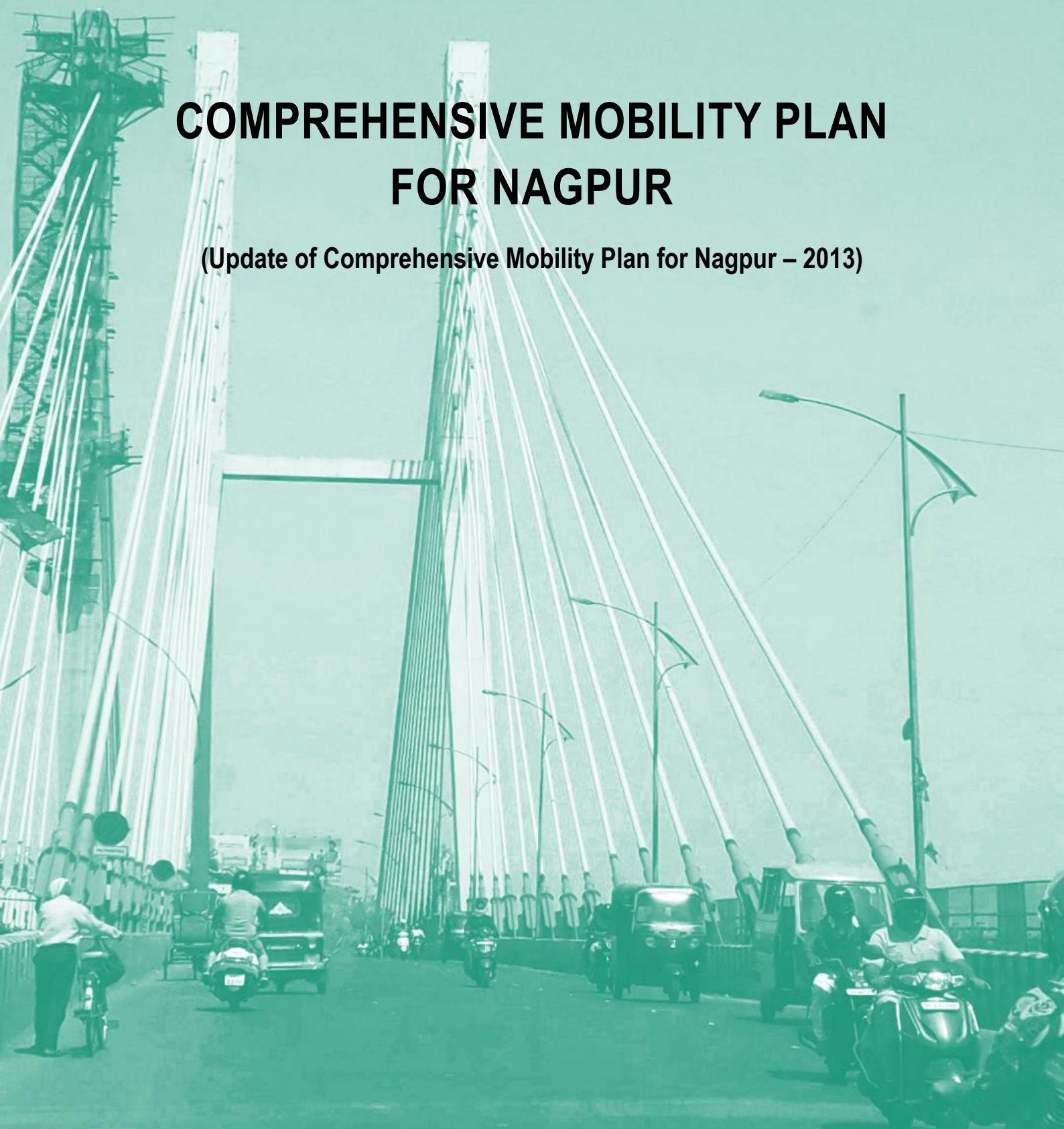
# COMPREHENSIVE MOBILITY PLAN FOR NAGPUR

**(Update of Comprehensive Mobility Plan for Nagpur – 2013)**



***Disclaimer:***

This document has been prepared for the "Comprehensive Mobility Plan for Nagpur". This Study is a mere update of the earlier project of Nagpur namely, Comprehensive Mobility Plan for Nagpur (2013). The present Study however is prepared by updating the traffic studies and the transport model built for the earlier study, and is as per the guidelines suggested by the then Ministry of Urban Development (MoUD) which is currently the Ministry of Housing and Urban Affairs. This Report should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority of UMTC being obtained. UMTC accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm his agreement to indemnify UMTC for all loss or damage resulting there from. UMTC accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned

# EXECUTIVE SUMMARY

# COMPREHENSIVE MOBILITY PLAN FOR NAGPUR

**(Update of Comprehensive Mobility Plan for Nagpur – 2013)**

Urban Mass Transit Company Limited

महा मेट्रो
NAGPUR METRO

# INTRODUCTION

## BACKGROUND

A Comprehensive Mobility Plan is needed to address the mobility needs of the people focusing on non-motorized and public transport, rather than catering to the needs of private automobile as an effective platform for integrating land use and transport planning.

In this regard, the Nagpur Improvement Trust (NIT) had prepared a Comprehensive Mobility Plan in the year 2013. However, now it is required that this study be updated considering the developments that have happened in the past five years in Nagpur. In this context, Nagpur Metro Rail Corporation Limited (NMRCL) wanted to update the earlier study prepared for Nagpur, namely Nagpur Comprehensive Mobility Plan, 2013 (CMP). Accordingly, NMRCL has awarded the study of preparing the Comprehensive Mobility Plan (CMP) to Urban Mass Transit Company Limited (UMTC) by updating the traffic data, the transport model built and the proposals recommended in the earlier studies. This Study will develop a perspective plan for sustainable urban transport over a 20-year horizon period.

## OBJECTIVES AND SCOPE OF THE STUDY

The ultimate Goal of a CMP is to provide a long-term strategy for the desirable mobility pattern of a city's populace. To achieve this goal, the following are the main objectives:

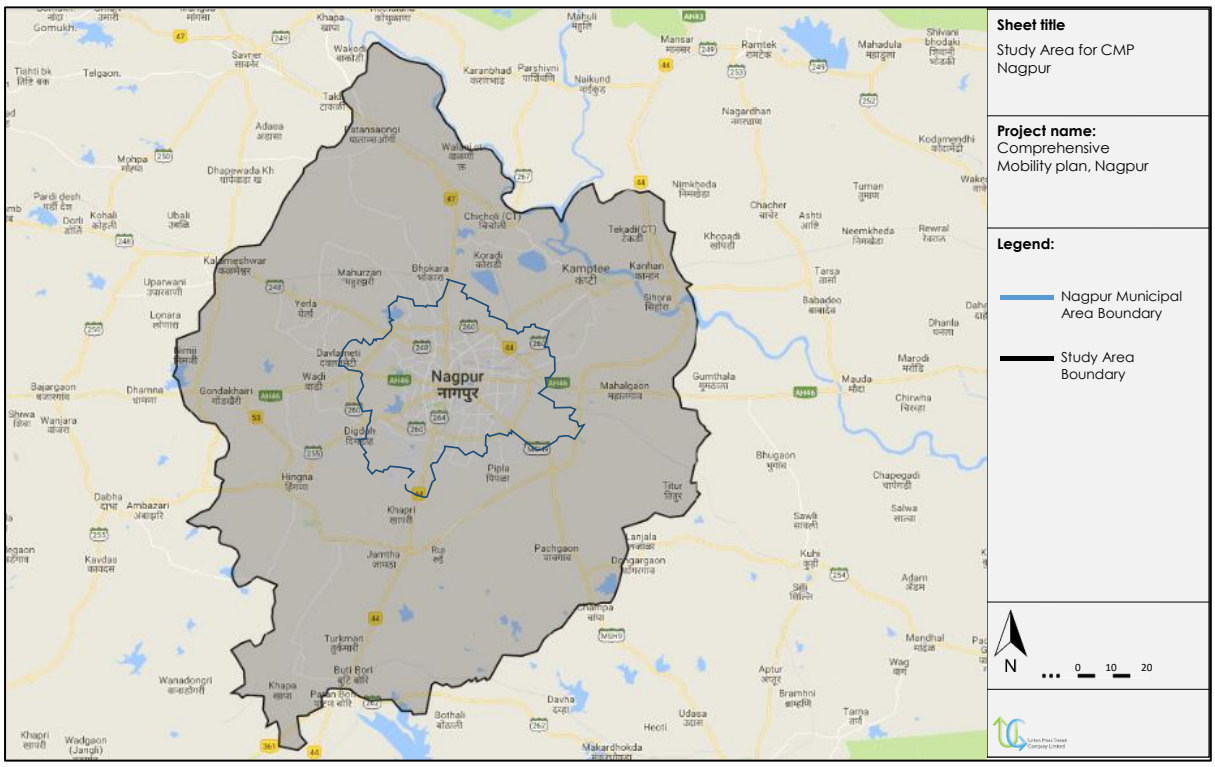
- *Develop public transit system in conformity with the land use that is accessible, efficient and effective.*
- *Ensure safety and mobility of pedestrians and cyclists by designing streets and areas that make a more desirable, livable city for residents and visitors and support the public transport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

The CMP which is prepared in accordance with the Revised CMP Toolkit, published by the MoHUA, will also focus on the following:

- *A study of Service Level Benchmarks as per MoHUA's Handbook on Service Level Benchmarks for Urban Transport.*
- *Study on Sustainable Habitat Mission for the city to make habitat sustainable through modal shift to public transport, as per National Mission on Sustainable Habitat. The study will also look in to the possibility of enhancing the NMT programs to make the sustainable habitat an integral part of the planning process.*

## STUDY AREA

The geographic area within the jurisdiction of Nagpur Municipal Corporation (NMC) along with other areas including Municipal Councils of Kamptee, Kalameshwar, Hingna and surrounding villages is taken as the study area. The study area comprise of about 1550 sq km out of total 3567sq km of NMA area.




Nagpur Study Area

## CITY PROFILE

**Demographics:** Nagpur city is the third largest urban agglomeration in the state of Maharashtra in terms of population. As per Census 2011, Nagpur accounted for 6% of the total urban population of the state and 76% of the district urban population of Nagpur district. In addition, 52% of the total district population resides within NMC. The study area population for the year 2011 has been taken from Census 2011 data. The population of NMC area is 24.1 Lakh and other areas including Kamptee, Kalmeshwar, Hingna and surrounding villages is 6.6 Lakh. The total population of study area is estimated at 30.7 Lakh in 2011

**Population Density:** The distribution of population in NMA is highly uneven. The city is characterized by low-rise development, which becomes dense in the older and inner parts of the city, and by a lot of vacant land in the outer areas of the city. The inner area of the city has a high density range of 700-850 persons per ha (as per Census 1991) and also along national highways, NH-6 and NH-7. But the peripheral areas indicated densities ranging from as low as 10 persons per ha to 150 persons per ha.

**Economy:** Nagpur is an emerging metropolis. In 2004, it was ranked the fastest-growing city in India. Nagpur has been the main center of commerce and is an important trading location. The city is also home to various food manufacturing units. The Maharashtra Agro Industrial Development Corporation has its

multi fruit processing division called Nagpur Orange Grower's Association (NOGA) which has an installed capacity of 4,950 MT of fruits per annum. The city is also undertaking the MIHAN project which is the biggest economic development project currently underway in India in terms of investments.

**Connectivity:** Nagpur city Nagpur is well-connected with most other cities of India by Rail and Roads. Railways started in Nagpur in 1867 when portion of Bombay-Bhusaval-Nagpur line was opened for traffic. Train service from Nagpur to Calcutta was started in 1881. Today, a total of 260 trains stop at Nagpur railway station. Nagpur Central Railway Station connects major railway trunk routes. An electrified broad gauge railway track connects Nagpur to the four major metros.

Nagpur is a major junction for roadways as India's two major national highways, Kanyakumari-Varanasi (National Highway 7) and Hajira-Kolkata (National Highway 6). Highway number 69 connects Nagpur to Obaidullaganj near Bhopal. Nagpur is at the junction of two Asian Highways namely AH43 Agra to Matara, Sri Lanka and AH46 connecting Kharagpur, India to Dhule, India Bhopal. Nagpur is at the junction of two Asian Highways namely AH43 Agra to Matara, Sri Lanka and AH46 connecting Kharagpur, India to Dhule, India.

## LAND AND TRANSPORT CHRACTERISTICS

At present, Nagpur is spread over an area of 227 Sqkm. As per the 1984 land use plan, only 80% of the land was developable, which has been increased to 100% in 2011. Also, approximately 150 sqkm of area is developed, which is 69% of the total area, and developed area in last three decades (since 1984) has doubled.

As per the existing land use, majority of the land portion is developed as residential which is 45%; commercial and industrial land use is 6%; land under public use is approximately 41%; and 8% is under parks and gardens. As per the Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines, the existing land use conforms to the norms in case of land under residential use, commercial use and land under public use. The total area considered under the revised development plan being prepared by NMC is 227 sq km. Of this, 217.56 sq km is under NMC jurisdiction, and rest 7.25 sq km is located outside NMC limits.

An area of 17.65 sq km is earmarked for sewerage and drainage disposal schemes. NMC has divided the entire area into 7 planning units for preparing the development plan. Area of newly merged census town is 7.25 sq km which will also be added to the NMC area for future development under revise development plan.

Nagpur has a distinct radial pattern and has two ring roads. The total length of the roads is about 1,907 kms, of which 1,150 kms of roads is within the jurisdiction of NMC. Nagpur is also a major junction for roadways as India’s two major national highways – National Highway (NH) 7 – Kanyakumari to Varanasi and National Highway (NH) 6 – Mumbai to Kolkata via Sambalpur pass through the city.

NH 69 also connects Nagpur to Obaiddullaganj near Bhopal.

The city bus service in Nagpur city (i.e the Nagpur Municipal Boundary) is operated by the Nagpur Mahanagar Parivahan Limited (NMPL), a special purpose vehicle (SPV) of Nagpur Municipal Corporation (NMC). The services have a fleet of 254 operational buses which ply on 36 routes of the registered 183 routes in the city.

## SECONDARY DATA COLLECTION

This plan will base its information from several studies undertaken in the recent past, in addition to carrying out some primary surveys. Reports which would be referred are:

1. Detailed Project Report for Rail Based Mass Transit System in Nagpur (Traffic and system selection report, 2017)
2. Comprehensive Mobility plan (2013)
3. Detailed Project Report for Feeder System for Nagpur Metro (2017)
4. Nagpur Parking Policy and Parking Master Plan (2016/7)
5. City Development Plan for Nagpur City for 2041
6. District Census Handbook Nagpur Nagar
7. Smart City Mission report (2016)
8. Environmental status report 2013-14 of Nagpur City

## PRIMARY DATA COLLECTION

Primary surveys are the on-site data collection exercise to collect data essential for the study and is not available through secondary sources. Numerous traffic surveys are required to fulfil data requirements for a CMP study. A detailed assessment of the data available through secondary sources in Nagpur is done and type of primary surveys to be conducted were finalized. The following table represents the primary surveys conducted for preparation of Comprehensive Mobility Plan.

List of Primary Surveys

| SN | Surveys | Unit | Quantity |
|---|---|---|---|
| 1 | Classified Volume count surveys at outer cordon locations (16 hours; 1 -day) | Location | 12 |
| 2 | Classified Volume counts at Mid-block/Screenline locations (16 hours) | Location | 60 |
| 3 | Classified Turning moment Volume Counts at Junctions (16hours) | Location | 20 |
| 4 | Road Side Interview at Outer Cordon locations (16 hours) | Location | 12 |
| 5 | Bus / Rail Terminal Passenger Count survey (boarding & alighting) 16 hours | Location | 14 |
| 6 | Bus/Rail/Terminal passenger OD Surveys (16 hours) | Location | 14 |
| 7 | Pedestrian Volume Counts at critical junctions (16 hours) | Location | 90 |
| 8 | Speed and Delay Study at peak and off peak hours | Km | 767 |
| 9 | Parking Number Plate Survey (Off Street; 16 hrs.) | Location | 40 |
| 10 | Parking Number Plate Survey (On Street; 16 hrs.) | Km | |
| 11 | House Hold Interview (1.5 %) | Sample | 8,123 |
| 12 | Road Network Inventory | Km | 767 |
| 13 | Occupancy at outer cordon locations (16 hours; 1 -day) | Location | 12 |
| 14 | Occupancy surveys at Mid-Block locations (16 hours; 1 day) | Location | 60 |

## EXISTING TRAFFIC CHARACTERISTICS

The salient features of the traffic and travel characteristics in the city based on the primary surveys executed are explained in the following sub sections.

### MODE SHARE

It can be observed that the share of 2 wheelers is the highest at 42.6% followed by Auto rickshaws at 19.8% and Bus at 15.6%. Whereas cars have the lowest mode share at 5.7%

### SPEED AND DELAY CHARACTERISTICS

It is observed from that about 54% of the total road network has journey speed upto 30 kmph and 28% of network has journey speed more than 40 kmph during peak hours. About 40% of surveyed network has journey speed upto 30 kmph and 32% of network has journey speed more than 40 kmph during off-peak hours. Average Journey Speed during peak and off-peak period for city as a whole is observed to be 23.4 kmph and 27.1 kmph respectively. It is also observed that journey speed in core area is about 19 kmph and 34 kmph in outer area during peak hours.

