Integrated Comprehensive Mobility Plan- Noida and Greater Noida

Final report

August 2015

Urban Mass Transit Company Limited

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Abbreviations

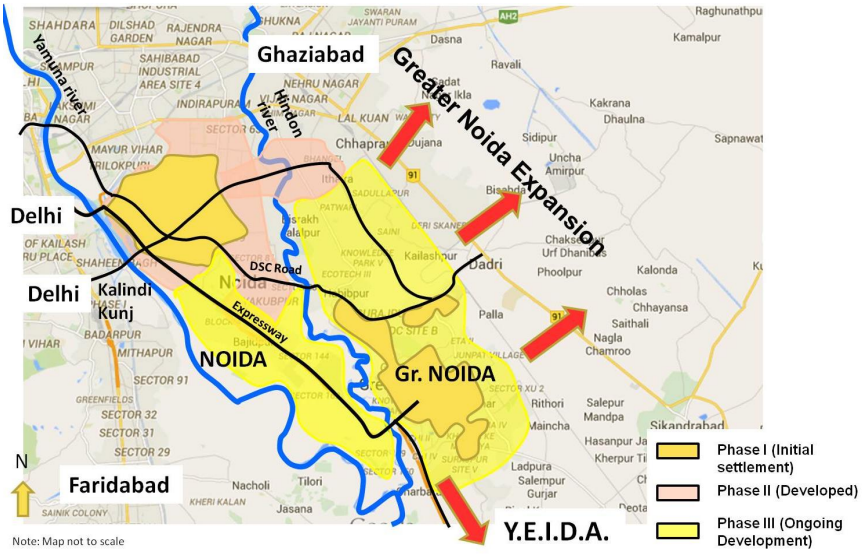
1	ADB	Asian Development Bank
2	BAU	Business As Usual
3	BQS	Bus Queue Shelter
4	BRTS	Bus Rapid Transit System
5	CMP	Comprehensive Mobility Plan
6	CT	Census Town
7	DFC	Dedicated Freight Corridor
8	DMRC	Delhi Metro Rail Corporation
9	DND	Delhi-Noida-Direct
10	DPR	Detailed Project Report
11	DSC	Delhi-Surajpur-Chalera
12	DTC	Delhi Transport Corporation
13	FNG	Faridabad-Noida-Ghaziabad
14	FOB	Foot Over Bridge
15	GIS	Geographic Information System
16	GNIDA	Greater Noida Industrial Development Authority
17	GoI	Government of India
18	ICD	Inland Container Depot
19	IIDD	Infrastructure and Industrial Development Department
20	IPT	Intermediate Public Transport
21	IRC	Indian Road Code
22	ISBT	Inter State Bus Terminal
23	ITES	Information Technology Enabled Services
24	ITS	Intelligent Transport System
25	JnNURM	Jawahar lal Nehru National Urban Renewal Mission
26	KMPH	Kilo Meter Per Hour
27	KP	Knowledge Park
28	LMV	Light Motorized Vehicle
29	LOS	Level of Service
30	LRT	Light Rail Transport
31	MLCP	Multi-Level Car Parking
32	MMTH	Multi Modal Transport Hub
33	MoUD	Ministry of Urban Development

34	MRTS	Mass Rapid Transit System
35	MV	Motor Vehicle
36	NCR	National Capital Region
37	NCRPB	National Capital Region Planning Board
38	NMRC	Noida Metro Rail Corporation
39	NMSH	National Mission on Sustainable Habitat
40	NMV	Non-Motorized Vehicle
41	NOIDA	New Okhla Industrial Development Authority
42	NUTP	National Urban Transport Policy
43	O-D	Origin - Destination
44	O&M	Operation & Maintenance
45	PCE	Passenger Car Unit
46	PCU	Passenger Car Unit
47	PPHPD	Passengers Per Hour Peak Direction
48	PPP	Public Private Partnership
49	PT	Public Transport
50	ROW	Right Of Way
51	RoB	River over Bridge / Rail Over Bridge
52	RTO	Regional Transport Office
53	SPV	Special Purpose Vehicle
54	TAZ	Traffic Analysis Zone
55	TDM	Transit Development Management
56	TIMCC	Traffic Information and Management Control Centre
57	TOD	Transit Oriented Development
58	UDPFI	Urban Development Plans Formulation and Implementation
59	UMTA	Urban Metropolitan Transport Authority
60	UPSIDC	Uttar Pradesh State Industrial Development Corporation
61	UPSRTC	Uttar Pradesh State Road Transport Corporation
62	VGF	Viability Gap Funding
63	WFPR	Work Force Participation Rate
64	YEIDA	Yamuna Expressway Industrial Development Authority

Executive Summary

Background

Noida and Greater Noida are two urban centres lying in Gautam Budh Nagar district of Uttar Pradesh. The creation of Noida and Greater Noida is an outcome of the intensive pressure of the National Capital of Delhi on its periphery.



Inherent to the development of cities has been the need and development of transport systems, which are necessary to make the goods and services (produced at a centre) available to the end user, and in most cases, a wide range of end users. Thus, Mobility (defined as the ability to move) and Accessibility (defined as the ease with which a person can access a particular service) have become two critical factors for the growth of an urban economy. While the provision of a good transport system serves the increasing demands of mobility, the existence of an efficient Land Use and Transport System ensures that the city is made accessible to its residents.

Increased interaction between various land uses, on account of increasing levels of urbanization and economic growth, has led to an unprecedented increase in the need for efficient transfer of people and goods. In case of developing countries with typically unplanned cities in the absence of sophisticated transport systems, the above phenomenon has brought planning for accessibility and mobility to the centre-stage of most urban economies. This has necessitated cities to plan for a system that enables the interaction between various land uses in an efficient, safe and sustainable manner. Thus, avoiding piece-meal measures to deal with issues of mobility and going for a holistic approach in solving mobility problems of cities are soon becoming a norm.

Need for Comprehensive Mobility Plan

Any unplanned city suffers primarily from a lack of a proper land use and transport system. Increasing urbanization leads to haphazard increase in travel demand. Till the time the city authorities realize and wake up to the fact, the urban citizen goes for the obvious option of personal mobility in the form of an automobile. This is again driven by the increasing prosperity brought on by increasing urbanization. All in all, the private vehicular ownership pattern of the city rises and its usage takes its toll on the urban transport system. Now, any urban transport system has five basic stakeholders: Consumers (the user of the system), Environment, City Authorities, the Producers/Manufacturers (the drivers of local urban economy) and the Region surrounding the city. Increasing usage of the automobile results primarily in congestion, that in turn creates varying dimensions of problems for different stakeholders of the system. The Consumer suffers from increased travel time. The urban environment suffers from pollution. The city authorities suffer from an inefficient usage of the transport system supply and face with the only prospect of increased investment on transport systems (which in most cases is to keep on increasing and widening the existing road network to alleviate congestion). Absence of suitable infrastructure and system for freight drives up the production cost of manufacturers. The region suffers from obstacles to regional traffic that has to invariably negotiate with the local urban traffic and congestion.

During the last decade, the urban sprawl in Noida and Greater Noida has been growing at a faster rate and has resulted in increase of traffic also. The traffic congestion due to the increase in number of private vehicles coupled with inadequate public transport services have become major concerns in Noida and Greater Noida. Substantial efforts have been made by Noida and Greater Noida (GNIDA) on various road widening, network improvement and other planning activities such as new flyovers, improvement in public transport, parking scenario etc. However, most of these initiatives are planned in isolation, independent of each other with a piece-meal approach. Hence, it is important to prepare a long-term strategic plan focused on mobility of people as basis for developing cost-effective and equitable urban transport measures with an appropriate and consistent methodology, in line with the National Urban Transport Policy (NUTP). Accordingly, the Ministry of Urban Development (MoUD) encourages cities to prepare "Comprehensive Mobility Plans" (CMPs) as part of long-term urban transport strategy for sustainable improvement of people's mobility in metropolitan regions. As a part of it, UMTC has been awarded by Noida authority on 03 March 2014 to conduct a study for "Integrated Comprehensive Mobility Plan for Noida and Greater Noida"

Objectives of the study

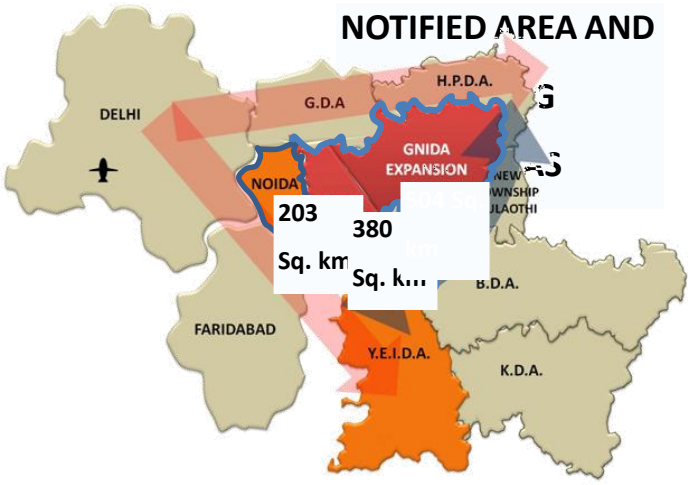
- To provide long-term vision(s) and goals for desirable urban development in Noida and Greater Noida;
- To illustrate a basic plan for urban development and include a list of proposed transport measures to be implemented within a time span of 20 years or more; and
- To ensure that the most appropriate, sustainable and cost-effective implementation program is undertaken in the urban transport sector.

Scope of Study

- Review past studies, reports and plans which are related to traffic and transportation issues in Noida and Greater Noida city such as Master Plan, Traffic and transportation studies etc.
- Diagnose existing traffic and transportation system in the study area
- Perform traffic analysis based on the primary surveys conducted
- Suggest Short-term traffic improvements needed for twin city
- Develop and validate the travel demand model for the study area
- Project travel demand in the study area for different horizon years (2024 and 2034)
- Develop and evaluate various transport strategies
- Propose Short term, Medium-term and Long-term traffic improvement measures for the twin city
- Provide Transport Investment Options and Implementation Plan
- Suggest Institutional Arrangement

Study Area

Noida & Greater Noida are two urban centres lying in Gautam Budh Nagar district of Uttar Pradesh. The planning region of Noida-Greater Noida covers a total area of 1087 sq.km, which comprises of notified areas under Noida (203 sq. km), Greater Noida existing (380 sq.km) and Greater Noida expansion (504 sq. km). As per 2011 Census, the population of Noida was 6,37,272 and of Greater Noida was 700,000 (inclusive rural population along with urban population of 102,054 as per census 2011).



For the whole study area, the base year (2014) population is 0.77 million in Noida and 1 million in Greater Noida. The region is estimated to grow to about 3.1 million and 5.4 million populations respectively for Noida and Greater Noida by 2034. Similarly the employment grows from 0.6 million (0.26 million in Noida and 0.34 million in Greater Noida) in base year (2014) to about 2.8 million (1 million in Noida and 1.8 million in Greater Noida) in horizon year 2034. The proposed road network as per the master plans for Noida and Greater Noida are taken into account while conducting this study.

Data collection and Survey Findings

The data required for traffic analysis and subsequent development of a four stage transport model was collected both from secondary and primary sources. The literature review was undertaken based on the available past studies, while the latest traffic data were collected through manual surveys. The summary of traffic survey analyses is presented below:

S. No	Content	Unit	Noida	GNIDA
1	Average Occupancy for Two Wheeler	Passenger / vehicle	1.4	1.5
2	Average Occupancy for Car	Passenger / vehicle	2	2
3	Average Occupancy for Auto including Share Auto rickshaws	Passenger / vehicle	2.8	3.5
4	Average Occupancy for Bus	Passenger / vehicle	32.6	31.5
5	Average household income	Rs /Month	Rs 23,710	Rs 22,940
6	Average household size	Family Members / Household	3.05	3.49
7	Average Household Monthly expenditure on transport	Rs /Month	Rs 2,297	Rs 3,540
8	Average trip length for cars	Km	7.5	19.1

S. No	Content	Unit	Noida	GNIDA
9	Average trip length for two wheelers	Km	6.4	13.7
10	Average trip length for auto rickshaw	Km	6.3	5.4
11	Average trip length for Bus	Km	6.4	19.6

Issues

- Both the cities lack dedicated City Bus Service for the intra city movement.
- The current public transport facility has low coverage and low frequency of buses (15-60 min.)
- High network coverage of IPT with good frequency (2-10 min.) is present.
- There is lack of feeder service for existing metro stations.
- Haphazard parking of IPT on roads and stoppage of bus near junctions results congestion and safety issues.
- Absence of proper infrastructure for buses halt during off peak hours result into a long queue of buses at main arterial road.
- There is absence of Integrated Public Transport System
- Lack of enforcement of strict rules and policies results in underutilization of existing Infrastructure
- Lack of efficient parking policy measures
- The unorganised and irregular on-street parking can be seen on majority of roads in Noida which results in decreasing the capacity of road and create congestion.
- Cycle tracks, footpaths and other NMT infrastructure are missing in majority of roads and where ever present are not in usuable condition because of the encroachment, discontinuity, barriers, absence of proper lighting, poor condition etc.

Service Level Benchmarks

Overall Level of Service (LOS)		
1	Overall Public Transport Facilities	4
2	Overall Pedestrian Infrastructure Facilities	3
3	Overall Non- Motorized Transport Facilities	3
4	Level of Usage of ITS facilities	4
5	Travel Speed along major corridors	2
6	Availability of Parking Spaces	3
7	Road Safety	3
8	Pollution Levels	4
9	Integrated Land-use Transport Integration	3
10	Financial Sustainability of Public transport	3

Travel Demand Forecast – Model Development

Household and roadside passenger interview data were used to develop the observed mode-wise trip matrices. The external trips for cars, two wheelers, auto rickshaws, public transport and commercial vehicles were constructed based on the O-D survey conducted at the outer cordons. From the primary surveys it has been observed that the evening peak is more critical during 17:30 to 18:30. So the model was built for this duration. In total, 208 internal and 14 external zones (including 6 metro stations) were built. The model is validated across cordons and screen lines within a confidence range of +/-10%. The model was developed for three different scenarios:

- Do Nothing – Without Any Development
- Do Something – For 2024, Considering Sanctioned Projects alone
- Do Everything: For 2034, Higher, Middle and Lower Order Mass Transit System with Transit Oriented development

Vision

"To ensure that Noida and Greater Noida will have a systematically planned urban transport system for the mobility of people and goods that is safe, efficient, economical and sustainable, which aims to support economic development while improving livability".

Goals

To ensure that Mobility solutions for the twin-city are sustainable and in conformity with sustainable mobility, following Goals have been formulated:

- Goal 1: Develop public transit system in conformity with the land use that is accessible, efficient and effective.
- Goal 2: Ensure safety and mobility of pedestrians and cyclists by designing streets and areas that make a more desirable, livable city for residents and visitors and support the public transport system.
- Goal 3 : Develop traffic and transport solutions that are economically and financially viable and environmentally sustainable for efficient and effective movement of people and goods
- Goal 4: 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.

Urban mobility solutions cannot be evolved by a single source strategy. The mobility goals for Noida and Greater Noida were addressed through a multipronged strategic approach.

Mobility Corridor Strategy and Proposal

As a part of this strategy, all important Expressways, Highways – NH 24, NH 91 and all major roads comprising DSC Road, DND flyway, Link Road, 105 m road, Dadri- Hapur Road, New bridge on river hindon connecting Sec. 78 in Noida to Bisrakh in GNIDA, Dankaur-Sikandrabad-Galauthi Road and Mini Ghaziabad highway. Roads are recommended as mobility corridors which will maximize throughput of people, focusing on mass transport and non-motorized traffic, rather than personal automobile traffic.

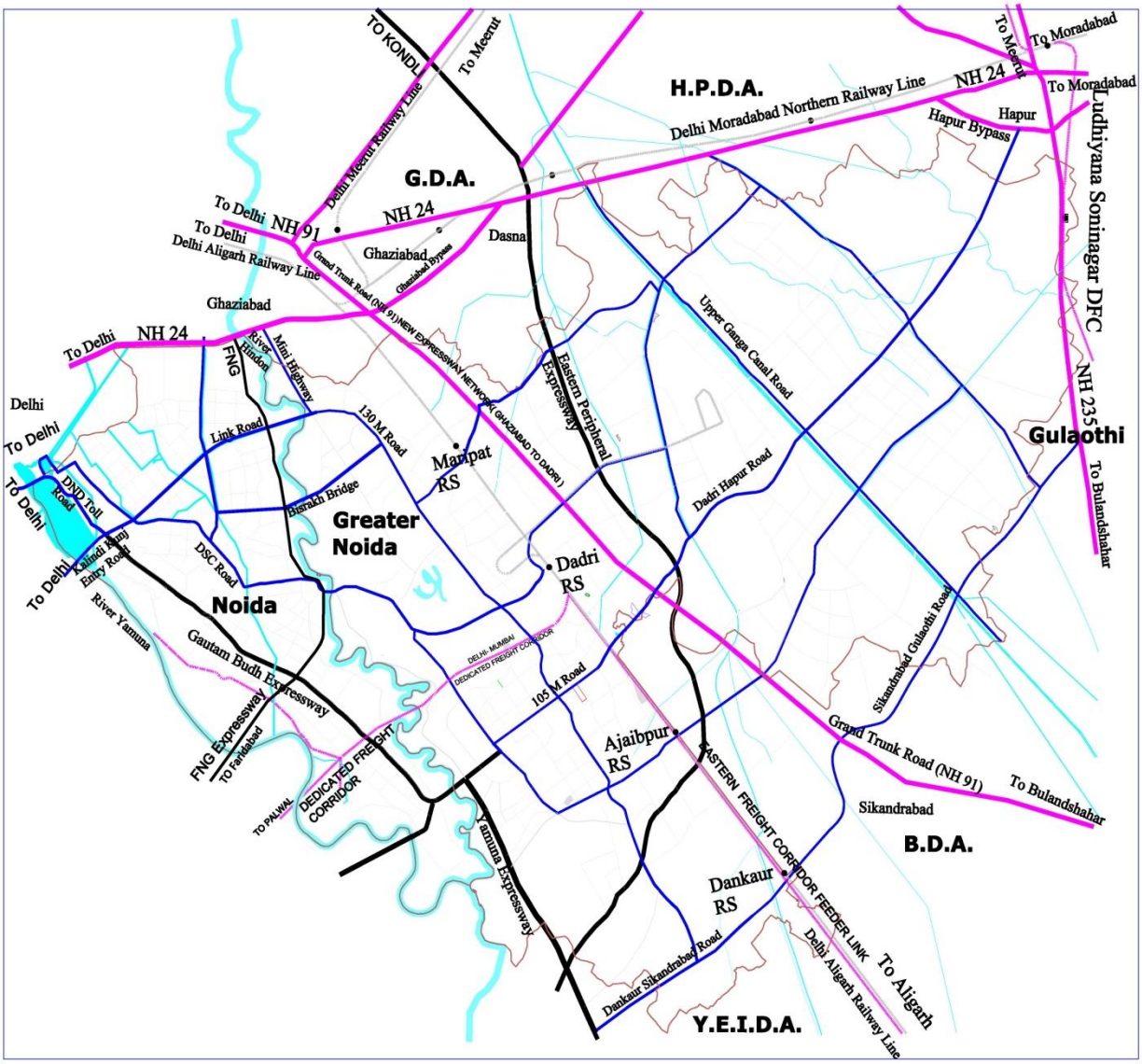


Figure : Identified Mobility Corridors for the Study Area (Stage 2 - 2034)

Landuse and Transport Strategy and Proposal

One of the strategies of integrating land use and transport is the consideration of Transit Oriented Development (TOD) strategy. This concept can be applied along the major identified mobility corridors that have the potential to carry higher order mass transit systems. Following three corridors have been identified for TOD strategy:

1. Gautam Budh Expressway and 105M Road Corridor
2. From Sec. 52-72 chowk to Gautam Budh Expressway along Drain in Noida
3. 130 M wide road

Public Transit Strategy and Proposal

One of the goals defined as part of the vision is to increase the public transport share to 60% from the existing 27%. For this purpose, we should consider the hierarchy of public transport system including Higher order system (**HOS**) like metro and Commuter rail, Middle order system (**MOS**) like Bus Rapid Transit, Monorail, LRT, Tram etc., High capacity bus service (**HCBS**) and city Bus Service (**CBS**) with IPT on feeder corridors and NMT network all around the city.

Table 1 : Phase wise Public Transport Plan (2014, 2024, 2034)

S. No.	Identified PT Corridors	Expected PPHPD in 2014	Type of System	Expected PPHPD in 2024	Type of System	Expected PPHPD in 2034	Type of System
1	DND Flyway (Delhi – Noida)	2296	HCBS	7329	MOS	12971	HOS
2	IOC Gol Chakkar to Sec. 37 junction	3494	HCBS	8650	MOS	12422	HOS
3	DSC Road (from Sec. 37 junction towards EP expressway via Dadri RoB)	2684	HCBS	9865	MOS	13945	HOS
4	Surajpur Junction to Kasna	1389	CBS	10232	MOS	15642	HOS
5	Kalindi Kunj Bridge (South Delhi – Sector 37 Junction)	1430	CBS	8315	MOS	12280	HOS
6	MP 3 Road (Sec. 37 junction to Sec. 52-72 junction	2575	HCBS	8575	MOS	13200	HOS
7	Sec-52-72 Junction to Gaur chowk	690	CBS	9132	MOS	13024	HOS
8	130 Mts Road (Gaur Chowk to Theta –II Sector)	590	CBS	7874	MOS	14400	HOS
9	Mini Ghaziabad Road (NH-24 to Gaur chowk)	564	CBS	3950	HCBS	8432	MOS

S. No.	Identified PT Corridors	Expected PPHPD in 2014	Type of System	Expected PPHPD in 2024	Type of System	Expected PPHPD in 2034	Type of System
10	Entry Road (from Gaur chowk to Surajpur junction)	402	CBS	4250	HCBS	9120	MOS
11	Noida – Greater Noida Expressway	2892	HCBS	8758	MOS	20115	HOS
12	105 mts Road (Theta II to GT Road)	-	-	13500	HOS	19870	HOS
13	Sec-62 Junction to Sec-52-72 Junction	980	CBS	7692	MOS	11490	MOS
14	Bisrakh Village Bridge (Noida - Greater Noida)	1065	CBS	8377	MOS	12320	HOS
15	FNG Expressway (Faridabad – Noida)	1491	CBS	4751	HCBS	10124	MOS
16	G.T. Road (Greater Noida – Faridabad)	1347	CBS	6874	HCBS	8346	MOS
17	Eastern Peripheral Expressway (Ghaziabad - Greater Noida)	-	-	6351	HCBS	8437	MOS
18	Dankaur-Sikandarabad-Gulaothi Road	-	-	6532	HCBS	9246	MOS
19	From GB University to GT Road via Ghodi Bachheda	-	-	2124	HCBS	8344	MOS

Non-Motorize Transport Strategy and Proposal

Provision for pedestrians: "Because all trips begin and end with a walk, walking should be made as comfortable as possible"

While focusing on the sustainable development in the city, we recommend that the corridors identified as mobility corridors in Noida and Greater Noida should have cycle tracks on both sides of the road. To promote NMT in the city, a Public Bike-Sharing

scheme is also suggested. The NMT proposals also include running of cycle tracks along the drains, grade separated pedestrian crossing, pedestrian signals, table tops etc.

Parking Strategy and Proposal

Parking in Noida and Greater Noida, especially along DSC road in Noida, has become a serious concern and needs immediate attention. The ICMP aims to bringing the parking supply and demand into balance that will require a strong policy of enforcement of parking violations. At the same time, the re-organisation of parking spaces and improvements to the pedestrian realm shall be proposed in a staged programme.

Because of the limited land availability for parking at ground, the existing public spaces like gardens can be considered for underground parking so as to serve dual purpose. The potential sites which can be considered for off-street parking are Sector 18, Sector 1, Sector 3, Sector 5 Sector 16A, Sector 38 A and Noida city centre.

Freight Management Strategy and Proposal

In Noida, a Transport Nagar has been proposed at sector 69, by the side of proposed Bus Depot. It will provide facilities for idle parking of trucks, repair workshops, offices of booking and forwarding agencies, petrol filling and service station and related facilities. While in Greater Noida, there is a proposal of transport hub at Boraki, which shall provide comprehensive facilities for the integration of passenger railway station, ISBT, Truck Terminal etc.

Anticipated Impact of Proposed Projects

Projects evolved in ICMP will help to achieve sustainable development goals by means of reducing private mode share, emission levels and travel time. The anticipated impacts of proposed projects are presented in the table below.

Scenario	Private vehicle share (%)	IPT Share (%)	PT Share (%)
Base Year-2014	54	18	27
Do Nothing -2034	73	15	11
Scenario 1 : with improvements in 2014	47	13	35

Scenario 2 : with improvements in 2024	36	8	50
Scenario 3 : with improvements in 2034	28	6	60

Project Phasing: Short, Medium and Long Term Improvements

All the proposals are broadly grouped under three categories based on their usefulness.

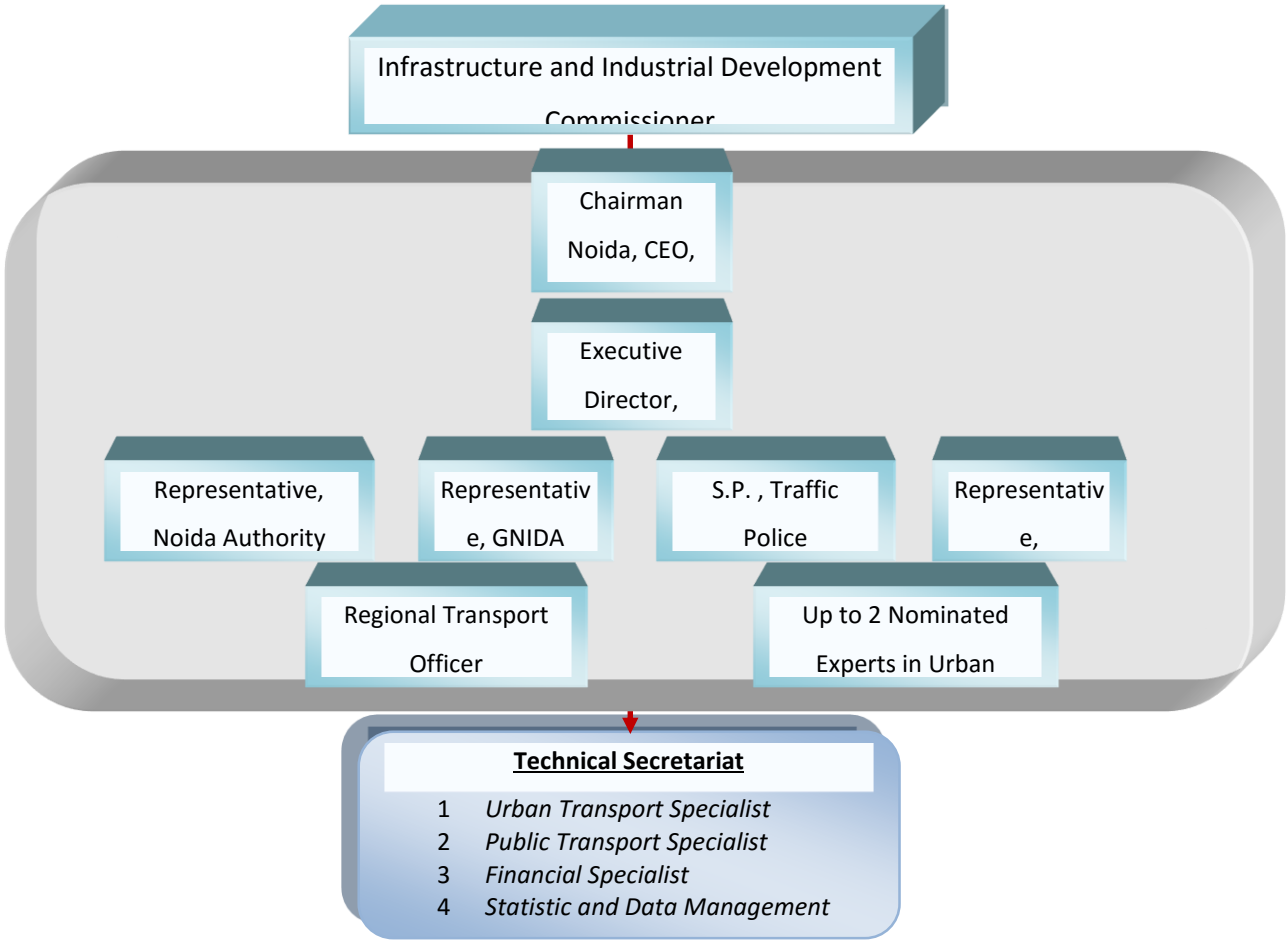
Phase of Plan	Estimated cost of projects (in Rs. Crores)
Phase I (2015-2019)	2143.81
Phase II (2020-2024)	1916.10
Phase III (2025-2034)	7190.32
TOTAL	**11250.23**

Institutional Framework

With a view to coordinate all urban transport activities in the city, it is recommended that an Urban Metropolitan Transport Authority (UMTA) be set up that acts as a planning and decision making body for all matters related to urban transport in the twin city. It is also recommended that the UMTA be set up on an executive order for the ease of formation, however, it must be given a legal backing so that it's functioning falls under an act and commands greater authority. All other existing agencies need to work in tandem under the umbrella of UMTA. The umbrella agency 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.

It is recommended that Noida Metro Rail Corporation (NMRC) should act as a UMTA for Noida and Greater Noida. In the light of the above guidelines/recommendations, the following structure is proposed for UMTA:

Figure : Organizational Structure of proposed UMTA

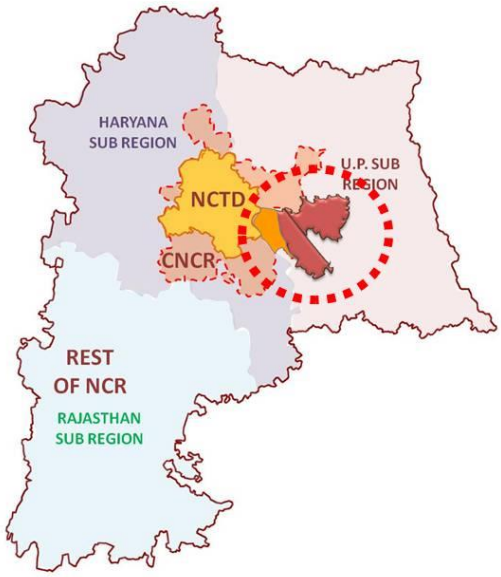


Chapter 1 Introduction

1.1 Background

Noida and Greater Noida are two urban centres lying in Gautam Budh Nagar district of Uttar Pradesh. The creation of Noida and Greater Noida is an outcome of the intensive pressure of the National Capital of Delhi on its periphery.

The Government of Uttar Pradesh foreseeing the development potential of the area bordering the erstwhile Union Territory of Delhi (now NCT of Delhi), in April 1976, notified an area of 36 revenue estates (villages) u/s 3(i) of U.P. Industrial Area Development Act, 1976. Further, to ensure planned development and growth of this area mainly for industrial and allied uses / activities, a new statutory body, namely, the New Okhla Industrial Development Authority (NOIDA) was constituted. As a priority, this Authority prepared a Master Plan for the area for horizon 1991. Noida thus began to develop in a planned manner.



However, within a few years, the pressure of development around Delhi and the newly developing township of Noida started manifesting itself in the form of haphazard growth by colonizers engaging in speculative land dealings in the areas just outside the notified area of Noida. In the meanwhile, the NCRPB came into being through an Act of Parliament in 1985 for Planned Development of the National Capital Region (NCR) including the Uttar Pradesh (UP) Sub region. However, in September 1989, the Government of Uttar Pradesh, concerned with unplanned growth in the vicinity of Noida, notified the entire area that was being exploited by colonizers under the U.P. Industrial Area Development Act, 1976 and, in January 1991, the Greater Noida Industrial Development Authority (GNIDA) was created. Figure **1-1** shows the direction of growth of Noida and Greater Noida.

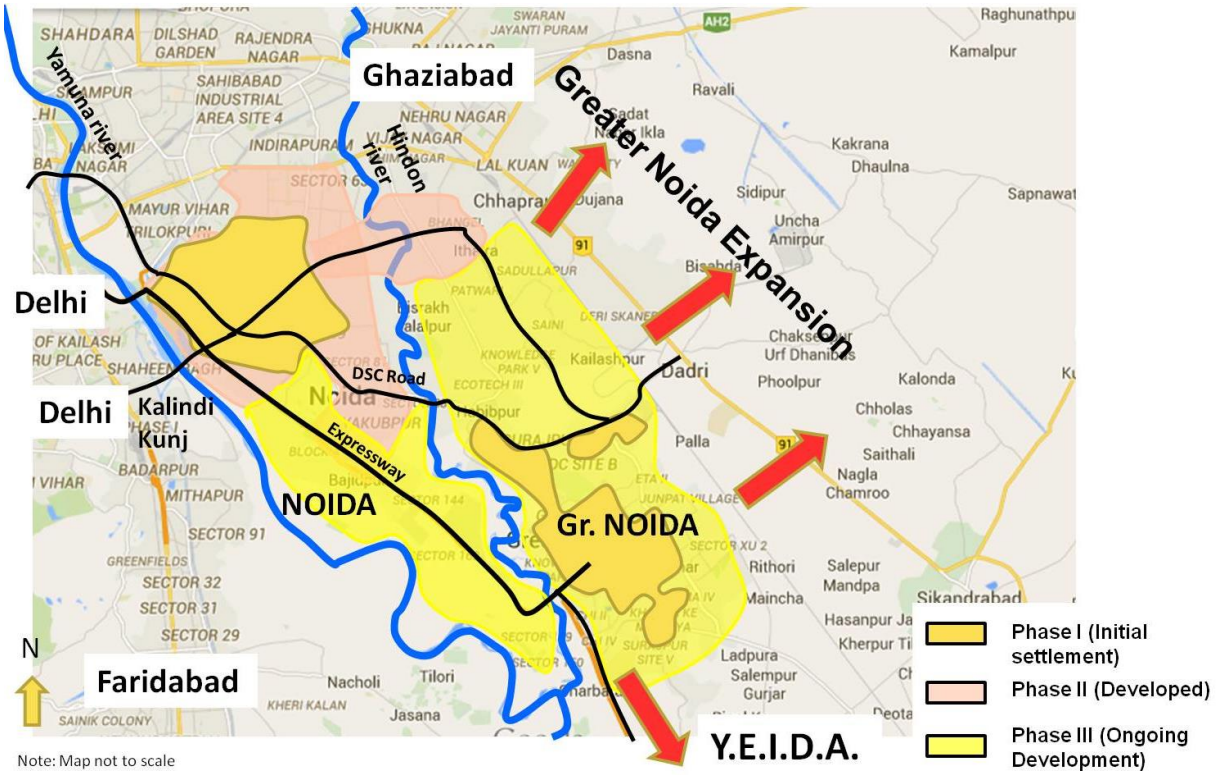


Figure 1-1 Growth pattern of Noida and Greater Noida

During the last decade, the urban sprawl in Noida and Greater Noida has been growing at a faster rate and has resulted in increase of traffic also. The traffic congestion due to the increase in number of private vehicles coupled with inadequate public transport services have become major concerns in Noida and Greater Noida. Substantial efforts have been made by Noida and Greater Noida (GNIDA) on various road widening, network improvement and other planning activities such as new flyovers, improvement in public transport, parking scenario etc. However, most of these initiatives are planned in isolation, independent of each other with a piece-meal approach. Hence, it is important to prepare a long-term strategic plan focused on mobility of people as basis for developing cost-effective and equitable urban transport measures with an appropriate and consistent methodology, in line with the National Urban Transport Policy (NUTP). Accordingly, the Ministry of Urban Development (MoUD) encourages cities to prepare "Comprehensive Mobility Plans" (CMPs) as part of long-term urban transport strategy for sustainable improvement of people's mobility in metropolitan regions. As a part of it, UMTC has been awarded by Noida authority on 03 March 2014 to conduct a study for "Integrated Comprehensive Mobility Plan for Noida and Greater Noida"

Noida

- Major hub of IT-BPO, industries, news channels (film city), commercial etc.
- Fastest growing urban region in the country with best infrastructure.
- Model city in U.P.

Greater Noida

- Part of Noida : during the 1990s (the Noida extension)
- Major hub of real estate industry and education
- India's smartest city
- Planned township.
- Roads are wide with service lanes for every major road.
- The most beautifully landscaped Expressway

1.2 Need for Integrated Comprehensive Mobility Plan

Inherent to the development of cities has been the need and development of transport systems, which are necessary to make the goods and services available to the end user, and in most cases, a wide range of end users. Thus, Mobility (defined as the ability to move) and Accessibility (defined as the ease with which a person can access a particular service) have become two crucial factors for the growth of an urban economy. While, the provision of a good transport system serves the increasing demands for mobility, the existence of an efficient land use and transport system ensures that the city is made accessible to its residents.

The need for land use-transport integration has been long recognised. However, transportation plans in India are typically prepared separately from land use plans and coordinating land use transport decisions becomes difficult. This often results in inefficient development which in turn leads to transportation proposals to deal with problems arising thereof and are therefore reactive in nature. This has necessitated cities to plan for a system that enables the interaction between various land uses in an efficient, safe and sustainable manner. Thus, there is a need for avoiding piece-meal measures to deal with issues of mobility and going for a holistic approach in solving mobility problems of cities.

What is a CMP?

A long term vision for desirable accessibility and mobility pattern for people and goods in the city to provide, safe, secure, efficient, reliable, seamless connectivity that supports and enhances economic, social and environmental sustainability.

A CMP addresses all the components of a city's urban transport system:

1. Public Transport
2. Traffic Management and Engineering
3. Non-Motorised Transport
4. Freight Management
5. Parking Management
6. Travel Demand Management
7. Road Network

1.3 Scope of Study

The Scope of work for preparation of Integrated Comprehensive Mobility Plan for Noida and Greater Noida is given below:

- Define objectives of the mobility plan and delineate the 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 vision and goals for the study area and identify strategies and action plan for achieving the vision.
- Identification of projects and policy measures that the city authorities would need to implement as part of the mobility plan.
- Preparation of a mobility plan implementation program involving stakeholder's consultation.

1.4 Methodology

The methodology for the study gives due consideration to study area demography and travel characteristics, project challenges and issues and concerns of all project stakeholders. The methodology for preparing this ICMP has been formulated after establishing the need for preparing an ICMP (refer to Figure 1-2) in the following steps:

- Define objectives of the Mobility Plan and delineate planning are and horizon of the Mobility plan.
- Analyze Demand - Supply gap of transportation needs and related infrastructure over the planning horizon.
- Assess existing problems and issues for mobility of people and goods within the study area.
- Define Mobility Vision and Goals for the study area and identify strategy and action plan for achieving the Vision.
- Identify projects and policy measures that the city authority would need to implement as part of the mobility plan.
- Prepare the Mobility Plan Implementation Program involving Stakeholders consultation.

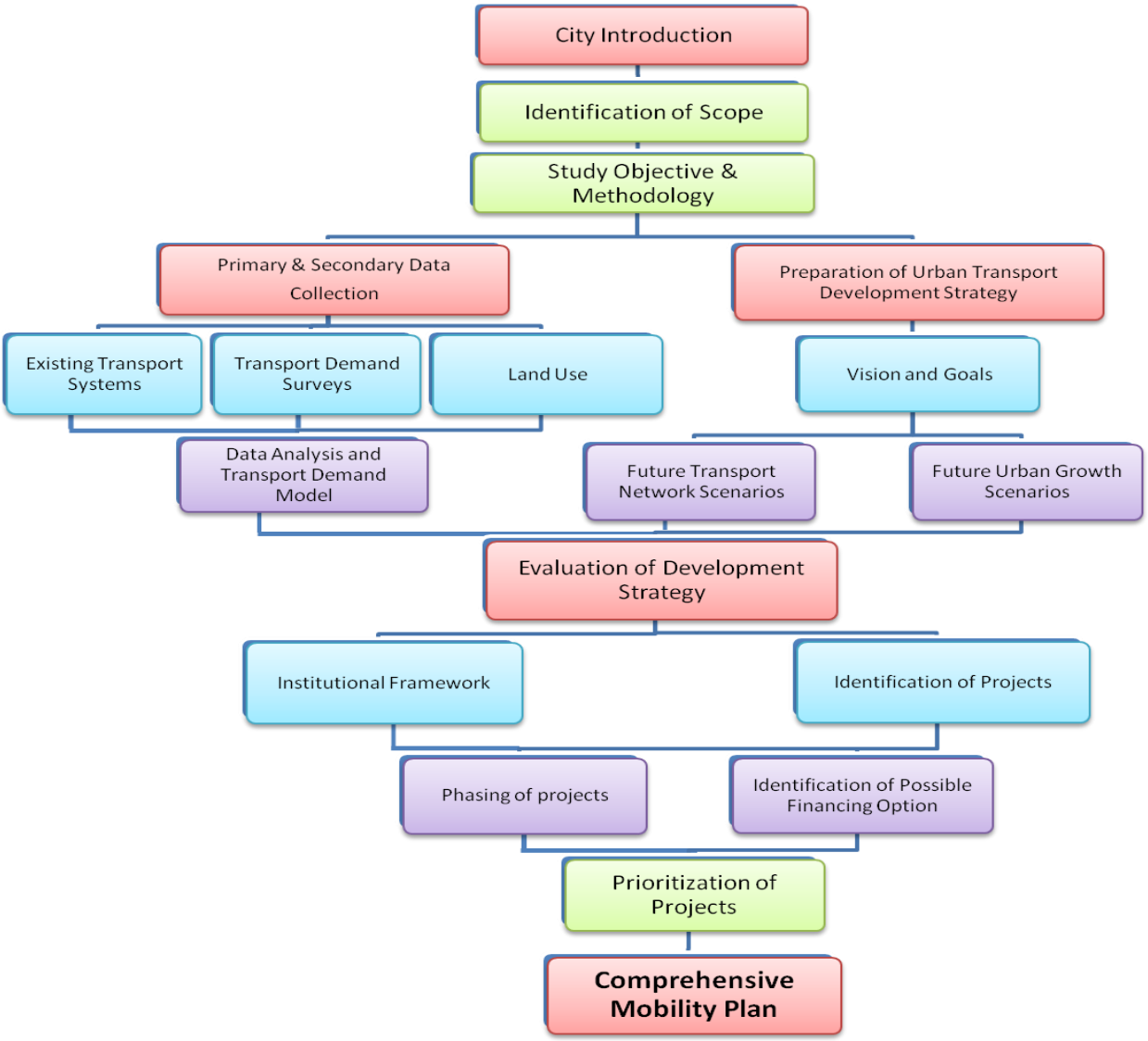


Figure 1-2 Methodology for the preparation of Integrated Comprehensive Mobility Plan

1.5 Study Area

The time horizon for ICMP Noida and Greater Noida is 20 years i.e. 2024 and 2034. The planning region of Noida-Greater Noida covers a total area of 1087 sq.km, which comprises notified areas under Noida (203 sq. km), Greater Noida existing (380 sq.km) and Greater Noida expansion (504 sq. km) (refer Figure 1- 3). These are summarized in Table **1-1**:

Table 1-1 Composition of Noida-Greater Noida Study Region

Notified Areas	Area	Comprises of
Noida	203 Sq. km	81 villages
Greater Noida Existing	380 Sq. km	85 villages
Greater Noida Expansion	504 Sq. km	145 villages
Total	**1087 Sq. km**	**311 villages**

Source: Master Plan-2031 (Noida) and Transport plan for GNIDA expansion 2031

For the whole study area, the base year (2014) population is 0.77 million in Noida and 1 million in Greater Noida. The region is estimated to grow to about 3.1 million and 5.4 million populations respectively for Noida and Greater Noida by 2034. Both the cities are expected to cater around 0.6 million (0.26 million in Noida and 0.34 million in Greater Noida) jobs in base year. Today, most of the activities are concentrated in the western and northern part of Noida while in Greater Noida the developed area is southern part due to the presence of Gautam Budh Expressway and Surajpur Kasna Road. The number of jobs are expected to rise to about 2.8 million (1 million in Noida and 1.8 million in Greater Noida) in 2034 with an annual growth rate of about 7.2 % in Noida and 8.7% in Greater Noida. Given the trends, it is expected that of the new jobs getting created, more jobs would be located in the surrounding urban areas. Hence, the plan has to address the needs of the intra-urban mobility as well as those of regional movements. The mobility needs of Noida – Greater Noida region is expected to grow rapidly in the next 20 years. The dynamic nature of the region is attracting large investments. The planned investments in Special Economic Zones, UPSIDC, Techzones and Institutions are envisaged as major growth propellers. The upcoming Dedicated Freight Corridor (DFC) would add to the pace of growth. Consequently, the mobility needs and travel demands would also increase. This plan therefore looks at structuring the future growth along with the transportation system in the study area.

