road_Sadanand Nagar	0.73
7	Penkharpada Road	0.59
8	Cabin road	0.94
9	Shanti Vidya Nagari Road	0.90
10	Mari Gold Road	0.84

4.5 Service Level Benchmark

The CMP for Mira Bhayandar has also computed the existing level of service of overall traffic and transportation scenario based on a number of parameters. The **Table 4-29** shows

the existing Level of Service (LOS). LOS is a measure of quality of service in terms of ranking, the higher the value of LOS, the lower is the quality and vice versa.

Table 4-29 Service Level Benchmark

S.No	Indicators	LOS - Existing
1	Overall Public Transport facilities City wide	2
2	Overall Pedestrian Infrastructure Facilities	3
3	Level of usage of ITS facilities	4
4	Availability of Parking Spaces	3
5	Land-use Transport Integration	3

4.6 Accidents

Pedestrians are the most common victim of road fatalities is supported by the fact that they accounted for the maximum fatalities. This is due to the fact that there is significant presence of pedestrians and NH-8 is passing through the study area. This is attributed to high speed, constrained road capacities, and the through highway traffic that has nothing to do with the city.

A study depicts that the maximum accidents took place on highways for these happen to be the busiest roads with heavy traffic loads. Further, drivers are tempted to drive at high speeds. The following table gives the statistics of Road accidents in Thane Rural district:

Table 4-30 Accident details of Thane (Rural) District

Description	2004	2005	2006	2007	2008	2009
Number of Accidents	3146	3397	3562	3484	3594	3428
Number of Persons Killed	509	587	641	599	611	534
Number of Persons injured	1879	2349	2562	2617	2373	2178

4.7 Conclusion

The present situation in Mira Bhayandar will only continue to worsen unless the Government authorities respond appropriately in this regard. In the absence of

Government interference, by 2031, the share of public transport will go down leading to more congested road space attributed by higher use of private mode. Performance indicators have been developed to arrive at goals to be achieved for the city of Mira Bhayandar. The goals have been defined with vision and objectives. The mobility strategies developed will aim at attaining these goals.

5 Travel Demand Assessment

5.1 Background

To appreciate and understand the base year travel demand of the study area and to estimate the travel demand for the horizon years, an urban transport model was developed. Based on the travel demand model, various travel demand scenarios along with proposed interventions and recommendations have been developed and tested. The process of developing the transport model is discussed in the subsequent sections.

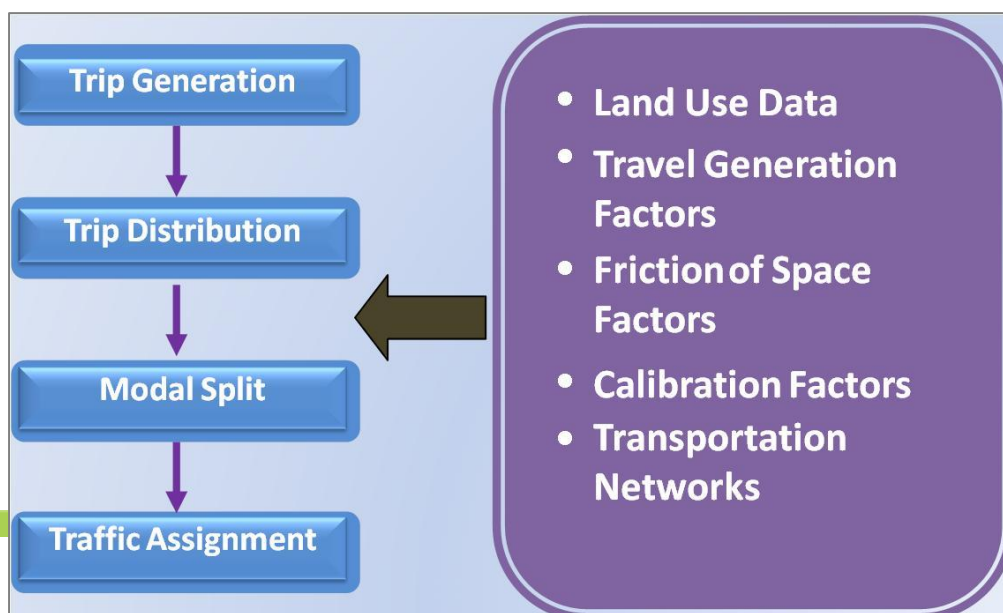


Figure 5-1 Four Stage Transport Model Structure

5.2 Model Structure

The model is based on a conventional Four-Stage Transport Model approach (refer to **Figure 5-1**).

It includes:

- Trip Generation – calculating the number of Productions and Attractions for each zone
- Trip Distribution – distributing these Productions and Attractions for each origin-destination (O-D) pair.
- Mode Choice – determining the mode for each trip (Two wheeler, Car, Taxi, Public Transport)
- Assignment – assigning passengers to their respective highway and transit networks

5.3 Study Area Zoning

The study area has been divided into smaller areas called Traffic Analysis Zone (TAZ) for analysis. The study area has 90 internal zones and the outside area is grouped into 4 external zones. **Figure 5-2** shows the TAZs with zone number. The zone parameters such as population, no. of households for these TAZs are given in **Table 5-1**.

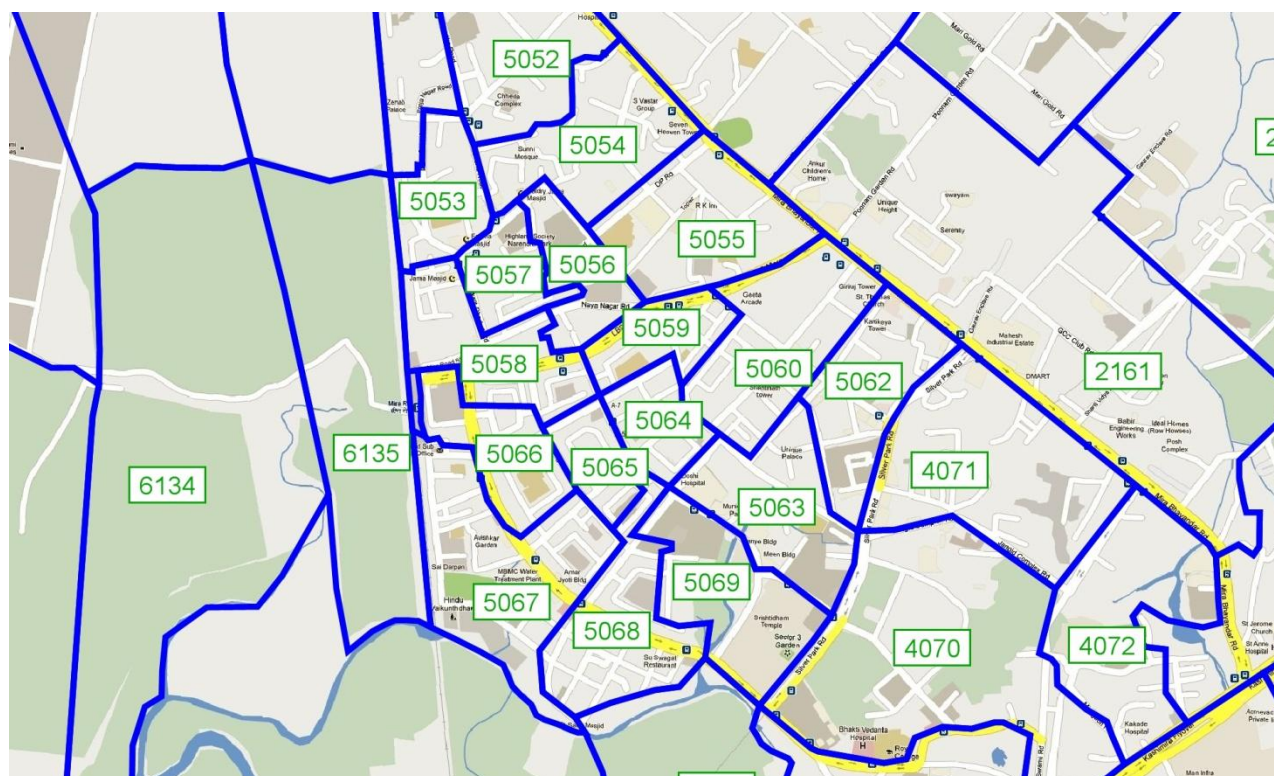


Figure 5-2 Traffic Analysis Zones for Mira Bhayandar

Table 5-1 TAZ wise Demographic Data

TAZ No	AREA(Sq.km)	Population_2011	NO_OF_HH_2011
1003	0.19	6975	1620
1004	0.12	7385	1792
1005	0.09	6244	1487
1006	0.07	9030	1839
1007	0.11	8852	2351
1008	0.06	7997	1840
1009	0.12	6594	1533
1010	0.09	6798	1583
1011	0.27	11748	2577
1015	0.05	6950	1664
1016	0.05	6538	1516
1017	0.05	5154	1273
1018	0.14	4912	1138
1019	0.06	5928	1371
1040	0.04	6567	1511
1041	0.03	4992	1219
1042	0.04	4609	1075
1043	0.04	5375	1296
1044	0.11	6060	1397
1047	0.06	5021	1151

TAZ No	AREA(Sq.km)	Population_2011	NO_OF_HH_2011
1048	0.05	7387	1693
1049	0.13	8585	1914
2012	0.27	10262	2331
2013	0.51	11206	2637
2014	0.03	5807	1397
2045	0.11	11138	2574
2046	0.36	13077	2964
2073	0.49	7068	1391
2151	1.36	50610	12142
2161	1.2	35166	8446
2251	2.35	12653	3036
2261	2	8791	2111
3075	3.94	16686	3640
3076	0.07	8950	2036
3174	8.48	75	16
3274	1.18	5270	1134
3374	2.98	2183	470
4070	0.65	17028	4334
4071	0.39	20562	5192
4072	0.3	14643	3220
4077	1.89	8903	2147
4078	0.36	10601	2655
4079	0.38	11276	2706
5050	0.31	12448	2566
5052	0.31	16852	3465
5053	0.12	10206	1881
5054	0.23	19193	4064
5055	0.25	12053	2885
5056	0.11	7696	1618
5057	0.09	9708	1780
5058	0.19	10755	2366
5059	0.1	5807	1497
5060	0.25	10820	2586
5062	0.19	11892	2741
5063	0.21	11185	2814
5064	0.09	5913	1432
5065	0.08	6540	1556
5066	0.14	6674	1620
5067	0.32	13988	3340
5068	0.21	15022	3674
5069	0.22	7180	1916
6133	1.3	72	16
6134	1.17	691	163
6135	0.54	889	197
6233	1.25	7112	1632

TAZ No	AREA(Sq.km)	Population_2011	NO_OF_HH_2011
6234	0.89	13124	3091
6235	0.69	16890	3747
7127	3.18	6505	1559
7128	3.53	8768	2100
7129	14.87	4720	957
8030	1.57	7369	1391
8031	0.27	6006	991
8032	1.62	6835	1324
8229	1.61	726	147
8329	4.54	1815	368
9001	2.03	11301	2662
9026	0.83	7397	1653
9227	1.67	4336	1039
9228	1.82	2192	525
10002	0.54	8998	2063
10020	0.09	7948	1843
10021	0.05	6546	1516
10022	0.06	5982	1366
10023	0.05	8230	2047
10024	0.05	7105	1656
10025	0.11	6942	1664
10036	0.15	10853	2584
10037	0.07	6924	1655
10038	0.07	6521	1448
10039	0.05	6269	1430

5.4 Network Development

The coded highway network for the study area primarily consists of nodes (intersections) and links connecting the nodes. Connectivity between the network and zones is provided through centroid connectors. Based on the network inventory, each link has been assigned attributes such as number of lanes, divided or undivided carriageway, one way/two way, encroachments, availability of footpaths, etc. **Figure 5-3** shows the Base Year Road Network for the Study Area. The network attributes linked with geographic files have been used to develop the transport model using VISUM Software.

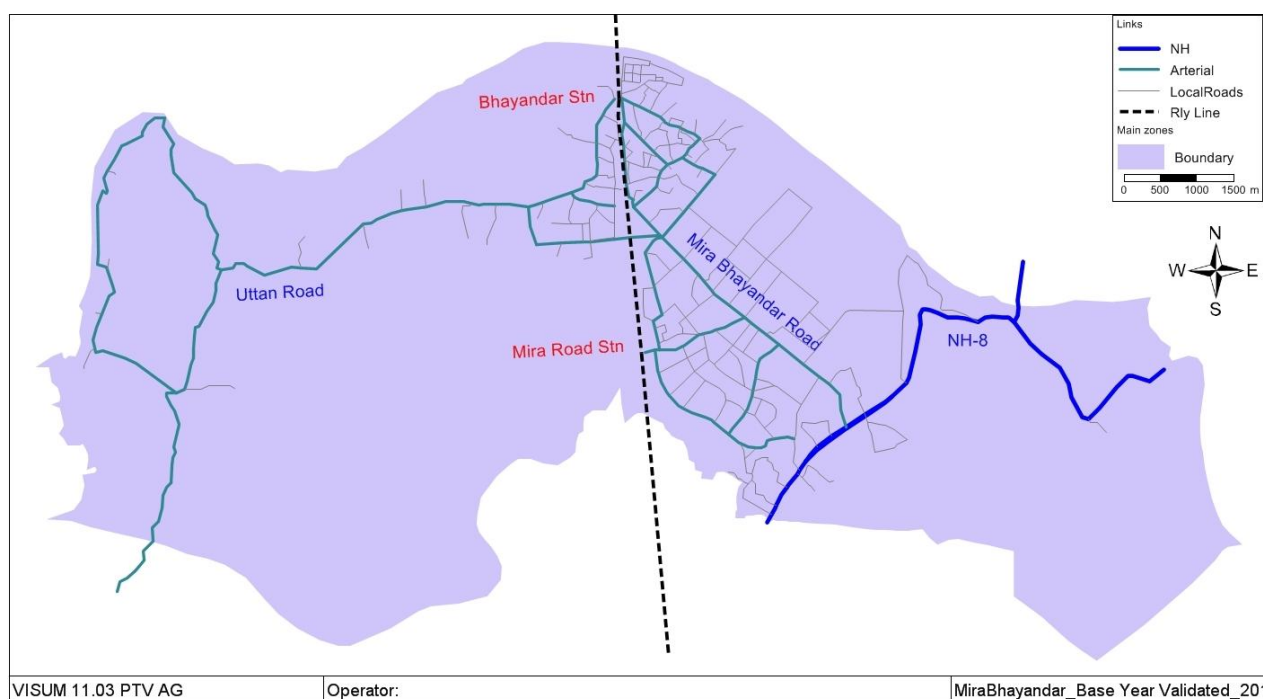


Figure 5-3 Mira Bhayandar Road Network

5.5 Base Year (2012) Travel Pattern

The base year trip matrices have been developed using the data compiled from household surveys, Railway Station surveys and roadside interview survey. These have been adjusted to the counts observed on links and turns using the TFlowFuzzy process available in VISUM.

5.5.1 TFlowFuzzy Matrix Correction

TFlowFuzzy is procedure developed based on Fuzzy logic techniques and made available in VISUM to correct an O-D matrix based on a comparison of counted volumes and assignment volumes.

It is possible to run TFlowFuzzy with any combination of counts on links, turns and O-D traffic for zones. The basic idea behind this procedure is best illustrated with **Figure 5-4**.

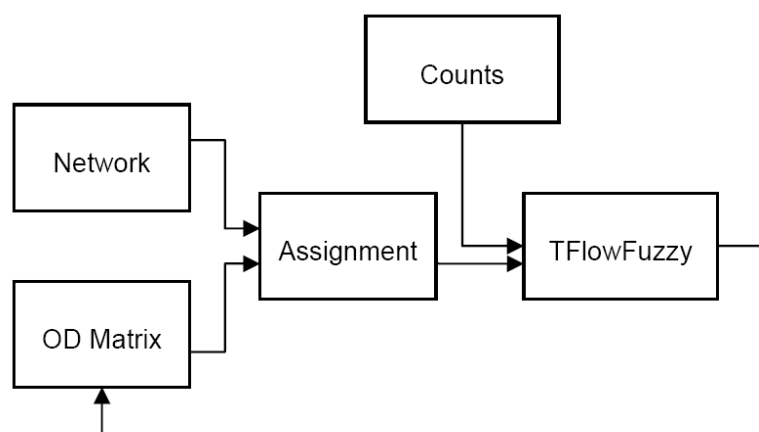


Figure 5-4 TFlowFuzzy Matrix Correction Methodology Flow Chart

TFlowFuzzy is an iterative exercise since the corrected matrices in the first iteration will be assigned again after relevant network corrections until a satisfactory GEH (Explained in detail in Section 5.5.2) is achieved, i.e. a calibrated-validated model.

5.5.2 Base Year Calibration/Validation

A base year model is said to be calibrated and validated if the assigned traffic volumes when compared the observed traffic counts should be in the prescribed limit. Generally GEH Statistics, an empirically derived statistical relationship, is used to compare two sets of traffic volumes. The formula of GEH Statistic is as follows:

$$GEH = \sqrt{\frac{2(M - C)^2}{M + C}}$$

Where,

‘M’ is the hourly traffic volume from the traffic model and

‘C’ is the real-world hourly traffic count

The use of GEH as an acceptance criterion is recognized in the UK Highways Agency's Design Manual for Roads & Bridges (DMRB). According to DMRB, 85% of the volumes in a traffic model should have a GEH less than 5.0 and 5% of the volumes with GEH greater than 10.

Table 5-2 gives the GEH statistic value for different modes in Mira Bhayandar.

Table 5-2 GEH statistic for Mira Bhayandar

GEH	Cycle	2W	3W	4W	Goods
-----	-------	----	----	----	-------

Value	Links	Turns	Links	Turns	Links	Turns	Links	Turns	Links	Turns
<5	81%	85%	81%	80%	81%	80%	81%	80%	80%	81%
>10	2%	3%	6%	5%	4%	6%	6%	6%	2%	0%

From the above table, GEH values are close to DMRB standards in most of the cases. Hence, the base year travel demand model parameters are acceptable for further application / Forecasting.

5.6 Base Year (2012) Traffic Characteristics

The traffic characteristics of the study area are identified in terms of average trip length, volume to capacity ratio, etc. The results of the travel-demand-estimation for base year and trip-rate-analysis is summarized in the **Table 5-3**. The base year desired line diagrams are shown from **Figure 5-5 to Figure 5-7**.

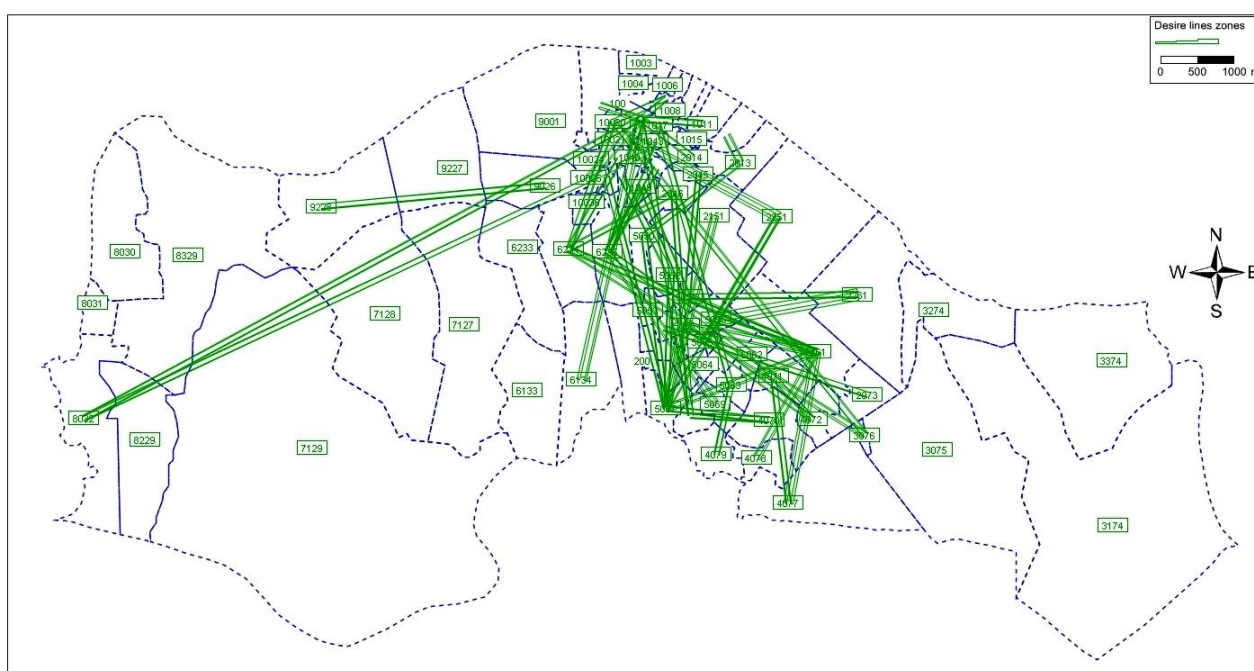


Figure 5-5 Desire Line diagram for Internal Travel_Base Year

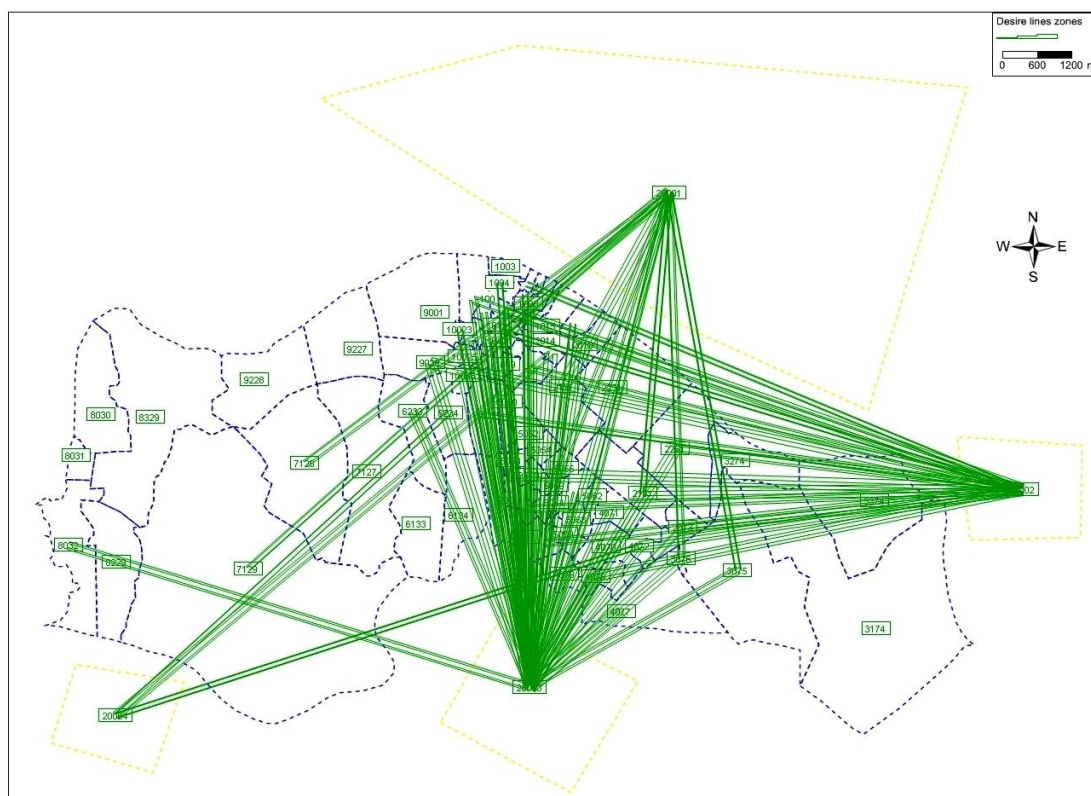


Figure 5-6 Desire Line diagram between Internal to External Zones Base Year

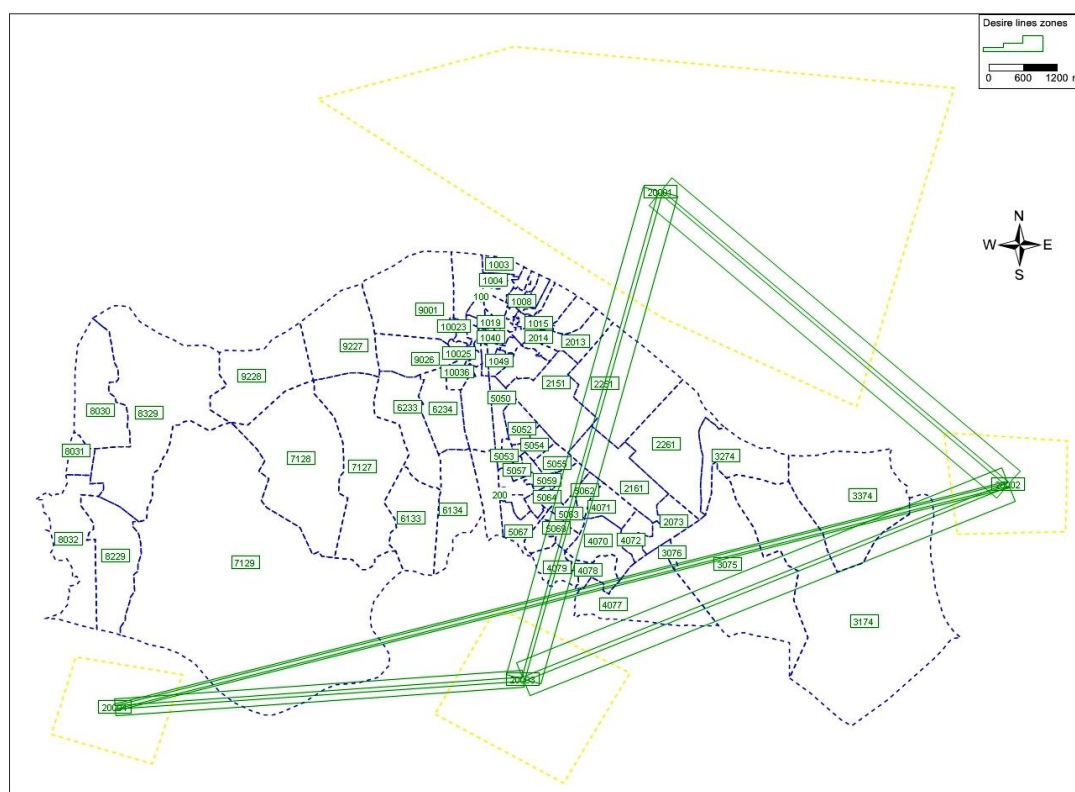


Figure 5-7 Desire Line diagram for External Travel_Base Year

Per capita trip rate is defined as the ratio of number of trips per day to the population of the city. For example, a city with a population of 100 persons with a distribution of 60 workers (who go to work in the morning and come back home in the evening), 20 school/college going students and 20 non trip making persons (Eg: Infants & old people who do not make any trip). Then the per capita trip rate will be 1.6 (Total trips 160 (60+20+60+20) divided by population 100). The PCTR for Mira Bhayandar is found to be 1.18. PCTR & other travel characteristics are shown in **Table 5-3**. The Base year mode shares for different travel patterns are shown from **Table 5-4** to

Table 5-6.**Table 5-3 Base Year Travel Characteristics**

Description	Value
Per Capita Trip Rate	1.18
Trip Rate per Household	5.10
Work Force Participation Ratio	0.37
Average Trip Length for Car in KM (Internal Travel)	3.81
Average Trip Length for Two Wheelers in KM (Internal Travel)	3.20
Average Trip Length for Auto in KM (Internal Travel)	2.80

Table 5-4 Base Year Internal to Internal Travel mode shares

Mode	Mode_Share for Int to Int
Walk	41.9%
Cycle	0.1%
2W	9.5%
3W	20.3%
4W	12.8%
Bus	15.4%
Total	100.0%

Table 5-5 Base Year Internal to External Travel mode shares

Mode	Mode_Share for Int to Ext
2W	5.0%
3W	1.4%

4W	16.7%
Bus	36.2%
Train	40.7%
Total	100.0%

Table 5-6 Base Year access mode shares to Railway Stations

Mode	Mode_Shares for access to Stn
Walk	26.8%
Cycle	1.0%
2W	7.9%
3W	9.9%
4W	5.6%
Bus	48.9%
Total	100.0%

The volumes to capacity (v/c) ratios for few selected corridors are shown in **Table 5-7**.

Table 5-7 Average V/C Ratios on few selected corridors for Base Year

S.No	Road Name	v/c ratio
1	Cabin Road	0.62
2	Uttan Road_Flyover_GoldenNest	0.56
3	Phatak Road	0.94
4	Sant Tukaram Marg	0.61
5	Punam Garden Road	0.76
6	Uttan Road_Sadanand Nagar	0.73
7	Penkharpada Road	0.59

5.7 Travel Demand Model Calibration

A four stage transportation model that includes, trip generation, trip distribution, mode choice and assignment was developed for Mira Bhayandar for estimating the travel demand for forecasted scenarios. Values of various constants and parameters for trip generation and distribution were estimated for the base year model. These were checked against the observed values of variables, obtained from the surveys of actual travel patterns. Once satisfactory estimates of the parameters for all models were obtained, the models were checked to ensure that they adequately perform the functions for which they are intended.

5.7.1 Trip Generation Calibration

Trip generation models were built to forecast the number of person trips that will begin from or end in each travel analysis zone within the region for a typical day of the target year. Multiple linear regression method has been adopted for developing trip end equations for Mira Bhayandar as they were found to be giving the best-fit results. The trip production attraction models developed are presented in **Table 5-8**.

Table 5-8 Calibrated Trip End Models

Production	R Square
Trip Productions = $0.7384 * \text{Population} - 2169$	0.83
Attraction	R Square
Trip Attractions = $1.1894 * \text{Employment} - 341$	0.72

Comparison of the modeled production-attraction as compared to the observed production-attraction is shown in **Figure 5-8** and **Figure 5-9**.

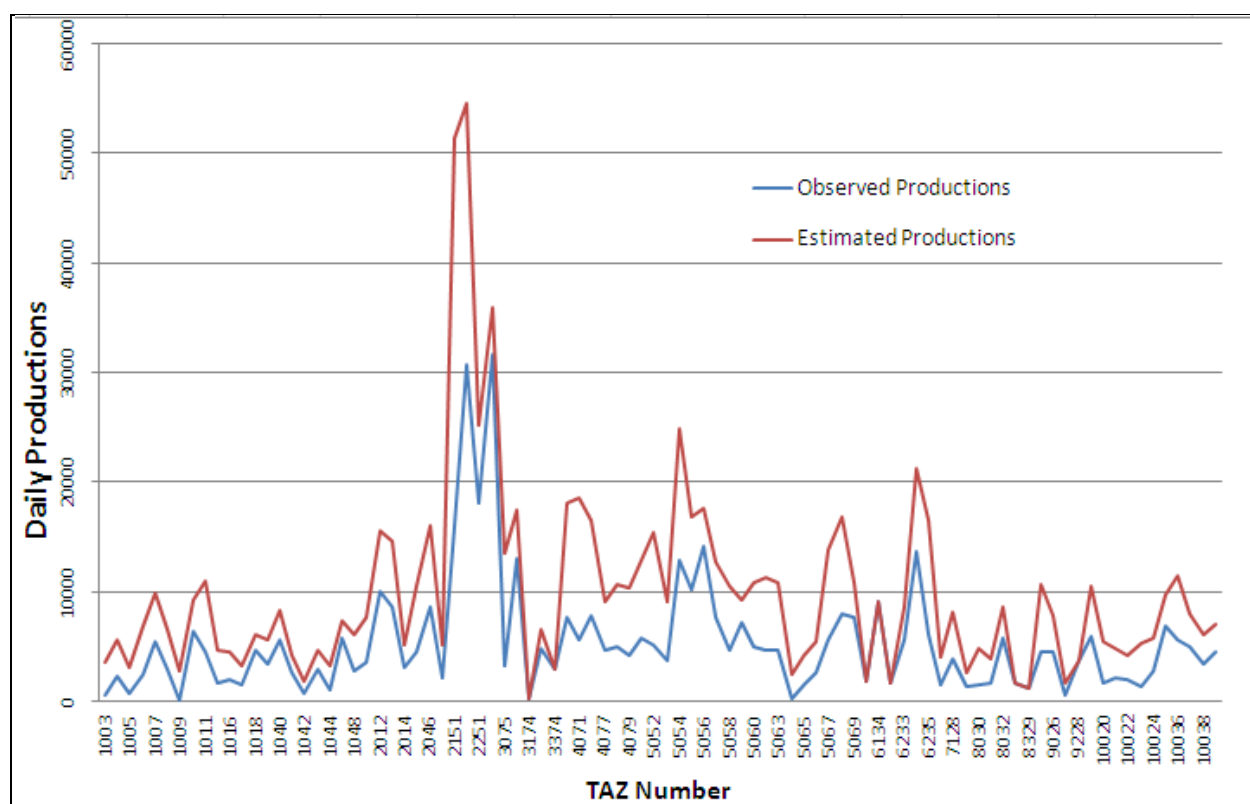


Figure 5-8 Comparison of Observed and Estimated Trip Productions

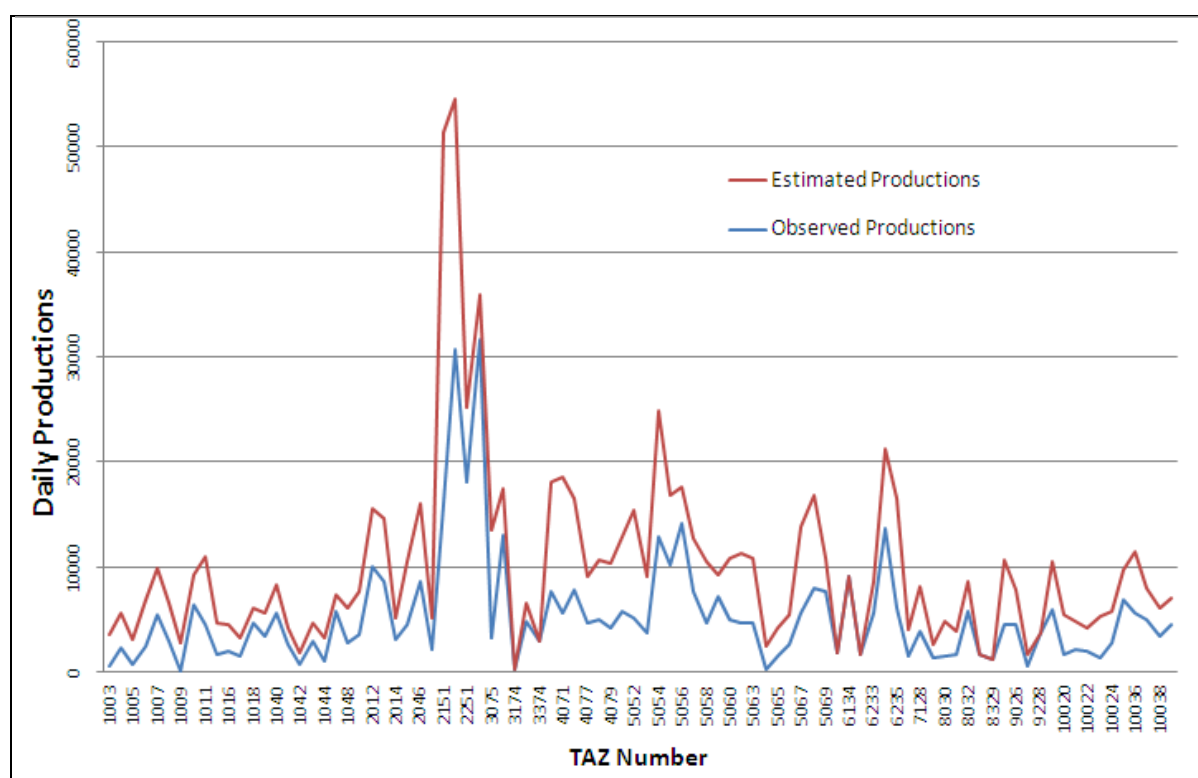


Figure 5-9 Comparison of Observed and Estimated Trip Attractions

5.7.2 Trip Distribution Calibration (Gravity Model)

Gravity model was used to estimate the trips distribution parameters. To arrive at this, different distribution functions like Gamma, Inverse and Exponential functions were tested to fit the data from survey. It was found that Gamma function gave the best fit when compared against the observed data. The Gamma function formulation is as below:

$$f(d_{ij}) = a * d_{ij}^b * e^{c(d_{ij})}$$

Where,

d_{ij} : distance in shortest path from zone i to j.

a, b, c : calibrated parameters

The calibrated gravity model parameters are shown in the **Table 5-9**.