### TRIP PURPOSE

The total daily trips are estimated at 51,20,650 as derived from the household survey, of which the majority trips (43.3%) are for Work and Business whereas education accounts for 31.3% trips.

### PER CAPITA TRIP RATE

The total daily trips are estimated at 51,20,650 as derived from the household survey. About 90% of these are vehicular trips while 10% are walk trips. The per capita trip rate for motorized trip in the study area is 1.3.

### TRIP LENGTH

In Nagpur the average trip lengths are observed to be 7.6 km (including walk trips) and 8.2 km (excluding walk). The analysis of trips lengths by different modes estimates the average trip length by trains to be 23 km, whereas by cars and 2 wheelers to be 10.8 km and 8.6 km respectively. NMT modes such as walk, cycle and cycle rickshaws have an average trip length of 2 km, 3.3 km and 2.5 km respectively.

### TRAVEL TIME

The analysis of trips by all modes reveals that maximum trips i.e. 37% are made in 11-20 minutes and about 21% in 1-10 minutes.

### TRAVEL COST

It is observed that a major % of trips (32%) cost between Rs 6 to Rs 10, 15% of trips cost between Rs 21 to Rs 30 where as 6% of the trips cost upto Rs.5 for travelling in Nagpur.

# SERVICE LEVEL BENCHMARKING

Summary table of LoS calculated for study area (Overall LoS) is presented in table below:

**Service Level Benchmarking Summary**

| | Existing LoS | Remarks |
|---|---|---|
| **Public Transport Facilities** | 2 | The city has a public transport system which may need considerable improvements in terms of supply of buses/coaches. The network coverage is good but frequency of services available may need improvements. |
| **Pedestrian Infrastructure facilities** | 3 | The city has very poor pedestrian facilities which need significant improvements. The pedestrian facilities at intersections, footpaths etc. needs improvement as also many parts of city are not served by it. |
| **Non-Motorized Transport (NMT) facilities** | 4 | The city lacks adequate NMT facilities. |
| **Level of usage of Intelligent Transport System (ITS) facilities** | 4 | The city lacks adequate ITS facilities. |
| **Travel speed (Motorized and Mass Transit) along major corridors** | 3 | Significant approach delays and average travel speed of 1/3 the free flow speed or lower. Such condition causing combination of one or more reasons such as high signal density, extensive queuing at critical intersection and appropriate signal timing. |
| **Parking spaces** | 4 | The city authority need to initiate immediate actions with respect to providing paid parking spaces and demand management for parking. |
| **Road Safety** | 1 | Level of fatality rate in a city is very low. |
| **Pollution levels** | 2 | Need some improvement in emission standards, checking pollution etc. |
| **Availability of parking spaces** | 4 | The city authorities need to initiate immediate actions with respect of providing paid parking spaces and demand management for parking |
| **Integrated land use transport system** | 3 | Faint coherence between study area structure and public transport system. |
| **Sustainability of Public Transport** | 2 | The public transport is financial sustainable but need significant improvements |

# TRAVEL DEMAND MODELLING AND FORECASTING

An urban transport model to replicate the Study area transportation system is developed with a state-of-the-art software and modelling technology. The Nagpur transport model is developed using Cube software (a state-of-the-art Travel Demand Modelling software).

## STUDY AREA AND DELINEATION

The study area comprises of Nagpur Municipal Corporation and Other Areas such as Kamptee, Kalmeshwar, Hingna and surrounding villages making a total of 1550 sq.km. It has been subdivided into smaller physical units, termed as Traffic Analysis Zones (TAZs) to facilitate understanding of travel pattern within the study area. Consultant have chosen current municipal wards as TAZs for which demographic, socio-economic and other planning data is readily available from secondary sources.

## INTERNAL ZONES

The study area is divided into 182 TAZs as per prevailing demarcation of municipal wards. These wards are taken as internal zones

## EXTERNAL ZONES

The Regions beyond the study area have been delineated into external zones based on the catchment of the existing transport links feeding into the study area. A total of 12 external zones are considered representing the world outside the study area. In summary, study area is divided into total 194 TAZs.

## HORIZON PERIOD

Year 2018 is considered as Base Year. The travel demand forecasts is to be prepared up to 2041. Therefore for the purpose of sequential planning and design of the systems, these travel demand forecasts are presented for the years 2021, 2031 and 2041.

## PREPARATION OF DATA BASE

Data required for the analysis of travel demand can be categorized into three types.

- Planning variables
- Transport network
- Travel Demand and Characteristics

## BASE YEAR TRAVEL DEMAND MODEL

The base year scenario represents the present road network and current travel demand of the city. The interaction between traffic analysis zones based on the mode people choose will give fair idea about the travel behaviour. This information allows transport agency / stakeholders to comprehend travel patterns and characteristics; measure trends; provide input to travel demand model development, forecasting, and planning for city wide transportation infrastructure needs and monitor progress and changes due to implementation of transportation systems. The trunk network length modelled is 767 kms.
The trips shown in tables below were assigned to the base model to assess the network efficacy.

Table 1 Number of trips Purpose-Wise Trips Modelled

| Mode | Number of Trips |
|---|---|
| **Home based Work** | 20,29,672 |
| **Home based Education** | 12,38,254 |
| **Home based Others** | 10,17,307 |

Table 2 Number of Mode-Wise Trips Modelled (Motorized modes only)

| Modal Split 2018 | HBW | HBE | HBO |
|---|---|---|---|
| **Car** | 226934 | 21477 | 43144 |
| **2-Whlr** | 1541498 | 354181 | 274735 |
| **Auto** | 117078 | 235202 | 470403 |
| **Bus** | 132093 | 339831 | 227409 |
| **Mini Bus** | 4561 | 48466 | 760 |
| **School Bus** | 3231 | 238718 | 855 |
| **Chartered Bus** | 4276 | 380 | 0 |

### Inferences:

Base year model stands validated and V/C ratios along some of the major roads have been compiled and presented in Table 31.

Table 3 V/C and Average Network Speed for various Corridors

| Sno | Name Of Road | V/c Ratio - Maximum | V/c Ratio- Average | Average Network Speed |
|---|---|---|---|---|
| **1** | Ajini Road | 0.94 | 0.49 | 25 |
| **2** | Ambazari Lake Road | 0.70 | 0.63 | 22 |
| **3** | Amaravathi Road | 0.49 | 0.25 | 26 |
| **4** | Central Avenue Road | 0.80 | 0.36 | 25 |
| **5** | Ghat Road | 0.78 | 0.47 | 22 |
| **6** | Umred Road | 0.59 | 0.30 | 24 |
| **7** | Wardha Road | 0.51 | 0.25 | 23 |

# HORIZON YEAR TRAVEL DEMAND MODELLING

## SCENARIOS SPECIFICATIONS AND TRAVEL DEMAND

The section provides the description and analysis for the scenarios for understanding of the transport network and indicators while describing the travel pattern. As per ''trip generation model zoning'' the framework for understanding of interaction (trips) between the zones is created i.e. scenarios are developed as discussed below:

***Business as Usual/Do nothing scenario***: Scenario describe the future year (2021, 2031 and 2041) and future demand with minimum investments done on public transportation sector, this will help in analysing the efficacy of the existing network, and how it perform under given traffic demand. The problems (congestion and congested network, increased travel time etc.) can be identified and possible solutions/ interventions can be proposed to mitigate the same. The population and employment for horizon years have been projected based on the parameters such as potential density and highway connectivity. The projected population and employment figures for the horizon years are shown in the Table 32:

Table 4 Planning Variables for study area in BAU Scenario

| Year | Population | Employment |
|---|---|---|
| 2018 | 3430000 | 1270000 |
| 2021 | 3613307 | 1364484 |
| 2031 | 4334357 | 1709181 |
| 2041 | 5035375 | 2033464 |

With the help of the base year transport model developed for the study area, travel demand has been estimated for the horizon years 2021, 2031 and 2041 for BAU scenarios and listed in Table 33.

Table 5 Total Trips in BAU Scenario

| Total Trips | 2018 | 2021 | 2031 | 2041 |
|---|---|---|---|---|
| **Home based Work** | 2218499 | 2360431 | 2859779 | 3355529 |
| **Home based Education** | 1604408 | 1707053 | 2068179 | 2426703 |
| **Home based Others** | 1297743 | 1380769 | 1672870 | 1962866 |
| **Total** | 5120650 | 5448252 | 6600828 | 7745098 |

Table 6 Details of Trips in BAU Scenario

| Trips % Classification | % |
|---|---|
| **Home based Work** | |
| **PT** | 7% |
| **IPT** | 6% |
| **PVT** | 80% |
| **NMT** | 8% |
| **Home based Education** | |
| **PT** | 39% |
| **IPT** | 15% |
| **PVT** | 23% |
| **NMT** | 22% |
| **Home based Others** | |
| **PT** | 18% |
| **IPT** | 37% |
| **PVT** | 24% |
| **NMT** | 21% |

***A Sustainable Urban Transport* Scenario *(Transit Oriented Development Scenario)*** is a compact high density mixed use development that is planned along public transit stations (or corridors) which provide housing, employment, entertainment and civic functions within the walking distance. In this scenario, it is assumed that a population density of 400 persons per hectare will be achieved in the zones along transit corridors by the year 2041. With the help of the base year transport model developed for the study area, travel demand has been estimated for the horizon years 2021, 2031 and 2041 for Sustainable Urban Transport scenarios listed in Table 35.

Table 7 Counts of Trips in SUT Scenario

| Trips Count Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 631021 | 883022 | 1178690 |
| **IPT** | 91885 | 106796 | 116455 |
| **PVT** | 1459468 | 1654237 | 1807264 |
| **NMT** | 178056 | 215724 | 253120 |
| | **2360431** | **2859779** | **3355529** |
| **Home based Education** | | | |
| **PT** | 843977 | 1055827 | 1285055 |
| **IPT** | 176034 | 204178 | 221785 |
| **PVT** | 304338 | 344509 | 375821 |
| **NMT** | 382704 | 463665 | 544043 |
| **IIPT** | **1707053** | **2068179** | **2426703** |
| **Home based Others** | | | |
| **PT** | 481737 | 622328 | 789825 |
| **IPT** | 347518 | 402844 | 437103 |
| **PVT** | 262842 | 297958 | 325570 |
| **NMT** | 288671 | 349739 | 410368 |
| | 1380769 | 1672870 | 1962866 |
| **Total** | **5448252** | **6600828** | **7745098** |

Table 8 Details of Trips in SUT Scenario

| Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 27% | 31% | 35% |
| **IPT** | 4% | 4% | 3% |
| **PVT** | 62% | 58% | 54% |
| **NMT** | 8% | 8% | 8% |
| **Home based Education** | | | |
| **PT** | 49% | 51% | 53% |
| **IPT** | 10% | 10% | 9% |
| **PVT** | 18% | 17% | 15% |
| **NMT** | 22% | 22% | 22% |
| **Home based Others** | | | |
| **PT** | 35% | 37% | 40% |
| **IPT** | 25% | 24% | 22% |
| **PVT** | 19% | 18% | 17% |
| **NMT** | 21% | 21% | 21% |

Sustainable Urban Transport Scenario comprises of transport network incorporating committed projects along with major proposed projects. The section 'Mobility Improvement Measure' describes each in detail.

## TRAFFIC CHARACTERISTICS – HORIZON (2041)

### BUSINESS AS USUAL SCENARIO

It has been observed that the share of Public Transport (Bus) and IPT in Business As Usual Scenario is 24% and 19% respectively. Table below shows the modal share for various trip purposes.

**Modal Share (purpose wise) in BAU scenario**

| Motorized Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 8% | 8% | 8% |
| **IPT** | 6% | 6% | 6% |
| **PVT** | 86% | 86% | 86% |
| | | | |
| **Home based Education** | | | |
| **PT** | 50% | 50% | 50% |
| **IPT** | 19% | 19% | 19% |
| **PVT** | 30% | 30% | 30% |
| | | | |
| **Home based Others** | | | |
| **PT** | 23% | 23% | 23% |
| **IPT** | 46% | 46% | 46% |
| **PVT** | 31% | 31% | 31% |

Table below gives the estimated modal split at aggregate level for study area for Business as Usual scenario.

**Total trips in BAU scenario (modal spilt aggregate)**

| Mode Split | 2021 | 2031 | 2041 |
|---|---|---|---|
| **PT** | 24% | 24% | 24% |
| **IPT** | 19% | 19% | 19% |
| **Pvt (Car +Two Wheeler)** | 57% | 57% | 57% |

### SUSTAINABLE URBAN TRANSPORT SCENARIO

It has been observed that the share of Public Transport (High capacity MRTS, Medium capacity MRTS, Bus Trips) in Sustainable Urban Transport Scenario has increased by 20 % in comparison to Scenario 1 (Business As Usual Scenario). The modal split is given in table below:

**Modal Share (purpose wise) in SUT scenario**

| Motorized Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 29% | 33% | 38% |
| **IPT** | 4% | 4% | 4% |
| **PVT** | 67% | 63% | 58% |
| | | | |
| **Home based Education** | | | |
| **PT** | 64% | 66% | 68% |
| **IPT** | 13% | 13% | 12% |
| **PVT** | 23% | 21% | 20% |

| | | | |
|---|---|---|---|
| **Home based Others** | | | |
| **PT** | 44% | 47% | 51% |
| **IPT** | 32% | 30% | 28% |
| **PVT** | 24% | 23% | 21% |

Table below gives the estimated modal split at aggregate level for study area for SUT scenario.

*Total trips in SUT scenario*

| Mode Split | 2021 | 2031 | 2041 |
|---|---|---|---|
| **PT** | 43% | 46% | 50% |
| **IPT** | 13% | 13% | 12% |
| **Pvt (Car +Two Wheeler)** | 44% | 41% | 38% |

## COMPARISON OF NETWORK CHARACTERISTICS IN VARIOUS SCENARIOS

Network characteristics for Base year (2018) and Horizon year (2041) for various scenarios during peak hour are presented in Table 41 below.

**Comparison of Network Attributes (Aggregate level) on links for Various Scenarios**

| Network Characteristic | Base Year (2018) | Horizon Year (2041) | |
|---|---|---|---|
| | | Scenario-I: Business As Usual Scenario | Scenario-II: Sustainable Urban Transport Scenario |
| **Avg. Network Speed (kmph)** | 23.4 | < 20 | 30 |
| **Avg. V/C Ratio** | 0.72 | > 0.90 | 0.70 |

It is observed that, in comparison to BAU 2041, average V/C ratio has reduced to 0.7 and average network speed has increased by 25 % in Sustainable urban transport scenario. Scenario-II is selected for proposing various transport improvement proposals.

**Comparison of Network Attributes (Link wise) on links for Various Scenarios**

| Major Road | V/C Ratio comparison | |
|---|---|---|
| | Scenario-I: Business As Usual Scenario | Scenario-II: Sustainable Urban Transport Scenario |
| **Ajni Road** | 0.94 | 0.80 |
| **Ambazari Lake road** | 0.70 | 0.60 |
| **Amaravati Road** | 0.49 | 0.42 |
| **Central Avenue** | 0.80 | 0.68 |
| **Ghat Road** | 0.78 | 0.66 |
| **Umred Road** | 0.59 | 0.50 |
| **Wardha Road** | 0.51 | 0.44 |

# MOBILITY VISION AND GOALS

The concept of Comprehensive Mobility Plan (CMP) is to have a long-term vision for desirable accessibility and mobility pattern for people and goods in the urban agglomeration. It focuses on the mobility of people to address urban transport problems and promote better use of existing infrastructure, which as such leads to the integration of land-use and transport and is essential to build smart cities.