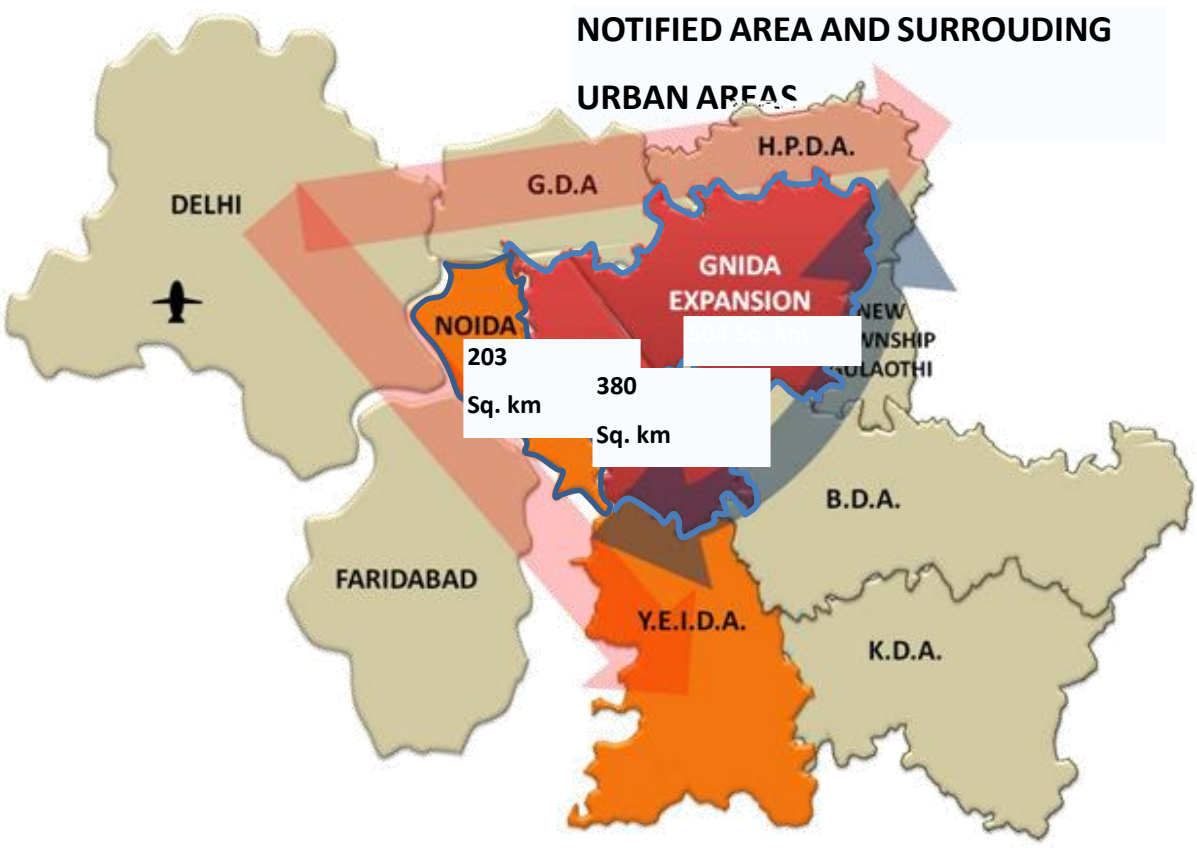


Figure 1-3 Study area delineation and surrounding urban areas

1.6 Organisation of the Report

This document is the Final Report covering the analysis of the surveys conducted there by, presenting the existing and future transportation scenario along with the list of proposals identified for the twin cities. The report also presents the future forecasts and the strategies to overcome the transportation deficiencies in the coming years within the study area. All the recommendations in the form of short, medium and long term proposals along with their block cost estimates have been presented.
The report covers the following chapters:

The first chapter "Introduction" describes the background of the cities, need for ICMP for Noida and Greater Noida, scope of work, approach and methodology and study area delineation.

The second chapter "Study Area Characteristics" describes the different aspects of the study area such as physical connectivity, demographic characteristic and landuse pattern of the study area.

Chapter three "Existing Transportation Scenario" describes the existing traffic, socio-economic and travel characteristics in the study area, which includes a number of surveys carried out along with their analysis.

Chapter four "Travel Demand Assessment" descibes 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 Noida and Greater Noida.

Chapter five "Vision" describes the vision, goals and objectives of the study along with various approaches for achieving mobility vision of the study area.

Chapter six "Mobility Plan Strategy" describes the various strategies proposed to improve the mobility of Noida and Greater Noida which includes public transport strategy, mobility corridor strategy, NMT strategy, Parking strategy, freight strategy etc. This chapter incudes identification of number of intervention measures ranging from landuse-transport integration to NMT and Parking for improving mobility of the study area based on data analysis and transportation model.

Chapter seven "Environmental and Social Impact Assessment" defines the Impact of various proposed projects.

Chapter eight "Implementation Programme and Costing" defines phases for implementing the projects identified in chapter five in terms of priority. This chapter also descibes the cost estimates associated with implementation of each projects. The financing options to implement each of the projects is also described in this chapter.

Chapter nine "Institutional Framework" descibes the existing city and state level institutional structures responsible for managing and monitoring the urban transport. This chapter recommends the number of reform measures for improvement of existing city and state level institutional structures.

Chapter ten "Stakeholder Consultations" describes the details of stakeholder consulted during the whole process of preparation of Integrated Comprehenshive Mobility Plan for Noida and Greater Noida.

Chapter 2 Study Area Characteristics

2.1 Study Area Characteristics

Rapid urbanization is an intrinsic part of the development process. One of the major challenges before the nation is to provide for planned urban settlements with adequate greenery and open spaces rather than unplanned, haphazard and polluted slum like urban settlements. The quality of the urban centre determines the quality of life of the inhabitants. Planning of a new urban centre therefore is of utmost importance for defining the quality of life.

2.2 Regional Connectivity

No city can develop in isolation without proper access from surrounding areas. Noida and Greater Noida are parts of National Capital Region and surrounded by many developed urban centres like Ghaziabad, Faridabad, Hapur, Meerut, YEIDA etc.

A. Road network

Noida and Greater Noida are connected to Delhi and other surrounding urban areas through Gautam Budh Expressway, DND toll way, NH 24, NH 91 etc which provide seamless connectivity to the users. The two cities are well connected with one another by the means of three links i.e. Link road connect the northern parts, DSC road connect at the centre and Noida- Greater Noida Expressway at the southern part of both the cities. The subarterial roads connect the major nodes within the city.

Noida has been planned sector wise on a grid-iron pattern. The township is planned on the concept of self-contained integrated township. The high-density residential areas are located close to work places. The commercial centres are well distributed over space. The city has only road linkages with Delhi and the adjoining urban centres of Uttar Pradesh and Haryana states. In the south-west side, the Okhla Barrage over river Yamuna links Noida with Delhi, Faridabad, and other parts of Haryana and in fact the whole of southern India through NH-2 (Mathura Road).

Greater Noida has also been developed on grid iron pattern with hierarchy of roads (Sector roads 60 – 108 M ROW). Bus bay and service roads are parts of road design which do not allow direct access to sectoral roads on arterial roads. The major

development is the 130 M wide road which acts as a backbone connecting the northern end to southern end. The city is well connected to NH-24 through Mini highway.

B. Railways

At present, the nearest railway stations to the twin cities are located at Dadri, Ghaziabad and New Delhi (Hazrat Nizzamuddin Railway Station). The proposed Western Dedicated Freight Corridor (DFC) from Dadri Railway Station will also pass through Noida (near Sector 159 and Sector 160). For the same, a railway station and ICD is proposed in Noida at sector 160. As per the GNIDA Master Plan 2021, a transportation hub is proposed at Boraki which includes railway station, ICD, ISBT, commercial, Multi storey parking etc.

At present in Noida, a Metro Rail service is operational from Delhi to Noida City Centre with six metro stations (four on DSC Road and two on MP 3 Road). The three metro lines are under construction, which are expected to be operational by the end of the years 2016 and 2017.

C. Airport

Indira Gandhi International Airport, Delhi which is approximately 25 km from Noida and 40 Km from Greater Noida, is the nearest airport to these twin cities. This airport is well connected to major cities in India and across the globe.

2.3 Population and Employment

As per the 1981 Census, the population of Noida was 36,972. In the year 1991, NOIDA was categorised as a Census Town (CT) and its population became 1,46,514. The 1991 Census also revealed that in addition to the population in the developed urban limits of Noida, 34,489 persons lived in the peripheral villages which makes a total population of 181,003. As shown in Table 2-1, the population of Noida city has grown at a faster rate during 1981-91. This is due to the take-off stage of the new town, which was founded in 1978. As per 2011 Census, the population of Noida was 6,37,272. Out of the total population, 245,508 was worker population (wfpr 38%). Noida experienced an exponential growth rate that has ushered in due to fast pace of urban development activities being undertaken in the area by the Noida Authority.

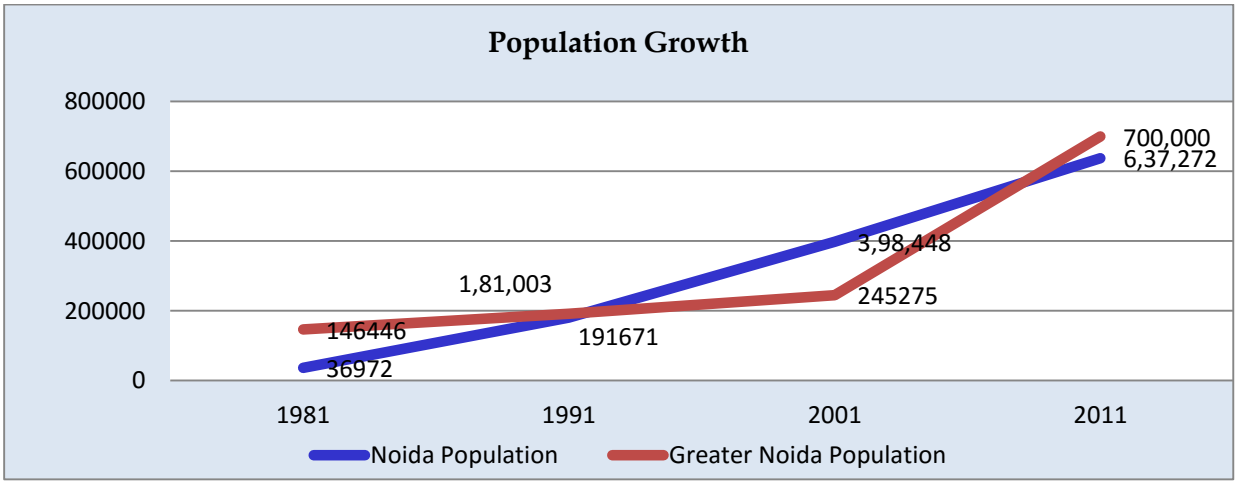
For Greater Noida, the population for 2011 is 7,00,000 which has been considered from the Master plan – 2021, incorporating all rural population in addition to the urban

population (102,054 as per census 2011). Looking at the trend over the years, the growth rate (around 30%) was constant for the decades 1981-1991 and 1991-2001. But sudden increase in growth rate (185%) has been seen for the last decade (2001-2011) mainly due to the development of Gautam Budh Expressway which provide direct connectivity of the city to Delhi and Noida.

Table 2-1 : Population of Noida and Greater Noida (1981-2011)

Year	Noida Population	Decadal Growth Rate	Greater Noida Population	Decadal Growth Rate
1981	36, 972		1,46, 446	
1991	1,81,003	390%	1, 91, 671	31%
2001	3,98,448	120%	2, 45, 275	28%
2011	6,37,272	60%	7,00, 000*	185%

*Source: Census of India, 2011 *Inclusive rural population as per Greater Noida Master Plan 2021*



Source: Master Plan for NOIDA 2031 & Census 2011

Figure 2-1 Growth of Population in Noida and Greater Noida

The Total workers in Noida for the year 2011 are 2,45,508 with WFPR ratio of 38%. Similarly, the total workers in Greater Noida Urban are 37,381 with a WFPR ratio of 35% (refer Table 2-2)

Table 2-2: WFPR of Noida & Greater Noida -2011

City	Urban Population	Total Workers	Main Workers	Marginal Workers	WFPR
NOIDA	6,37,272	2,45,508	2,13,982	31,526	38%
Greater NOIDA	1,02,054	37,381	31,579	5,802	35%

Source: Census of India, 2011

2.4 Existing land use system

A. Land Use Noida

As per the Master plan 2031, out of the total notified area (20300 hectare), 25% is the flood prone area and suitable to riverfront development. Hence, about 15280 hectare land situated broadly between the two rivers (river Yamuna and Hindon) embankments is proposed for planned urban development and has been divided into sectors and development facilities have been distributed almost in all the areas of the city. It is observed that by the year 2031 when the town population is expected to reach 25 lakhs, the overall density of Noida will be about 164 persons per hectare.

Table 2-3: Existing and Proposed Land-use Distribution for Noida 2010 and 2031

S.No.	Land Use Category	Proposed for 2031		Actual Development by 2010	
		Area in Hectare	% age	Area in Hectare	% age
1	**Residential**	5722.14	37.45	3357.64	36.45
2	**Commercial**	581.33	3.80	101.89	1.11
3	**Industrial**	2806.52	18.37	1267.14	13.76
4	**Institutional / Facilities**	1357.97	8.89	813.28	8.83
5	**Transportation**	1942.15	12.71	1804.31	19.59
6	**Recreational**	2432.82	15.92	1761.98	19.13
7	**Agriculture**	332.47	2.18	-	-
8	**Water Body**	104.50	0.68	104.50	1.13

	Total	15279.90	100.00	9210.74	100.00

Source : Master Plan for Noida_2031

Land use distribution for different activities is guided by the existing development pattern, potentials of development with relation to land suitability and other large scale or Regional level infrastructure development projects and the possible optimum utilization of available land. As shown in the Figure 2-2, the percentage share of industrial use has been increased from 13.76% in 2010 to 18.37% in 2031 (from 1267.14 Ha to 2806.52 Ha) while the area under transportation has been increased from 1804.31 Ha in 2010 to 1942.15 Ha in 2031 (from 19.59% in 2010 to 12.71% in 2031).

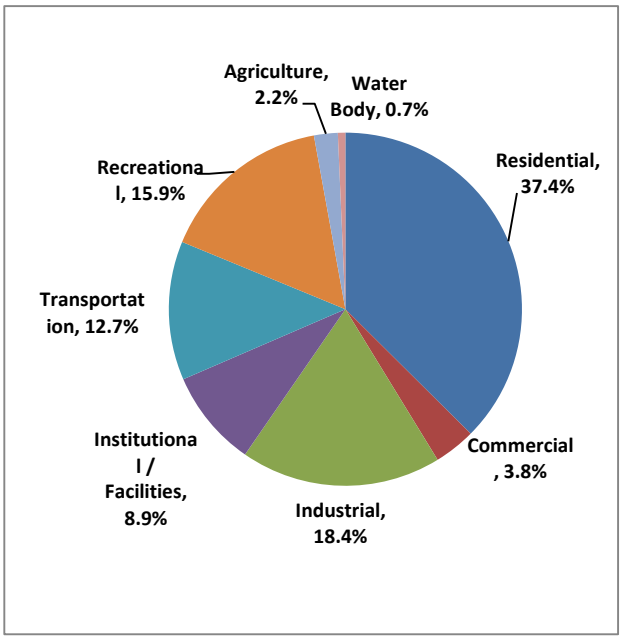


Figure 2-2: Proposed Land Use Distribution -2031

B. Landuse Greater Noida

The Master Plan-2021 has been prepared for total area of about 223 sq.km with gross density of about 55 ppha, which means an increase of about 340% from the 51 sq.km in 2001 with gross density of about 60 ppha. As shown in the Table 2-4, the area under industrial use has been increased from 1596.96 hectare in 2001 to 4201.23 hectare in 2021 while for transportation, the area has been increased multifold from 137.32 hectare in 2001 to 3339.78 hectare in 2031 contributing 15% share of total (refer Figure 2-3)

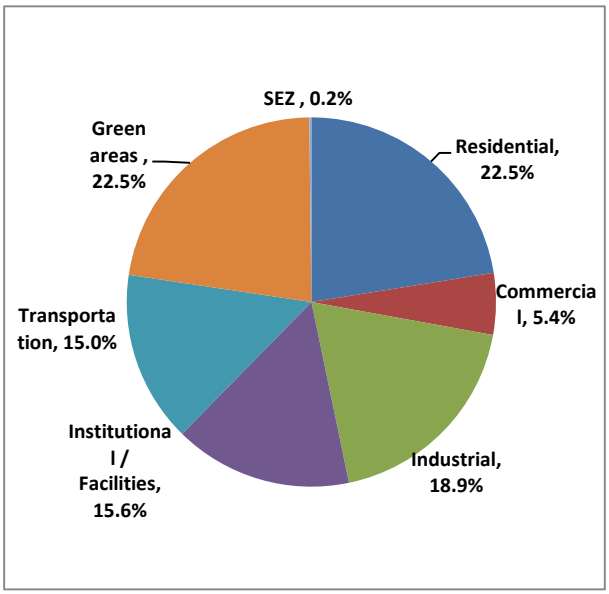


Figure 2-3: Proposed Land Use Distribution 2031

Table 2-4: Land Use Breakup for Greater Noida: 2001, 2011 and 2021

Land use	2001(ha)	%age	2011(ha)	%age	2021(ha)	%age
Residential	1310.00	25.80	3000.00	22.10	5000.00	22.36
Industrial	1596.96	31.50	3027.30	22. 30	4201.23	18.88
Commercial	99.74	2.00	720.00	5.30	1200.00	5.39
Institutional	570.63	11.20	2502.70	18.40	3473.99	15.51
Green areas	1361.90	26.80	3000.00	22.10	5000.00	22.36
Transportation	137.32	2.70	1280.00	9.45	3339.78	15.01
SEZ			40.00	0.30	40.00	0.78
Total	5075.00	100.00	13570.00	100.00	22255.00	100.00

Source: Master Plan for Greater Noida 2021

Chapter 3 Existing Transportation Scenario

3.1 Introduction

In order to diagnose the city we need to assess the traffic characteristics within the city. It is an essential pre-requisite to understand 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.

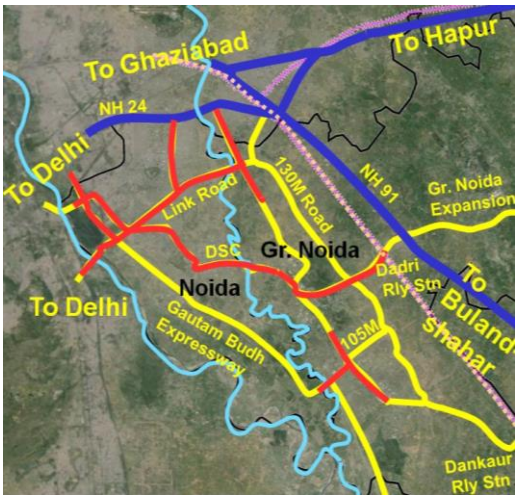


Figure 3-1: Congested stretches at entry points

The study is aimed to improve the intra city movement within Noida, within Greater Noida along with Noida-Greater Noida connectivity as well as movement to surrounding urban areas like Delhi, Ghaziabad etc – duly integrating with the proposed Metro System. Traffic surveys are integral part of the study, as these establish the travel demand in base year (2014) as well as in horizon years (2024 and 2034).

Thus, apart from the data collection, compilation and analysis of secondary data, a number of primary surveys have been conducted within the study area such as road inventory, speed and delay, traffic volume count at outer cordons, passenger occupancy counts, road side origin destination surveys, PT and IPT survey, parking survey, pedestrian survey etc. In addition, household surveys have also been carried out in the total study area on a sample basis.

On-site check by Authority Officials (Left: Noida Authority, Right: Greater Noida Authority)

Traffic Police help during surveys

Classified Traffic Volume Count Survey

Pedestrian Count Survey

Origin destination survey at midblock (Private vehicles)

Origin destination survey at outer cordon (Private vehicles)

Origin destination survey (IPT)

Urban Mass Transit Company Limited

Origin destination survey (NMT)

Origin destination survey (Goods Vehicles)

Urban Mass Transit Company Limited

Based on secondary and primary data, the analysis and inferences of existing transportation scenario of the study area are highlighted herein.

3.2 Road network characteristics

The objective of road network inventory is to determine the capacity of the existing road network, type of development along the roads and the extent to which they could be improved, keeping in view the likely future traffic. The road network inventory map and details are given in Annexure report.

Both Noida and Greater Noida are having extensive road network. As per the Master Plans, 12.7% in Noida and 15% area in Greater Noida is proposed under Traffic & Transportation. The development works happening in both the cities have resulted in an increase in the traffic volumes, especially that of personalized vehicles.

The roads are divided in different levels ranging from level 1 to level 4 based on the function, completeness and right of way. The classification of roads is described as below:

Table 3-1: Road Classification

Levels	Road Classification	Definition
1	Arterial	• All radials and rings that are 80% complete • National Highway and State Highway Orbital roads that are long and that cut across the city OR • Roads that have right of way: >36m-60m
2	Sub Arterial	• All radials that are 50% complete • Major district roads and other district roads OR • Roads that have right of way >24m-36m
3	Collector	• Roads that connect level 1 and level 2 roads • Substantially long roads OR • Roads that have right of way >9m
4	Local	• Roads that connect to residential units OR • Roads that have right of way <9m

3.2.1 Road Network: Characteristics and Issues

Based on the results of a Road Network Inventory survey carried out on all major stretches of roads in Noida and Greater Noida (for a total of about 170 kms), the following major characteristics of the existing road network can be deduced:

- About 92% of the total network surveyed has divided carriageway.
- Majority of road stretches in the twin cities have more than 4 lanes (78%), while about 20 % roads have about 3-4 lane and about 2% road stretches have 1-2 lane.
- Majority of road stretches in the city have ROW more than 30 m (67% in Noida and 98% in Greater Noida) while only 10% roads are below 18 m in Noida and 2% below 30 m in Greater Noida.
- There are no footpaths on almost 56% of road stretches in the city, and wherever present, footpaths are not in good condition and also lack continuity along with more height and less width.
- Median is present on almost 92% of surveyed road network.
- About 33% traffic is coming in the study area from surrounding areas especially from Delhi and Ghaziabad for work while 26% traffic is going out of the study area.
- About 2% traffic entering the city is through traffic.
- Encroachments on carriageway and footpaths in most parts of the city lead to slow speeds and higher possibility of accidents.
- The haphazard and unorganized on street parking is one of the major issues in Noida.

3.3 Travel speed

Travel speed is an important characteristic of traffic. Its measurement is important in transport planning particularly to evaluate the road network system, provide vital inputs to transport demand-modeling process and assist in economic analysis of improvement plans.

The surveyed corridors connect the major attraction and production nodes within the city (refer

Table 3-2). The corridor from Model town Chowki to Rajnigandha chowk via 12-22 circle was observed with an average journey speed of 17.8 KMPH. The average journey speeds on all other corridors was around 22 KMPH.

Table 3-2 : Summary of Speed and Delay survey

Sr. No	Corridors	Total Length (Kms)	Avg. Journey Time (sec)	Avg. Journey Speed (Kms./Hr.)	Avg. Running Speed (Kms./Hr.)
1	Sec-62 (NIB Chowki) to Rajnigandha Chowk Via Sec. 12-22 circle	10.4	130.8	17.8	24.3
2	Sec-62 (Model Town chowki) to Botanical Garden Via Sec. 52-72 chowk and MP 3 road	9.36	115.5	22.5	28.4
3	Sec-15 to Phase-II via Barola, DSC Road	14.46	150.4	22.7	28.1
4	Sec. 12-22 circle to Botanical Garden via MP 2 road	6.27	117.4	21.6	28.1

Source : Primary Surveys, 2014

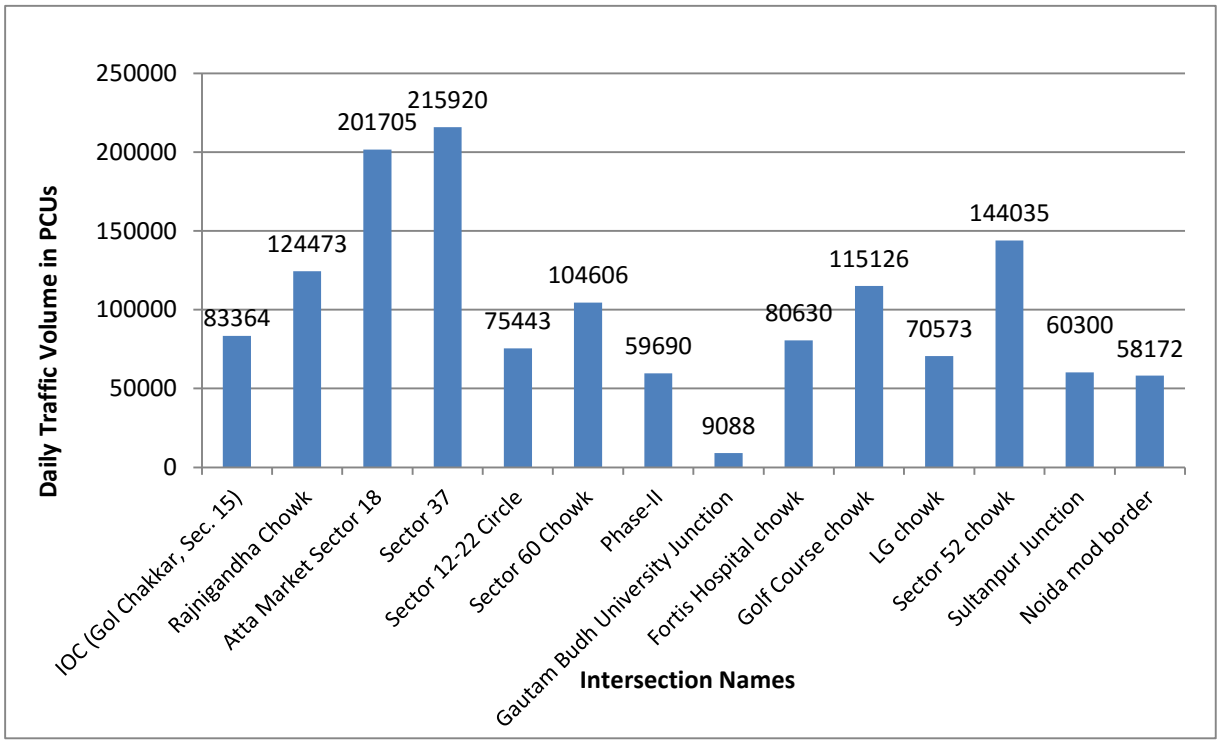
3.4 Turning Movement counts at intersections locations

To capture the internal movements in both the cities, the turning movement counts and origin destination surveys were carried out at various intersections within the study area. The quantum and temporal variation of total daily traffic and peak hour traffic are presented in the following sections (for details and location map, refer Annexure II).

Turning movement count survey was carried out at 14 major intersections for 16-hour period (0600 Hrs to 2200 Hrs) on a normal working day.

In Noida, it was observed that the total daily approach traffic at different locations varies from minimum of 58,172 PCUs at Noida mod border to maximum of 215,920 PCUs at Sector 37 junction.

In Greater Noida, it was observed that the total daily approach traffic at different locations varies from minimum of 9,088 PCUs at Gautam Budh University junction to maximum of 70,573 PCUs at LG chowk (refer Figure 3-2).



Source: Primary Surveys, 2014Peak Hour Traffic

Figure 3-2 : Turning Movement count at major intersections

3.4.1 Peak Hour Traffic

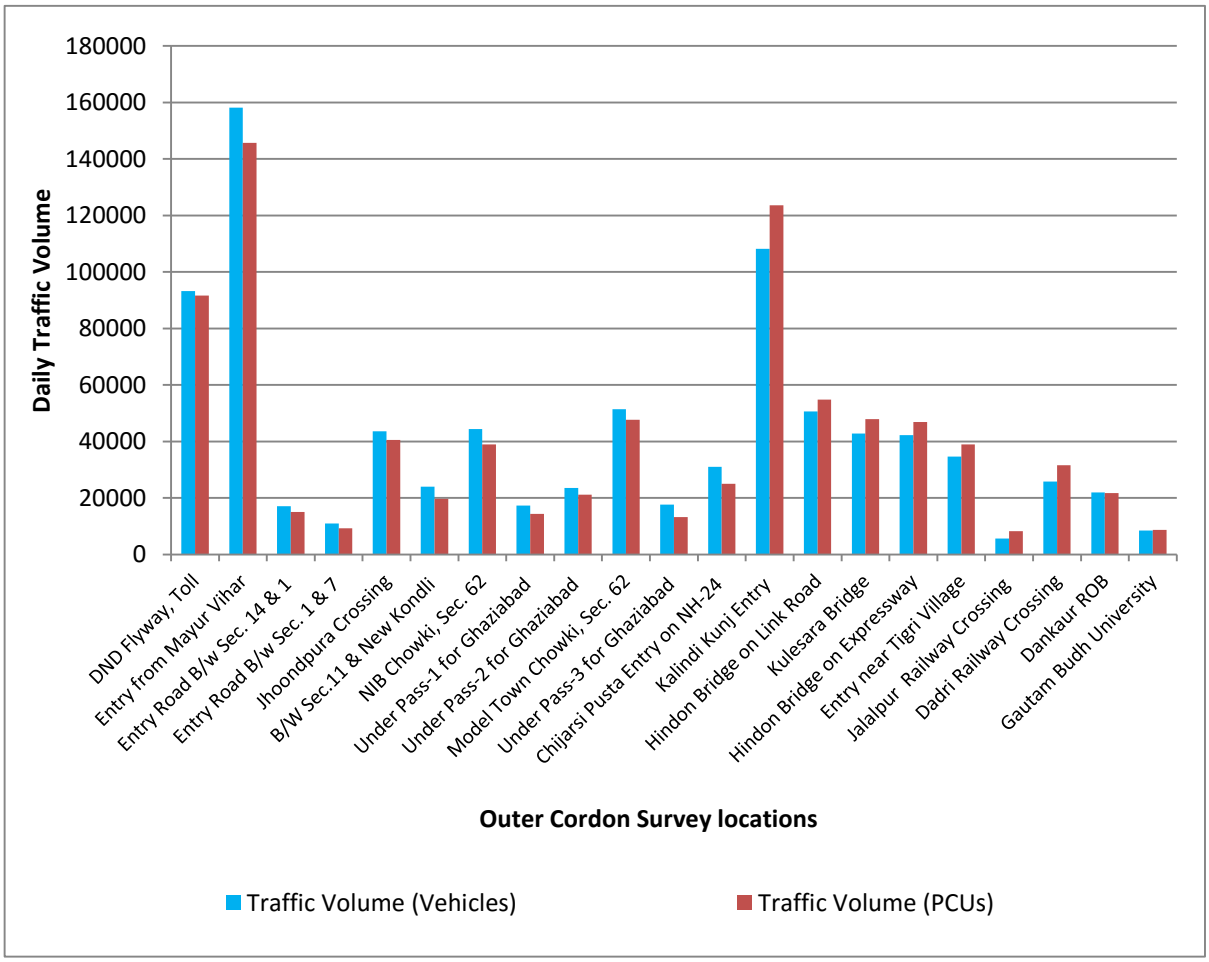
All the surveyed intersections have different characteristics and different flow patterns. It is observed that the morning peak hour volume varies from 1032 PCUs (1088 vehicles) at Gautam Budh University junction, Greater Noida to 14099 PCUs (14869 vehicles) at Atta market, Sector 18 Noida. Similarly, the evening peak hour volume varies from 834 PCUs (819 vehicles) at Gautam Budh University junction, Greater Noida to 18981 PCU's (19513 vehicles) at Sector 37, Noida.

3.5 Classified traffic volume counts at Outer Cordon Locations

The survey had been conducted at 18 outer cordon locations, which are primarily the major entry and exit points of the study area. The traffic volume counts both in terms of numbers of vehicles and passenger car units (PCUs) have been computed for the total daily (24 hour) traffic at various outer cordon locations and graphically present in Figure 3-3. For details and location map refer Annexure II.

It is observed that in Noida, the traffic at different locations varies from 9,224 PCUs at entry road between Sector 7 & Sector 1 to 145,725 PCUs at entry from Mayur Vihar, Sector 14A followed by Kalindi kunj entry with 123594 PCUs.

Similarly, in Greater Noida, the traffic varies from 8,285 PCU's at Jalapur Level Crossing to 37,672 PCU's at Entry from N-24 at Tigri chowk road. It has been observed that about 734,114 vehicles enter and exit in the study area on a typical working day. Figure 3-4 shows the traffic characteristics at outer cordons.



Source: Primary Surveys, 2014

Figure 3-3 : Traffic Volume at Outer Cordons

3.5.1 Peak Hour Traffic

The Peak Hour Traffic Characteristics at outer cordon locations shows that in study area the share of morning and evening peak hour traffic volume ranges from 7.02% to 13.25% with average share of 9.09% of total daily traffic during morning peak hour and 9.03% during evening peak hour. The morning peak hour traffic volume varies from 582 PCUs (471 vehicles) at Jalapur level crossing, Greater Noida to 11,975 PCUs (14,319 vehicles) at the entry from Mayur Vihar to Sector 14A, Noida with an average volume of 3,331 PCUs (3,741 vehicles). Similarly the magnitude of evening peak traffic varies from 577 PCUs (389 vehicles) at Jalapur level crossing, Greater Noida to 14,062

PCU's (15,720 vehicles) at the entry from Mayur Vihar to Sector 14A, Noida with an average volume of 3,752 PCUs (3,932 vehicles).

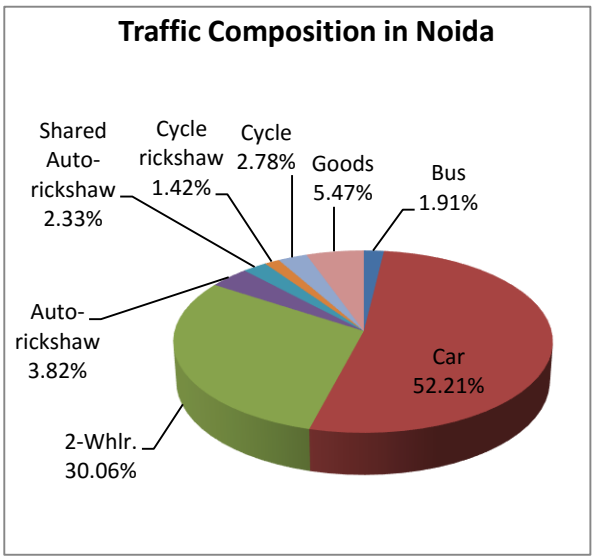
3.5.2 Composition of traffic

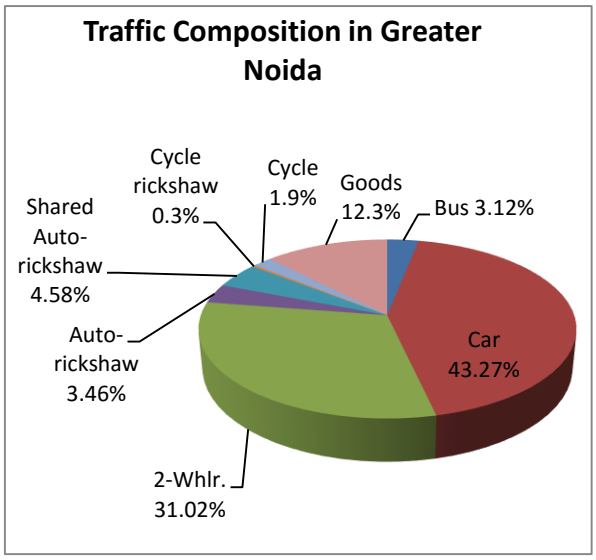
The daily traffic composition at outer cordon locations exhibits predominance of fast moving passenger traffic consisting two wheelers, cars, jeep/van etc.

In Noida, on an average about 30% of the total traffic constitute of 2-wheelers, 52% constitute of cars, jeeps and vans, about 2% of constitutes buses, about 6% of constitutes 3-wheelers, about 4% constitutes of cycles and cycle rickshaws and about 6% constitute of goods vehicles. Slow moving vehicles have minimal share at all the locations except at the entry road between Sector 7 & sector 1 (41%) & entry road between Sector 11 and New Kondli (20%) (refer Figure 3-4)

In Greater Noida, on an average about 31% of the total traffic constitutes of 2-wheelers, 43.3% constitute of cars, jeeps and vans, about 3.1% constitutes of buses, about 8.1% constitutes of 3-wheelers, about 2.2% constitutes of cycles and cycle rickshaws and about 12.3% constitute of goods vehicles. Slow moving vehicles have minimal share at all the locations (refer Figure 3-4)

Figure 3-4: Traffic Composition in Noida and Greater Noida





Source: Primary Surveys, 2014

3.5.3 Passenger Occupancy

Passenger occupancy survey has been carried out along with traffic volume counts and O-D survey at all outer cordon locations. The average occupancy of bus is 32, of cars is 2.1, of 3-wheelers is 3.2 and of 2-wheelers is 1.4.

3.5.4 Passenger Trip Characteristics at Outer Cordon Locations

On an average, about 30% passenger trips in the study area are being catered by public transport and rest 70% trips by private vehicles. It is observed that about 5% of total trips at Underpass 3 for Ghaziabad to 51% of total trips at Jhoondpura crossing, Noida are being catered by public transport and about 49% to 95% trips are performed by private modes at different outer cordon locations.

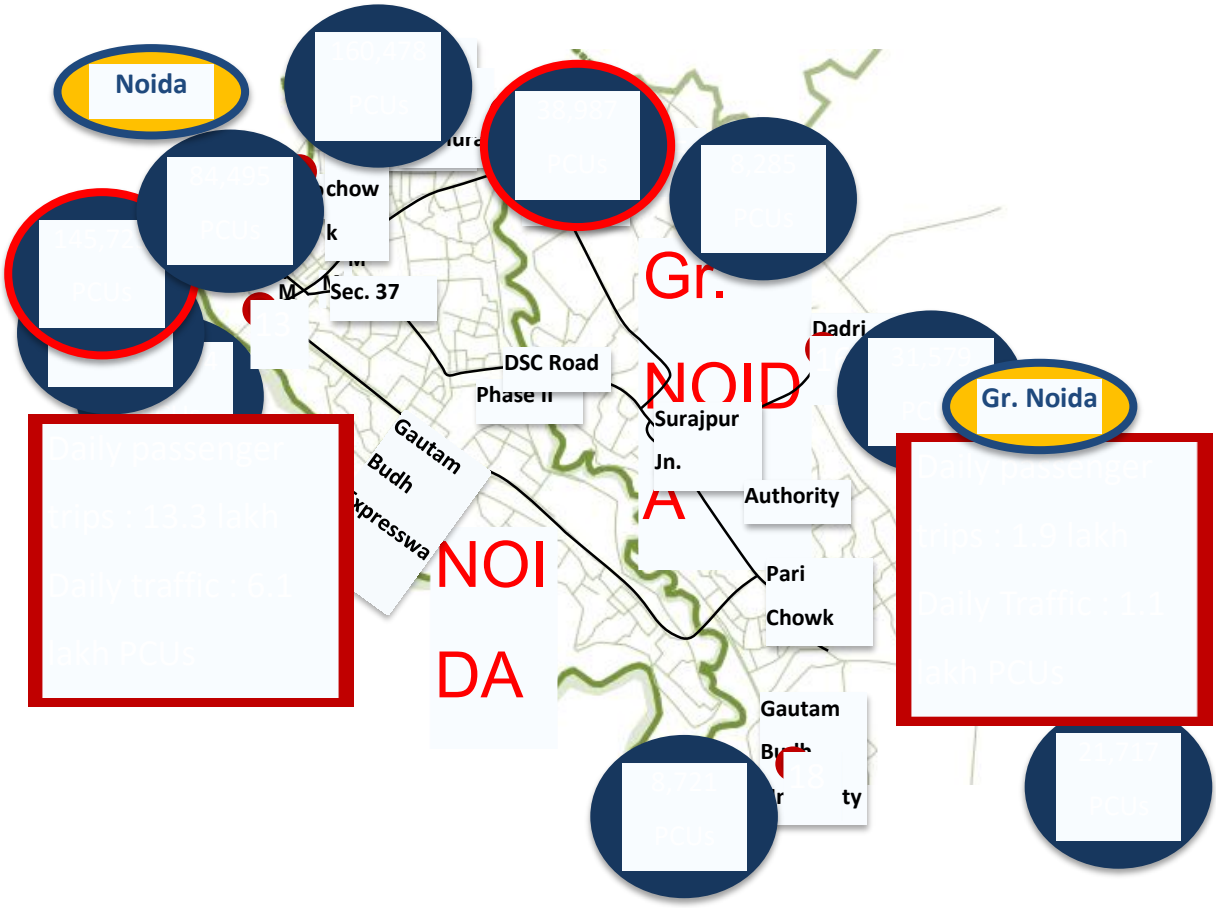
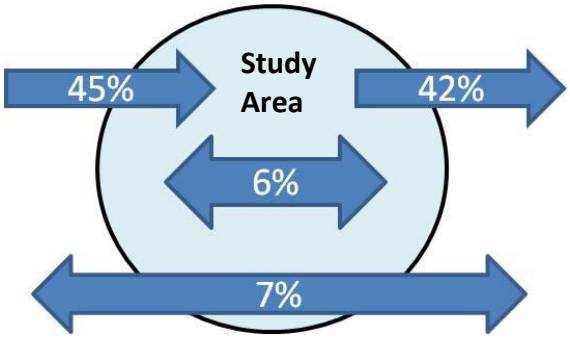


Figure 3-5 : Daily Traffic (In and Out) at different Outer Cordon locations

3.5.5 Distribution of Trips by Category

For the 18 outer cordon points, 6% of total trips made through these locations are internal to internal, 42% trips are internal to external, 45% trips are external to internal and remaining 7% trips are external to external with respect to the study area.



From the roadside OD survey data, it is observed that nearly 15.2 lakh passenger trips are performed through different outer cordon points in the study area. It is observed that about 21.4% of passenger trips are being made by bus, about 47.5% by Car/Van/Jeeps, 7.9% by 3-Wheelers, 20.6% by 2-Wheelers and 2.6% by Cycle and cycle rickshaw.

3.6 Public transport characteristics

Public transport plays a crucial role in the commuter transportation in any City. It offers economies of scale with minimized road congestion and low per capita road usage. Cheaper and affordable public transport systems have proved to promote mobility – move people more efficiently and safely with increased opportunities for education, employment, social development etc.

In Noida and Greater Noida, the intercity transport started with operation of buses by UPSRTC and later joined by DTC buses to connect Noida with various places in Delhi. Due to the lack of good network coverage of both UPSRTC and DTC buses along with low frequencies, the private bus operators and IPT (shared auto rickshaws, Vikram, Tata Magic) came into existence and provide a good network with high frequencies and reliability.

The bus system cannot be viewed in isolation and the transport system of Noida and Greater Noida has to be appreciated as a whole. Therefore, to analyze the public transport system, extensive studies have been conducted among public transport users, those who travel by metro, IPT and buses, to compile their travel characteristics and collect their feedback and suggestions. At present UPSRTC itself runs 160 buses in Noida and 80 buses in Greater Noida (for both intercity and intracity routes). In addition to that DTC runs 119 buses in Noida. Majority of routes are for intercity service connecting Delhi and Ghaziabad.

3.6.1 Uttar Pradesh State Regional Transport Corporation (UPSRTC):

Currently, UPSRTC operates from Noida depot (Morna depot at Sector 35) with a fleet size of 160 buses (Non-AC) and from Greater Noida depot (Kasna depot) with a fleet size of 80 buses (Non-AC) providing intercity connectivity to adjoining cities like Delhi and Ghaziabad with few intracity routes also. Majority of these buses are on the verge of completing their life span.

DTC depot at Sector 16, Noida

UPSRTC Depot at Sector 35, Noida

UPSRTC Depot at Kasna, Greater Noida

3.6.2 Delhi Transport Corporation (DTC)

DTC runs AC and Non-AC buses in Noida to cater public transport demand. Majority of routes are for the connectivity of Noida with Delhi.

3.6.3 Regional bus services

There is a proposal of ISBT at Sector 144 in Noida and at Bodaki in Greater Noida as per the respective Master Plans.

3.6.4 Bus Terminals facilities

The terminal facilities for the buses in Noida are located at Sector 35 for UPSRTC with total fleet size of 160 buses, Sector 16 for DTC with fleet of 119 buses while at Kasna in Greater Noida for UPSRTC with total fleet of 80 buses. The frequency of buses during peak hours is 15-30 minutes while during off peak hour it varies from 15-60 minutes on total 36 operational routes.

3.6.5 Characteristics of passengers at terminals

The survey was carried out at two major Bus Terminus i.e Morna Bus Terminal at Noida (UPSRTC), Kasna Bus terminal at Greater Noida (UPSRTC) and three railway stations i.e. Ghaziabad railway station, Dadri railway station and Dankaur railway station in the study area. On a normal working day, about 4,826 boarding and alighting were observed at bus terminals and 39,541 boarding and alighting were observed at railway terminals. Table **3-3** and Figure 3-6 show the daily traffic at bus and railway terminals.