Table 5-9 Calibrated Gravity Model Parameters

Parameters/Mode	Cycle	Two Wheeler	Auto	Car	Goods	Bus	All Modes
a	0.043	0.115	0.738	0.770	0.250	0.178	0.107
b	4.495	0.000	0.847	0.758	0.000	0.542	2.357
c	-1.058	-0.016	-0.595	-0.516	-0.142	-0.194	-0.662

The base year (2012) Productions and Attractions obtained from the corrected O-D matrices, mode wise skim matrices from network and the calibrated Gamma function parameters were used to generate mode wise synthetic matrices in VISUM.

The Trip length distributions from Observed/Corrected and Synthetic O-D matrices were calculated and the mode wise comparison graphs are shown from **Figure 5-10** to **Figure 5-16**.

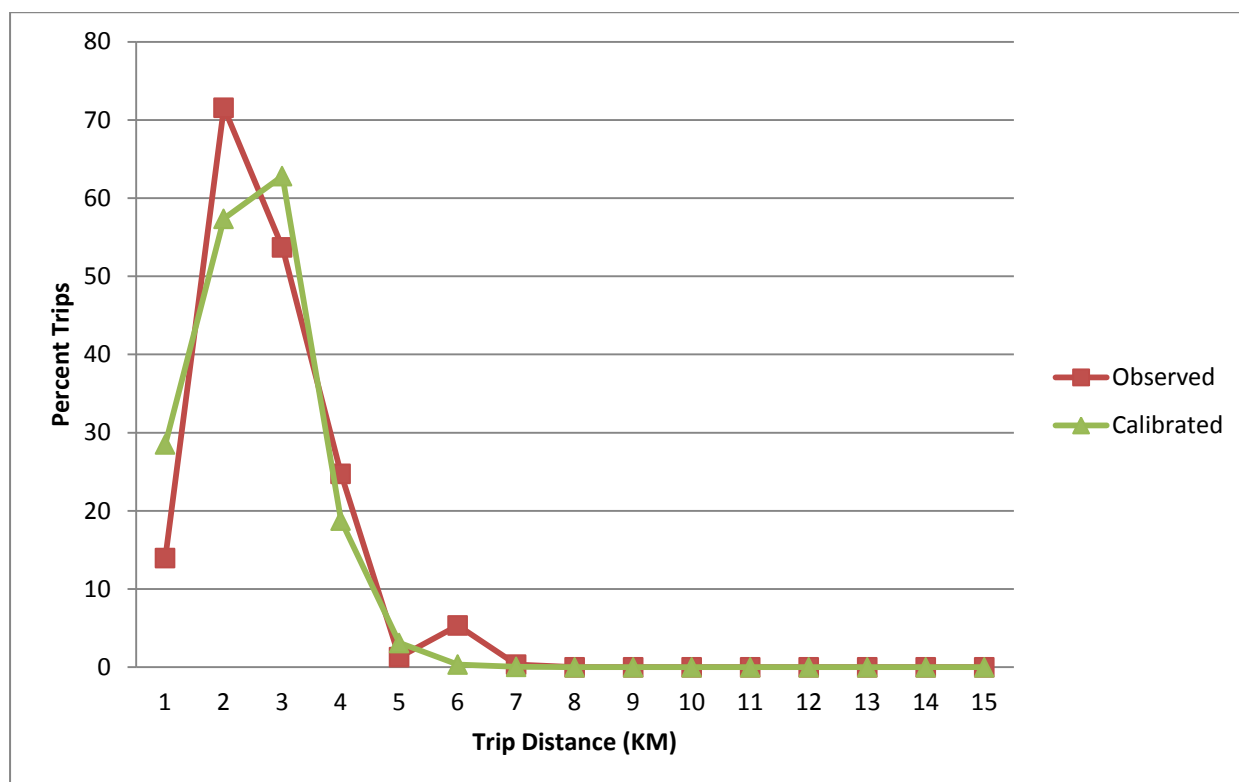


Figure 5-10 Observed and Calibrated Trip Length Distribution for Cycle

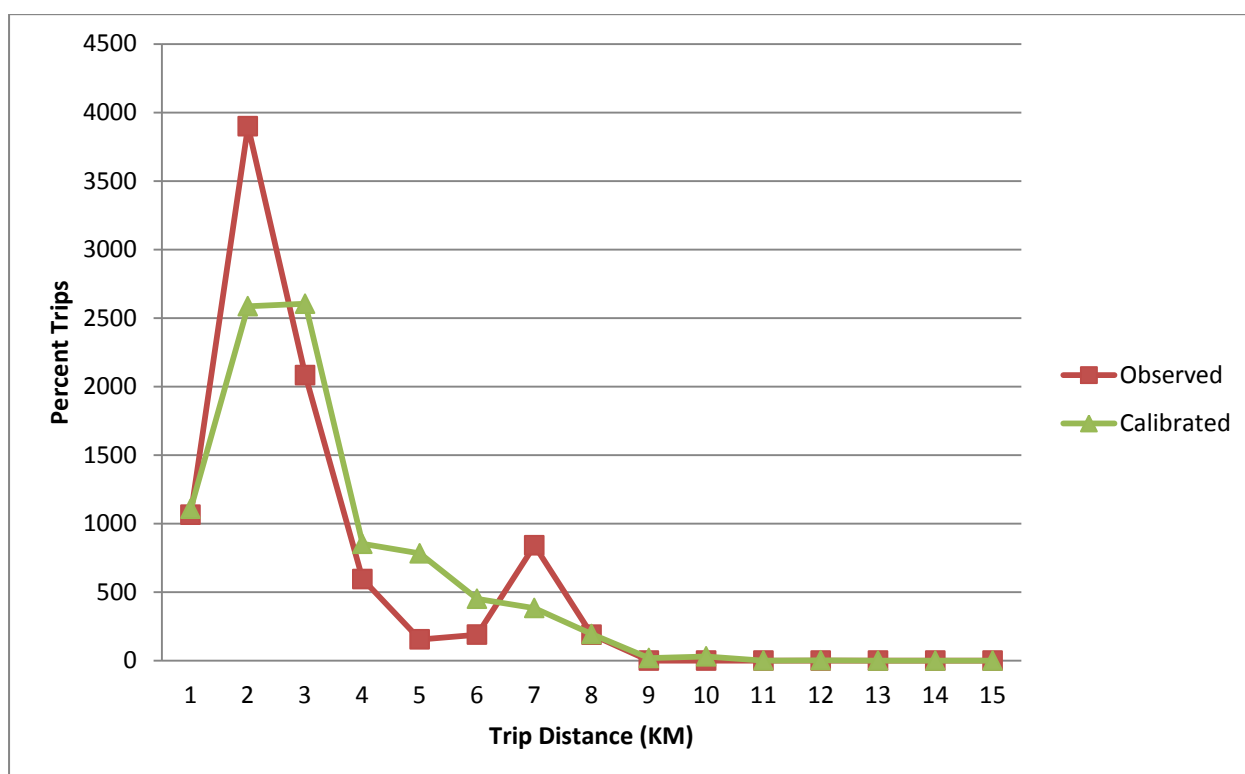


Figure 5-11 Observed and Calibrated Trip Length Distribution for Two Wheeler

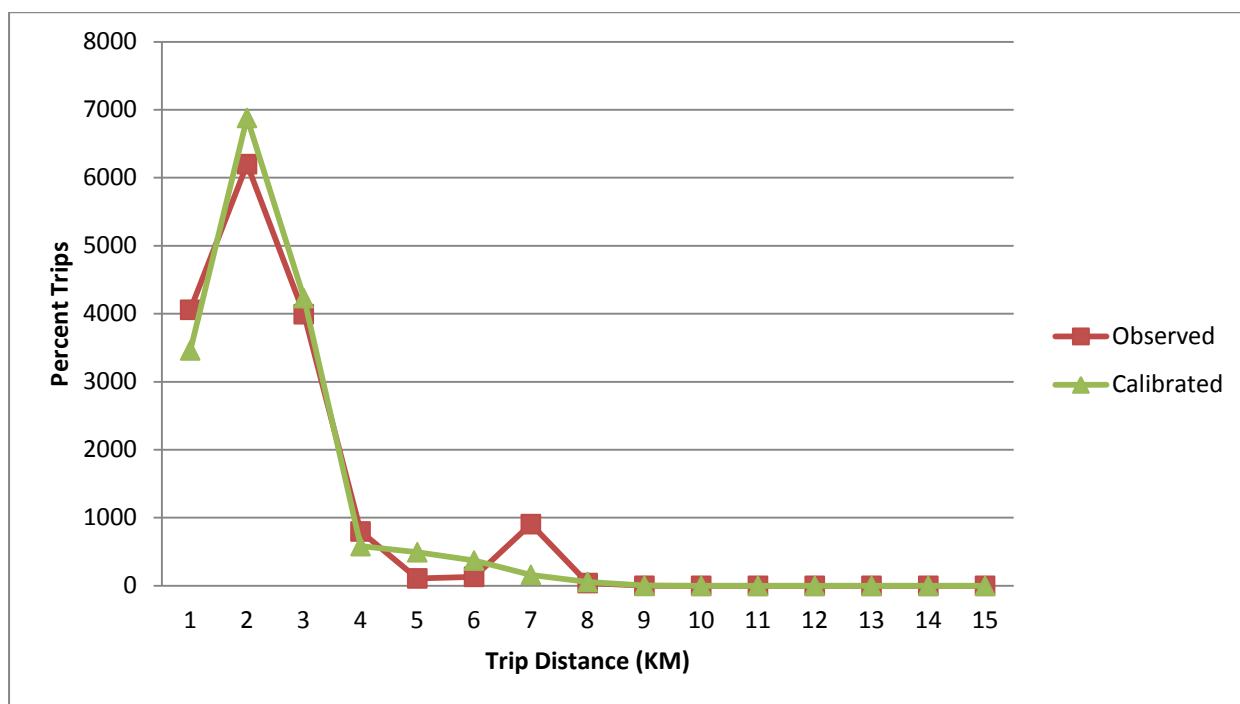


Figure 5-12 Observed and Calibrated Trip Length Distribution for Auto Rickshaw

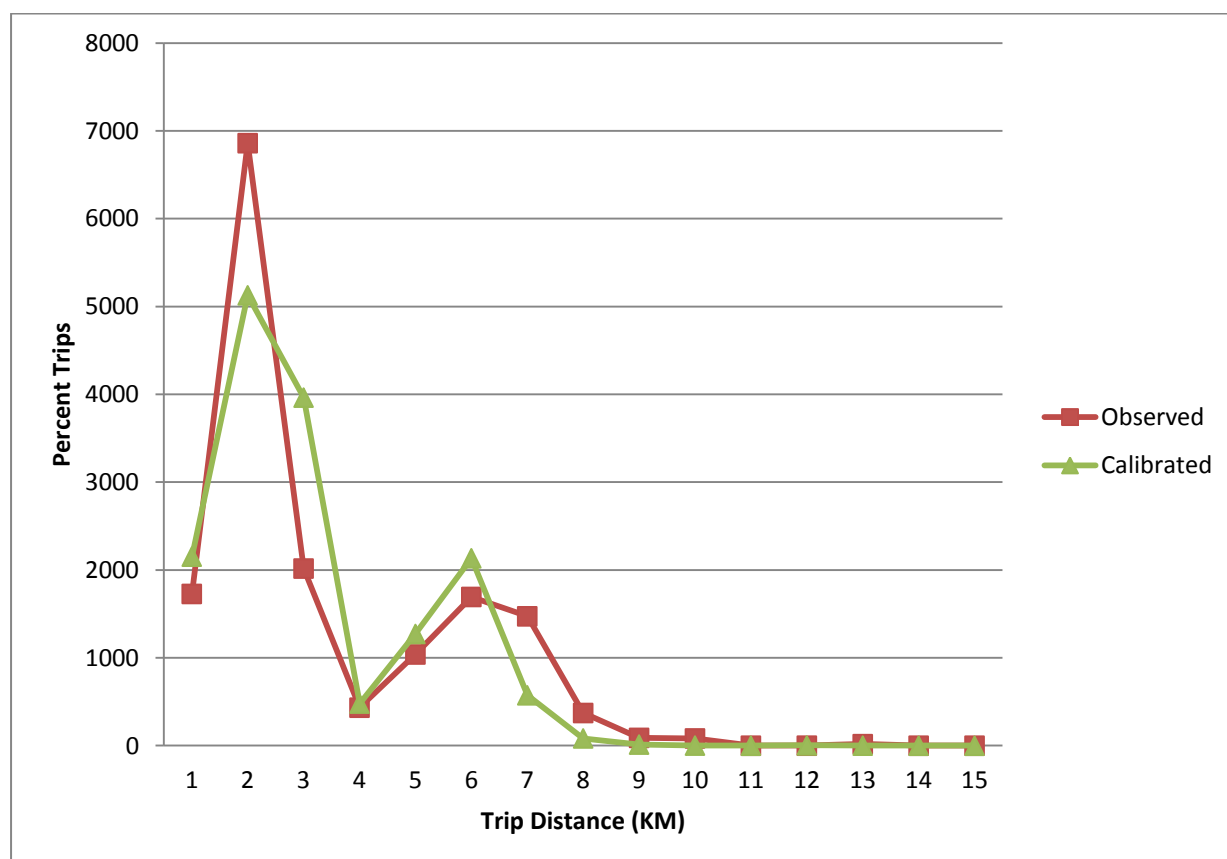


Figure 5-13 Observed and Calibrated Trip Length Distribution for Car

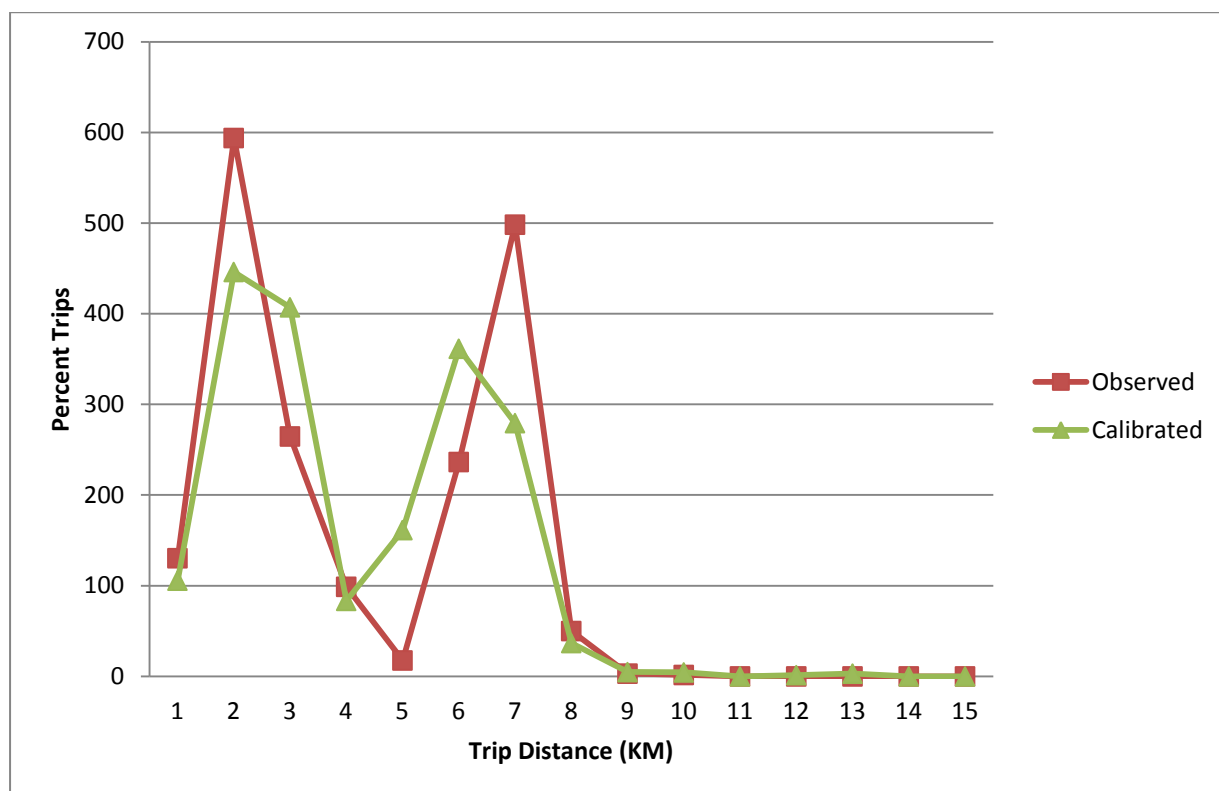


Figure 5-14 Observed and Calibrated Trip Length Distribution for Goods

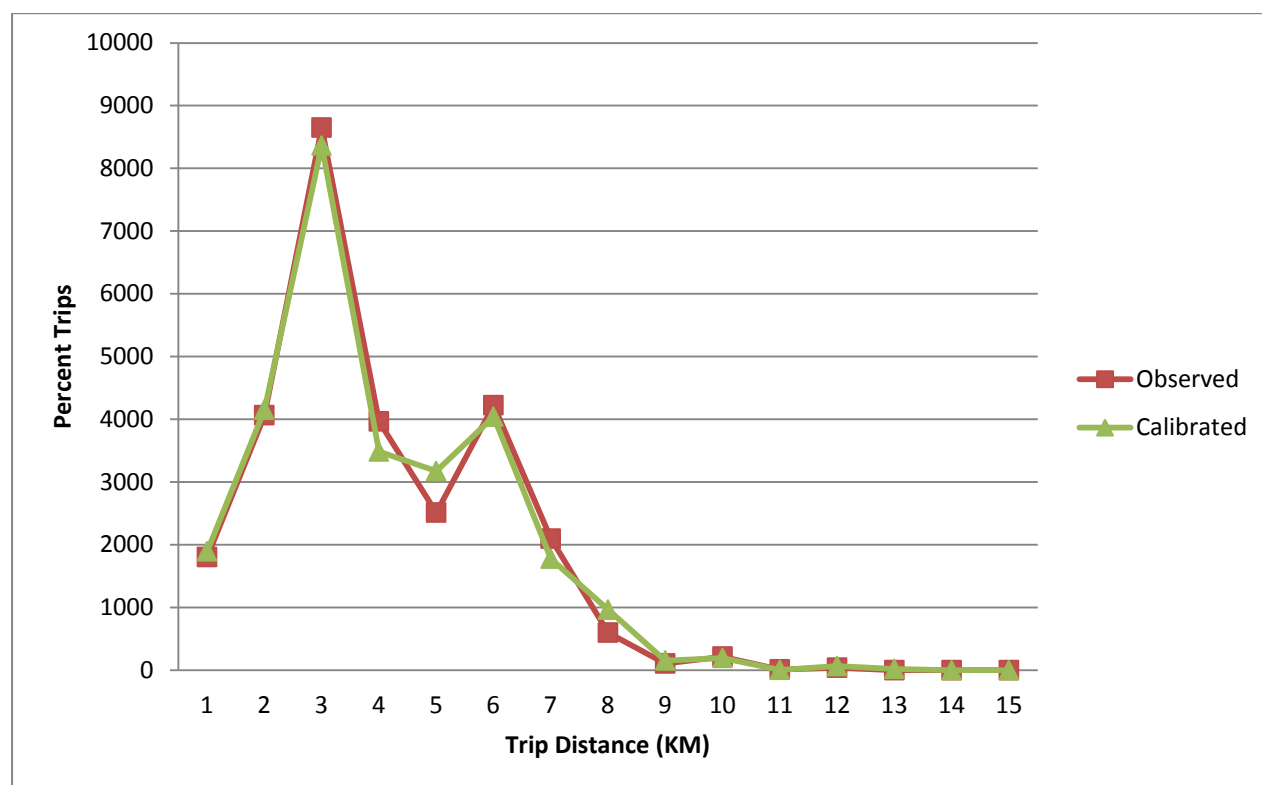


Figure 5-15 Observed and Calibrated Trip Length Distribution for Bus

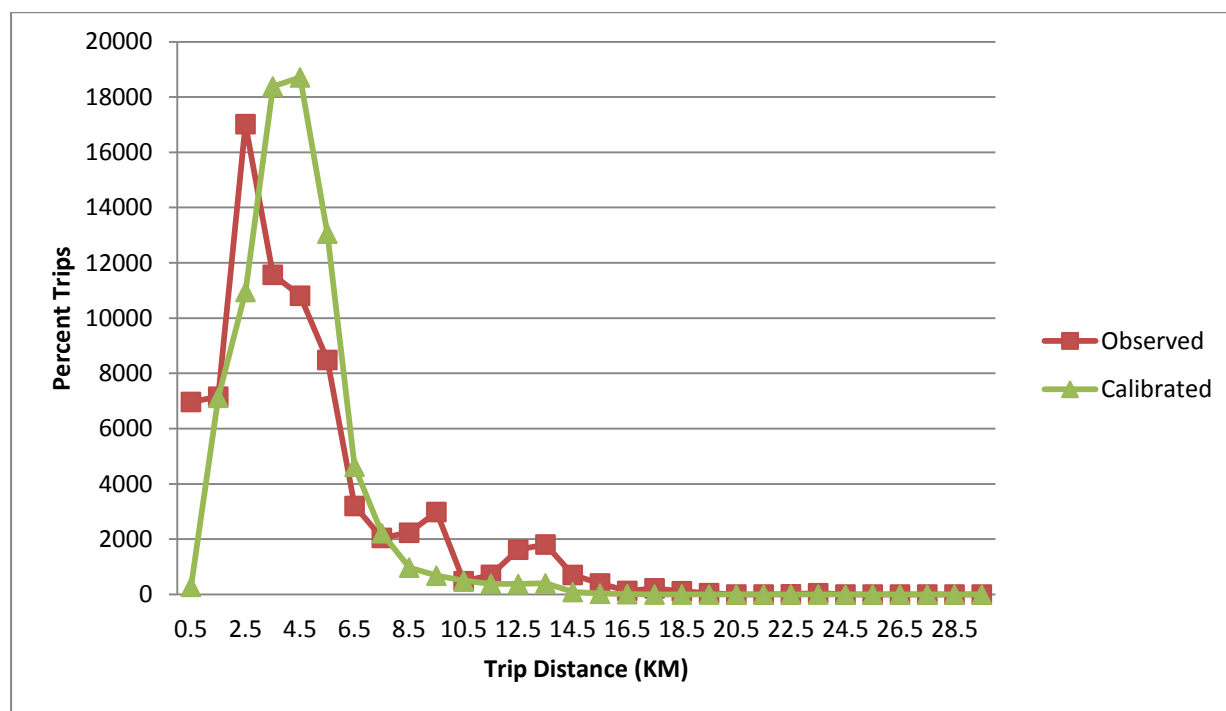


Figure 5-16 Observed and Calibrated Trip Length Distribution for all modes

5.8 Travel Demand Forecasting

Since the urban land use and transportation have a strong relationship, the policy makers need a decision support system to arrive at promoting a guided scenario selected from a set of alternatives tested to best suit the land use-transport cycle. With respect to the characteristics of a city, there may be several combinations of development scenarios possible to overwhelm the deteriorating condition of the city. Hence, it is necessary to test various alternatives of mobility planning and development and select the best one based on forecasted travel demand and its subsequent network impact to arrive at the best sustainable solution for Mira Bhayandar.

The validated travel demand model developed in this study was used to estimate/ project the travel demand for the horizon years 2016, 2021 and 2031 under respective transport systems and network scenarios. Three different scenarios of travel demand pattern were assessed for the study area.

The Population and Employment data projected for each horizon year is shown in the **Table 5-10** below. The TAZ wise projected population and Employment are given in **Annexure B**. Population for the year 2031 is taken from the approved City Development Plan (CDP) Report for Mira

Bhayandar.

Table 5-10 Projected Population and Employment

Year	Population	Employment
2016	12,40,333	4,22,851
2021	15,55,331	5,47,424
2031	22,09,008	8,00,998

Based on the projected population & employment as dependant variables and using trip generation equations estimated (**Table 5-8**), horizon year daily productions and attractions were estimated. The trip rates are calculated based on projected population and estimated horizon trips. **Table 5-11** shows the estimated trips and per capita trip rates.

Table 5-11 Estimated Total Trips for Horizon Period

Year	Total Trips	PCTR
2016	7,20,624	1.16
2021	9,53,214	1.23
2031	14,35,891	1.30

The number of trips estimated for the future year remains the same throughout the network based option testing exercise.

5.8.1 Mobility Scenarios

Scenario 1: Do Minimum

This scenario considers the current works under progress such as underpass at Bhayandar Railway Station connecting East & West of Bhayandar which would affect the network or the mobility in any form. The flyover is expected to be completed and open for traffic before 2016.

The map showing the transport network considered for Do Minimum Scenario for the year 2032 is given in the below **Figure 5-17**.

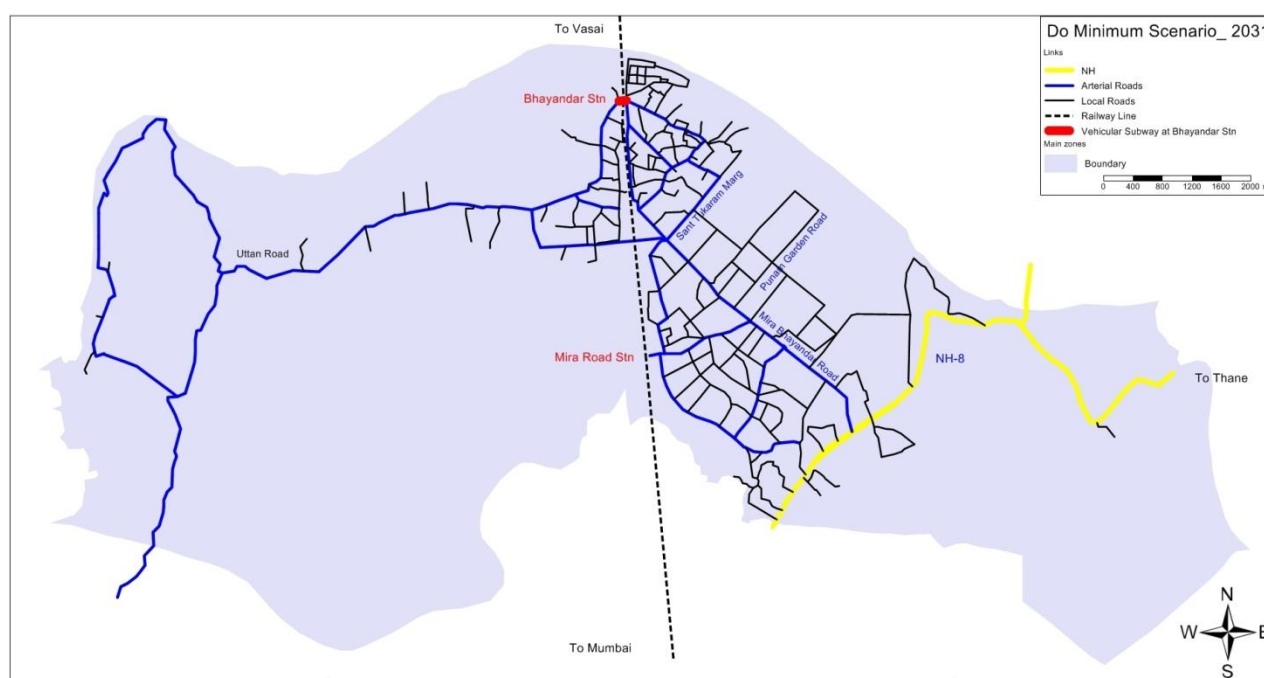


Figure 5-17 Transport Network for Do Minimum Scenario for the year 2031

Scenario 2: Road Network Improvement only

This scenario considers the future proposals in terms of Road Network Improvements only. This scenario includes all highway improvement proposals like

1. New Coastal Road connecting Bhayandar East and west.
2. New Road connecting Bhayandar Railway station west to Subhash Chandra Bose Maidan parallel to the existing station road
3. New Road connecting Uttan Road with Mira Road Station East
4. Development of few links in Manori Uttan Gorai notified area
5. A new expressway connecting Vasai and Borivali passing through Mira Bhayandar with alignment parallel to the existing railway line.
6. Vehicular underpasses on Mira Bhayandar Road.
7. An elevated road from Radhanath Satsang Junction to Morwa Gaon parallel to Uttan Road.

The above proposals are explained in detail in Section 6.5.1.4 and the corresponding map is shown in **Figure 5-18**.

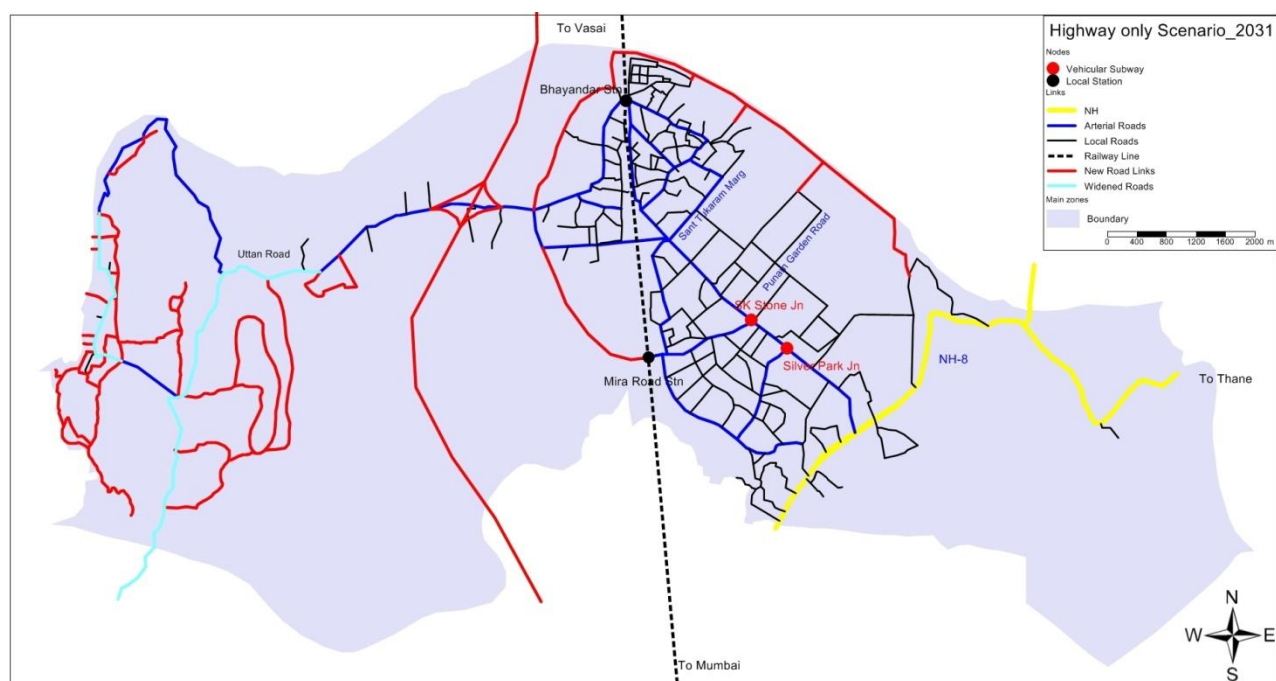


Figure 5-18 Transport Network for Road Network Improvement Scenario for the year 2031

Scenario 3: Public Transport Improvement only

This scenario considers the future proposals in terms of public transport Improvements only. This scenario includes all PT proposals like

- A Metro system connecting Borivali & Vasai with an alignment parallel to the existing Sub urban railway system.
- Another Metro Route is proposed connecting Dahisar and Thane with an alignment parallel to the existing NH8.
- A two track elevated corridor over the Existing Railway track with a capacity to run 8 car air conditioned trains with a minimum frequency of 90 seconds along churchgate –virar section.
- Increase in the service frequency of the existing bus routes

The above proposals are explained in detail in Section **6.5.2.1** & **6.5.2.2** and the corresponding map is shown in **Figure 5-19**.

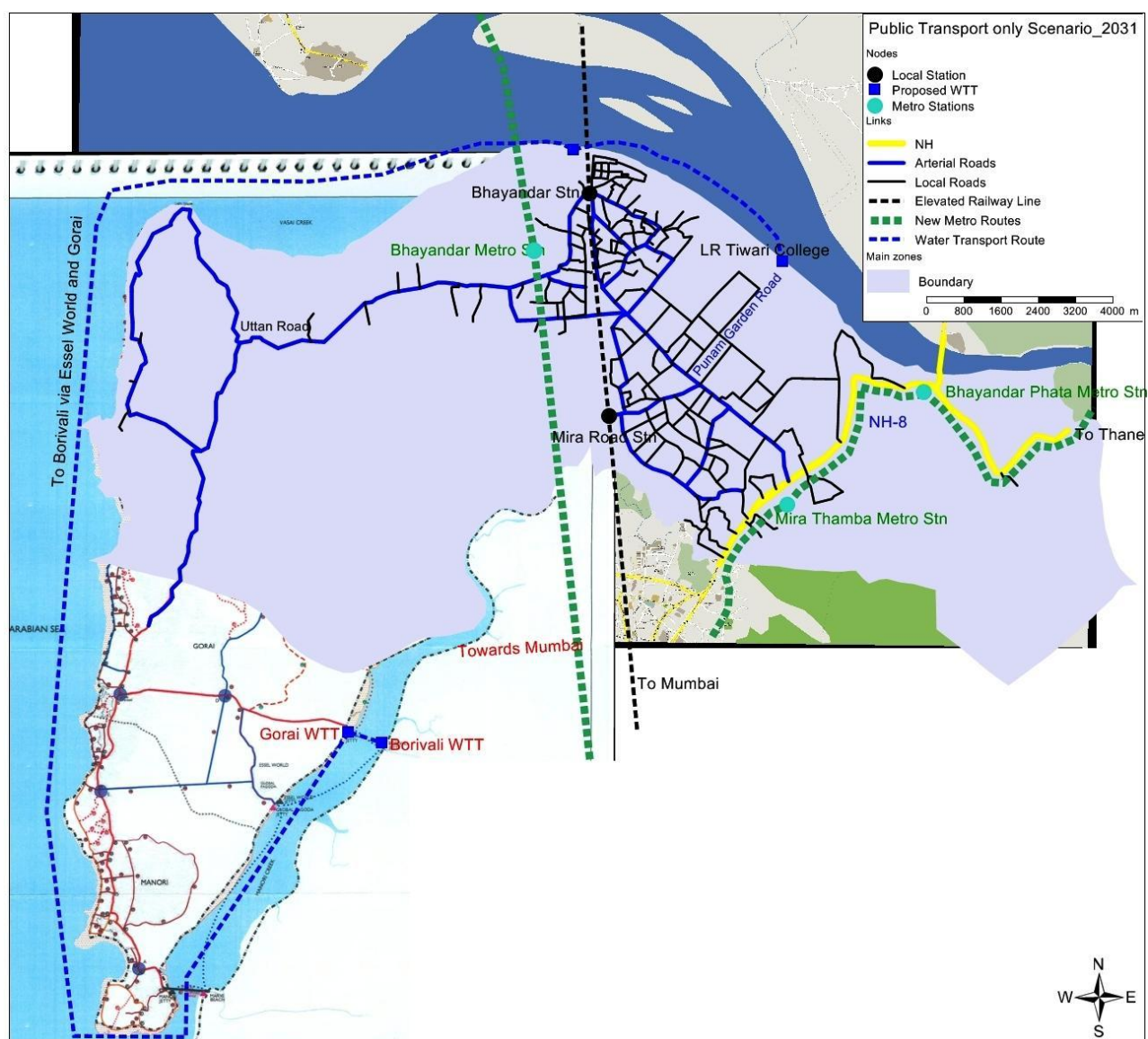


Figure 5-19 Transport Network for PT Improvement Scenario for the year 2031

Scenario 4: Road Network and Public Transit Improvement with Feeder services

This scenario considers the road network proposals as discussed in Scenario 2 as well as improved Public Transit augmentation proposals which include Scenario 3 proposals as well as feeder services on the improved road network. The feeder bus routes proposed are shown in **Table 6-3**.