***"To ensure that Nagpur 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 liveability."***

To ensure that Mobility solutions for Nagpur that 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, liveable 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 Policy that discourage the demand for parking and need for private mode of transport and also facilitate organized parking for various types of vehicles.*

# STRATEGIES AND PROJECTS

## LAND USE TRANSPORT STRATEGY

This strategy is focused 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. High demand mobility corridors which are eligible for a Transit Oriented Development are given in table below:

Proposed Transit Oriented Development Corridors

| Sno | Mass Transit Corridors | Length (km) |
|---|---|---|
| 1 | Automotive Square to Khapri Station | 19.7 |
| 2 | Pardi to Mount View (Hingna) | 20.1 |
| 3 | Automotive Square to Kanhan River | 13 |
| 4 | Prajapati Nagar to Transport Nagar | 5.6 |
| 5 | MIHAN to MIDC ESR | 18.5 |
| 6 | Lokmanya Nagar to Hingna | 6.7 |
| 7 | Vasudev Nagar to Dattawadi | 4.5 |

## PUBLIC TRANSPORT STRATEGY

One of the goals identified as part of the vision is to increase the integrated public transport share (PT+IPT) to 60% from the existing 43%. For this purpose, we could consider augmentation of City Bus System, including Route Rationalization, before embarking on capital intensive system(s). Bus systems only may not be able to meet the desired goal and on key corridors (mobility corridors) a case exists for providing a higher capacity mass transit system such as Monorail / LRT/ Metro. High demand mobility corridors which are eligible for a Mass Rapid Transit Systems are identified and presented in table below:

Table: Proposed Transit corridors

| Sno | Mass Transit Corridors | Length (km) |
|---|---|---|
| 1 | Automotive Square to Khapri Station | 19.7 |
| 2 | Pardi to Mount View (Hingna) | 20.1 |
| 3 | Automotive Square to Kanhan River | 13 |
| 4 | Prajapati Nagar to Transport Nagar | 5.6 |
| 5 | MIHAN to MIDC ESR | 18.5 |
| 6 | Lokmanya Nagar to Hingna | 6.7 |
| 7 | Vasudev Nagar to Dattawadi | 4.5 |
| 8 | Katol Road | 5.8 |
| 9 | Koradi Road | 2.6 |
| 10 | Umred Road | 5.5 |
| 11 | Amaravathi Road | 8.2 |
| 12 | Vasudev Nagar to Dattawadi on Inner Ring Road connecting Katol Rd. Amravati Rd. Hingana Rd, Wardha Rd., Umred Rd., Bhardara Rd & Kamptee | 34 |

Based on the future transit demands estimated through 4-stage model the above mobility corridors are categorized into High capacity MRTS Corridors and Medium Capacity MRTS Corridors

Proposed High Capacity Mass Rapid Transit Corridors

| SN | High Capacity MRTS Corridors | Length (km) | Phase | PHPDT (2021) | PHPDT (2031) | PHPDT (2041) |
|---|---|---|---|---|---|---|
| 1 | Automotive Square to Khapri Station | 19.7 | 1 | 12,500 | 13,000 | 15,000 |
| 2 | Pardi to Mount View (Hingna) | 20.1 | 1 | 9,000 | 11,000 | 16,500 |
| 3 | Automotive Square to Kanhan River | 13 | 2 | 8,300 | 8,900 | 10,500 |
| 4 | Prajapati Nagar to Transport Nagar | 5.6 | 2 | 3,100 | 3,800 | 5100 |
| 5 | MIHAN to MIDC ESR | 18.5 | 2 | 3,000 | 4,400 | 5600 |
| 6 | Lokmanya Nagar to Hingna | 6.7 | 2 | 3,150 | 3,800 | 5,100 |
| 7 | Vasudev Nagar to Dattawadi | 4.5 | 2 | 3,300 | 4,800 | 5,800 |

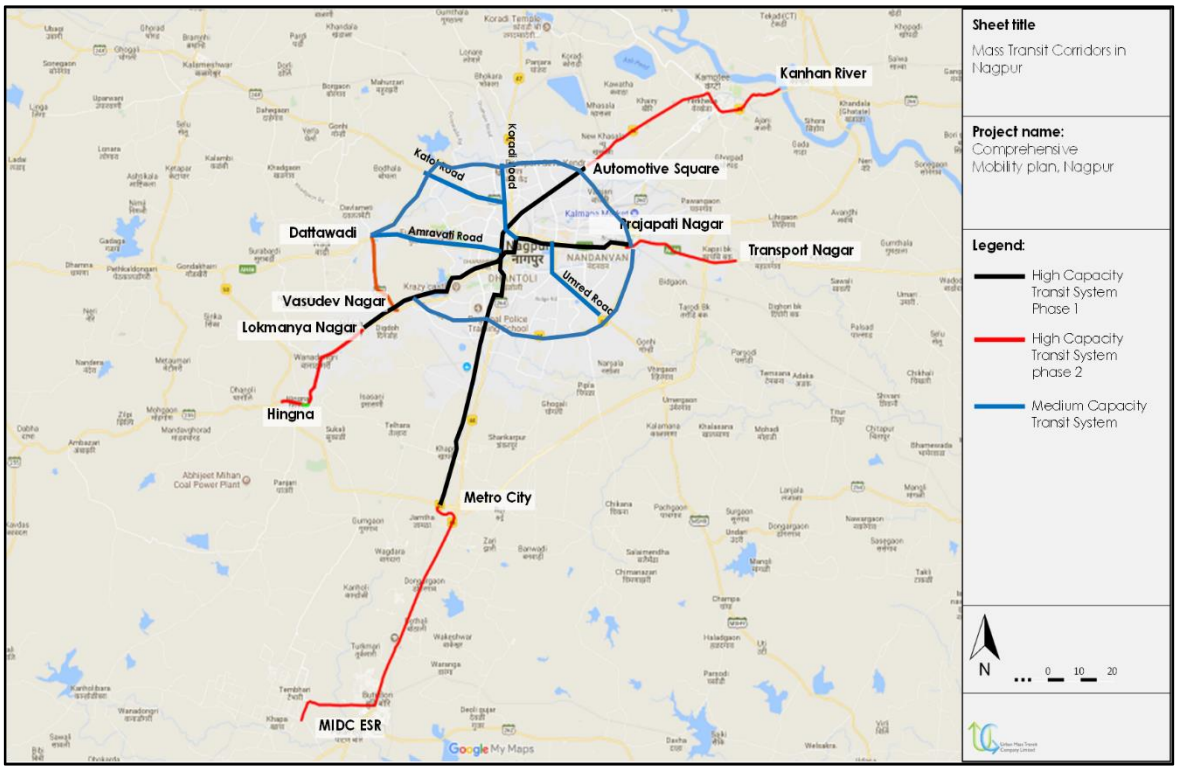
The appropriate mode for proposed mass transit corridors can be selected based on detailed alternative analysis of the available mode options. The Daily trips by High Capacity MRTS Corridors calculated for Nagpur and presented in table below is based on the assumption that the overall transportation infrastructure of the city is developed in line with all the proposals made as part of the CMP.

Proposed Medium Capacity Transit System corridors

| Medium Capacity MRTS Corridors | Length (km) |
|---|---|
| Katol Road | 5.8 |
| Koradi Road | 2.6 |
| Umred Road | 5.5 |
| Amaravathi Road | 8.2 |
| Vasudev Nagar to Dattawadi on Inner Ring Road connecting Katol Rd. Amravati Rd. Hingana Rd, Wardha Rd., Umred Rd., Bhardara Rd & Kamptee | 34 |

Daily trips (In Lacs) in Mass Rapid Transit system

| | 2021 | 2031 | 2041 |
|---|---|---|---|
| Daily trips in High Capacity MRTS Corridors | 5.01 | 6.33 | 7.74 |
| Daily trips in Medium Capacity MRTS Corridors | 0.64 | 0.81 | 0.99 |
| Total Public Transport Ridership | **5.65** | **7.14** | **8.73** |




Proposed Transit Corridors



Urban Mass Transit Company Limited

NAGPUR METRO

## MULTI MODAL TRANSIT HUBS

Inter-modal integration is a strategy proposed for Nagpur which will ensure efficient and effective coordination across various transport modes. Important Multi Modal Hub locations were identified during the planning of mobility corridors in Nagpur and listed in table below.

List of Multi Modal Hubs

| Type | Proposed Multi-Modal Hub Location | Number of modes | Modes |
|---|---|---|---|
| **Level 1 City Transport Modes Only** | Mor Bhawan Bus Terminal | 3 | • High Capacity Mass Rapid Transit system<br>• IPT Connectors<br>• City Bus Service |
| | Sitabardi Bus Terminal | 3 | • High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT Connectors |
| **Level 2 Regional Transport Modes + City Transport Modes** | Ganesh Peth Bus Terminal | 2 | • Regional Bus Service<br>• City Bus Service<br>• IPT Connectors |
| | Chatterpati Bus Terminal | 2 | • Regional Rail<br>• City Bus Service |
| | Ravi Nagar Bus Stop | 2 | |
| | Nagpur Railway Station | | • Regional Rail<br>• High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT System |
| | Ajni Railway Station | 3 | • Regional Rail<br>• City Bus Service<br>• IPT System |
| | Kamptee Railway Station | 3 | • Regional Rail<br>• High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT System |
| | Nagpur Airport | 2 | • High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT/Airport Connectors |

Interchanges and Terminals for Multimodal Integration

## ROAD NETWORK PROPOSALS

Ring radial road network pattern is proposed for Nagpur. Based on the road network envisaged some semi-ring and radial roads are proposed to be completed/constructed to achieve the desired overall road network in the city. The proposed complete road network for Nagpur including new links is shown below and all the semi-ring and radial roads are listed below:

**Major Rings**

**A**. Chandrapur Nagur road – Tekdi Road

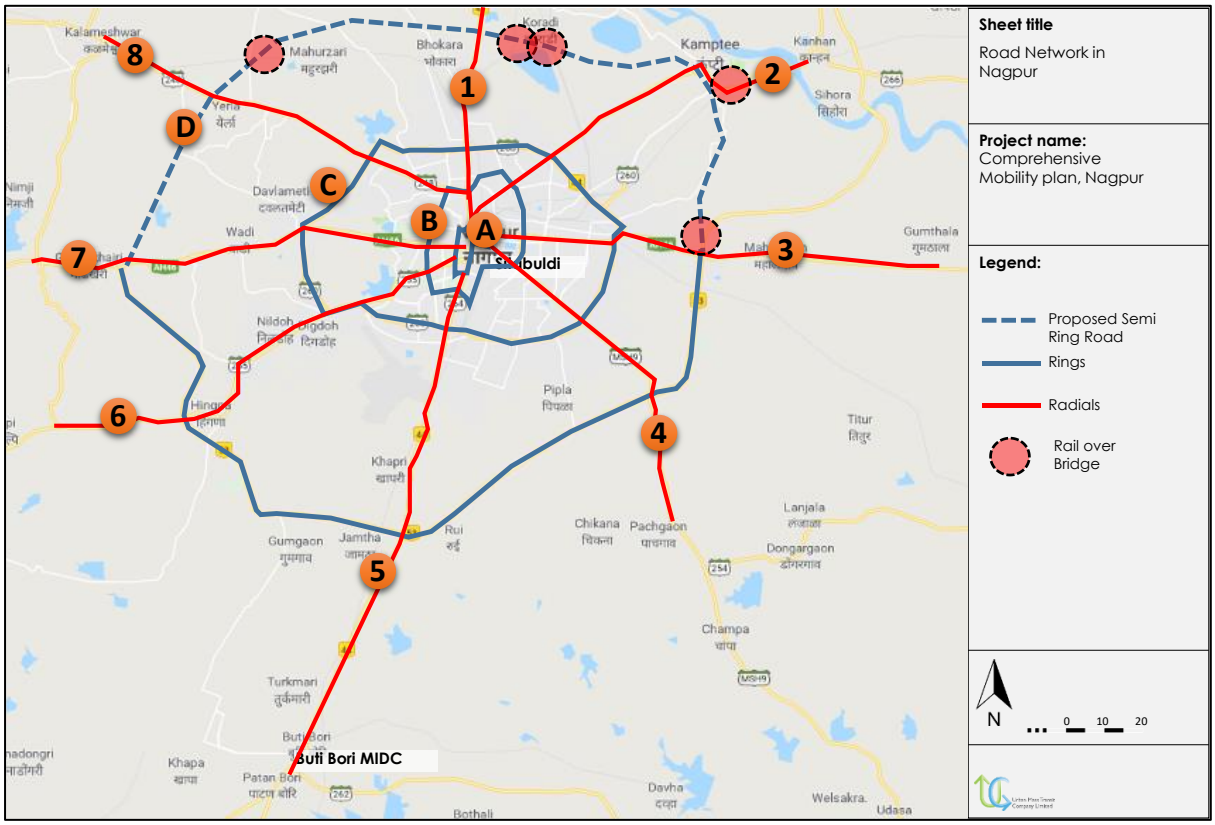
**B.** W High Court Road – Mescobagh raod – Dr Ambedkar raod – Ajni Road

**C.** Inner Ring road

**D.** Outer New ring* (Existing part ring = Gondakkhairi – Hingna – Gavsi Manapur – Umergaon – Kapsi BK, Proposed part ring = Gondakkhairi – Dahegaon – Mahadula - Kamptee )

**Major Radials**

1. Koradi Road
2. Kamptee road
3. NH-6 (Donargarh – Nagpur Road)
4. Taj Bagh Road
5. Wardha Road
6. Hingna Road
7. Amravati Road
8. Katol Road




Proposed semi ring radial network in Nagpur

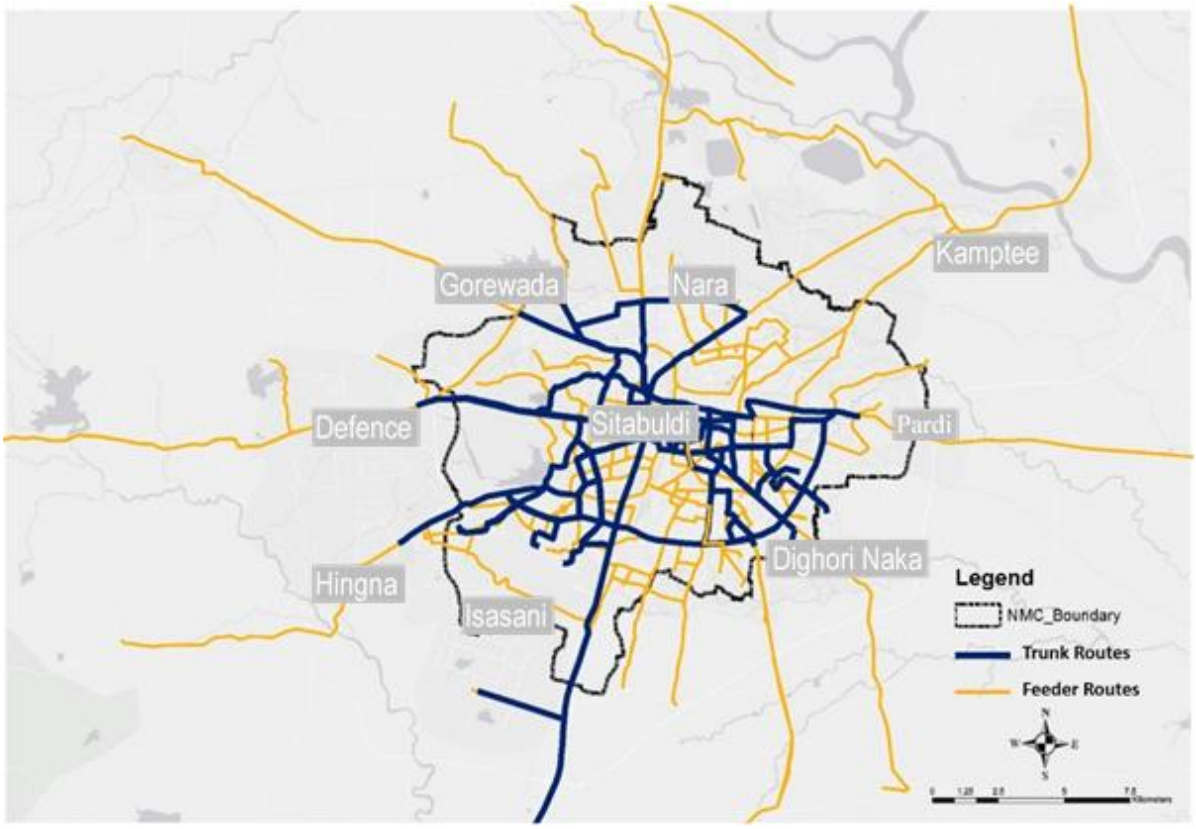
## CITY BUS SYSTEM IMPROVEMENT

The current city bus services in Nagpur are radial in nature, wherein the city has strong central core around which the development has taken place directionally. As in case of Nagpur, the string central core is Sitabuldi, wherein the city bus routes are connected to the major fringe areas around the city which are; Kamptee, Pardi, Kharbi, Piplafata, Buti Bori, MIDC Hingana, Defence, Gorewada, Suradevi, Khaparkheda etc.

To achieve the optimum level of service in Public Transport for Nagpur city, rationalization of the city bus routes has been recommended based on the “Hub & Spoke Model”. The trunk routes would operate along the major transit corridors, direction wise connecting the major activity centers within the city (designed as Hubs) whereas the feeder routes would operate from hubs to the minor activity centers.

Based on the Rationalization of the City Bus Services in Nagpur, 76 City Bus Routes have been recommended for introduction and operations in Phase wise manner.

Recommended Truck and Feeder Network of the Rationalized City Bus Routes




It is important that an optimal fleet size is determined and such a system needs to be developed which ensures enough fleet size to meet the ridership demand at the same time being self-sustainable. Based on the above mentioned demand, the city bus fleet augmentation is proposed based on the LoS-1 benchmark requirement of SLB Handbook. The proposed city bus fleet size for the future years.