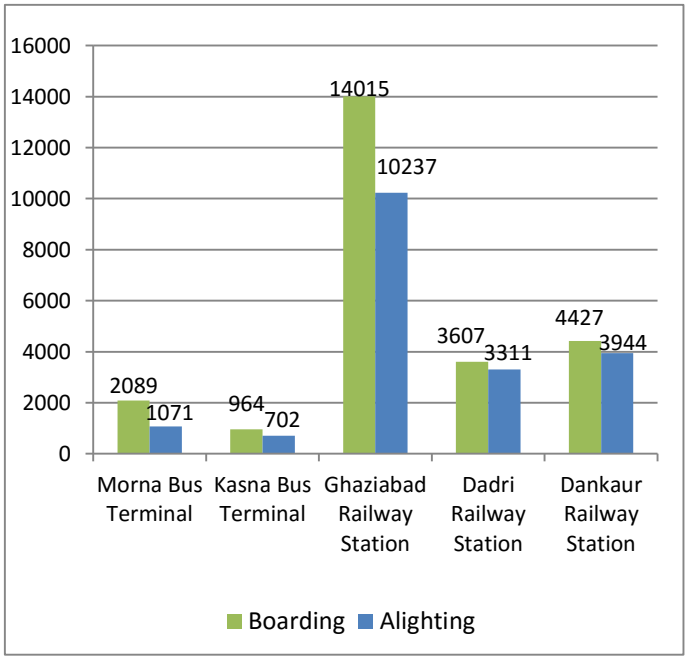


Figure 3-6 : Total Boarding and Alighting at Terminals

Table 3-3 Total daily passenger traffic at terminals

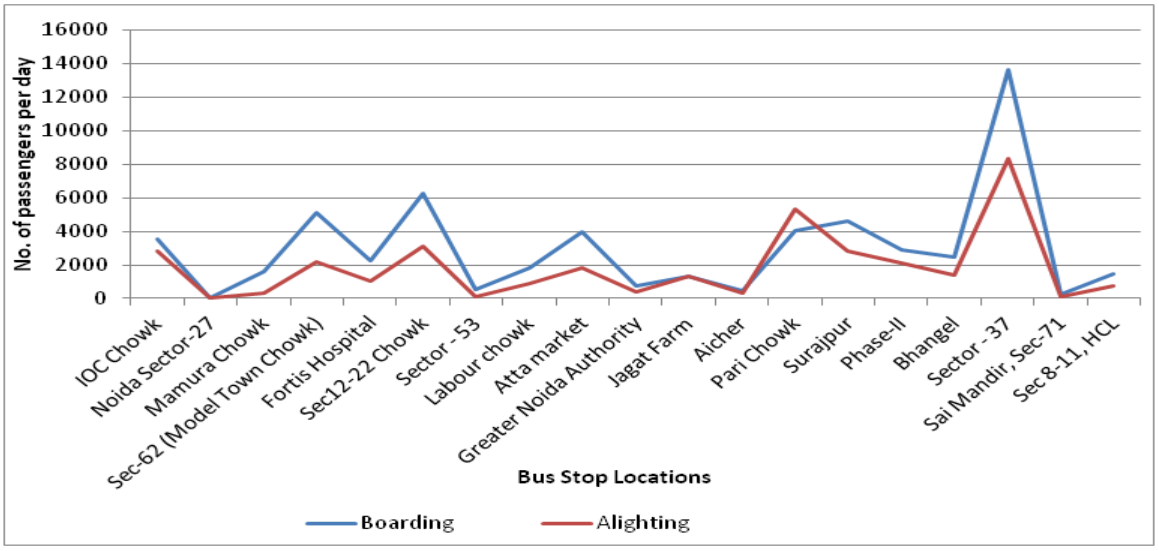
S. No.	Name of terminal	Total Entry	Total Exit	Total Passengers

1	Morna Bus Terminal	2089	1071	3160
2	Kasna Bus Terminal	964	702	1666
3	Ghaziabad Railway Station	14015	10237	24252
4	Dadri Railway Station	3607	3311	6918
5	Dankaur Railway Station	4427	3944	8371
	Total	**25102**	**19265**	**44367**

Source: Primary Surveys, 2014

3.6.6 Bus stop passenger characteristics

The bus stop Boarding-Alighting and Origin-Destination survey were conducted at 19 major bus stops (both directions). On a normal working day, about 92,249 boardings and alightings were observed at the surveyed bus stops (refer Figure 3-7).



Source: Primary Surveys, 2014

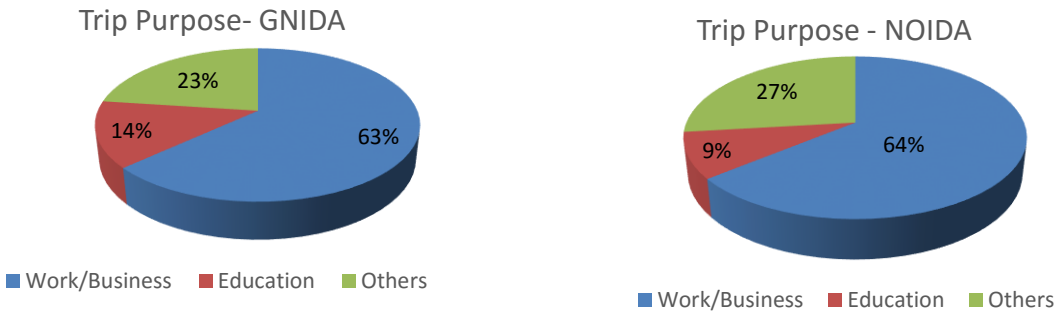
Based on the survey data, In Noida, the Passenger traffic is highest (21,946 passengers) at Sec. 37 BQS near Botanical Garden Metro Station followed by the stop at the Junction of Sec. 12-22 with 9,355 passengers.

Figure 3-7 : Daily Passenger boarding and alighting count at major Bus stops

Similarly in Greater Noida, it is highest (9373 passengers) at Pari Chowk followed by Surajpur Junction with 7432 passenger traffic. The PT passenger traffic volume in Greater Noida is less as compared to Noida along with the number of operational buses.

Following are the outcomes of Origin Destination survey at 19 bus queue shelters:-

1. Majority of the bus passenger trips are observed for the purpose of work (63-64%) followed by others i.e. about 27% trips in NOIDA and 23% in Greater NOIDA, which include trips done for social and recreational purposes



Source: Primary Surveys, May'2014

Figure 3-8: Distribution of PT trips by purpose- Noida and Greater Noida

2. The average trip length for PT passengers for the complete journey is around 17.50 km (Noida-15 km and Greater Noida-20 km) as many passengers commute daily to neighbouring areas like Delhi & Ghaziabad. . Around 37% of the PT users travel more than 25 km followed by 35% of passengers travelling 15 to 25 km while only 9% of the users travel less than 10 km (refer Figure 3-9).

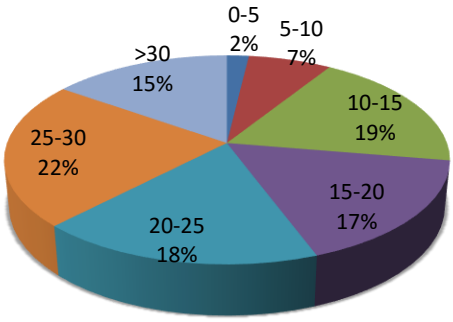


Figure 3-9 : Distribution of Trips by Trip Length

3. The average cost for access trip for PT passengers is Rs 5.60 while the average egress trip cost is Rs 5.45. Around 18-20% of the passengers in Noida pay more than Rs 10 for access/egress trips whereas for Greater Noida around 30% passengers pay more than Rs 10 as an access or egress trip cost. The passengers boarding from Greater Noida are paying more because of the less network coverage of PT in Greater Noida as compared to Noida. If the last mile

connectivity is available, the access and egress cost of the passengers can be reduced.

3.7 Intermediate Public Transport (IPT) Characteristics

3.7.1 Existing Network

Absence of an efficient Public Transport (PT) system has resulted in transfer of trips from buses to IPT (shared autorickshaw, Vikram, Tata Magic) along the major demand corridors in both the cities. There are around 2772 new registered auto rickshaws (year 2014) in both the cities and majority of them operate as a shared mode for most part of the day. This has also resulted in increased congestion and pollution levels in the city.

Based on the reconnaissance survey and primary surveys, it has been observed that there are around 14 major auto rickshaw routes in both the cities with the effective headway of around 3 minutes (refer Annexure II for location map) . Low fare, frequent service and good coverage of auto rickshaws along with poor performance of the bus services have been instrumental in emergence of auto rickshaws as major mode of transport system in both the cities.

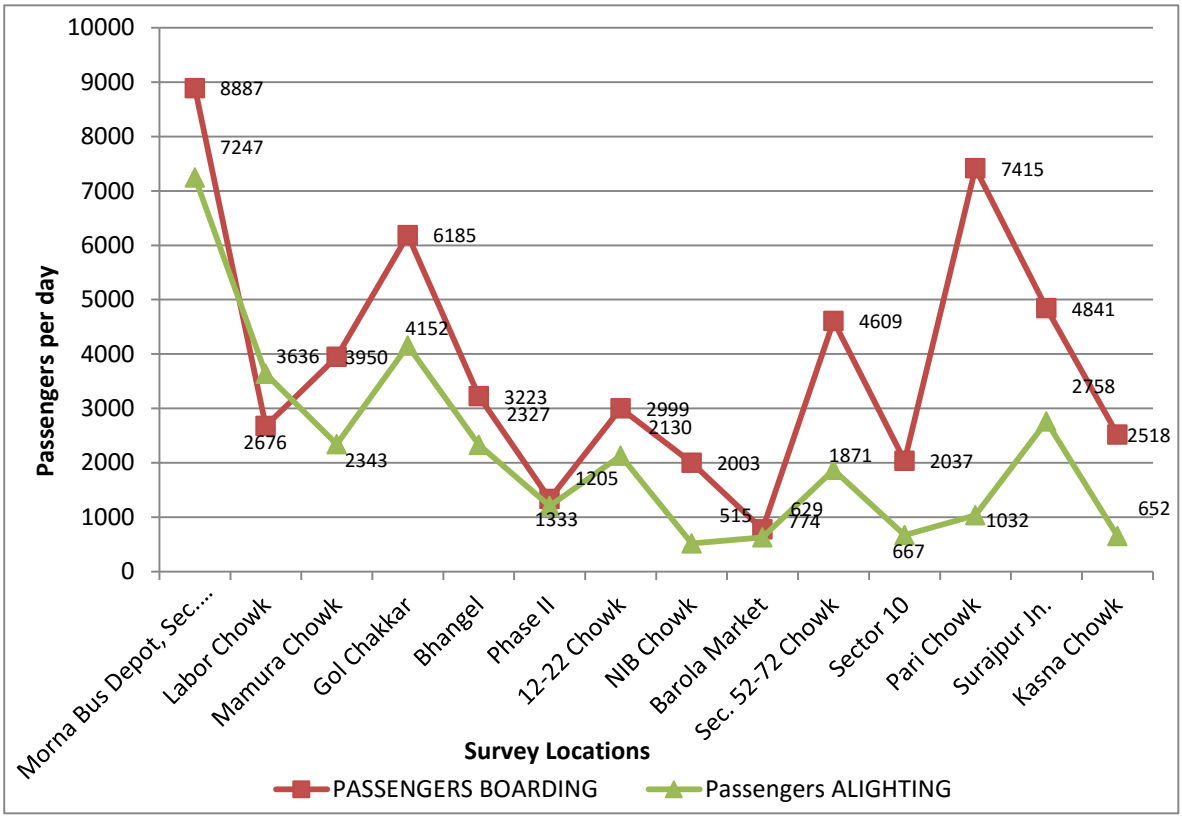
As per the survey analysis, higher presence of auto rickshaws are observed at Sec-63, Sec-62, Mayur Vihar entry and Kalindi Kunj Bridge. These autos are used by passengers to travel from Delhi and Ghaziabad to Noida and vice versa.

3.7.2 Analysis

Based on the data collected, an assessment of existing service levels of shared auto-rickshaw was carried out. These have been summarised below:

3.7.3 IPT Passengers Boarding-Alighting Count

As per the survey data shown in fig 3-12, the Passenger traffic is highest (16,134 passengers) at Morna bus depot, Sector 35 near NOIDA City Centre Metro Station (Noida) followed by Pari Chowk (Greater Noida) with 8447 passengers and IOC Gol Chakkar, Sector 15 (Noida) with 10,334 passengers. The IPT passenger traffic volume in Greater NOIDA is less as compared to NOIDA along with number of shared autorickshaws.



Source: Primary Surveys, May 2014

Figure 3-10: Passengers daily Boarding Alighting Count at major IPT stands

3.7.4 Travel Characteristics

Based on the origin and destination survey data of the IPT passengers, the passenger information on boarding and alighting points like purpose and frequency of trips, trip lengths, travel time and details of their trip origins and destinations were analysed and given in the following section:

1. Around 72% and 69% of total commuters for Noida and Greater Noida respectively travel daily while 11-12% commuters travel occasionally, 8-9% travels weekly and remaining travels fortnightly or monthly.

2. In Noida, about 58% of total IPT passenger trips have a total trip length of above 10 km and about 15% have less than 6 km while about 70% trips in Greater Noida have the trip length above 10 kms and 14% trips are below 6 Km.

3. The average access / egress trip cost for IPT passengers is Rs 5.70 for Noida City and Rs 6.50 for Greater Noida city. In Noida, around 82% of total IPT passengers pay either none or less than Rs 10 to reach at IPT stops from their initial origins (access travel cost) while in Greater Noida, it is 77% (refer Table 3-4). The access / egress travel cost in Greater Noida is higher as compare to Noida.

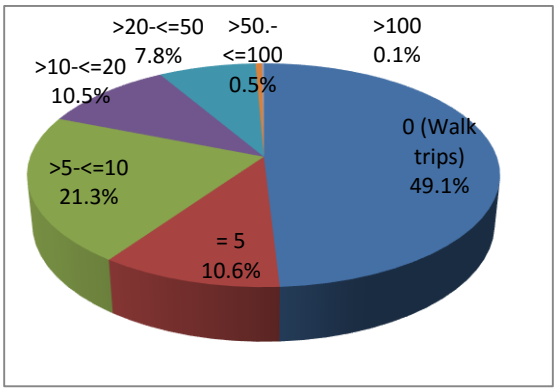


Figure 3-11 : Access Travel cost for IPT passengers for Noida and Greater Noida

Table 3-4 : Distribution of boarding passengers by travel cost to reach IPT stop from initial origin

S. No.	Travel Cost (Rs)	Noida (% share)	GNIDA (% share)	Total (% share)
1	0 (Walk trips)	50.1%	44.1%	49.1%
2	= 5	11.7%	5.6%	10.7%
3	>5-<=10	20.0%	27.5%	21.3%
4	>10-<=20	9.2%	16.5%	10.5%
5	>20-<=50	8.4%	5.2%	7.8%
6	>50-<=100	0.5%	0.7%	0.5%
7	>100	0.1%	0.4%	0.1%
Total		**100.0%**	**100.0%**	**100.0%**

Source: Primary Surveys, May 2014

4. As shown in Table **3-5**, both access (Mode to reach IPT stop from initial origin) and egress mode (Mode to reach actual destination from IPT stop) for 35% of the total trips is walk depicting auto rickshaw routes c linking the origins and destination points for them. Another 58% of trips require some interchange at one end. Around 7% of the trips are external trips which have the access and egress mode as Metro train.

Table 3-5: Modal Split for the Access and Egress Trips for IPT Passengers

Mode used for Access trips	Mode Used for Egress trips									Grand Total
	Walk	**Shared Auto-rickshaw**	**Auto-rickshaw**	**Cycle rickshaw**	**Car**	**2 - Wheeler**	**Cycle**	**Bus**	**Metro**	
Walk	34.5%	3.8%	3.4%	2.5%	0.2%	0.5%	0.1%	3.6%	0.5%	**49.1%**
Shared Autorickshaw	19.1%	4.0%	0.4%	1.6%	0.1%	0.2%	0.0%	2.2%	0.3%	**28.0%**
Autorickshaw	2.7%	0.2%	1.9%	0.5%	0.0%	0.0%	0.0%	0.2%	0.0%	**5.6%**

Cycle Rickshaw	1.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	**1.3%**
Car	0.4%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	**0.7%**
2 Wheeler	1.0%	0.3%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	**1.7%**
Cycle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.1%**
Bus	4.7%	0.8%	0.6%	0.4%	0.0%	0.0%	0.0%	0.3%	0.0%	**6.9%**
Metro	5.0%	0.6%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	**6.6%**
Grand Total	68.4%	9.9%	7.0%	5.9%	0.6%	1.0%	0.2%	6.4%	0.8%	**100.0%**
Source: Primary Survey, May 2014										

3.8 Access-Egress Trip Survey at Metro Stations

It is important to understand the origins and destinations of the commuters so as to provide an efficient and comfortable public transport system to all the people residing in the city. To do this exercise, it is imperative to understand the travel pattern of commuters by all modes plying in the city. Keeping this in view we have also conducted the O-D survey for all access/egress of the commuters using the metro system in Noida.

Following are the outcomes of O-D survey at existing 6 metro stations in Noida:

1. Majority of the metro train trips are observed for the purpose of work (58%) followed by others (29%) and for education (13%).
2. The commuters using the metro train travel daily for the purposes like work, education are about 67% while 19% commuters travel occasionally, 11% travel weekly and remaining 3% travels monthly.

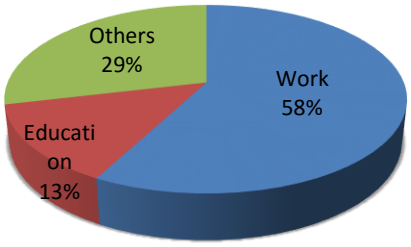


Figure 3-12 : Distribution of trips by purpose

3. Majority of metro commuters (38.1%) use shared auto rickshaws as access mode. The average trip length of these trips is about 5.40 km with a average trip time of about 18 minutes while 20.9% use bus from origin of their journey to the metro station with a average trip length of about 11.50 kilometres and take relatively longer at about 35 minutes. The shared auto rickshaws has highest share because of their easy availability and frequency at all the metro stations.

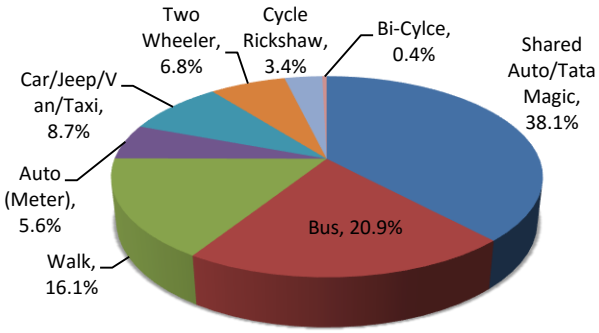


Figure 3-13 : Modal share for Access trips of metro commuters, 2014

4. Thus overall 68% of total Metro Commuters use public transport such as bus, shared auto rickshaw, metered auto rickshaw, cycle rickshaw etc to access the Metro Stations while 15.9% commuters use private transport such as Car, 2-wheeler, cycle and remaining 16.1% walk to Metro Stations.

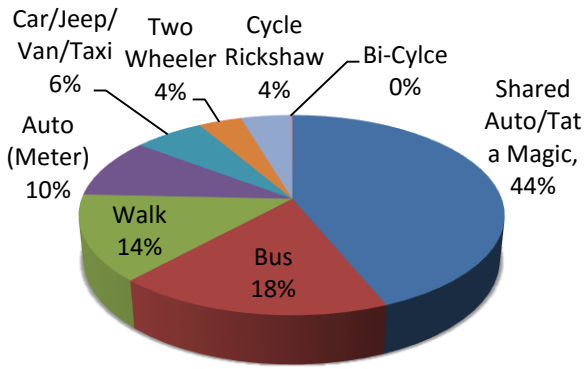


Figure 3-14 : Modal Share for Egress trips used after the Metro Train, 2014

5. For egress trips, 43.8% of metro commuters use shared autorickshaw from Metro stations to their destination. These shared autorickshaw trips average 5 km or 18 minutes while 9.6% are metered auto rickshaw trips average 4 km or 13 minutes. Eighteen percent of Metro train trips involve a change to a bus to continue on their journey. These bus trips are about 13 km and take 30 minutes on average.

6. Thus overall 75.9% of total Metro Commuters use public transport such as bus, shared autorickshaw, metered autorickshaw, cycle rickshaw etc to reach their destinations from Metro Stations while 10.2% commuters use private transport such as Car, 2-wheeler, cycle and remaining 13.9% walk from Metro Stations.

3.9 Pedestrian volume count

Pedestrian volume surveys were conducted at all major intersections to assess the pedestrian volume and flow across and along the intersections for designing the pedestrian facilities. It was observed that there is high amount of pedestrian vehicular conflict at

Picture 2: Pedestrian Movement Count at Metro station

certain intersections as indicated by PV^2 value[1] like Botanical Garden (17.71), Atta Junction (13.21), Rajnigandha chowk (7.57) etc in Noida (See Table 3-6). The high PV^2 value observed at Atta junction across DSC Road is due to high commercial development along the stretch.

Table 3-6: PV^2 Values at some of the major Intersections of Noida and Greater Noida

Sr. No.	Location Code	Morning PV^2		Evening PV^2	
		Time	**PV^2 ($2X10^{10}$)**	**Time**	**PV^2 ($2X10^{10}$)**
Noida					
1.	IOC (Gol Chakkar, Sec. 15) (Across the Udyog Marg Sec1-2)	09:30- 10:30	1.13	18:30-19:30	1.44
2.	Rajnigandha Chowk (Across DSC Road)	10.00-11.00	1.15	18:00-19:00	0.90
3.	Atta Junction (Across DSC road)	09:30- 10:30	2.16	19:00-20:00	4.96
4.	Sector 37 (Across Capt. Shashi kant Marg Sec 38A- 37)	08:30-09:30	7.80	18:15-19:15	20.78
5.	Sector 12-22 Circle (Across Amaltash Marg MPII)	08:30- 09:30	0.99	18:15-19:15	0.78
6.	Sector 60 Chowk, (Towards Fortis across U flex tower)	08:30-09:30	0.19	16:00-17:00	0.44
7.	Phase-II, (Across Dadri road towards NEPZ)	08:30-09:30	0.25	18:30-19:30	0.20
8.	Fortis Hospital chowk (Across Fortis hospital)	08:30- 09:30	1.01	18:30-19:30	0.43
9.	Sashi Chowk (Golf Course) (Across Capt. Shashi kant Marg Sec 39-36)	08:30-09:30	0.43	18:30-19:30	0.20
10.	Sector 52-72 chowk (Across Capt. Shashi kant Marg Sec 52-71)	09:30-10:30	1.07	18:15-19:15	1.06
GREATER Noida					

[1] The degree of conflict between pedestrians and vehicles is determined by PV^2 where V is the two-way total hourly flow of vehicles and P is the two-way total hourly flow of pedestrians crossing the road within 50 m on either side of the site during peak hours. If the value of PV^2 exceeds 10^8 (or 1 = $PV^2/10^8$) for an undivided road or 2 x 10^8 (or 2 = $PV^2/10^8$) for a divided road, then there is requirement of pedestrian crossing facility.

11.	LG chowk (Towards Pari chowk)	09:00-10:00	0.07	18:45-19:45	0.08
12.	Gaur Chowk (Across Mini Ghaziabad highway)	09:45-10:45	2.00	18:00-19:00	2.39

Source: Primary Surveys, 2014

3.10 On-Street Parking Survey Analysis

Parking survey was conducted for a period of 12 hrs continuously at nine identified locations/stretches. Survey data were analysed and the findings such as accumulation of vehicles and duration of parking were worked out. The location wise survey analysis and location maps are given in Annexure II. The Parking Car Equivalents (PCE) adopted for different vehicle types for the analysis are given in Table 3-7.

Table 3-7 : PCE Values Adopted for Various Vehicle Types

Sl. No.	Vehicle Category	PCE
1	Car	1.0
2	Two Wheelers	0.2
3	Van/Mini Bus	1.75
4	Bus	2.5
5	Auto rickshaw	0.5
6	Trucks	2.5
7	MAV	2.5
8	LCV	1.75

3.10.1 Parking Accumulation:

Number of vehicles parked in an area at any specific moment constitutes the parking accumulation.

In Noida, the survey data shows that the parking demand exists uniformly through out the day with highest demand during the evening period from 16:00 to 17:00. The demand for parking begins at around 10:00 and lasted till 20:00 hours.

In Greater Noida, the survey data shows that the parking demand is highest during morning peak from 10:00 to 13:00 and it exists uniform for the rest of the day. The demand for parking begins at around 09:00 and lasted till 20:00 hours.

Figure 3-15 shows the hourly parking accumulation at all the locations separately for Noida and Greater Noida.

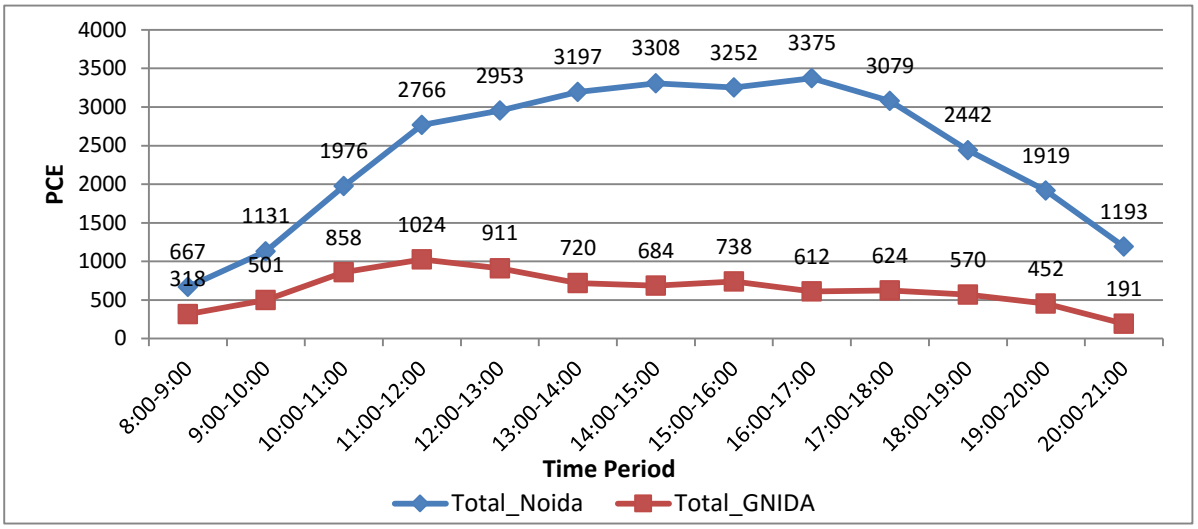


Figure 3-15 : Hourly-wise Parking Accumulation

The important parking characteristic of each location is presented in **Table 3-8**. All these road stretches have significant parking alongside, reducing road capacity by utilizing the road space. It is seen that parking is severe at Sector 18 in Noida and at Sector Alpha 1, 105 m road in Greater Noida.

Table 3-8 : Parking Accumulation at all on-street parking survey locations

S. No.	Road / Area Name	Peak PCE	Peak hour
1	Sector 18, Noida	1690	14:00-15:00
2	Amity University, Noida	882	13:00-14:00
3	Sector 62, near fortis hospital	525	14:00-15:00
4	Sector 51, Near Iskon Temple, Noida	327	16:00-17:00
5	Sector Alpha-1 (105M Road), GNIDA	326	11:00-12:00
6	Gamma Market, GNIDA	207	11:00-12:00
7	Jagat market, GNIDA	223	12:00-13:00
8	Pari chowk, GNIDA	43	14:00-15:00
9	Outside Sharda University, KP III, GNIDA	290	10:00-11:00
10	Amrapali Hospital, PS 1, GNIDA	44	19:00-20:00

Source : Primary Surveys 2014

3.10.2 Parking Duration

In Noida, around 55% of the total parked vehicles are parked for less than 1 hour and other 18% for 1-2 hours while in Greater Noida, around 78% of the total parked vehicles are parked for less than 1 hour and other 13% for a period of 1-2 hours, which technically can be considered as a short duration parking. This also reflects that the activities performed on these corridors are mostly associated with the mixed landuse and involves commercial predominantly. The location wise details of parking with map is given in Annexure II.

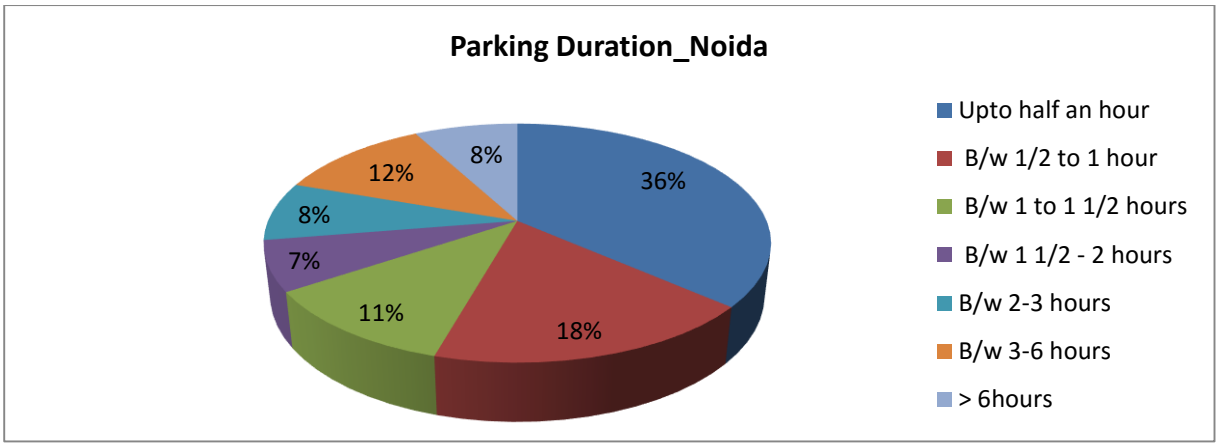


Figure 3-16 : Parking Duration of vehicles at Noida

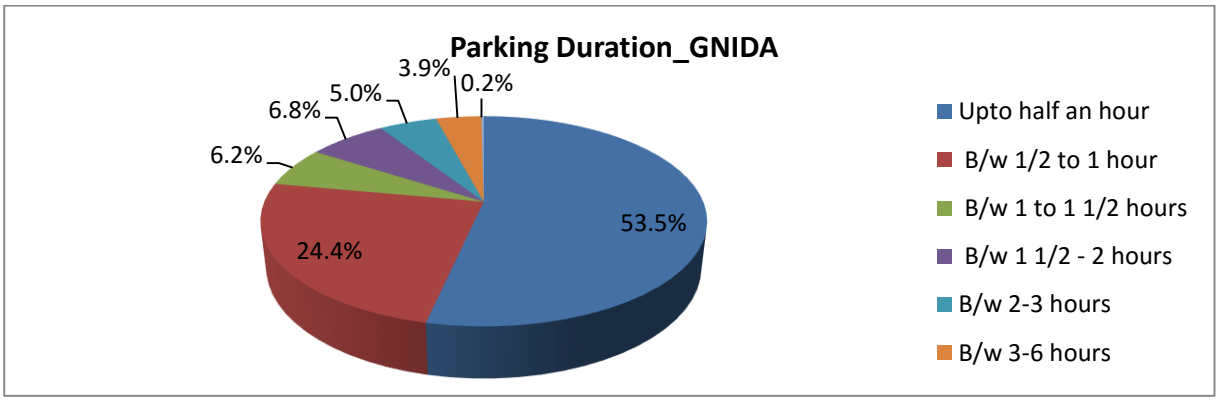


Figure 3-17 : Parking Duration of vehicles at Greater Noida

3.10.3 Composition of Parked Vehicles:

The average composition of vehicles parked at all the locations separately for Noida and Greater Noida are shown in Figure 3-18.

In Noida, Cars shared the majority of the total vehicles parked (61% of the total vehicles) followed by two wheelers which is 34% while buses, auto rickshaw and LCV shared a negligible share of the total vehicles parked.

In Greater Noida, Cars shared the majority of the total vehicles parked (67% of the total vehicles) followed by two wheelers which is 27% while buses, auto rickshaw and LCV shared a negligible share of the total vehicles parked.

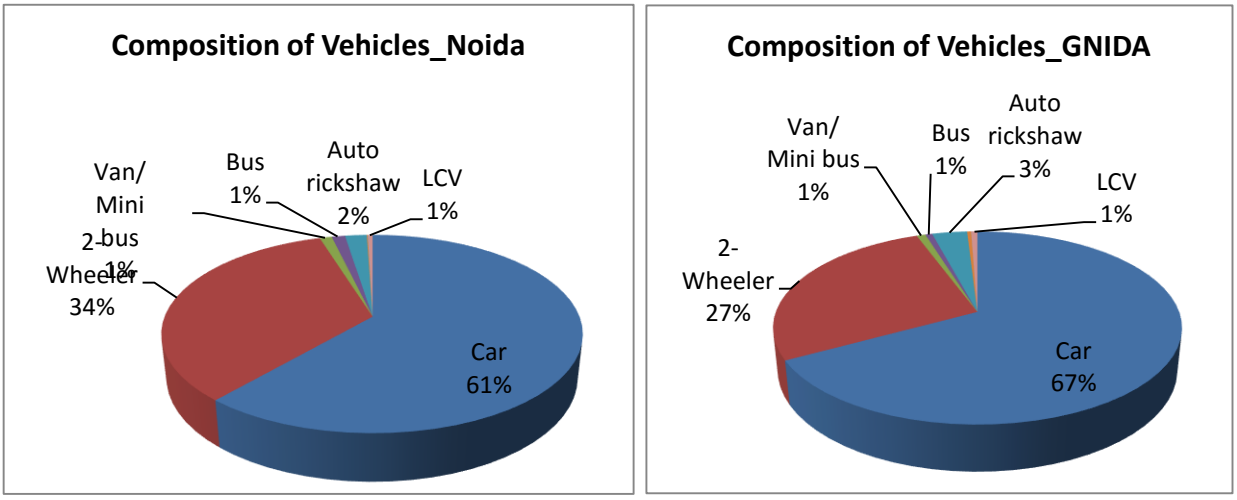


Figure 3-18 : Average Composition of Parked vehicles

3.11 Road safety

Road safety is another major issue of concern for Noida and Greater Noida. The Major roads in Noida and Greater Noida are functioning at more than their capacities causing congestion and bottleneck points.

Although 22% trips are made by walk, but Noida and Greater Noida cities are devoid of adequate infrastructure to sustain walks trips. There is discontinuity of footpaths, lack of adequate pedestrian crossing facility, lack of pedestrian signage's etc.

All these have resulted in road safety hazards for both the resident population as well as for floating population. The total number of accidents for the year 2014, in Noida and Greater Noida are 563, out of which 27% (149) involve fatalities. Table 3-9 shows the details of accidents in last quarter of year 2014 in Noida and Greater Noida.

Table 3-9 : List of accidents in Noida and Greater Noida from Oct. 2014 to Dec. 2014

S. No.	Location	Total No. of Accidents	Total No. of Deaths	Total No. of Injuries
1	Yamuna Expressway	17	12	41
2	Sec. 62	15	3	8
3	Sec. 63	14	4	6

4	In front of Sec. 93	11	7	12
5	Khurja road	11	7	10
6	Yamuna Expressway	11	5	18
7	Tappal road	9	5	6
8	Galgotia University	7	7	3
9	NSEZ, Noida	6	3	6
10	Yamuna Expressway	6	7	8
	Total	**107**	**60**	**118**

Source: Traffic Police, Gautambudh Nagar

3.12 Service Level Benchmarks

The ICMP for Noida and Greater Noida has also computed the existing level of service of overall traffic and transportation scenario based on a number of parameters. 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 3-10 shows the existing Levels of Service (LOS) on various parameters.

Table 3-10 Service Level Benchmark

Overall Level of Service (LOS)		
A	Overall Public Transport Facilities	4
B	Overall Pedestrian Infrastructure Facilities	3
C	Overall Non- Motorized Transport Facilities	3
C	Level of Usage of ITS facilities	4
D	Travel Speed along major corridors	2
E	Availability of Parking Spaces	3
F	Road Safety	3
G	Pollution Levels	4
H	Integrated Land-use Transport Integration	3
I	Financial Sustainability of Public transport	3

3.13 Issues and Challenges ahead

The following major issues have been identified from the analysis of various aspects of the existing traffic and transportation scenario for the twin-city:

3.13.1 Public Transport

- Both the cities lack dedicated City Bus Service for the intra city movement.

- There is absence of ISBT in the twin-city
- The current public transport facility has low coverage and low frequency of buses (15-60 min.)
- High network coverage of IPT with good frequency (2-10 min.) is present.
- There is lack of feeder service for existing metro stations.
- Haphazard parking of IPT on roads results congestion and safety issues.

Auto rickshaws are an important paratransit mode in most Indian cities. In the absence of adequate provisions, they are creating both safety and traffic congestion problems in Noida and Greater Noida.

- There is huge congestion at Pari Chowk (GNIDA) due to the origin of many IPT routes.
- Congestion at Metro Stations like Botanical Garden and Noida City Centre (Noida) is due to the origin of PT and IPT routes from the metro station and moreover they act as the major interchange points for Greater Noida
- Entry and exit of buses from Inter-city Bus Terminal of UPSRTC at Morna depot and DTC buses at Sector 16, happens straight on to the main arterial road, creates hindrance to the movement of other traffic resulting in bottlenecks at junction near Noida city centre and at the entry road from Sector 16 metro station
- There is absence of Integrated Public Transport System

Lack of enforcement of strict rules and policies results in underutilization of existing Infrastructure

Absence of proper infrastructure for buses halt during off peak hours result into a long queue of buses at main arterial road.

3.13.2 Parking

- Lack of efficient parking policy measures
- On-street parking is witnessed all along the roads and particularly along DSC road. Parking of vehicles on roads is one of the major reasons for under performance of many roads in Noida.
- In Noida, there is heavy and unorganized on-street parking near wave centre and Sector 18 metro station, DSC road near Bhangel market, Sector 62 along fortis hospital etc in Noida and at Gamma market, KP II and III in Greater Noida which results in reduction of effective carriage way width.
- Absence of parking facilities with in commercial / Institutional buildings such as Sector 18, Sector 62 in Noida and KP II and III in GNIDA
- Absence of off-street parking facilities near the major commercial centres or markets leads to encroachment of the carriageway by on-street parking, which further adds to the congestion.
- Absence of a proper levy of parking fee for on-street parking (except for few locations) encourages growth in demand for parking.

On-street parking at service lane at Noida City Centre Metro Station along with authorized off-street parking lot

Un-authorized On-street Parking at Sector 18, Noida

On-street Parking at Sector 18

3.13.3 NMT Facilities

- More than 50% of the major road network lacks foot path facility.
- The height of riser is not as per the *IRC cod*e causing inconvenience to the pedestrians.
- In order to have hassle free movement sufficient clear width is not available.
- Footpaths are encroached with vendors and hawkers and as a result, the pedestrians are forced to spill over the MV lane.
- Cycle tracks and other cycle promoting infrastructure are completely missing.
- The current cycle tracks present over only 16% of the road network are not in usable condition due to encroachment, absence of proper street light, bad condition.



In most Indian cities, the bicycle is only one of many different NMT vehicles, such as tricycles, vendor push-carts, cycle-rickshaws, etc. NMT infrastructure needs to cater for all such vehicle types.

The absence of footpath forces pedestrians to walk in the carriageway

Excessive height make footpath hard to use, and many pedestrians prefer to walk in the carriageway

Encroachment and obstructions on the footpath make them unusable for many pedestrians.

Existing footpath that constantly changes levels (at the property entrance), discourages pedestrians from using it. Pedestrians prefer to walk on the carriageway instead.

	
Uneven surface and bad condition make a footpath difficult to use	Absence of Road markings and pedestrian signals at junctions and midblocks

3.14 Conclusion on existing transportation scenario of the study area

The present situation in Noida and Greater Noida will only continue to worsen unless the Noida & Greater Noida Authorities respond appropriately in this regard. In the absence of Authorities' interference, by 2031, the share of public transport will go down leading to more congested road space attributed by higher use of private vehicles. Traffic forecast data shows that by 2031, the network speed of the study area will be less than 15 Kmph, depicting a really serious and unsustainable situation. These goals have been defined with vision and objectives. The mobility strategies developed for Noida & Greater Noida aim at attaining these goals.

Chapter 4 Travel Demand Assessment

4.1 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 has been developed. Based on the travel demand model, various travel demand scenarios along with proposed interventions and recommendations have been developed.

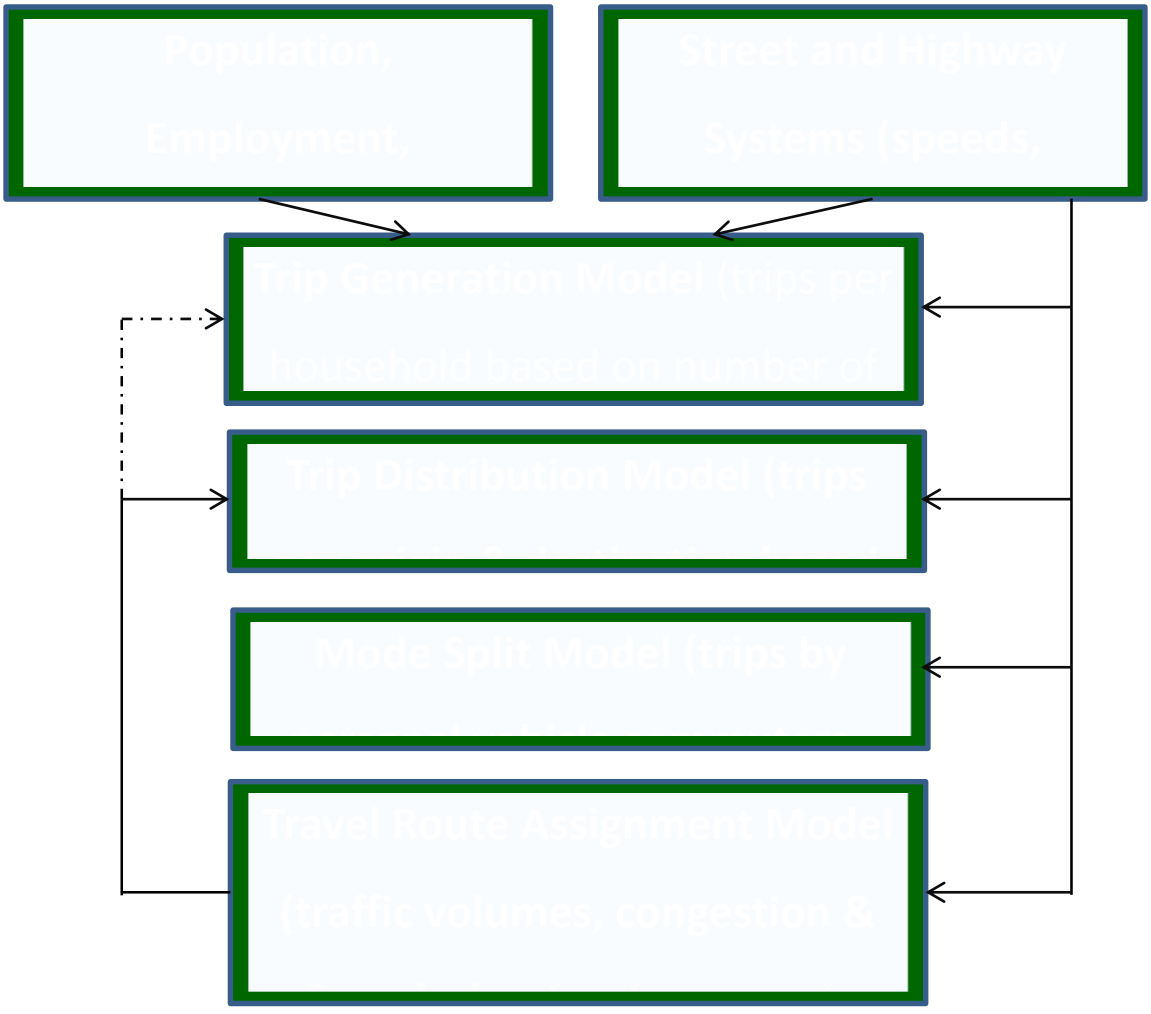


Figure 4-1 Four Stage Transport Model Structure

4.2 Model Structure

The model is based on a conventional Four-Stage Transport Model approach (refer to **Figure 4.1**). It includes:

- **Trip Generation** – trip generation aims at predicting the total number of trips generated and attracted to each zone of the study area. In other words

this stage answers the questions to 'how many trips' originate at each zone, from the data on household and socioeconomic attributes.

- **Trip Distribution** – the generated trips from each zone is then distributed to all other zones based on the choice of destination. There are number of methods to distribute the trips among destinations; and two such methods are growth factor model and gravity model. An important aspect of use of gravity models is their calibration, that is the task of fixing their parameters so that the base year travel pattern is well represented by the model.
- **Mode Choice** – the trip matrix or origin-destination matrix obtained from the trip distribution is sliced into number of matrices representing each mode. Mode choice could be aggregate if they are based on zonal and inter-zonal information. they can be called disaggregate if they are based on household data.
- **Traffic Assignment** – the process of allocating given set of trip interchanges to the specified transportation system is usually referred to as traffic assignment. All-or-nothing, user-equilibrium, and system-optimum assignment models are the commonly used models. User-equilibrium assignment is used in Noida travel demand model

4.3 Study Area Zoning

The Noida and Greater Noida areas have been divided into smaller areas called as Traffic Analysis Zone (TAZ) for analysis. The study area has been divided into 208 internal zones and the outside area is grouped into 14 external zones (including 6 zones for metro stations). Figure 4.2 shows the details of TAZ with zone number. The broad breakup of TAZ is given below:

Table 4-1 Description of Traffic Analysis Zones

Serial No	Description of TAZ	No of TAZ
1	Noida Area (Sectors)	164
2	Greater Noida (Sectors & Expansion Area)	44
3	Metro Stations	06
External Zones		**08**
Total Zones		**222**

The zone details have been given in Annexure III.