5.9 Traffic Forecast under Mobility Scenarios

The traffic characteristics of the study area are extracted from the model for all scenarios are given in the tables from **Table 5-12** to **Table 5-15**.

Table 5-12 Mode Shares for Internal Travel in 2031 for different Scenarios

Scenario	Private Mode	Intermediate	Public Transit
Do Minimum	51.4%	35.7%	12.9%
Highway only	54.3%	28.6%	17.1%
PT only	35.4%	24.6%	40.0%
Highway & PT	26.2%	20.0%	53.8%

Table 5-13 Mode Shares for Internal to External Travel in 2031 for different Scenarios

Scenario	Private Mode	Intermediate	Public Transit
Do Minimum	40.0%	5.0%	55.0%
Highway only	43.0%	6.0%	51.0%
PT only	35.9%	4.1%	60.0%
Highway & PT	31.0%	4.0%	65.0%

Table 5-14 Mode Shares for station access in 2031 for different Scenarios

Scenario	Private Mode	Intermediate	Public Transit
Do Minimum	38.8%	23.8%	37.5%
Highway only	45.0%	25.0%	30.0%
PT only	27.5%	22.5%	50.0%
Highway & PT	25.7%	19.3%	55.0%

Table 5-15: V/C Ratios on Selected Corridors for Different Scenarios in 2031.

S.No	Road Name	Do Nothing v/c	Highway Only v/c	PT only v/c	Highway+PT+ Feeder v/c
1	Cabin Road	1.49	1.12	1.01	0.85
2	Uttan Road_Flyover_GoldenNest	2.24	1.86	1.63	0.97
3	Phatak Road	3.45	2.50	2.38	0.79
4	Sant Tukaram Marg	1.00	0.92	0.70	0.73
5	Punam Garden Road	0.90	0.72	0.80	0.61
6	Uttan Road_Sadanand Nagar	3.93	0.80	2.72	0.49
7	Penkharpada Road	1.89	1.52	1.76	0.82

In 2031, for Do Minimum scenario it is noted that the level of saturation is beyond 1, on all roads except punam garden road. A purely road network (highway) based analysis is providing additional options to road based trips, thereby inducing road based private mode based trips. This is estimated to cause more congestion but better than Do Nothing scenario since extra infrastructure was provided. The situation on the few roads is estimated to get better with PT based system. A combination of road network and PT based schemes is found to be the best option with v/c ratios below saturation. Considering all the scenarios, scenario 4 is found to be most sustainable and gives optimum mobility solution for Mira Bhayandar.

6 Mobility Plan

6.1 Vision Statement

The Comprehensive Mobility Plan for Mira Bhayandar is developed with the following vision.

“To provide safe, efficient, and environmentally sustainable means of transportation system for improving mobility of people in Mira Bhayandar.”

Truly reflecting the status that the Mira Bhayandar city, it is proposed to have a sustainable, low carbon well networked integrated transportation system, by developing and sustaining quality transportation infrastructure with the help of an urban transport strategy. The strategy is envisioned to be in line with the current National Urban Transport Policy (NUTP),

- that will move people and goods safely, efficiently and securely.
- that will provide affordable mobility for people, goods and commerce (and maximize the benefit of transportation investments and facilitating implementation of priority projects of city and region wide significance over the short, medium and long term).
- that will improve quality of life (by providing a recognized and effective platform for integrating land use, transportation, and economic development that minimizes the need for travel, provides choices for modes that are safe and also socially, economically, financially and environmentally sustainable).

6.2 Mobility Pillars

The three most important pillars for ensuring sustainable mobility in urban areas are:

- Integrated land use-transport planning
- Bringing a control on movement of personal vehicles
- Encourage public transport system and other sustainable modes of transport

Sustainable mobility however can only be ensured if the solutions are environmentally, socially, and economically sustainable as presented in **Figure 6-1**.

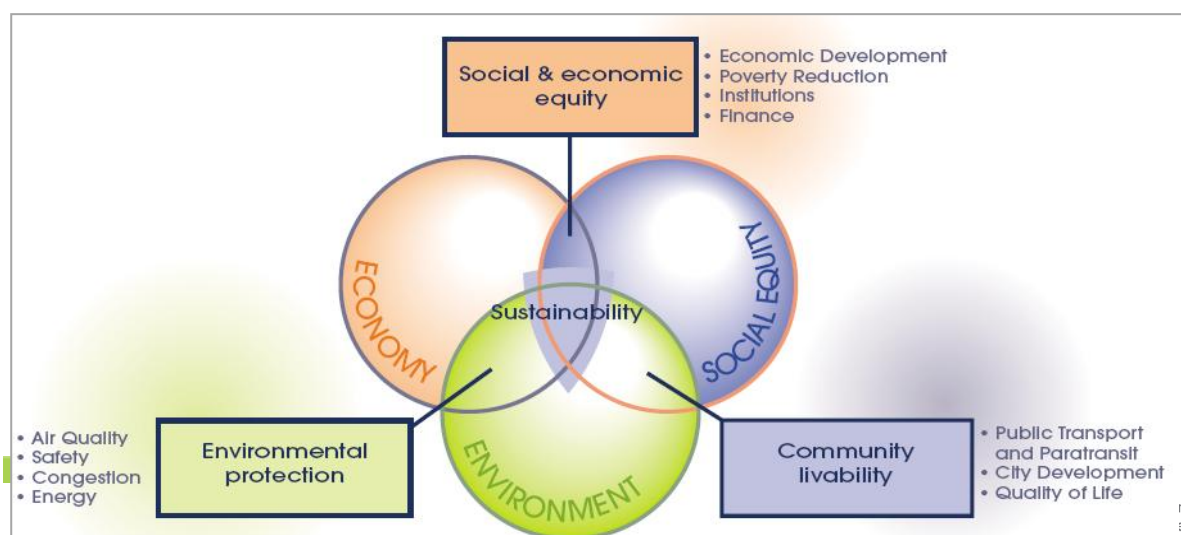


Figure 6-1 Sustainable Mobility Solutions

6.3 Goals

To ensure that mobility solutions for Mira Bhayandar are sustainable and in conformity with the pillars of sustainable mobility, following goals have been formulated:

1. **Goal 1:** Develop public transit system in conformity with the land use that is accessible, efficient, and effective.
2. **Goal 2:** Ensure safety and mobility of pedestrians and non-motorized transport (NMT) users by designing streets and areas that make a more desirable and livable city for residents and visitors and support the public transport system.
3. **Goal 3:** Decongest the core areas of the city to improve quality of life.
4. **Goal 4:** Develop traffic and transport solutions that are economically and financially viable and environmentally sustainable for efficient and effective movement of people and goods.
5. **Goal 5:** Develop a parking system that reduces the demand for parking and need for private mode of transport and also facilitate organized parking for various types of vehicles.

6.4 Objectives

In order to address the existing and envisaged mobility situation in 2031 and to fulfill the vision stated above, objectives and targets for each of the goals are given below:

1. **Goal 1:** Develop public transit system in conformity with the land use that is accessible, efficient and effective.

Objectives:

- (a) Provide good quality public transport system that is accessible, efficient and effective.

- (b) Develop strategy to integrate public transport system.
 - (c) Develop strategies to encourage people to use public transport system and discourage use of private vehicles, specially two wheelers.
 - (d) Develop policies that encourage concentrated mixed land use development along the public transport corridors.
2. **Goal 2:** Ensure safety and mobility of pedestrians and non-motorized transport (NMT) users by designing streets and areas that make a more desirable and livable city for residents and visitors and support the public transport system.

Objectives

- (a) To improve pedestrian facilities in areas of pedestrian concentration and encourage pedestrian movement in heavy pedestrian movement areas and restrict use of private vehicles.
 - (b) To provide facilities to pedestrians and NMT users in order to ensure safety by segregating their movement from vehicles along major corridors.
 - (c) To provide safe pedestrian facilities along major public transport nodes and transfer points.
 - (d) To develop a pedestrian strategy for safe and efficient movement of people within the city.
3. **Goal 3:** Decongest the core areas of the city to improve quality of life.

Objectives

- (a) Develop strategies to encourage people to shift out of the core city area.
 - (b) To restrict entry of personal vehicles in the core city area and reduction of on street parking and encourage public transport and pedestrian movement in the core city area.
4. **Goal 4:** Develop traffic and transport solutions that are economically and financially viable and environmentally sustainable for efficient and effective movement of people and goods.

Objectives

- (a) Develop short term strategies such as traffic management and engineering solutions to ease flow of traffic at major congestion points within the city.
 - (b) Develop medium and long-term measures such as construction of new link roads, subways etc., to ease traffic flow along major roads within the city.
5. **Goal 5:** Develop a parking system that reduces the demand for parking and need for private mode of transport and also facilitate organized parking for various types of vehicles.

Objectives

- (a) Create off-street parking (wherever possible multi-level parking) near major activity centers, transit stations/terminals to meet the growing parking demand.
- (b) To suggest various measures through a combination of demand management and fiscal measures to restrain the demand for parking of private vehicles at critical locations.

6.5 Mobility plan and its approach

Urban mobility solutions cannot be evolved by a single source strategy, the mobility goals for Mira Bhayandar will need to be addressed through a multi-pronged approach. The following strategies are adopted to meet the various goals set for Mira Bhayandar:

- ✓ Integrated land use and transport plan
- ✓ Public transit strategy
- ✓ Non-motorized transport strategy
- ✓ Freight management strategy
- ✓ Traffic engineering & management measures
- ✓ Water transport plan
- ✓ Parking management Plan
- ✓ Education & enforcement

All the listed strategies are equally important and the order of listing does not imply priority. Each of the broad strategies includes sub- strategies of immense importance. The strategies when implemented through specific projects shall fulfill the goals and objectives of the CMP. The sections below discuss these strategies.

Based on the framework of the plan, travel demand model, and the strategy for achieving the vision under realistic scenario, the mobility plan has been prepared and various components and details of the same are given as under:

6.5.1 Integrated land use and transport Plan

The Comprehensive Mobility Plan for Mira Bhayandar suggests and emphasizes on the strategies and proposals such as smooth, effective and efficient transport systems in and surrounding of city the area, reassessment of new roads/link roads, redevelopment of terminals/stations, rapid corridors development, transit locations, freight management etc.

In order to develop effective and efficient transport network and infrastructure, the CMP for Mira Bhayandar has adopted overall Three-way approach as follows:

- Development alternate roads to relieve from heavy traffic in the city especially Mira Bhayandar Road
- Development of Transport Infrastructure to improve the connectivity among different parts of the planning area including new metro stations and railway stations.
- Improving the existing PT systems in terms of efficiency, frequency of operations etc.,

Figure 6-2 shows the concept of integrated land use transport strategy.

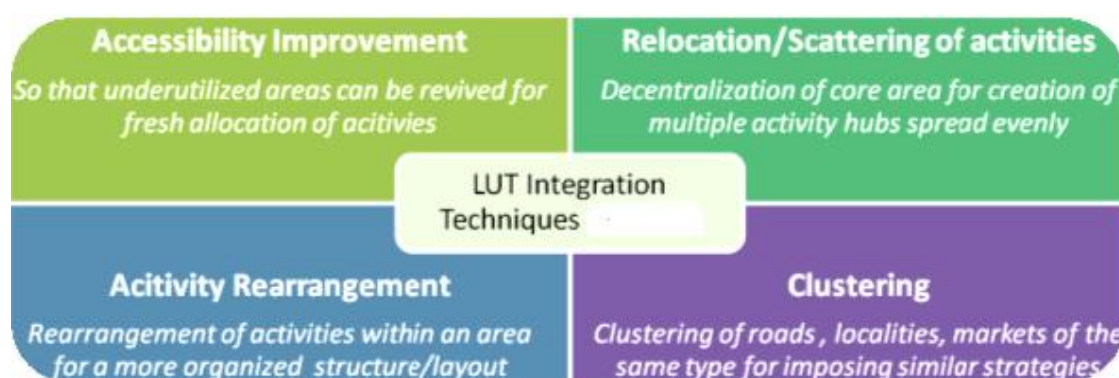


Figure 6-2 Integrated Land Use Transport Strategy**6.5.1.1 Development of Induced Growth Centres based on TOD Concept**

Higher density development should be concentrated near transit stations to make transit convenient for more people and encourage ridership. This form of development utilizes existing infrastructure, optimizes use of the transit network and creates mobility options for transit riders and the local community. Successful (Transit Oriented Development) TOD provides a mix of land uses and densities that create a convenient, interesting and vibrant community for local residents and visitors alike.

Thus, Induced Growth Centers (IGC) have been proposed at the major residential areas along the proposed new Metro lines based on the Transit Oriented Development principle. The purpose of developing IGCs of sub-city centres is to promote mix of commercial and public/semi-public landuse, thus enhancing the ridership of the metro lines. Once developed, they would result in a decentralized growth of the region and make the balanced landuse-transport integration policy effective for Mira Bhayandar. These centers are proposed to be developed in Phase III (2021-2031) with identification of exact site based on detailed studies and proximity to surrounding areas and approved landuse plan for the region.

Proposed locations of these hubs are shown in **Figure 6-3**.

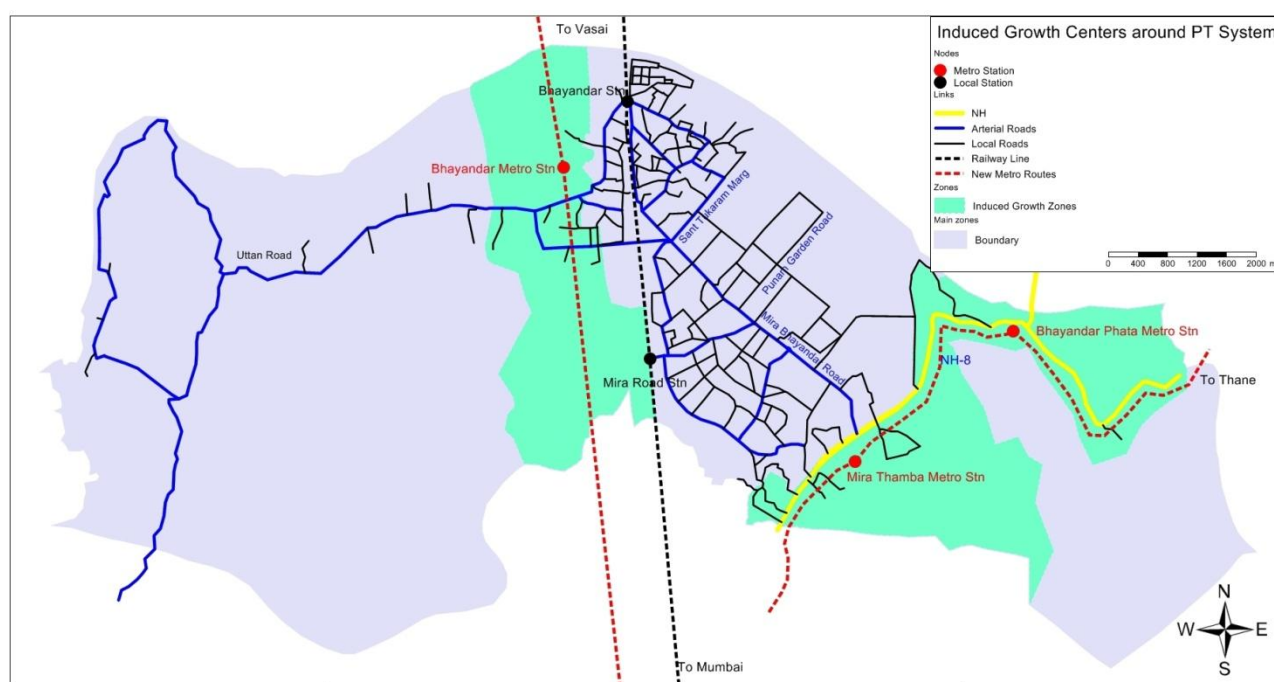


Figure 6-3 Proposed locations for Induced Growth Centres

6.5.1.2 Development of regional connectivity

The Comprehensive Mobility Plan for Mira Bhayandar has further suggested developing an effective and efficient transport network to connect Vasai and Mumbai to main city of Mira Bhayandar in a strategic manner so as to discourage by-passable traffic through the city. In order to develop effective and efficient transport network, the CMP for Mira Bhayandar has adopted two-way approach:

1. Development of Expressway for network connectivity (Detailed proposal for Expressway is given in Network Improvement Plan section).
2. Introduction of feeder Bus system (Detailed proposal is given in Public Transport Plan section) along the proposed roads.

6.5.1.3 Mobility Corridors

As speed of public transport vehicles reduce, travel times increase to such an extent that commuters look for personalized modes of travel. In addition to the user travel preferences the road design and operations also have a bearing on traffic congestion. Development of hierarchy in road network of a city helps in addressing the specific problems of a particular kind of road in the entire network with specific solutions.

By designating certain roads as primary mobility corridors, the transport corridors get a priority for increasing the throughput. Development of mobility corridor based on functional characteristics of a corridor is an important step towards efficient utilization of road space. Mobility corridor should have right of way of at least 25 m for mixed traffic conditions and 30 m for carriageway with dedicated public transport bus lane. These corridors should have the following cross-sectional elements:

1. Continuous kerb, footpath-cum-drain
2. Service roads where ever feasible
3. Restriction or preferably prohibition of parking on the carriageway/shoulders
4. At-grade/grade-separated public transport systems as per the public transport/mass transport master plan

It is suggested that the Mira Bhayandar road starting from kashimira Junction to Golden Nest should be developed as mobility corridor (Refer to **Figure 6-4.**) This mobility corridor will augment the connectivity to MBMC area both within & from outside areas.

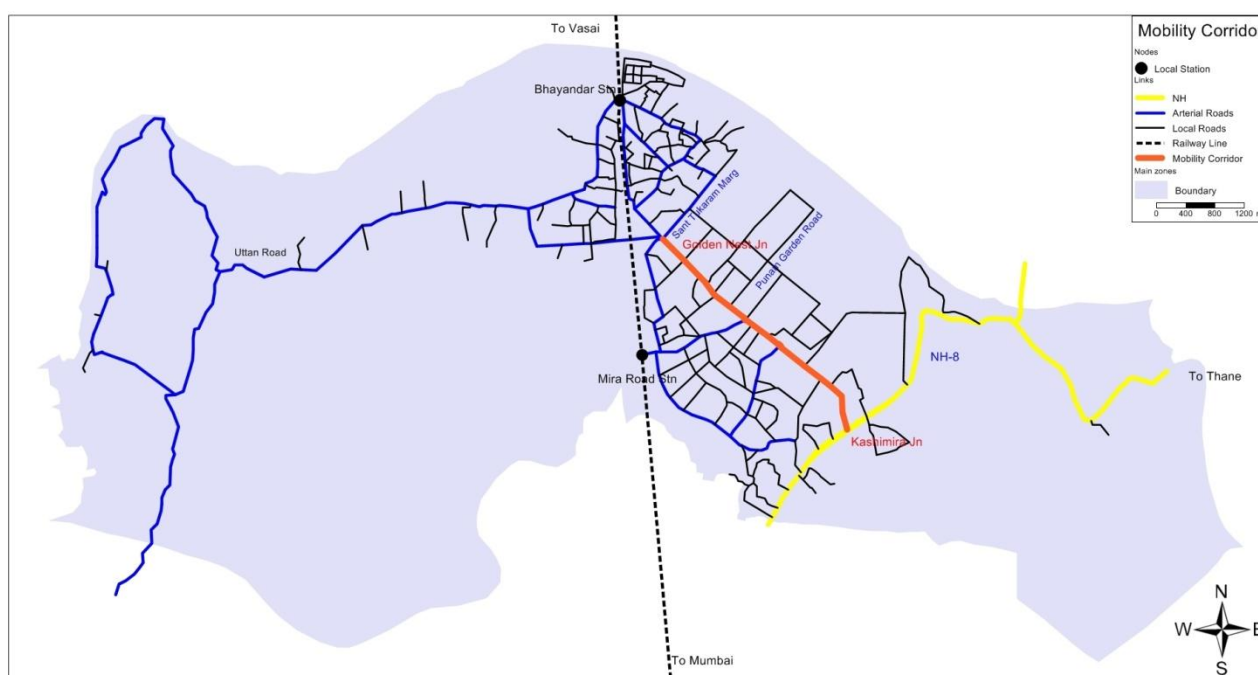


Figure 6-4 Proposed Mobility Corridor

6.5.1.4 Network Improvement Plan

The Comprehensive Mobility Plan for Mira Bhayandar has suggested improvement of network for overall enhancement of connectivity. As a part of its network improvement plan, the following aspects have been covered:

- Completion of New Links
- Widening of Roads
- Development of new flyovers

Each of these aforementioned aspects have been described as a part of network improvement plan in detail in the subsequent sections.

Proposed New Road Links

S.No	Description of road proposed	Category of Road
1	Development of new coastal road starting from Ghodunder to Khadi Road connecting Mira Road East & Bhayandar East to Bhayandar West & Bhayandar Railway Station. This will decongest the existing mira bhayandar road. Extensions of few link roads to access coastal road are also proposed.	DP Road
2	A new road connecting Bhayandar Railway Station west to Subhash Chandra Bose Maidan is proposed to decongest the existing station road.	DP Road
3	A new road connecting Uttan Road to Mira Road Railway Station West is proposed. This Road starts at Radhanath Swami Satsang Bhavan and ends at Mira Road Station West which will enable all Mira Road East Residents a better connectivity to Mira Road Station. This will decongest the Uttan Road and Lodha Road connecting Mira Road Station East.	DP Road
4	Considering the importance of Uttan as a tourist place & its inherent fishing activity, UMTC proposed development of few road stretches in Uttan area in accordance with the norms of Manori Gorai & Uttan Notified area development plans.	MGU Tourism
5	A new expressway connecting vasai and borivali passing through mira	MMRDA Regional

	bhayandar is conceived from MMRDA master plan proposals to decongest NH8 and to provide an alternate connectivity to NH8. An Interchange is proposed at Murdha khadi by UMTC to enable better connectivity of Mira Bhayandar residents to Vasai and Mumbai.	
6	An elevated road from Radhanath Satsang Junction to Morwa Gaon parallel to uttan road is also proposed.	CMP new road

The above proposals are shown in **Figure 6-5**.

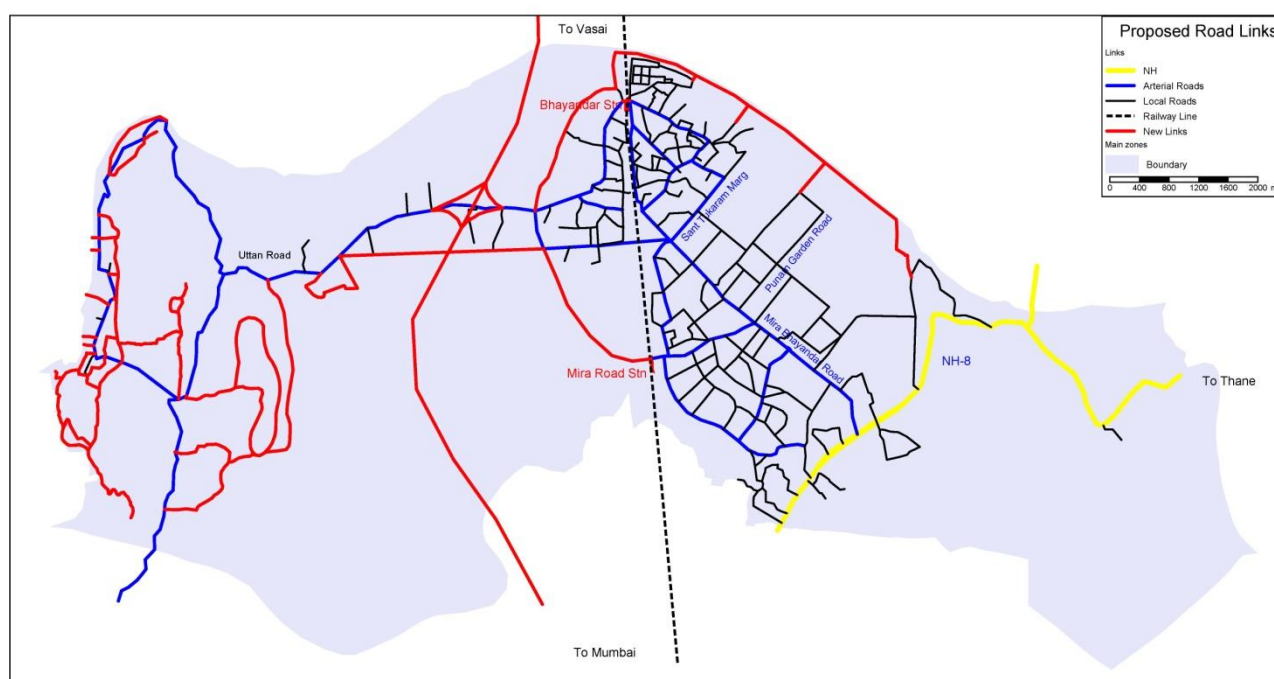


Figure 6-5 Summary of Proposed New Roads in Mira Bhayandar

Proposed Road Widening

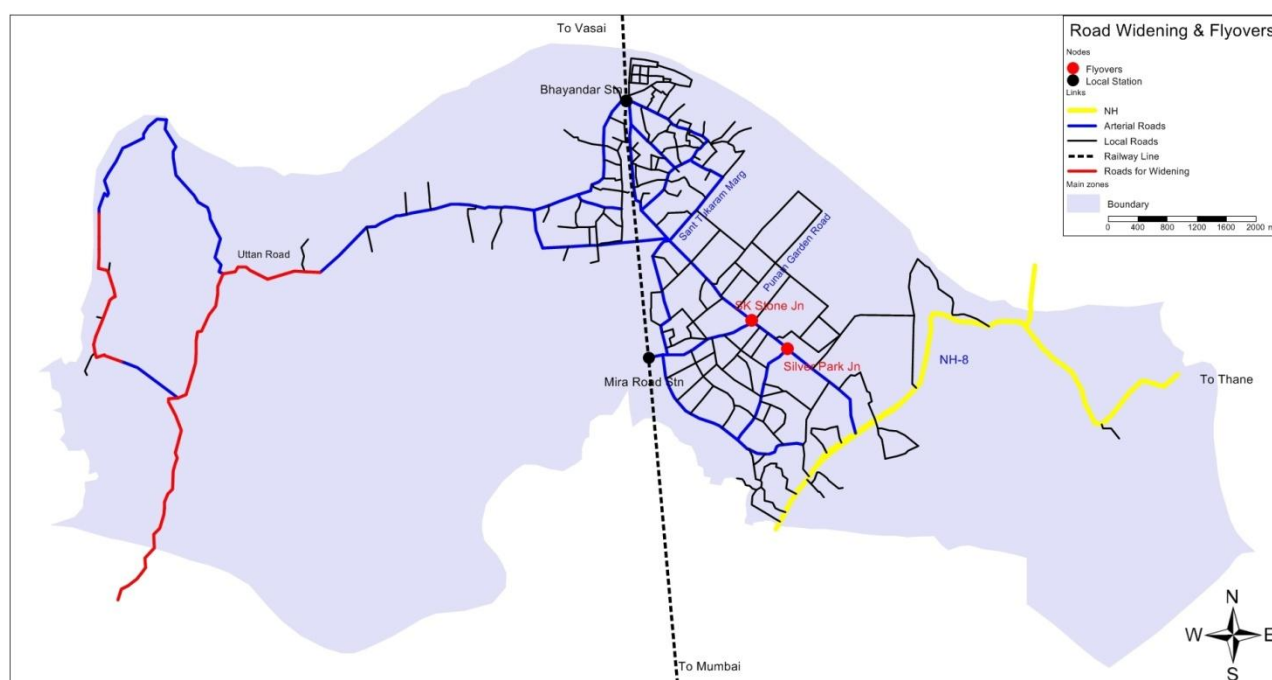
Uttan is a commercial cum tourist area in Bhayandar West with congested roads, partly because of encroachment and hawkers. Thus, considering this aspect, the Uttan, Manori & Gorai Master Plan 2022 has identified the designated right-of-ways for few road sections in these areas. Currently, majority of them have abundant encroachment upto the carriageway under use. Based on secondary data and primary data the CMP for Mira Bhayandar has also suggested widening for the following roads (by removing encroachments). **Table 6-1 & Figure 6-6** gives the details of the roads to be widened.

Table 6-1: Road widening proposals for Mira Bhayandar

S.No.	Road Name	Proposed Carriageway Width (m)
1	Uttan Pali Road (From Uttan Police Chowk to Pali Beach Resort)	9
2	Uttan Road (Morwa Gaon to Sawant Wadi)	20

Development of Flyovers

Origin – Destination survey conducted at various locations showed that there is a considerable straight moving traffic on Mira Bhayandar Road i.e from Kahsimira Junction to Golden Nest Junction or vice versa. Significant time is being spent for the straight moving traffic at Traffic Signals. Hence, CMP has suggested two flyovers at SK Stone and Silver Park Junctions with 2 lanes for each direction for straight moving traffic. **Figure 6-6** gives the details of these proposed flyovers.

**Figure 6-6 Proposed Road Widening & Vehicular Flyovers**

6.5.2 Public transit strategy and Plan

The public transport strategy for Mira Bhayandar derives considering all the existing factors of urban mobility and other master plan proposals.

The main existing mode of public transport in Mira Bhayandar is Suburban Train Service operated by Indian Railways. The other modes include public transport buses operated by MBMT, BEST, TMT, MSRTC, NMMT and Auto Rickshaws (IPT mode). However, there exists number of possible interventions for improvement of the existing condition of city bus services such as improvement in service frequency, quality, coverage and accessibility, introduction of Intelligent Transport Systems (real time passenger information system at terminals & bus stops), Integration of PT systems, identification of possibility of Trunk & Feeder kind of systems, improvement of essential physical infrastructure such as Terminals, depots, workshops, stations, interchanges, shelters and stops etc.

The strategy for public transport for the study area is based on following postulates:

- Complete connectivity within MBMC Area as well as inter-connectivity between the main city, Vasai, Thane and Mumbai for improved mobility and to facilitate better regional connectivity
- Transport Infrastructure to support the public transit system guiding sustainable growth of the city
- Provision of alternative Public Transport Systems and their integration with other modes such as Metro, IPT (shared autos/Cycle rickshaws).

The strategy for integrated public transport for MBMC Area is shown in **Figure 6-7**.

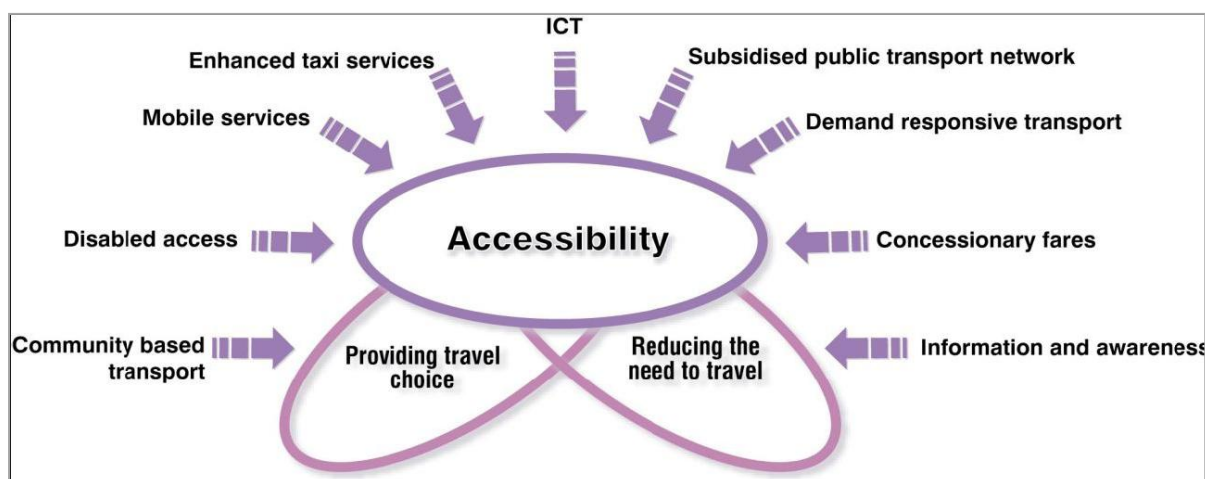


Figure 6-7 Public Transit Strategy for Mira Bhayandar

The objective of CMP is to move people and not just the vehicles by promoting public transport. By following the NUTP guidelines and to fulfill the objective of a CMP, the CMP for Mira Bhayandar has carried out various alternative scenarios to arrive at the best feasible

and sustainable public transport scenario for Mira Bhayandar. The details of scenarios are described in Travel Demand Assessment Chapter. The city is mainly dependant on Sub urban Rail Transport for external travel and on MBMT buses for within city travel.

Considering all these aspects, the CMP Mira Bhayandar suggests developing 3 tiers of public transport system for Mira Bhayandar, which consists of New Metro Routes, Improving the service of existing Railways and its integration with the City Bus Services and the Bus based system. However the detailed feasibility studies need to be carried out for the development of each of the above systems.

Public Transport Plan for Mira Bhayandar Includes:

6.5.2.1 MRTS proposals:

- A Metro system connecting Borivali & Vasai with an alignment parallel to the existing Sub urban railway system. This Metro route will be accessed through a station in Bhayandar West. Another Metro Route is proposed connecting Dahisar and Thane with an alignment parallel to the existing NH8. This route will be accessed through Mira Thamba and Bhayandar Phata Metro Stations.
- A two track elevated corridor is proposed over the Existing Railway track with a capacity to run 8 car air conditioned trains with a minimum frequency of 90 seconds along churchgate –virar section.

The MRTS proposals for Mira Bhayandar Municipal Corporation Area is shown in **Figure 6-8**.