Bus Augmentation

| Year | Ridership | No. of Buses (A) | No. of Spare Buses (B) | Total No. of Buses (C = A+B) |
|---|---|---|---|---|
| **2018** | 3,60,363 | 577 | 30 | 607 |
| **2021** | 4,87,098 | 780 | 40 | 820 |
| **2031** | 9,55,394 | 1814 | 91 | 1904 |
| **2041** | 12,13,677 | 2303 | 115 | 2418 |

NMC has been currently operating 237 diesel fueled standard buses, 10 ethanol fueled standard buses, i.e; a total of 248 buses. NMC has also made plans to introduce a total of 487 buses into the system including the already operational buses, in coordination with the 3 city bus operators. As the GoI is actively promoting electric vehicles through its National Electric Mobility Mission Plan 2020, it is recommended to include 10% of the total fleet to be electric buses into the city bus fleet, i.e; 54, 74, 171 and 215 buses in 2018, 2021, 2031 and 2041. These buses would be fully electric that shall be based on Battery, Pantograph, Articulated arm or Inductive charging. These technologies have zero tail pipe emission, thereby reducing the emissions to almost negligible.

To support the proposed augmented city bus services, the support infrastructure/allied infrastructure to facilitate operations with proposed augmented fleet size, which are;

1. Bus Stops/Bus Q Shelters
2. Bus Depots
3. Bus Terminals/Interchanges

**Bus Stops/Bus Q Shelters:**

Total no. of 900 Bus Q Shelters would be required to be developed on 225 Km of road network in Nagpur, considering an average distance of 500 M between two consecutive bus Q shelters on either side of the road network. Since NMC already developed and maintains 190 bus Q shelters, additionally 710 bus Q shelters needs to be developed.

**Bus Depot and Terminal**

In Nagpur, there are 4 depots (i.e, Zero Mile, Tekanaka, Hingana and Patwardhan) which are already in operation. Based on the outcomes of the CMP, it is very essential to upgrade the current depot infrastructure covering both civil infrastructure as well as depot equipment, which will have a huge impact on the quality of city bus operations in Nagpur city.

The intra city terminal facilities in Nagpur are concentrated only at Mor Bhawan terminal, which is located in the city core area. Based on the routing pattern of the city bus services in Nagpur, the tentative location of the terminals/mobility hub has been identified.

In addition to the existing 4 depots in the city, 6 new depot locations have been identified tentatively in the city outskirts along the inner ring road to facilitate decongestion of city bus services at the city center, minimize the dead mileage and increase operational efficiency. It is also proposed to have integrated depot and terminal, which would facilitate decongestion of the city bus services from the city center and enabling direction-oriented transfer facilities. However, the urban local bodies would be either required to identify potential new sites for depot development or allocate appropriate land space in identified potential depot locations accommodating minimum of 2418 buses by 2041. The tentative locations of proposed new depots and terminals are as under; (Refer to Figure 28).

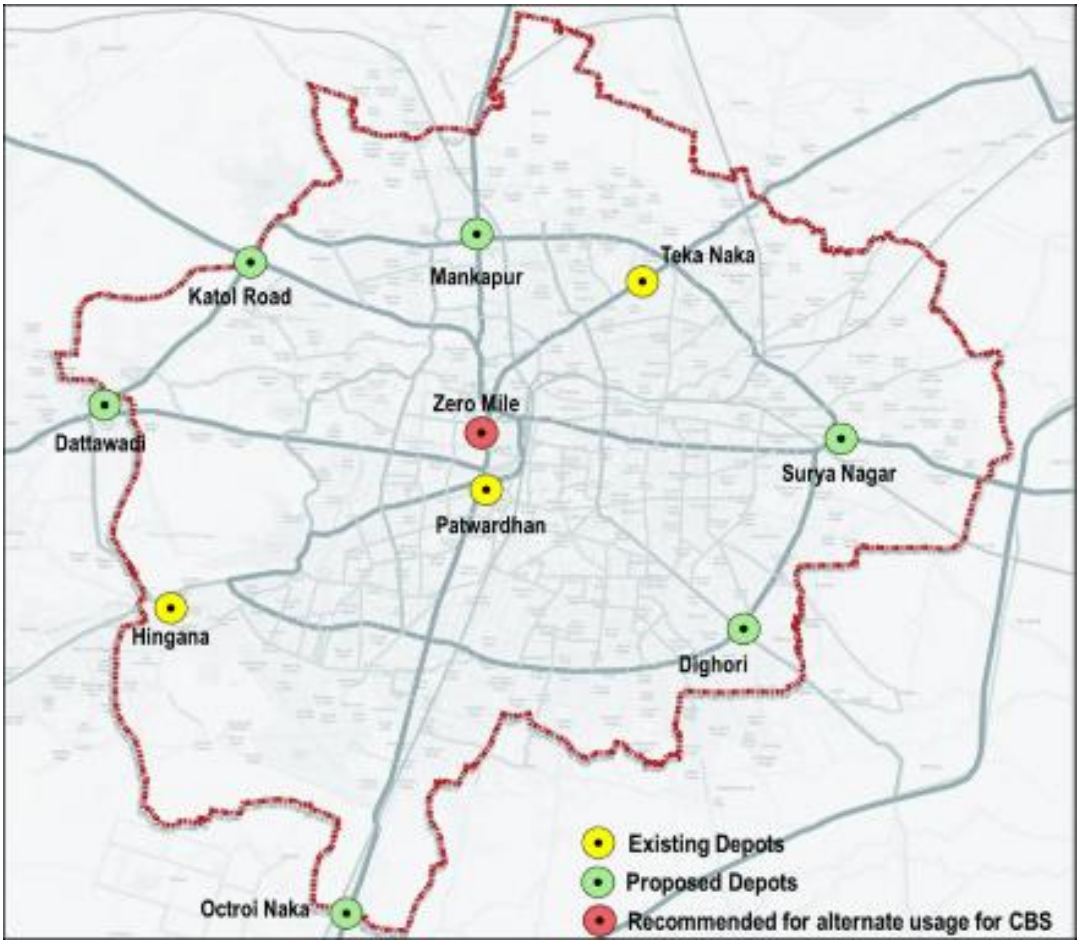
1. Mankapur Chowk (junction on Koradi road and inner ring road)
2. Junction on Katol Road and Inner Ring Road
3. Junction on Amravati road and Inner Ring Road Dattawadi
4. Octroi Chekpost
5. Junction on Umred Road and Inner Ring Road Dighori
6. Surya Nagar

After detailed assessment of location of the existing depots in Nagpur, it has been noted that the Zero Mile Depot is located right in the heart of the city covering an area of 0.5 acres. Considering the activities undertaken in the depots, during the day and night, the depot shall create disturbance/noise pollution for the surrounding areas. Since the area is only 0.5 acres, depot doesn't have adequate space to accommodate enough no. of buses. Under the mentioned circumstances, it is recommended to shut down the depot at the aforementioned location and requisite land space be utilized for the other services of City Buses.

Proposed New Bus Depot and Terminal Locations

| SN | Proposed Location | Facility |
|---|---|---|
| 1 | **Dattawadi** | Depot/Terminal Proposed |
| 2 | **Babulkheda** | Depot/Terminal Proposed |
| 3 | **Hingana** | Depot Existing, Terminal Proposed |
| 4 | **Katol Naka** | Depot/Terminal Proposed |
| 5 | **Takli** | Depot/Terminal Proposed |
| 6 | **Octroi Checkpost** | Depot/Terminal Proposed |
| 7 | **Patwardhan** | Depot Existing, Terminal Proposed |
| 8 | **Wathoda** | Depot/Terminal Proposed |
| 9 | **Teka Naka** | Depot Existing, Terminal Proposed |

At the proposed location, the land required for a depot would be approximately 5 acres for 100 buses and some additional area would be required for terminal facility. In absence of sufficient land, the possibility of multistory bus parking could be explored through a detailed technical and financial feasibility study.




Proposed New Bus Depot and Terminal Location

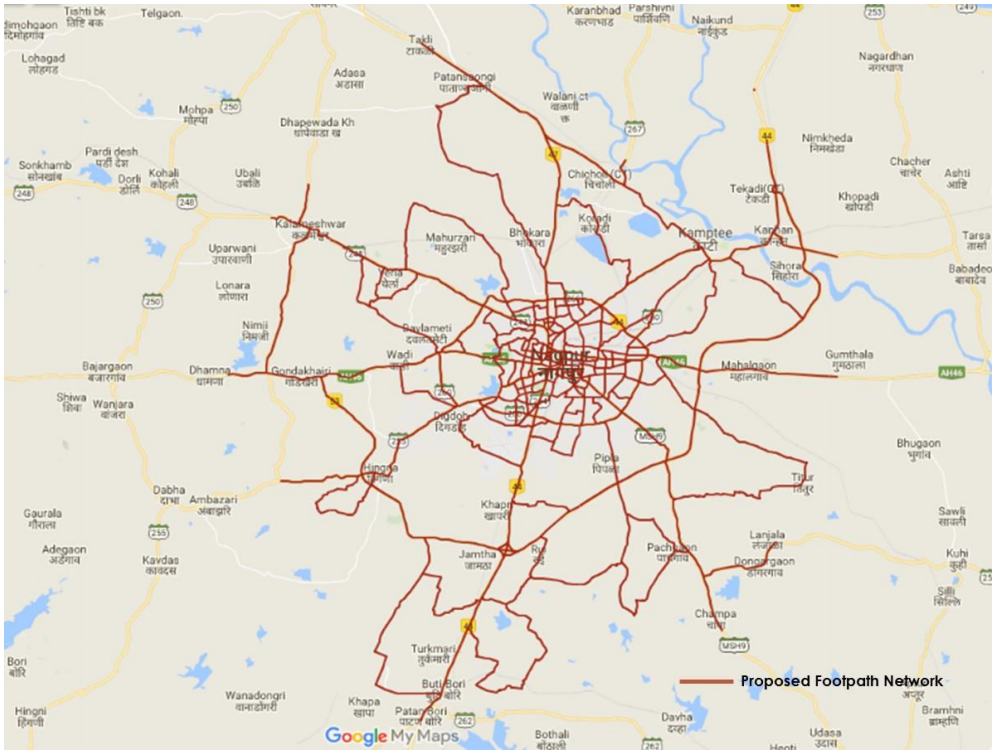
## INTELLIGENT TRANSPORTATION SYSTEM (ITS)

ITS is proposed for Nagpur essentially offers a highly capable and automated transit management platform, which shall enable modern city bus services to provide high level of service along with high operational efficiency. Proposed ITS will play a key role in improving the efficiency of City Bus Services.

## NON-MOTORIZED TRANSPORT PROPOSAL

### Construction of Footpaths

As observed from surveys it is learned that about 80% of the road network does not have footpaths, thus it is proposed to construct these footpaths. Apart from the proposed new roads 664 kms (614 kms + 50 kms) must also have proper footpaths. The proposed footpath network is shown in figure below:




Proposed Footpath Plan

### Construction of Cycle Track

The corridors identified as mobility corridors in Nagpur are proposed as priority corridors for providing cycle track on both side of the road. The cycle tracks are proposed to be constructed along with the construction of proposed Mass Transit System along these corridors. Phase-1 Cycle Track network is proposed along High Capacity MRTS Corridors. Apart from phase-I cycle track corridors some mobility corridors and several other roads are identified for construction of cycle tracks in Phase-2.
The total road length proposed for cycle track provision is 146 kms, 87km is proposed to be constructed in Phase-I and the remaining shall be constructed in Phase-2

## FREIGHT MANAGEMENT

A comprehensive freight network has been envisaged and proposed for Nagpur. All road improvement/ development proposals for the road links falling in the freight network was already proposed in the previous sections regarding road widening and new road proposals and shall only be reproduced in the following sections. The proposed freight network is shown figure below and the proposed freight management plan is described as under

1) **Freight Corridor:** The network of roads identified as freight corridors in Nagpur are listed in table below:

Proposed Freight corridors

| Sn | Freight Corridors | Length | Lanes |
|---|---|---|---|
| 1 | Inner ring road | 40 | 6 |
| 2 | Outer New ring* (Existing part ring = Gondakkhairi – Hingna – Gavsi Manapur – Umergaon – Kapsi BK, Proposed part ring = Gondakkhairi – Dahegaon – Mahadula - Kamptee ) | 110 | 6 |

For freight management of the city, the proposal has been worked out in phases.

**Phase # 1**

**Improvement of existing Transport Nagar –**

- Segregating loading/unloading lanes
- Road Improvement
- Parking Bays
- Terminal facilities like public utilities, rest rooms for drivers and labours
- Weighing Machines

**Movement Restrictions of heavy vehicles in the city** from 09:00am – 07:00pm, these restrictions may be relaxed for Ring Roads.

**Movement restrictions for animal carts on all Orbital and Radial roads from 09:00am - 06:00pm**

**Phase # 2**

1) Development of new goods/truck terminal near Kapsi in proximity to the Outer Ring Road.

2) Identification of a Mobility Corridor for Goods Vehicles, movement to be restricted completely on all other roads

3) Complete ban on all animal carts being used for goods movement

**Phase # 2-3**

1) Setting up of truck terminals at the following locations

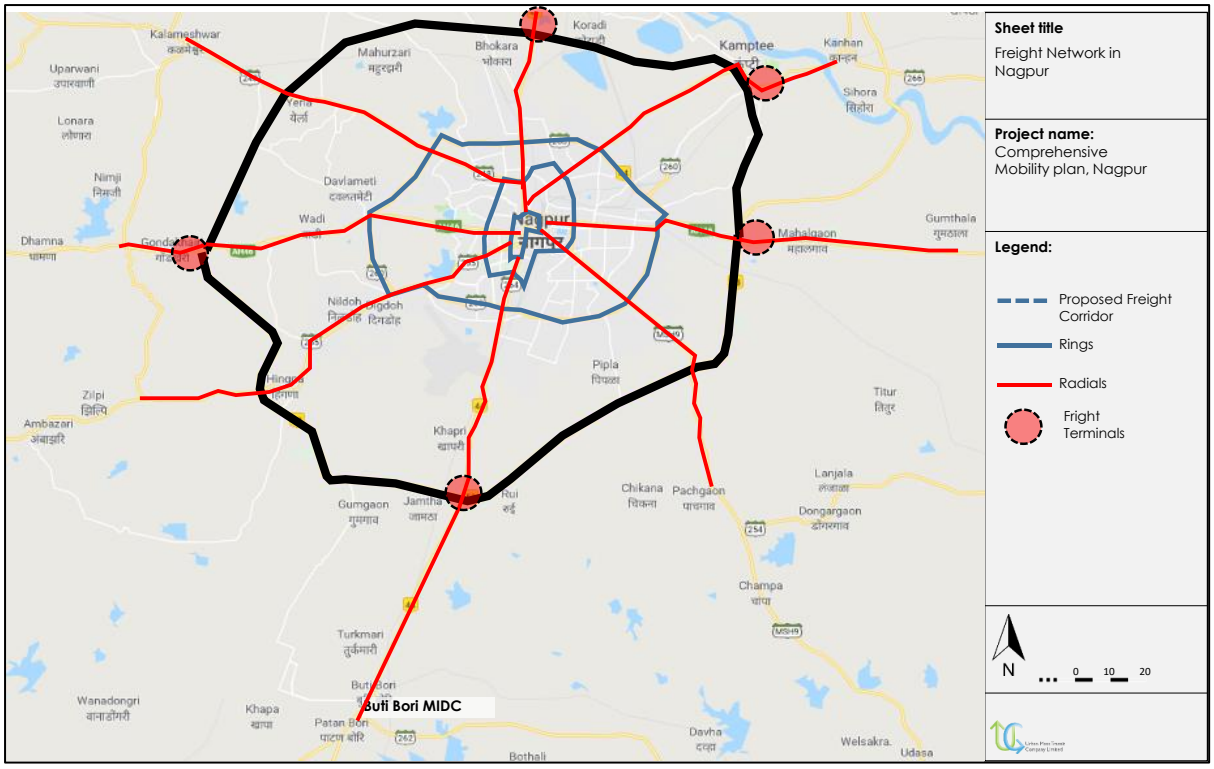
- Koradi
- Kamptee
- Kapsi
- Gumgaon
- Gondakhari

2) Segregated high speed goods vehicle lane on Ring Road

3) Promotion of Use of small and medium size vehicles with modern emission controls in the central city areas

4) Adjoining table indicates the types of facilities required inside the upcoming freight terminals along with area requirement.

5) Location of new freight terminals is indicated in figure below:




Proposed Freight corridors and Freight Terminal

## PARKING MANAGEMENT

Development of a parking strategy is necessary in order to shape the framework for the future provision, management and maintenance of parking facilities. The development of this Parking Strategy has been based on an understanding of the parking supply and demand position in Nagpur City.
The parking strategies that would be considered for Nagpur include

- *Off Street parking facilities*
- *On Street Parking Pricing*
- *Restriction of on street parking on certain corridors*

# IMPLEMENTATION PLAN

The implementation plan also provides various financial options to be looked at towards implementing the proposed projects. A proper Institutional Frame Work is of utmost importance for the successful implementation and monitoring of all the schemes. In this regard, an Institutional set up is also recommended.

## PRIORITIZATION OF PROJECTS

All the proposals discussed so far can be broadly grouped under three categories:

- Long Term Improvements: the usefulness of these improvements will last for more than 10-15 years
- Medium Term Improvements: the usefulness of these improvements will last for about 5-10 years
- Short Term Improvements: these are short term proposals that need to be reviewed and revised within 5 years as per the requirement.