Figure 4-2 Traffic Analysis Zones of Noida and Greater Noida

4.4 Network Development

Transport network developed for the model comprises two components:

1. **Road Network:** The coded road network for the study area represents the nodes (intersections) and links connecting 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; capacity; encroachments; availability of footpaths, etc. Figure 4-3 shows the base year road network of study area. The network attributes linked with geographic files are used for development of models. GIS stores the data from which a desired view can be drawn to suit a particular application. There are two types of data in GIS, spatial data and non-spatial data (attribute data). Non-spatial data includes information about the features.

2. **Public Transport Network:** The transit network represents the connectivity, headways, speeds and accessibility of transit services. In Noida and Greater Noida, majority of buses ply on the main radial corridors. Hence, the existing bus transport system is included in the model's transit network. The transit routes are specified as those using the transport links and having stops/stations at determined locations. The access to the stops/stations from zone centroids and other nodes is provided either by existing highway links or by defining exclusive walk links. The distance between the bus stop/stations is assumed between 500m to 1000m in the public transport assignment. Figure 4-4 shows the base year Transit Network.

4.5 Development of Matrices

Household and roadside passenger interview data were used to develop the observed mode-wise trip matrices. The external trips for the car, two wheeler, auto, public transport and commercial vehicles were constructed based on the O-D survey conducted at the outer cordon locations.

Based on the primary data analysis, the evening peak hour (17:30 to 18:30) is observed to be more critical. Accordingly, the mode wise matrices were developed for Evening peak hour. The base year peak hour travel demand pattern between internal zones and external zones for Noida and Greater Noida is presented in the Table **4-2**

Table 4-2 : Travel Demand Pattern between Internal and External Zones

S.No	Type of Trip	Number of Trips	Percentage
1	Internal – Internal	104,151	39%
2	Internal – External	69,251	26%
3	External – Internal	88,093	33%
4	External - External	6,697	2%
	Total	268,192	100%

Highway Assignment - A user-equilibrium multi-modal assignment procedure based on generalized cost was used for loading matrices in PCU values.

Transit Assignment – The public transport assignment process is a multi path assignment which enumerates and evaluates the "reasonable" or "attractive" multiple discrete routes between zones, considering number of transfers, non transit and in vehicle cost, boarding and transfer penalties and fares etc.

4.6 Trip Generation

The objective of a trip generation model is to forecast the number of person-trips that will begin from or end in each travel-analysis zone. In the present study, base variable for Population & Employment of each zone are Production & Attraction. The corresponding trip generation equations are

Productions:

Trip Production = 0.121*Population+ 10.10 R^2 = 0.75

Attractions:

Trip Attraction = 0.325 * Employment + 120.11 R^2 = 0.57

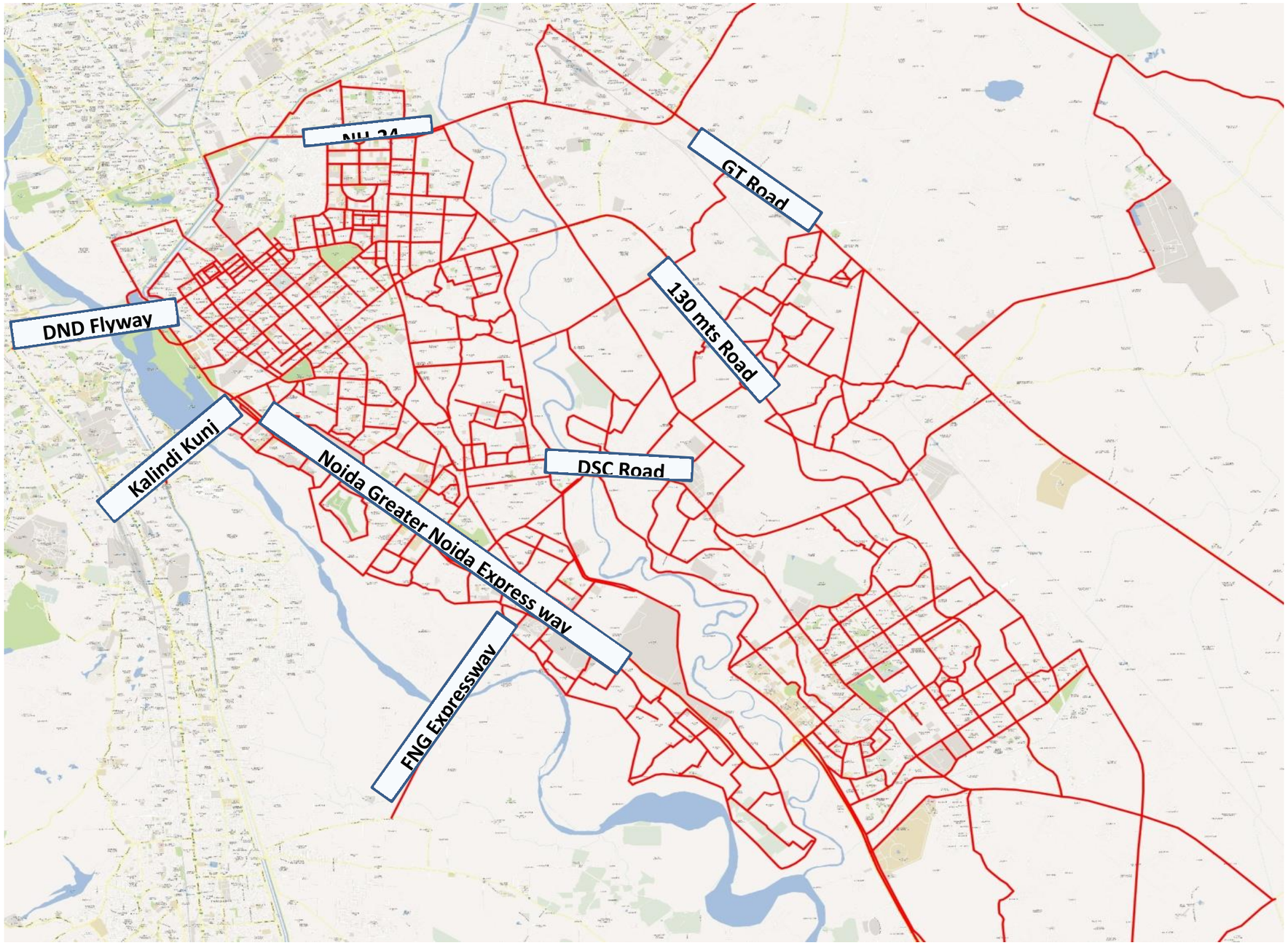


Figure 4-3 Base Year (2014) Road Network for Noida and Greater Noida

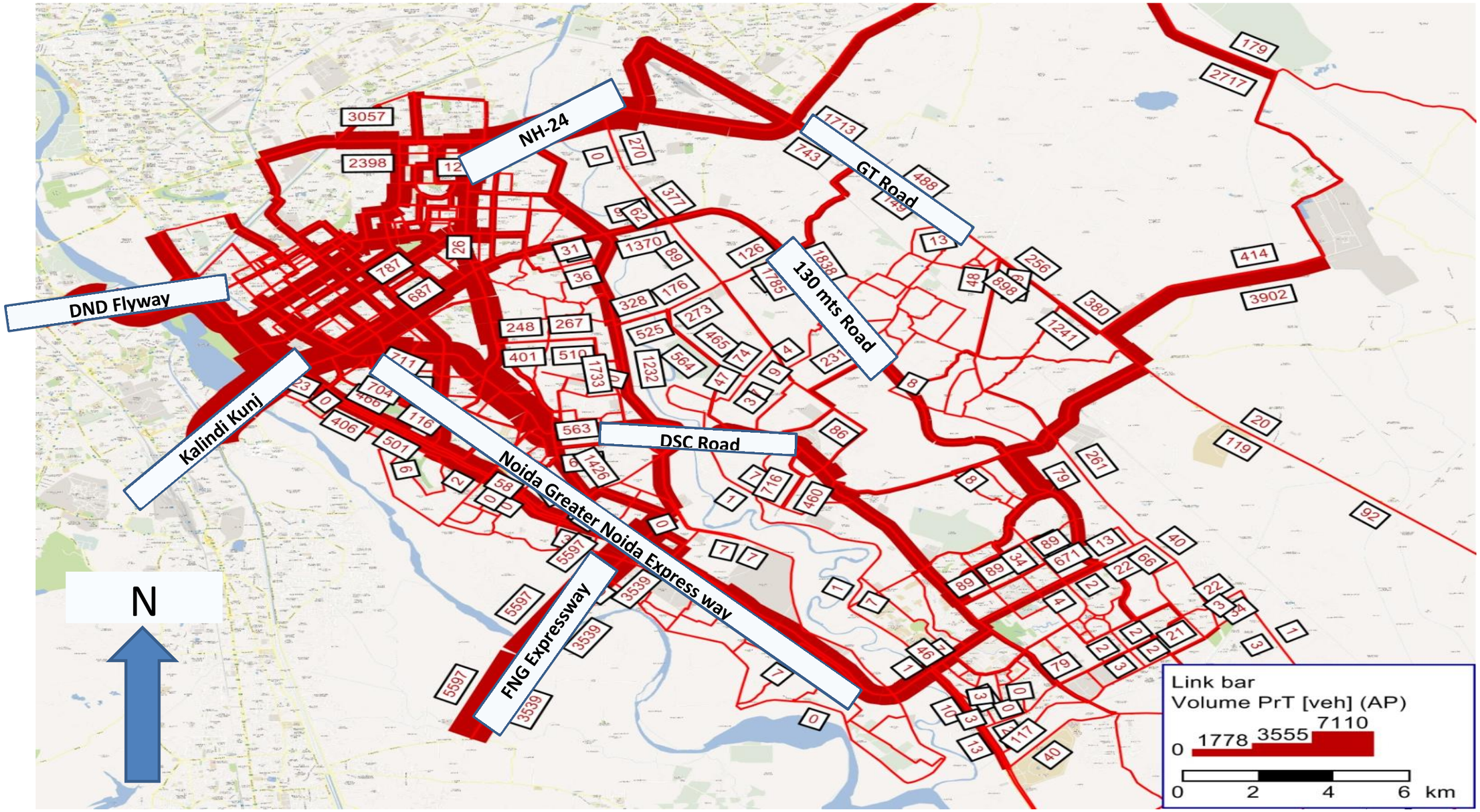


Figure 4-4 Base year (2014) Passenger Demand on Existing Road Network

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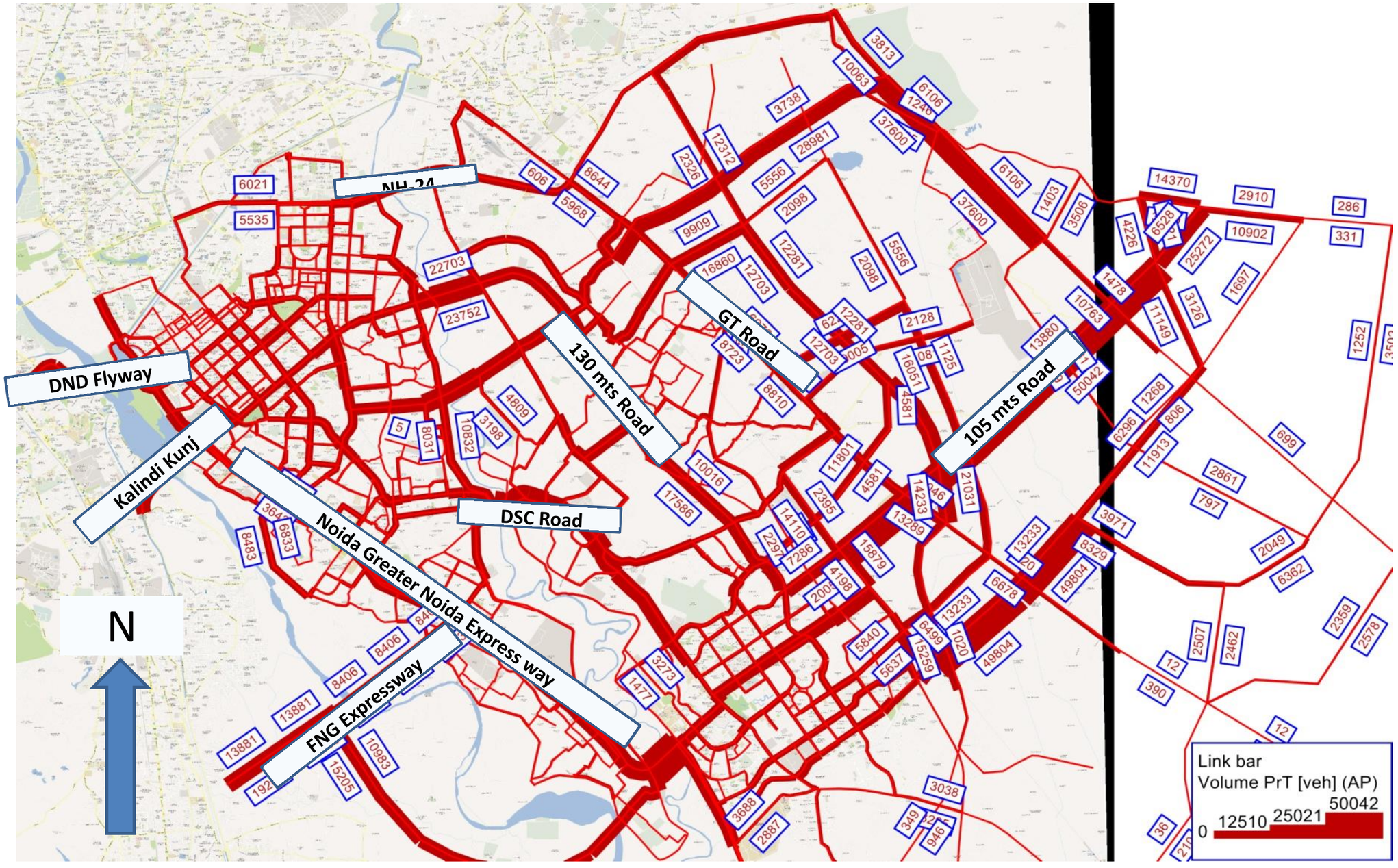

Figure 4-5 Horizon year (2024) Passenger Demand with all improvements

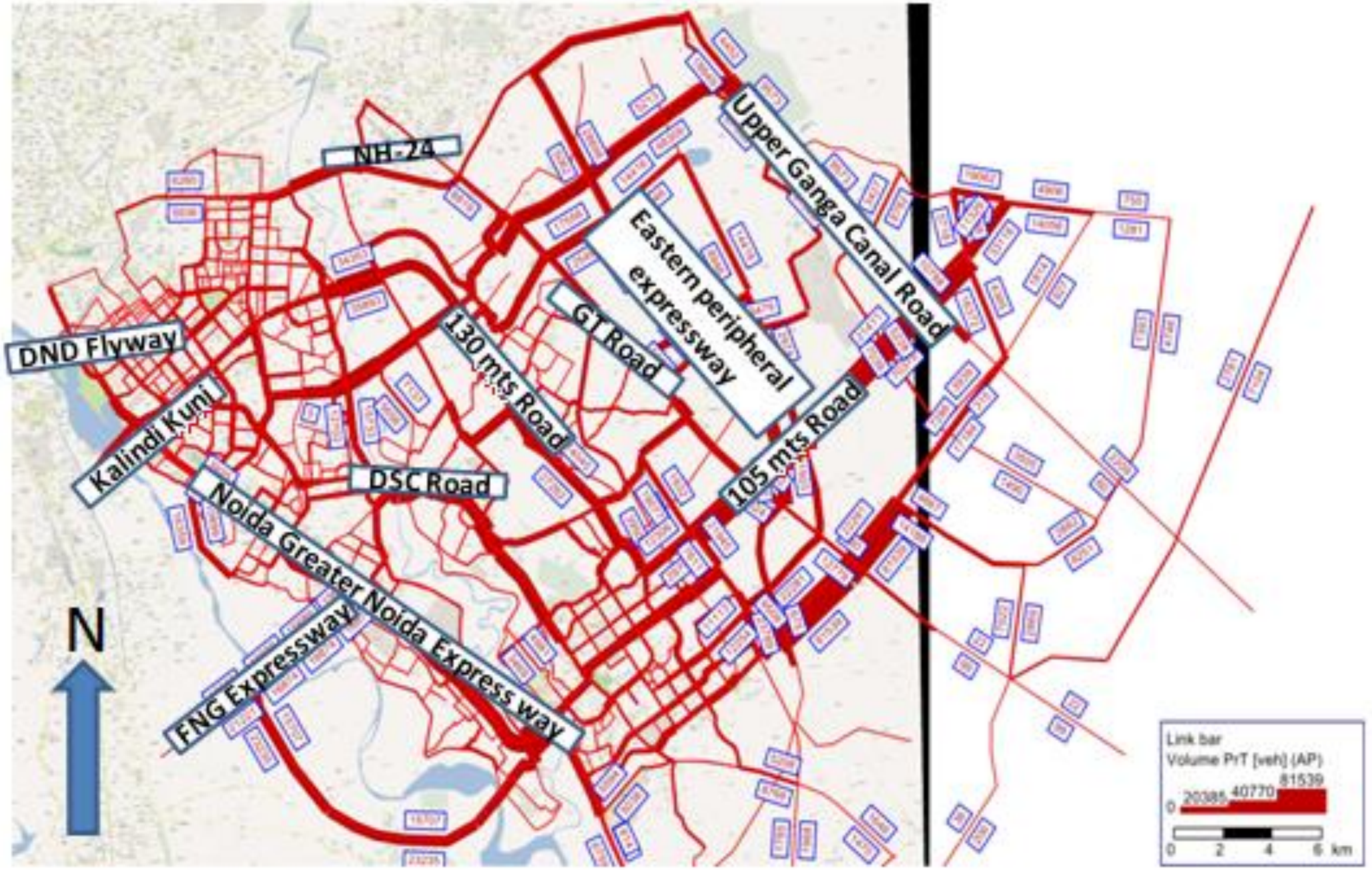

Figure 4-6 Horizon Year (2034) Passenger Demand with all Improvements

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4.7 Trip Distribution and Modal Split

Trip details regarding calibration of doubly constrained gravity model will be validated with base year results and exponential distribution function parameters are as follows

f(U) = a*U^b*e^(cU)

a= 0.83697833, b= -0.41584661, c=-0.00888095, R^2= 0.86417470

Base year mode splits with walk trips and without walk trips are given below.

Table 4-3 Mode Split of various modes without walk trips

Mode Split without Walk Trips		
Mode	**Trips**	**% share**
Car	103,347	39%
2-W	39,479	15%
Auto rickshaw	43,912	16%
Public Transport	73,414	27%
Cycle -Rickshaw	4,584	2%
Cycle	3,456	1%
Total	**268192**	**100%**

Table 4-4 Mode Split of various modes with walk trips

Mode Split with Walk Trips		
Mode	**Trips**	**% share**
Car	103,347	30%
2-W	39,479	12%
Auto rickshaw	43,912	13%
Public Transport	73,414	21%
Cycle Rickshaw	4,584	1%
Cycle	3,456	1%
walk	73,694	22%
Total	**341,886**	**100%**

4.8 Trip Assignment

Traffic assignment is the stage in the transport planning process wherein the trip interchanges are allocated to different parts of the network forming the transport system.

- **Highway Assignment**: User-equilibrium procedure based on travel time was used for assignment of highway traffic.
- **Public Transport/Transit Assignment**: Stochastic user equilibrium method based on generalized cost has been performed for Transit Assignment.

4.9 Base Year (2014) Travel Pattern

The base year trip matrix have been developed using the data extracted from household surveys and roadside interview surveys and passenger terminal surveys. The traffic characteristics of the study area are identified in terms of average network speed, average trip length volume to capacity ratio, vehicle distance travelled, total passenger hours, etc. The results of the travel-demand-estimation for base year and trip-rate-analysis is summarized in the Table 4-5.

Table 4-5 Base Year Travel Characteristics

Description	Value
Network Traffic (PCU/day)	1220378
Personalized Trips (Pax/day)	2165900
Per Capita Trip Rate	1.21

Referring to Figure 4-7 the base year desire line diagram shows that maximum trips occur between Delhi and study area. This is apparent from the land use pattern also, as the study area experiences maximum activities in terms of both residential and commercial activity.

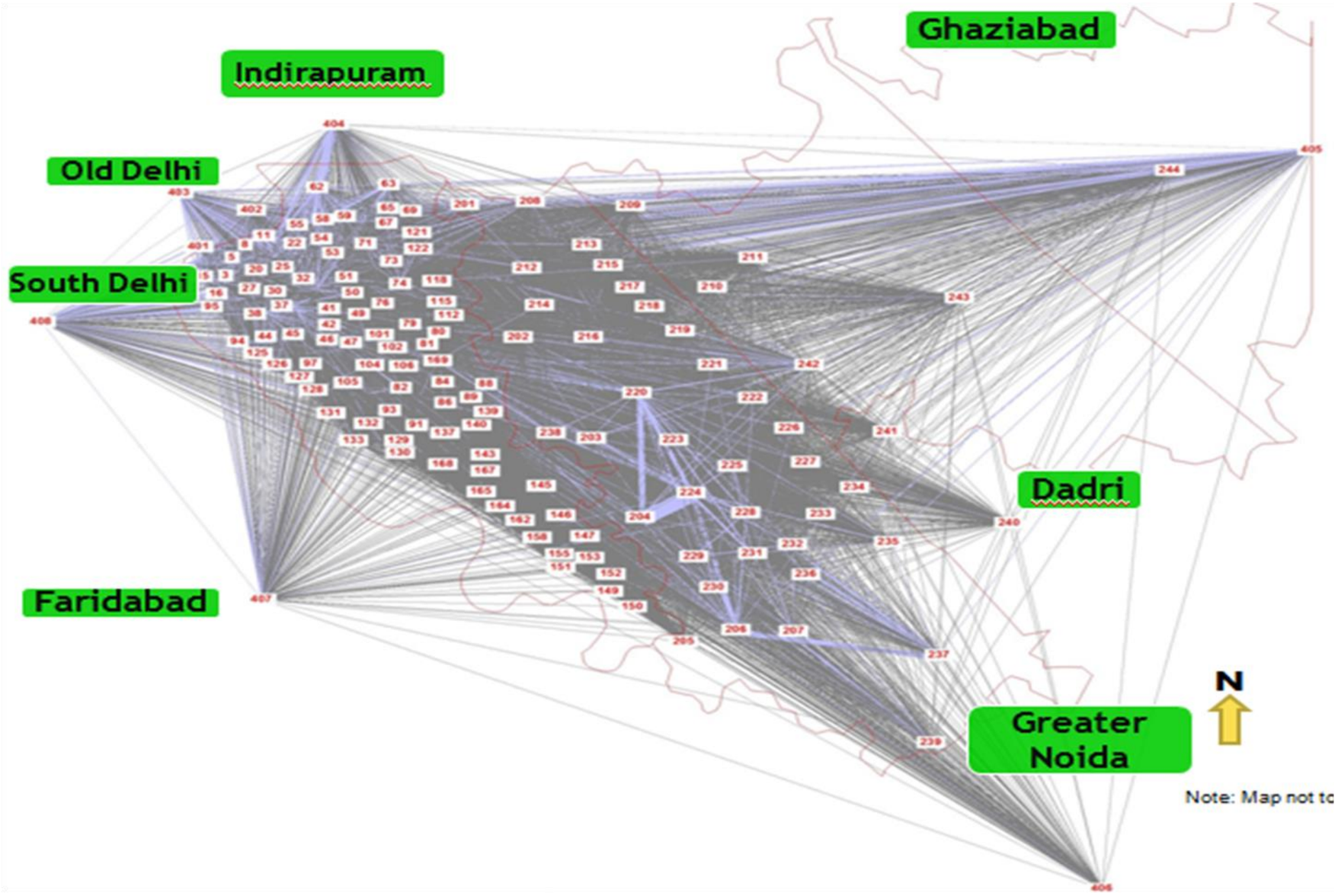

Figure 4-7: Base year (2014) desire line diagram

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4.10 Assigned and Observed OD Validation

Base year mode-wise matrices developed were then assigned to the network. The assigned volume on the network was compared with the observed volume on few selected Roads. Since the variation was within the range of ± 10% on many road stretches, the model parameters are found acceptable for further application. GEH Validation details for various travel modes are shown in Table 4-6

Table 4-6 T-Flow Fuzzy validation for various Modes

% validation	Cycle	2W	IPT	Cars	Auto	PT	Goods
	Links	**Links**	**Links**	**Links**	**Links**	**Links**	**Links**
<5%	85%	85%	90%	84%	87%	86%	92%
>10%	3%	9%	3%	8%	7%	4%	0%

4.11 Travel Demand Forecasting

Since the urban land use and transport has closer interaction, the policy makers need broad idea about the availability of land, the possible orientation of development and the transportation system required to be contemplated while formulating the policies. There are several combinations of development scenarios available. Hence, it is necessary to test various alternatives of development and select the best one from travel demand point of view. After validating, the travel demand model developed was used to estimate or project the travel demand for the horizon years 2024 and 2034 under respective transport system and network scenarios. The projected population and employment for study area are given in Table 4-7.

Table 4-7 Population & Employment for base and horizon years

Year	Noida Projected Population	GNIDA Projected Population	Noida Employment	GNIDA Employment
2014	770000	1020000	254100	336600
2024	1500000	3000000	493350	983400
2034	3100000	5400000	1023000	1782000

Source: UMTC projections

The projected population were further used to estimate the trips in the corresponding horizon years. Based on the estimated trips, three different scenarios of travel demand pattern have been assessed for the study area.

4.12 Scenario building

Based on forecasted traffic and trips three different scenarios were built and assessed according with number of performance parameters to arrive at the best sustainable solution for Noida and Greater Noida. The various scenarios are described as follows:

1. **Scenario 1, Base year (2014):** Base year scenario means projecting or visualizing the current year traffic & travel or the mobility situation assuming if ongoing mobility improvement measure is going to be undertaken. The outcome or the results drawn from this scenario show the overall deterioration of mobility in the study area. Decrease in share of trips by public transport by 27% and increase in trips by private vehicles 54%, which is not desirable. As the share of public transport goes down the overall mobility situation in Noida and Greater Noida worsens which is clear from Table 4-8. It shows that to improve the traffic and transportation scenario in Noida, the average value of V/C ratio will increase resulting more congested road network in base year and the same is also reflected in estimated congestion index of 0.68[2]. Vehicle kilometers will also increase; increase in vehicle kilometers implies the increase in emission level and increase in likelihood of occurring more traffic accidents. Thus in order to arrive at sustainable and improved mobility for Noida and Greater Noida, the ICMP for Noida and Greater Noida has assessed and examined various alternative targets of mode share in favor of public transport comparing the performance parameters of corresponding targets. In order to improve the mobility scenario in Noida and Greater Noida, after in-depth examination, the ICMP for Noida and Greater Noida has fixed the target of achieving 50% trips through public transport by 2024. **Scenario 2** and **Scenario 3** have been developed and tested adopting two different approaches to achieve the target of 50% and 60% trips in favor of public transport by 2034.
2. **Scenario 1 (a), With proposed Improvements in Base Year:** Under this scenario, the ICMP for Noida and Greater Noida has assessed and examined to achieve

[2] Congestion index is the ratio of observed speed to posted speed, if the value of congestion index is less than 0.75 it means traffic flow speed along the stretch is guided by number of vehicles, in other words congested network.

the target of 35% mode share in favor of public transport by implementing city bus service by 2015, implementation of MRTS corridors between Noida city centre to Electronic city , Botanical garden to Kalindi Kunj and Noida Sector 72 to Theta-II Sector by 2017. Widening of road links, 6.0 KM Elevated Road on DSC Road and Completion of 20.0 KM FNG Expressway and widening of NH-24 and Completion of Additional Bridges Across Hindon, Yamuna rivers at Bisrakh and Kalindi Kunj. From the analysis, it was found that through Implementation of city bus services and MRTS corridors, it is possible to achieve the target of 35% mode share in favor of public transport, however this scenario targets are achievable by 2017.

3. **Scenario 1 (b), Business As Usual (BAU-2024):** Under business as usual scenario in 2024, the ICMP for Noida and Greater Noida has assessed and examined to without any major changes to the mobility corridors and public transport system. From the analysis, it was found that through BAU-2024 city bus services will deteriorate further and public transport mode share will come down to 18% and mode share of Private vehicles will be around 65%.
4. **Scenario 1 (c), Business As Usual (BAU-2034):** Under business as usual scenario in 2034, the ICMP for Noida and Greater Noida has assessed and examined to without any major changes to the mobility corridors and public transport system. From the analysis, it was found that through BAU-2034 city bus services will deteriorate further and public transport mode share will come down to 11% and Mode share of Private vehicles will be around 73%.
5. **Scenario 2, Network Improvement by Expressways, ROBs, Public Transport Improvement by MRTS Corridors and Bus fleet Augmentation:** Under this scenario, the ICMP for Noida and Greater Noida has assessed and examined to achieve the target of 50% mode share in favor of public transport by augmenting city bus service, network improvement and widening of existing links, RoBs, Grade Separators at intersections new bridges across Hindon and Yamuna by 2024. From the analysis, it was found that it is possible to achieve the target of 50% mode share in favor of public transport, however this scenario is unsustainable. For achieving the target of 50% mode share in favor of public transport, more and more number of buses has to be added every year, which will further lead to addition of more vehicles on the same road space, resulting in congestion and reduced travel speed.
6. **Scenario 3, Overall Mobility Improvement of the study area through adoption of number of intervention measures:** Under this scenario, the ICMP has assessed and examined to achieve the target of 60% mode share in favor of public

transport (by 2034) through undertaking number of improvement strategies, which includes:

- Augmentation of city bus service
- Improvement of road network by developing new links, expressway and widening of existing links
- Introducing and developing public transport modes such as city bus, Medium Order System and Higher Order System.

This scenario shows an overall improvement of mobility scenario in the study area reflected by improvement in number of performance indicators. Referring to table 4-8 which shows improvement V/C ratio, congestion index and decrease in private vehicle mode share. Considering all the scenarios, scenario 3 is found to be sustainable and optimum mobility solution for Noida and Greater Noida.

Table 4-8 Performance of different scenarios

Scenario	Private vehicle share (%)	V/C ratio	PT Share (%)	Congestion Index
Scenario 1**: Base Year (2014)**	54%	1.28	27%	0.68
Scenario 1 (a): **With Proposed Improvement Measures in Base Year (2014) such as:** • ***Network Improvement through development of:*** – **New Links, Expressways** – **RoB's , Grade Separators** – **Elevated Corridors** • ***Public Tranport Improvement through:*** – **Implementation of bus service with new bus routes, increased frequency etc.** – **Introduction of Higher Capacity Mass Rapid Transit System**	47%	0.87	35%*	0.84
Scenario 1 (b): **Business As Usual (BAU-2024)**	65%	2.47	18%	0.49
Scenario 1 (C): **Business As Usual (BAU-2034)**	73%	3.19	11%	0.33

From the above table, it is clear that the scenario 3 is most desirable scenario for overall improvement of mobility in Noida and Greater Noida (refer to Table 4-9 and 4-10). Thus

Scenario 2: **With all Proposed Improvement Measures –(2024) such as:** • *Network Improvement through development of:* – **New Links, Expressways** – **RoB's , Grade Separators** – **Widening of Exisitng Links** • *Public Tranport Improvement through:* – **Augmentation of bus service with new bus routes, increased frequency etc.** – **Introduction of Higher** – **Introduction of Medium Capacity Mass Rapid Transit System**	36%	0.84	50%*	0.74
Scenario 3: **With all Proposed Improvement Measures –(2034) such as:** • *Network Improvement through development of:* – **Expressways** – **RoB's ,** – **Widening of Links** • *Public Tranport Improvement through:* – **Augmentation of bus service with new bus routes, increased frequency etc.** – **Introduction of Higher Order Mass Rapid Transit System**	28%	0.91	60%*	0.76

in the subsequent sections, the ICMP for Noida and Greater Noida has suggested number of improvements measures to achieve the sustainable mobility solution for Noida and Greater Noida in consistent with scenario 3.

Table 4-9 V/C Ratios for BAU scenarios

S.No	Location	Scenario 1: Business as Usual (2014)	Scenario 2: Business as Usual (2024)	Scenario 3: Business as Usual (2034)

1	Kalindi Kunj Road	3.59	5.62	9.29
2	Captain Sashikant Marg, MP3	1.26	2.78	4.26
3	DSC Road	1.02	2.83	4.17
4	Udhyog Marg	0.89	1.44	2.63
5	Ashok Marg, MP 2 Road	0.90	1.32	2.24
6	Noida 22 Main Road (coming from Labour chowk)	1.12	2.34	3.76
7	Noida – Greater Noida Link Road	0.98	1.56	2.81
8	Sector-62 Road (fortis hospital)	0.92	1.81	3.01
9	Pari Chowk Road (Expressway)	0.90	2.02	3.31

Table 4-10 V/C Ratios for Improved Scenarios

S.No	Location	Scenario 1: Improved Base Year(2014)	Scenario 2: With all improvement Measures (2024)	Scenario 3: With all improvement Measures (2034)
1	Kalindi Kunj Road	0.89	1.02	0.89
2	Captain Sashikant Marg, MP 3 Road	0.76	0.78	1.19
3	DSC Road	0.62	0.94	1.15
4	Udhyog Marg	0.61	0.77	0.81
5	Ashok Marg, MP 2 Road	0.72	0.70	0.82
6	Noida 22 Main Road (coming from Labour chowk)	0.84	0.64	0.74
7	Noida – Greater Noida Link Road	0.84	1.12	0.81
8	Sector-62 Road (Fortis Hospital)	0.74	0.62	1.04
9	Pari Chowk Road (Expressway)	0.68	0.97	1.11

Chapter 5 The Vision

"Integrated Comprehensive Mobility Plan is designed to develop a world-leading transport system that meets the needs of residents, visitors, and businesses in the most efficient, safe, attractive, reliable, and environmentally sustainable way."

5.1 The Vision

The mobility plan seeks to "move people, not vehicles". By emphasizing the pre-eminence of public transport and non-motorized transport, and integrating the land use with transport networks, it seeks to achieve the objectives of the National Urban Transport Policy (NUTP) in Noida and Greater Noida. The ICMP vision for transport in twin-city ensures that both the cities will have a planned, best performing transport system(s). Accordingly, the transport vision for twin-city can be defined as:

"To ensure that Noida and Greater Noida will have a systematically planned urban transport system for the mobility of people and goods that is safe, efficient, economical and sustainable, which aims to support economic development while improving livability".

"To ensure planned, best performing transport system that addresses the needs and concerns of the City"

5.2 Imaging the future of Transport

Imagine Noida – Greater Noida as cities where public transport is available 24 hours a day

… where the most advanced transport technologies allow you to travel swiftly to work, shopping, schools, entertainment and even to Delhi, Ghaziabad, Faridabad

… where high-tech electronic information systems tell you exactly when the next metro or bus is scheduled to arrive

… where the nearest public transport stop is less than a 5 minute walk from your home.

Imagine Noida – Greater Noida as cities that are designed for the enjoyment of pedestrians

… where awnings and trees offer shade from the sun

… where pavements are wide and city streets become a place to sit, socialise, or have coffee with your friends

… where housing, jobs, shopping, and entertainment destinations mingle close together and are easily accessible on foot

Imagine Noida – Greater Noida as cities that are easy to drive around … where a fine-grained, interconnected street system gives drivers a variety of routes to choose from

… where short blocks, clear signage, and well-timed signals make navigation easy and travel times shorter

… where parking structures are located conveniently close to your destination

… where reduced congestion and better technologies lead to lower fuel emissions and cleaner air.

This ambitious vision for the future of transport in Noida and Greater Noida is on its way to becoming a reality…..

5.3 World Class City, World Class Transport

The vision for ICMP for the future calls for nothing less than a world class, sustainable transport system—one that sets a global standard for efficient services, integrated technologies, and innovative policies. This transport system is also envisioned to support Noida-Greater Noida economic, social and cultural, and environmental needs through the set goals.

The future of transport in Noida and Greater Noida will include highly integrated choices:

5.4 Mobility Pillars

The six most important pillars for ensuring Sustainable Mobility in urban areas are:

- Integrating Land use and Transport in Planning Process
- Recognizing the use of non motorized means of movement by introducing NMT favorable strategies
- Bringing a control on movement of personal vehicles
- Managing parking in the city
- Encouraging Public Transport System and other Sustainable modes
- Directing city growth in a uniform manner with the help of better links and access roads

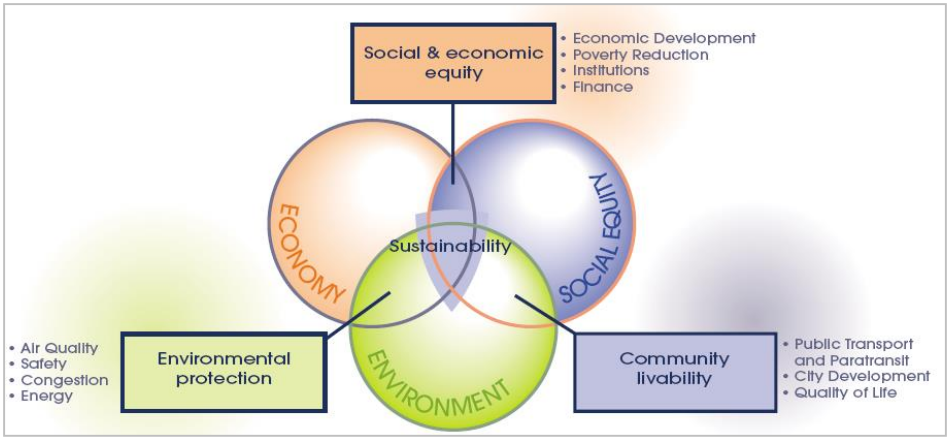


Figure 5-1 : Frame work for Mobility Planning

Sustainable Mobility however can only be ensured if the solutions are environmentally, socially and economically sustainable as presented in Figure 5.1.

5.5 Goals

To ensure that Mobility solutions for the twin-city are sustainable and in conformity with sustainable mobility, following Goals have been formulated:

- **Goal 1:** Develop public transit system in conformity with the land use that is accessible, efficient and effective.
- **Goal 2:** Ensure safety and mobility of pedestrians and cyclists by designing streets and areas that make a more desirable, livable city for residents and visitors and support the public transport system.
- **Goal 3 :** Develop traffic and transport solutions that are economically and financially viable and environmentally sustainable for efficient and effective movement of people and goods
- **Goal 4:** 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.

Each goal can be achieved by meeting the following objectives:

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

   Objectives

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

   (b) Develop strategy to integrate public transport system with existing IPT System

   (c) Develop strategies to encourage people to use public transport system and discourage use of private vehicles

   (d) Develop policies that encourage concentrated mixed land use development along the public transport corridors

2. **Goal 2:** *Ensure safety and mobility of Pedestrian and cyclist by designing streets and areas that make a more desirable, livable city for residents and visitors and support the public transport system.*

Objectives

(a) To improve pedestrian facilities in areas of pedestrian concentration
(b) To provide facilities to pedestrians and ensure safety to segregate their movement from vehicles along major corridors
(c) To encourage pedestrian movement in heavy pedestrian movement areas and restrict use of private vehicles
(d) To provide safe pedestrian facilities along major public transport nodes and transfer points
(e) To provide segregated facilities for movement of cyclist
(f) To develop a Pedestrian policy for safe and efficient movement of people

3. **Goal 3:** *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 immediate / 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 / long term measures such as new links, road network development, flyovers, underpasses and ROBs to ease traffic flow along major roads.

4. **Goal 4:** *Develop a Parking Policy 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) Restrict On Street Parking at critical locations
(b) Create off Street Parking (wherever possible Multilevel Parking) near major activity centers, transit stations/terminals to meet the growing parking demand.
(c) 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.

The goals and objectives set for the mobility needs of twin-city, can be achieved by formulating a series of strategies as per NUTP guidelines. Each of the strategies will be evaluated to see their suitability and applicability for Noida and Greater Noida.

Besides the above mentioned Goals, some principles of National Mission on Sustainable Habitat (NMSH) need to be considered in this study before formulating the strategies. Accordingly, a brief introduction to NMSH is presented in the following section.

5.6 National Mission on Sustainable Habitat (NMSH)

Under the National Action Plan for Climate Change, the National Mission on Sustainable Habitat has been launched to cover various aspects which inter alia include better urban planning and modal shift to public transport. The main objective of the mission is to address the following:

- Development of Norms integrating measures related to taxation, parking and congestion charges, public carriage specifications and service
- Norms to encourage public transportation
- Development of Norms for pedestrianization and cycling
- Modal regulations for integrating Transport Planning (CMP) with Master Plans and Development Plans.

The habitat parameters also take note of the ongoing reform based JnNURM program that has been designed to achieve NUTP principles in the urban transport sector. Accordingly, to ensure sustainability in urban transport planning, the following eight-principles have been proposed. This ICMP study also attempts to integrate these principles in its approach.

1. Make walkable Cities and Towns

A great walking environment must protect pedestrians from motor vehicles. Vehicle speeds need to be radically slowed or else, streets need footpaths. Footpaths need to be unobstructed, continuous and well lit. Crossings should be made safer with pedestrian crossing signals, pedestrian islands and pedestrian table-tops that minimize crossing distances and offer safety for pedestrians. Accessibility to wheelchairs must be

ensured. The pedestrian network should foster the most direct access to all local destinations like schools, work, bus stops etc.

The following indicators have been recommended for pedestrian facilities:

- All arterial streets should have >= 75% of their lengths having non obstructed footpaths to achieve a LOS 1 for the pedestrian facility
- All other sub arterial and local streets should have 50 – 75% of their lengths having footpaths for a LOS 2
- At-grade pedestrian crossings at maximum intervals of 70-250 m

The twin-city does not meet these standards. We include a separate strategy to non motorized transport improvements where the focus is to develop better walking and cycling facilities in Noida and Greater Noida.

2. Create environment for bicycles

The more bicycles (and any people-powered transport) on the streets the safer and less polluted the streets become. Segregated bicycle lanes are needed on higher speed roads, while on local streets traffic calming and shared street designs are better, allowing traffic to mix at slower speeds. Building bike lanes and slowing down traffic are keys to making urban transport sustainable.

The following indicators have been recommended for pedestrian facilities:

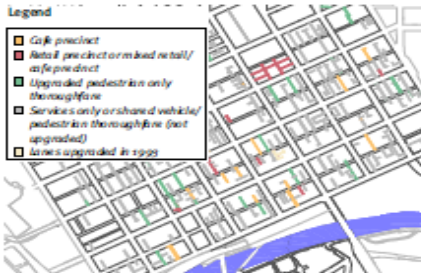
NMT network should have at least 25% of the road network coverage to achieve a LOS 1 for NMT facilities NMT parking facilities should be available at more than 50% of the interchanges (bus stops, terminals, railway stations) to achieve a LOS 2.

The twin-city has a significant cycling population and every care must be taken to preserve and better it. The observed 1% cycle share of total trips can be improved. Our cycling strategy hence will focus on developing a strong bi-cycle network.

3. Connect the blocks

Cities that are pleasant to walk and bicycle typically have large numbers of short streets and many intersections per unit of area. This makes the traffic slow down while walking

becomes more direct, varied, interesting and attractive. The tighter the street grid, the fewer detours to a destination. Detours can affect the decision to undertake a trip and by what means. Streets that are short offer good opportunities to connect with the surroundings. Buildings, shops and streetscape elements are closer to the pedestrians and cyclists as they travel.



It is recommended that the indicator for the number of intersections of pedestrian and cycle network per square kilometer be 50.

4. Get on the Public Transport

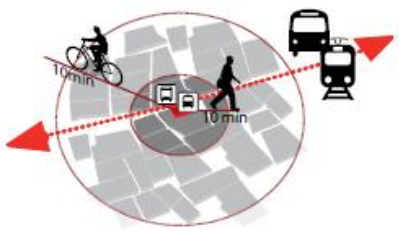
Mass transit can move a large number of people quickly and comfortably using a fraction of the fuel and street space required by automobiles. The bus transit systems are proving able to keep pace with the rapid motorization and metropolitan growth. Busses are more accessible, have a wider coverage and are cheaper.

The following indicators need to be used to assess the effective usage of public transport:

- Percentage of residents within 800 m of public transport stops
- Percent mode share of public transport and IPT desired
- Percent of stops with frequency of service greater than 15 buses per hour

There is no separate city bus system in the twin-city, UPSRTC and DTC buses are currently providing this service. Thus, the twin-city require a separate city bus system with well-defined integration of main haul and feeder services.

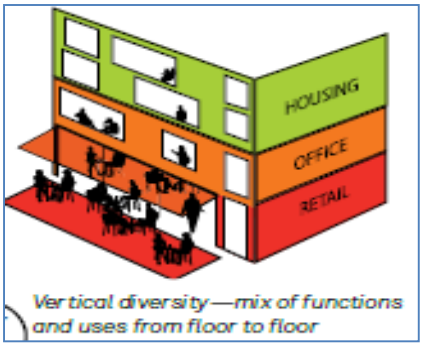
5. Build dense - people and transit oriented cities; mix people and activities



The first step to accommodating future urban growth is to densify existing urban land while providing excellent and diversified services and amenities. Dense communities are a foundation for the mixed-use urban areas where walking, cycling and transit can be integral parts of the way of life.