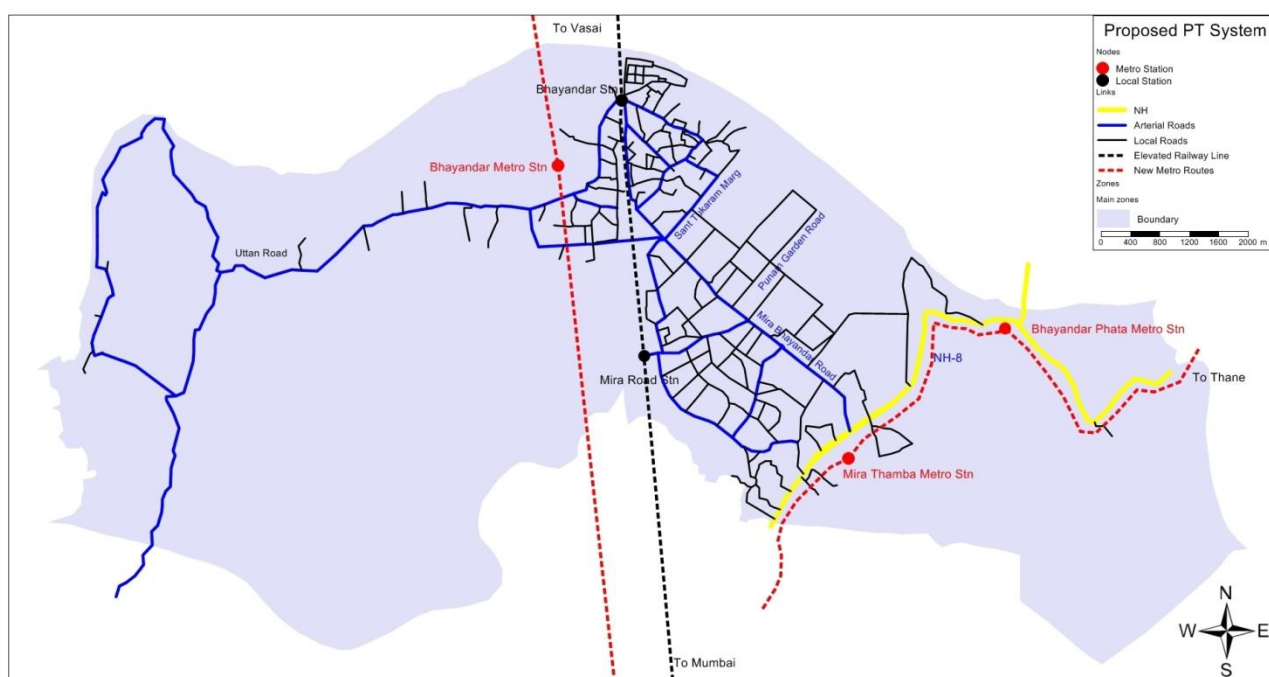


Figure 6-8 MRTS Proposals for Mira Bhayandar

6.5.2.2 Increase in Service Frequency of City Bus Services:

Increase in the service frequencies of existing buses to enable more number of passengers to use buses and decrease the waiting times at bus stops. **Table 6-2** gives the details of the proposed service frequency for different city bus routes.

Table 6-2 Proposed Service Frequency for MBMT Buses

S.No.	Route no.	From- To	Route Length (KM)	One-way Run Time (min)	Existing Fleet	Existing Head way[In Min]	Revised Headway (min)	Required Fleet
1	1	Bhayandar st.(W) to Chowk	14.2	45	6	30	15	7
2	2	Bhayandar st.(W) to Uttan Naka	10.3	30	6	15	10	7
3	3	Bhayandar st.(W) to	19.3	50	1	110	45	2

		Manori Tar						
4	4	Bhayandar st.(W) to Essel World	16.1	50	2	50	25	4
5	5	Bhayander Station [W] to Maxus Mall	5.9	30	2	40	20	4
6	6	Uttan Naka to Manori Tar	11.6	35	3	30	15	5
7	7	Bhayandar st.(W) to Vaesova Bridge / Kajupada	11.4	40	1	45	20	5
8	8	Uttan Naka to Gorai Tar	9.7	30	1	70	35	2
9	10	Bhayandar st.(W) to Thane St. (E) Kopari) Via W.E.H Majiwada	34.5	90	7	60	30	6
10	11	Bhayandar st.(E) to Magathane Depo via M.T.N.L. Surshti. Dahisar Cheeknaka.	13.2	60	1	60	30	4
11	12	Bhayandar st.(E) to Magathane Depo Via Nayanagar Mira Road St.(E) Dahisar Chek Naka 9.00Borivali (E)	13.1	60	1	60	30	4
12	13	Versova Brige to Magathane Depo Via hatkesh	12.7	60	1	60	30	4

13	14	Bhayandar st.(E) to Magathane Depo Via kashimira borivali St (E)	13.5	60	6	20	15	9
14	15	Mira Road St.(E) to Rasmi Comp.via. s.k.ston Bevaly park cine max	4.1	18	5	7	7	7
15	17	Bhayander st to Western Park	8.6	45	1	90	45	2
16	18	Western Park to Jogeshwari [West]	19.8	90	1	60	30	6
17	19	Bhayander Station [E] to penkar pada	8.8	30	1	40	20	4
18	20	Bhayander Station [W] to Morva	5.5	20	1	25	15	3
19	21	Mira Road Station [E] to Ramdev Park Via Rasaz Theater Bharati Park Shivar Garden	3.1	15	3	8	4	10
20	22	Mira Road Station [E] to Shanti Vidhya Nagari Via Jain Mandir Vijay Park Silver Park	4.4	20	4	11	11	5
21	23	Bhayander Station [E] Vai Ghoddev Naka Indralok Mira Road	15	60	2	20	10	13

		Station [E] Royal College						
22	24	Mira Road Station [E] to Western Park	5.7	20	2	20	10	5
23	27	Bhayander Station [W] to Bhivandi via majivada	46.9	120	1	120	60	4
24	30	Bhayander Station [W] to Shirsadh Phata	36.5	90	1	90	45	4
25	28	Mira road st. to Ideal Park	2.2	30	1	60	30	2
26	29	Mira road to Thane Kopari	30.2	75	1	120	60	3
27	33	Bhayandar st. (w) to Ullasnagar	61.2	120	1	240	120	2

Due to the increase in the service frequency, additional 70 buses are required to be operated through MBMT. This increase in number of buses will further increase the passenger load to the existing sub urban railway stations in Mira Bhayandar. The additional passenger load at Mira Road station is estimated to be 413 pax/hr during the peak hour. Similarly, the additional load at Bhayandar station is 1321 pax/hr during the peak hour. Low floor buses are recommended which are user friendly especially for vulnerable groups like women, children and old people.

6.5.2.3 Development of Bus Shelters:

Bus stops are the most frequently used elements of the transit by the public. CMP Mira Bhayandar proposes that these bus stops should be upgraded with pedestrian facilities and parking facility for IPT modes to provide interchange facilities to improve the mobility of the city. Up gradation of Bus shelters is proposed with the provision of:

- An appropriately designed bus bay(s) for stoppage of buses and with platform for convenient boarding and alighting of commuters including those with disabilities
- Covered roof
- Proper sitting space for passengers
- Adequate space for displaying passenger oriented information
- Suitable space for display of commercial hoardings to generate revenue
- An area to house telecommunication gadgets for vehicle tracking, etc.
- A sturdy structure to support the above
- Space for easy ingress and egress of commuters from the bus stops.



CMP Mira Bhayandar Proposes all the existing bus stops of Mira Bhayandar should be upgraded with the provisions explained above.

6.5.2.4 Development of new bus routes & public transport hub:

A public transport hub is proposed near existing Bhayandar MSRTC Bus stand at Bhayandar Railway Station West. This hub consists a Bus Depot, Commercial Complex and which acts as an interchange point for passengers using Metro, local train and bus services.

The proposed transport hub along with the feeder bus routes is shown in **Figure 6-9**.

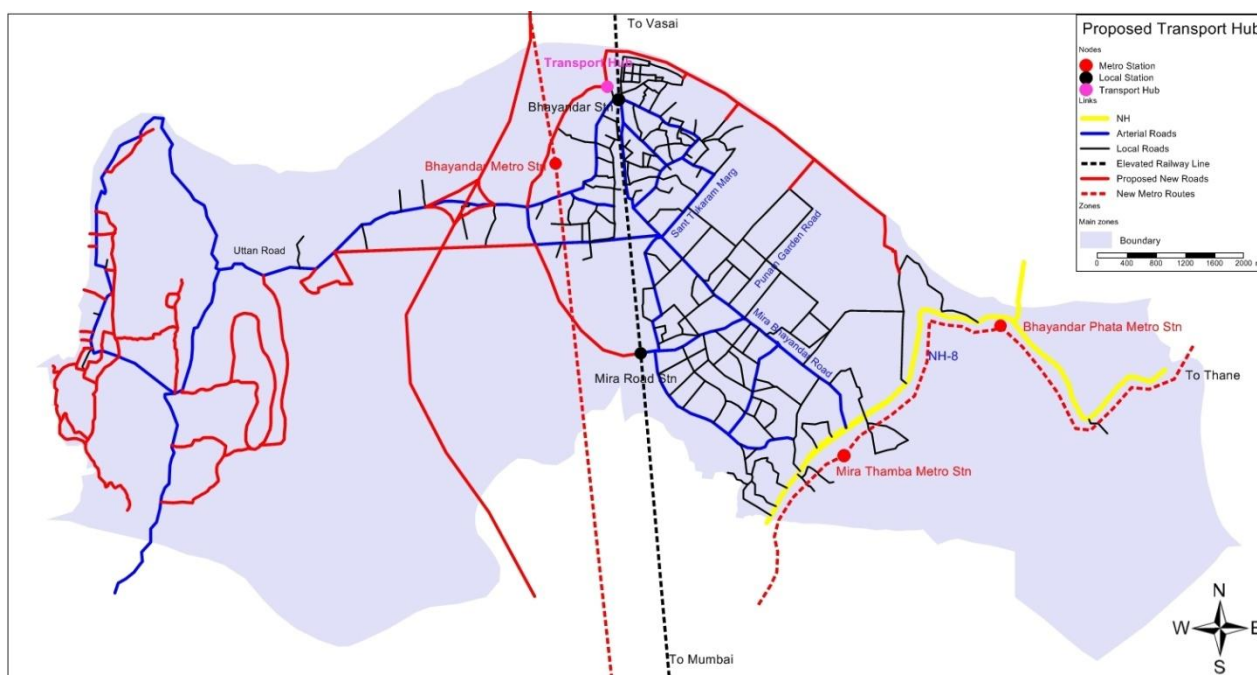


Figure 6-9 Proposed location of transport hub

A new feeder bus system with battery operated buses is proposed to integrate different public transport proposals. This feeder bus system aims at connecting proposed metro stations with existing railway stations passing through various residential areas.

Table 6-3 gives the details of new bus routes proposed.

Table 6-3 Feeder Bus Route Details

S.No	Route Description	Proposed Frequency (min)
1	Bhayandar Metro Station to Mira Road Station East via Transport Hub, Bhayandar Phata Metro Station, Mira Thamba Metro Station passing through proposed coastal road, NH-8, Mira Bhayandar Road and LBS marg.	7

2	Transport Hub to Bhayandar Phata Metro Station via Bhayandar Metro Station, Mira Road Station East and Mira Thamba Metro Station passing through new link from transport hub to bhayandar metro station, uttan road, lodha raod, LBS marg, Mira Bhayandar Road and NH-8.	7
---	--	---

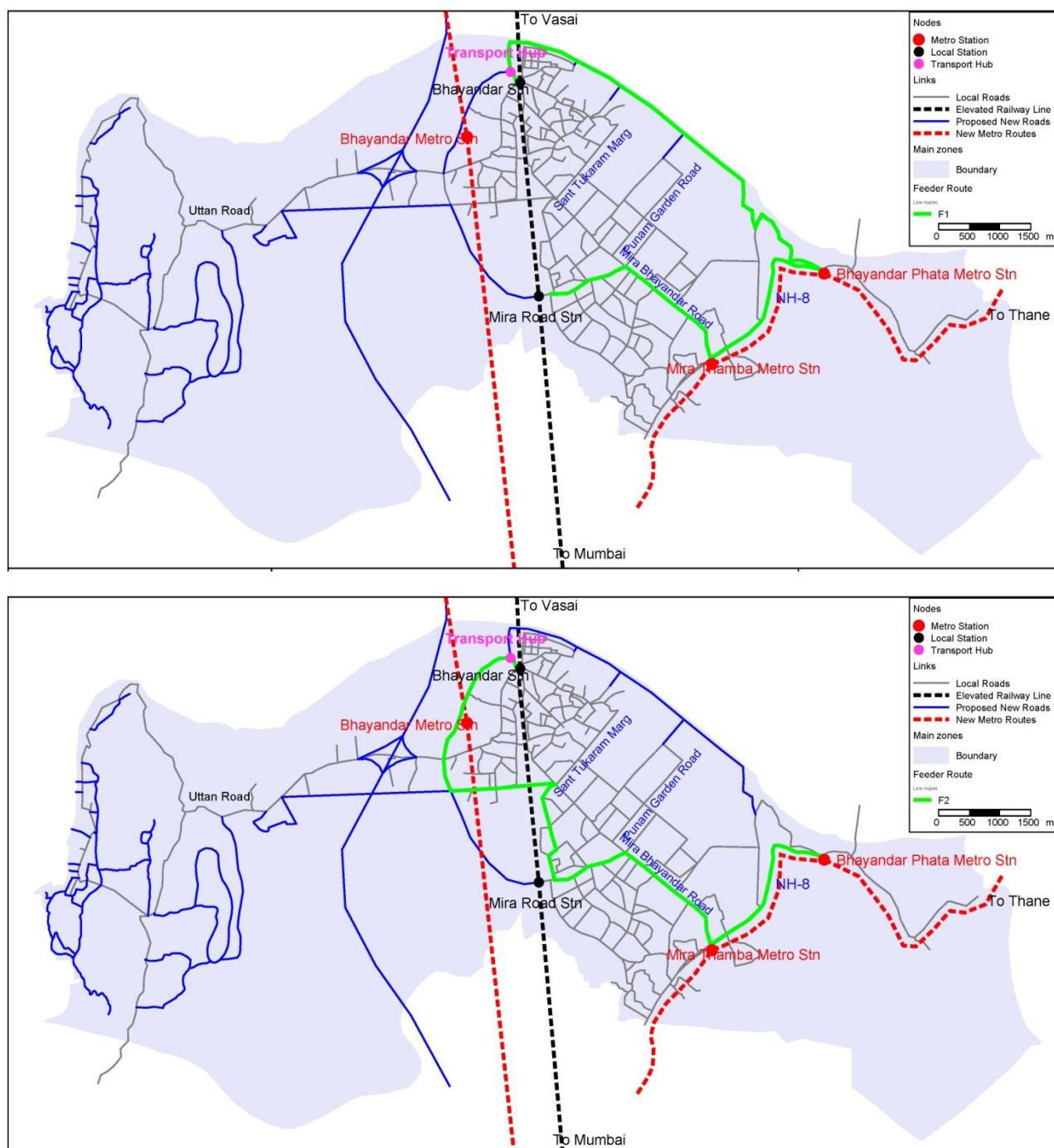


Figure 6-10: Feeder Bus Routes proposed in Mira Bhayandar

6.5.2.5 Development of Bus Infrastructure:

At present, there is one small terminal near Bhayandar station (west). In addition to this, other empty lands have been identified which would be developed by MBMTU. The details of these are given in **Table 6-4** below and shown in **Figure 6-11**.

Table 6-4: list of Terminals and Depots

Sr.No.	Location	Approximate Area (Acres)	Proposal
1	Uttan	1.35	Terminal
2	Mira Road (West)	0.35	Terminal
3	Mira road (East)	0.39	Terminal
4	Ghodbunder	0.65	Terminal
5	Bhayandar west	5.00	Bus Depot & Terminal
6	Kanakiya	3.00	Bus Depot & Terminal
7	Near Kashmir junction	1.00	Terminal
	Total	13.24	

Source: Mira Bhayandar Municipal Corporation

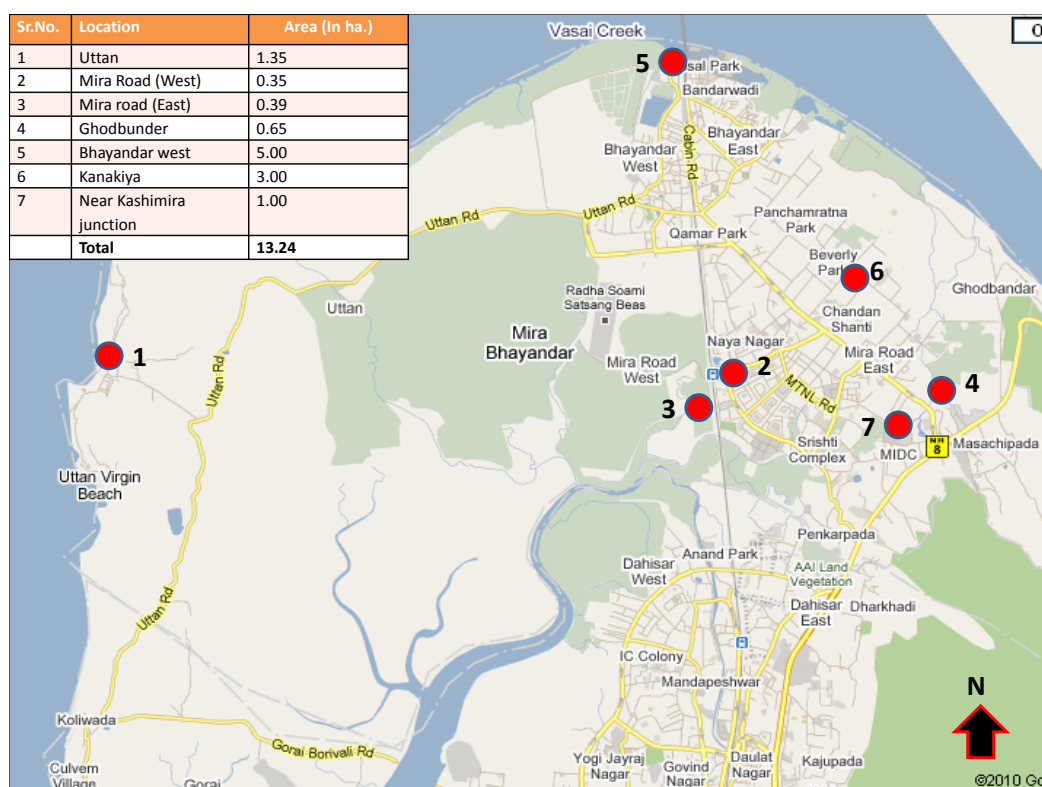


Figure 6-11: Location of Terminals and Depots**(a) Proposed Bus depot**

A bus depot is an essential part of support infrastructure for smooth and efficient operations of city bus services. Bus depot not only serves as an idle parking facility for buses but also houses facilities for day to day servicing, repair and maintenance of buses besides providing space for administrative and operations planning, monitoring and control activities.

Components of a standard depot

A standard bus depot shall constitute the administrative building, workshop or bus engineering facilities, bus parking area, adequate circulation area and other facilities such as fuel sheds, cleaning sheds, washing sheds etc. which are explained below:

Administrative Building – Administrative building shall consist of Managers room, admin staff room, cash collection office, ticket issuing office, bank area, canteen or refreshment areas, meeting/discussion room, store room, locker room, rest area and other support facilities.

Workshop/Bus Engineering Building – Workshop or bus engineering building shall consist of major pits, minor pits, general checking area, workshop office room, store room, inspection ramp, engine overhaul section, re-ringing section, spare parts room, tool room, engineering facilities room, parking area and other support facilities.

6.5.2.6 Passenger Information System (PIS) at all bus stops

It is envisaged that passengers using the system would be given updated information on the following:

At each bus stop

The displays at bus stop have to be capable of displaying data in a multi-lingual format and should have the capability of scrolling between different languages and different character sets, for example, between English, Hindi and Marathi. All the bus stops available with proper bus shelter are proposed to have this PIS display system.

6.5.2.7 Central Control Facility

A central control facility should be set up for controlling the services. This acts as a nerve centre of the entire system and associated services and provides the overall control and co-ordination of the system and it consists of all the necessary computing and communications hardware and software needed to fulfill this function. This shall have, at a minimum, the following:

Control panels on which the location of all buses can be spotted and tracked
Monitors to which visuals of the actual ground position can be transmitted by cameras located at strategic points on the corridor
Facilities for voice communication between the drivers and the control room as well as between terminal/bus stop supervisors and marshals and the control room
Facilities to receive and transmit, as needed, all data being collected by the vehicle mounted units, fare collection units, cameras, all other hardware
Report and alert operators to errors and faults with the RTPi system; and
Collect, process and store data generated by the system;

This central control facility can be provided as a part of Depots proposed.

6.5.2.8 Fare Collection System

Technology for Fare Collection should be capable of the following:

1. Avoid over travel possibility on payment of lower tariffs.
2. Establishes Data transfer links between the ticket vending system and control centre
3. Generation of Management Information System (MIS) for trip-wise/route wise / duty-wise revenue collected, passenger flow, trend analysis (both physical and financial trends) & decision making.
4. Enable PMC to conduct routine appraisals of drivers' and conductors' performance in terms of earning per kilometre (EPK), revenue collected, etc.
5. Analyze frequency / intensity of use of various ticketing instruments for facilitating expansion of ticket issue centres.

The proposed Fare Collection System for bus operations broadly comprises of sub-systems discussed here under:

- **On board ticket vending and verification:** Each bus is proposed to be provided with hand-held Electronic Ticket Vending and Verification Machine (ETVM). The machines

shall be capable of verification of/charging from contact less cards, magnetic cards / Smart Cards and other user tariff charging instruments such as the seasonal travel passes, prepaid cards, single journey tickets, integrated tickets, etc issued earlier or off board or by other mass passenger transport operators. Assuming two shifts per day, the total number if ETVM machines will be twice the number of buses.

6.5.2.9 Public Participation and awareness programme

For successful implementation of any transport project in general and public transport project in particular, it is necessary to promote public awareness and create a sense of public ownership of the project. It is necessary to evolve an outreach and education strategy for public transport. The outreach and education goals need to be defined at the planning stage of the public transport itself to focus the efforts of the project implementation team. To secure support of the public for the public transport facilities and obtain acceptance thereof the outreach and education goals are defined as follows:

- Introduce the concept of public transport, its purpose and benefits to the various stakeholders
- Create profile of public transport as a big impact, incremental step for achieving the long-term vision for mobility in the city
- Enhance understanding that public transport projects positively impact economic health and environmental sustainability of the city
- Introduce the concept of public transport as an important strategy in making best use of transportation resources
- Establish communication channels for the public to receive information and interact with the project implementation team

Education and Outreach goals can be addressed by utilizing the following strategies:

- Create a network of allies and provide platforms for them to actively participate as disseminators of project benefits
- Use proactive and creative media relations to promote key public transport messages, particularly trip reliability messages.

Communication Media

The selection of the communication media is critical in ensuring that the message is delivered effectively to the target audience. Available media include:

1. Print – newsletters, newspapers, magazines
2. Broadcast – radio, TV
3. New Media – internet, web sites
4. Out of Home – hoardings, posters, short films, display models
5. Direct mail – flyers, inserts, brochures, letters, fact sheets
6. Event marketing – special events, workshops/conferences
7. Public Relations – media management, general awareness programme
8. Mobile phone – Through SMS, toll free enquiry system etc.

The choice of media is predicated on budget, ability to reach target audience, the desired impact and the message to be communicated. The messages have to be reiterated at a regular frequency for them to impact the target audience effectively. The development of the message is also critical to the success of the marketing plan and the message has to be well crafted with both written copy and visual component. The messages should be focused on the benefits of public transport, should be supported by facts, positive and consistent.

Communication Objectives

- Create awareness of the project
- Improve image of bus as a transit mode
- Build brand identity
- Maximize rider ship
- Disseminate information on user benefits
- Provide information on service (routes, schedules, fares)

Target Audience

- Segment 1 - Existing public transport users (such as bus and local train users)

- Segment 2- Potential Users – two wheeler users, auto rickshaw users, car users
- Segment 3- Local Community /Special Interest Groups/NGOs

Marketing strategies are to be designed to cater the specific needs of each of these segments separately.

6.5.3 Non-motorized transport Plan

Huge pedestrian movement was observed along roads and at intersections in and around the city. Besides a few narrow roads, footpaths exist on many of the city roads in newly developed areas. The poor maintenance of footpaths is forcing people to walk on pavement. The pedestrian crossing facilities are inadequate in Mira Bhayandar. **Table 6-5** shows the pedestrian counts at different locations.

Table 6-5 Peak Pedestrian crossing count at different locations

S.No	Location	Peak Crossing Pedestrian Count
1	Golden Nest Jn	1306
2	SK Stone Jn	790
3	Kashimira JN	677

As part of analysis, Referring to **Table 6-6**, PV^2 values at the above intersections are higher than 1 (one) which necessitates improvement in pedestrian crossing facility.

Table 6-6 PV^2 values at different locations

S.No	Location	$PV^2/10^8$
1	Golden Nest Jn	126.3
2	SK Stone Jn	75.6
3	Kashimira JN	44.9

Accordingly, the proposed measures to develop facilities for pedestrians on the streets include:

- Pedestrian Phase at all Signalized Intersections.
- Incorporating all essential elements including zebra crossings, hand rails on existing foot paths (Proposal submitted in STTIMP Final Report Submitted to MBMC on 01st September 2012).
- Provide Mechanized Foot over Bridges for pedestrian crossing at Golden Nest, Vardhaman Fantasy Park and Kashimira Junctions.

The NMT mobility plan is shown in **Figure 6-12**.

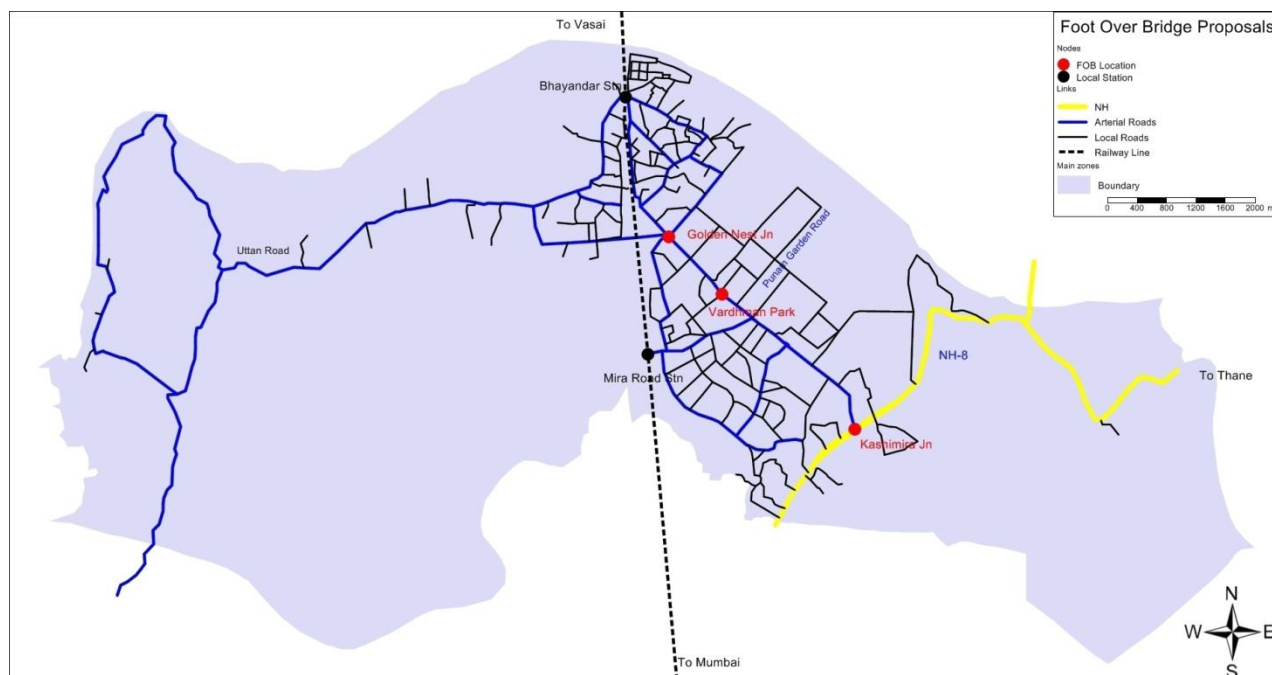


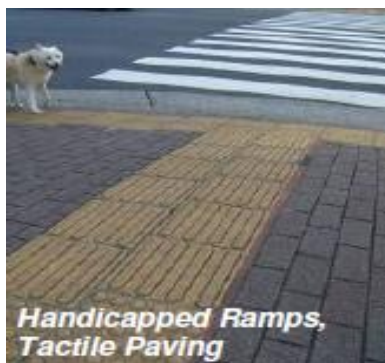
Figure 6-12 Proposed FOBs at various locations in Mira Bhayandar

Accessibility for the Differently abled:

Tactile guidance blocks (Line-type) indicate a barrier free route for a person with visual impairment. Care must be taken to ensure that there are no obstacles, such as trees, poles or uneven surface, along the route traversed by the guidance block. Also there should be clear headroom of at least 2.1 m height above the tactile guidance block, free of protruding objects such as overhanging tree branches and signage, along the entire length of the walk.

Tactile warning blocks (Dot-type) indicate an approaching potential hazard or a change in direction of the walkway, and serves as a warning of the approaching danger to persons with visual impairment, preparing them to tread cautiously and expect obstacles along the travel path, traffic intersections etc. It is recommended to install two ROWs of tactile warning tiles at appropriate places, such as before intersections, change in direction etc. Some of the examples are shown below:

Tactile paving for blinds



Audible crossing signals help visually impaired persons in crossing MV lanes. It should be kept in mind that pedestrian traffic lights are provided with clearly audible signals to facilitate safe and independent crossing of pedestrians with low vision or vision impairments. The acoustic devices should be installed on a pole at the point of origin of crossing and not at the point of destination. A typical Audible crossing signal is shown below;



6.5.4 Freight management Plan

Freight movement in a city is an inevitable process of trade and economy. Traditionally, movement of goods for local consumption and sale generally takes place from a certain location within a city which is closest to the wholesale markets. In other cases where there have been successful planning interventions, the goods terminal is preferred to be located on the outskirts of the city, in order to prevent the entry of heavy vehicles into the

congested parts of the city. The freight traffic mobility improvement strategies are summarized as follows:

- Ban on goods carrying vehicles during 06:30 hrs To 10:00 hrs and 17:00 hrs to 22:00 hrs on all narrow roads
- Development of Truck Terminal near Ghodbunder with an area of 34,000 sq.m.

The Truck Terminal Location is shown in **Figure 6-13**.

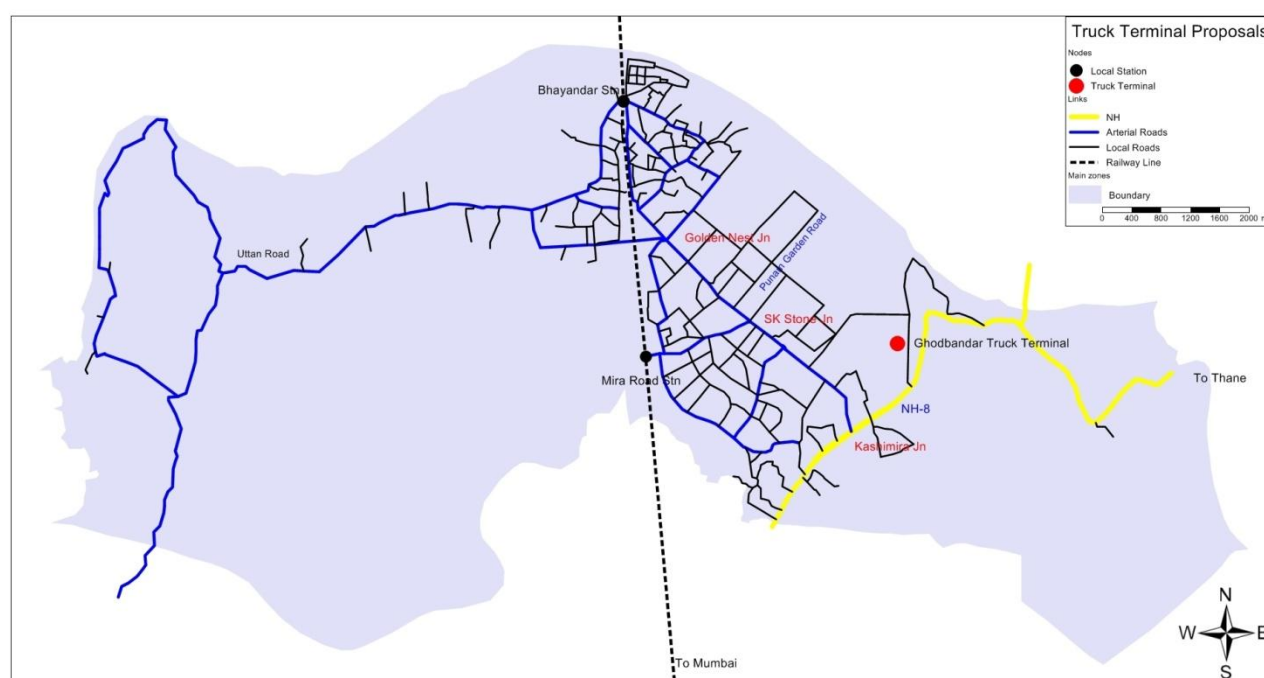


Figure 6-13 Proposed Truck Terminal near Ghodbunder Gaon

6.5.5 Traffic engineering and management measures

Traffic engineering and management measures generally qualify as short term measures for bringing in immediate relief from traffic problems. These measures are generally not very capital intensive and give instant results.

A detailed report is submitted by UMTC on 01st September 2012 regarding Short Term Traffic Improvement & Management Plan for Mira Bhayandar which covered following aspects:

- Road Markings
- Provision of Medians

- On street parking management
- Removal of temporary encroachment
- Street Lighting
- Provision of Bus Post & Bus Box
- Oneway Schemes
- Resurfacing of Roads
- Signals with Pedestrian Phasing Plan
- Geometric Design of junctions

6.5.6 Water Transport Plan

Reasonably quick, economical and reliable transport is a pre-requisite for any developmental or industrial activity to succeed in modern times. It is more so in the case of mega- cities like Mumbai, where people travel long distances to and fro to earn their living. The other possible mode that can be considered to supplement the rail and road based transport systems in catering the travel demand is water transport, as Mumbai has vast coast line.

However, before opting for water transport, there are certain ground realities, which should be fully appreciated and understood. It is very important to understand the major limitations of this mode of transportation i.e. it is unable to provide services round the year on the routes exposed to the open sea, especially during monsoon season. The selection of the vessels to be deployed, therefore, needs to be done very judiciously to ensure a reliable, economical and fully safe service to the public with minimum possible interruption during the year.

Accordingly, CMP Mira Bhayandar has proposed development of two Water Transport Terminal (WTT) in Mira Bhayandar Municipal Area. Since, Essel world and Gorai can be easily accessed through water transport; a new water transport route is planned from Proposed LR Tiwari College Jetty to Borivali Jetty.

This route is planned to reach Borivali WTT via Bhayandar West WTT, Essel World and Gorai WTT. The location details and proposed route is shown in **Figure 6-14**.