Accordingly, long term, medium term and short term proposals for Nagpur are shown in tables below

Short Term Improvement Projects

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| 1 | Traffic and Pedestrian Management measures | Km | 664 | 0.05 | 33.2 |
| 2 | Junction Improvements and Management Measures | Nos | 10 | 20 | 200 |
| 3 | Construction of Footpaths | Km | 664 | 0.2 | 132.8 |
| 4 | Provision of Cycle Tracks | Km | 146 | 0.5 | 73 |
| 5 | Provision of Pedestrian Zones and Pedestrian Infrastructure | Nos | 4 | 2 | 8 |
| | ***Cost of Development of Short-Term Improvement Plan*** | | | | ***447*** |

Medium Term Projects

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| 6 | FOB/ Walkways (10 Junctions) | Nos | 10 | 10 | 100 |
| 7 | **Bus Augmentation** | ***Nos*** | **1904** | | ***1359*** |
| 7a | *Midi* | *Nos* | *474* | *0.45* | *213* |
| 7b | *Standard - B* | *Nos* | *280* | *1.15* | *322* |
| 7c | *Standard - D* | *Nos* | *980* | *0.63* | *613* |
| 7d | *Standard E* | *Nos* | *170* | *1.24* | *211* |
| 8 | Bus Q Shelter | Nos | 710 | 0.06 | *45* |
| 9 | Off Street Parking Locations | Nos | 5 | 10 | 50 |
| 10 | ITS (Control room / PIS and Traffic Information System) | Ls | 1 | 25 | 25 |
| 11 | Development and Upgradation of Bus Depot and Workshop | Nos | 9 | 20 | 180 |
| 12 | Redevelopment of Bus Terminal - Multi Mobility Hub at Mor Bhawan | Nos | 1 | 100 | 100 |
| 13 | Rail Over Bridges | Nos | 5 | 25 | 125 |
| 14 | Bike Sharing Plan : Main Docking Station | Nos | 9 | 0.5 | 4.5 |
| 15 | Bike Sharing Plan : Substations | Nos | 75 | 0.1 | 7.5 |
| | ***Cost of Development of** Medium-Term **Improvement Plan*** | | | | ***1993*** |

Long Term Proposals

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| 16 | Medium Capacity Mass Transit System | Km | 56.5 | 20 | 1130 |
| 17 | High Capacity Mass Transit System | | | | |

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| **17a** | Under Construction (Cost as per DPR) | Km | 40 | - | 8680 |
| **17b** | Proposed extension | Km | 48.1 | 400 | 19240 |
| **18** | Road Network Improvement Plan (New Roads) - Long Term | Kms | 50 | 10 | 500 |
| **19** | Freight terminals | Nos | 5 | 20 | 100 |
| **20** | Development of New Bus Terminals | Nos | 9 | 10 | 90 |
| | ***Cost of Development of Long Term Improvement Plan*** | | | | ***29740*** |

**Total Project Cost**

| Project Priority | Total Cost (Crores - INR) |
|---|---|
| Short Term Projects | 447 |
| Medium Term Projects | 1993 |
| Long Term Projects | 29740 |
| **Total Cost** | **32180** |

## PHASING PLAN AND PPP POTENTIAL

The projects identified in the earlier section are divided into three categories based on the urgency and duration of the implementation. Some of the long term projects have potential to enter into Public Private Partnership (PPP); however, case to case project reports are required for validating the feasibility of each project. The cost of all the recommended projects is around **23500*** Crores. It is important to highlight that the CMP serves only to identify schemes and the costs presented are only BLOCK COST estimates for decision makers. Detailed cost estimates need to be worked out at further stages.

**-Excluding the Cost of Phase I MRTS System*

Project Phasing and PPP Potential

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) | Quantity Phase 1 | Quantity Phase 2 | Quantity Phase 3 | Cost(In Cr) Phase 1 | Cost(In Cr) Phase 2 | Cost(In Cr) Phase 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ***Short Term Improvements*** | | | | | | | | |
| **1** | Traffic and Pedestrian Management measures - | Km | 664 | 0.05 | 33.2 | 614 | 50 | 0 | 30.7 | 2.5 | 0 |
| **2** | Junction Improvements and Management Measures | Nos | 10 | 20 | 200 | 10 | 0 | 0 | 200 | 0 | 0 |
| **3** | Construction of Footpaths | Km | 664 | 0.2 | 132.8 | 614 | 50 | 0 | 122.8 | 10 | 0 |
| **4** | Provision of Cycle Tracks | Km | 146 | 0.5 | 73 | 87 | 59 | 0 | 43.5 | 29.5 | 0 |
| **5** | Provision of Pedestrian Zones and Pedestrian Infrastructure | Nos | 4 | 2 | 8 | 4 | 0 | 0 | 8 | 0 | 0 |
| | ***Cost of Development of Short Term Improvement Plan*** | | | | ***447*** | | | | ***405*** | ***42*** | ***0*** |
| | | | ***Medium Term Improvements*** | | | | | | | | |
| **6** | FOB/ Walkways (10 Junctions) | Nos | 10 | 10 | 100 | 10 | 0 | 0 | 100 | 0 | 0 |
| **7** | **Bus Augmentation** | ***Nos*** | **1904** | | ***1359*** | ***607*** | ***213*** | ***1084*** | ***433*** | ***152*** | ***774*** |
| **7a** | *Midi* | *Nos* | *474* | *0.45* | *213* | *151* | *53* | *270* | *68* | *24* | *122* |
| **7b** | *Standard - B* | *Nos* | *280* | *1.15* | *322* | *89* | *31* | *160* | *102* | *36* | *184* |
| **7c** | *Standard - D* | *Nos* | *980* | *0.63* | *613* | *313* | *109* | *558* | *196* | *68* | *349* |
| **7d** | *Standard E* | *Nos* | *170* | *1.24* | *211* | *54* | *20* | *96* | *67* | *25* | *119* |
| **8** | Bus Q Shelter | Nos | 710 | 0.06 | *45* | 0 | 710 | 0 | 0 | 45 | 0 |
| **9** | Off Street Parking Locations | Nos | 5 | 10 | 50 | 5 | 0 | 0 | 50 | 0 | 0 |
| **10** | ITS (Control room / PIS and Traffic Information System) | Ls | 1 | 25 | 25 | 1 | 0 | 0 | 25 | 0 | 0 |
| **11** | Development and Upgradation of Bus Depot and Workshop | Nos | 9 | 20 | 180 | 3 | 3 | 3 | 60 | 60 | 60 |
| **12** | Redevelopment of Bus Terminal - Multi Mobility Hub at Mor Bhawan | Nos | 1 | 100 | 100 | 0 | 1 | 0 | 0 | 100 | 0 |
| **13** | Rail Over Bridges | Nos | 5 | 25 | 125 | 0 | 5 | 0 | 0 | 125 | 0 |
| **14** | Bike Sharing Plan : Main Docking Station | Nos | 9 | 0.5 | 4.5 | 9 | 0 | 0 | 5 | 0 | 0 |
| **15** | Bike Sharing Plan : Substations | Nos | 75 | 0.1 | 7.5 | 31 | 44 | 0 | 3 | 0 | 0 |
| | ***Cost of Development of Medium Term Improvement Plan*** | | | | ***1993*** | | | | ***676*** | ***483*** | ***834*** |
| | | | ***Long Term Improvements*** | | | | | | | | |
| **16** | Medium Capacity Mass Transit System | Km | 56.5 | 20 | 1130 | 22.5 | 34 | 0 | 450 | 680 | 0 |
| **17** | High Capacity Mass Transit System | Km | 88.1 | | | | | | | | |
| **17a** | Under Construction (Cost as per DPR) | Km | 40 | - | 8680 | 40 | 0 | 0 | 8680 | 0 | 0 |
| **17b** | | | 48.1 | 400 | 19240 | 0 | 48.1 | 0 | 0 | 19240 | 0 |
| **18** | Road Network Improvement Plan (New Roads) - Long Term | Kms | 50 | 10 | 500 | 50 | 0 | 0 | 500 | 0 | 0 |
| **19** | Freight terminals | Nos | 5 | 20 | 100 | 0 | 5 | 0 | 0 | 100 | 0 |
| **20** | Development of New Bus Terminals | Nos | 9 | 10 | 90 | 4 | 5 | 0 | 40 | 50 | 0 |
| | ***Cost of Development of Long Term Improvement Plan*** | | | | ***29740*** | | | | ***9670*** | ***20070*** | ***0*** |
| | ***Total Cost (Short, Medium and Long term Projects)*** | | | | ***32180*** | | | | ***17991*** | ***20665*** | ***834*** |

*- Including the cost of Phase-I MRTS System

## FINANCING OPTIONS

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 the 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 an indispensable goal of the governance.

The key funding sources besides GBS and fare box can be dedicated levies, land monetization, recovery from non-user beneficiaries, debt and private investments. The paradigm of financing has to clearly move towards non-users pay principle and the polluters pay principle. There is a need for long-term sustainable dedicated 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.

They are:

- Public Private Partnership
- Government sources of funding
- Dedicated Urban Transport fund at City level
- External Funding Agencies

## INSTITUTIONAL FRAMEWORK

City transport system generally involves several organizations that look after various forms and aspects of the transport system and network and have overlapping functions and areas of work. Therefore to delineate areas and to remove ambiguity of functions the institutional framework has been proposed. With the formation of a State level UMTA, part of the problem can been sorted. With a view to coordinate all urban transport activities in the city, it is recommended that a UMTA be set up at the city level that acts as a planning and decision making body for all matters related to urban transport in the city. It is recommended that the city level UMTA be set up on an executive order for the ease of formation however, it must be given a legal backing so that it's functioning falls under an act and commands greater authority.

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# INTRODUCTION

# 1. INTRODUCTION

## 1.1. BACKGROUND

Recent rapid urban development in India has resulted in transport problems such as traffic congestion and increase in traffic accidents in all the cities/towns.

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. This in turn have resulted in transport problems such as traffic congestion, increased travel times, and increased traffic accidents. These issues have brought planning for accessibility and mobility to the centre-stage of most urban economies and have necessitated the need to plan for improved transport solutions that enable 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.

Although governments and local administrations have been working on proposals to improve urban transport, problems have been aggravated to a large extent by the rapidly increasing private vehicle population.

Existing capacities in the local governments for undertaking systematic urban transport planning are still insufficient. Specifically, the problems seen in most cities are:

- *Most cities do not have a long-term comprehensive urban transport strategy. Accordingly, the proposals for specific projects are often not integrated with other urban transport measures or with land use patterns.*

- *Some cities prepare urban transport master plans by conducting Transport and Traffic Studies. However, these studies mainly focused on vehicle movements and did not pay enough attention to the mobility of people and goods.*

It is important to prepare long-term strategic plans focused on mobility of people as a 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 Housing and Urban Affairs (MoHUA) encourages cities to prepare “Comprehensive Mobility Plans” (CMPs) as part of long-term urban transport strategy providing for a sustainable improvement of people’s mobility.

**Nagpur city**, like all other cities in India, is experiencing increased dependency on private motor vehicles for personal trips, leading to increased vehicular congestion and emissions.

The previous Comprehensive Mobility Plan for Nagpur indicated inadequate existing transportation infrastructure to serve the future travel demand and a high growth in the private vehicle share in the city and surrounding region. On the other hand, increased economic activities in the region have given a boost to the regional economy and employment especially in the sectors like Information Technology, and financial companies etc., which in turn had increased demand for ease of travel and connectivity on a day to day basis, which is very much the need of the hour.

The Comprehensive mobility plan of 2013 has indicated that -

- *Motor vehicle population has increased at a phenomenal rate during the last few decades and Vehicle growth trends revealed that the fleet of buses had a marginal increase over the years, while two wheelers experienced a remarkable increase. The growing number of automobiles in the city region- whereas, the much affordable public transport share has remained stagnant and inadequate. Besides, the haphazard and disorganized parking of vehicles has added up to the everyday traffic chaos on the streets of Nagpur.*

- *Conflicts between fast moving vehicular traffic and bicycle and pedestrian traffic have reduced the capacity and safety.*

- *Bus and rail developing as competing modes rather than being complementary to each other and the sprawling suburban development without adequate transport facilities has placed considerable demand in favour of private vehicles and has emphasized the warrant for interchange facilities at mass transit stations.*

## 1.2. NEED FOR A COMPREHENSIVE MOBILITY PLAN

To understand the need for a Comprehensive Mobility Plan, let us first look at the way transport problems emerge in a city, what dimensions they take, the response generated from city authorities and the citizens and the problems generated from there.

Any unplanned city suffers primarily from a lack of a proper integration of 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 will eventually result in congestion, which creates varying dimensions of problems for different stakeholders of the system. The consumer suffers from increased travel time; urban environment suffers from pollution; and 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 goes 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.

To counter the above problem of congestion and its various dimensions, the city authorities resort to an increased supply of transport systems (in the form of roads or public transport corridors) on an as-and-when-needed basis. This leads to an increase in public investment on urban transport sector as well as an increased footprint of transport systems on the city. Increased footprint of transport systems, however, only leads to increased usage of the automobile, thus adding to overall congestion.

On the other hand, the supply-demand gap leads to proliferation of informal systems of transport – Intermediate Public Transport (IPT) such as auto rickshaws and taxis, which further add to the traffic and congestion on roads. The production units opt for informal logistics systems. To accommodate regional traffic, bypasses at the city edge are provided, which in the absence of suitable land use control, lead to development of undesirable nature along the corridors.

### *Need for updated CMP*

- *Track and evaluate the changes after last CMP*
- *Coherence with ongoing Projects*
- *Metro Rail Policy mandates an updated CMP for approval of Metro's next phase*
- *Update the earlier CMP with additional projects (if any)*

In light of these facts, a Comprehensive Mobility Plan is needed to address the mobility needs of the people focusing on non-motorized and public transport, rather than catering to the needs of private automobile as an effective platform for integrating land use and transport planning.

In this regard, the Nagpur Improvement Trust (NIT) had prepared a Comprehensive Mobility Plan in the year 2013. However, now it is required that this study be updated considering the developments that have happened in the past five years in Nagpur.
In this context, Nagpur Metro Rail Corporation Limited (NMRCL) wanted to update the earlier study prepared for Nagpur, namely Nagpur Comprehensive Mobility Plan, 2013 (CMP). Accordingly, NMRCL has awarded the study of preparing the Comprehensive Mobility Plan (CMP) to **Urban Mass Transit Company Limited (UMTC)** by updating the traffic data, the transport model built and the proposals recommended in the earlier studies. This Study will develop a perspective plan for sustainable urban transport over a 20-year horizon period.

## 1.3. OBJECTIVES AND SCOPE OF THE STUDY

The ultimate Goal of a CMP is to provide a long-term strategy for the desirable mobility pattern of a city's populace. To achieve this goal, the following are the main objectives:

- *Develop public transit system in conformity with the land use that is accessible, efficient and effective.*
- *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.*
- *Develop traffic and transport solutions that are economically and financially viable and environmentally sustainable for efficient and effective movement of people and goods*
- *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*

The CMP which is prepared in accordance with the Revised CMP Toolkit, published by the MoHUA, will also focus on the following:

- *A study of Service Level Benchmarks as per MoHUA's Handbook on Service Level Benchmarks for Urban Transport.*
- *Study on Sustainable Habitat Mission for the city to make habitat sustainable through modal shift to public transport, as per National Mission on Sustainable Habitat. The study will also look in to the possibility of enhancing the NMT programs to make the sustainable habitat an integral part of the planning process.*

The broad Scope of the Comprehensive Mobility Plan is listed below:

- *To review the demographical profile of the city which includes location, land area etc.*
- *To delineate the traffic analysis zones and review the existing urban transport and environment*
- *To describe the existing traffic and transportation system in the study area*
- *To identify in detail, the problematic situations related to the existing transportation infrastructure and traffic operation*
- *To understand the level of service provided to the citizens with the help of service level benchmarking*
- *To develop a Business as Usual (BaU) scenario based on land use transitions and socio-economic projection and comparing the travel characteristics of BaU scenario with the base year as well as SLB*
- *To present the projected travel demand in the study area for different horizon years*
- *To develop and evaluate various transport strategies*
- *To recommend various medium-term and long-term traffic improvement measures based on the scenarios and to develop an Urban Mobility Plan*
- *To develop Transport Investment Options and Implementation Plan*
- *To suggest an Institutional Arrangement*

Accordingly, while updating the CMP, all the objectives stated above will be met and the mobility plan will be prepared as per the Guidelines of the Ministry.

## 1.4. STRUCTURE OF THE REPORT

The draft report for Quick Comprehensive Mobility Plan for Nagpur Metropolitan Region will have following chapters:

- *Chapter 1: Introduction to the study and its objectives*
- *Chapter 2: Existing traffic and transport characteristics of the city*
- *Chapter 3: Travel Demand Modelling and Forecasting*
- *Chapter 4: Mobility Vision and Goals of the city*
- *Chapter 5: Mobility Improvement Measure*
- *Chapter 6: Implementation Program*
- *Chapter 7: Outcomes*

# EXISTING TRAFFIC AND TRANSPORT CHARACTERISTICS

# 2. EXISTING TRAFFIC AND TRANSPORT CHARACTERISTICS

## 2.1. INTRODUCTION TO NAGPUR

Nagpur is the winter capital, a sprawling metropolis, and the third largest city of the Indian state of Maharashtra after Mumbai and Pune. Nagpur is the 13th largest Indian city in terms of population. It has been proposed as one of the Smart Cities in Maharashtra.