The following indicators are recommended for densification:

- Densify transport nodes according to pedestrian and cycling – 10 minute catchment areas
- 800 m for pedestrians and 3 km for cyclists



Vertical diversity—mix of functions and uses from floor to floor

Integrating residential, work, retail and entertainment activities into one area makes for better cities. Trip lengths and travel times can be reduced.

6. Shift to Public Transport

Shift from unsustainable mobility to sustainable mode like the public transport can be achieved using technology, regulating road use, parking and fiscal measures. High quality public transport vehicles with efficient service, easy accessibility, wide coverage and reasonable affordability are required to induce shift from private to public vehicles. This has to be coupled with measures like congestion charges in core areas; high parking fee; limited parking spaces; tax on private vehicles; implementation of demand management measures etc.

There is a requirement to control the demand of parking by adopting parking policy and other measures. Haphazard and unregulated on-street parking become the major concerns as they create bottlenecks. Also there is requirement of providing off-street parking facility which can help in increasing the effective road capacity.

7. Urban Transport Funding

Proper institutional set up and an efficient funding mechanism are need of the hour to ensure financial sustainability of investments in public transport and non-motorized transport. Urban transport financial resources should be pooled within an urban transport fund administered by the strategic transport authority at the municipal or metropolitan level. Private sector financing for transport infrastructure should be raised through competitive tendering of concessions that may be supported by public contributions as long as they are subjected to cost-benefit analysis.

8. Impact Assessment

New developments and projects will draw increasingly more attention in the future as these induce and attract additional traffic in the neighbourhood. It is suggested an Impact Assessment needs to be done to estimate the additional traffic and the infrastructure needs of the neighbourhood.

Chapter 6 Mobility Plan Strategy

The mobility goals for the twin-city need to be addressed through a multipronged approach. Solutions for complex transport improvements cannot be achieved by a single strategy. The following strategies need to be adopted in tandem to meet the various goals set for the ICMP:

- Mobility Corridor Strategy
- Land Use and Transport Strategy
- Public Transit Improvement Strategy
- Non-Motorized Transport Strategy
- Parking Management Strategy
- Freight Management Strategy
- Traffic Engineering Measures

"The complex transport situation needs a multi pronged approach"

It is important to note that each of the above strategies is 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 ICMP. The sections below discuss these strategies.

6.1 Mobility corridor Strategy

By designating certain roads as 'Mobility Corridors', the transport corridors get priority for increasing the throughput as well as congestion would then be focused and appropriate solutions would be identified.

A strategy of mobility corridors have been devised to deal with the traffic and transport problems of the city. These mobility corridors have been identified as the major trunk roads which at present carry the bulk of the traffic in the city and other roads that have been identified under the travel demand model to carry heavy traffic in the future. The mobility corridors are devised so as to maximize throughput of traffic and trips within the city. Adequate provision of road widths through necessary widening and reclamation of carriageway ensures efficient movement of traffic. Focus of public transport and non-motorised transport infrastructure on the corridors further increases the load of trips carried by the roads. This shall ensure adequate traffic distribution on all road stretches without overloading and choking any particular corridor.

As a part of this strategy, it has been proposed that some corridors will act as mobility corridors in the twin-city. The same have been presented in Figure 6.1 and 6.2. These corridors should be considered with desired and dedicated public transport systems. The typical cross sections for dedicated public transport systems on the mobility corridors are presented in Figure 6.3 and 6.4. Initially, the mobility corridors should be implemented up to the railway line (Greater Noida existing) and later can be extended up to the expansion. The study will need revision in the ridership estimation for the extension part in future.

The mobility corridors for the study area constitute of expressways, National highways complemented with major connecting roads for the smooth traffic. Following are the identified mobility corridors:

Highway

1. NH 24
2. NH 91

Expressway

1. Gautam Budh Expressway
2. Yamuna Expressway
3. FNG Expressway
4. Eastern Peripheral Expressway

Major Roads

1. DND flyway
2. DSC Road
3. Kalindi Kunj entry
4. Link Road and 130 M Road
5. New bridge on river hindon connecting Sec. 78 in Noida to Bisrakh in GNIDA
6. Mini Ghaziabad Highway
7. 105 M road and Dadri-Hapur
8. Dankaur Sikandrabad Galauthi road
9. Upper Ganga Canal Road

Figure 6-1: Identified Mobility Corridors for the Study Area (Stage1 -2014)

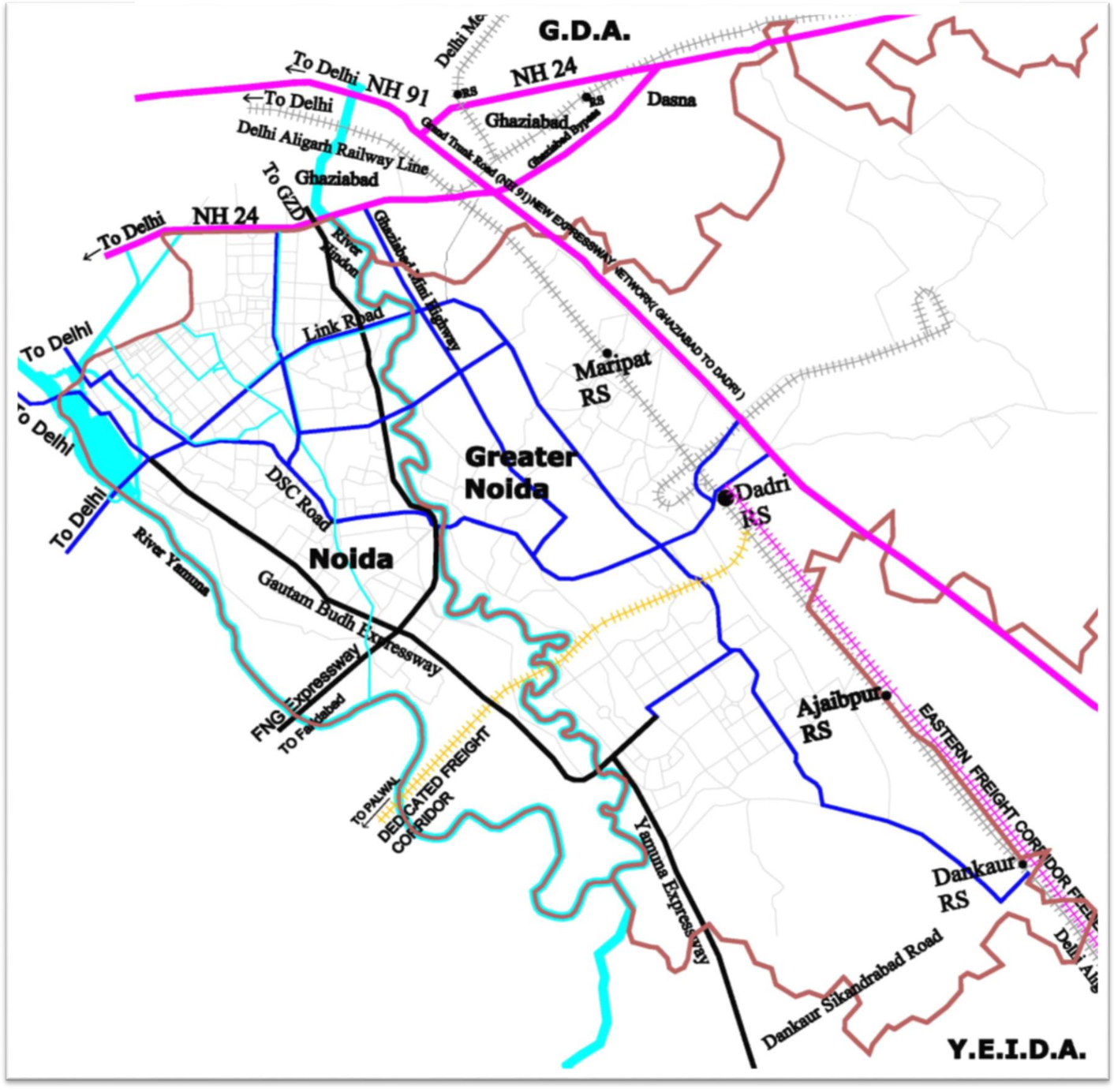


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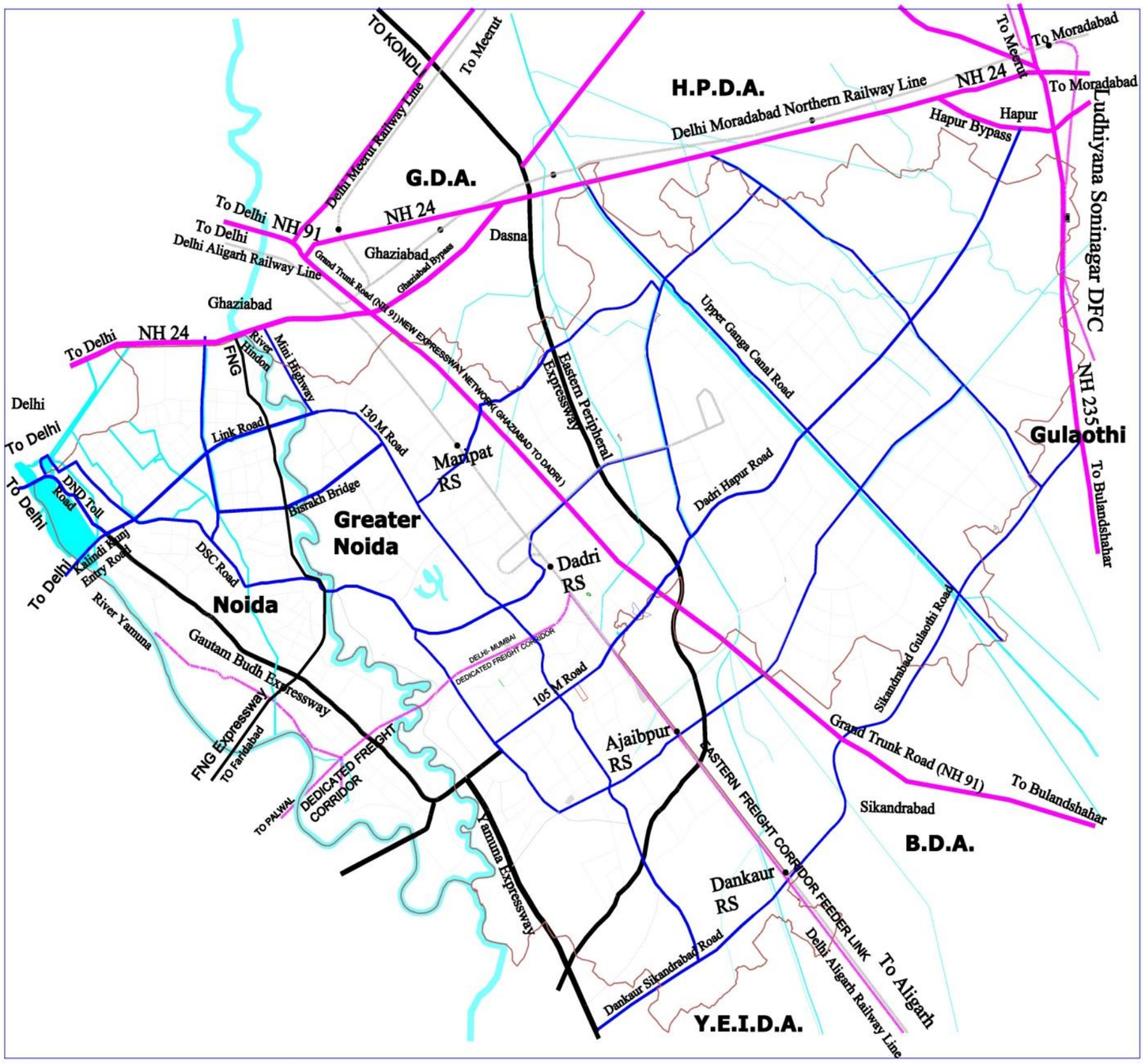
Figure 6.2 : Identified Mobility Corridors for the Study Area (Stage 2 – 2024)



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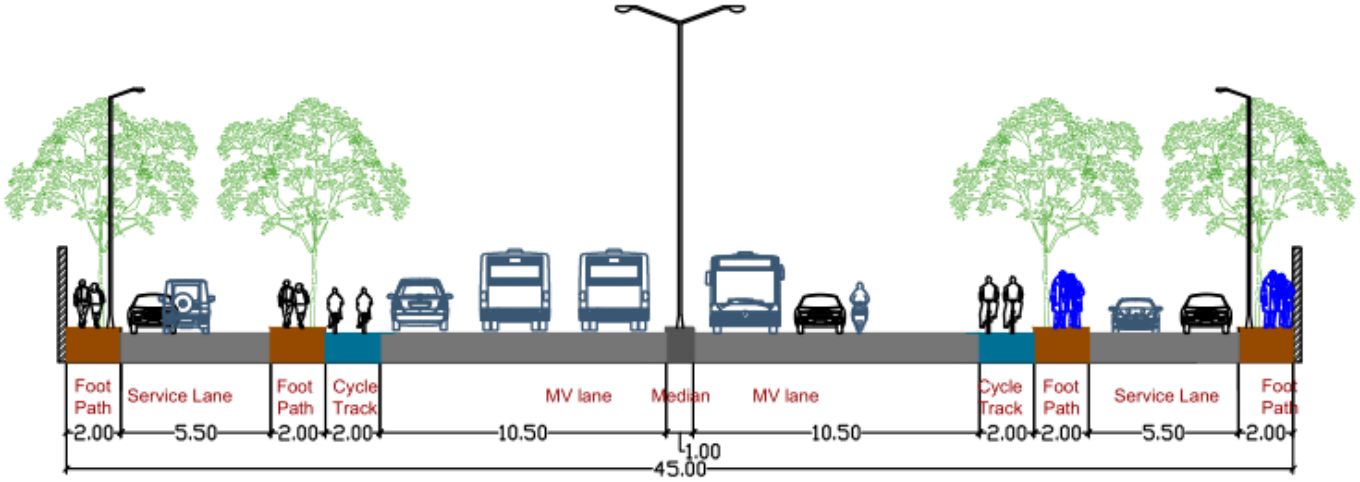
Typical cross-sections with ROW 45 m, 60M, 80M and 130 m respectively are given in Figure 6-3 to Figure 6-6



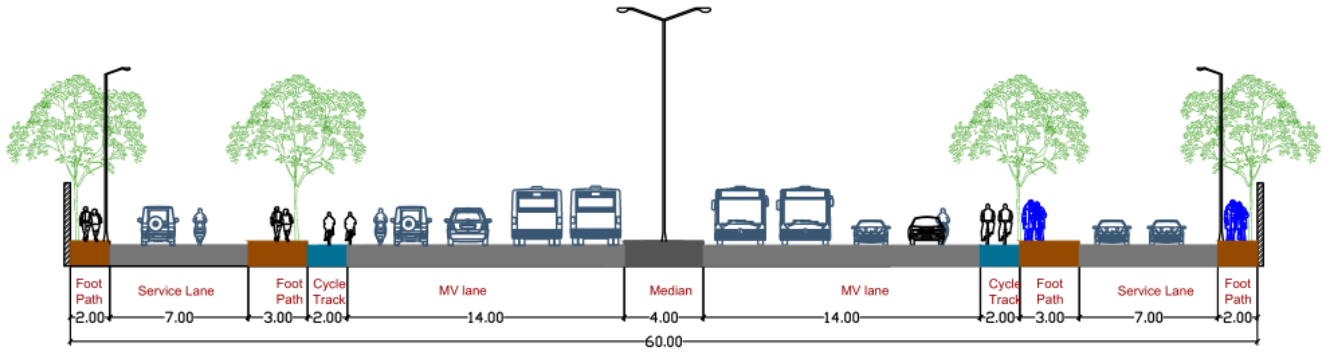


Figure 6-4 : Typical cross section of 60 M wide road

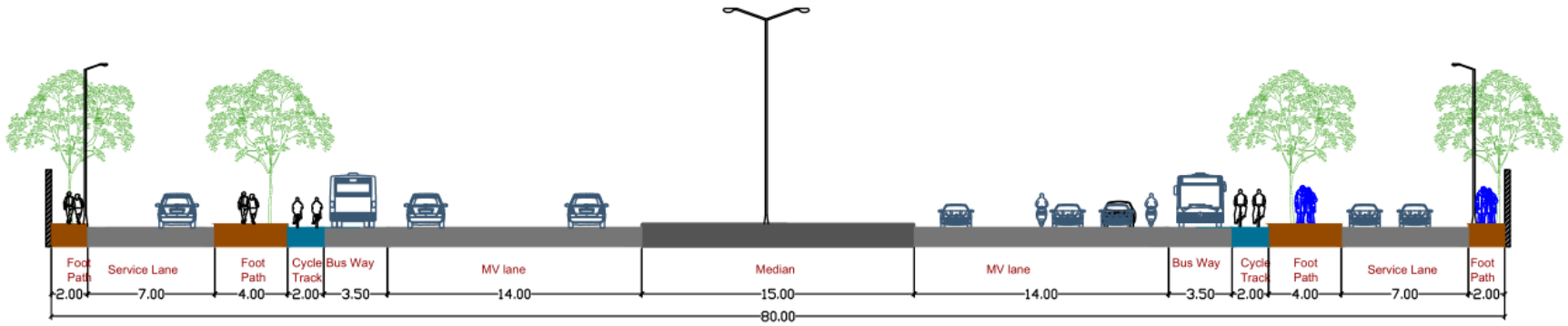
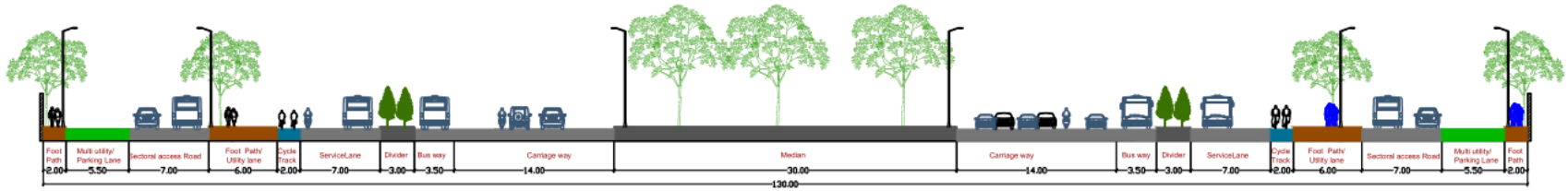


Figure 6-5 : Typical cross section of 80M wide Road



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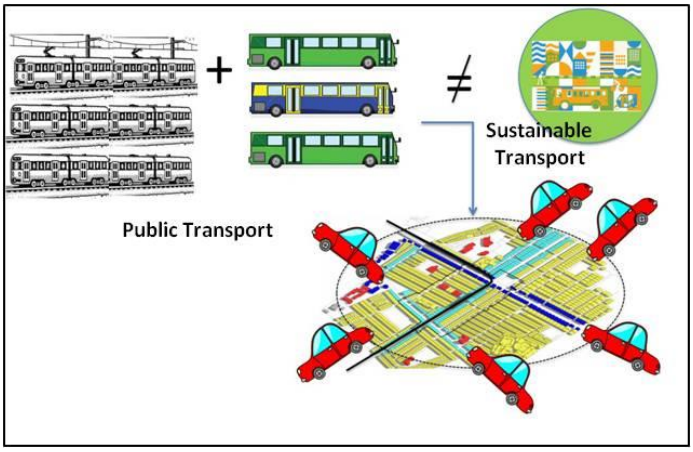
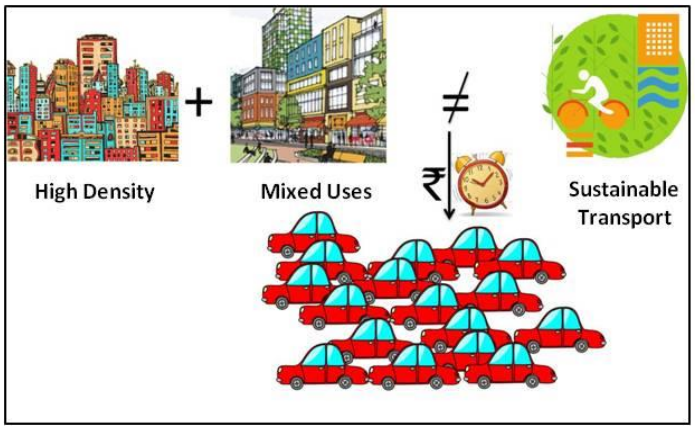
6.2 Land Use and Transport Strategy

The structure and shape of the transport network is dependent on land use. Land use and the network strategy must go hand in hand. As land use cannot happen as planned, if there is no connectivity.



Transport policies to improve public transport alone do not prevent private vehicle travel
Public transport alone do not attract development around stations

Figure -6-7 : Transport Policies alone are not enough for sustainable transport



Land use policies on increasing densities or mixed land use without accompanying measures to make car travel more expensive or slower have little effect as people will continue to make long trips to maximise opportunities within their time and budgets

Figure-6-8 : Land Use Policies alone are not enough for sustainable transport

Integrated land use and transport policies are more successful than isolated individual policies in either field: In the wake of emerging importance to control urban sprawl and providing environmentally sustainable development, it is necessary to adopt all urban issues in an integrated manner. Land use has crucial impact on travel demand and can guide the future travel demand.

This strategy should focus on accessibility, connectivity, mixed land use developments to minimize vehicle trips, encourage transit oriented development, and the long term transport strategy be framed around the structural form of urban growth envisaged.

Integrated land use and transport development promotes balanced regional growth in line with regional development strategies, with the objective of:

- Promoting balanced spatial growth
- Minimizing land requirements for transport
- Promoting transit oriented growth
- Reducing the need to travel
- Encouraging walkable/cyclable neighborhoods

In order to provide mobility solutions for Noida and Greater Noida, it is vital that there is an effective integration between land use and transport in the entire region, without which, it will be difficult to coordinate growth in sustained manner.

One of the strategies integrating land use and transport that can be adopted for the twin-city is the Transit Oriented Development (TOD) strategy. This concept can be applied along the major identified mobility corridors that have the potential to carry higher order mass transit systems.

6.2.1 Transit Oriented Development (TOD)

By designating certain roads as corridors to maximize passenger throughput, these corridors get priority planning for public transit systems. Mixed use development that is cognizant of the low income users of the transit system, is important. Land use planning can be used to create urban and suburban environments where walking and transit are viable transportation options (Transit Oriented Design/Transit Supportive Design, TOD) by making it easier to go from one transportation mode to another, the connection between community and development is enhanced ensuring that a community is accessible to all. Resilient neighborhoods will provide the needs of daily living, within walking distance (1/2 to 1 km radius). The twin-city has the potential to adopt these principles. The TOD planning process includes:

Travel Connections: This would focus on convenient and direct pedestrian connections, pedestrian scale blocks, interconnected street network including bicycle circulation and parking. Increased density in neighborhood centers would make transit service more effective.

Building Scale and Orientation: Transit-supportive design assumes people are willing to walk a maximum of ½ mile for premium transit and rail service and ¼ mile for other bus services. Building placement is a powerful tool in reinforcing streets as public amenities. Sensitivity to the physical design and location of buildings is important in order for travel connections to be attractive. The quality of "out of vehicle" experiences is influenced by the placement of buildings in relation to the street and other buildings, as well as their height and scale.

Public Spaces: This would include pedestrian-friendly streets including adoption of traffic calming measures, parks and Plazas as community gathering spaces to enable social interaction, quality facilities for transit users (features such as benches, shelters, landscaping and adequate lighting make people feel comfortable while waiting for transit service). Additionally, services such as child care facilities, dry cleaners, postal facilities and health care offices can be included as part of bus transfer centers or rail stations.

Parking: The proper location and size of parking facilities are essential if pathways, buildings and public spaces are to succeed in creating transit-supportive settings. Parking structures/shared parking lots are two ways to reduce the amount of space occupied by parking facilities.

Successful Transit Oriented Development can significantly reduce per capita motor vehicle travel, and reduced travel time. Reduced travel time in turn leads to lower pollution including lower GHG and particle emissions.

Table 8.2: Benefits of TOD: Case Study

Design Feature	Reduced Vehicle Travel
Residential development around transit centers	10%
Commercial development around transit centers	15%
Residential development along transit corridor	5%
Commercial development along transit corridor	7%
Residential mixed-use development around transit centers	15%
Commercial mixed-use development around transit centers	20%
Residential mixed-use development along transit corridors	7%
Commercial mixed-use development along transit corridors	10%

Source : Features of landuse design by Dagang, 1995

Given the benefits of a transit oriented development, it is very important to assess its impact on land price, area character, and the socio-economic profile of the corridor, so that poor and disadvantaged population does not stand to lose. The equity and inclusive planning process becomes core to this strategy.

Following are the three major corridors that have been identified along which TOD can be initiated.

Corridor 1: Gautam Budh Expressway and 105M Road
Corridor 2: from Sec. 52-72 chowk to GB Expressway along Drain in Noida
Corridor 3: 130 M wide Road

Mixed land use is a particularly important element of TOD. Intermixing housing, offices, retail shops, and other urban amenities in close proximity to public transit stations integrates long-distance travel by transit and short-distance, within-neighborhood travel by foot. When coupled with transportation demand management (TDM) measures, TOD can become even more effective.

6.2.2 Transport Demand Management (TDM)

TDM aims to alter the demand for travel in order to reduce traffic congestion and improve environmental conditions – mainly to encourage people to utilise non-car modes or to make fewer trips. It includes measures that modify the physical designs of cities and streetscapes as well as various incentive mechanisms that change the cost of transportation to users. Physical design examples include pedestrian- and bicycle-friendly street designs, traffic calming, and intermixing of land uses to shorten trip distances. Examples of TDM include congestion pricing, parking controls, and car sharing. Experience shows that combining TOD and TDM measures can induce people to use public transit and non-motorized transportation and to reduce levels of car ownership and usage.

1. Implement Parking Pricing and Management

One of the visible problems that one beholds when visiting Noida is heavy and haphazard on-street parking. Due to shortage of adequate off-street parking space, on-street parking is observed on most of the major roads of Noida. Alpha-II market, Gamma-II market area and Knowledge Park -III in Greater Noida are also facing similar problem but not at the scale of Noida. Although, Noida Authority has authorized on-street parking at some major commercial areas, but at the same time, in many places un-authorized on-street parking were also observed.

To manage the problem of parking in the twin-city, the following measures are proposed:

- Organise and convert all on-street parking to paid-parking and parking bays should be marked properly.

- Create off-street parking facilities near locations of intense demand, such as Sector 18 market, Botanical Garden, Sector 62-63 at Noida and Jagat Market and near authority in Greater Noida.
- Create a parking policy for new planned development to prevent parking problems in future.

2. Improve Public Information

The change from a car-based culture to one in which public transport is the mode of choice will require significant changes in public perceptions and behaviour. Publicity campaigns will be an important element in influencing local attitudes and changing such behaviour; these will need to be introduced as soon as bus services provide a satisfactory alternative to the private car and will require strong reinforcement once the additional three extensions of metro services begin operation.

3. Provide Park and Ride Schemes

Park and Ride schemes will provide a more reliable and convenient alternative to driving in to the study area. To facilitate this, Park and Ride sites are planned at the multi modal hubs and interchange locations.

4. Provide Measures to Encourage Teleworking and Car Sharing

Measures to encourage working at home, the use of information technology and car sharing to reduce the demand for travel are supported by the Plan.

6.3 Public Transit Improvement Strategy

"Public Transport as an attractive choice"

A key component of the ICMP is the provision of a comprehensive, fine grained and integrated public transport system that provides regular and reliable services accessible to all and offers an attractive, high quality alternative to the private car.

The vehicle registration data Figure 6-7 shows that over the years, registration of private vehicles has outnumbered (registration of private vehicles is more than 150 times higher than that of buses) the registration of buses. In 2013-14, the total number of registered vehicles in Noida and Greater Noida are 54,927; out of which four wheeler constitute 32% and two wheelers constitute 58%. Public transport (Bus) accounts only 0.5% while auto rickshaw and taxi accounts for 7.2% of total registered vehicles. Further, the share of public transport has also declined from 61% during 2007 to 45% in 2014 (include metro, Bus and IPT). Thus, if the same trend continues, by 2034 the traffic and transportation situation of Noida and Greater Noida will be completely unsustainable.

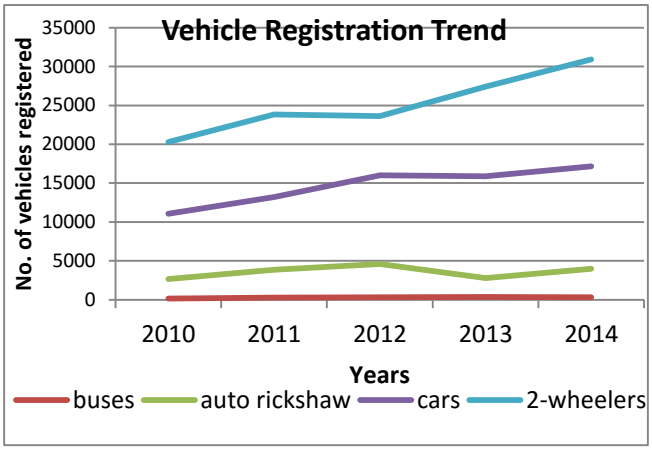


Figure 6-9 : Vehicle Registration trend in Noida and Greater Noida

At present, the transport needs for the residents of Noida and Greater Noida are fulfilled by inter-city bus services (UPSRTC, DTC, Private), 6 metro stations and shared auto rickshaws. Both cities lack the separate intra-city bus service and metro feeder service. Due to the lack of good network coverage of both UPSRTC and DTC buses along with low frequencies, the private bus operators and IPT (shared auto rickshaws, Vikram, Tata Magic) came into existence and provide a good network with high frequencies and reliability but at the same time making cities more congested and unsafe for pedestrians.

Thus, the Integrated Comprehensive Mobility Plan for Noida and Greater Noida incorporates numerous approaches in making the public transport system as user friendly and easy to navigate as possible. All public transport modes will be closely integrated and will feature a uniform brand and symbol. When users see the symbol, they will know they have reached an entry point of access to the entire system.

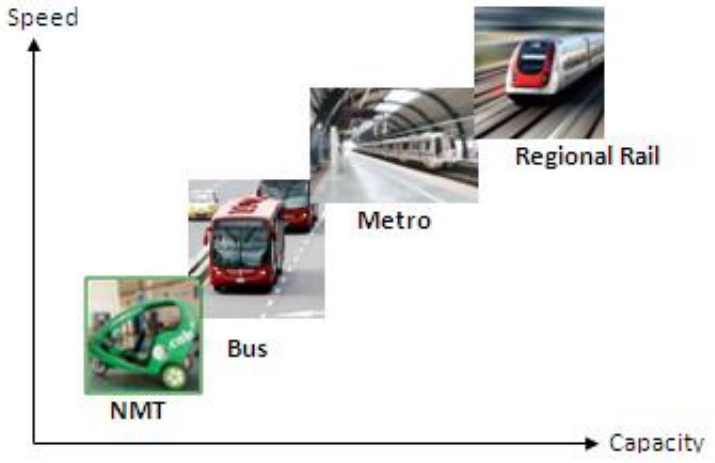
To achieve the goals set for the study area, of achieving the modal share of 50% and 60% by 2024 and 2034 respectively in favour of public transport, the ICMP for Noida and Greater Noida has proposed adoption of a number of strategies for promotion and development of public transport systems. These strategies include:

1. Development of heirarchy of public transport systems which shall include:
    - Higher Order Public Transport System
    - Middle Order Public Transport System
    - City Bus service
    - Improvement and regularisation of Intemediate Public Transport (IPT)
2. Improvement and development of adequate infrastructure for promotion of public transport and multi-modal integration
3. Implementation of ITS for improving reliability of public transport
4. Initiating reform measures in Urban Transport
5. Promoting public participation and campaigning mass awareness programme
6. Encouraging private sector in promotion of public transport
7. Adoption of private vehicle usage reducing strategies and policies

Hierarchy of Public Transport

For longer journeys, regional rail and metro stations will be at key locations so travellers will be able to transfer directly from local services to fast long distance services. Parking will be provided at key interchanges to enable travellers to park-and-ride.

The layered hierarchy of public transport will cater for a wide range of travel needs from short distance trips by Middle order system (tram, bus, IPT)to longer distance trips by Higher order system (metro and rail).



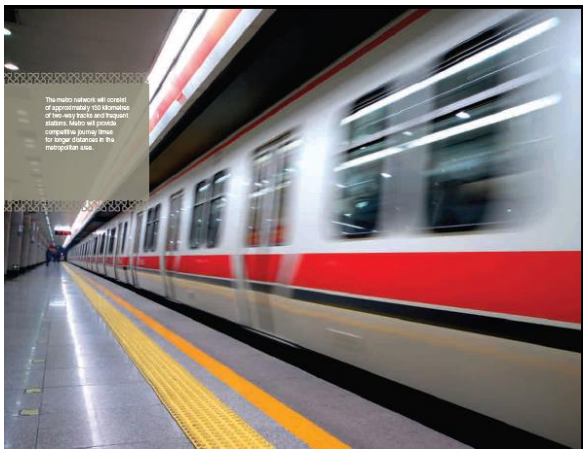
The complete public transport network will be designed and operated as a single integrated system so that a high level of accessibility is maintained irrespective of location or service. There will be a single fare system that does not impose extra transfer costs, a timetable that minimises waiting time and real-time information for all potential travellers, including updates in the event of delays or disruptions. Provision will also be made for convenient and safe walking and cycling to access the public transport system and to serve more local journeys.

The full hierarchy of modes is as follows:

Regional Rail: Regional rail will provide intercity trains from Greater Noida to neighbouring urban areas. The service will interchange with the Metro and other modes at the proposed transport hub at Boraki in Greater Noida which will have Railway Station, ISBT, City bus service, Metro, Multi-level Car parking etc.

Metro: Metro will provide fast, high-capacity services to connect both the cities with Delhi and Ghaziabad (refer). One metro line is currently operational having six metro stations in Noida.

The metro network will consist of approximately 47 kilometres of two-way tracks and frequent stations. Metro will provide competitive journey times for longer distances for Noida and Greater Noida connectivity.



Trams: The tram provides frequent and reliable services covering the more densely developed areas where the higher capacity can be justified, with a fine-grained network providing excellent accessibility.

Bus: The bus system provides an ideal extension to the public transport network in locations where travel needs do not demand the capacity provided by metro. Bus will provide frequent and reliable services with peak period frequencies of at least 6-8 buses per hour on a fine-grained network providing excellent accessibility within Noida, within Greater Noida and for Noida-Greater Noida Connectivity. Feeder buses are also proposed for all existing and proposed metro stations to provide the better connectivity for the catchment areas. School and Company buses will be provided where appropriate. The overall bus network will be developed and extended into a comprehensive system.

The stops will be located every 400-500 metres so that most people can reach a stop with no more than a 300 metre walk. Well-integrated interchanges with the metro are provided so travellers can seamlessly transfer to the metro for longer distance journeys. Similarly, at key bus stops, interchanges with feeder bus and IPT will be provided to permit easy transfers for last mile connectivity. All stops will be provided with waiting shelters (with passive cooling technology wherever possible) providing a comfortable waiting environment with real-time bus service and inter-modal

connection information provided by built-in displays and will be fully integrated with the pedestrian and NMT network serving the local area.

Intermediate Para transit (IPT) : Metered auto rickshaw will continue to provide a door-to-door service for those willing to pay the higher fares. Shared auto rickshaws are proposed to run on route permits instead of area permits (current practice).

In order to address short-term issues, to support provision of park and ride, and to enhance the existing bus services there is a need for bus priority measures to be introduced. To ensure that the transport infrastructure projects contribute towards the strategy of providing high quality alternatives to the private car; the following initiatives are proposed to be developed.

6.3.1 Higher Order Public Transport System

Higher Order Public Transport refers to the systems including Commuter Rail, Metro etc. The total metro network in the study area will consist of 3 lines of approximately 47 kilometres of two-way tracks and frequent stations as per the approved alignments including current metro line of approx. 6.5 km and 6 metro stations. Metro will provide competitive journey times for longer distances for the connectivity of Noida and Greater Noida.

Following three metro lines are under construction, and once completed, will provide fast connectivity from Noida and Greater Noida to Delhi and Ghaziabad (refer Figure 6-10).

1. From Delhi to Botanical Garden via Kalindi Kunj : this 3.8 km (3 stations) under construction stretch is expected to be commissioned by 2016.

2. From Noida City Centre Metro Station, Sectro 32 to Electronic city, Sector 62 : this 6.675 km (6 stations) stretch is expected to be commissioned by 2017

3. From Sector 72, Noida to Theta II, Greater Noida along Expressway : this 29.707 km (22 stations) stretch is expected to be commissioned by 2017

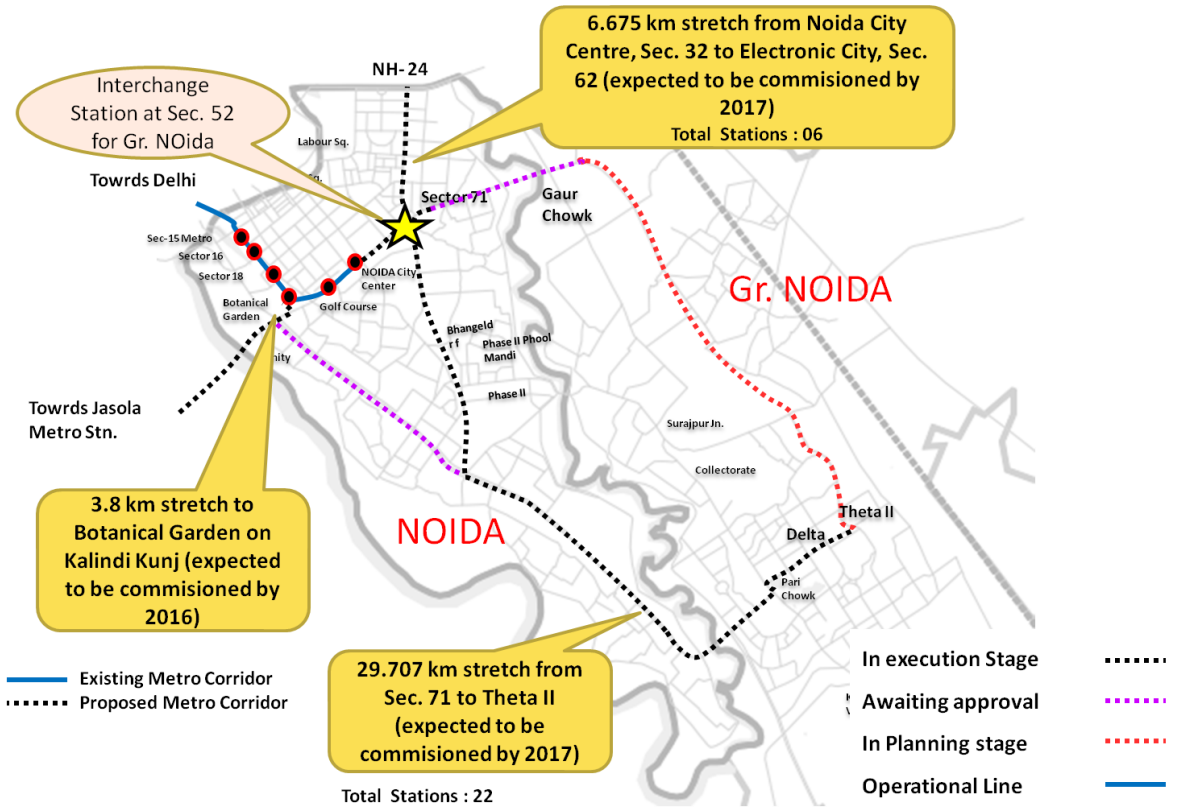


Figure 6-10 : Metro Network

6.3.2 Middle Order Public Transport System

Middle Order Public Transport refers to the rapid transit systems including Bus Rapid Transit, Monorail, LRT, tram etc. These systems have higher carrying capacity and network speed compare to the existing bus service. The role of middle order system is to cater more trips along the mobility corridors by public transport mode in an efficient manner. The higher order and middle order system selection is based on the Passengers per Hour per Direction (PPHPD), cost and feasibility of implementation, along with other parameters. As part of the Middle Order Public Transport System development one of the potential corridor based on preliminary assessment has been identified as a 12.6 km route from Botanical Garden to Sec. 144 ISBT (MMTH) via Expressway. However, a detailed feasibility study needs to be done so as to assess the techno-economic feasibility of the tram route as also given in the figure below:

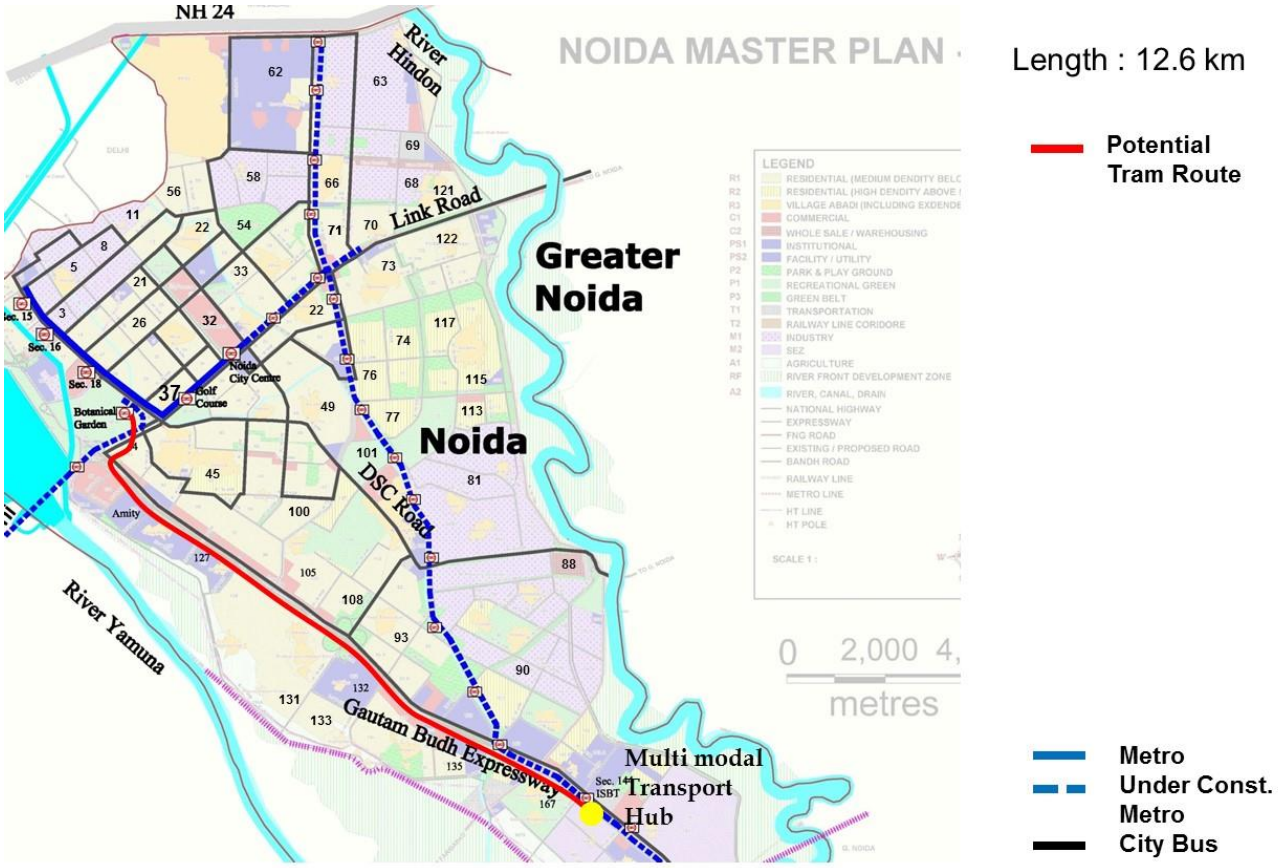


Figure 6-111 : Potential Tram Route

6.3.3 Introduction of new city bus service

The new city bus system is proposed to be confined mainly on the mobility corridors. All other forms of inter-mediate public transport system shall be allowed to ply on all other corridors so as to give a dedicated ridership base to the city bus system. Keeping different routes/ corridors shall also ensure that the ridership base of IPT modes do not overlap with the city bus system and the systems shall complement each other in terms of trunk and feeder routes.

The public transport system is proposed to be strengthened in Phase II and Phase III through introducing high density bus corridors on different links in the proposed mobility corridors. The high density bus corridors have a higher frequency of buses (3 to 4 buses every 10 minutes) passing through them and requires an increase in fleet size of the city bus system.

However, a detailed feasibility study shall be required to determine the alignment of the proposed system in the future. The feasibility study shall have to take into account various criteria such as available ROW, turning radius and ridership among others.

The bus fleet shall require expansion in subsequent phases to cater to the increasing frequency and coverage of service. The infrastructure for the public transport system shall have to be accordingly upgraded through provision of terminals, depots and workshop for the city bus system. Further, bus-queue shelters shall have to be provided at appropriate places to provide comfort to waiting passengers and avoid chaotic stoppage of buses and associated boarding-alighting of passengers. These have been detailed in the subsequent sections.

The bus service in Noida and Greater Noida is proposed to be improved by adopting the following sub-strategies:

1. ***Segregation of intercity and intra-city bus service***

   Currently, there is no segregated city bus service in Noida and Greater Noida. The same service is provided by Uttar Pradesh Road Transportation Corporation (UPSRTC), Delhi Transport Corporation (DTC) and by private operators in Noida while in Greater Noida, only UPSRTC buses provide intercity and intracity connectivity. As the existing bus service is not able to meet the demand for public transport system of both the cities, there is an urgent need to segregate the inter city and intra city bus services by introducing new intra city system which will provide a high level of connectivity within the city with the integration of other modes also.