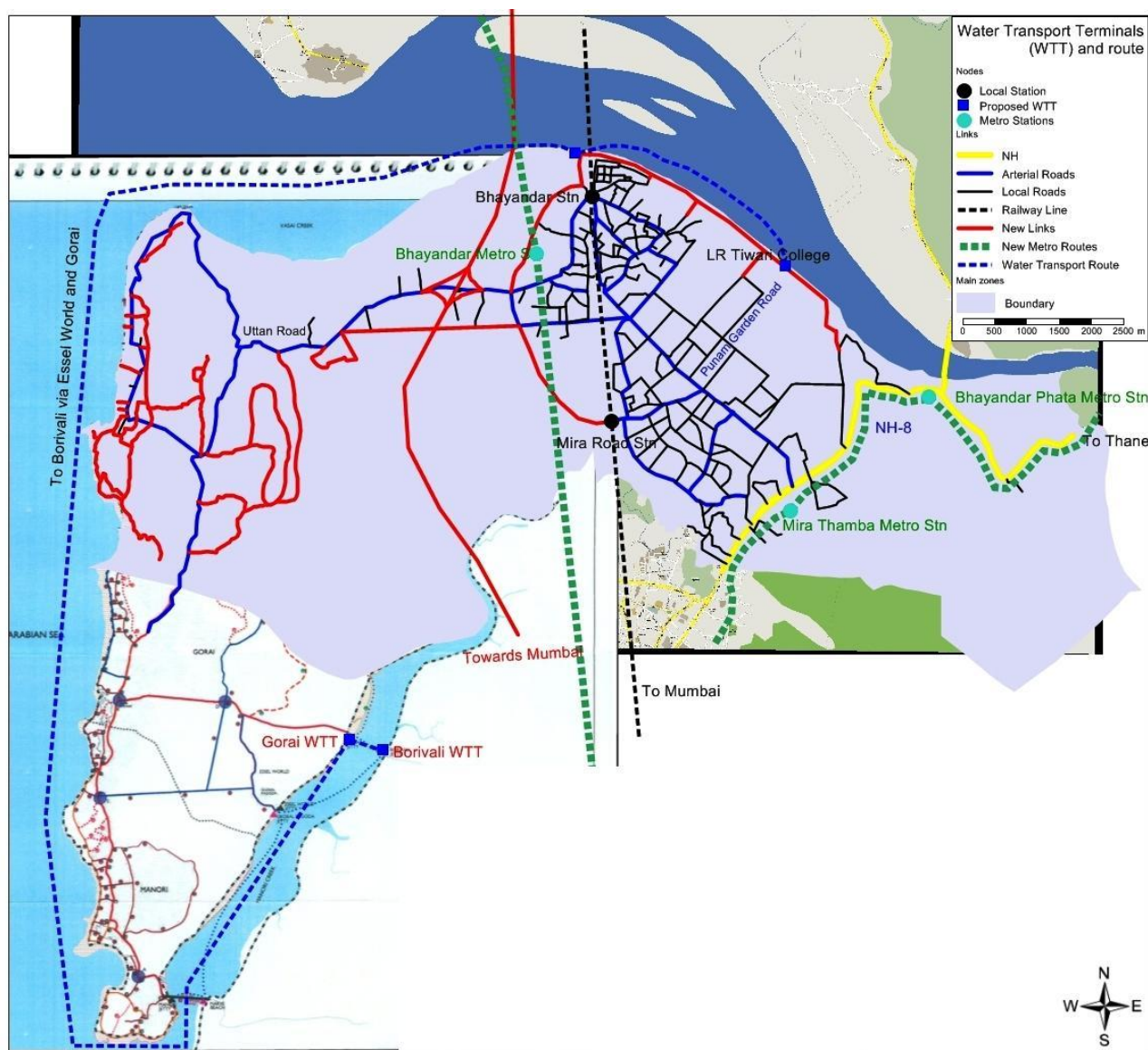


Figure 6-14 Proposed Water Transport Terminals and Route

6.5.7 Parking Management Plan

One of the reasons for traffic congestion in Mira Bhayandar is irregular On-Street parking. The expensive road space occupied by the parked vehicles and their maneuver decreases the road space available for smooth movement of traffic. Considering this aspect, the Mira Bhayandar CMP has suggested development of off-street parking space at various locations. However, the CMP for Mira Bhayandar proposes the creation of off-street parking facilities in order to augment the parking supply, and, on the other hand, also seeks to discourage the use of private vehicles by promoting public transport, and thereby reducing private

vehicle ownership so as to restrict the demand for parking. The strategies suggested by Mira Bhayandar CMP are as follows:

(A) Support public transport- Park & Ride facility

The CMP for Mira Bhayandar has suggested development of parking lots for private vehicles at major transit interchange nodes such as railway stations, bus terminals, as park and ride facility. Provision of park & ride facility will not only improve the ridership for public transport but also will help in reducing the private vehicles usage. Multi Level Car Parking lots are proposed at Mira Road Station East, Mira Road Station West and at Transport hub of Bhayandar West. Parking areas are proposed at all new metro stations to facilitate Park & Ride passengers.

The location details are shown in **Figure 6-15**.

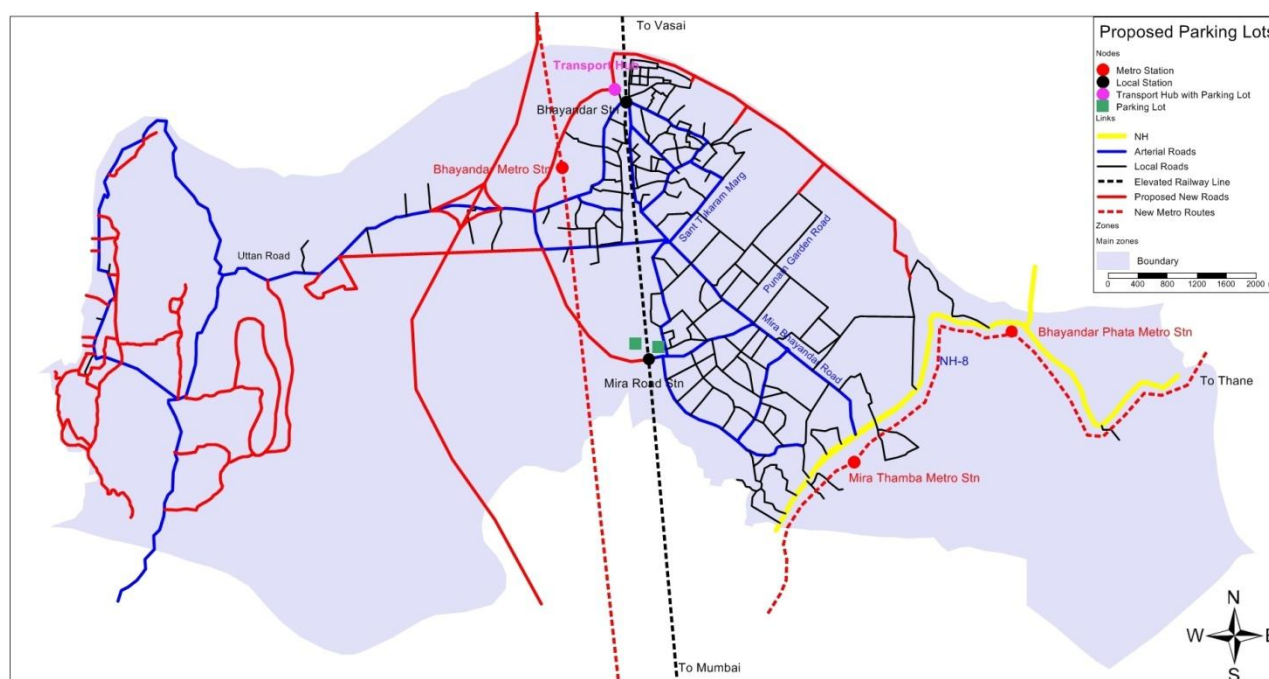


Figure 6-15 Proposed locations for Multi Level Parking lots

(B) Differential parking rates location wise

In order to reduce the usage of private vehicles and to promote public transport, the CMP for Mira Bhayandar suggests differential rate scheme for parking depending upon the location of parking. The parking rates at the locations other than the locations integrated

with public transport nodes such as Mira Road Station, Bhayandar Station and Transit hub at Bhayandar West should be 1.5 to 2 times higher.

(C) Regulation of on-street parking

Managing on-street parking using demarcation of parking spaces on the roads where sufficient carriageway is available and banning of on-street parking at specified locations is explained in detail in Section 3.2.3 of Short Term Traffic Improvement & Management Plan Report submitted by UMTC on 01st September 2012.

6.5.8 Education & Enforcement

Traffic Police should work in the direction to increase the overall awareness of the traffic discipline & compliance with the traffic rules by road users in Mira Bhayandar. Special traffic drives have to be planned by them for making public aware of traffic rules. The Road Safety programmes should aim at users and should serve three main purposes:

1. To inform the public about the new regulations or changes to the traffic regulation system
2. To influence the attitudes towards road safety
3. To persuade road users to change their behavior in relation to identified causal factors in road accidents

7 Implementation Programme and Costing

7.1 Phasing Plan

The projects identified have been phased depending upon several criteria like urgency of implementation, capital investment, ease of implementation, resource availability and environmental considerations. The phasing is generally done according to Long Term, Medium Term and Short Term requirements.

Projects, which do not require high capital investment and resource allocation and would prove useful in providing instant relief to the traffic problems of the city are given high priority and fall under Short Term Projects. Similarly, projects requiring high amounts of capital inflow and which have other issues like land availability problems and do not cater to immediate demand, are identified for medium and long term.

7.2 Project Prioritisation

As given in the above section, in accordance with NUTP and based on the detailed analysis, all the projects identified have been prioritized as follows:

1. Public Transport
2. Non-Motorized Transport
3. Travel Demand Management techniques
4. Parking facilities
5. Transport hubs
6. Terminal Facilities
7. New Roads
8. Road widening
9. Flyovers

The details of prioritization are given in the **Table 7-1**.

Table 7-1: Prioritization and Phasing of Projects

S. No	Project Component	Phase		
		Short	Medium	Long
		2013-16	2017-21	2022-31
1	INTEGRATED LAND USE AND TRANSPORT PLAN	L	M	H
1. (a)	Development of Induced Growth Centers	L	M	H
1. (b)	New Road Links	L	L	H
1. (c)	Widening of Roads	L	L	H
1. (d)	Development of Flyovers	L	M	H
1. (e)	Mobility Corridors	H	H	H
2	PUBLIC TRANSPORT STRATEGY AND PLAN	M	H	H
2. (a)	MRTS Proposals	H	H	H
2. (b)	Increase in Service Frequency of City Bus Services	M	H	H
2. (c)	Development of Bus Shelters	M	H	H
2. (d)	Development of New Bus Routes	L	M	H
2. (e)	Creation of Public Transport Hub	L	M	H
2. (e)	Development of Bus Infrastructure	H	H	H
3	NON MOTORIZED TRANSPORT PLAN	H	H	H
3. (a)	Pedestrian Phase at all Signalized Intersections	H	H	H
3. (b)	Mechanized Foot Over Bridges	M	H	H
4	FRIEGHT MANAGEMENT PLAN	M	M	H
4. (a)	Goods Vehicle Management	H	H	H
4. (b)	Development of Truck Terminal	L	M	H
5	TRAFFIC ENGINEERING AND MANAGEMENT MEASURES	H	H	H
5. (a)	Road Markings	H	H	H
5. (b)	Road Studs	H	H	H
5. (c)	Road Median	H	H	H
5. (d)	On Street Parking Management	H	H	H
5. (e)	Removal of Temporary Encroachment	H	H	H
5. (f)	Street Lighting	H	H	H
5. (g)	Provision of Bus Post & Bus Box	H	H	H
5. (h)	Oneway Schemes	H	H	H
5. (i)	Re Surfacing of Roads	H	H	H
5. (j)	Goemetric Design of Junctions	H	H	H
6	WATER TRANSPORT PLAN	L	L	M
6. (a)	Development of Jetties	L	L	M
6. (b)	New Water Transport Routes	L	L	M

S. No	Project Component	Phase		
		Short	Medium	Long
		2013-16	2017-21	2022-31
7	PARKING MANAGEMENT PLAN	M	H	H
7. (a)	Construction of Multi Level Parking Lots	M	H	H
7. (b)	Differential Parking Rates	L	M	H
8	EDUCATION AND ENFORCEMENT	H	H	H
8. (a)	Public Participation and awareness programme	H	H	H
8. (b)	Road Safety Programmes	H	H	H

(Note: H- High, M - Medium and L- Lowest Priority)

The mobility plan components discussed in the previous sections were considered in the estimation of block cost estimate for implementing the elements in the future. The approximate capital cost, excluding land acquisition, for implementing the mobility plan is about Rs. 899 Crores.

The Phase wise costing details are given in **Table 7-2**.

Table 7-2: Phase wise cost details

Phases	Project Cost (Rs crores)
Phase I : Short Term Projects: 2013-2016	70
Phase II : Medium Term Projects: 2017-2021	360
Phase III : Long Term Projects: 2022-2031	463
Total	893

The breakup of phase wise project cost are given in the **Table 7-3** to

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs crores)
1	Development of Bus Shelters	55	Nos	0.22 (PPP)	0.0
2	Grade Separated Pedestrian Facilities	2	Nos	5.62	11.2
3	City Bus Augmentation	75	Nos	0.39	29.5
4	Widening of Roads	7.1	km	1	7.1
5	Development of Subways	2	Nos	30	60.0
6	Multi Level Car Parking Lots stage 1	2	Nos	6	12.0

7	Development of New Roads	30.0	Km	8	240.0
Total Cost in Crores					360

Table 7-5 below. The reference for unit costs include Thane Schedule of Rates, CTS Study by MMRDA, Project Memorandum of elevated corridor by Indian Railways and few market rates wherever appropriate.

Table 7-3: Detailed costing of Projects in Phase I (2013-2016)

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Unit Rate (Rs crores)
1	Development of Bus Shelters	70	Nos	0.2 (PPP Mode)	0.0
2	Grade Separated Pedestrian Facilities	1	Nos	5	5.0
3	Road Markings	5.8	Sq.KM	0.735	4.3
4	Road Studs	1804	Nos	0.00018	0.3
5	Road Median	32	KM	0.05	1.6
6	On street Parking Management	23	KM	0.04	0.9
7	Street Lights	6	Nos	0.09	0.5
8	Bus Stop Signs and Bus Box	180	Nos	0.04	7.2
9	Road Re surfacing	17	KM	0.535	9.1
10	Intersection improvement	8	Nos	0.585	4.7
11	Bus Infrastructure (Depots)		LS		12.2
12	City Bus Augmentation	70	Nos	0.35	24.5
Total Cost (Crores)					70

Table 7-4: Detailed costing of Projects in Phase II (2016-2021)

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs crores)
1	Development of Bus Shelters	55	Nos	0.22 (PPP)	0.0
2	Grade Separated Pedestrian Facilities	2	Nos	5.62	11.2
3	City Bus Augmentation	75	Nos	0.39	29.5
4	Widening of Roads	7.1	km	1	7.1
5	Development of Subways	2	Nos	30	60.0
6	Multi Level Car Parking Lots stage 1	2	Nos	6	12.0
7	Development of New Roads	30.0	Km	8	240.0
Total Cost in Crores					360

Table 7-5: Detailed costing of Projects in Phase III (2021-2031)

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs Crores)
1	Development of Bus Shelters	75	Nos	0.33 (PPP)	0.0
2	Grade Separated Pedestrian Facilities	1	Km	8.3	8.3
3	Development of Truck Terminal	1	Nos	5.07	5.1
4	City Bus Augmentation	100	Kms	0.72	72.0
5	Creation of Transport Hub	1	LS	-	70.0
6	Development of Jetties & vessels	2	Nos	68	136.0
7	Development of New Roads	13.7	KM	11.8	162.2
8	Multi Level Car Parking Lots stage 2	1	Nos	8.9	8.9
Total Cost in Crores					463

7.2.1 Regional Development Cost

Few Proposals mentioned in the CMP are in the interest of regional connectivity of Mira Bhayandar. Projects like Elevated Suburban Rail corridor, Metro alignments and Expressway falls under this category. The total costs of these projects are given in the **Table 7-6**. The alignments of these proposals pass through MBMC study area.

Table 7-6 Projects under Regional Development Cost

Corridor	Total Length (KM)	Estimated Total Cost (Rs Crores) at 2005-06
Metro M10 (Dahisar-Mira Road-Manikpur-Virar)	29.9	5618
Metro M12 (Thane-Ghodbunder-Dahisar)	27.2	3182
Highway H20 & H21 Western Sea Link North Extension (Bandra-Dahisar-Virar)	63.98	15355

(Source: CTS Study by MMRDA)

7.3 Financing Options for Urban Transport Projects

As per the Recommendations of Working Group on Urban Transport for 12th Five Year Plan, the financing of urban transport projects in the country has largely been confined to gross budgetary support from the government and the user charges. Due to heavy investment needs of urban transport and conflicting demands on the general exchequer, the

investment in urban transport in past has not kept pace with the rapidly increasing requirement of the sector. The current level of user charges of limited urban transport facilities, do not make the system self sustainable. At the same time, providing safe, comfortable, speedy and affordable public urban transport to all has to be a necessary goal of the governance. The key funding sources besides GBS and fare box can be, dedicated levies, land monetization, recovery from non-user beneficiaries, debt and private investments. The paradigm of financing has to clearly move towards non-users pay principle and the polluters pay principle. There is a need for long-term sustainable dedicating financing mechanism to address fast worsening scenario in the field of urban transport. All the various components in which the investment would be required in the 12th Five Year Plan would need to be funded through a combination of funding from Govt. of India, State Govt./urban local body, development agencies, property development, loan from domestic and financial institutions as well as PPP. Thus, it is imperative to identify projects that are amenable to Government funding or PPP.

7.3.1 Public Private Partnership

Public-Private Partnerships is cooperation between a public authority and private companies, created to carry out a specific project. They can take on a number of forms, and can be a useful method of capturing property value gains generated by transport infrastructure. In a PPP for a new transport infrastructure development project, the public authority creates a secure environment for the private sector to carry out the project, and the private partner offers its industry know-how, provides funding and shares in the project's risk.

The objectives of the public and private sector partners appear to be quite different. The public sector aims to best serve the interests of taxpayers. The aim is not to use public money to obtain a return on capital investments. The private sector, on the other hand, aims to ensure a return on investment for its shareholders and to be as profitable as possible and yet these two contrasting goals can function perfectly well together in the framework of a PPP.

The decision to undertake a public-private partnership and the choice of the most suitable form of partnership greatly depends on the context and the type of project to be developed is given below:

- The project context may influence the type of PPP to be implemented. The public partner must evaluate the total cost of the project, its importance in terms of public need, the time frame, the number of actors involved and the geographic area in question. Does providing this public service require a major infrastructure? Will it require high levels of human and financial resources to provide this service? Before a decision can be made, it is necessary to fully understand the context of the proposed project.
- The cost of the project is of course a critical factor, which will weigh on the choice. Many PPP concern projects for underground systems, LRT and BRT requiring significant levels of financing which the local authorities would have difficulty assuming alone.
- A well-structured institutional framework and the local authority's experience in developing transport projects are also decisive factors. Urban transport is an industrial and commercial activity, which involves financial risk. Bringing in experienced partners is one way of compensating for a lack of certain skills in this field, though a good PPP should call upon other forms of expertise on the part of the public authority. This can sometimes facilitate obtaining a loan, in particular from international funding agencies.
- The tasks entrusted to the private sector (design, construction, development, operation, maintenance) will influence the type of contract.
- The sharing of responsibilities and risks will determine the degree of involvement of each partner and the type and clauses of the contract. There are many types of contracts but it is primarily the sharing of financial risk, which will determine the key characteristics. There are two categories of risk: commercial risk, related to trends in revenue, and industrial risk, related to the cost of construction and trends in operating and maintenance expenses. If both types of risk are covered by the public partner, then it would be a management contract in which the private partner is merely

performing the work. The private partner must meet the specifications but will not be motivated to improve the service nor propose innovative techniques or management;

- If the project is not self-financing, i.e. if, at the end of the contract, the total revenues and gains do not balance out the total costs, the transit authority may be required to provide compensation, depending on the clauses of the contract.

7.3.2 Alternate Sources of Funding

It is one of the most widely used source for raising funds particularly for projects like public transport, flyovers etc. In this process, property developers are invited to develop the land along the transport corridors and share profit arising out of such sale of property. The model is widely accepted around the globe and has been well adopted in India.

7.3.2.1 Dedicated Urban Transport Fund

Various states such as Tamil Nadu and Punjab have created dedicated Road Fund for development of roads, by levying cess on turnover, betterment levy, shops and establishment levy, tax on employment, surcharge on octroi and other levies. In Madhya Pradesh, the Infrastructure Initiative Fund has also been created. Cities like Surat in Gujarat have also set-up a dedicated fund for Urban Transport.

7.3.2.2 Viability Gap Funding

In a recent initiative, the Government of India has established a special financing facility called "Viability Gap Funding" under the Department of Economic Affairs, Ministry of Finance, to provide support to PPP infrastructure projects that have at least 40% private equity committed to each such project. The Government of India has set certain criteria to avail this facility under formal legal guidelines, issued in August 2004, to support infrastructure under PPP framework.

Viability Gap Funding can take various forms such as capital grants, subordinated loans, O&M support grants and interest subsidies. It will be provided in installments, preferably in the form of annuities. However, the Ministry of Finance guidelines require that the total government support to such a project, including Viability Gap Funding and the financial support of other Ministries and agencies of the Government of India, must not exceed 20% of the total project cost as estimated in the preliminary project appraisal, or the actual project cost, whichever is lower.

Projects in the following sectors implemented by the Private Sector are eligible for funding:

- (a) Roads and bridges, railways, seaports, airports, inland waterways
- (b) Power
- (c) Urban transport, water supply, sewerage, solid waste management and other physical infrastructure in urban areas
- (d) Infrastructure projects in Special Economic Zones
- (e) International convention centers and other tourism infrastructure projects

7.3.2.3 Cess on Turnover

A substantial amount of revenue could be generated through cess on turnover, particularly in cities, based on industry, trade and commerce activities. Such cess has already been levied for Bangalore MRTS project.

7.3.2.4 Betterment Levy through Value Capture Mechanism

It is a fiscal instrument to generate funds by recouping the land value increment. It aims to recover the project cost from the beneficiaries of the project. This method has been experimented in the case of Bangalore for LRT project in the form of metro tax. In Mumbai, for the improvement of transportation system, resource mobilisation is proposed through raising revenues from value capture resources, which include contribution from employees, transport development levy, development cess on daily rail and intercity bus tickets, surcharge on seasonal tickets, property development levy, etc.

7.3.2.5 Shops and Establishment Levy

This method has the potential to be one of the large revenue gathering measures, particularly in Indore city, where the predominant economic base is trade and commerce:

- Tax on Employment - An additional source of revenue can be generated by an additional levy on the employer. This has been successfully adopted in cities of developed countries like Paris and France.
- Surcharge Levy on Octroi Rates - This method involves levying a surcharge on Octroi. In areas where there is a proposal for abolishment of Octroi, a substitute in the form of Entry Tax has been enforced which has potential to generate sizeable source of revenue.

- Sale of Government Land and other Property - It is an efficient source of raising resources by local bodies. Cities in India have been raising funds through sale of government land for road infrastructure improvement projects.

7.3.2.6 Green Tax

The Municipal Corporation should levy and charge a fee on vehicles entering Uttan-Pali tourist area bearing registration numbers other than MBMC (who are not residents of Mira Bhayandar).

The fee collected should be utilized for tourism related activities however a certain percentage of proceeds should be transferred to the Urban Transport fund.

Besides the above-identified sources, the city can also access carbon credits and grants from other international sources including GEF, DFID, GIZ, etc. It can also access loans from international banks like ADB, World Bank, etc.

8 Institutional Framework

8.1 Introduction

City transport system generally involves several organizations that look after various forms and aspects of the transport system and network and have overlapping functions and areas of work. The existing institutional setup in Mira Bhayandar includes a variety of institutions sharing their responsibilities in different aspects of governance of Mira Bhayandar city. Mira Bhayandar Municipal Corporation (MBMC), which is primarily responsible for the governance of the city and for providing urban infrastructure and services to its citizens, is one of them for instance. Aside from the local level institutions, various departments and agencies from the State Government play important roles. Therefore, to delineate areas and to remove ambiguity of functions, the institutional framework has been proposed.

There are many agencies involved in transport sector in MBMC Region. They are directly or indirectly related to supply and management of the transport infrastructure. Each of these organizations formulates projects based on its own needs without considering those of other organizations. This results in projects with conflicting objectives, inconsistent with the overall development objectives.

Funding arrangements for urban transport infrastructure and services in MBMC are split between a number of national, state and local government agencies. No single agency has the role or responsibility for preparing affordable, integrated investment and operations budgets to meet travel demands and policy objectives. Overall levels of investment have been lagging demand (most notably on the railways), while maintenance expenditure is about half of what is needed to maintain roads in good condition. Inadequate funding for transport schemes at the various levels has also affected Mumbai.

8.2 Issues with the Present Institutional Set up

- Multiplicity of agencies
- Difficulty in coordinating the roles of central, state and Local Government agencies
- Lack of inter-sectoral institutional coordination resulting in schemes with conflicting objectives which are inconsistent with overall development objectives

- It is rare to find a single authority needed to deal with the large range of transportation problems and to coordinate over all solutions
- Lack of adequate resource allocation has a crippling effect on the performance of the institutions resulting in delayed implementation or non implementation of essential schemes
- Difficulties Encountered Within Individual Transport Agencies
- 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. This is more apparent at medium and senior levels of management
- Lack of Legislative Support
- In order to promote integrated transport system development, regulate transport services comprising various modes, inter & intra sectoral coordination consolidation of objectives, functional processes and procedures under one comprehensive statute is required.
- Lack of expertise in Traffic & Transportation Planning/ Engineering field
- No dedicated cell in ULBs and concerned agencies to look after traffic & transportation aspects

8.3 Proposed Institutional Framework

8.3.1 Unified Metropolitan Transport Authority (UMTA)

In order to facilitate integration of transport services holistically and pragmatically, an “institution” needs to be created to coordinate the activities and functions of multiple organizations dealing with complex issues of urban transport. With the formation of a State-level UMTA, part of the problem would be sorted out. However, this would have a macroscopic view of resolving policy issues for all urban centers within the state. Still, there is a need to set-up a localized organization that results in coordinated strategic level planning at the city level and deals with more day-to-day issues of urban transport.

8.3.2 City Level Unified Metropolitan Transport Authority

With a view to coordinate all urban transport activities in the city, it is recommended that a UMTA be set up at the city level also that acts as a planning and decision-making body for all matters related to urban transport in the city.

It is recommended that the city level UMTA be set up on an executive order for the ease of formation; however, it must be given a legal backing so that its functioning falls under an act and commands greater authority.

8.3.3 Broad Functions

The following functions are proposed to fall under the purview of the city level UMTA:

- Undertake overall planning for public transport in the city, covering all modes - road, rail and water transport systems
- Allocate routes amongst different operators
- Procure public bus services for different routes through contracting, concessioning, etc.
- Ensure compliance of terms and conditions of license
- Recommend revocation of license for non-compliance of terms and conditions of the license
- Carry out surveys and manage a database for scientific planning of public transport requirements
- Co-ordinate fare integration among different operators of public transport and determine the basis for sharing of revenues earned from common tickets or passes
- Operate a scheme of passes for the users of public transport and channelize subsidies to operators for any concessions that are offered in accordance with government policy
- Regulate the arrangement amongst operators for the sharing of their revenue derived from the use of passes

- Promote efficiency in public transport operation
- Protect the interest of the consumers
- Settle disputes between different operators and between operators and infrastructure providers
- Levy fees and other charges at such rates and in respect of such services as may be determined by regulations

8.3.4 Proposed Structure of UMTA

The National Urban Transport Policy, 2006 and GoI recommends setting up of UMTA in all million-plus cities, the extract of which is re-produced herein below:

“The current structure of governance for the transport sector is not equipped to deal with the problems of urban transport. Those structures were put in place well before the problems of urban transport began to surface in India and hence do not provide for the right co-ordination mechanisms to deal with urban transport.

The Central Government will therefore recommend the setting up of Unified Metropolitan Transport Authorities (UMTAs) in all million-plus cities to facilitate more co-ordinated planning and implementation of urban transport programmes and projects and an integrated management of urban transport systems. Such Metropolitan Transport Authorities would need statutory backing in order to be meaningful.

The Central Government would also encourage the setting up of professional bodies that have the capacity to make scientific assessment of the demand on various routes and contract services that can be properly monitored. Towards this end, it would encourage the setting up of umbrella bodies that regulate the overall performance of the Public Transport System and ensure that the city has a Comprehensive Public Transport System”.

The overall aim of the UMTA will be to promote public transport in the urban areas through formulation of policies, programmes, rules and regulations related to urban transit. Its function is to facilitate/ co-ordinate planning and implementation of urban transport programmes and projects in an integrated management framework. To be effective, such Urban Metropolitan Transport Authority would need statutory backing.

The National Urban Transport Policy clearly identifies land use and transport as two intricately linked elements of urban system that has bearing on each other. Hence, the distinctive role of UMTA regarding formation of progressive land use and transportation policy for metropolitan area becomes critical.

8.3.5 Composition of UMTA

As per the National Urban Transport Policy (NUTP-2006), representation of agencies involved in the preparation of land use and transportation plan is required in UMTA. In the light of the above guidelines/recommendations, the following structure is proposed for UMTA. Refer **Figure 8-1**.

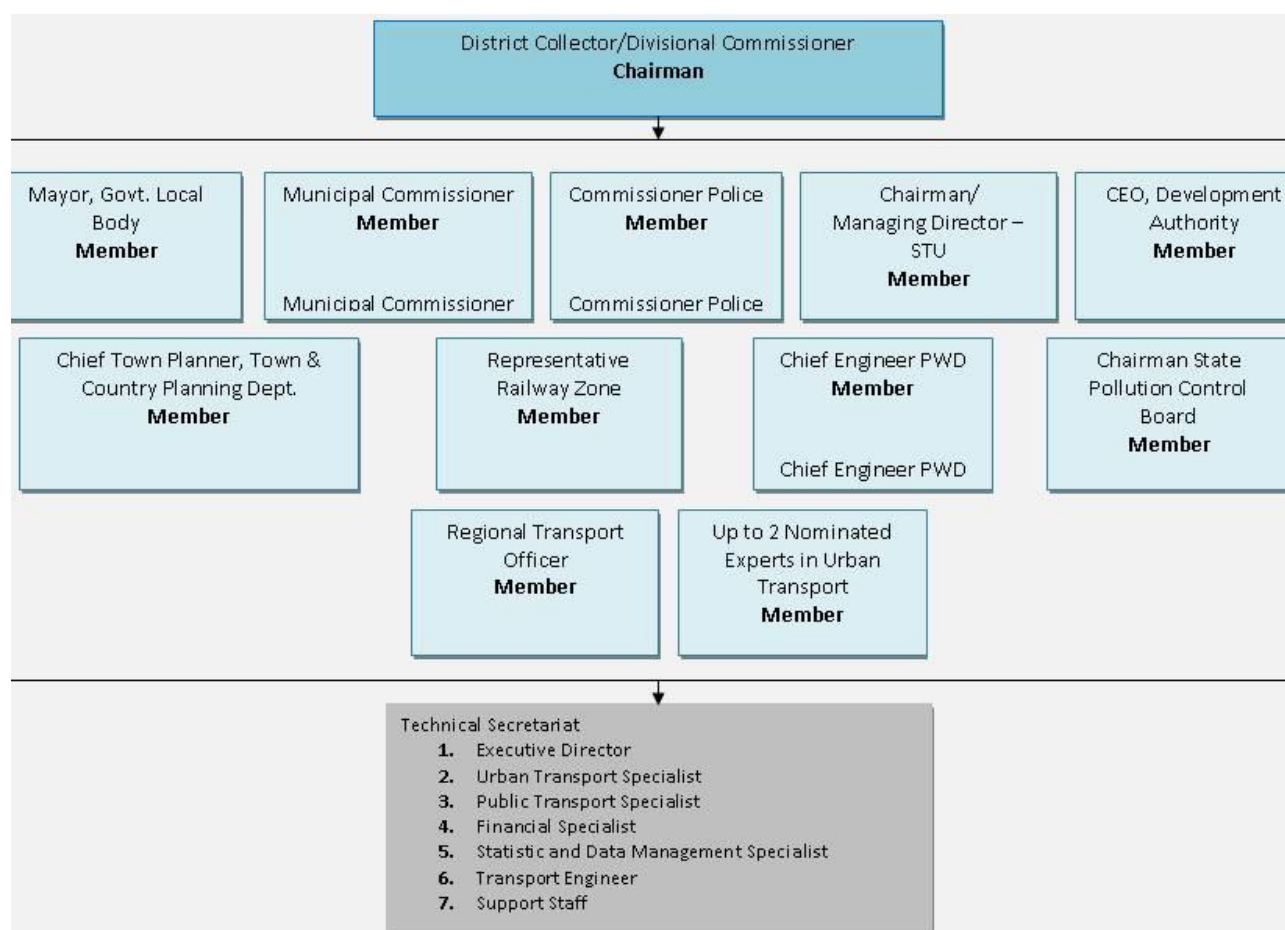


Figure 8-1 Departments and Organizations involved in Urban Affairs and Urban Transport

Besides the above members, Government could invite representatives from other government departments, bus operation unions, auto rickshaw unions, etc. as considered necessary from time to time.

8.3.6 Legal backing of UMTA

In order to give UMTA objectives, functions and operations a legal status, a draft Act has to be prepared by UMTA to be taken up for approval by the State Cabinet after finalization. The draft Act shall cover the following:

1. Objectives and functions of UMTA
2. Operational area of UMTA
3. Powers and delegation of powers of UMTA
4. Authority to have power to acquire land by agreement

5. Power of Government to transfer to the Authority lands belonging to it or to other ULBs, etc.
6. Power of Authority to borrow
7. Laying of annual estimate of income and expenditure
8. Authority to approve or amend such estimate
9. Estimates to be submitted to Government for sanction
10. Supplementary estimates may be prepared and submitted when necessary
11. Provisions regarding expenditure
12. Accounts and audit
13. Schedule of officers and employees to be submitted for sanction of Government
14. Appointments, etc., by whom to be made
15. Powers of entry
16. Directions by the Authority
17. Members and officers to be public servants
18. Power to make rules
19. Power to make regulations

8.3.7 Manpower Requirement and Staffing Plan

UMTA shall have to avail the services of an expert team of traffic and transportation planners, engineers, urban planners and other technical advisers. In order to strengthen its human resource, UMTA shall have to form a schedule of officers and employees whom it shall deem it necessary and proper to maintain for the purposes of UMTA Act. In addition to this, various powers related to appointment, promotion, suspension, etc shall also have to be worked out as per the Government's schedule.

8.3.8 Priorities of the coordinating agency

- **Safety:** It will plan and deliver a transportation system that promotes health, safety and security of the public.
- **Fiscal Responsibility:** The Authority will invest the public's transportation funds wisely to ensure that the system is sustainable in the long term and the Authority will make every effort to attract financial partners.

- **Accountability:** The Authority will account for its achievements, shortcomings, challenges to the public, stakeholders and partners.
- **Communication and Consultation:** The Authority will listen to and actively seek the ideas of the public, partners and stakeholders. It will provide clear and concise information in timely manner.
- **Customer Service:** The Authority will understand its customers and increase their satisfaction with the services they receive.
- **Integrity:** The Authority will conduct itself ethically, respectfully and honestly as stewards of the MMR transportation system.
- **Teamwork and Partnership:** The Authority will work together as partners to achieve a sustainable transportation network that meets the concern and future needs of the city.

9 Environmental and Social Impact Assessment

9.1 National Level Policy and Legal Framework

As per Section 3 of EIA Notification S.O. 1533 dated 14th September 2006, the Central government formed a State-level Environment Impact Assessment Authority. All projects and activities are broadly categorised into two categories as Category A and B. The projects which have been classified as Category A projects are those having potential impacts on human health and natural and man-made resources. Those projects require prior environmental clearance from the Central government in the Ministry of Environment and Forests (MoEF). The projects categorised as Category B projects require prior environmental clearance from the State/Union Territory Environment Impact Assessment Authority (SEIAA). The SEIAA's decisions are based on the recommendations of a State or Union Territory-level Expert Appraisal Committee (SEAC) as to be constituted for in this notification.