Nagpur is the seat of the annual winter session of the Maharashtra state assembly. It is a major commercial and political centre of the Vidarbha region of Maharashtra. In addition, the city derives unique importance from being the headquarters for the Hindu nationalist organisation RSS and an important location for the Dalit Buddhist movement. Nagpur is also known for Deekshabhoomi, the largest hollow stupa among all the Buddhist stupas in the world. It is famous for Nagpur oranges and is sometimes known as the Orange City for being a major trade center of oranges cultivated in the region. The city was founded in 1703 by the Gonds King Bakht Buland Shah of Deogarh and later became a part of the Maratha Empire under the royal Bhonsale dynasty

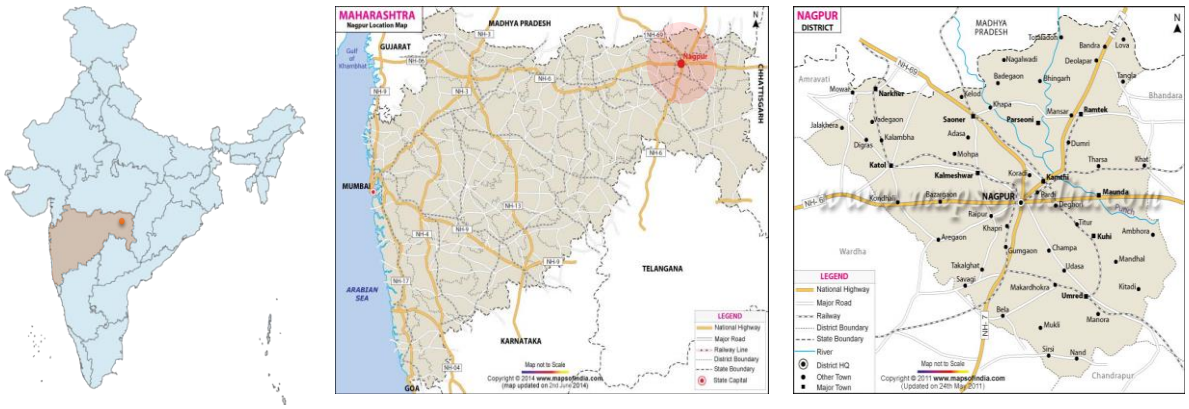


Figure 1 Geographical location of Nagpur

The CMP study generally is conducted for Local Planning Area (LPA) to provide comprehensive mobility solutions. However in Nagpur, the administration heading the urban development under two domains viz. Nagpur Metropolitan Region (NMR) and the area under Nagpur Municipal Corporation (NMC – 145 wards). For study purpose, the area under NMC is important considering intensity of the mobility. However this needs to be addressed with the traffic impact made by rest of the metropolitan area. So NMC area along with the area within outer ring road is considered for providing various mobility development schemes but the impact of metropolitan region will be considered to formulate corresponding schemes.

## 2.2. STUDY AREA

The geographic area within the jurisdiction of Nagpur Municipal Corporation (NMC) along with other areas including Municipal Councils of Kamptee, Kalameshwar, Hingna and surrounding villages is taken as the study area. The study area comprise of about 1550 sq km out of total 3567sq km of NMA area.

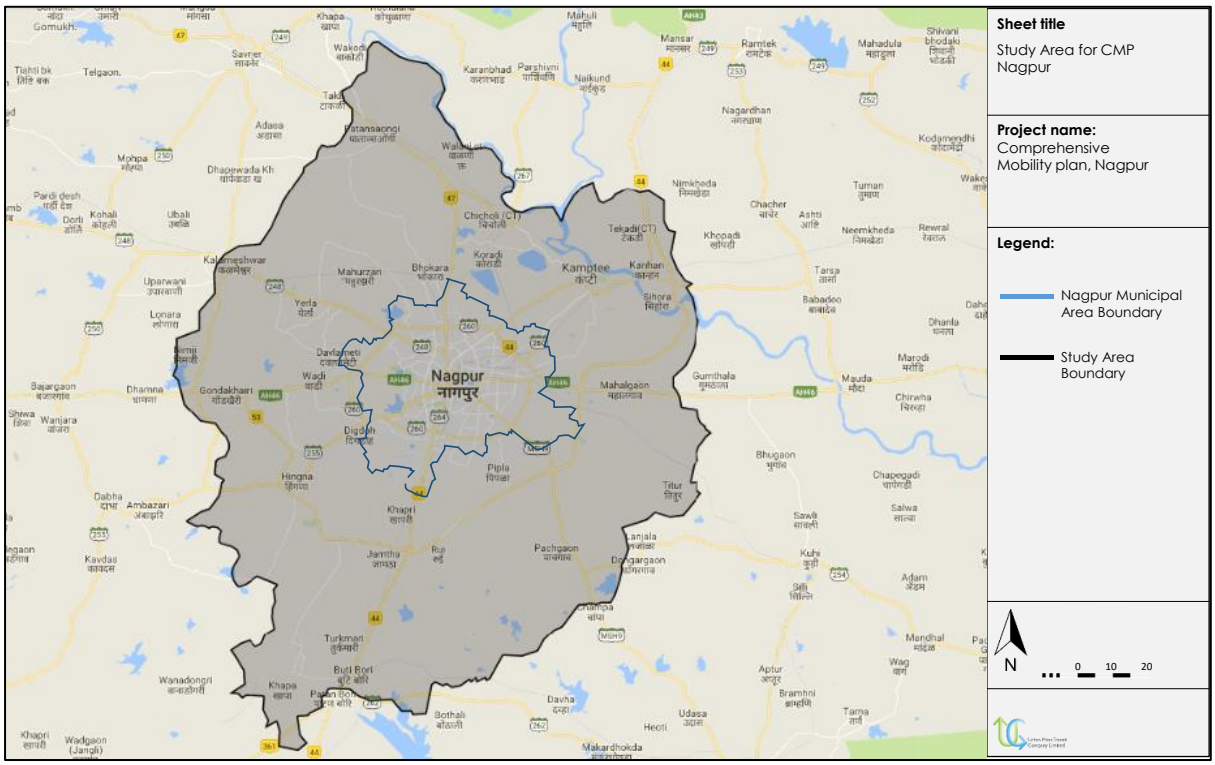


Figure 2 Nagpur Study Area

## 2.3. CONNECTIVITY

Nagpur city Nagpur is well-connected with most other cities of India by Rail and Roads. Railways started in Nagpur in 1867 when portion of Bombay-Bhusaval-Nagpur line was opened for traffic. Train service from Nagpur to Calcutta was started in 1881. Today, a total of 260 trains stop at Nagpur railway station. Nagpur Central Railway Station connects major railway trunk routes. An electrified broad gauge railway track connects Nagpur to the four major metros.

Nagpur is a major junction for roadways as India's two major national highways, Kanyakumari-Varanasi (National Highway 7) and Hajira-Kolkata (National Highway 6). Highway number 69 connects Nagpur to Obaidullaganj near Bhopal. Nagpur is at the junction of two Asian Highways namely AH43 Agra to Matara, Sri Lanka and AH46 connecting Kharagpur, India to Dhule, India Bhopal. Nagpur is at the junction of two Asian Highways namely AH43 Agra to Matara, Sri Lanka and AH46 connecting Kharagpur, India to Dhule, India.

## 2.4. DEMOGRAPHICS

Nagpur city is the third largest urban agglomeration in the state of Maharashtra in terms of population. As per Census 2011, Nagpur accounted for 6% of the total urban population of the state and 76% of the district urban population of Nagpur district. In addition, 52% of the total district population resides within NMC. In the past, Nagpur attracted the migration and floating population from the neighbouring districts of Maharashtra for education, employment, and business. However, the trend has decreased over the last decade.

The population of Nagpur has increased from 1.5 Lakh in 1921 to 24.98 Lakh in 2011 as represented in Table 9 and

| SN | Area | Population (Lakh) | | | | |
|---|---|---|---|---|---|---|
| | | **2011** | **2018** | **2021** | **2031** | **2041** |
| **1** | Nagpur Municipal Corporation | 24.1 | 26.5 | 27.6 | 31.1 | 34.8 |
| **2** | Other than NMC Areas Including Kamptee, Kalmeshwar, Hingna and surrounding villages | 6.6 | 7.8 | 8.6 | 12.3 | 15.5 |
| | Total | **30.7** | **34.3** | **36.2** | **43.4** | **50.3** |

. As indicated in the table and figure below, it could be observed that the decade 2001-2011 has registered the lowest decadal change of only 17%.

The study area population for the year 2011 has been taken from Census 2011 data. The population of NMC area is 24.1 Lakh and other areas including Kamptee, Kalmeshwar, Hingna and surrounding villages is 6.6 Lakh. The total population of study area is estimated at 30.7 Lakh in 2011 (**Error! Reference source not found.**,


| SN | Area | Population (Lakh) | | | | |
|---|---|---|---|---|---|---|
| | | **2011** | **2018** | **2021** | **2031** | **2041** |
| **1** | Nagpur Municipal Corporation | 24.1 | 26.5 | 27.6 | 31.1 | 34.8 |
| **2** | Other than NMC Areas Including Kamptee, Kalmeshwar, Hingna and surrounding villages | 6.6 | 7.8 | 8.6 | 12.3 | 15.5 |
| | Total | **30.7** | **34.3** | **36.2** | **43.4** | **50.3** |


and Table 9).

**Table 9 Decadal Population Growth in NMC Area**


| SN | Area | Population (Lakh) | | | | |
|---|---|---|---|---|---|---|
| | | **2011** | **2018** | **2021** | **2031** | **2041** |
| **1** | Nagpur Municipal Corporation | 24.1 | 26.5 | 27.6 | 31.1 | 34.8 |
| **2** | Other than NMC Areas Including Kamptee, Kalmeshwar, Hingna and surrounding villages | 6.6 | 7.8 | 8.6 | 12.3 | 15.5 |
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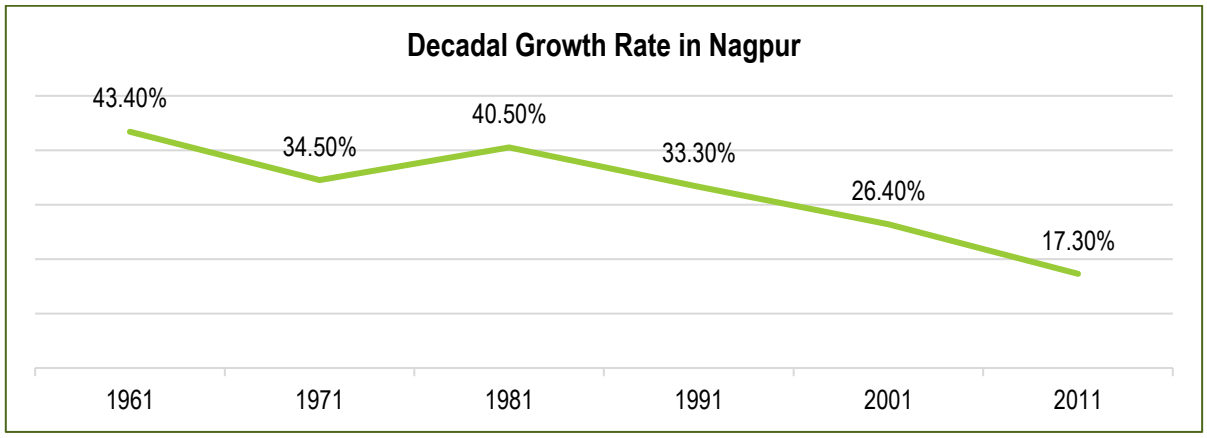



Figure 3 Decadal Population Growth in NMC Area

The average annual growth rates of 1.4%, 1.2% & 1.1% have been considered for the years 2021, 2031 and 2041 respectively for the NMC area. Other than NMC areas are expected to grow with higher growth rates as per NMA Development Plans. The same annual growth rates of about 3% up to 2031 and about 2% for 2041 have been considered for projecting the population of Other than NMC areas.

The overall study area population annual growth rates is 1.8% up to the year 2031 and 1.5% up to 2041.

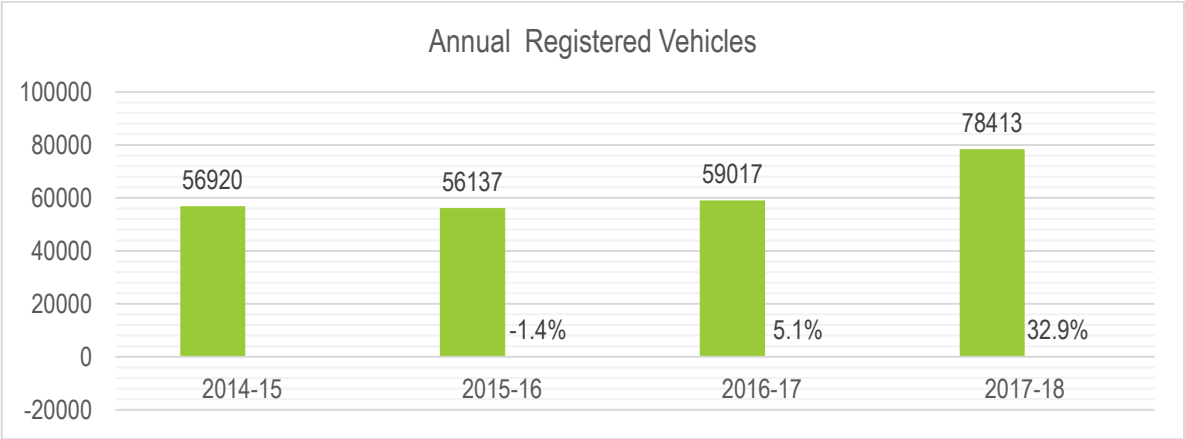
## 2.5. EXISTING TRANSPORTATION CHRACTERISTICS

### 2.5.1 GROWTH OF MOTOR VEHICLES

With the rapid growth of urban population, there is an ever increasing demand on the city's infrastructure to serve the population. The rapid motorization rates have further complicated issues to compete with the public transport systems in the cities, as mode choices for commuting. The trips per household have increased over the years, with increasing per capita incomes and increase in vehicle ownership.

Considering the improving socio-economic level in most Indian cities and the inadequate mass transport systems, personalized motor vehicles have been growing at the rate of 6% to 15% per annum in different cities. In most of the cities, 2-wheelers comprise more than 60% of the total motor vehicles.

Figure 4 Growth of Vehicles in Nagpur City



From Figure 4 it could be observed that the no. of vehicles in the city of Nagpur has increased at 12% per annum in the last 3 years. It has also been observed that the vehicular growth per annum is twice the population growth of the city. Table 10 represents the Mode wise distribution of the registered vehicles in Nagpur city from 2014 up till 2018.

Table 10 Mode-Wise Distribution of the Vehicles Registered In Nagpur City

| S.No. | Vehicle Category | Registered Vehicle in Nagpur City | | | |
|---|---|---|---|---|---|
| | | 2014-15 | 2015-16 | 2016-17 | 2017-18 |
| 1 | Total Two Wheelers | 42958 | 42617 | 42280 | 61412 |
| 2 | Cars | 6524 | 7498 | 8094 | 11157 |
| 3 | Jeeps | 1789 | 1851 | 2187 | 734 |
| 4 | Stn. Wagons | 0 | 0 | 0 | 4 |
| 5 | Taxies a) Meter Fitted | 3 | 0 | 0 | 0 |
| | b) Luxury & Tourist Cabs | 413 | 576 | 1752 | 866 |
| 6 | Auto rickshaws | 2746 | 1079 | 1884 | 1920 |
| 7 | Stage Carriage | 0 | 0 | 40 | 53 |
| 8 | Contract Carriage | 35 | 43 | 58 | 45 |
| 9 | Mini Buses | 0 | 0 | 0 | 0 |
| 10 | School Buses | 254 | 303 | 224 | 137 |
| 11 | Pvt. Ser. Vehicle | 4 | 1 | 2 | 0 |
| 12 | Ambulance | 27 | 43 | 40 | 30 |
| 13 | Multi & articulated Veh. | 22 | 41 | 63 | 151 |
| 14 | Trucks | 144 | 166 | 187 | 200 |
| 15 | Tanker | 11 | 15 | 309 | 0 |
| 16 | Del. Van. ( 4 Wheelers ) | 911 | 833 | 846 | 860 |
| 17 | Del. Van. ( 3 Wheelers ) | 1041 | 985 | 808 | 719 |
| 18 | Tractors | 30 | 68 | 213 | 88 |
| 19 | Trailers | 8 | 16 | 10 | 3 |
| 20 | Other Tippers | 0 | 2 | 20 | 34 |
| **Total** | | 56920 | 56137 | 59017 | 78413 |

*(Source: RTO – Nagpur).*

It is observed that 2-Wheelers account for the largest chunk of registered vehicles accounting to upto 75.6% of the total vehicles registered in Nagpur followed by cars at 13.3%. The sharp increase of two-wheelers and cars could be attributed to the improved economic status of people and deficient public transport supply. The phenomenal increase of cars and the resulting demand for more road-space has resulted in dense concentration of traffic on roads. This trend has to be kept checked, in terms of the cost it imposes on users demand after a careful consideration.