2. ***New city bus service with high frequency and good network coverage***

   The existing frequency of UPSRTC and DTC buses varies from 15 minutes to 60 minutes. Thus, in order to rationalize the frequency and to improve the reliability of city bus service, the ICMP for Noida and Greater Noida has suggested improvement of bus service by augmenting the frequency of service on intercity routes while for intracity, new bus service is proposed. City bus service should have the minimum frequency of 5 minutes during peak hours as per the demand.

3. ***Introduction of new feeder buses for metro stations:***

   Currently six metro stations are operational in Noida. It has been proposed that all the metro stations should be provided with the feeder service to connect the catchment area within 5 km radius.

4. ***Bus fleet expansion***

To achieve the public transport system as explained above, the fleet of the city bus system shall have to be suitably augmented over the years to support a desirable level of service. This shall have to be done in various phases as given in Table 6-1. The bus fleet calculation has been done keeping in mind the type of system proposed on various corridors and the estimated headway required to service the demand. It may be noted however that additional fleet acquisition might be needed from time to time to replace the aging buses.

Table 6-1 : Bus Fleet expansion in base year and horizon years

	2014	2024	2034
No. of buses for acquisition	392	527	654

5. ***Development of feeder Service to connect New depot cum terminal for city bus service at Sec. 90, Noida with the UPSRTC depot (inter city) at Sector 35, Noida:***

In order to promote public transport in Noida and Greater Noida, the regional bus service originated/terminated at Morna depot (Noida) should be integrated with city bus service, which has been proposed to originate/terminate at Sector 90, Noida. Thus, for integration of regional bus service and city bus service, the ICMP has suggested to ply feeder service between old and New depots.

6. ***Installation of ITS at bus stops and on buses for better reliability of the system:***

Intelligent Transport System (ITS) plays a crucial role in promoting public transport in recent times. The detailed ITS application for improving city bus service is described in ITS for Public Transport section.

6.3.4 Public Transport Corridors

The output of transport model has highlighted major corridors which need to be well thought-out for selecting higher and middle order public transport system in the study area. The corridors comprise Expressways, Link road, DSC road, 130 M road, 105 M Road etc. These corridors have been evaluated by the travel demand model. The passenger carrying capacities on these mobility corridors for the horizon year have been predicted in the model. The capacities are expressed as "passengers per hour per direction (PPHPD)". The PPHPD values are estimated incorporating the land-use transport strategy like TOD and PT strategies.

The public transport plan for Phase I (2014), Phase II (2024) and Phase III (2034) is given in Tables 6-2 to 6-4 and in Figures 6-7 to 6-9.

Table 6-2 : Public Transport Plan for Phase I (2014)

S. No.	Identified PT Corridors	Expected PPHPD	Type of System
1	DND Flyway (Delhi –Noida)	2296	High Capacity Bus System
2	IOC Gol Chakkar to Sec. 37 junction	3494	High Capacity Bus System
3	DSC Road (Sec. 37 to GT Road via Dadri Rly Crossing)	2684	High Capacity Bus System
4	Surajpur Junction to Kasna	1389	City bus System
5	Kalindi Kunj Bridge (South Delhi – Sector 37 Junction)	1430	City bus System
6	MP 3 Road (Sec. 37 junction to Sec. 52 junction	2575	High Capacity Bus System
7	Sec-52-72 Junction to Gaur chowk	690	City bus System
8	130 Mts Road (Gaur Chowk to Theta –II Sector)	590	City bus System
9	Mini Ghaziabad Road (NH-24 to Gaur chowk)	564	City bus System
10	Entry Road (from Gaur chowk to Surajpur junction)	402	City bus System
11	Noida – Greater Noida Expressway	2892	High Capacity Bus System
12	Sec-62 Junction to Sec-52-72 Junction	980	City bus System
13	Bisrakh Village Bridge (Noida - Greater Noida)	1065	City bus System
14	FNG Expressway (Faridabad – Noida)	1491	City bus System
15	G.T. Road (Greater Noida – Faridabad)	1347	City bus System

Figure 6-7: Public transport plan for Phase I (2014)

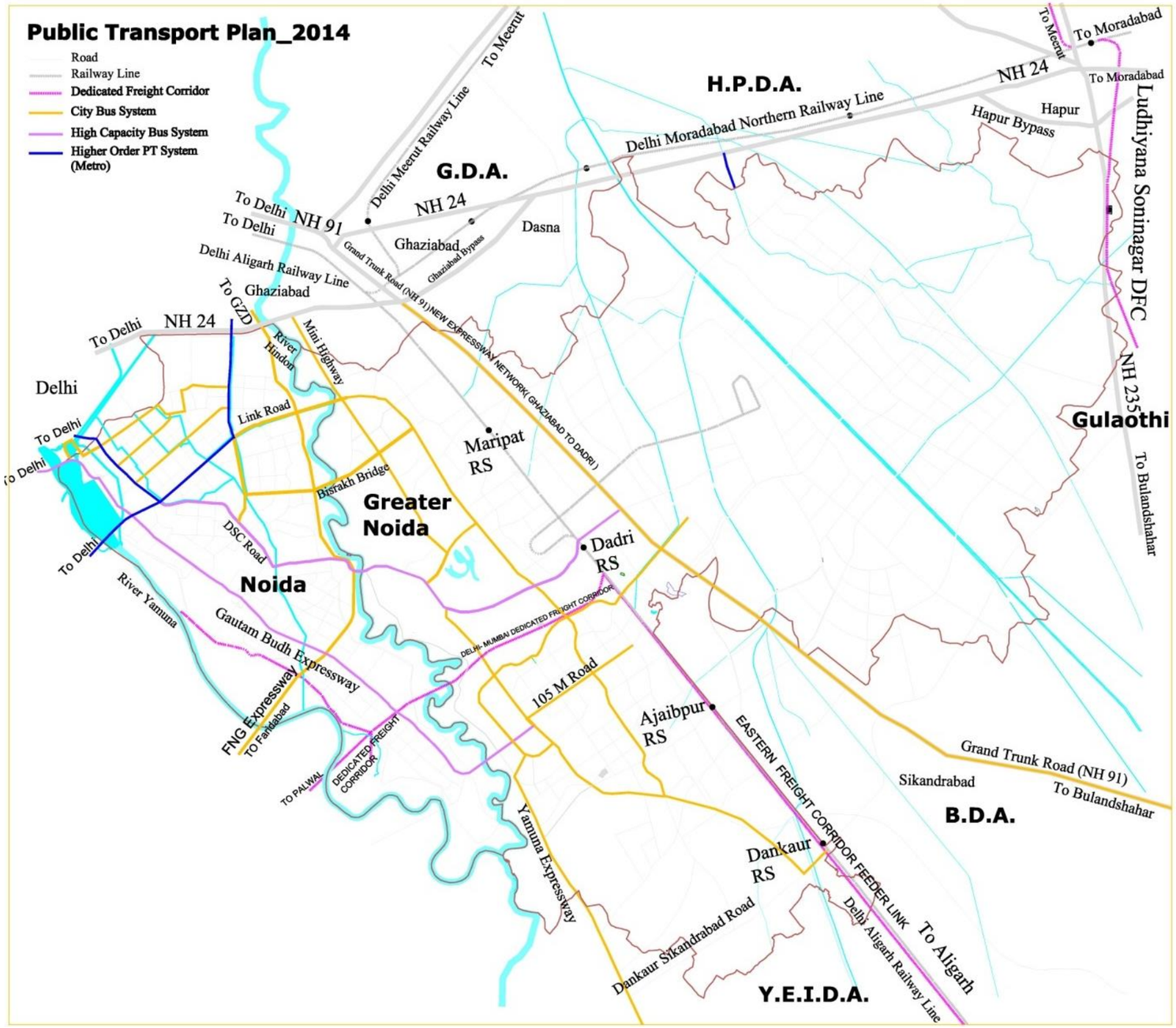


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Table 6-3 : Public Transport Plan for Phase II (2024)

S. No	Identified PT Corridors	Expected PPHPD	Type of System
1	DND Flyway (Delhi –Noida)	7329	Middle Order System
2	IOC Gol Chakkar to Sec. 37 junction	8650	Middle Order System
3	DSC Road (from Sec. 37 junction towards EP expressway via Dadri RoB)	9865	Middle Order System
4	Surajpur Junction to Kasna	10232	MiddleOrder System
5	Kalindi Kunj Bridge (South Delhi – Sector 37 Junction)	8315	Middle Order System
6	MP 3 Road (Sec. 37 junction to Sec. 52-72 junction	8575	Middle Order System
7	Sec-52-72 Junction to Gaur chowk	9132	Middle Order System
8	130 Mts Road (Gaur Chowk to Theta –II Sector)	6874	Middle Order System
9	Mini Ghaziabad Road (NH-24 to Gaur chowk)	3950	High Capacity Bus System
10	Entry Road (from Gaur chowk to Surajpur junction)	4250	High Capacity Bus System
11	Noida – Greater Noida Expressway	8758	Middle Order System
12	105 mts Road (Theta II to GT Road)	13500	Higher Order System
13	Sec-62 Junction to Sec-52-72 Junction	7692	Middle Order System
14	Bisrakh Village Bridge (Noida - Greater Noida)	8377	Middle Order System
15	FNG Expressway (Faridabad – Noida)	4751	High Capacity Bus System
16	G.T. Road (Greater Noida – Faridabad)	6874	Middle Order System
17	Eastern Peripheral Expressway (Ghaziabad - Greater Noida)	6351	City Bus System
18	Dankaur-Sikandarabad-Gulaothi Road	6532	City Bus System
19	From GB University to GT Road via Ghodi Bachheda	2124	High Capacity Bus System

Figure 6-7: Public transport plan for Phase II (2024)

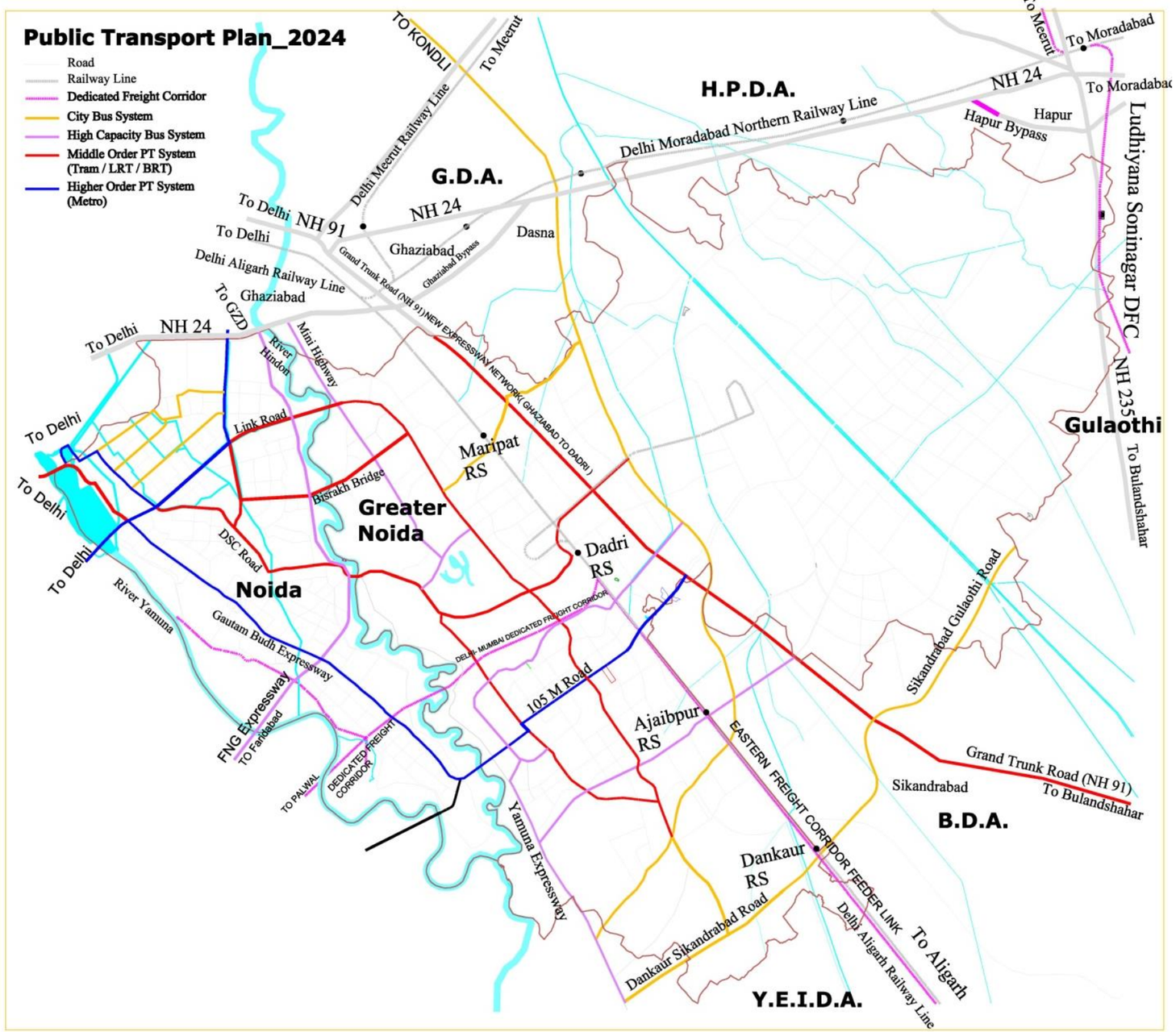

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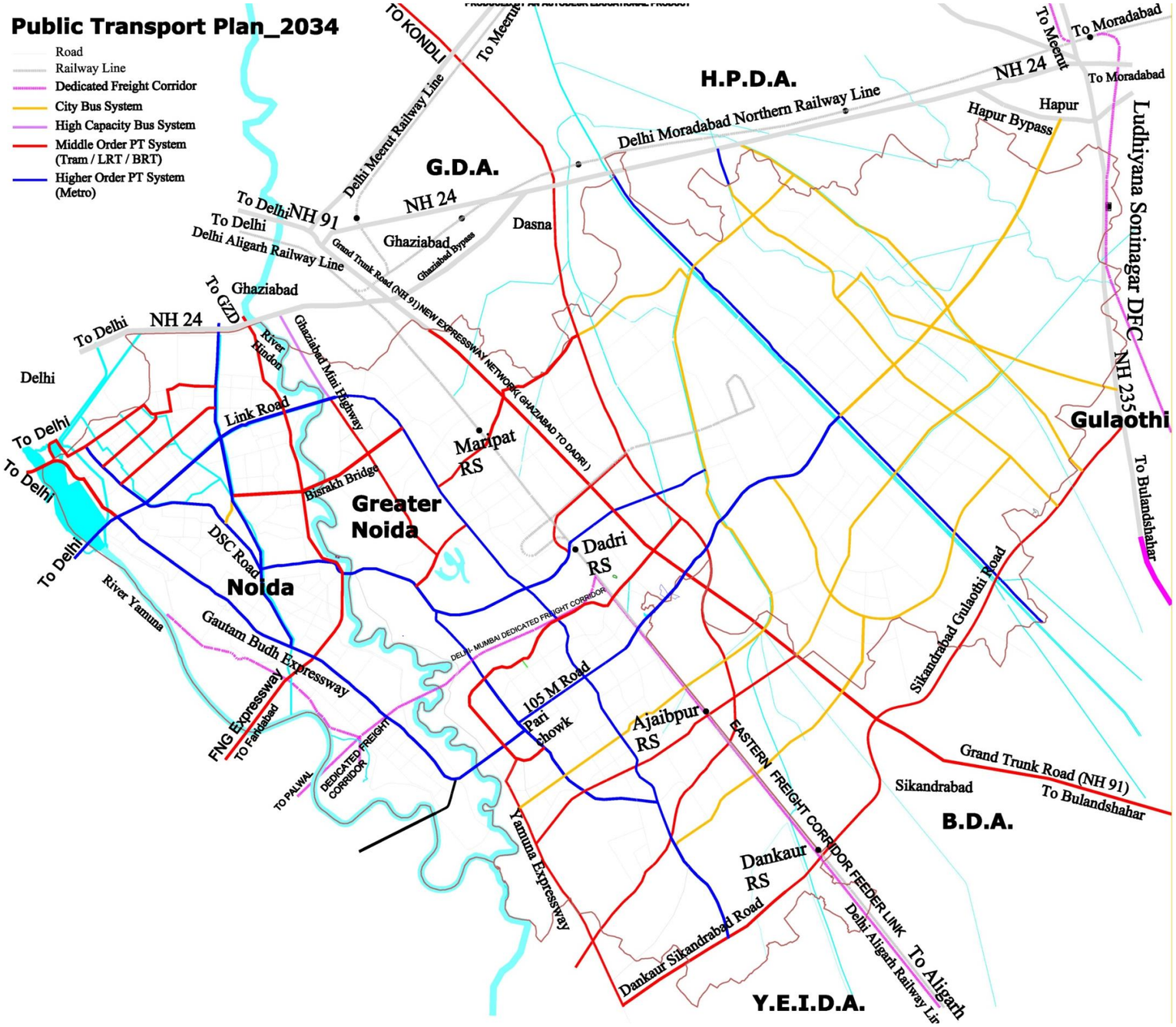
Table 6-4 : Public Transport Plan for Phase III (2034)

S. No.	Identified PT Corridors	Expected PPHPD	Type of System
1	DND Flyway (Delhi –Noida)	8971	Middle Order System
2	IOC Gol Chakkar to Sec. 37 junction	12422	Higher Order System
3	DSC Road (from Sec. 37 junction towards EP expressway via Dadri RoB)	13945	Higher Order System
4	Surajpur Junction to Kasna	15642	Higher Order System
5	Kalindi Kunj Bridge (South Delhi – Sector 37 Junction)	9280	Middle Order System
6	MP 3 Road (Sec. 37 junction to Sec. 52-72 junction	13200	Higher Order System
7	Sec-52-72 Junction to Gaur chowk	13024	Higher Order System
8	130 Mts Road (Gaur Chowk to Theta –II Sector)	14400	Higher Order System
9	Mini Ghaziabad Road (NH-24 to Gaur chowk)	5432	High Capacity Bus System
10	Entry Road (from Gaur chowk to Surajpur junction)	9120	Middle Order System
11	Noida – Greater Noida Expressway	20115	Higher Order System
12	105 mts Road (Theta II to GT Road)	19870	Higher Order System
13	Sec-62 Junction to Sec-52-72 Junction	12490	Middle Order System
14	Bisrakh Village Bridge (Noida - Greater Noida)	12320	Middle Order System
15	FNG Expressway (Faridabad – Noida)	10124	Middle Order System
16	G.T. Road (Greater Noida – Faridabad)	8346	Middle Order System
17	Eastern Peripheral Expressway (Ghaziabad - Greater Noida)	8437	Middle Order System
18	Dankaur-Sikandarabad-Gulaothi Road	9246	Middle Order System
19	From GB University to GT Road via Ghodi Bachheda	8344	Middle Order System

Figure 6-7: Public transport plan for Phase III (2034)



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From the estimated PPHPD table, it is evident that the twin city needs a metro system on the three major identified TOD corridors by the year 2034. The rest of the mobility corridors can have Middle order system. The Middle order system can be the feeder system for the proposed metro on the designated corridors. The city buses and feeder buses, in turn, can act as feeders to the Middle order system.

6.3.5 Intermediate public transport management plan

The Intermediate Public Transport (IPT) System comprising cycle-rickshaws, auto rickshaws, shared tempos and auto-rickshaws presently caters to a large percentage of daily trips. However, since the introduction of the city bus system, competition on the roads between the IPT modes and the city bus service has risen. While it has been proposed to give exclusive operational rights to the city bus service on the proposed mobility corridors, it is in turn proposed to give exclusive operational rights to the IPT modes for corridors that do not lie on the mobility corridors. While on one hand, this shall ensure a dedicated non-competitive passenger base for both the city bus and the IPT modes and additionally ensure that the IPT system acts as a feeder to the city bus system. This shall financially benefit both the systems. Shared auto-rickshaws should be issued route permits/ licenses instead of area permits (current practice) across mobility corridors. These circular routes shall have to be worked out by the RTO in consultation with the auto-rickshaw drivers' union and other concerned stakeholders.

Auto-rickshaws should be issued area-based permits/ licenses with permission to ply on all roads and corridors including the mobility corridors. This shall be necessary since they cater end-to-end trips and hence they would require access to all roads and links.

To manage the cycle rickshaws, the entire city is proposed to be divided into various zones. For each zone, the cycle rickshaws can be given different colours/ colour based identification devices along with their licenses with each cycle-rickshaw bearing a particular colour being permitted to ply in 2-4 contiguous zones only. This shall not only organise the entire system but also help in regulating the supply of cycle-rickshaws in the twin-city. Again, the cycle rickshaws shall not be allowed to ply on the mobility corridors but shall ply on all roads cutting across the mobility corridors.

6.3.6 Infrastructure for Public transport

For development of three tiers of public transport, it is imperative to develop adequate infrastructure. Considering the multimodal integration of different types of

public transport, there should be a complete and supportive public transport infrastructure.

Following infrastructure elements are to be provided in a phased manner:

- Construction of new BQS along PT corridor and upgradation of existing BQS
- Development of new depot cum terminal for city bus service at Sector 90 in Noida and Kasna in Greater Noida
- Development of new ISBT at Sector 144 in Noida and at Boraki in Greater Noida
- Installation of ITS at bus stops and on buses for better reliability of the system

6.3.7 Integrated Multi modal System

The future of transport in Noida and Greater Noida transcends individual modes of travel. Many journeys will utilise a number of transport modes, with each mode functioning effectively not only in isolation, but in concert with the other modes.

For example, a traveller's journey could begin in a residential neighbourhood in sector 6 of Noida, where he/she might take a feeder bus or NMT (cycle rickshaw or battery operated rickshaw) to the nearest metro station (Sector 15 metro station) that rapidly transports him/her to the destined station at Knowledge Park (Greater Noida) including one interchange of metro at Sector 52 and finally switch to a feeder or NMT for his/her desired destination at Sharda University.

The Integrated Comprehensive Mobility Plan is designed to ensure that this journey is as efficient and pleasant as possible. It calls for two key ingredients to ensure a successful network-wide travel experience:

1. A comprehensive, "macro" level approach. The ICMP approaches transport planning comprehensively, ensuring that the sum of its individual parts equals a

highly coordinated and integrated multimodal transport solution – a solution that will provide travellers with seamless, enjoyable travel throughout the network. Each mode of transport is designed to not only work logically and reliably on its own, but to do so in relation to connecting modes of travel.

2. The inclusion of world-class technology to aid coordination. Best practices in Intelligent Transport Systems (ITS) from across the world are combined to ensure that the residents of Noida and Greater Noida benefit from the best that technology can deliver.

Travel modes are coordinated through integrated travel network management and control systems. Easy-to-use ticketing, travel planning, and real-time travel updates make each journey pleasant and free of logistical barriers.

Travellers will be able to make informed travel choices based on journey travel times, journey cost, and reliability (taking into account the impact of special events and unplanned incidents).

Multi modal transport hub:

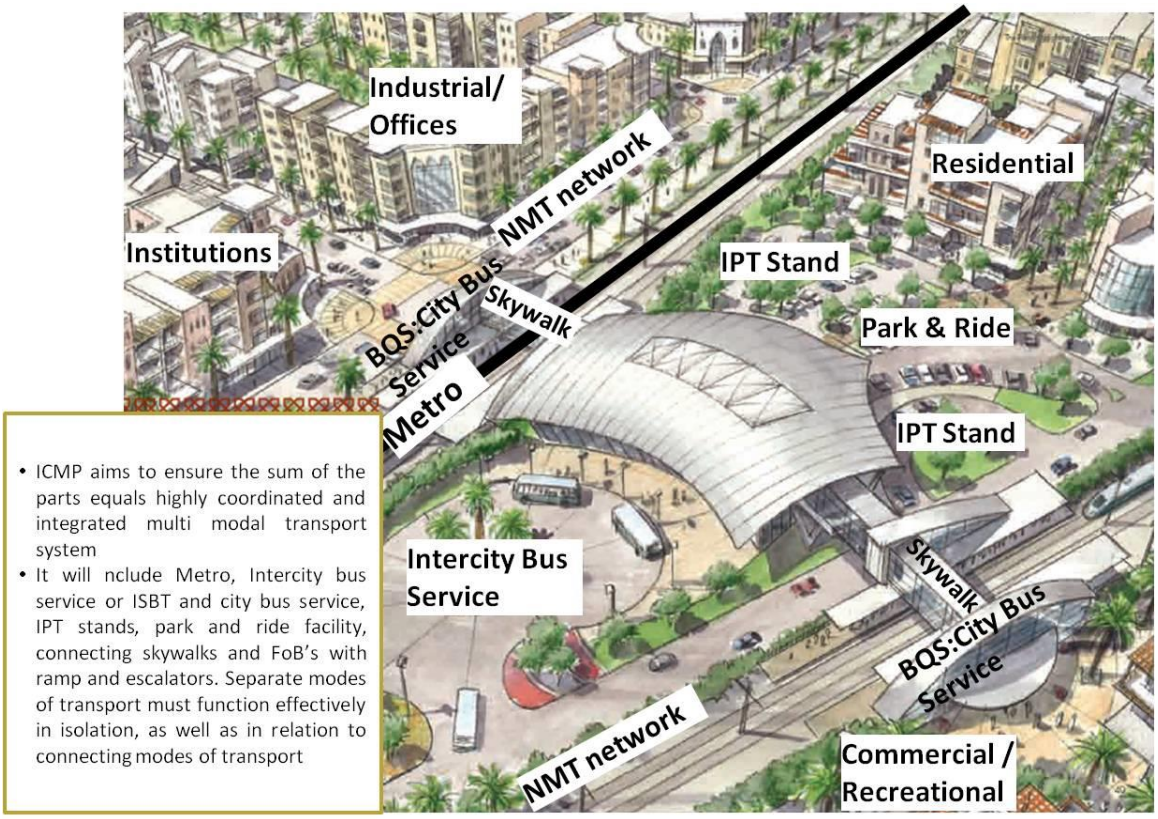


Figure 6-12 : Concept design for Multi modal transport hub

A multimodal transport hub (MMTH) is a place where passengers transfer between different services or modes of public transport as a part of their journey. An MMTH zone is often a gateway to the public transport network, in that it represents the interface between the public transport services and the surrounding area (or the 'urban context'). This includes metro stations, bus stations, IPT stand and connections by the most common mode of access-walking and even by the private car also. An approx. Minimum area of 7 acre is proposed for an individual multi modal hub to incorporate essential components. Figure 6.9 shows the concept layout of multi modal transport hub, which is proposed to give the last mile connectivity to the users.

Importance of a Multimodal Transport Hub: A world-class multimodal transport hub, incorporating best practice, will help to meet the social, economic and environmental needs of a thriving and growing world cities like Noida and Greater Noida including:

- Supporting the continued economic development of the city
- Minimizing the need to travel by concentrating new jobs and homes around accessible locations
- Ease congestion and tackling climate change by promoting more sustainable modes
- To meet the increasing demand for travel by public transport
- Improving access to facilities and services in urban centers
- Providing links between neighborhoods and employment, education and other opportunities
- Improving quality of life by saving time and improving the quality of travel
- Acting as a catalyst for socio-economic and physical regeneration in local communities
- Creating more attractive buildings and public spaces
- Removing barriers which prevent disabled people and others with reduced mobility from travelling freely
- Providing safer and more secure journeys

The goal of this very significant recommendation of Multi-modal Integration at major Metro stations is to provide comfortable last-mile-connectivity options to people. This may be done by:

- Providing well planned and properly designated spaces for all modes such as buses, autos, rickshaws, cycles, etc. within the 5 minute walking catchment of the stations.

- Providing basic amenities like toilets, proper signage, cafes, vendor-stands, lighting, trees, shading devices, etc. for commuters.
- Providing High quality walking environment including safe crossings/ skywalks/ well-shaded walkways/footpaths, etc.
- Providing safety and a sense of safety for all users esp. women and children.
- Direct pedestrian crossovers/skywalks to all neighborhoods/ destinations within the catchment so that people can walk to the metro station directly rather than coming on ground level and looking for motorized transport to cover short distances.

To develop multi modal transport hub and transit interchange points, following locations have been identified:

(I) **Multi- Modal Transport Hub**

For Noida

1. Sec. 144 ISBT

For Greater Noida

2. Boraki Transport Hub

(II) **Major Transit Interchange Points**

For Noida

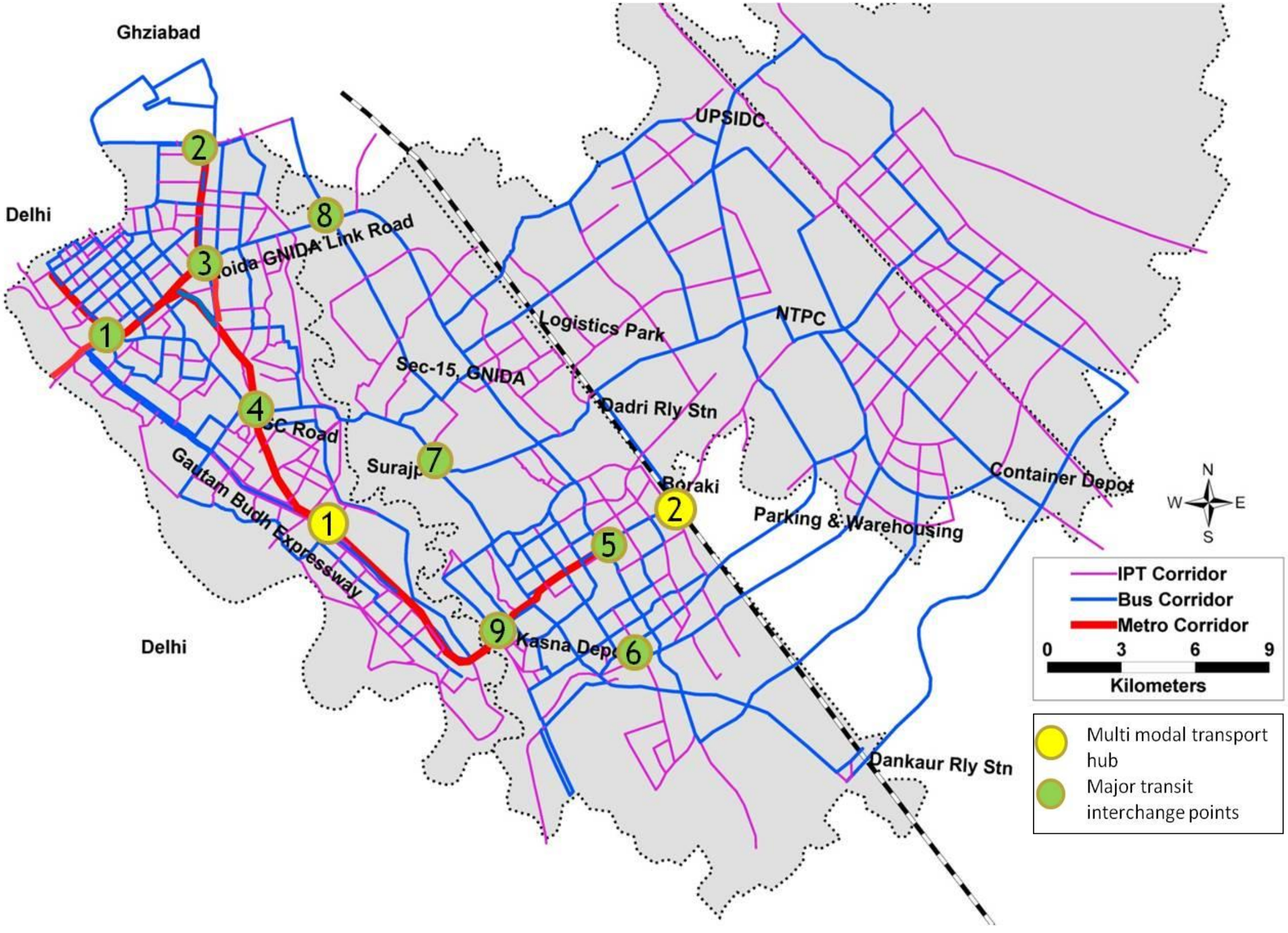
1. Botanical Garden
2. Electronic city, Sector 62
3. Sector 52
4. Sector 82

For Greater Noida

5. Theta II
6. Kasna Depot
7. Surajpur junction
8. Gaur chowk
9. Knowledge Park II

All above Major transit interchange points will integrate more than one transport system

. Figure 6-13 : Location of Multi modal transport hub and major interchange points



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These Multi Modal Transit Hub and major transit Interchange Points will have park and ride facility i.e. development of private vehicle parking lots at these locations to support public transport. Developing parking lots at the transit locations will generate additional ridership.

The major components of a multi-modal transport hub are given below:

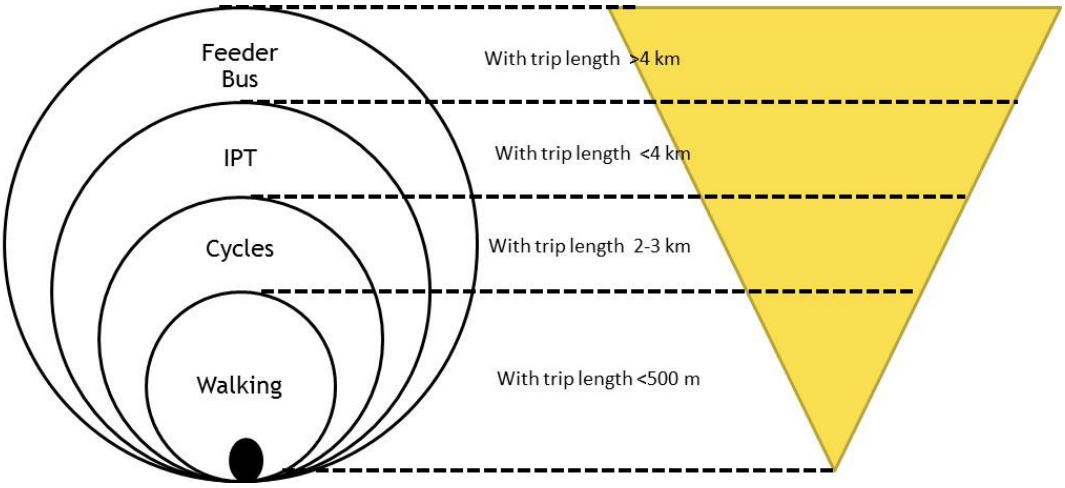
Approx. Area : Minimum 7 acre as per the requirement

2 acre for metro, 3 acres for bus bays and idle bus parking, 1 acre for car and IPT parking (MLCP) and 1 acre for other services like control room, ITS etc.

- Infrastructure facilities for city bus services integrated with Higher and Middle order public transport system and Intercity bus service including shared bus bays, idle bus parking slots etc., passenger terminals etc.
- Waiting area
- Office space
- Central control room
- Ticket counters
- Passenger information centre
- Facilities for park and ride system (for cars, 2-w, cycles)
- Facilities for IPT stand
- Retail/commercial area as revenue generating sources

6.4 Improving First and Last Mile Connectivity

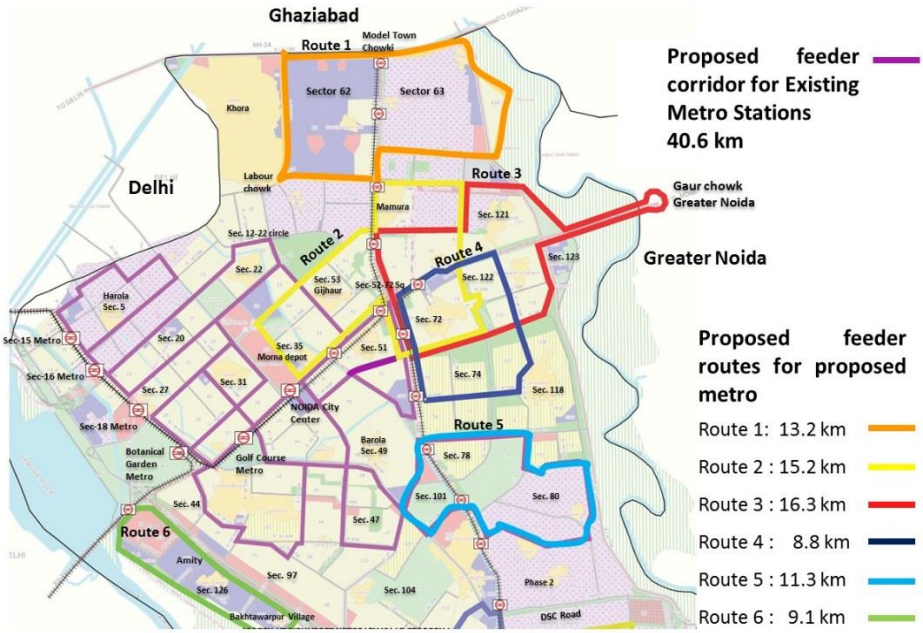
The First and last mile constitute 50% of the total travel time of the average metro user. A convenient first and last mile connectivity reduces total travel time and makes fixed systems like metro more flexible and expands their reach resulting in increased ridership. It helps connect low demand areas with metro systems at a low cost and also reduce the parking demand at metro stations. The Choice of feeder mode is a variable of access/egress trip length of metro commuter. The various options available for first and last mile connectivity is given in the figure below:



As part of the strategy for improving first and last mile connectivity, it is proposed to develop a network that covers almost each and every sector which will consist of a feeder bus system such that the distance between two parallel routes ranges from 800 – 1100 m i.e. effective distance is 400 – 550 m which is a walkable distance.

It would also include provision of Auto rickshaw and Cycle rickshaw stand at each bus stop for last mile connectivity and provision of PBS docking stations at all metro stations, sector markets, Institutional buildings etc.

The proposed feeder routes for metro system in Noida and Greater Noida is given in Figure below:



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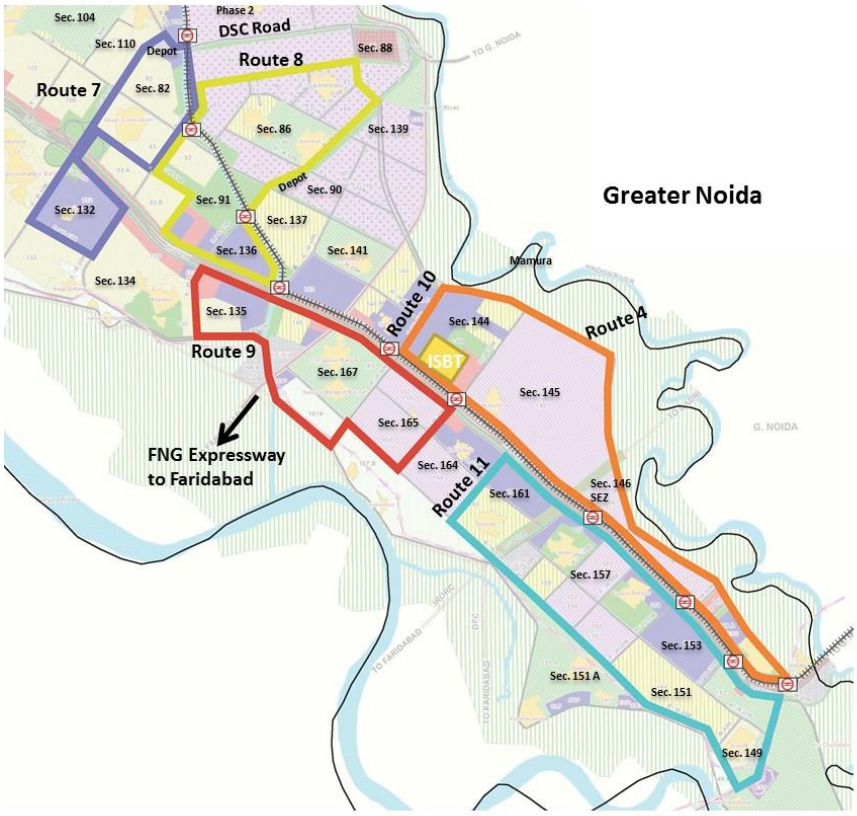


Proposed feeder routes for proposed metro

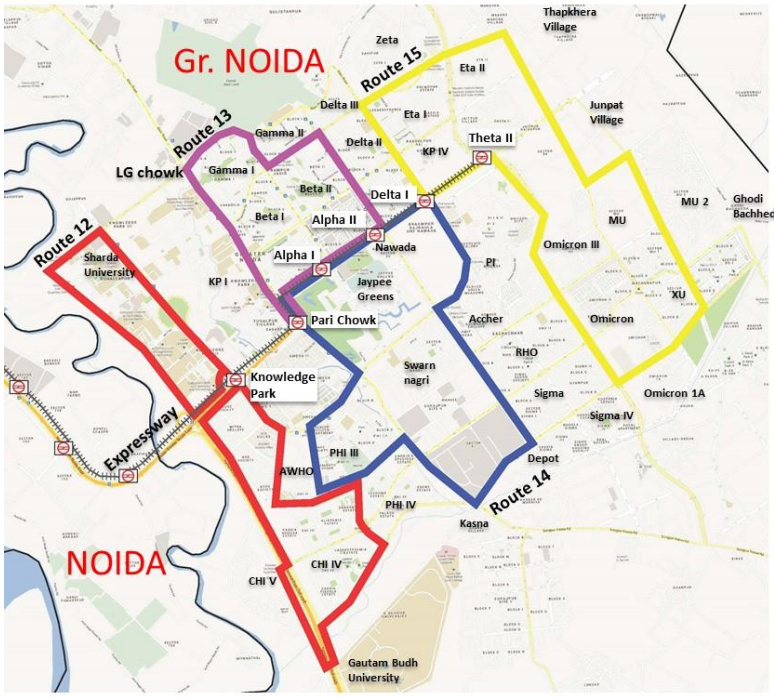
Route 7 : 10.5 km

Route 8 : 11.5 km

Route 9 : 11.0 km

Route 10 : 17.4 km

Route 11 : 14.4 km



Proposed feeder routes for proposed metro

Route 12 : 19.7 km

Route 13 : 9.5 km

Route 14 : 15.2 km

Route 15 : 16.9 km

6.4.1 Bike Sharing Scheme

A Public **bicycle sharing system** is a service in which bicycles are made available for shared use to individuals on a very short term basis. Bike share schemes allow people to borrow a bike from point "A" and return it at point "B". Many bike-share systems offer subscriptions that make the first 30–45 minutes of use either free or very inexpensive, encouraging use as transportation. This allows each bike to serve several users per day. In most bike-share cities, casual riding over several hours or days is better served by bicycle rental than by bike-share. For many systems, smartphone mapping apps show nearby stations with available bikes and open docks.

Today, more than 600 cities around the globe have their own bike-share systems, and more programs are starting every year. The largest systems are in China, in cities such as Hangzhou and Shanghai. In Paris, London, and Washington, D.C., highly successful systems have helped to promote cycling as a viable and valued transport option. Each city has made bike-share its own, adapting it to the local context, including the city's density, topography, weather, infrastructure, and culture. Although other cities' examples can serve as useful guides, there is no single model of bike-share.