9.2 Screening and Identification of Impacts

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the CMP. Screening is conducted by identifying the interaction of environmental components on the project activities for various projects. Screening conducted for the identified projects and respective impacts identified are presented in the **Table 9-1** given below.

Table 9-1 Environmental Impacts of Important Projects

Broad Project Category	Activities / Sub Components	Impacts
Induced Growth Centres	• Development of serviced land for high density development	• Land acquisition from farmers
Pedestrian / NMT Infrastructure Improvement	• Road widening and creation of service lane wherever necessary • Land acquisition wherever necessary	• Relocation of existing vending activity • Removal of squatters and encroachers from the footpaths • Causing livelihood losses even though they are illegal • Loss of shelter for temporary shops / residences for squatters and encroachers
	• Construction of new footpaths	• Improvement in safety of pedestrians due to measures proposed
	• Pedestrian Infrastructure development like foot over bridges/ signals etc	• Improvement in pedestrian safety • Slowing of traffic at the time of constructing and erecting structures across major intersections
Public Transport Planning	• Metro routes	• Generation of noxious gases during construction, increasing air pollution • During the Metro development, there will be an increase in noise level in the tunnels (metro Corridor) and nearby ambient air (rail corridor). However, noise levels in the core city are likely to go down. The increase in levels are likely to be marginal, hence local population will not be adversely affected. • Aquatic ecosystems likely to be impacted by

Broad Project Category	Activities / Sub Components	Impacts
		the proposed infrastructure plan could be surface water bodies such as creeks, rivers, ponds, lakes, wetlands and ground water sources like tube wells, wells, tanks etc located in the direct influence zone of the corridors. • Impacts on water sources could be temporary or permanent based on their proximity to the corridors. Construction of bridges and other cross drainage structures can affect the flow rate and pattern of streams and rivers. • The transport network traverses through several coastal wetland areas. Impacts on wetland would be most pronounced during construction stage and are likely to continue during operation stage as well. Construction activities at these locations can directly or indirectly impound a wetland, even if culverts are used which in turn may change the functions of the wetland. • Roads / bridges for freeway / expressway, metro or sub-urban rail services located near riparian areas and wetlands may contain culverts that alter the natural hydrography of these water bodies. These culvert placements often set the water level either above or below natural levels. Most

Broad Project Category	Activities / Sub Components	Impacts
		wetlands have seasonally fluctuating water tables allowing plants and animals to fulfill their annual life cycle requirements. Certain wetland maintenance techniques, such as stop-log structures, maintaining water levels of wetlands located upstream of the transport link, simulating the natural hydrology throughout the year. Habitat for native fish, wildlife, and plant species can be maintained and restored by this technique. • Coastal zones are transition areas between land and water. Coastal erosion is one of the impacts of construction activities in coastal areas and can lead to loss of shoreline and associated flora and fauna. Natural processes of sedimentation and the coastal protection provided can be very severely impaired by the removal of sand from river systems or from beaches. • Infrastructure development in coastal areas can lead to destruction of adjoining mangroves through addition of sediment load and increased surface runoff from roads. Operation stage impacts of roads in coastal areas are likely to be as severe as construction stage impacts. During operation stage, accidental oil slicks from coastal roads get deposited on aerial roots

Broad Project Category	Activities / Sub Components	Impacts
		of trees and kill organisms in the habitat. In addition land take in coastal areas can cause beach vegetation to be removed and replaced in part by plants inappropriate to that location, which provide less protection against soil erosion. • The Environmental legislation has provisions to minimize impacts in coastal areas through enforcement of the Coastal Zone Regulation Act. The Maharashtra State has a coastal zone management plan in place. To the extent feasible, construction of infrastructure facilities are to be avoided in the Coastal Regulation Zones. However, regulatory measures as generic to working near water bodies specified above need to be undertaken. • The eastern coast is covered with large mangrove swamps, rich in biodiversity. Apart from this, the transport network traverses the Sanjay Gandhi National Park. The proposed corridors though pass through the area, do not sever the National Reserve but passes adjacent to Bassein Creek on the northern part of the park.
	• Terminals/Depots	• Acquisition of land for the facilities causes R&R issues as loss of livelihood, loss of shelter, severance of community & social ties

Broad Project Category	Activities / Sub Components	Impacts
		• Increase of noise and air pollution in the areas of terminals and depots • Improvement in approaches to the terminals and depots causing impacts on adjacent landuses and land acquisition • Additional land acquisition, if any, for the approach road improvement will lead to R&R issues along the roads and cause impacts on livelihood and shelter • Construction of stage impacts include the increase in air and noise pollution • Contamination of road runoff with stacked construction materials • Improvement of traffic conditions during operation stage causing reduction in air and noise pollution
	• Bus-Stops and FOBs/Sub-ways	• Temporary interruption to traffic and increase of emissions from vehicles due to higher idling times • Temporary increase of noise levels due to idling and traffic snarls • Alternate traffic diversion routes increasing route length and consequently emissions • Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air/noise pollution • Removal of squatters and encroachers from

Broad Project Category	Activities / Sub Components	Impacts
		the footpaths causing livelihood losses at approaches to the sub-ways / FOBs • Loss of shelter for temporary shops / residences for squatters and encroachers at approaches to the sub-ways / FOBs • Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth
Others-Road Infrastructure	• Junction/Rotary Improvements	• Additional land requirement for junction improvements will cause R&R (Rehabilitation & Resettlement) impacts as loss of livelihood and loss of shelter • May cause removal / displacement of squatters & Encroachers • Air and noise pollution from construction impacts • Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth
Freight Management	• Banning and restrictions	• Reduction in urban congestion due to banned movement of freight in the day hours
	• Creation of new freight terminal	• Acquisition of land in the peripheries • Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth

9.3 Location Impacts

The location impacts being analysed are associated with site selection and project location on environment and resettlement or livelihood related impacts on communities. Some of the generic impacts associated with location of project facilities that involves construction activities either by acquiring additional land and / or public land encroached by residents are as below:

- Major environmental features as lake fronts, parks etc., in the urban areas would generally be avoided and hence environmental impacts on these areas would be minimal to absent
- Projects do not have any major environmental features that are sensitive to acquisition of land as it is nominal in case of the conceived projects
- Removal of encroachments and squatters leading to loss of livelihood and / or shelter
- Vulnerable Project Affected People (PAP) within the encroachers would be further impacted by the pressure of relocation as well as loss of income and their removal
- Break-up of established social fabric that can cause severance of established relationships amongst the community
- Temporary loss of services provided by the encroaching PAP due to their removal

Some of the specific impacts associated with construction of bridges and flyovers involves disruption to existing traffic flow, especially, if located in the congested urban stretches. These would also involve land acquisition (either temporary or permanent) and would also impact the squatters and encroachers affecting residences and / or livelihood.

They would cause traffic congestion and delays and may also involve changes in the project design and alternatives. Project interventions as ITS application and improvement in public transport infrastructure would only improve the environment rather than causing pollution though resettlement impacts would be present to a limited extent.

9.4 Construction Impacts

Impacts resulting from pre-construction and construction activities including site clearance, earthworks, civil works, etc are identified in this section. Pre-construction and construction impacts arise due to dismantling of existing facilities, use of heavy construction machinery,

spillage/disposal of construction debris, runoff from construction site, inadequate or inappropriate drainage of the construction site, inadequate safety measures, etc. These are some of the direct impacts of construction in the project area.

In addition to the above, there are few indirect impacts or impacts that result from construction activities though not causing the impacts, support to cause the impacts. Some of these impacts include generation of vectors and vector borne diseases, spread of STD / HIV amongst the construction workers and within the community in the vicinity of construction activities, etc. The above environmental impacts are generic in nature occurring along all the project activities where civil works are involved. Impacts that are specific to the construction activities in a project intervention are presented below:

- Construction activities in case of reconstruction of footpaths or construction of new foot paths would cause temporary interruption to traffic and increase of emissions from vehicles due to higher idling times apart from temporary increase of noise levels due to idling and traffic snarls.
- Loss of adequate frontage in few cases of foot path construction.
- Relocation of utilities in the pre-construction stage causing temporary disruption to services. These impacts would be more severe in case of construction foot paths.
- Safety of pedestrians and traffic in the area is likely to be affected due to the progress of construction activities.
- Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth.
- Construction activities elevate the air pollution and noise pollution in the project area temporarily. Air pollution is due to generation of noxious gases emanating from asphalt plants, construction equipment, crushers, etc., while noise pollution is due to operation of various types of construction equipments.
- Stacking of construction waste causing interruption to traffic and pedestrian movements.
- Runoff from stacked construction waste entering the water bodies and existing drainage systems causing clogging of drain outlets as well as the drains themselves.

Project interventions as procurement of low emission vehicle fleets, traffic signal prioritisation, ITS, provision of signages, etc., involve minimal construction activities and

hence, environmental and social benefits from these activities will outweigh any minimal impacts that may occur.

9.5 Operation Impacts

These are the Impacts associated with the operation and maintenance of the infrastructure built in the project. The project interventions are conceived to provide maximum benefits to the community with the implementation of the project. The project interventions, as could be judged from the discussion so far, involve environmental and resettlement impacts during pre-construction and construction stages of the project and appropriate mitigation and management measures would be undertaken to avoid the same.

Negative environmental / social impacts in the operation stage would mostly be limited to air and noise pollution along the improved road infrastructure as well as the parking areas. While there would be loss of usual transport routes for provision of pedestrian routes or NMT, overall improvement in environmental quality is anticipated in the operation stage.

While in previously polluted and congested core city areas / heritage areas would be experiencing better environmental quality than before the project implementation, due to pedestrianisation and encouraging NMT, pedestrian safety would also be improved with the implementation of the project.

Implementation of traffic signal prioritisation interventions would also aid in better management of traffic leading to improvements in air and noise quality.

9.6 Social Impact

The impact of the proposed projects from the social angle is analysed at a broader perspective. It is found that most of the projects have significantly less impact with respect to Rehabilitation and Resettlement. Land acquisition for some of the projects is inevitable. The proposed projects significantly improve mobility with reduced travel time. The broad impacts have been compiled in the **Table 9-3**.

9.7 Strategies of Risk & Quality Management

9.7.1 Risk mitigation process

The objectives of risk mitigation process is to explore risk response strategies for the high risk items. The process identifies and assigns parties to take responsibility for each risk response. It ensures that each risk requiring a response has an owner. The owner of the risk could be an agency planner, engineer, or construction manager, depending on the point in project development, or it could be a private sector contractor or partner, depending on the contracting method and risk allocation.

Risk mitigation and planning efforts may require that agencies set policies, procedures, goals, and responsibility standards. Formalizing risk mitigation and planning will help establish a risk culture that should result in better cost management from planning through construction and better allocation of project risks that align teams with customer-oriented performance goals.

Once the agency planner, engineers, and construction managers have thoroughly analyzed the critical set of risks, they are in a better position to determine the best course of action to mitigate those risks.

Risk mitigation handling options include:

- Assume/Accept: Acknowledge the existence of a particular risk, and make a deliberate decision to accept it without engaging in special efforts to control it. Approval of project or program leaders is required.
- Avoid: Adjust program requirements or constraints to eliminate or reduce the risk. This adjustment could be accommodated by a change in funding, schedule, or technical requirements.
- Control: Implement actions to minimize the impact or likelihood of the risk.
- Transfer: Reassign organizational accountability, responsibility, and authority to another stakeholder willing to accept the risk.
- Watch/Monitor: Monitor the environment for changes that affect the nature and/or the impact of the risk.

9.7.2 Risk regarding availability of land

The problem in many markets around the country right now is that land is more expensive than can be supported by a land residual analysis. The resultant Involuntary resettlement due to land acquisition refers both to physical displacement (relocation or loss of shelter) and to economic displacement (access to resources for income generation or means of livelihood) due to land acquisition (including rights-of-way) associated with a client's/investee's operations. Resettlement is considered involuntary when affected individuals or communities do not have the right to refuse displacement. This occurs in cases of: i) lawful expropriation or restrictions on land use based on eminent domain; and ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

Displaced persons may be classified as persons who:

1. have formal legal rights to the land they occupy;
2. do not have formal legal rights to land, but have a claim to land that is recognized or recognizable under the national laws; or
3. have no recognizable legal right or claim to the land they occupy.

Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for affected persons and communities, as well as environmental damage and social stress in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided or at least minimized. However, where it is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented with appropriate disclosure of information, consultation, and the informed participation of affected persons. This includes implementing the following actions:

1. Compensation and benefits for displaced persons. When displacement cannot be avoided, the client/investee will offer displaced persons and communities compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods.

2. Grievance mechanism. The client/investee needs to ensure that a grievance mechanism is in place to receive and address specific concerns about compensation and relocation that are raised by displaced persons or members of host communities.
3. Social impact assessment, resettlement planning and implementation. Where involuntary resettlement is unavoidable, the client/investee will conduct a census to identify the persons who will be displaced by the project, understand the likely impacts on the affected persons and community, develop entitlement framework and determine who will be eligible for compensation.
4. Physical displacement. If people living on the site of a client's/investee's operations must move to another location, the client/investee will: i) offer displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation; and ii) provide relocation assistance suited to the needs of each group of displaced persons, with particular attention paid to the needs of the poor and the vulnerable. New resettlement sites built for displaced persons will offer improved living conditions.
5. Economic displacement. If land acquisition for the client's/investee's operations causes loss of income or livelihood, the client/investee will promptly compensate these persons, for example by compensating affected business owners for the cost of reestablishing commercial activities elsewhere, for lost net income during the period of transition, and for the costs of the transfer and reinstallation of their business operations.
6. Government-managed resettlement. Where land acquisition and resettlement are the responsibility of the government, the client/investee needs to collaborate with the responsible government agency to the extent permitted by the agency to achieve outcomes that are consistent with best international practice.

If a client's/investee's operations involve land acquisition and resettlement, this should be carefully managed to prevent the likelihood of hardship and impoverishment for affected persons and communities. Given that a displaced community will not be entirely satisfied with its new situation unless there is noticeable improvement in standards of living or livelihoods, this will remain a reputational risk for the client/investee.

9.7.3 Risks in funding

Due to the uncertainty of the current economic environment, funding uncertainty becomes one of the main risk factors for budget/cash management, project management, and its implementation. Therefore, it is desirable to incorporate funding risks into the project risk management process for better decision-making in budget management, cash management, project management, and implementation under changing funding conditions.

Funding project risk management is a process for identifying, assessing, and prioritizing funding project risks. In order to minimize or eliminate the impact of negative outcomes, one must identify what projects have higher risk to avoid potential project delays or funding issues. The idea behind using risk management practices is to protect organizations from being vulnerable in project implementations. Hence, funding project risk management becomes essential as part of decision-making processes.

Instead of depending on government based funding resources, innovative funding options must be studied. The following table gives the details of various funding options possible for implementing different projects:

Table 9-2 : Various options for funding Urban Transport projects

Funding Source	Type	Options	Responsibility
Funding from Domestic Source at Local Level (ULB)	Public Domestically Mobilized fund	– Advertisement/Fare revenue/Parking Fee box – Creation of City Level UTF – Congestion pricing – Cess on fuel, private vehicle taxation/ green cess on existing private vehicles – Property development/TOD – Land value capture/ Betterment charges/ Vacant land tax – Municipal bonds – Pooled Financing	ULB / State Govt.
Funding from Domestic Source at State Level	Public Domestically Mobilized fund	– General budget funding – Viability gap funding – Loans from Financial Institution/Banks – Creation of State Level UTF	State Govt.

Funding Source	Type	Options	Responsibility
Funding from Domestic Source at National Level	Public fund Domestically Mobilized	– General budget funding – National level funding Scheme like JnNURM – Viability gap funding – Climate Funding (NAMA Financing)	Central Govt.
Funding from International Source	Public fund Mobilized from International Source	– Loans from Multilateral Funding Agency – Carbon Finance – Climate Funding (NAMA Financing)	Central Govt., State Govt. and ULB
Funding from Private Source	Private fund Domestically Mobilized	– PPP Options (BOOT/BOT/Lease/Annuity etc.)	State Govt. and ULB

9.7.4 Stakeholder consultation

Stakeholder consultation is an important exercise for various reasons:

- 1) Understanding the city: It is necessary to engage with stakeholders who work in the city.
- 2) Stakeholder consultations have been widely recognized as an important exercise in recent times. The top down approach where, recommendations are made to a city without involving it in the deliberation process and using its know-how has been widely criticized. It is now recognized that each city has its unique character. The recommendations made, have to be suited to the unique circumstances under which the city functions.
- 3) The scope of work of each organization: There are a number of agencies that operate in a city.
- 4) Sometimes, multiple agencies will be involved in the same area. For example: Construction and maintenance of roads in a city won't fall under the jurisdiction of a single agency. A number of agencies are involved in the same.
- 5) There is usually but a clear demarcation of what the scope of work of each agency is. It is necessary to understand the exact jurisdiction of each agency. This will help us in understanding the exact tasks that each organization is responsible for and also identify areas where there is overlap of tasks and responsibilities.
- 6) Developing alternative scenarios: CMP would involve developing alternative scenarios. The differences between the alternatives will be made of differences in policy;

institutional framework; transport plans of the city; technological innovations and other such details. Stakeholder consultation will help in building these alternative scenarios

- 7) Building a rapport with the city: By engaging with the stakeholders, we will be able to create a rapport in the city. This is highly necessary because certain recommendations will be made in the
- 8) CMP which need to be implemented. Having a rapport with the city will ensure that the recommendations are smoothly implemented and problems and bottlenecks are minimized in the implementation stage.
- 9) It is to be noted that certain stakeholders may not contribute to the creation of CMP but could be powerful enough to hinder the implementation. By engaging these stakeholders and keeping them regularly in the loop of the project and taking some of their recommendations into consideration, will help in ensuring maximum support from the city.
- 10) In making informed plans with corrective mechanism Identifying Stakeholders Stakeholders to be included from a wide list which includes:
 - a) Government Bodies like Municipal corporations, Development Authorities, Public Works Departments, Traffic Police, Transport Department, Environment Pollution Control Authority (EPCA), Fire and Ambulance Services, Environment Department, Cantonment Board, Transport Corporations, etc.
 - b) Experts in the field of transport from Academic Institutes and Research bodies and Consultants or practitioners in the field.
 - c) Media- Both print and electronic media
 - d) Non-governmental organisations (NGOs)/ Civil Society Organisations (CSOs)
 - e) Elected Representatives from city (Ward councillors/ Corporators), state (MLAs, Transport minister) or Centre (MP).
 - f) Operators like auto rickshaw unions, private bus operators.
 - g) Others like Unions, Bus and Cycle Manufactures, owners and operators of transport infrastructure
 - h) User groups like resident welfare associations, local businesses, etc.

Classifying stakeholders on the basis of their role in transport

- Organizations or individuals responsible for making decisions regarding transport. These organizations could be involved either at city level planning of transport or framing policies or in transport operations. That is, government organizations for which transport is one of the primary focus and thus they are directly involved.
- Organizations or individuals who are not part of the government but are directly involved in the transport operations in the city. This could include auto rickshaw unions, taxi drivers association, parking lot managers or owners, travel association, etc. This group could also include Private players who are involved with the government in various transport based PPP operations like operation of buses, toll roads, etc.
- Organizations or individuals (government or non-government) whose activities tend to shape the transport needs and demands of the city. This will include large industrial units, urban development authorities, ports, railways, etc. as well as regular citizen groups represented through RWAs.
- Organizations and individuals (government or non-government) who hold prominent positions are important opinion makers in the city. This will include the Press; Universities, colleges and other educational institutes; popular NGOs and other popular representative organizations like Confederation of Indian Industry.

The project impacts for various project identified in CMP are given in the following table:

Table 9-3 Project Impacts

Project	Right of Way / Land Acquisition	Requirement of Rehabilitation & Resettlement	Improve Mobility	Reduction in Travel Time
Bus Fleet Augmentation	No	No	Yes	Yes
MRTS routes	Yes	Yes	Yes	Yes
Bus Terminals	Yes	No	Yes	Yes
Bus Shelters & Bus Bays	No	No	Yes	Yes
Road Widening	Yes	No	Yes	Yes
New Roads	Yes	Yes	Yes	Yes
Expressway Road	Yes	Yes	Yes	Yes

Project	Right of Way / Land Acquisition	Requirement of Rehabilitation & Resettlement	Improve Mobility	Reduction in Travel Time
Footpath cum drains	No	No	Yes	NA
Pedestrian FoB /Subway	No	No	Yes	NA
Major Junction Improvements	No	No	Yes	Yes
Signages and Road Markings	No	No	Yes	Yes
Freight Terminals	Yes	No	Yes	NA

10 Outcomes

10.1 Level of Service

The CMP for Mira Bhayandar has proposed various phase-wise mobility improvement measures in terms of projects and policy interventions in consistence with the goals and objectives set for Mira Bhayandar. The CMP for Mira Bhayandar estimated the outcomes in terms of certain mobility improvement indicating parameters of each scenario as described in detail in Chapter 5 Travel Demand Assessment. Referring to **Table 10-1**, the outcomes of scenario 4, with improvement measures of highway, public transport and feeder services shows the overall improvement in mobility scenario in the study area.

Table 10-1: Scenario wise outcomes

Scenario	Private vehicle share (%)	IPT Share (%)	PT Share (%)	V/C ratio (Maximum)
Do Minimum (2031)	43%	21%	35%	3.93
Highway Improvement only (2031)	47%	20%	33%	2.50
PT Improvement only (2031)	33%	17%	50%	2.38
Highway + PT +Feeder Services (2031)	28%	14%	58%	0.97

The outcomes of the projects proposed could be assessed in terms of improvements in the Level of Service (LOS) Benchmarks defined by the Ministry of Urban Development, Government of India.

10.2 Improved Level of Service

The overall LOS achieved for all the Benchmarks are given in **Table 10-2**. A significant improvement can be observed from the existing LOS. These could be attributed to various factors as given below:

Table 10-2: Overall LOS

S.No	Indicators	LOS - Existing	LOS – Improved by CMP Proposals
1	Overall Public Transport facilities City wide	2	1
2	Overall Pedestrian Infrastructure Facilities	3	1
3	Level of usage of ITS facilities	4	2
4	Availability of Parking Spaces	3	2
5	Land-use Transport Integration	3	1

10.3 Conclusion

During the last decade, the urban sprawl in Indian cities has extended far beyond the existing territorial jurisdiction of the city administration resulting in high usage of private modes. Despite substantial efforts, cities are facing difficulty in coping with increase of private vehicles along with improving personal mobility and goods distribution. Mira Bhayandar city has been experiencing high growth of population over the years, which can be attributed to high natural growth and migration from the adjacent areas and towns with expectation of better livelihood opportunity.

With rapid pace of urbanisation together with increase in population and private vehicles in Mira Bhayandar city will pose an unimaginable load on city's already struggling transport infrastructure. On the other hand the low share of public transport is leading to more usage of private vehicles for mobility needs and increased demand for parking of private vehicles.

The National Urban Transport Policy (NUTP), 2006, therefore emphasises on personal mobility to achieve cost-effective and equitable urban transport measures within an appropriate and consistent methodology. Accordingly, the Comprehensive Mobility Plan (CMP) for Mira Bhayandar city lays out a set of measured steps that are designed to improve transportation in the city in a sustainable manner to meet the needs of a growing population.

11 Annexures

Annexure A Intersection survey Results

The following figures give the mode wise turning flows at the surveyed Intersections

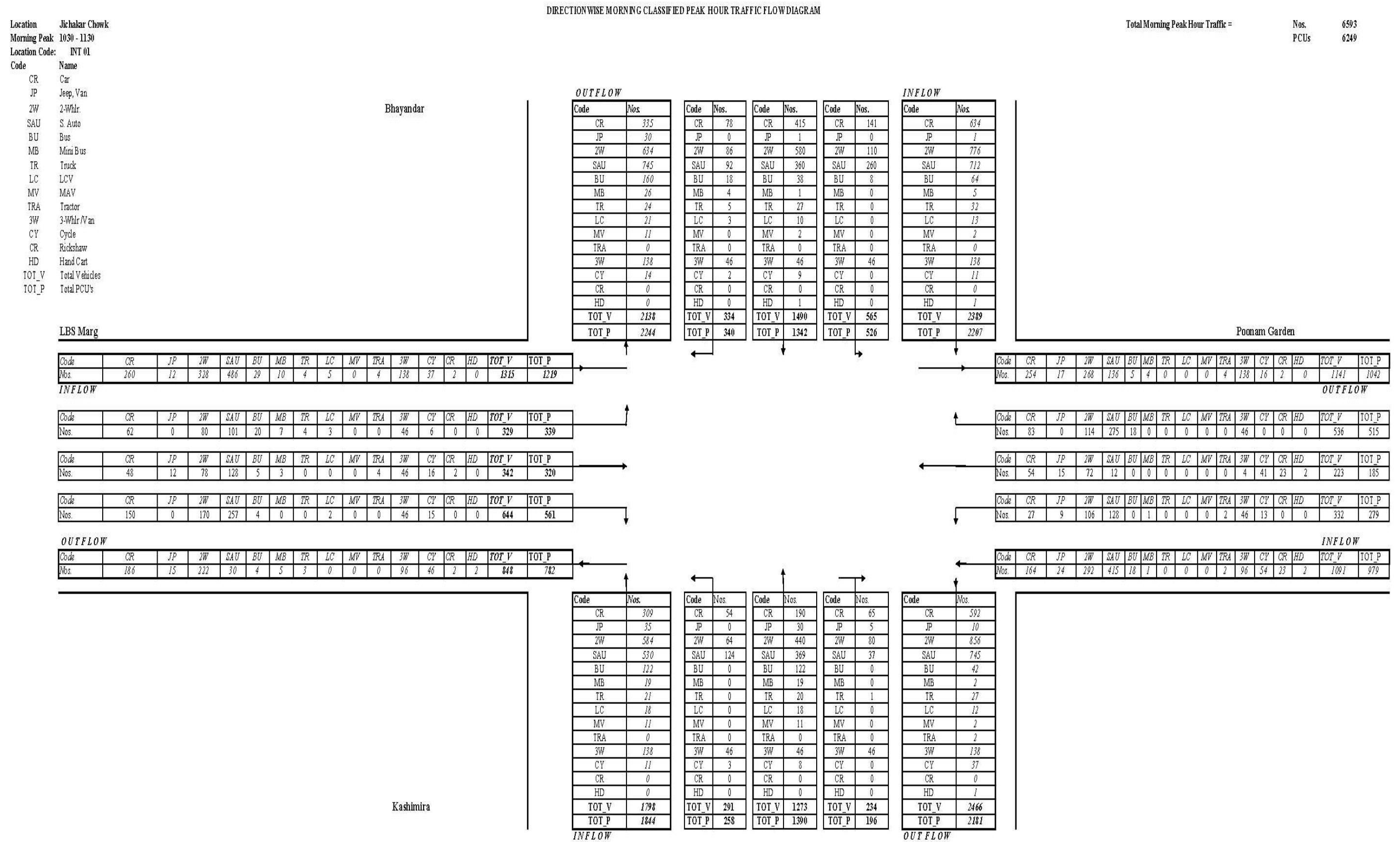
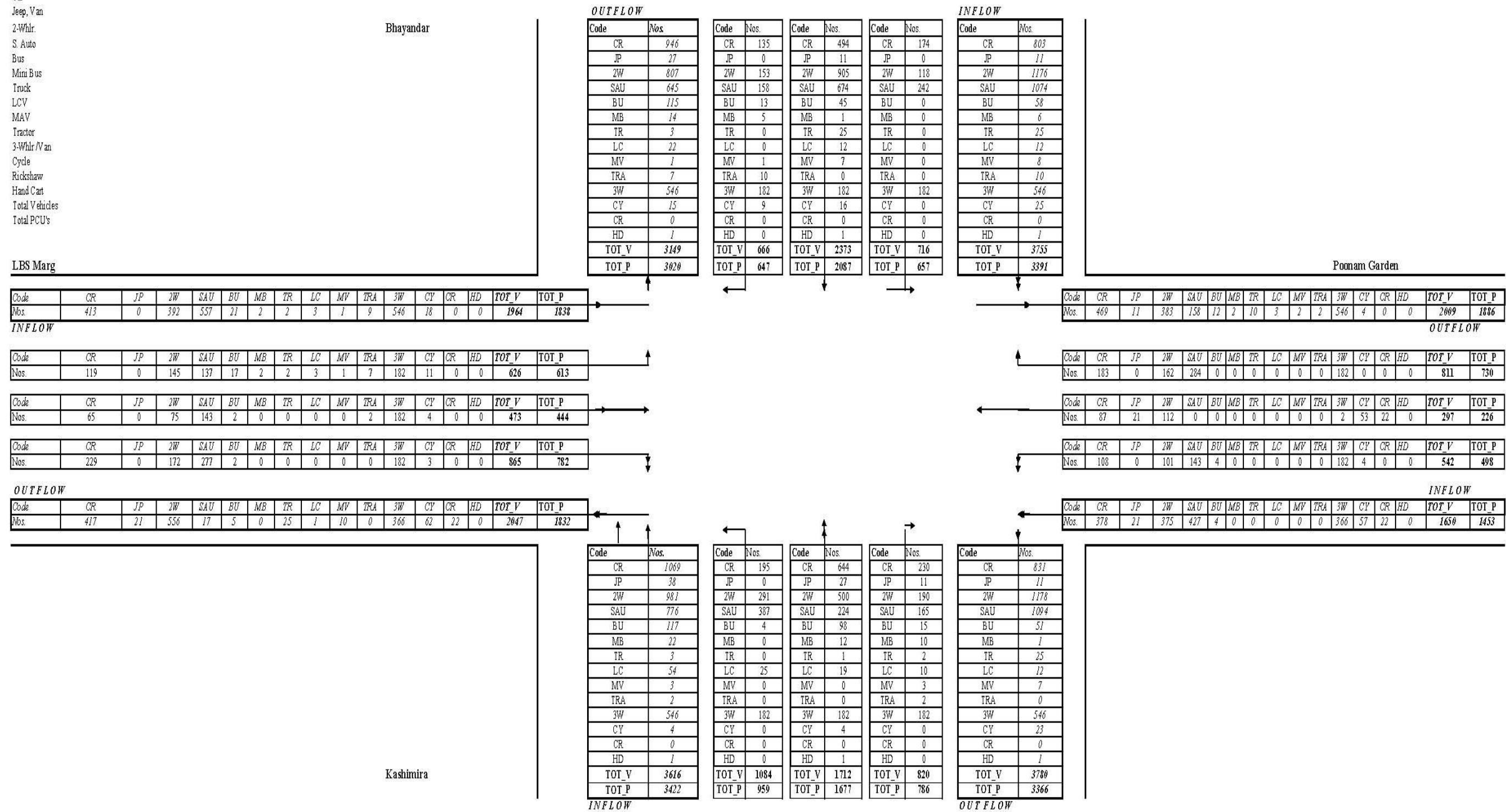


Figure 11-1 AM Peak hour Traffic Flow at Intersection 1-Jichakar Chwok

Location Jichakar Chowk
 Evening Peak 1900 - 2000
 Location Code: INT 01
 Code Name
 CR Car
 JP Jeep, Van
 2W 2-Wheeler
 SAU S. Auto
 BU Bus
 MB Mini Bus
 TR Truck
 LC LCV
 MV MAV
 TRA Tractor
 3W 3-Wheeler/Van
 CY Cycle
 CR Rickshaw
 HD Hand Cart
 TOT_V Total Vehicles
 TOT_P Total PCUs

DIRECTIONWISE EVENING CLASSIFIED PEAK HOUR TRAFFIC FLOW DIAGRAM

Total Evening Peak Hour Traffic = Nos. 10985
 PCUs 10104



Traffic flow diagram of TMC1_Jichkar Chowk Analysis.xls

Figure 11-2 PM Peak hour Traffic Flow at Intersection 1-Jichakar Chowk

Location Golden Nest Jn
Morning Peak 1015 - 1115
Location Code: INT 02

Total Morning Peak Hour Traffic =
Nos. 15499
PCUs 11742

Code	Name
CR	Car, Jeep & Van
2W	2-Wheeler
SA	Small Auto
LA	Large Auto (7 seater)
CB	City Bus (Mini)
SR	State Roadways
PR	Private Roadways
SB	School Bus
TO	Tourist & Other
TR	Truck
LC	LCV
MV	Multi Axle Veh.
CY	Cycles
CR	Rickshaw
OT	Other
TOT_V	Total Vehicles
TOT_P	Total PCU's

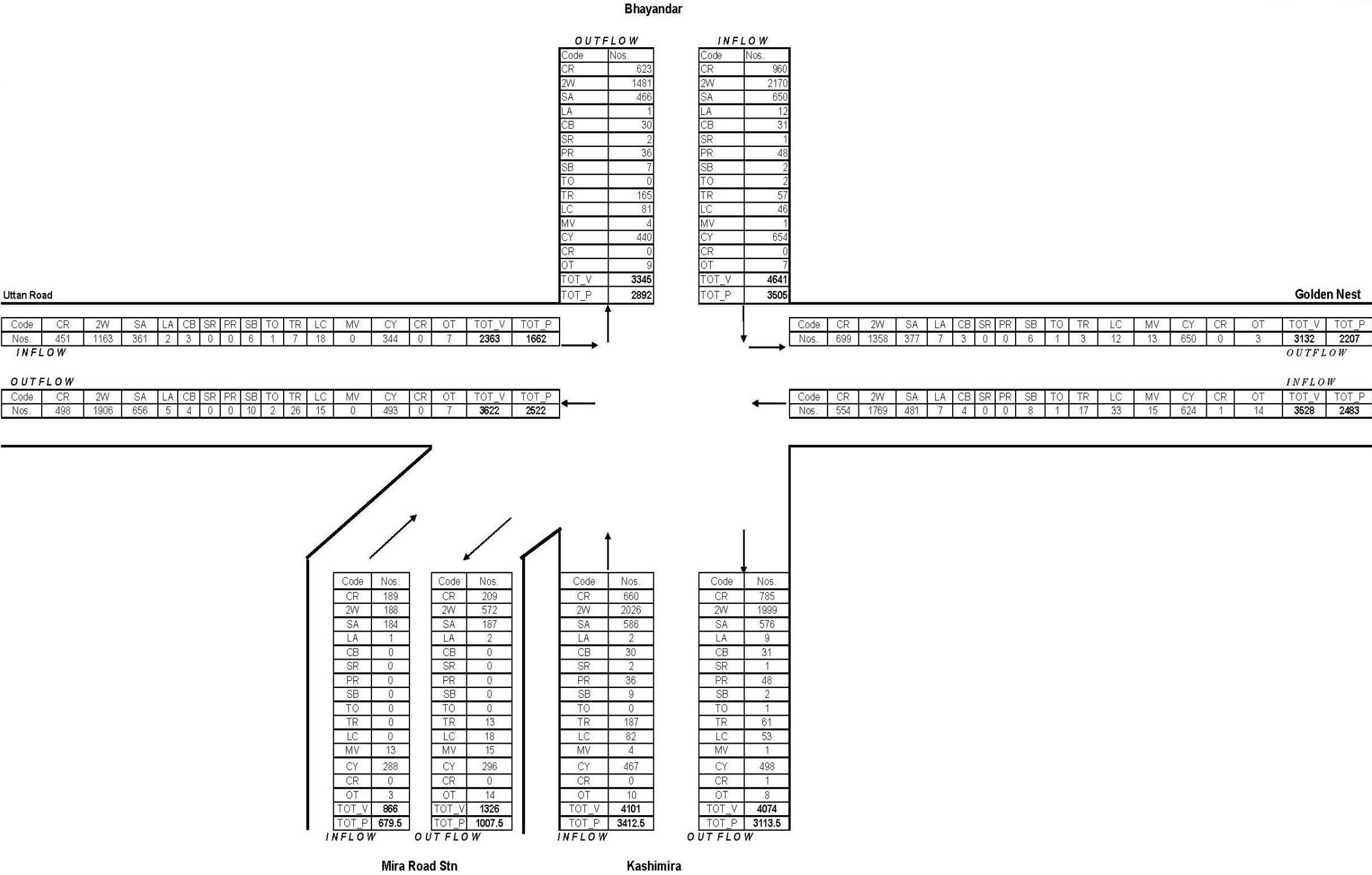


Figure 11-3 AM Peak hour Traffic Flow at Intersection 2-Golden Nest Junction

Location Golden Nest Jn
Evening Peak 1800 - 1900
Location Code: INT 02

Total Evening Peak Hour Traffic =

Nos. 13156
PCUs 10132

Code	Name
CR	Car, Jeep & Van
2W	2-Wheeler
SA	Small Auto
LA	Large Auto (7 seater)
CB	City Bus (Mini)
SR	State Roadways
PR	Private Roadways
SB	School Bus
TO	Tourist & Other
TR	Truck
LC	LCV
MV	Multi Axle Veh.
CY	Cycles
CR	Rickshaw
OT	Other
TOT_V	Total Vehicles
TOT_P	Total PCUs