## 2.5.2 ROAD NETWORK

Nagpur is located 837 kms north east of Mumbai, 1094 kms South of Delhi, 1092 kms North of Chennai and 1140 kms West of Kolkata. Nagpur is also a major junction for roadways as India's two major national highways – National Highway (NH) 7 – Kanyakumari to Varanasi and National Highway (NH) 6 – Mumbai to Kolkata via Sambalpur pass through the city. NH 69 also connects Nagpur to Obaiddullaganj near Bhopal. Maharashtra Samruddhi Mahamarg connecting Nagpur-Aurangabad-Mumbai Expressway is a state highway is being constructed in two phases, in line with the National Express Highway Standards and is expected to be completed by 2019.

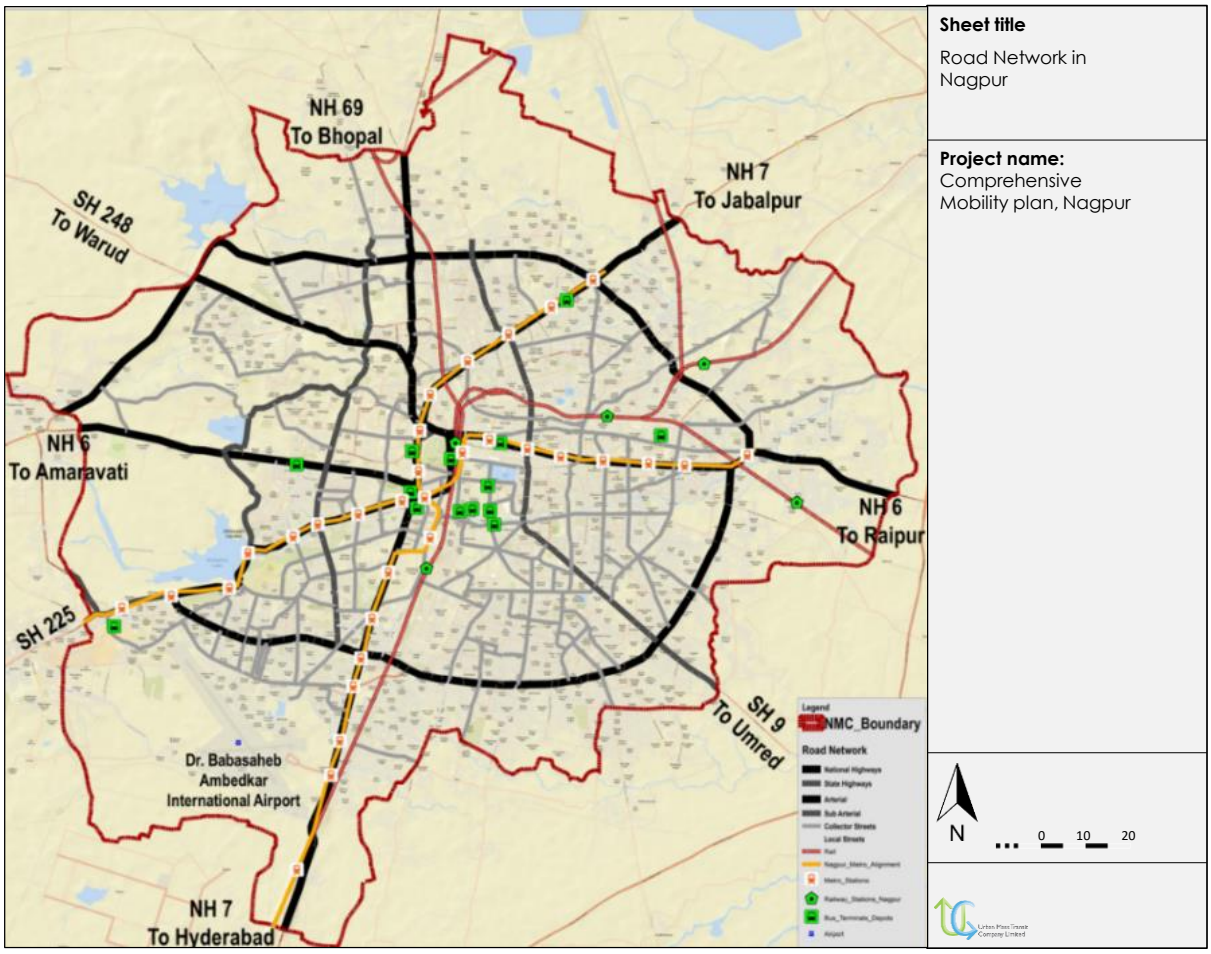



Figure 5 Road Network of Nagpur

It can be clearly observed that the city has a distinct radial pattern and has two ring roads. The total length of the roads is about 1,907 kms, of which 1,150 kms of roads is within the jurisdiction of NMC, which means the city has a road density of 6.66 kms per sq. km of surface area.

The road network in Nagpur is evolved with two national highways in north south and east west direction along with radial pattern formulated by two ring roads. The total length of roads in the city is 1907 km (CDP 2007), of which the length of major roads is 500 km, the remaining being the internal roads.

The Nagpur Municipal Corporation (NMC) has executed an Integrated Road Development Project (IRDP) to improve the transportation system within the city limits.

The details of the road network characteristics are as described in the following sections:

## RIGHT OF WAY

The distribution of the road network as per right of way (ROW) is presented in Table 11. It can be observed from the table that about 22% of the road network has less than 20 m ROW, 32% has 20-30 m ROW and only 19% has ROW above 40 m. The average width of the carriage way in Nagpur is estimated to be in the range of 6 to 14 m

Table 11: Right of Way distribution

| S.No. | Right of Way (m) | Percentage (%) |
|---|---|---|
| 1 | < 10 | 0.7 |
| 2 | 10 – 20 | 21.1 |
| 3 | 20 – 30 | 32.3 |
| 4 | 30 – 40 | 26.7 |
| 5 | >40 | 19.3 |
| | Total | 100 |

*Source: Primary Survey, 2017-18*

## ROAD SURFACE

It was observed that 65% of the roads in Nagpur are paved tar roads, whereas 33% of the roads are unpaved even now within the city limits (Table 12).

Table 12: Road Network characteristics (Road Surface)

| Road Surfacing | Length (km) | Percentage share |
|---|---|---|
| Cement roads | 25 | 2% |
| Paved Tar Roads | 747.5 | 65% |
| Unpaved Roads | 380 | 33% |
| Total Length of roads (NMC Area) | 1150 | 100% |

*Source: Primary Survey, 2017-18*

## LANE CLASSIFICATION

Majority of the roads in Nagpur are observed to be 4-Lane Divided accounting to about 46% of the total roads followed by 29% 6-Lane Divided and 21% 2-Lane Undivided roads.

## FOOTPATH AVAILABILITY

It is observed that 80% of the roads in Nagpur do not have footpaths on either sides (Table 13), whereas only 18.7% (core city/CBD) of the roads have footpaths for use.

Table 13: Footpath Availability

| S. No. | Footpath | Percentage (%) |
|---|---|---|
| 1 | Present (One Side 1.2 and Both Sides 18.7) | 19.9 |
| 2 | Absent | 80.1 |
| | Total | 100 |

*Source: Primary Survey, 2017-18*

## 2.5.3 ROAD ACCIDENTS

With the increase in the number of the private vehicles and inter mixing of the slow and fast moving vehicles on roads has led to increase in the number of accidents on roads in Nagpur, which is a cause of concern. Considering the urban expanse, population growth and increased number of vehicles on the city roads; the safety of the commuters is equally vital.

The accidents are also caused due to the casual approach of road users in observing driving rules, adhering to the safety precautions and regulations. Over-speeding and negligent driving has proved to

be a frequent cause of serious and fatal accidents. Similarly, poor road geometry has also increased the incidence of accidents on urban roads.

An insight into the trends and type of accidents occurred in Nagpur City is represented in the Table 14. As seen from the table that the total no. of accidents occurred in 2017 was 1373 of which around 310 were fatal and 1510 were non-fatal. The number of accidents per lakh population in Nagpur has been observed to be 113, which is three times more than the national average of 40 accidents per lakh population.

Table 14 Accident Data – Nagpur City

| Year | Registered Vehicles | Total Accidents | Fatal Accidents | Injury |
|---|---|---|---|---|
| **2014** | 13,10,344 | 1,149 | 281 | 1094 |
| **2015** | 13,78,051 | 1254 | 260 | 1203 |
| **2016** | 14,26,694 | 1242 | 232 | 1285 |
| **2017** | 14,75,217 | 1373 | 310 | 1510 |

*(Source: Year-wise Statistics on Road Accidents in Nagpur, Traffic Police, 2018)*

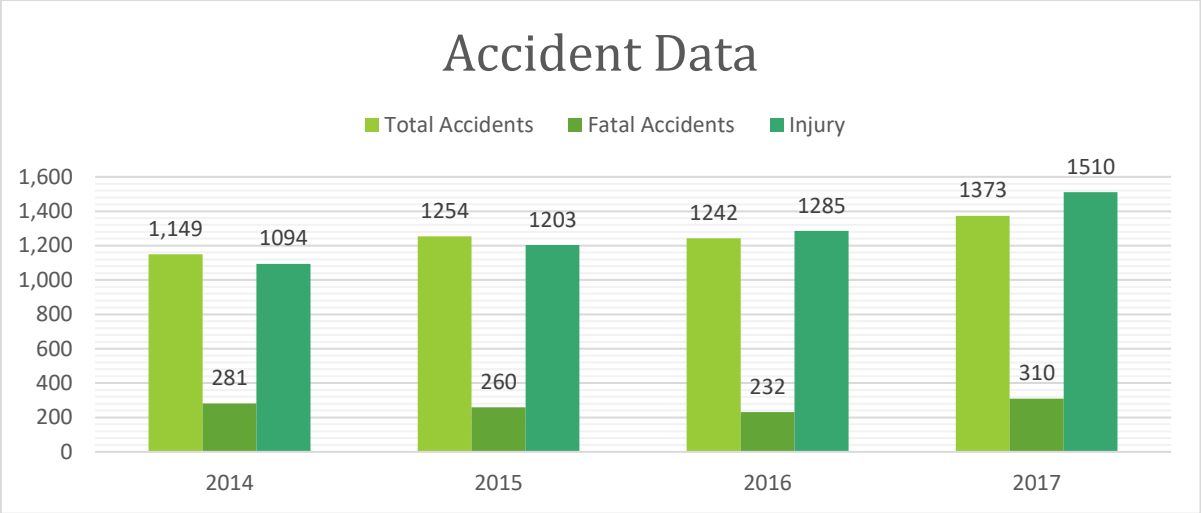



Figure 6 Road Accidents in Nagpur

It is observed that most of the accidents take place at the intersections along the major roads within the areas close to the city centre and with high population densities. It has also been observed that majority of the accidents involved pedestrians and cyclists with motor vehicles. 35 accident black spots have been identified on the basis of the detailed accident data collected Nagpur Traffic Police department, the same are referred to in Table 15 below.

Table 15: Location Wise Road Accidents in Nagpur

| SNo. | Locations | SNo. | Locations | SNo. | Locations |
|---|---|---|---|---|---|
| **1** | Mhalangi Nagar Square | **13** | Mihan Uddan Pul Mahesh Dhaba | 25 | Vaishali Nagar Square |
| **2** | Wadi T Point | **14** | Chinchbhawan Pul Wardha Road | 26 | Ordinance Factory Gate, 8th Mail |
| **3** | Dongargaon | **15** | Juna Pardi Naka | 27 | Marwa Transport, Waddhamna |
| **4** | Wathoda Ring Road | **16** | Mehta Wajan Kata, Dipti Signal | 28 | Manapur |

| | | | | | |
|---|---|---|---|---|---|
| **5** | Manewada Ring Road | **17** | Hanuman Mandir, Pardi | 29 | Rajiv Nagar |
| **6** | New Katol Naka Square | **18** | Prakash High School Chowk, Pardi | 30 | Trimurti Nagar |
| **7** | Japanese Garden Square | 19 | Jaripatka Ring Road Square | 31 | Subhash Nagar |
| **8** | Nagpur Sawner Highway | 20 | Maruti Showroom Square | 32 | Chatrapati Nagar |
| **9** | Telephone Exchange Square | 21 | Uppalwadi Pooliya | 33 | Mehdibagh Over Bridge |
| **10** | Gangabai Ghat Square | 22 | Witabhatti Square | 34 | Chamat Chakki Chowk |
| **11** | Khapri Naka | 23 | Prakash High School Near Khapsi pooliya | 35 | Vihirgaon Puliya |
| **12** | Chinch Bhawan Square | 24 | I C Square | | |

*(Source: Nagpur Traffic Police)*

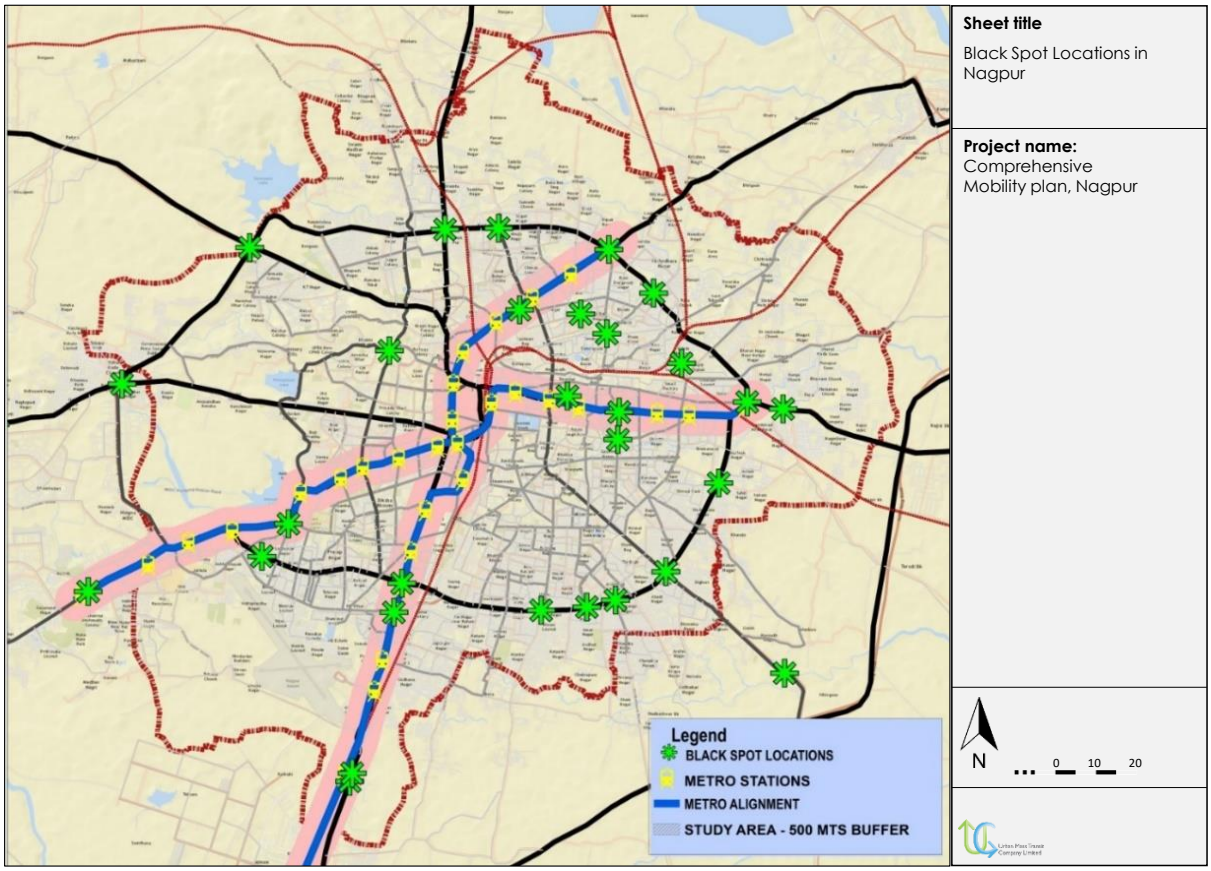



Figure 7: Accident Black Spots-Nagpur

## 2.5.4 PUBLIC TRANSPORT SYSTEMS

### 2.5.4.1 AIR TRAVEL

The Dr. Babasaheb Ambedkar International Airport located in Sonegaon 7.5 kms south of the Nagpur City is operated by Mihan India Private Limited (MIPL) and owned by Airports Authority of India (AAI). Nagpur is well connected by daily direct flights to domestic destinations such as Mumbai, Kolkata, Delhi, Bangalore, Pune, Indore, Raipur and Hyderabad. In addition to this international flights connecting to Sharjah, Singapore, Saudi Arabia and Bangkok also operate from Nagpur airport.