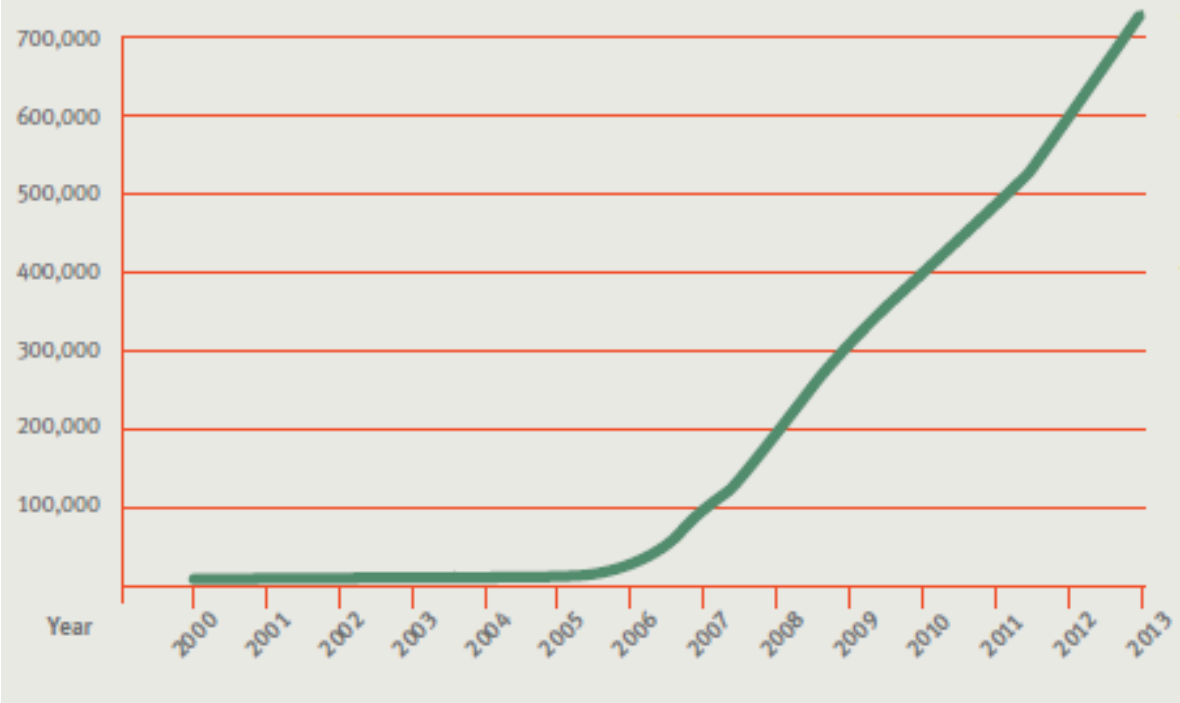


Figure 6-14 : Growth of Bike-share Worldwide (January 2000-July 2013)

1.1 Role of Public Bike in Urban Transportation

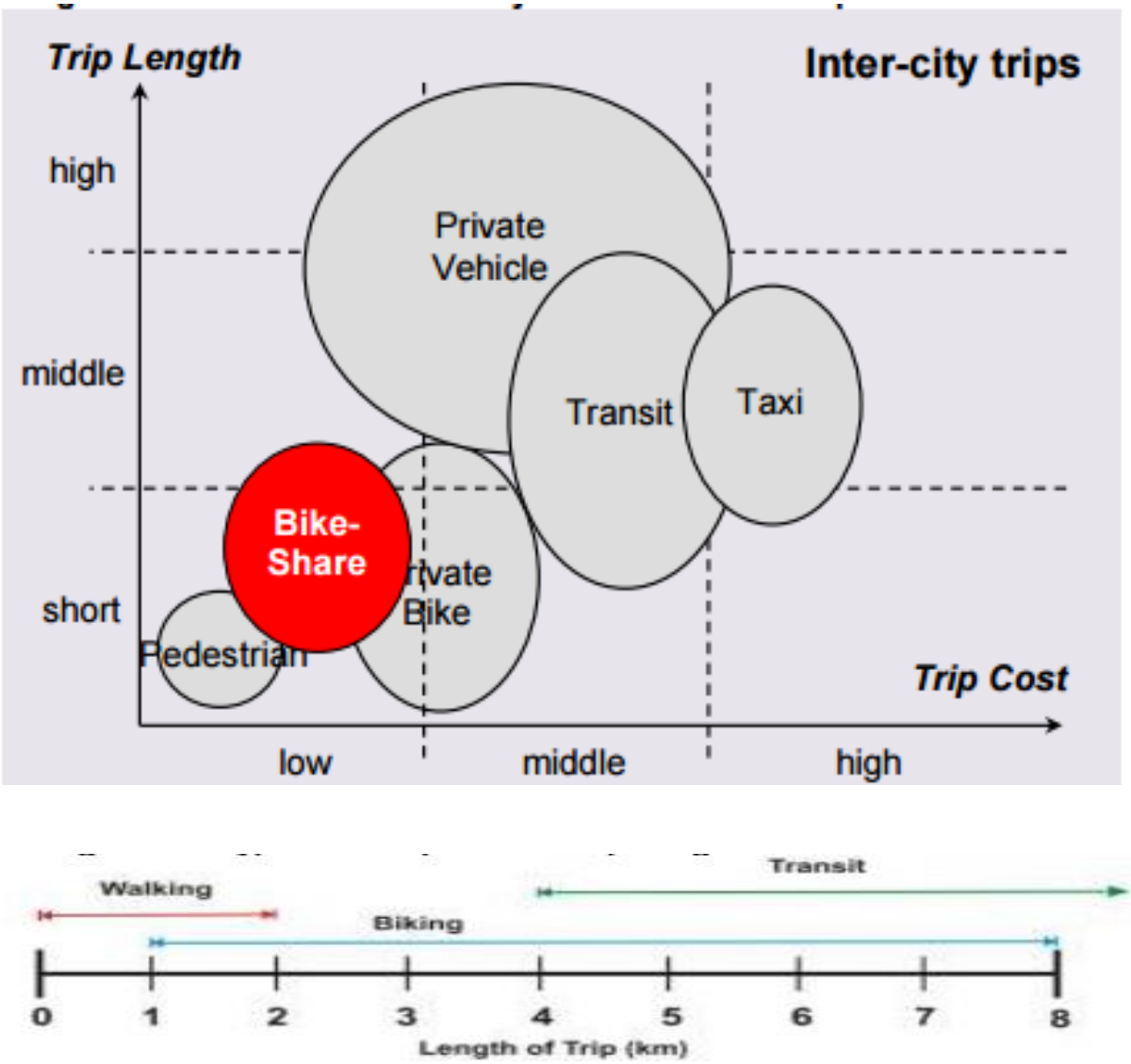


Figure 6-15 : Typical Transportation Trip Lengths

The travel distances that are presented at Figure 2.2 to indicate the gap filled by cyclists between typical walking and transit journey distances. These distances are not fixed boundaries as some people will walk longer distances or take transit over shorter distances. Its purpose is to highlight the flexibility that cycling provides over short distances.

It is important to establish that a PBS is an expansion of the public transportation system by its ability to supplement and enhance 'conventional' transit modes. This is particularly evident where PBS trips are linked to conventional transit trips at the start and / or end of the journey, or by filling gaps in the conventional transit network coverage.

1.2 Benefits of Bike Sharing

The reasons for implementing a bike-share program are often centered on goals of increasing cycling, reducing congestion, improving air quality, and offering last mile connectivity to the users. Bike-share has two key advantages when compared to other transportation projects: implementation costs are comparatively low and the timeline is short.

Following are the PBS benefits:

Individual

_ Increased mobility choices
_ Cost effective
_ Reduced travel times
_ Increases private bike use
_ Makes cycling safer for all cyclists
_ increases visibility, awareness & understanding of cyclist behaviour
_ Health benefits

City

_ Improves liveability of city
_ Positive public image for city and region
_ Supports pedestrian and transit modes
_ Increases number of social interactions - connects community
_ Shifts thinking about the use/allocation of road space
_ Increases local retail utilization

Transit

_ Effective 'last mile' for transit
_ promotes multi-modal trips
_ Potential to increase transit ridership
_ extends reach of transit network to micro destinations
_ Popular service
_ Subscription rates & customer satisfaction levels
_ Cost effective
_ Speed of implementation
_ Increased capacity
_ Mode shift from bus/rapid transit to bikes frees up capacity

Environment

_ Zero emission
_ Green house gas savings
_ 200g less CO2 per km travelled

1.3 Components of Public Bike Sharing (PBS) System

A typical PBS consists of a fleet of bicycles, a network of automated docking stations to store and access the bicycles, a user registration system, a system status information system, a maintenance program and a bicycle redistribution mechanism

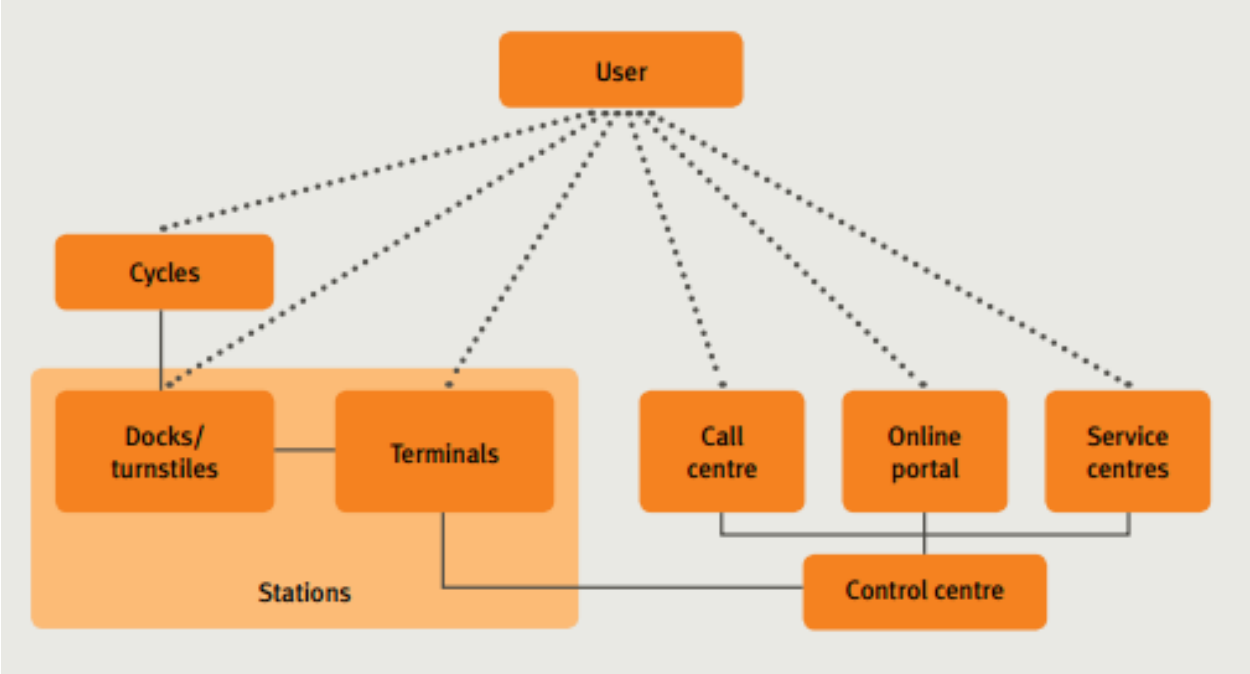
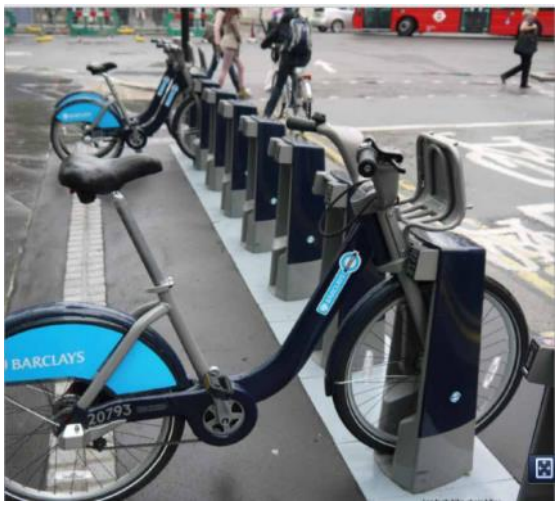


Figure 6-16 : Communications Systems and User-Interface Schematic

1. **Docking spaces** are the places at the station where bikes are parked and locked.



2. **Terminals** are places where users can get information about the system and check in and out bicycles. They can be self-service dynamic interfaces for the customer or static information systems that tell users how to check in or out a bike. They can serve as the nexus of communication between the bikes, the docking spaces, and the control center, as well as be the place for payment.

Terminal

Station

3. **Stations** are composed of docking spaces, terminals, and bicycles. Bikes are parked there for users to check out, and spaces should be available for users to return the bikes. Users can get information and pay for using the system. Stations can be manual or automated, or some variation in between. They can also be modular in design or fixed and permanent (i.e. built into the street).

4. **Control Centre** is where the central management of the bike-share system is housed.

5. **Depot** is where bikes are held while being serviced or stored.

6. **Maintenance Unit** is the unit responsible for responding to requests for repairs.

Control Centre

Redistribution Vehicle

7. **Bicycle Redistribution Vehicles** are often flatbed trucks or trailers carried behind vans, to redistribute the bicycles among stations as per the demand and peak hours.

There are four major cost areas in a PBS:

1. Direct capital costs for procuring and installing the system [bicycles and terminals];
2. Direct operating costs for running the system;
3. Associated capital costs for building cycling infrastructure and needed streetscape improvements [lanes and docking station areas];
4. Associated operating costs for maintaining the on-road cycling and docking station Infrastructure

1.4 Bike-Share Essentials

In order for a bike-share system to be well-used and efficient, it must be properly planned and designed. Based on the performance of existing systems across the globe, ITDP has developed the following planning and design guidelines that are characteristic of the best-used and most efficient systems.

Planning Guidelines

- Minimum System Coverage Area: 10 km2
- Station Density: 10–16 stations per km2
- Bikes/Resident: 10–30 bikes for every 1,000 residents (within coverage area)
- Docks per Bike Ratio: 2–2.5 docking spaces for every bike

Bike Guidelines

- Durable
- Attractive
- Utilitarian

Station Guidelines

- Theft-proof locking mechanisms or security system
- Clear signage and use instructions
- Quick and easy electronic bicycle check-in/check-out system

Performance Metrics

- System Efficiency: Average number of daily uses: Four to eight daily uses per bike
- Market Penetration: Average daily trips per resident: one daily trip per 20 to 40 residents

1.5 Detailed Design

Docking Stations for PBS are proposed at all metro stations, Sector markets, city parks and major institutional centres of Noida and Greater Noida.

Total Proposed docking stations in Noida are 82 which includes 38 large Stations with capacity of 50 docks and 44 Small Stations with capacity of 20 docks.

Details are shown in Figure 5-4.

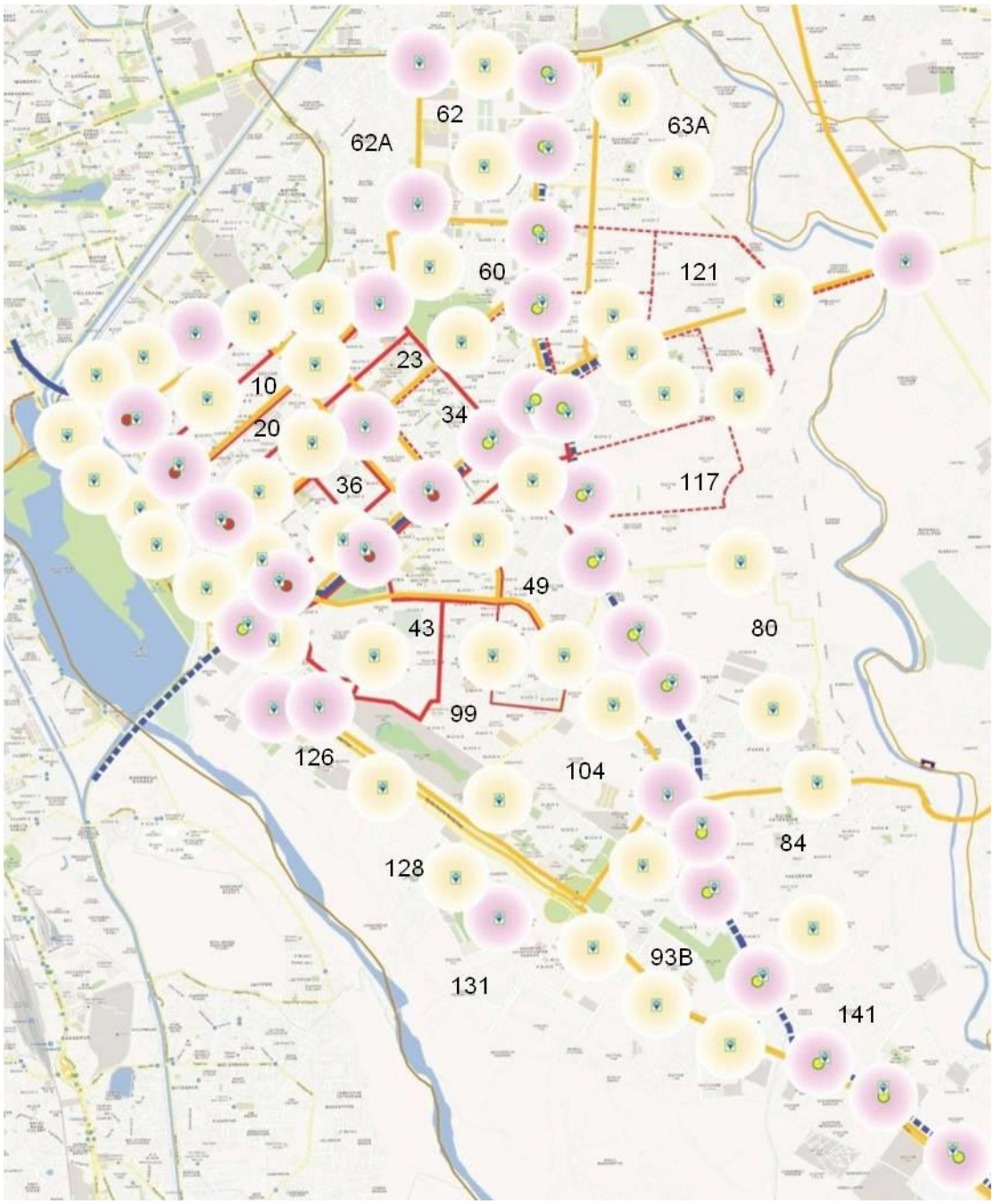
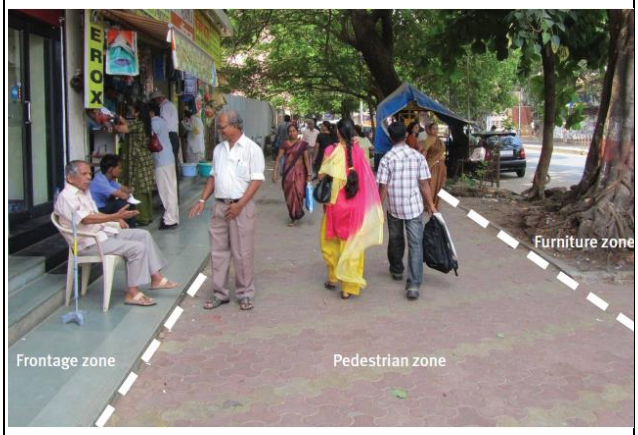


Figure 6-17 : Proposed Docking Stations for PBS in Noida

6.5 Non-motorised Transport Strategy

Provision for pedestrians: "Because all trips begin and end with a walk, walking should be made as comfortable as possible"

Creating a safe and pleasant walking experience throughout the Noida and Greater Noida is critical to encouraging the use of public transport and reducing the number of car trips. The vision for the future, as described before emphasizes the importance of creating an attractive and comfortable pedestrian realm.



Footpaths designed as per the zoning system provide uninterrupted walking space for pedestrians.

Footpaths with proper surfacing and no hindrance can be used by pedestrians

Footpaths with a height of no more than 150 mm are more likely to be used.

Footpaths that maintain a constant level through property entrances are convenient forpedestrians to use. Vehicles use a ramp, helping to reduce speeds.

Improved walking routes are essential in locations where there are high volumes of pedestrian movement or where there are links between transport interchanges and key facilities. Pedestrian amenities must create a perception of safety and security, so that those who walk feel protected from nearby traffic. A visually attractive environment will also encourage walking by making it interesting to move from origin

to boarding point. Taking into consideration the summer climate, it will be necessary to offer protection from the heat and create a reasonable comfort level along walking routes. Amenities such as trees, screens, and covered arcades can offer pedestrians shading and places for rest.

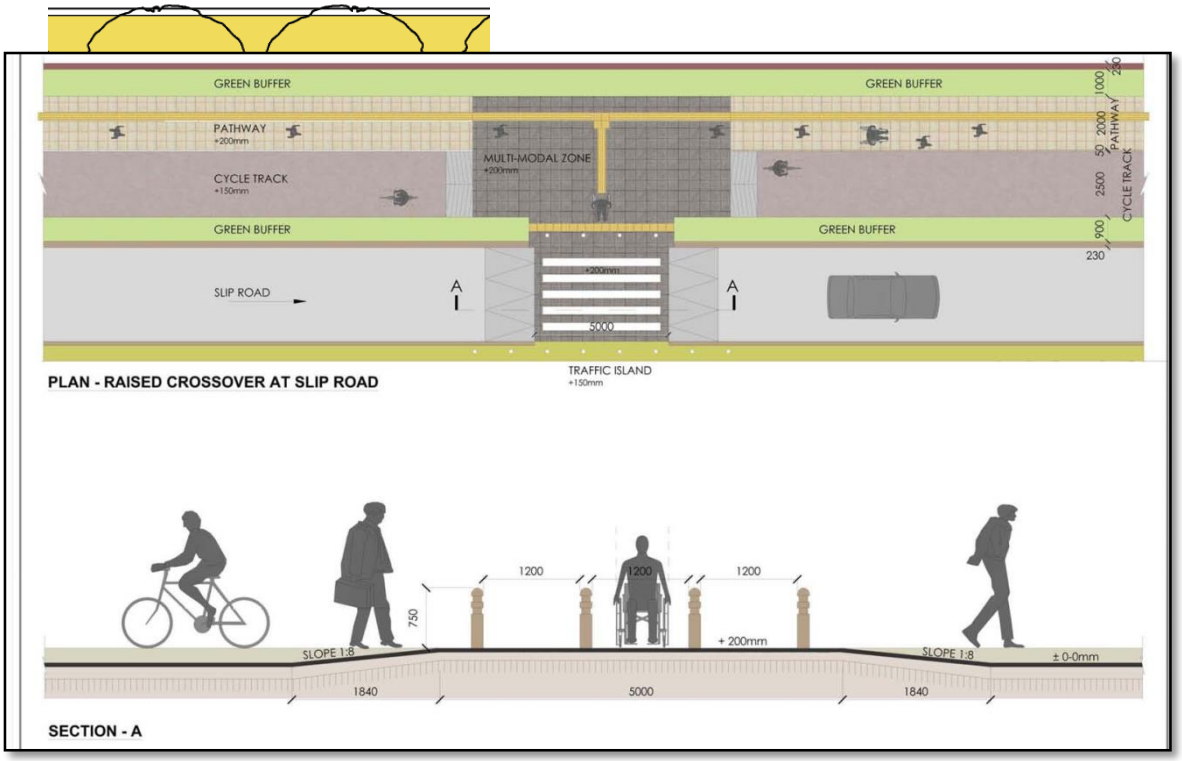
Following are the proposed sub-strategies for safe and convenient movement of pedestrians in twin-city:

- The high value of PV2 for pedestrian vehicular conflict at various locations like Atta Junction, IOC junction, Fortis Junction of Noida and Gaur City junction of Greater Noida require grade-separated facilities for safe crossing of pedestrians.

All Foot Over Bridges must be universally accessible. All Subways and Foot-over bridges must have a combination of either "Staircase + Ramp" or "StairCase + Elevator" for universal accessibility.

- A wide continuous network of footpaths incorporating all the components provided as per the pedestrian standards.
- Minimum widths of footpaths - 2000 mm, have been recommended for roads of Sec 27, Atta Market with predominant shopping and commercial activity. The improvement of footpath surface has also been recommended
- As observed in both Noida and Greater Noida the footpath height is kept very high which is not as per the prescribed standard for the convenience of pedestrians. Height of the footpath should not be greater than 150 mm.
- Footpath should be ramped at entry to property and junction. Location of kerb cut ramps must align with the Zebra Crossing location and the location of kerb cut ramp on the opposite side.

- As observed, one of the the major problems along DSC road and other major roads is the encroachments on the footpaths. As a result, pedestrians are forced to merge with MV lane, thereby, compromising on the safety issues. Footpaths, hence, should be free from encroachment and also continuous for comfort and safety of pedestrians.

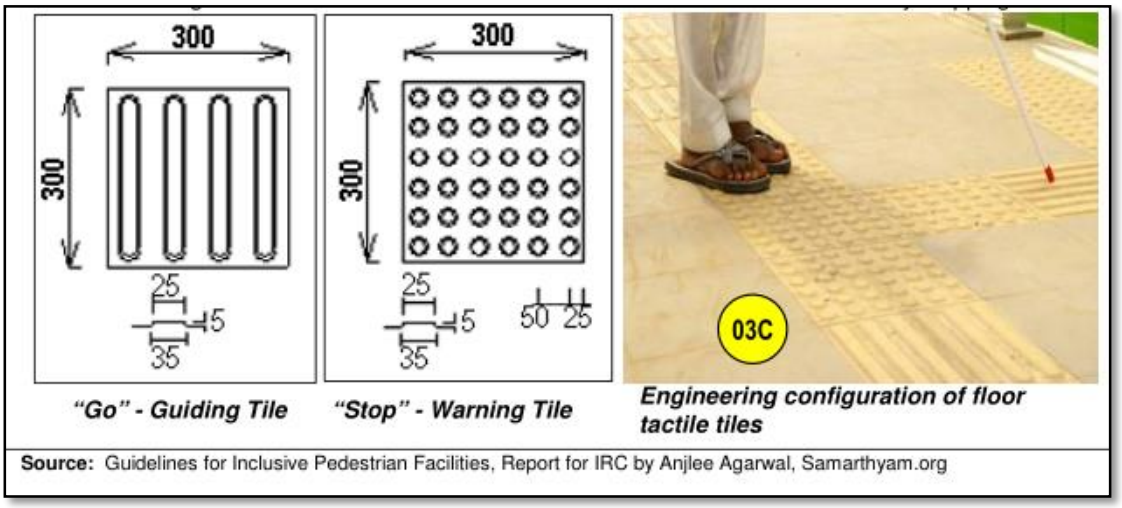


Design of Table Top Crossing at Intersection

- Pedestrian Guardrails have been proposed for all major intersections and important road sections.

Pedestrian Refuge at midblock: The refuge should be the same width as the pedestrian crossing and the depth should not be less than 2 m, enough to park a wheelchair (IRC:103-2012, 6.7.3.3).

- Pedestrian refuge islands should be present at the medians as refuge islands in a mid-block crossing that are essential when pedestrians need to cross more than two lanes. The islands gives pedestrians time to rest and reorient themselves before crossing the rest of the street.
- All roads where median has been provided, central guard should be provided.



"Go" - Guiding Tile "Stop" - Warning Tile Engineering configuration of floor tactile tiles

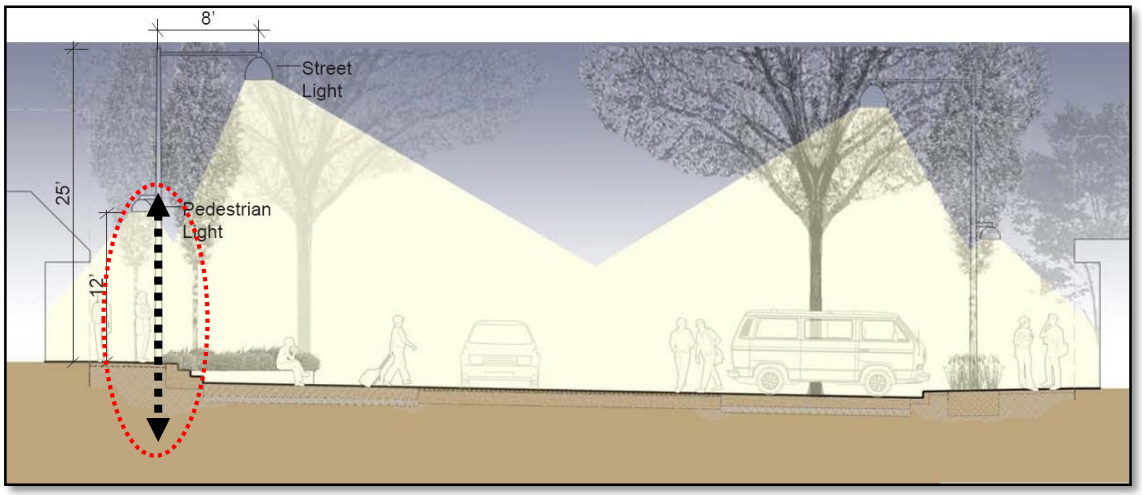
Source: Guidelines for Inclusive Pedestrian Facilities, Report for IRC by Anjlee Agarwal, Samarthyam.org

Design of Tactile tiles inclusive pedestrian walkways

- Tactile guidance blocks (Line-type) indicate a barrier free route for a person with visual impairment. It is recommended to install two rows of tactile guidance tiles along the entire length of the proposed accessible routes.
- 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. In addition, there should be clear headroom of at least 2100 mm height above the tactile guidance block, free of protruding objects such as overhanging tree branches and signage, along the entire length of the walk.

Footpath should have planting zone with clear tree canopy

- Both Noida and Greater Noida lack proper lighting facilities for pedestrians which creates high risk vulnerability in night. The footpath at both sides of the service lane has been provided with a lighting level of 12 – 15 lux at pedestrian scale.



- Noida has take an initiative to support for cycling by providing cycle tracks at major master plan roads but in order to promote cycling, a continuous network of cycle track has to be established on all major arterial roads and sub-arterial roads.

Segregated cycle tracks

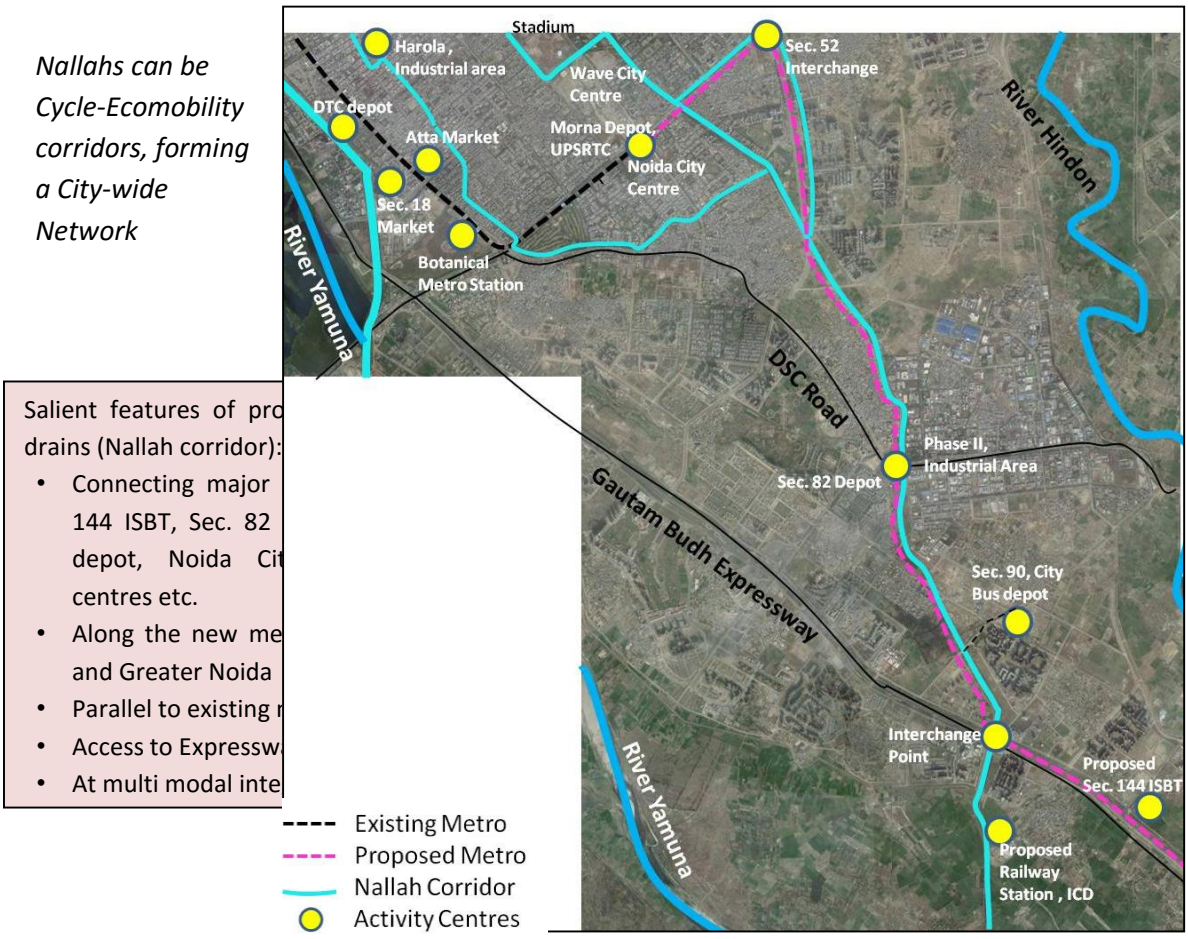
- The ICMP calls for a network of safe, clearly marked bicycle routes to connect existing and new developments. Short-term cycle hire will be available near major transport interchanges, metro stations and areas of concentrated activity such as business and shopping centres. Attractive and convenient bicycle parking and storage facilities will also be provided to encourage cycling as an alternative to motorised transport.
- To make the scheme sustainable, there is need for aggressive advertisement at both bike parking lots and on bicycles.

Nallah link corridors: *A complete City-wide Safe Cycling Network to be developed*

The Noida city possesses a wide network of drains ranging from a width of 30-40 m, such as Shahdara drain to others which are merely 20-25m (drain parallel to proposed metro passing through sectors 49, 50, 78, 101 etc) and 3 -7 m wide. It is proposed to utilize these drains to provide secondary movement channels for the city, primarily

for the non-motorised transport modes. In this respect, it is proposed to construct a dedicated cycle track and footpath along the drain. This could be done by channelizing the flow of the drain through a culvert pipe and reinforcing the sides of the drain channel around the pipe with concrete and putting an asphalt layer over the top to provide smooth movement. The said corridor shall cater to a large number of cycle trips connecting major activity centres like existing and proposed bus terminals, Metro stations, major commercial areas, industrial and institutional areas, interchange points etc. and otherwise promote the use of non-motorised modes within the city. This project is proposed to be taken in Phase I (2015-2019). Further, it shall also promote a culture of using NMT modes in the city. The proposed cycle tracks along drains (nallah corridor) are shown in Figure **6-13** while Figure 6-19 depicts the concept layout of Shahdara drain.

Nallahs can be Cycle-Ecomobility corridors, forming a City-wide Network



Salient features of pro drains (Nallah corridor):

- Connecting major 144 ISBT, Sec. 82 depot, Noida Cit centres etc.
- Along the new me and Greater Noida
- Parallel to existing r
- Access to Expressw
- At multi modal inte

Figure 6-18 : Proposed cycle tracks along existing drains

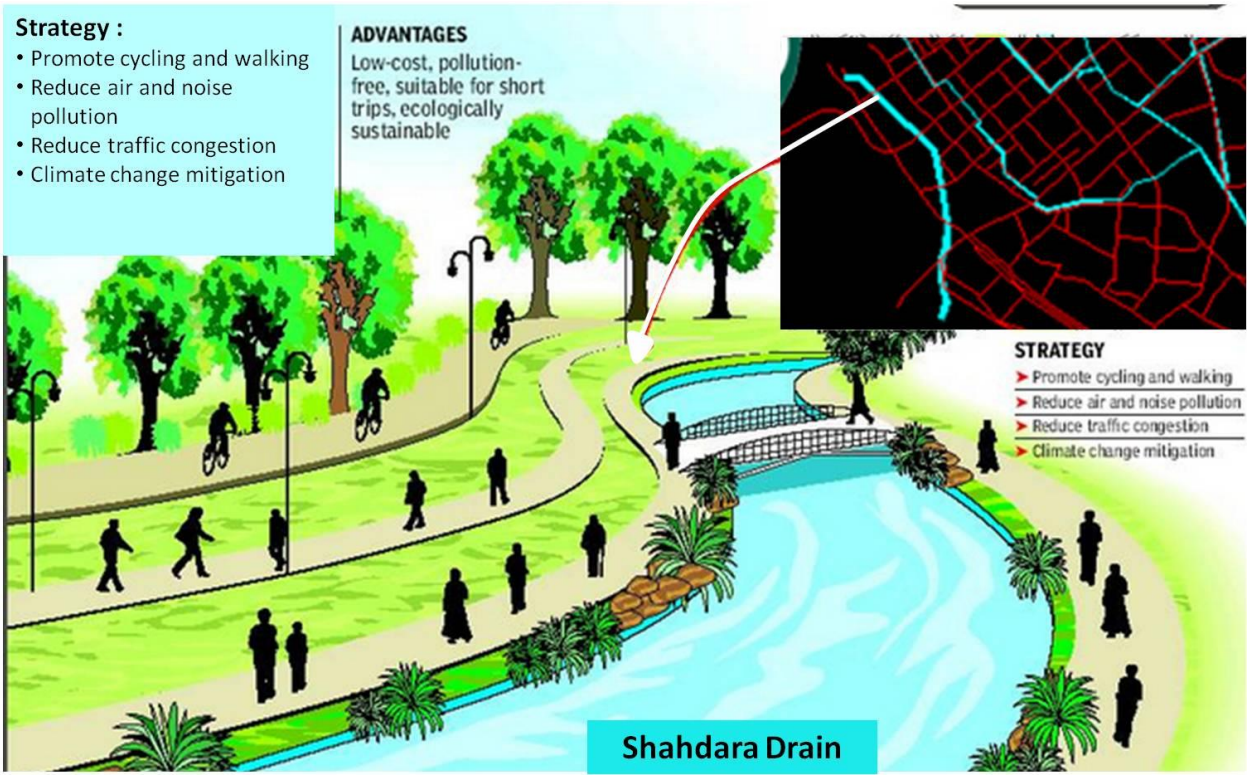


Figure 6-19 : Concept layout of Shahdara drain

6.6 Parking Management Strategy

Parking Management Strategy is the key measure for travel demand management. The supply of free/ inexpensive parking at the final destination is a key decision factor for people choosing to drive a personal vehicle, rather than taking a bus, Metro, IPT, NMT, walk or carpool. In many areas, it is not practicable to provide additional parking spaces at ground level, and indeed in many areas it will be appropriate to reduce parking spaces in order to improve facilities for pedestrians and public transport and to improve the urban streetscape and the safety of residents and visitors.

The limited availability of car parking space is currently a major problem In Noida. Rigorous measures are supported to address this.

Thus, the ICMP aims to bringing the parking supply and demand into balance that will require a strong policy of enforcement of parking violations. At the same time, the re-organisation of parking spaces and improvements to the pedestrian realm shall be proposed in a staged programme.

The ICMP for Noida and Greater Noida has suggested the adoption of following sub-strategies to make balance between the demand and supply of parking:

- **On-street parking, t**he unorganized and haphazard parking of cars and 2-wheelers on roads of the twin-city (both authorized and un-authorized) is proposed to be changed to a paid and organised system. This shall entail demarcating a stretch on the service road for parking and marking the parking bays for 2-wheelers and 4-wheelers. Thereafter the management of the stretch and collection of parking fee can be outsourced to a private operator through a competitive bidding process, for e.g. on a net-cost model in which case the operator pays a fixed amount to the respective authority and retains all the revenue collected. This shall ensure that parking gets organised, reduces the demand due to the effected pricing with the engagement of the private operator ensuring an effective management system. Further, to prevent the spillage of parking into un-authorised areas, the authorities can engage a private tow-away operator who can be paid on the basis of fines collected from vehicles that are towed away by the operator and the revenue collected from the on-street parking.
- **Pricing of parking shall be based on 'user pay' principle**, reflecting the cost of the public good – precious urban space. Without proper pricing of parking, it is impossible to manage/ curtail the ever increasing demand for parking space. No government subsidized parking for private motor vehicles is to be provided in public spaces or roads**.**
- **Differential parking rates location wise,** A vital component of the parking management strategy will be to balance the proportion of long-term and short-term parking spaces. The existing parking rate is uniform irrespective of the locations with differential rates by type of vehicles and duration. In order to reduce the usage of private vehicles and to promote public transport, the ICMP has suggested differential rate for parking depending upon the locations and peak or off peak hours. The parking rates at commercial areas and major locations should be 1.5 to 2 times higher than the locations integrated with public transport nodes such as terminals or interchange points. Also the parking rates are proposed to be vary with the peak and off peak hours of the day with high charges during morning and evening peak.
- Parking charges are proposed to be reviewed on a regular basis for both on-street and off-street parking to help address the congestion caused by

unrestrained long-term parking by residents and commuters and to address the changing balance between demand and supply.

- As a thumb rule – higher the congestion, higher the fee to be levied in the area to reduce parking demand.
- Parking on footpaths to be a cognizable offense with heavy penalties and compounding.
- On-street and off-street parking on roads and parking lots to be clearly demarcated on ground so that each parking space can be paid for, monitored and enforced.

Figure 5: Parking System and Markings

- All multi-level/ off-street designated parking lots should be developed as part of comprehensive area level plans for "**Parking Management Districts (PMD)**" that deals with on-street, off-street, multi-level and no-parking zones with proper circulation plan and demarcated "on-street parking" and "no parking" areas. The pricing of on-street and off-street should be adjusted, dynamically or by fixed pricing, such that people are induced to use off-street more than on-street. The entire PMD (composed of on-street, off-street, no-parking, multi-level parking and control centre) should be managed and enforced by a single government agency and operated on PPP basis. If on-street parking is strictly enforced (by the private agency with the help of police), no incentives for the use of multi-level parking facilities would be required as it will become a viable business opportunity.
- Management of street parking and multi-level parking is proposed to be done by same agency, in order to achieve success
- **Standalone parking-only sites are not required.** Parking lots are permissible in all land use zones (except green open space) and is free of FAR. Therefore, multi-level parking facilities could be provided by developers in any projects

such as commercial, social or industrial buildings and be made available to the public at a price. However this would be viable only if street level parking is clearly demarcated, priced and strictly enforced.

- All multi-level or exclusive parking facilities for private parking must also provide at least 10% of total space provision for IPT (Intermediate Public Transport) modes, NMV (Non-Motorized Vehicles) and feeder buses, as per local requirement.

Parking policy framework

While various on-street and off-street parking facilities shall alleviate the parking problems of the core area significantly, it is equally necessary to create a parking policy to regulate the parking demand in the areas of future development so as to prevent a similar problem as of the core area in those areas in future.

- **Residential areas**

  While it is important not to curb ownership of automobiles keeping in mind the economic growth considerations and societal aspirations, it is pertinent to regulate the provision of adequate parking spaces in all residential locations. Therefore, the authority bye-laws need to ensure that building plans include provision for adequate parking before they are cleared by the respective authorities. In doing so, norms can be laid down for the number of parking spaces that should be provided in different kinds of residential areas, such as those given in Table 6-5. While these indicative norms are given for group housing, similar norms can be developed for plotted housing schemes.

Table 6-5 : Proposed norms for parking in residential areas

Housing Type	Permitted Space for Parking in Building Plan
HIG	2 ECS + 20% extra space for visitor parking
MIG	0.75 - 1 ECS
LIG	0.33 ECS

- **Parking near commercial areas**

  While provision of parking near retail commercial establishments is necessary, it is equally important to ensure that the demand is well regulated. Markets attract both short and long duration parking, with shoppers needing short term parking and shop owners needing long duration parking.

  The parking rates must be reflective of rentals of the area, the size of the vehicle and the levels of congestion in the area.

  On street parking should be permitted normally only along one lane, with higher parking fee as compared to the available off street parking space.

Freight vehicles should be allowed entry for off-loading their goods only at night or in the early morning hours.

- **Parking near Office and Educational/Institutional areas**
  With regard to institutional and office areas, those which are well-connected by good public transport should have restricted parking availability and/ or have a high parking fee. This would encourage higher usage of public transport for their daily commute to work rather than use personal motor vehicles. Those who still like to use their personal motor vehicles should be required to pay the full value of the parking space they occupy. However, the emphasis should be on making investments in public transport rather than on parking space. Introduction of parking meters is also proposed in and around offices and educational/institutional areas.
- **Parking at hospitals and other medical establishments**
  For all hospitals and other medical establishments, it is necessary to provide a reasonable amount of parking space, as visitors/patients may find it difficult to use public transport. Some use personal motor vehicles and would need parking space; others may use para transit, thus necessitating the provision of both short and long duration parking spaces. While short duration parking can be made free of cost, it is recommended that the medium and long duration parking should be made to be paid for through a parking fee. The fee should only consider the cost of providing the parking space and not the cost of the land involved.
- **Integration of parking with Public Transport system**
  Parking lots should be located as close as possible to the Mass Transit terminals in order to promote people to park their vehicles and board the public transport system for their daily commute.
  Some additional measures for managing parking demand in the twin-city are listed below:
  - Ban the parking of vehicles near all intersections (up to 200 m on each arm).
  - Introduce variable parking fees which would enable higher parking charges to be levied in particularly problematic areas like Sector 18 in Noida in order to discourage people from travelling in their personal vehicles and hence reduce congestion.
  - Bicycle parking should be free of charge to promote greater use.
  - Suitable kerb side lengths would be kept clear of parked vehicles near bus bays
  - All mobility corridors would be declared as no-parking zones, to ensure better operational conditions for buses.
  - In all "no parking" areas, only –embarkment / disembarkment will be permitted for one minute only.

- Any large-scale new development would be mandated to submit an Impact Statement, clearly spelling out the impact it will have on all urban infrastructure, especially the transport infrastructure.
- Parking should be conforming to parking standards of each premise. Differential Parking fees for additional parking space
- Where no standards are prescribed, the standards (equivalent car space) given in the Development Code section of the Master Plan, UDPFI Guidelines should be followed.

6.7 Freight Management Strategy

The freight management Strategy seeks to enhance the effectiveness and efficiency of freight movement. The aim is to support the development of a sustainable freight distribution system that provides an appropriate balance between alternative transport modes, improves the utilisation of the transport resources deployed, and lowers the unit cost of freight based services.

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. For Noida and Greater Noida, the existing container terminal (ICD) is located near Dadri railway station, Greater Noida.

As per the Noida Master Plan-2031, a Transport Nagar has been proposed at sector 69, by the side of proposed Bus Depot. It will provide facilities for idle parking of trucks, repair workshops, offices of booking and forwarding agencies, petrol filling and service station and related facilities. Development of Transport Nagar is under progress.

Greater Noida Master Plan -2031 has a proposal of transport hub at Boraki, which shall provide comprehensive facilities for the integration of passenger railway station, ISBT, Truck Terminal etc.