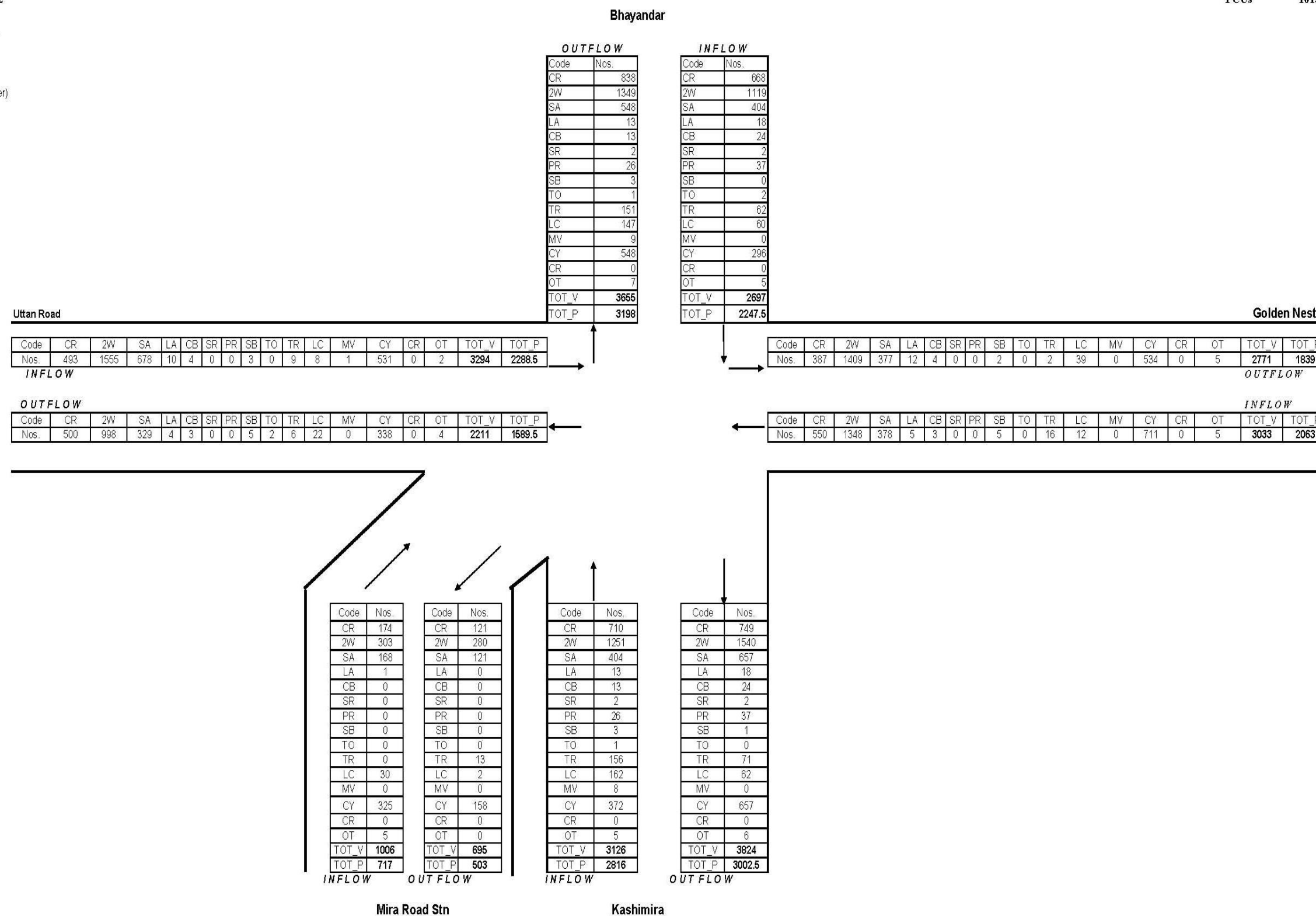


Figure 11-4 PM Peak hour Traffic Flow at Intersection 2-Golden Nest Junction

Location Kashmirira Jn
 Morning Peak 0930 - 1030
 Location Code: INT 03
 Code Name
 CR Car
 JP Jeep, Van
 2W 2-Wheeler
 SAU S. Auto
 BU Bus
 MB Mini Bus
 TR Truck
 LC LCV
 MV MAV
 TRA Tractor
 3W 3-Wheeler/Van
 CY Cycle
 CR Rickshaw
 HD Hand Cart
 TOT_V Total Vehicles
 TOT_P Total PCUs

DIRECTIONWISE MORNING CLASSIFIED PEAK HOUR TRAFFIC FLOW DIAGRAM

Total Morning Peak Hour Traffic = Nos. 3854
 PCUs 4443

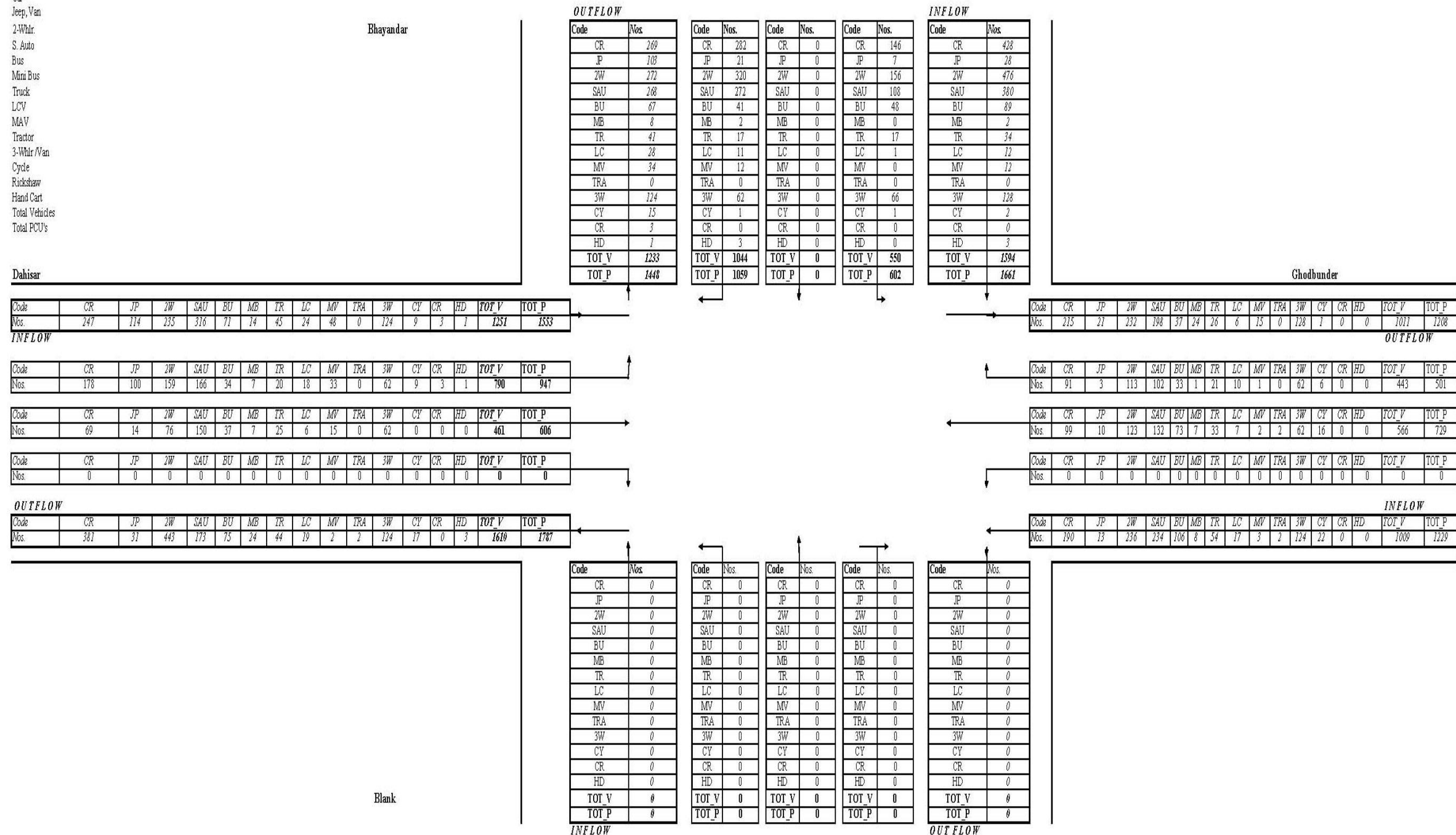


Figure 11-5 AM Peak hour Traffic Flow at Intersection 3-Kashimira Junction

Location Kashimira Jn
 Evening Peak 1900 - 2000
 Location Code: INT 03
 Code Name
 CR Car
 JP Jeep, Van
 2W 2-Wheeler
 SAU S. Auto
 BU Bus
 MB Mini Bus
 TR Truck
 LC LCV
 MV MAV
 TRA Tractor
 3W 3-Wheeler/Van
 CY Cycle
 CR Rickshaw
 HD Hand Cart
 TOT_V Total Vehicles
 TOT_P Total PCUs

DIRECTIONWISE EVENING CLASSIFIED PEAK HOUR TRAFFIC FLOW DIAGRAM

Total Evening Peak Hour Traffic =
 Nos. 5274
 PCUs 5650

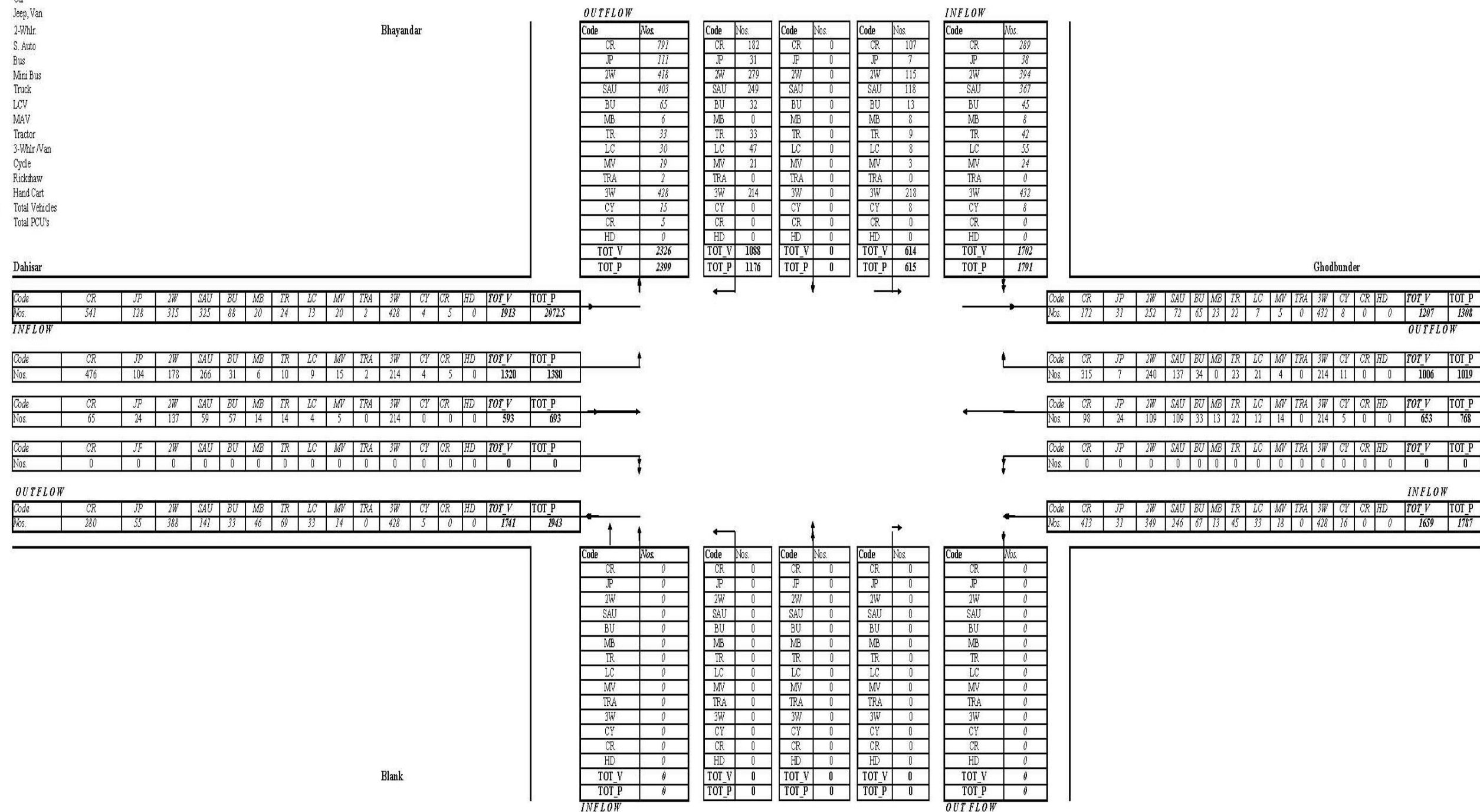


Figure 11-6 PM Peak hour Traffic Flow at Intersection 3-Kashimira Junction

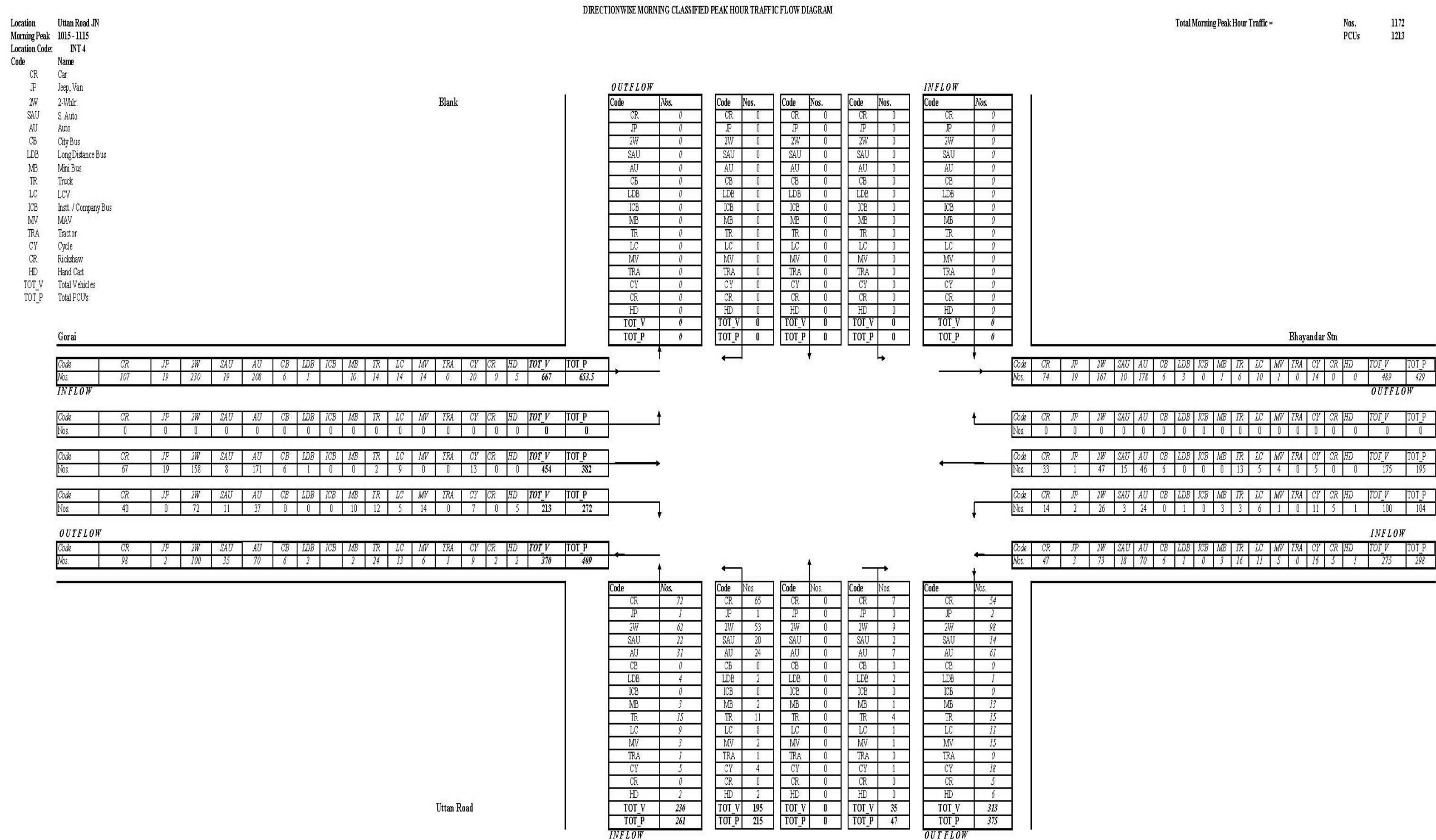
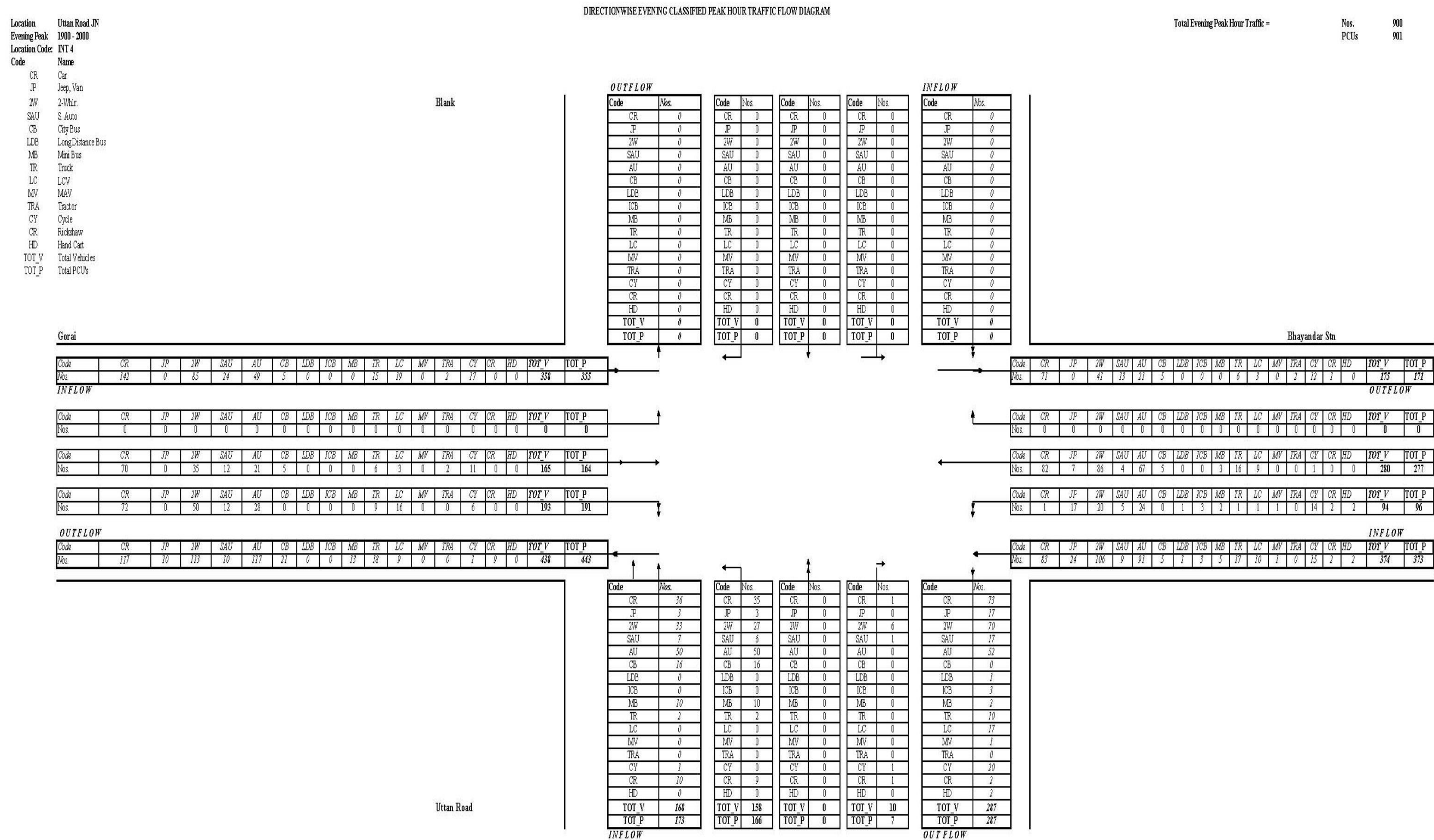
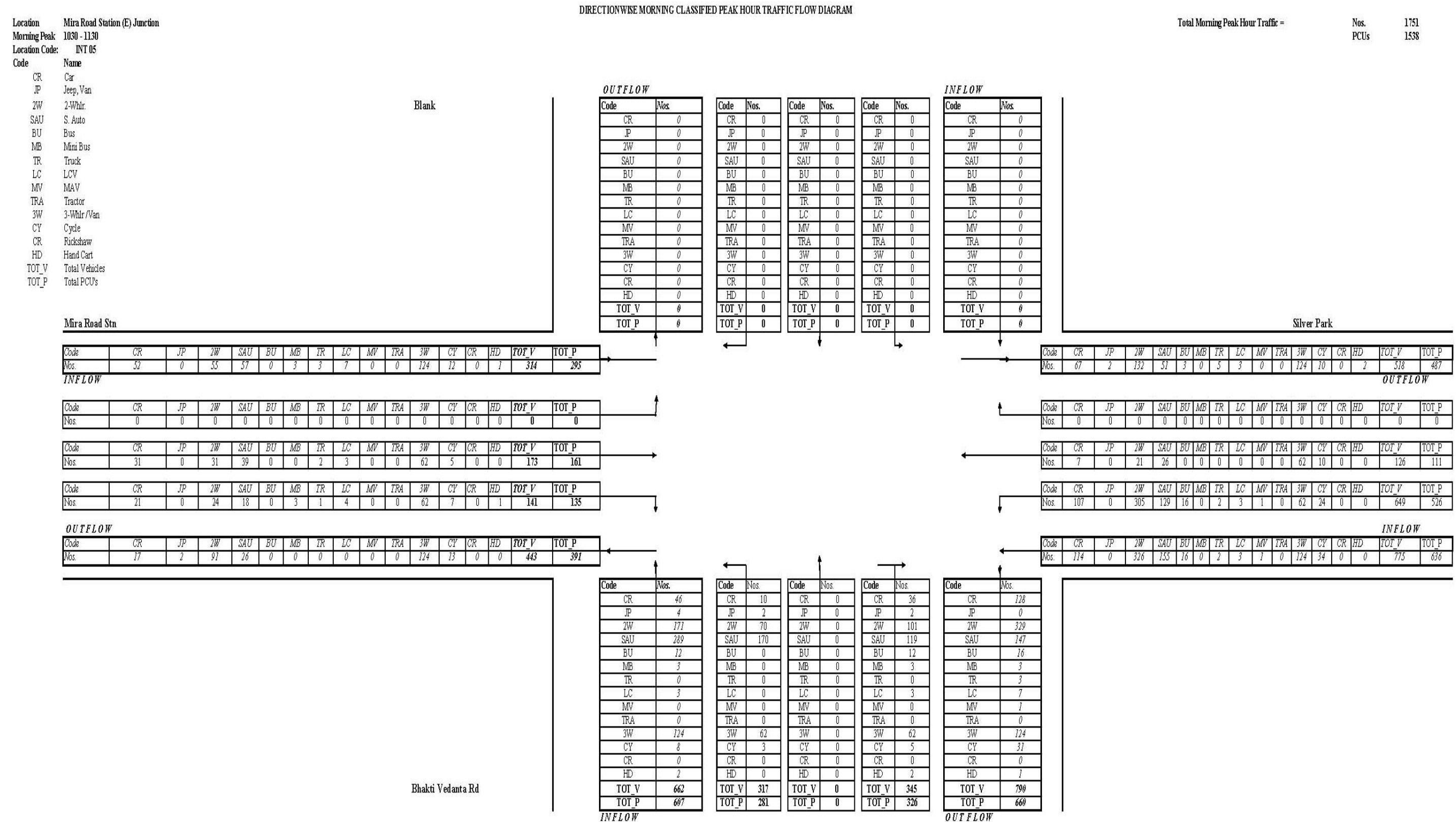


Figure 11-7 AM Peak hour Traffic Flow at Intersection 4-Uttan Road Junction





Location Mira Road Station (E) Junction

Evening Peak 1930 - 2030

Location Code: INT 05

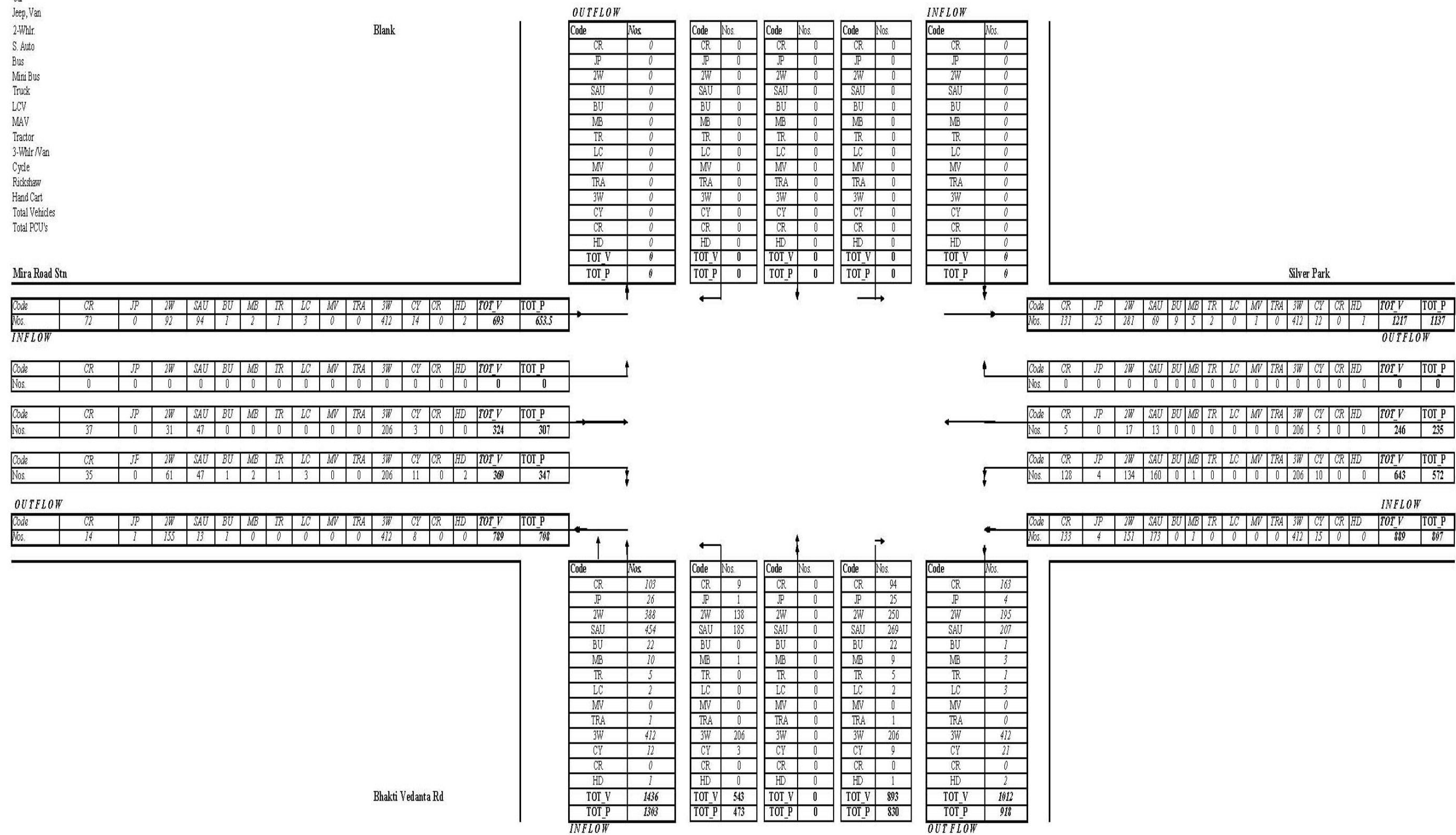
Code Name

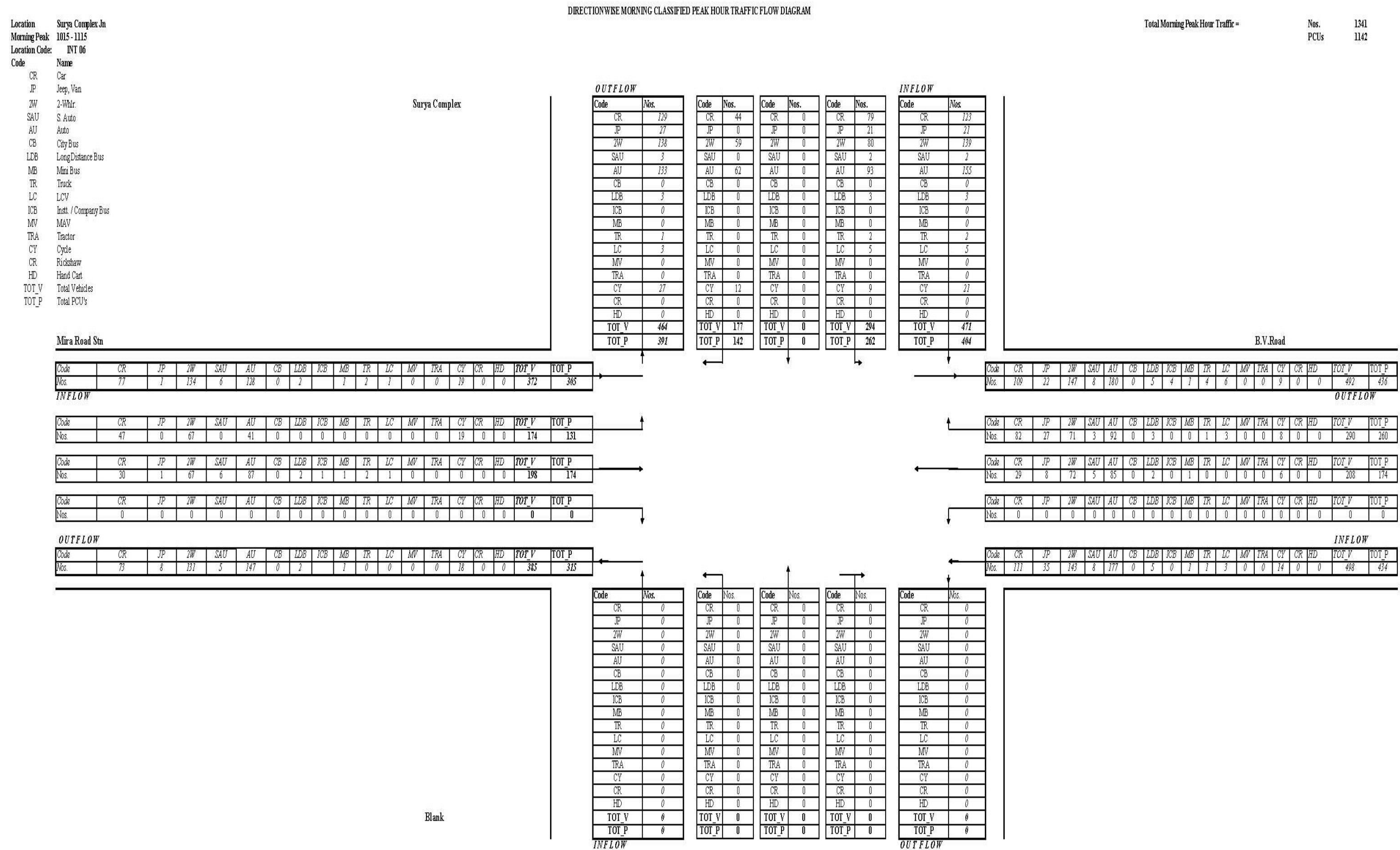
CR Car
JP Jeep/Van
2W 2-Wheeler
SAU S. Auto
BU Bus
MB Mini Bus
TR Truck
LC LCV
MV MAV
TRA Tractor
3W 3-Wheeler/Van
CY Cycle
CR Rickshaw
HD Hand Cart
TOT_V Total Vehicles
TOT_P Total PCUs

DIRECTIONWISE EVENING CLASSIFIED PEAK HOUR TRAFFIC FLOW DIAGRAM

Total Evening Peak Hour Traffic =

Nos. 3018
PCUs 2763







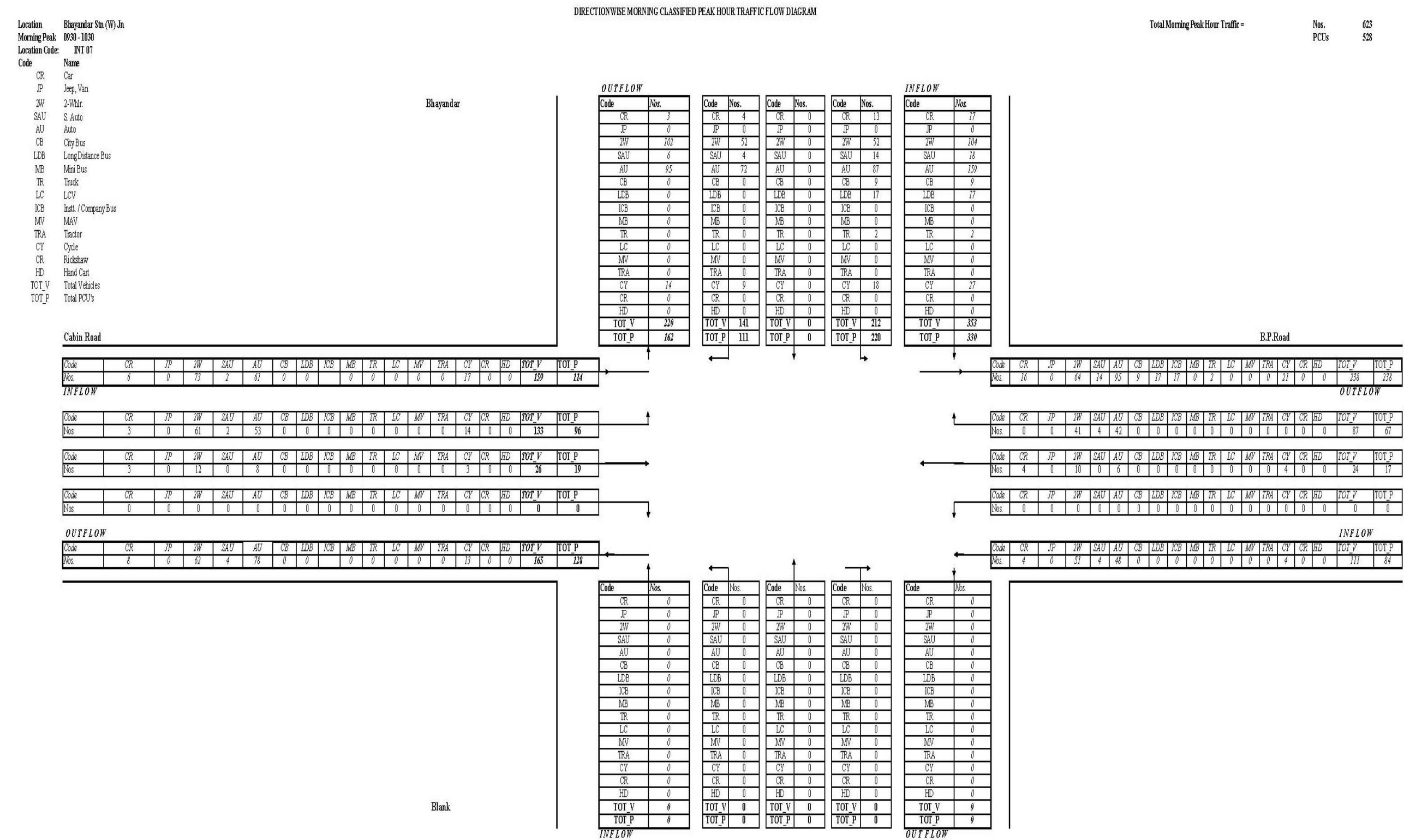


Figure 11-13 AM Peak hour Traffic Flow at Intersection 7-Bhayandar Station West Junction



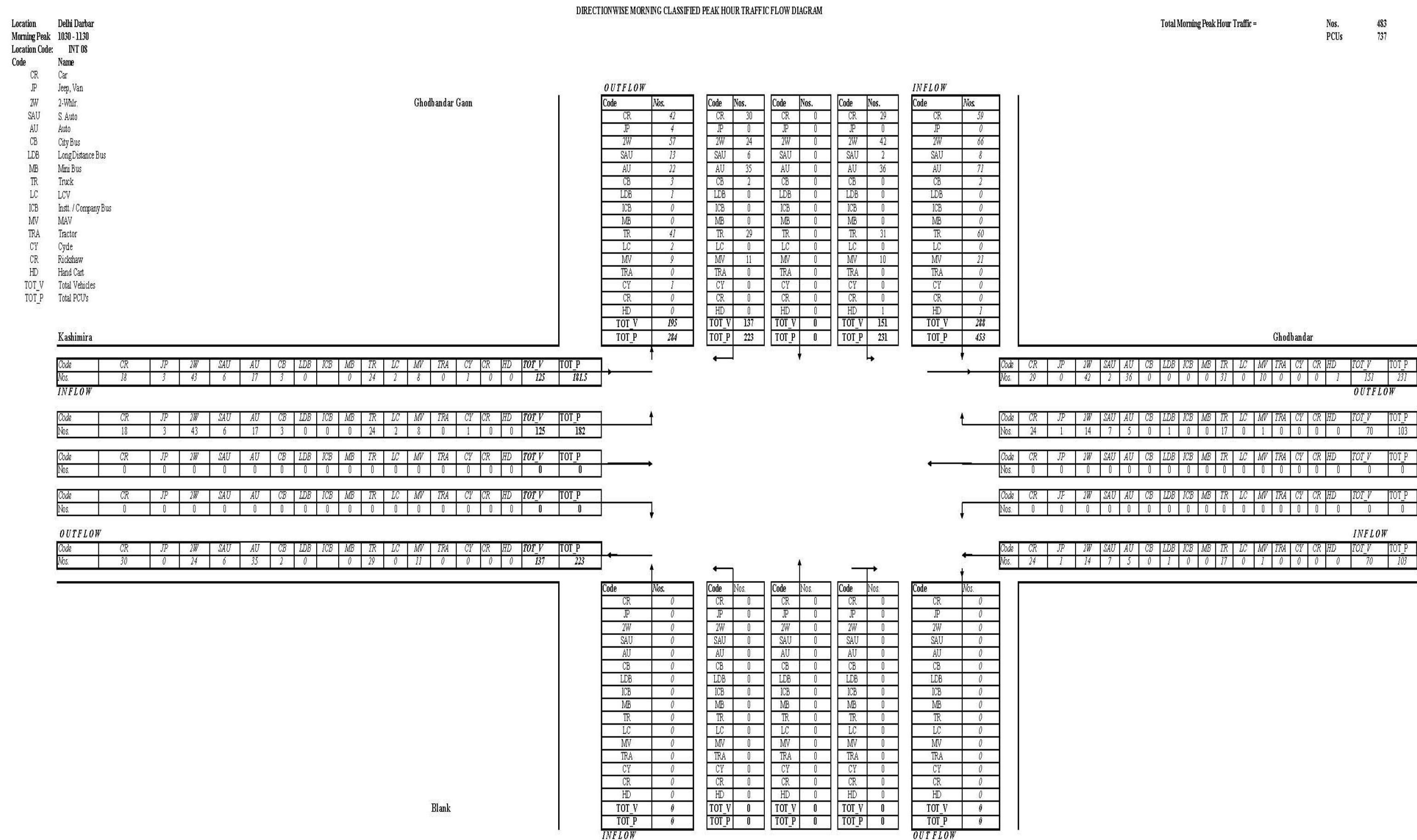
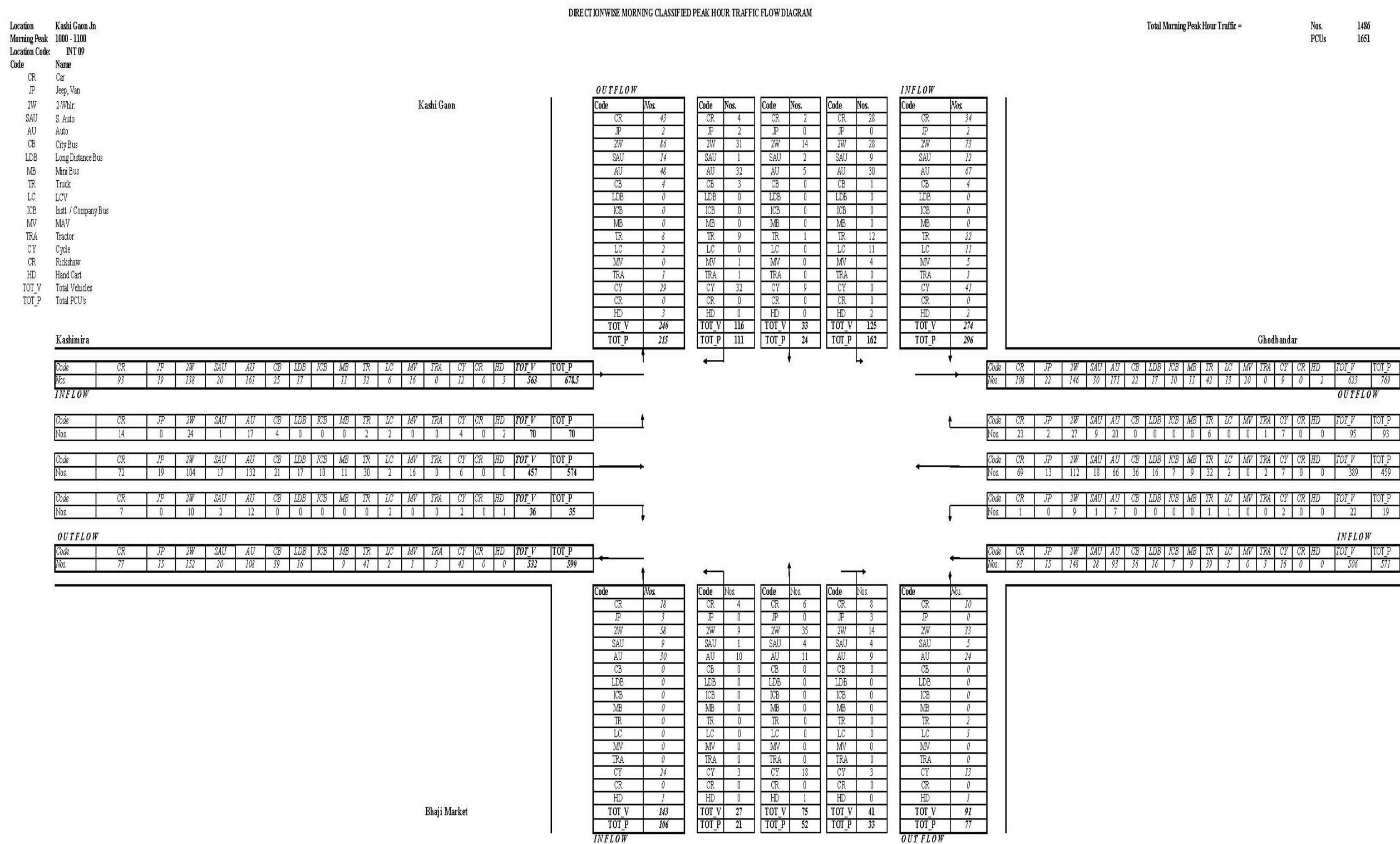
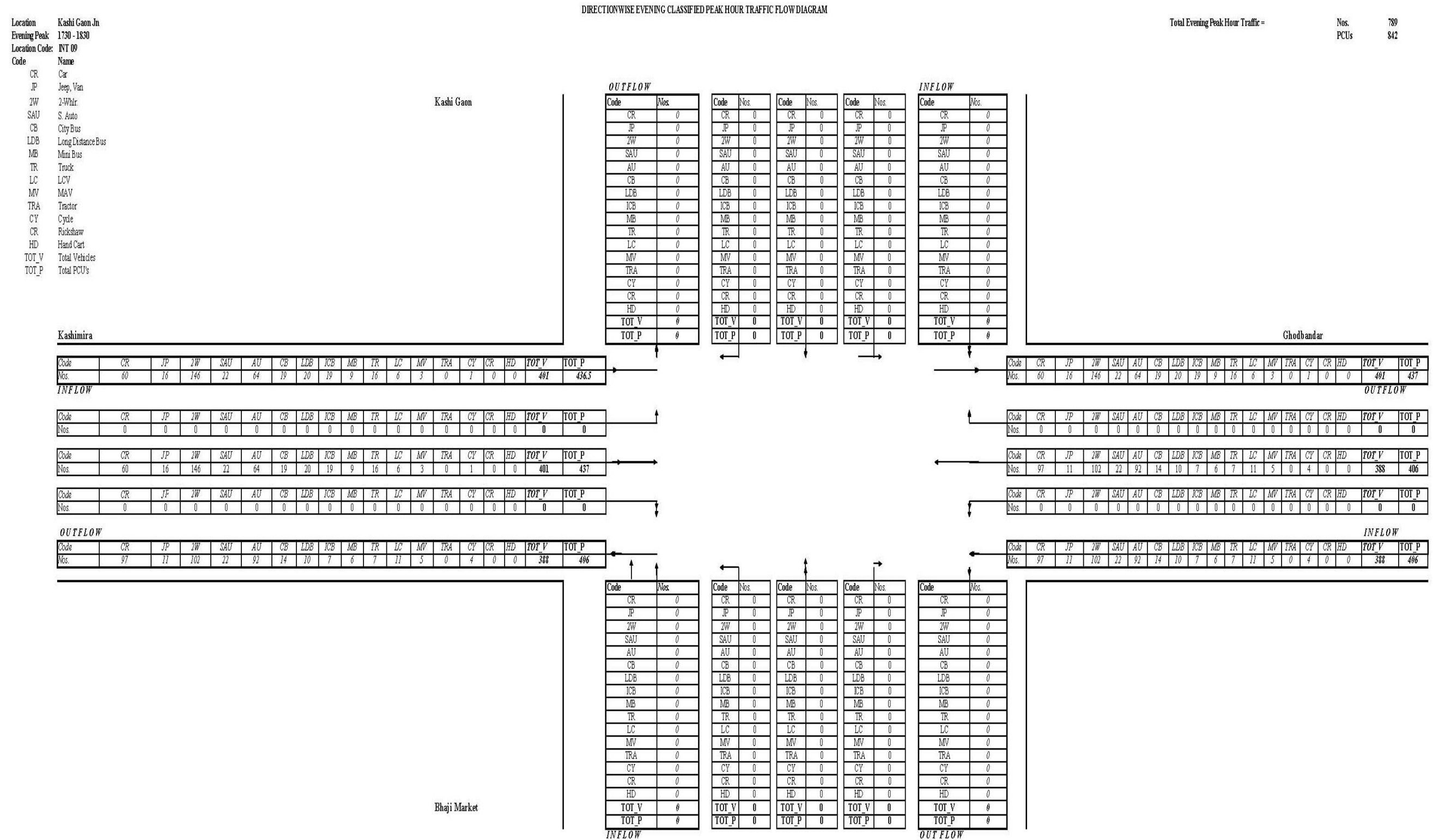


Figure 11-15 AM Peak hour Traffic Flow at Intersection 8-Delhi Darbar Junction





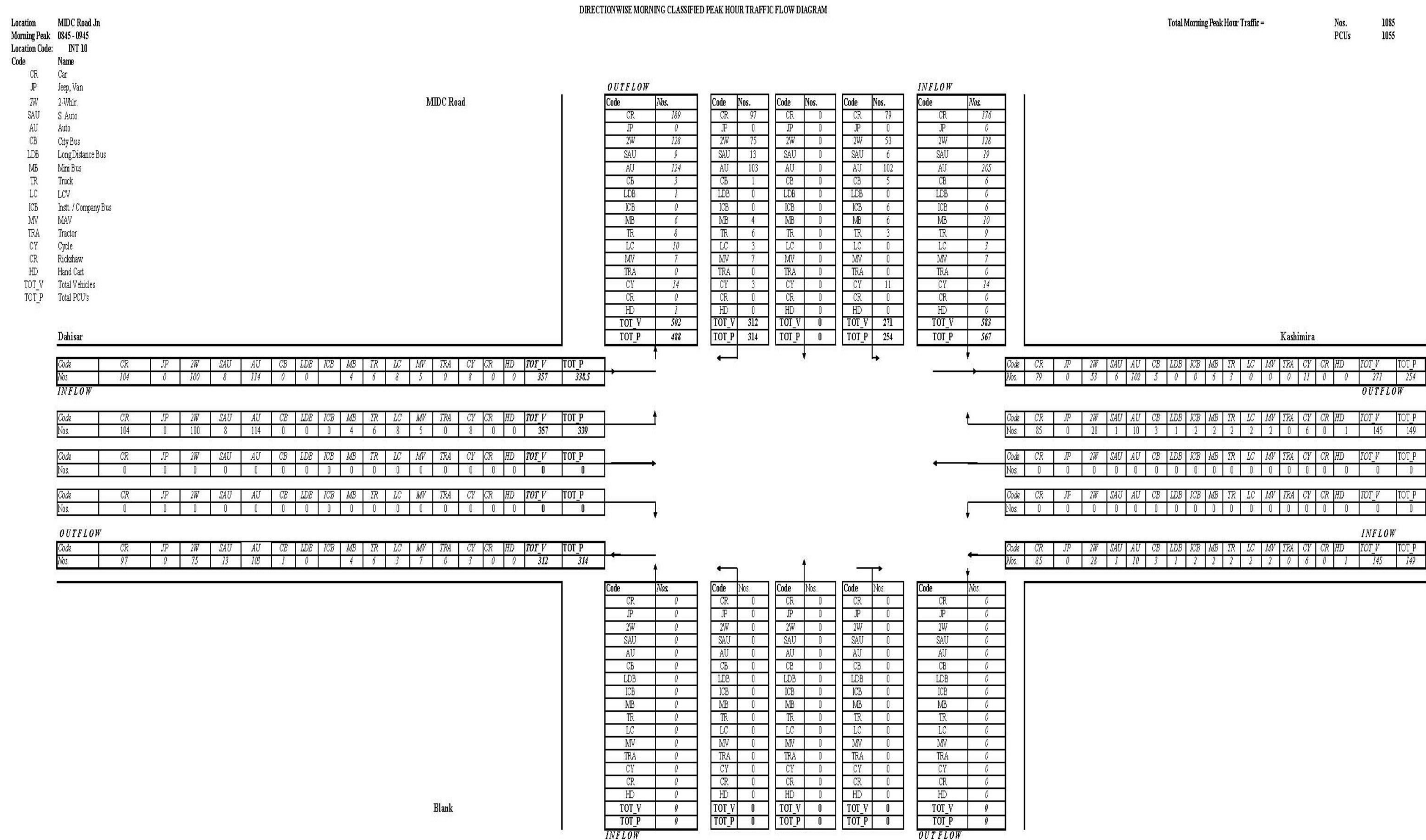
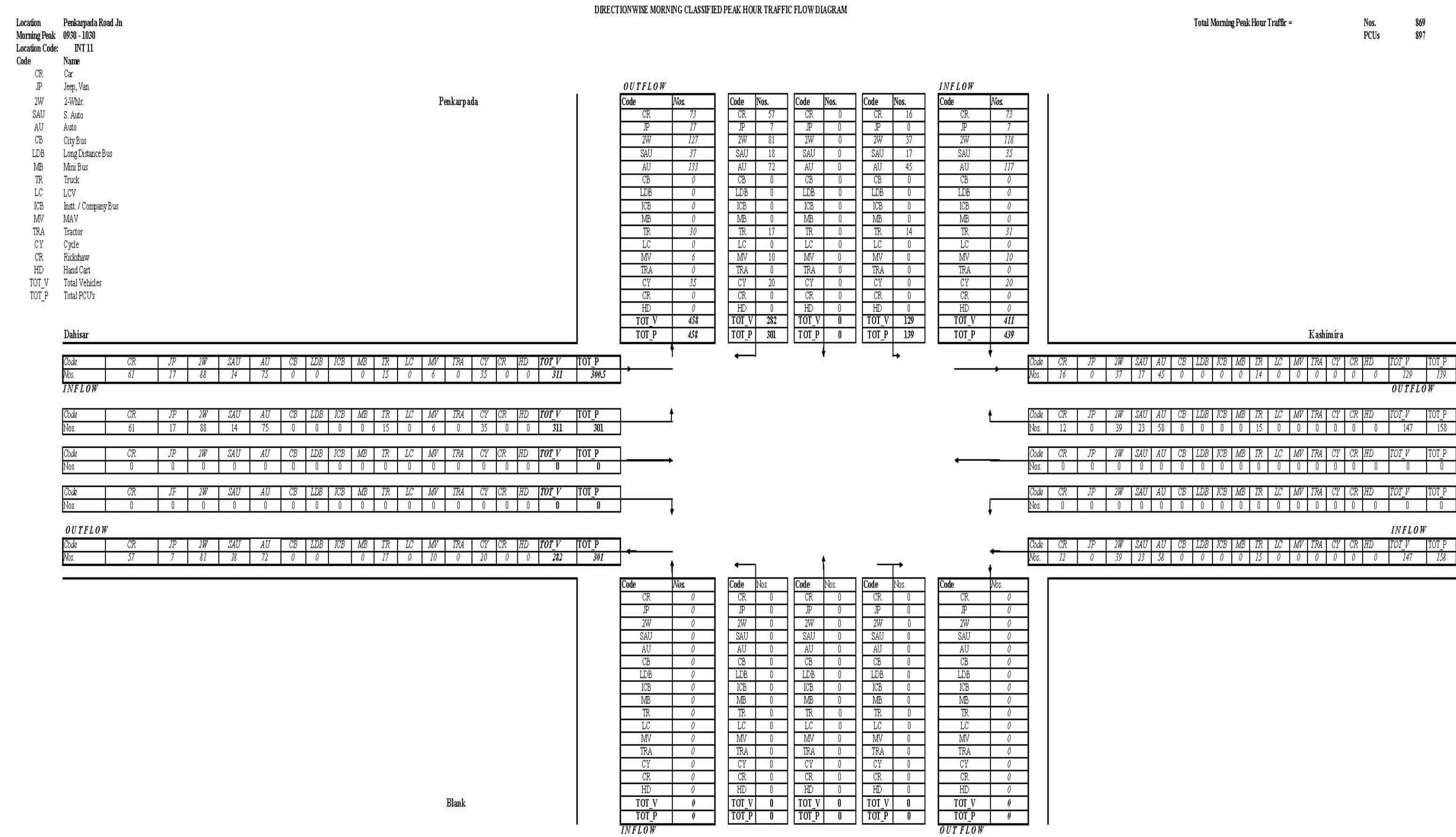


Figure 11-18 AM Peak hour Traffic Flow at Intersection 10-MIDC Road Junction



Annexure B Projected Population and Employment

The Projected Population and Employment for different Horizon Years are given below in **Table 11-1.**

Table 11-1 TAZ wise projected Population and Employment

TAZ No	Population _2016	Population _2021	Population _2031	Employment _2016	Employment _2021	Employment _2031
1003	7682	8826	11233	1614	2164	3264
1004	7682	8826	11233	1614	2164	3264
1005	7682	8826	11233	1614	2164	3264
1006	11485	13046	16492	1623	2167	3255
1007	11416	12968	16393	1613	2154	3236
1008	11416	12968	16393	1613	2154	3236
1009	11416	12968	16393	1613	2154	3236
1010	11485	13046	16492	1623	2167	3255
1011	11416	16242	28210	1613	6526	20742
1015	18625	18625	18625	18920	18920	18920
1016	7926	8821	10780	4482	6021	9100
1017	7682	8826	11233	1614	2164	3264
1018	7682	8826	11233	1614	2164	3264
1019	6224	6944	8395	4278	5723	8613
1040	7336	8152	9804	1652	2237	3407
1041	6224	6944	8395	4278	5723	8613
1042	7336	8152	9804	1652	2237	3407
1043	7682	8826	11233	1614	2164	3264
1044	7926	8821	10780	4482	6021	9100
1047	7336	8152	9804	1652	2237	3407
1048	7336	8152	9804	1652	2237	3407
1049	7336	8152	9804	1652	2237	3407
2012	9681	10851	12780	5319	6311	8296
2013	9681	12021	13950	5319	7303	11273
2014	9681	9681	9681	5319	5319	5319
2045	9681	10851	12780	5319	6311	8296
2046	9681	10851	12780	5319	6311	8296
2073	24970	31792	44350	4752	6664	10489
2151	24970	31792	44350	4752	6664	10489
2161	24970	31792	44350	4752	6664	10489
2251	24970	31792	44350	4752	6664	10489
2261	24970	31792	44350	4752	6664	10489
3075	17375	20954	28337	3851	4757	6569
3076	17375	20954	28337	3851	4757	6569
3174	4219	6440	11256	1293	1823	2882
3274	37970	57959	101306	11640	16407	25941
3374	42189	64399	112562	12934	18230	28823
4070	34406	46879	72871	11712	15067	21777

TAZ No	Population _2016	Population _2021	Population _2031	Employment _2016	Employment _2021	Employment _2031
4071	34406	46879	72871	11712	15067	21777
4072	34510	47019	73090	11747	15112	21842
4077	14252	17359	23781	4140	5004	6732
4078	14252	17359	23781	4140	5004	6732
4079	14295	17411	23852	4152	5019	6752
5050	11918	13419	16191	943	1112	1452
5052	11918	13419	16191	943	1112	1452
5053	11918	13419	16191	943	1112	1452
5054	11918	13419	16191	943	1112	1452
5055	11918	13419	16191	943	1112	1452
5056	11918	13419	16191	943	1112	1452
5057	11918	13419	16191	943	1112	1452
5058	11918	13419	16191	943	1112	1452
5059	12647	14421	18235	2868	3395	4450
5060	12736	14523	18363	2888	3419	4481
5062	12736	14523	18363	2888	3419	4481
5063	12736	14523	18363	2888	3419	4481
5064	11918	13419	16191	943	1112	1452
5065	12736	14523	18363	2888	3419	4481
5066	11918	13419	16191	943	1112	1452
5067	11787	13272	16013	932	1100	1436
5068	12736	14523	18363	2888	3419	4481
5069	12736	14523	18363	2888	3419	4481
6133	14427	19407	31458	6632	8867	13336
6134	14427	19407	31458	6632	8867	13336
6135	30295	42644	69432	24138	32614	49567
6233	11609	13768	17930	2532	2991	3908
6234	11609	13768	17930	2532	2991	3908
6235	30295	42644	69432	24138	32614	49567
7127	13002	16592	24181	2798	3578	5139
7128	13002	16592	24181	2798	3578	5139
7129	49475	71260	119650	38705	50053	72749
8030	3541	3884	4257	591	701	922
8031	3541	3884	4257	591	701	922
8032	3541	3884	4257	591	701	922
8229	3541	3884	4257	591	701	922
8329	3541	3884	4257	591	701	922
9001	29530	40628	64920	9623	13284	20607
9026	29530	40628	64920	9623	13284	20607
9227	6200	8429	13291	1895	2435	3514
9228	6200	8429	13291	1895	2435	3514
10002	38106	55920	94154	25072	33442	50181
10020	4750	4936	4819	2753	3577	5225
10021	4750	4936	4819	2753	3577	5225

TAZ No	Population _2016	Population _2021	Population _2031	Employment _2016	Employment _2021	Employment _2031
10022	4750	4936	4819	2753	3577	5225
10023	7820	8757	10450	2080	2398	3035
10024	7820	8757	10450	2080	2398	3035
10025	8354	9395	11363	4886	5658	7202
10036	8354	9395	11363	4886	5658	7202
10037	8354	9395	11363	4886	5658	7202
10038	8354	9395	11363	4886	5658	7202
10039	4750	4936	4819	2753	3577	5225
	1240333	1555331	2209008	422851	547424	800998

Annexure C Primary Survey Formats

The survey formats for different primary surveys are given below from **Table 11-2 to Table 11-15**.

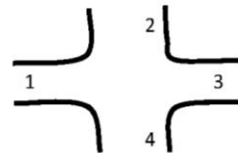
11.1 Classified Traffic Volume Count Survey (Intersection, mid-block, outer cordon)

URBAN MASS TRANSIT COMPANY (UMTC)																					
COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDAR																					
CLASSIFIED TRAFFIC VOLUME COUNT AT SCREEN POINTS AND OUTER CORDON																					
Location :				Date :				Day :				Enumerator :									
Road Name :				Direction :				Weather :													
Time	Buses				Private Vehicles & IPT							Goods Vehicles					Slow Moving Vehicles				
	City Bus	Long Distance Bus	Institutional Bus/Company Bus	Mini Bus	Van/Maxi Cab	Car	Taxi	Two Wheeler	shared Auto rickshaw/tempo	Auto rickshaw	Others	LCV	Trucks/2 Axle	MAV	Others	Tractor	Cycle rickshaw	Cycles	Othrs	Carts	
:00 to :15																					
:15 to :30																					
:30 to :45																					
:45 to :00																					

11.2 Intersection Volume Count Survey Format

URBAN MASS TRANSIT COMPANY (UMTC)
COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDER
CLASSIFIED TRAFFIC VOLUME SURVEY AT JUNCTIONS

LOCATION NUMBER
 JUNCTION NAME
 APPROACH ROAD NAME
 APPROACH ARM NO.
 DISCHARGE ARM NO.



DAY
 DATE

NAME OF SURVEYOR
 NAME OF SUPERVISOR

TO _____

Junction Name :					Date :					Enumerator:						
Road name :					Direction :					Weather :						
Time	Buses				Private Vehicles & IPT					Goods Vehicles				Slow moving vehicles		
	City Bus	Long Distance Bus	Institutional/Company Bus	Mini bus	Van/Maxi Cab	Car/jeep	Two wheeler	Shared Auto rickshaw	Auto rickshaw	Truck/ 2 Axle	3 Axle/MAV	LCV	Tractor	Cycle Rickshaw	Cycles	Cart
:00 to :15																
:15 to :30																
:30 to :45																
:45 to :00																

11.3 Road Side Interview Passengers at Outer Cordon Points Survey Format

URBAN MASS TRANSIT COMPANY (UMTC) COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDER Road Side Interview Survey Format-Passenger Vehicles					
Name of the Road :			Interviewer :		
Location:			Date :		
Direction:			Day :		
Time(Very Important)	Vehicle Type	Occupancy	Origin of the Trip	Destination of the Trip	Purpose of Journey

VEHICLE TYPE	1 -Two Wheeler	2- Car/Van/Jeep	3- Taxi	4- Auto Rickshaw	5-Pvt Bus	6-Govt Bus	7- Others
TRIP PURPOSE	1. Work	2. Car/Van/Jeep	3. Education	4. Shopping	5. Others	6. Return Work	7. Return Business
	8. Return Education	9. Return Other					

For Bus Mode, the purpose need not be asked.

URBAN MASS TRANSIT COMPANY (UMTC)			
COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDAR			
Road Side Interview Survey Format-Goods Vehicles			
Name of the Road :	Interviewer :		
Location:	Date :		
	Day :		
Direction:			

Time(very Important)	Vehicle Type	Origin of Trip	Destination of Trip

VEHICLE TYPE 1. Truck/2Axle, 2. MAV, 3. LCV, 4 Others

11.5 Household Survey Format

URBAN MASS TRANSIT COMPANY (UMTC) COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDER HOUSE HOLD INTERVIEW SURVEY							
TRAFFIC ZONE			DAY				
FORM NO.			DATE				
NAME OF ENUMERATION		NAME OF SUPERVISOR					
SECTION A: HOUSEHOLD INFORMATION							
1. ADDRESS OF HOUSEHOLD:							
2. TELEPHONE NO./MOBLINE NO:							
3. TOTAL NUMBER OF FAMILY MEMBERS (INCLUDING OLD PARENT AND CHILD)							
5	VEHICLE TYPE	CAR	2-WHEELERS	CYCLE	OTHERS		
	NUMBER OF VEHICLES						
SECTION B: INDIVIDUAL FAMILY MEMBERS INFORMATION							
S.NO	MEMBER NAME	ADDRESS OF WORK PLACE/ INSTITUTION/ ORGANIZATION/S CHOOL/ COLLEGE	SEX	OCCUPATION	MONTHLY INCOME (IN RS.)	MONTHLY EXP. ON TRANSPORT (IN RS.)	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
Legend							
Occupation	1. Govt. Service	2. Pvt. Service	3. Business	4. Student	5. Housewife	6. Retired	7. Unemployed 8. Others
MONTHLY INCOME	1-Upto 1500	2-1500-3000	3-3001-5000	4-5001-10000	5-10001-20000	6-20001-30000	7-30001-40000 8-40001-50000 9-Above 50000

212

URBAN MASS TRANSIT COMPANY (UMTC)																																																		
COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDER																																																		
ROAD INVENTORY SURVEY FORMAT																																																		
Land Use - R/C/A/O/ W R- Residential, C-Commercial, I - Institutional, A-Agricultural, O - Others, W-Waste Land																																																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47				
Node Number			Name of the Road	Name of From Node A	Name of To Node B	Total Length (KM)	Pavement Type	No. of Lanes	Divided/Undivided	One Way / Two Way	Carriage Way Width (mts) (Curb to Median)				Shoulder				Footpath				Drainage				Sewer		Right Of Way Width (Mtrs.)	Posted Speed Limit (kmph)	Any Auto Stand (On street/Off street)	Any Taxi Stand (On street/Off street)	Is it a Bus Route? (Yes/No)	No. of Designated Bus Stops	Any Bus Stop? (Mention the width and length)	On Street Parking	On Street Parking Length (m)	Land Use (LHS)	Land Use (RHS)	Encroachments on footpaths/Shoulders (m)	Street Lighting	Sign Boards	Road Markings	Remarks						
Link To	From Node	To Node					Flexible/Rigid/Improved				LHS Width (Mtrs.)	Median Width (Mtrs.)	RHS Width (Mtrs.)	Total Carriage Way Width	Type (P/U/P)	Width (Mtrs.)	Type (P/U/P)	Width (Mtrs.)	Type (P/U/P)	Width (Mtrs.)	Type (P/U/P)	Width (Mtrs.)	(Opened/Closed)	Width (Mtrs.)	(Opened/Closed)	Width (Mtrs.)	Left (Mtrs.)	Right (Mtrs.)																						
1	1	17																																																
2	2	1																																																
3	3	2																																																
4	4	2																																																
5	5	7																																																
6	6	3																																																
7	7	8																																																
8	8	6																																																
9	9	10																																																
10	10	6																																																
11	11	9																																																
12	12	9																																																
13	13	8																																																
14	14	10					</																																											

11.7 Road Network Inventory Survey Format

URBAN MASS TRANSIT COMPANY (UMTC) COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDER SPEED & DELAY SURVEY FORMAT																		
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
Link No	Node Number		Name of the Road	Name of From Node Jn	Name of To Node Jn	Total Length (KM)	PEAK HOUR (7.30 to 9.30 AM)JOURNEY DETAILS FOR PVT MODE						OFF PEAK HOUR(1.00-4.00 PM) JOURNEY DETAILS FOR PVT MODE					
	From Node	To Node					Running Time	Journey Time	Delay Time	Journey Speed	Running Speed	Reason of Delay	Running Time	Journey Time	Delay Time	Journey Speed	Running Speed	Reason of Delay
							(Sec)	(Sec)	(Sec)	(Kms./Hrs.)	(Kms./hrs.)	Delay	(Sec)	(Sec)	(Sec)	(Kms./Hrs.)	(Kms./hrs.)	Delay
1	1	17																
2	2	1																
3	3	2																
4	2	4																
5	4	7																
6	5	3																
7	4	8																
8	6	5																
9	7	10																
10	6	9																
11	8	6																
12	9	7																
13	8	9																
14	10	5																
15	9	10																
16	11	13																
17	10	12																
18	12	11																
19	13	14																
20	12	13																
21	14	3																
22	1	19																
23	15	24																
24	15	16																
25	17	11																
26	17	16																
27	18	14																

11.8 Parking Survey Format

[illegible]

11.9 Railway Station Survey Format

URBAN MASS TRANSIT COMPANY (UMTC) COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDAR RAILWAY PASSENGER SURVEY								
DAY:				DATE:				
FORM NO:								
NAME OF ENUMERATOR:				NAME OF SUPERVISOR				
Time	Initial Origin	Origin of Station	Destination	Details of reaching Station from Initial Origin			Trip Purpose	Commuter/ Occasional Traveler
				Mode	Travel Time	Travel Cost		

11.10 Occupancy Survey Format

COMPREHENSIVE MOBILITY PLAN FOR MIRA BHAYANDAR								
URBAN MASS TRANSIT COMPANY (UMTC) LIMITED								
OCCUPANCY SURVEY								
Location:			Date:			Enumerator:		
Direction:			Day:			Supervisor:		
Time*	Passenger Vehicles							
(15 mins)	Cars/Vans/ Jeeps	Taxis	3 Wheelers	2 Wheelers	Buses (State)	Other Buses	Cycles	Other Vehicle if any
TOTAL COUNT								
TOTAL COUNT								
TOTAL COUNT								
TOTAL COUNT								

Note: Time should be in 24 hrs format

Codes for Bus Occupancy

Half full -1

Full -2

Over Crowded-3

Capacity of BEST Bus _____

Capacity of MBMT Bus _____

Capacity of TMT Bus _____

Capacity of ST Bus _____

Annexure D Proposal Maps under Mobility Plan