In order to efficiently manage freight traffic, the ICMP has proposed the development of truck terminals at the proposed activity zones as suggested by the Noida and Greater Noida authorities.

The freight management strategies will comprise elements that are directly related to the freight sector, plus many initiatives that are common to both passenger and freight transport. Following are the proposed sub-strategies for freight management:

- Ban on movement of goods carrying vehicles inside the city during 6:30 AM to 10:00 PM
- Ban on old goods carrying vehicles
- Development of truck terminal at proposed activity center at Boraki and expansion of Dadri container terminal in Greater Noida.
- Development of Transport Nagar in Sector - 69 in Noida
- Development of DFC corridor through Frieght Corridor
- Introduction of a system of truck signage and real-time traffic information to provide an improved service to truck operators and drivers and to make most efficient use of the available road network at all times.
- The provision of real-time journey information can result in significant efficiency gains by truck operators.

6.8 Traffic Management Plan

Under traffic management plan, the ICMP for Noida and Greater Noida has suggested following improvement measures.

6.8.1 Traffic Intersection Improvement

Various traffic intersections in the twin-city suffer from inappropriate design, inadequate turning movement provision, absence of traffic signals, traffic enforcement and other such problems as these are the major sources for bottlenecks in the transportation network. To improve safety and to provide orderly movement of vehicles, improvements of junction such as installation of traffic signals, geometric improvements, provision for pedestrian and NMT etc. are necessary. The basic problems of junctions and suggested intervention measures are given in the table 6.6:-

Table 6-6: Problems and suggested interventions

Problems at Junction	Suggested Interventions

• Poor road geometrics • Lack of proper sight distance • Lack of pedestrian facility • Parking of private vehicles • Poor enforcement	• Provision of footpath and cycle track • Improvement of turning radius • Pedestrian crossing demarcation • Road Marking and signages • Provision of channelizers • Restrict parking till 200 m from the junction

Based on traffic volume survey and site observations, following are the major junctions which need immediate interventions and improvement measures:

Noida

1. Labour Chowk
2. Mamura chowk (crossing of Sector 62,64,59 and 66)
3. Sec -82 Chowk
4. Sector 12–22-56 Circle
5. IOC Chowk (Gol Chakkar)
6. Atta Chowk
7. Sector 37 and 44 chowk
8. Rajnigandha chowk
9. Sector 14A crossing
10. Morna Crossing
11. Phase II junction, DSC Road
12. Sector 52-72 chowk
13. Model Town Chowki, Sector 63
14. NIB chowki, Sector 62
15. Entry to Chijarsi, Pusta road
16. Golf course chowk

Greater Noida

1. Pari Chowk
2. LG chowk
3. Tugalpur chowk
4. Jagat farm chowk
5. Surajpur Junction
6. Gaur city Chowk
7. Kasna junction

Intersection design should manage conflict in a way that enhances safety for pedestrians and clear movement of vehicles. The preferred design is to raise the intersection to the level of the footpath. Vehicles slow down when crossing over the ramp, and a material difference emphasises that they are entering a shared space. Ramps should be provided at all intersections that are not signalised and without rotary to ensure that pedestrians can cross safely. Where raised crossings are not

provided (i.e., at intersections that are signalised), the footpath should be ramped down to the level of the carriageway. The ramp should not be steeper than 1:10 (IRC: 103-2012, 6.5).

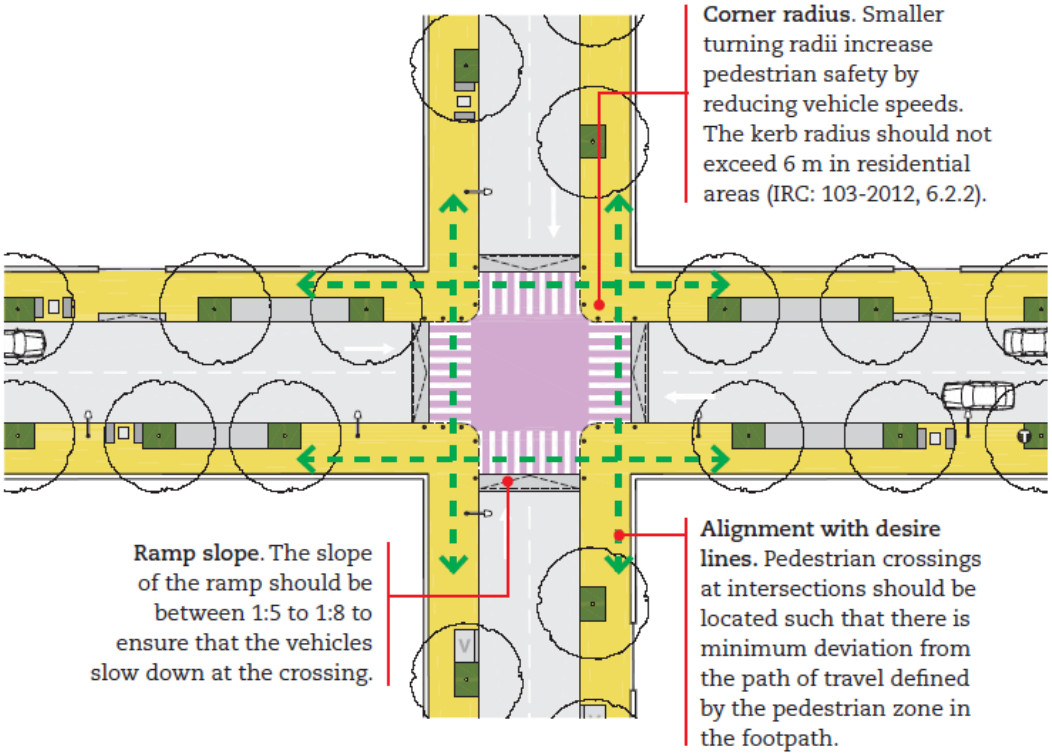


Figure 6-20 : Concept layout of non-signalised 4-arm junction with raised pedestrian crossing

For Non-Signalised Junction : *The entire intersection is proposed to be raised to the level of the footpath, compelling motor vehicles to slow down. The material difference alerts vehicle users that they are entering a shared space.*

For minor intersections: *If the intersection is not signalised, it is proposed to raise the crossings that are perpendicular to the minor arms while the crossing on the major arm is provided at grade*

For signalized intersections *: If the crossing is at the level of the carriageway, each corner must be ramped. The width of the ramp should be at least 1.2 m, and the slope no steeper than 1:10 (IRC: 103-2012, 6.2.2, 6.5)*

It is proposed to improve the junctions of twin-city incorporating following paramenters:

- Widening of carriageway to improve road capacity
- Geometry of junction
- Service road for access control
- Signage for guidance
- Lane markings for directing traffic
- Signals for capacity augmentation : exclusive signal phase for all possible movements for NMT and pedestrians.
- Closing of median
- Footpaths for pedestrian safety
- Dedicated cycle tracks for NMT
- Kerb improvement for safe turning
- Provision of bus bay where ever possible
- Shifting of services

- Drains to be closed or treated

6.8.2 Pedestrian refuges: Intersections

Intersections must provide direct, intuitive pedestrian crossings. Designated crossings should reflect pedestrian desire lines, avoiding detours. Crossing distances should be minimised, and pedestrian refuges are required to give pedestrians a safe space to wait before crossing successive streams of traffic. Wherever slip roads or turn pockets are present, raised table top crossings must be provided between the footpath and the triangular pedestrian refuge for safer crossing (IRC 103-2012, 6.7.3.3, 6.2.2). Slip roads or turn pockets should be avoided at intersections for streets with rights-of-way of 30 m or less. Pedestrian refuge islands must also be provided in medians. The refuges should be large enough to handle observed pedestrian volumes.

Refuge islands can provide a safe place for pedestrians to wait for a green signal. They also reduce the crossing distance. The placement of refuge islands should reflect pedestrian desire lines.

6.8.3 Pavement Markings and Signage

It is recommended that proper signs should be marked at appropriate locations. Signs near schools should be installed on priority basis. Traffic control facilities such as Center line, Traffic lane lines, Stop lines, Pedestrian crossings, Parking space limits,

Kerb marking for visibility, Obstruction marking etc. must be provided keeping in view all users of the road and especially for night time driving. All the traffic signs should be facilitated as per the guidelines provided in IRC publication 67-2001. Figure 6-16 shows different traffic signages.

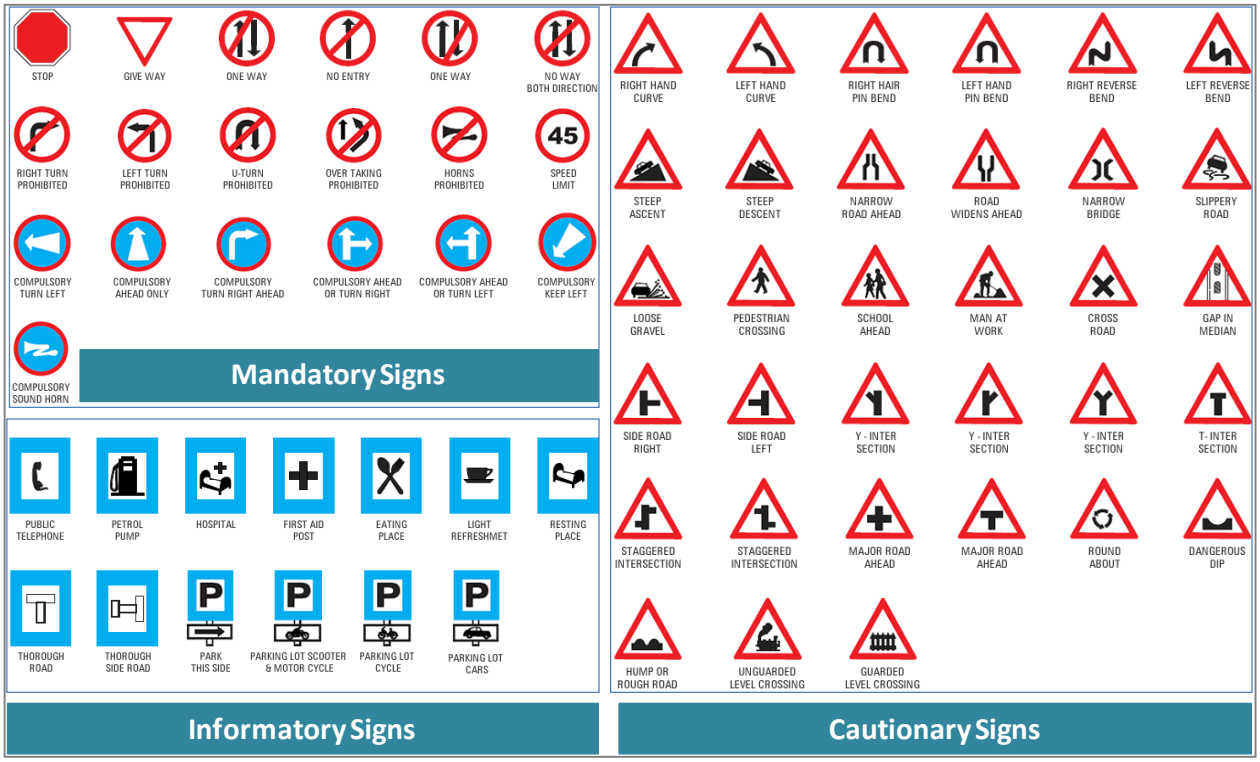


Figure 6-21 : Traffic signages

6.8.4 Traffic Information and Management Control Centre (TIMC)

Intelligent Transportation Systems such as vehicle-actuated traffic signals, surveillance cameras, and enforcement cameras etc., which enables decision makers to identify and react to an incident in a timely manner based on real-time data, will help to reduce incident response times, lower incident rates (mainly secondary incidents), disseminate traveller information and hence reduce congestion and enhance safety. As a first step, simple real time traffic monitoring equipments are proposed to be installed that will result in traffic assessment on various corridors within the city and can be accessed by the users and enforcement agencies on the web.

6.8.5 Safety Measures

Poor road geometry and lack of traffic sense of both drivers and pedestrians increases the incidence of accidents. Many of the accidents occur due to the casual approach of

the road users towards driving rules, safety precautions, and regulations. The following action programmes are proposed for implementation to enhance the safety of the road users:

- Black spots need to be identified along the major roads and specific improvements must be proposed at those locations. A Road Accident Analysis System based on the accident database must be implemented for accurate reporting and use in geometric improvements
- Provision of anti-crash barrier railing
- All speed breakers and humps be marked and signed adequately for night time visibility
- All traffic signage should be made retro reflective
- Create traffic safety patrol programmes for student volunteers at all schools
- Install pavement markings at all radial arterials and other major sub-arterials
- Provision of adequate street lighting on all arterials, sub-arterials, collectors, and local roads
- Setting up of a Road Accident Analysis System (RAAS)

6.8.6 Education and Enforcement

Overall awareness of the traffic discipline and compliance with the traffic rules by road users in Noida and Greater Noida is far below the desired level. Traffic Police in Noida and Greater Noida will have to offer positive leadership in this direction to make people responsible and rule-abiding road users. Special traffic drives have to be planned by them for making the public aware of the traffic rules. In addition, imposing fines at the spot procedure for defaulters may be reviewed in view of the large backlog of pending traffic offence cases. The Road Safety programmes is aimed at users and should serve three main purposes:

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

Chapter 7 Environmental and Social Impact Assessment

Anticipated Impact of Proposed Projects

Projects evolved in ICMP will help to achieve sustainable development goals by means of reducing private mode share, emission levels and travel time. The anticipated impacts of proposed projects are presented in Table 7-1.

Table 7-1 : Anticipated Impact of Proposed Projects

Scenario	Private vehicle share (%)	IPT Share (%)	PT Share (%)
Base Year - 2014	54	18	27
Do Nothing -2034	73	15	11
Scenario 1 – 2014	47	13	35
Secnario 2 – 2024	36	8	50
Scenario 3 - 2034	28	6	60

* Scenario 3 was considered as a ICMP scenario while recommending proposals.

7.1 Social Impact

The impact of the proposed projects from the social angle is analyzed 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 Table 7-2:

Table 7-2 : 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
High Order Transit System	Yes	Yes	Yes	Yes
Intermodal Stations	Yes	Yes	Yes	Yes
Bus Terminals	Yes	Yes	Yes	NA
Transport Hub	Yes	Yes	Yes	NA
Freight Terminals	Yes	Yes	Yes	NA

Project	Right of way / Land Acquisition	Requirement of Rehabilitation & Resettlement	Improve Mobility	Reduction in Travel Time
Bus Shelters & Bus bays	Yes	No	Yes	Yes
ROBs / New Roads	Yes	Yes	Yes	Yes
Foot Path cum drains	No	No	Yes	NA
Pedestrian FoB /Subway	No	No	Yes	NA
Major Junction Improvements	No	No	Yes	Yes

7.2 Environmental impacts

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the ICMP. 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 7-3.

Table 7-3 Environmental impacts of important projects

Broad Project category	Activities / Sub Components	Impacts
Pedestrian / NMT Infrastructure Improvement	• road widening and creation of service lane whereever necessary	• 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 subways/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	• Dedicated public transport network	• Land acquisition for dedicated lanes will cause Rehabilitation &Resettlement issues • Use of existing pavement width for dedicated bus lanes will cause removal of squatters and encroachments from roadsides causing loss of livelihood and loss of shelter • Construction / reconstruction / improvement of bus lanes will be causing construction issues as: ▪ Generation of noxious gases during construction . ▪ increasing air pollution ▪ Temporary increase in noise pollution during construction ▪ Contamination of road runoff with construction material stacked on road side ▪ Traffic safety during construction

		▪ Traffic diversions causing lengthening of routes increasing air emissions and exposing previously unexposed neighborhoods to noise • Reduction of additional lane width for other traffic if existing road width is used for demarcating the dedicated bus lanes • Reduction in private vehicles causing reduction in air / noise pollution
	• Terminals/Depots/ Interchange / Transport Hubs/ Commuter Amenity Centers	• Acquisition of land for the facilities causes . Rehabilitation &Resettlement issues as loss of livelihood, loss of shelter, severance of community & social ties • 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 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 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 Improvements	• 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 • Banning of use of animals for movement of goods in the city may result in ▪ Animal welfare and safety ▪ Improved speeds in core area due to reduction in congestion
	• Creation of new freight terminal	• Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth

7.3 Location Impacts

The location Impacts being analyzed 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 such 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 lead to loss of livelihood and / or shelters.
- Vulnerable PAP within the encroachers would be further impacted by the pressure of relocation as well as loss of income and their removal.
- Breakup of established social fabric and cause severance of established relationships amongst the community.
- Temporary loss of services provided by the encroaching PAPs due to their removal.

Some of the specific impacts associated with construction of flyovers involve 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 such as ITS application, improvement in public transport infrastructure would only improve the environment rather than causing pollution though resettlement impacts would be present to a limited extent.

7.4 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 or provision of additional cycle lanes and bus lanes
- Relocation of utilities in the pre-construction stage causing temporary disruption to services. These impacts would be more severe in case of construction of exclusive bus lanes and 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 equipment
- Stacking of construction waste causing interruption to traffic and pedestrian movements.
- Runoff from staked 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 prioritization, ITS, provision of signage etc., involve minimal construction activities and hence, environmental and social benefits from these activities will outweigh any minimal impacts that may occur.

7.5 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.

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

7.6 Disaster Management

Disaster Management is "The response of the organized activities to address problems created by unusual events". The key concept in planning/ design is 'Resilience' which is the ability of the system to adopt to unexpected conditions with out catastropic failure.
The major disasters includes:

- Floods
- Fire
- Cyclone/ Earthquakes
- Crash

The various transportation issues after disasters include:

- Evacuation: Evacuation should be done before, during and after disaster.
- Delivery of emergency supplies

- Rescue Operations
- Transport Infrastructure Repair

Recommendations for effective emergency response in ICMP

1. Include disaster response plan at local, regional and national level as part of transport planning. Consider possible range of disasters/ stresses on transport systems and solutions for the same.
   - The formation of a strong network strategy will be the first step to the disaster response plan at the city level.
2. Develop a plan telling ' who should do what' among civic authorities.
   - Focusing on public transport to also assist in disaster eviction can only be brought about if adequate public transport facilities are provided.
3. Develop multi modal transportation systems that provide variety of mobility options.
   - Our focus in twin-city includes Interchanges /Bus terminals/ Transport hub which would be the first steps in providing alternate evacuation points during disasters.
4. Create transport system networks that provide links to each destination- roads, rails, bridges
   - For the disaster response plan(Point 1), the basic issue of network and transport options become critical. The ICMP aims at creating a network structure which would provide strong inter connectivity between regions.
5. Develop plans to provide basic mobility to all. Planning should take into account people with special needs.
   - Footpaths which are clean and clear of obstruction would be a clear avenue of escape. The strategy of the ICMP that focuses on NMT would hence be critical to the mobility of people.
6. Develop effective ways to maintain information and communication systems among transport system managers and staff under emergency conditions. Training the staff for emergency preparedness.
   - The ITS system, the public transport operation and the police will all play a role in disaster management. The ICMP would form the basic infrastructure and people who would have to be trained in the aspect.

7. Develop ways to prioritize transport system resources when necessary. For example, design or plan systems to allow emergency service and freight vehicles priority over general traffic.
    - Mobility corridor strategy in conjunction with the network strategy and ITS can ensure the facilitation of emergency vehicles. The head room standards and design standards to ensure that these vehicles are not obstructed should be strictly followed in the design and implementation of the facilities planned in the ICMP.
8. Design critical components of transportation system to be fail-safe, repairable and redundant.
    - Alternate routes would render effected routes to the redundant. The design of all structures planned in the ICMP must adhere to the seismic/ Flood design standards required.
9. Plan for quick deployment of buses
    - The ICMP aims at moving people. In Noida and Greater Noida, we are proposing a new city bus system. They will be very useful during emergency times.
10. Officials muct be trained in traffic management strategies- Guiding special services along evacuation routes; using contraflow lanes; using shoulders as lanes; priority to HOV etc.

The ICMP provides/suggests an institutional structure where in traffic management is taken care of by a trained and well equipped traffic police. The training should lend itself to redesigning junctions etc.

Chapter 8 Implementation program and costing

8.1 Phasing plan

The projects identified are phased depending upon several criteria like urgency of implementation, capital investment, ease of implementation, resource availability etc. This is driven mainly by the need to put infrastructure in place to meet travel demand. 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 implementation.

8.2 Project prioritisation and costing

As discussed above, based on the detailed analysis, all the projects identified have been prioritised. As per National Urban Transport Policy* the prioritisation of projects is in the following order:

1. Public transport
2. Pedestrianisation
3. Non-motorised transport
4. Para transit facilities (IPT)
5. Parking
6. Terminal facilities
7. Road development
8. Bridges and flyovers

*National Urban Transport Policy was formulated with the following objectives:
- to bring about better integration of land use and transport planning so as to improve access to jobs, education, etc.
- to encourage public transport and non-motorized transport so that the dependence on personal motor vehicles is reduced;
- to offer central government support for investments in cycle tracks and pedestrian paths; • to offer central government support for investments in mass transit systems;
• to have a more coordinated approach to urban transport management through Unified Metropolitan Transport Authorities etc

The mobility plan components discussed in the previous sections are 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. 11,250.23 Crores (refer **Error! Reference source not found.**)

Table 8-1: Total project cost for all three phases

Phase of Plan	Estimated cost of projects (in Rs. Crores)
Phase I (2015-2019)	2143.81
Phase II (2020-2024)	1916.10
Phase III (2025-2034)	7190.32
TOTAL	**11250.23**

The breakup of the project cost is given through following tables:

Table 8-2: Project cost for Phase I (2015-2019)

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
1	Grade Separators, Noida: 10, GNIDA: 03	13	Nos	25	325.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
2	Rail Over Bridges	3	Nos	25	75.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
3	8- Lane Expansion of NH- 24	18.5	km	16.00	296.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
4	Bus Queue Shelters	279	nos	0.18	50.22	PPP	PPP
5	Foot Over Bridges in Noida and Greater Noida	22	nos	3.5	77.00	PPP	PPP
6	Implementation of cycle tracks on major roads	100	km	1.2	120.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
7	Bi-cycle Sharing Scheme	37	per station	0.1	3.70	Private	Private

S.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
8	Off- Street Parking/MLCP's	18727	per 100 ecs	0.05	936.35	Private	Private
9	Road Signages and Marking	42.5	km	0.005	0.21	Noida Authority/ GNIDA	Noida Authority/ GNIDA
10	Installation of Street Lights	105	km	0.65	68.25	Noida Authority/ GNIDA	Private
11	Bus	392	Nos	0.49	192.08	Noida Authority/ GNIDA	Private
13	ITS requirement for 392 Buses	392	Per Bus	0.096	37.63	Private	Private
14	Multi Modal Hub	1	Nos	15	15.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
15	Footpath	170	KM	0.17	28.31	Noida Authority/ GNIDA	Noida Authority/ GNIDA
	Total				2143.81		

Table 8-3: Project cost for Phase II (2020-2024)

Sl.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
1	Grade Separators , Noida :01, GNIDA:08	9	Nos	25.00	225.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
3	Rail Over Bridges	5	Nos	25.00	125.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
4	8.0 lane Eastern Peripheral Expressway (Palwal - Kundli, 135 Km)	30.24	Km	16.00	483.84	PPP	PPP
5	New Expressway Network from Ghaziabad to Dadri	12.7	Km	16.00	203.20	PPP	PPP
6	Extension of 105M road till hapur bypass	6.2	Km	16.00	99.20	Noida Authority/ GNIDA	Noida Authority/ GNIDA
8	Extension of Dadri Road to E.P Expressway	4.8	Km	16.00	76.80	Noida Authority/ GNIDA	Noida Authority/ GNIDA
9	Dankaur Sikandrabad Road	8.3		16.00	132.80	Noida Authority/ GNIDA	Noida Authority/ GNIDA
10	Sikandrabad Gulaothi Road till Upper Ganda Canal	15.6	Km	16.00	249.60	Noida Authority/ GNIDA	Noida Authority/ GNIDA
11	Bus	527	Nos	0.49	258.23	Noida Authority/ GNIDA	PPP

Sl.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
12	ITS requirement for Buses	527	Per Bus	0.09	47.43	PPP	PPP
13	Multi Modal Hub	1	Nos	15.00	15.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
	Total				**1916.10**		

Table 8-4: Project cost for Phase III (2025-2034)

Sl.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
1	Grade Separators. GNIDA 07	7	Nos	25.00	175.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
2	Rail Over Bridges	7	Nos	25.00	175.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
3	New Bridge across Hindon river	1	Km	280.00	280.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
4	Extension of 105M road till Hapur Byepass	26	Km	16.00	416.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
5	Extension of Dankaur Gulaothi road till Gulaothi	9.5	Km	16.00	152.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
6	Widening of FNG Expressway - 12 Lane	20	Km	16.00	320.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA

Sl.No	Project	Quantity	Unit	Unit Rate (Rs crores)	Cost (Rs. Crores)	Construction	Operation and Management
7	Widening of bridge to 8 lane at Hindon b/w sec 78 Bisrakh	5.43	Km	100.00	543.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
8	Extended MRTS on Dadri Hapur Expressway	19	km	250.00	4750.00	Noida Authority/ GNIDA	Noida Authority/ GNIDA
9	Bus	654	Nos	0.49	320.46	Noida Authority/ GNIDA	PPP
10	ITS requirement for Buses	654	Per Bus	0.09	58.86	PPP	PPP
	Total				7190.32		

The location Map of proposals like (RoB and Grade Seperators) are given in Annexure IV

8.3 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. 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.

8.3.1 Public Private Partnership (PPP)

In case of Noida and Greater Noida, even though the authorities are cash surplus whereas considering the operation and management of the infrastructure projects, the role of private sector will bring greater efficiency in service delivery. 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.

8.3.2 Government sources of funding

One of the particularities of the urban transport sector is that it depends on funding from several sources and involves various partners, public and private, individual and collective.

(a) **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:

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

(b) **Dedicated Urban Transport Fund at city level**

For the projects, which are not admissible under JnNURM, or viability gap funding, the alternative sources of funding that a city could avail by setting up a dedicated urban transport fund at city level are given below:

A dedicated urban transport fund would need to be created at the city level through other sources, especially land monetization, betterment levy, land value tax, enhanced property tax or grant of development rights, advertisement, employment tax, congestion, a cess on the sales tax, parking charges reflecting a true value of the land, traffic challans etc.

Pimpri-Chinchwad Municipal Corporation has already set up a dedicated urban transport fund through land monetization and advertisement rights. Similarly, Karnataka has set up a dedicated urban transport fund through MRTS cess on petrol and diesel sold in Bangalore, which is being used to fund the metro rail projects. The various sources of funding that can be used to set up the urban transport fund is given below:

(i) Anticipated purchase of land

This method involves public authorities buying land before announcing that an infrastructure will be built or where the route will run. In this way, the purchase can be made at market price without the infrastructure. The strategy then consists in:

- Directly selling the land to private developers including the estimated added value in the sale price, such as was done in Aguas Claras on the periphery of Brasilia, or in Copenhagen;
- Developing the area as part of an urban renewal project and then selling it at market price, as was done in Copenhagen or in Japan, where rail companies were the first to use this method to finance their operations

A city can also levy additional stamp duty (5%) on registration of property.

(ii) Betterment Tax

A betterment tax is not the same as a property tax, because the increase in value of property is not due to the action of the owner (such as would be the case with renovations and improvements) but from a community action, thus justifying the public authorities to impose such a tax. However, it is not easy to implement, which no doubt explains why this financing mechanism is still underused.
This tax must be levied on all areas that benefit from the new transport infrastructure. The land is valued each year based on an optimal use of each site, without taking into account the existing facilities. A tax based on the value of the land is then levied in order to generate funds for the public sector. Thus, if the value of the land increases, the tax collected also increases. This means that a vacant plot of land in the city centre which has been earmarked for building a residential and commercial complex will pay the same tax as an identical site which has already been developed in a similar manner. Unlike construction taxes, no tax reduction is available to landowners who leave the site empty. Likewise, taxes are not increased if the site is built upon. Landowners will therefore to seek to capitalise on the use of their land.

(iii) Land Value Tax

Once an area is well connected by public transport and is accessible to the commercial area and also the liveability of the area increases it is possible that the

price of the land will increase. Such increase in price can be source revenue for the municipality. Similar to parking, the obtained revenue needs to be utilized for improvement of the area and other areas in the vicinity. 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. Bangalore has also levied luxury tax and professional tax towards the metro fund.

(iv)Advertising

This is another important source of revenue for the city. When properly utilised this source can be of immense value in supporting sustainable urban transport measures in a city. The revenues from advertising in the city can be used to improve the existing transport system and/or create new schemes in sustainable transport.

Paris, France has used the advertising money in developing a public bike scheme, which is now a well renowned model. Similarly, Transport for London (TfL) has made a deal with the advertising specialist, Clear Channel, for the regular maintenance and design of the street furniture in return for the advertising space on bus shelters.

One important aspect that needs to be considered is that the advertising money needs to be utilised for improving the transport system rather than spending it on building more roads. In the similar way, the advertising should not be overdone to avoid visual pollution. Further, ideally advertising revenue should not be a reason for building of pedestrian overpasses as the greater good for the society from these overpasses is minimal.

(v) 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.

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.

Chapter 9 Institutional Framework

9.1 Introduction

City transport system generally involves several organisations 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 Noida and Greater Noida includes a variety of institutions sharing their responsibilities in different aspects of governance of Noida and Greater Noida. Noida Authority and GNIDA, which are primarily responsible for the governance of the respective cities and for providing urban infrastructure and services to their citizens, are 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 of operation and to remove ambiguity of functions, the institutional framework has been proposed.

Departments and Organisations involved in Urban Transport

- Infrastructure and Industrial Development Department, Govt. of U.P.
- Superintendent of Police (Traffic), Gautambudh Nagar
- New Okla Industrial Development Authority (NOIDA)
- Greater Noida Industrial Development Authority (GNIDA)
- Delhi Metro Rail Corporation (DMRC)
- Noida Metro Rail Corporation (NMRC)
- Uttar Pradesh State Road Transport Corporation (UPSRTC)
- Delhi Transport Corporation (DTC)
- Regional Transport Office (RTO), Ghaziabad
- ARTO, Noida

9.2 Existing City Level Institutions

9.2.1 New Okhla Industrial Development Authority (NOIDA)

NOIDA (New Okhla Industrial Development Authority) came into existence on 19th April 1976, with a view to develop an Integrated Industrial Township for the industrial growth of the area, under the UP industrial development act. Noida, set up by Sanjay Gandhi, spread over 20,316 hectares, is a well-planned, integrated and one of the largest planned industrial townships of Asia. Its development area consists of 81 villages of district Gautam Budh Nagar.

9.2.2 Greater Noida Industrial Development Authority (GNIDA)

The Government of Uttar Pradesh vide notification dated 28th January 1991 constituted Greater Noida Industrial Development Authority (GNIDA) and entrusted the responsibility of ensuring planned development of the notified area of Greater Noida comprising of 124 villages and about 3800 ha. of area.

Greater Noida is shaping up as India's smartest city, the National Capital Region's most modern urban development centre and its fastest-developing center of attraction. It has emerged as a modern model of far-sighted town planning.

9.2.3 Noida Metro Rail Corporation (NMRC) :

A Special Purpose Vehicle (SPV) has been formed for the Noida Metro Rail Project. It has been named Noida Metro Rail Corporation Ltd. and is chaired by the Chief Secretary of Uttar Pradesh. Special purpose vehicle (SPV) would be formed for the development, operation and maintenance of the metro rail. The Government of India and UP will each bear 20% of the costs and loans from external agencies would be taken to fund the rest 60% of the project. Twenty per cent funding from UP will be shared by Noida and Greater Noida Authorities, based on the length of track that passes through the two areas. The metro link is expected to be commissioned by 2017.

9.3 Existing State Level Institutions

9.3.1 Infrastructure and Industrial Development Department

The Department of Industrial Development was established to create enabling environment for industrial growth in Uttar Pradesh. It has been reconstituted as

Infrastructure & Industrial Development Department (IIDD) in the year 2007 with the merger of newly created Infrastructure Development Department.

IIDD functions as the government arm to formulate and implement industrial and infrastructure development policies and strategies according to the specific needs and objectives of enabling socio-economic development of Uttar Pradesh. In this endeavour, the Department is guided by the newly announced Infrastructure & Industrial Investment Policy-2012.

Industrial development involves the Primary sector, comprising of largely raw material extraction industries such as mining and farming; the Secondary sector, involving manufacturing, refining, and construction; and the Tertiary sector, which deals with services along with distribution of manufactured goods.

Infrastructure Development: Continuous development of world-class infrastructure is crucial for industrial development. Progress has to be preceded, accompanied and followed up by infrastructure development. Under the new Infrastructure & Industrial Investment Policy-2012, increasing the land bank, construction of roads, highways and expressways, augmentation of power capacity, improvement of air transportation and development of industrial infrastructure facilities have been earmarked as priority areas.

9.3.2 Uttar Pradesh State Road Transport Corporation (UPSRTC)

UPSRTC provides intra-city and state- wide public transport, maintenance of buses from their respective depots at Sector 35 in Noida and at Kasna in Greater Noida.

9.3.3 Issues with the Present Institutional Set up

The organisational form selected and institutional set up has a great impact on the functioning of the public transport system. As observed above, there are multiple organizations that are involved in transportation planning for both the Cities. While some of the transport related activities are performed by the local authority, a host of them fall under the purview of State and the Central Governments. These activities are divided in a number of departments making coordination difficult, time consuming and non-responsive to the expectations of the citizens. The transport system in twin-city is no exception to the above situation.

Currently transport related functions in Noida and Greater Noida performed by various agencies are listed in the Table 9-1.

Table 9-1 : Institutional involvement in Urban Transport

Sl.No.	Organisation	A Few Urban Transport Related Functions
1	Ministry of Urban Development, Government of India (GOI)	✓ Urban Transport Policy formulation
2	Department of Road transport and highways, GOI	✓ Motor vehicle act., its preparation, notification and administration
3	Ministry of Environment and Forest, GOI	✓ Setting Vehicular Emission Norms
4	Infrastructure and Industrial Development Department, Govt. of Uttar Pradesh	
5	Uttar Pradesh Police	✓ Enforcement of traffic and other related laws ✓ Administration and Control of traffic movement.
6	District Road Transport office (Ghaziabad)	✓ Preparation and administration of State Motor Vehicle Rules ✓ Administration of transport vehicle tariffs ✓ Inspection Certification and Registration of Motor Vehicles ✓ Administration and Control of route permits for public transport, IPT ✓ Administration of passenger tax, motor vehicle tax, road tax etc. ✓ Licensing of transport crew.
7	Noida Authority / Greater Noida Industrial Development Authority (GNIDA)	✓ Land use planning and distribution ✓ Preparation of Master Plans including that of urban transport ✓ Provisioning and maintenance of traffic signals, road signages, street furniture ✓ Construction and Maintenance of city roads ✓ Clearance of ROW encroachments
8	Delhi Metro Rail Corporation	✓ Construction of 3.9 km length of Metro from Kalindi Kunj to Botanical Garden ✓ Construction of 6.8 km length of Metro from Noida City Centre to NH-24
9	Noida Metro Rail Corporation	✓ Construction of Metro from Sec. 71 Noida to Boraki Greater Noida

It is observed from above table, that a number of agencies control urban transport system. Bus operations, land ownership issues, collection of parking fees and traffic violation fines, NMT planning, pedestrian safety, etc are several issues that are interconnected, but they fall under different departments. Such multiplicity of control leads to:

- ✓ A need for very high level of coordination
- ✓ Fragmentation of functional responsibilities
- ✓ Lack of local expertise
- ✓ Lack of focused attention and integrated approach in planning, budgeting, operation and control of the urban transport
- ✓ lack of coordination amongst all the departments in the urban transport sector
- ✓ Urban planning and transportation issues lacking in a coherent approach
- ✓ Road projects are implemented in isolation with other projects, which should otherwise be an integral part of road development like footpath, cycle tracks, pedestrian facilities, etc.
- ✓ There is no control over mushrooming growth of IPT modes in the city, which lead to issues of road congestion and also competing environment with the buses for passengers.
- ✓ Operational issues in public transport due to poor route and service planning.
- ✓ Multiplicity of command and control
- ✓ Paucity of expertise in innovative approach for raising finances for public transport

Thus, the need is felt for setting-up an umbrella level organisation for the overall planning and monitoring of the Urban Transport in both the cities.

9.4 Proposed Institutional Framework

9.4.1 Unified Metropolitan Transport Authority

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

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.

9.4.2 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 and rail transport systems.
- To serve as a single agency which will facilitate, coordinate, control and monitor the activities of various public and private partners that are an integral part of Public Transport System planning and Non-Motorised transport planning, implementation and operations.
- To serve as a centric regulatory agency, this will oversee the entire life cycle of Public Transport System operations.
- 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 public transport 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

9.4.3 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".

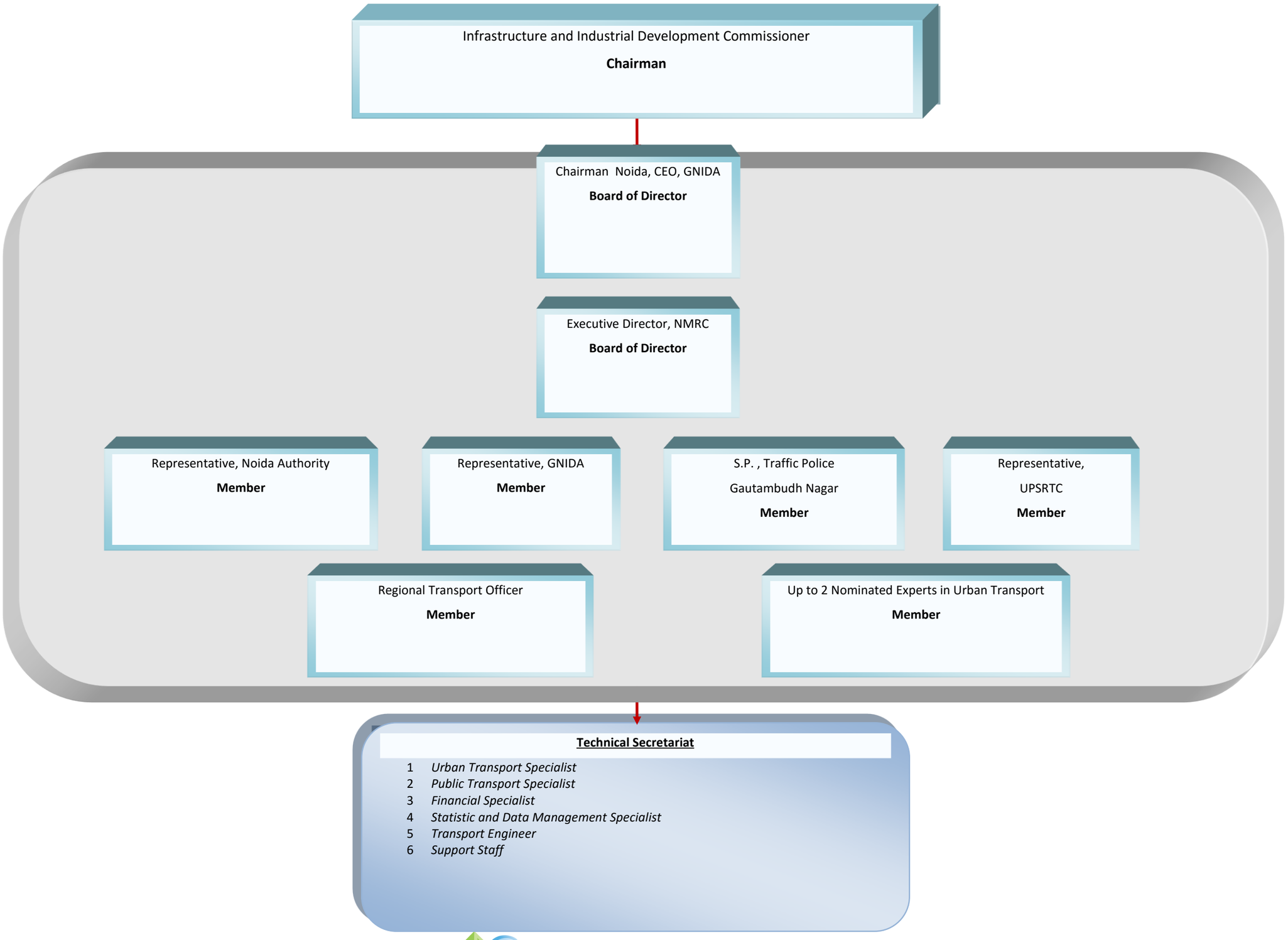
The overall aim of the UMTA will be to promote public transport in the urban areas through formulation of policies, programmes, rules and regulations related to urban transit. Its function is to facilitate/ co-ordinate planning and implementation of urban transport programmes and projects in an integrated 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.

Although Noida and Greater Noida are not million plus cities individually, but considering their importance as industrial and institutional hub, the ICMP for Noida and Greater Noida has suggested to form UMTA under the Directorate of Urban Development Department, Government of Uttar Pradesh. Formation of UMTA will not only ensure reduction of overlapping of responsibilities towards delivery of urban transport but will also make the whole system of delivery mechanism more efficient and effective.

9.4.4 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. It is recommended that Noida Metro Rail Corporation (NMRC) should act as a UMTA for Noida and Greater Noida. In the light of the above guidelines/recommendations, the following structure is proposed for UMTA:



Urban Mass Transit Company Limited

Besides the above members, Government of UP could invite representatives from other government departments, Vice Chairman (VC) of the concerned city development authority, bus operation unions, and other unions directly and/or indirectly related to provision of public transport, etc. as considered necessary from time to time.

9.4.5 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 finalisation. 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

9.4.6 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.

Chapter 10 Stakeholder Consultations

10.1 Introduction

Comprehenshive Mobility Plan, being the long term vision document, without active participation and feedbacks from different stakeholders, the process of preparing ICMP for Noida and Greater Noida can not be completed. Taking into cognizance of this fact, the process of preparing ICMP has been completed in consultation with all concerned stakeholders in each stage of the process. The details of stakeholder consultation is follows:

(a) **Finalization of Study Area, Horizon Year & Scope of Work Stage:** Each and every aspect of the scope of services has been discussued with Noida Authority and GNIDA.

(b) **Secondary Data Collection Stage:** Secondary data has been collected from various following agencies and departments along with their inputs:

1. Traffic Cell. Noida Authority
2. Planning Cell, Greater Noida Industrial Development Authority
3. Uttar Pradesh Road Transport Corporation
4. Delhi Road Transport Corporation
5. Traffic police, Gautambudh Nagar
6. Statistics Department
7. R.T.O. Ghaziabad
8. A.R.T.O. Noida
9. Noida Metro Rail Corporation (N.M.R.C.)
10. Delhi Metro Rail Corporation (D.M.R.C.)

(c) **Primary Data Collection Stage:** During the process of secondary data collection, UMTC has identified the data gaps and additional data requirements and accordingly, UMTC has carried out number of primary surveys (details of primary survey carried out has been discussed in Chapter 2 of this report) in consultation with Traffic police, Noida Authority and GNIDA. The locations of primary survey such as traffic and travel survey has been discussed with Noida authority and GNIDA officials along with the consultation of traffic police.

(d) **Data Analysis Stage:** The data collected from both secondary and primary sources has been compiled and analyzed. Based on the analysis of the data, inferences has been drawn and broad recommendations were dovetailed and the same has been submitted to the Noida Authority and GNIDA in the form of second deliverable, Interim Report.

(e) **Planning & Proposal Formulation Stage:** After incorporating the comments and suggestions, UTMC has prepared a detailed Transport Demand Model using transportation software to forecast future transport demand. Based on forecasted traffic and population, in consulation with stakeholders UMTC has formulated various intervention measures for improving the mobility scenario of Noida and Greater Noida. UMTC had made presentation on Draft Final Report and Final report to various stakeholders (refer Table 10-1) and received feedbacks and suggestions from them, all of which are incorporated in the report. Minutes of all the meetings mentioned below are given in Annexure.

Table 10-1 : Stakeholder Consultations

S. No.	Date	Purpose	Stakeholders
1	2nd Feb. 2015	Presentation for Draft final Repot	Noida and GNIDA authority officials, Traffic Police
2	20th March 2015	Presentation for Draft final Repot	Noida and GNIDA authority officials
3	24th March 2015	Presentation for final Repot	Noida and GNIDA authority officials
4	21st April 2015	Presentation for final Repot	Noida and GNIDA authority officials
5	18th May 2015	Presentation for final Repot	Noida and GNIDA authority officials
6	24th June 2015	Presentation for final Repot	Noida and GNIDA authority officials

Chapter 11 Way Forward

11.1 Next Steps

As a part of ICMP for Noida and Greater Noida, number of projects have been identified to improve the mobility of people. Following are the way forwards which needs to be taken up phase wise:

- Prioritize Projects for implementation- Action Plan
- Set up a high level monitoring committee
- Feasibility Reports/ DPRs prepared for individual projects, which should cover following aspects:
  - Technical and Physical feasibility
  - Technical System specifications
  - Detailed engineering specifications
  - Detailed Capital cost and O&M estimates
  - Potential revenues sources
  - Financial and Economic viability
  - Project Structuring and Means of Finance
  - Phasing and Implementation Plan
  - Micro level study for last mile connectivity including the provision of auto rickshaw and cycle rickshaw stands at property entrances.
- Submit DPR to various agencies for funding; GoI, VGF, ADB, World Bank etc.