### 2.5.4.2 RAIL NETWORK

Figure 8 Nagpur Airport

Railways first started in Nagpur in 1867. Nagpur Central Railway Station connects major railway trunk routes. City is a divisional headquarters for the Central Railway and South East Central Railway Zone of Indian Railways

Today, a total of 260 trains stop at Nagpur railway station. These include passenger, express, mail, Duronto, Rajdhani, Garib Rath trains. Of these 65 are daily trains and 26 terminate/originate from Nagpur. Almost 1.6 lakh passengers board/leave Nagpur Railway Station Nagpur railway station. Apart from the Nagpur railway station, Ajni Railway Station and Itwari Railway Station are the important stations of the city. Other railway stations in the city include Motibagh, Kalamna and Godhani.

Nagpur has a rare distinction of being the Divisional Headquarters for the Central Railway and South East Central Railway Zone of Indian Railways.

The other stations within the city include Ajni. Itwari, Kalamna, Kamthi, Godhni, Bharatwada, Kalameshwar, Kapri and Bahandewari Railway Stations.

Figure 9 Nagpur Railway Station

### 2.5.4.3 BUS SERVICES

The city bus systems play a vital role in meeting the travel needs of the city's population. The road transport services in Maharashtra State are operated and maintained by the Maharashtra State Road Transport Corporation (MSRTC), which typically operates the Inter City, Intra State and Inter State services within Maharashtra.


Figure 10 City Bus Services – Nagpur

MSRTC also operates City Bus Services in 7 cities in Maharashtra, namely Nashik, Nanded, Ratnagiri, Miraj, Vasai, Nalasopara, Aurangabad and Chandrapur. The city bus service in Nagpur city (i.e the Nagpur Municipal Boundary) is operated by the Nagpur Mahanagar Parivahan Limited (NMPL), a special purpose vehicle (SPV) of Nagpur Municipal Corporation (NMC). In 2007, the NMC signed an agreement with the private operator "Vansh Nimay Infraprojects Pvt Ltd (VNIL)" to purchase and operate the buses under Net Cost Contract (NCC), wherein VNIL paid corporation a fixed royalty per bus. The corporation was to earn back 50% of its revenue from advertisements on buses. A snapshot of the City Bus Services up until March 2017 is as represented in the Table 16.

Table 16: Snap Shot of City Bus Services in Nagpur

| Sl. No | Particulars | 2015-16 |
|---|---|---|
| 1 | **Total Fleet Size (Diesel)** | **470 (Planned)** |
| 2 | **Fleet Owned by VNIL** | **230** |
| 2a | Standard Bus | 150 |
| 2b | Midi Bus | 80 |
| 3 | **Fleet Procured under JnNURM** | **240** |
| 3a | Standard Bus | 240 |
| 4 | On Road Fleet | 254 |
| 5 | Operational Efficiency | 54.04% |
| 6 | No. of Routes identified/planned | 142 |
| 6a | Routes operational | 56 |
| 6b | Weekdays | 65 |
| 6c | Weekends | 47 |
| 7 | Average Daily Ridership | 1.25 lakhs |
| 8 | **Infrastructure** | |
| 8a | No. of Depots/Stations | 4 |
| 8b | No. of terminals | 0 |
| 8c | No. of Bus Shelters | 190 |

There are 183[1] Bus routes notified by the Regional Transport Office for Nagpur City. Of which till March 2017, only 36 routes were operated on a daily basis. However, post March 2017, Integrated Bus Transport Manager has taken initiatives to improve the quality and reliability of the services on various routes and have increased the total no. of operated routes from 36 to 38.

[1] Total No. of City Bus Services Routes Notified by the RTO for operations by NMC is 183. However the team received list of 154 routes, which has been utilized for the current study. Of the 154 routes, 36 routes are operational and remaining 118 routes are non-operational.

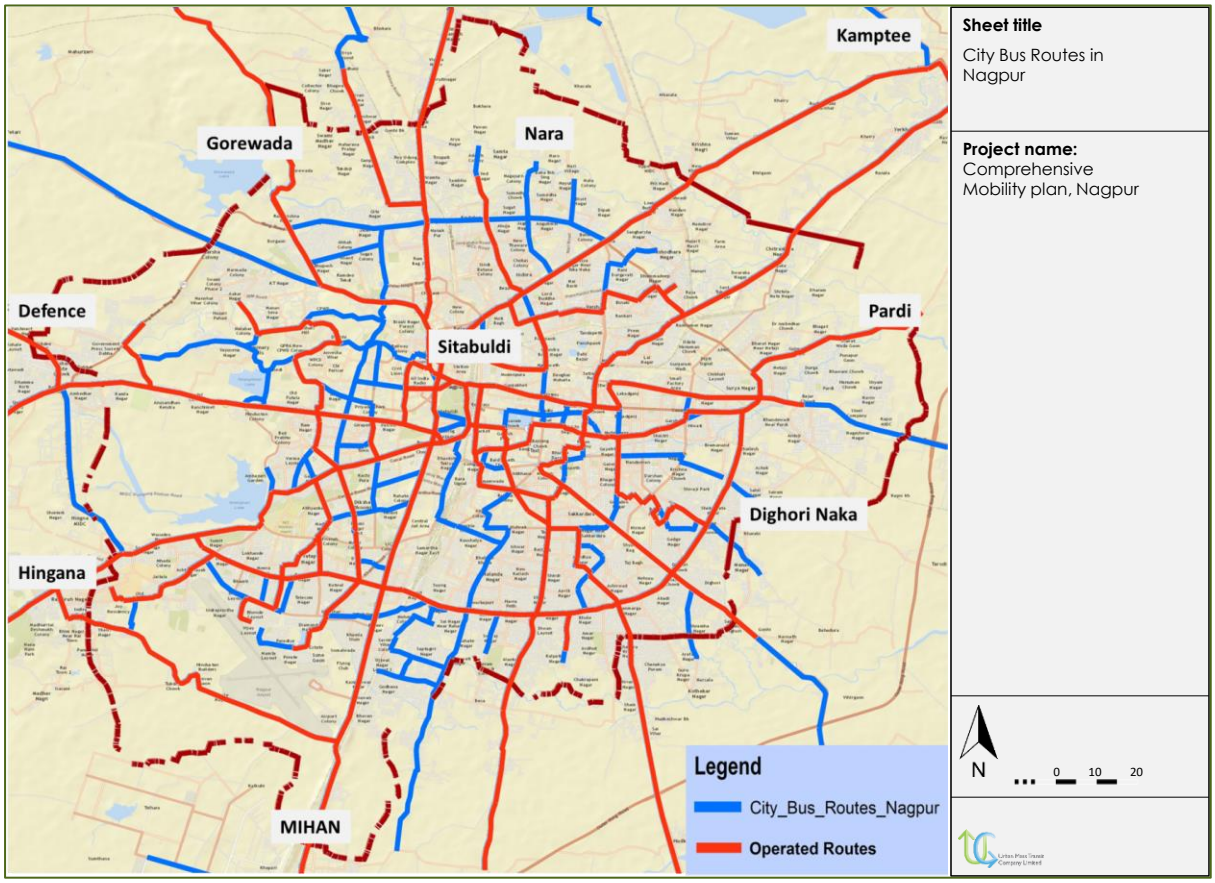



Figure 11 City Bus Services – Notified Route Network Vs Operated Routes

*(Source: UMTC Primary Survey 2017-18)*

Since, city bus services in Nagpur have not been able to live up to the expectation of the bus commuters in Nagpur, especially due to the Quality of the buses and inefficient operations, lack of maintenance of buses etc. Considering the above, there is a need to consider the city bus route rationalization plan for the short term and long term improvement proposals.

### 2.5.4.4 NAGPUR METRO RAIL

Recognizing the increasing travel demand in the city, a metro rail system for Nagpur was envisaged in 2013. The metro project consisted of two routes: Automotive Square, Kamptee to MIHAN Metro depot and Prajapati Nagar, East Wardhaman Nagar to Lokmanya Nagar, Hingna (refer Figure 12).

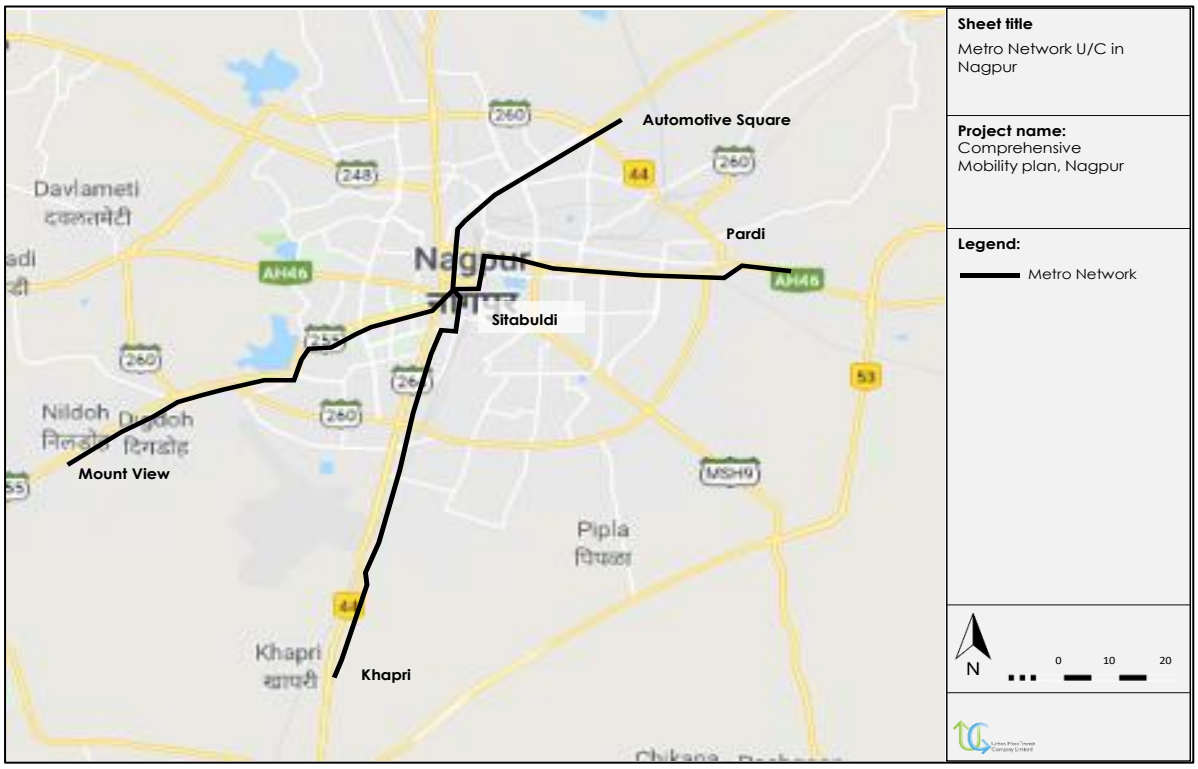



Figure 12 Nagpur Metro Corridor Alignment

### ALIGNMENT 1: NORTH-SOUTH CORRIDOR

This corridor originates from Automotive Square on Kamptee Road; moves along Kamptee Road and reaches the intersection point of Amravati Road and Wardha Road, then after crossing Fly Over moves towards Munje Square, moves towards Dhantoli and along nala moves towards Empire/Dr Munje Marg, leads towards Congress Nagar T-Point, then on Rahate Colony Road and then falls on Wardha Road, leads towards NEERI, then moves along Wardha Road and then west of Railway Track in MIHAN area and passes through 14m wide stretch of land between the railway boundary line and the road near proposed Container Depot. Entire length (19.6 km.) of this corridor is proposed as elevated except after Airport Station and in MIHAN area near Khapri Railway Station. There are 20 stations on this corridor of which 15 stations are elevated and 5 stations are at Grade. Sitaburdi Station is an Inter-change station.

### ALIGNMENT 2: EAST-WEST CORRIDOR

This corridor originates from Prajapati Nagar and runs westwards, through Vaishnodevi Chowk, Ambedkar Chowk, Telephone Exchange, Chittar Oli Chowk, Agarsen Chowk, Doser Vaisya Chowk, Nagpur Railway Station, Sitaburdi, Jhansi Rani Square, Institute of Engineers, Shankar Nagar Square, Lad chowk, Dharmpeth College, Subhash Nagar, Rachna (Ring road Junction), Vasudev Nagar, Bansi Nagar to Lomanya Nagar. The entire corridor is elevated. The total length of the corridor is 18.557 kilometer. There are 20 stations on this corridor.

## 2.5.4.5 INTERMEDIATE PUBLIC TRANSPORT

Intermediate public transport (IPT) modes i.e. Autos, Shared Autos and Taxis in large cities play an important role in meeting unstructured travel demands of the users. IPT performs as feeder service to the main mass transport system (Both Rail and road based) and provides accessible movement in predefined areas. The services provided by the IPT are intermittent in nature and this has complete flexibility in destination which is determined by the passengers. Autos, Shared Autos and Taxis are the primary form of IPT available in Nagpur. Within Nagpur city, IPT acts as competent access/egress modes and competing with the road based public transport system especially on short trip lengths. Trip characteristics by these modes are entirely different compared to the trips made by other motorized modes, as these modes offer high flexibility, services from almost door to door, fare, etc.

As in case of Nagpur, the IPT is unorganized and is operating independently by the auto drivers. The current mode share of Auto rickshaws is 19.8% which is observed to be more than that of the public transport. Table 17 illustrates the growth of IPT modes which includes 3 Wheelers, Motor Cabs, Maxi Cabs and other vehicles in the Nagpur City between 2010 & 2016. The average growth rate of these IPT vehicles in the city is observed to be -1.23% it could also be observed that maximum no. of Auto rickshaws have been registered in the past year, with a share of 1.01%. It could also be observed from the table that during the same period the average growth rate of Taxies is witnessed to be 10.75% with a share of 0.30%.

Table 17: Growth of IPT Vehicles In Nagpur City

| Category | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| Taxi Cabs | 2388 | 2661 | 2907 | 3132 | 3380 | 3817 | 4407 |
| Growth Rate of Taxi | | 11.43% | 9.24% | 7.74% | 7.92% | 12.93% | 15.46% |
| Auto Rickshaws | 16058 | 16417 | 17149 | 16743 | 15764 | 8494 | 8437 |
| Growth Rate of Auto Rickshaws | | 2.24% | 4.46% | 0.77% | 3.37% | -20.23% | 4.59% |

*(Source: Motor Transport Statistics of Maharashtra)*

The auto rickshaw permit is issued as per the Section 72 of Maharashtra Motor Vehicle Rules of 1989, which is valid for 5 years. The permitted passenger capacity of these vehicles is 3-4 PAX. At present there are 317 authorized auto rickshaw stands in Nagpur City.

Apart from the regular auto rickshaws and shared auto rickshaws, battery operated vehicles also operate within the Nagpur City. The shared autos are operating from the prime locations such as the Nagpur Railway Station, Medical Chowk, Ajni Railway Station, Ganeshpeth and Mayo Hospital. Table 18 lists out the shared auto routes in Nagpur.

Table 18: List of Shared Auto Routes in Nagpur

| Sl. No | Route | Route Length | Fare (Rs) | Sl. No | Route | Route Length | Fare (Rs) |
|---|---|---|---|---|---|---|---|
| 1 | Railway Station to Maratha Mandir | 2 | 7.5 | 31 | More Bhawan to Ambazari | 3.7 | 13 |
| 2 | Railway Station to Chatrapati Chowk | 5.7 | 19.5 | 32 | More Bhawan to Law College | 2.5 | 9 |
| 3 | Railway Station to Airport | 9 | 30 | 33 | More Bhawan to Vidhyapeth | 4.3 | 15 |
| 4 | Railway Station to Khamla | 5.8 | 20 | 34 | More Bhawan to Chawani | 3 | 11 |
| 5 | Railway Station to Dharampeth | 3.6 | 12.5 | 35 | More Bhawan to Friends Colony | 5.9 | 23.5 |
| 6 | Railway Station to Ambazari | 5.9 | 20 | 36 | More Bhawan to Zingabai Thakli | 5.6 | 19 |
| 7 | Railway Station to Variety Chowk | 5.9 | 8 | 37 | More Bhawan to Teka Naka | 5.2 | 21 |
| 8 | Railway Station to Ravi Nagar | 4.1 | 14.5 | 38 | More Bhawan to Railway Station | 2.3 | 8.5 |
| 9 | Railway Station to Chawni | 2.7 | 10 | 39 | More Bhawan to Medical Chowk | 4.1 | 14.5 |
| 10 | Railway Station to Gaddi Godam | 5.3 | 18 | 40 | More Bhawan to Manewada Chowk | 5.8 | 23 |
| 11 | Railway Station to Mental Hospital | 3.5 | 12.5 | 41 | More Bhawan to Ganeshpeth Bus Stand | 2.2 | 8 |
| 12 | Railway Station to Zingabai Thakli | 5.9 | 20 | 42 | Ganeshpeth to Ajni Railway Station | 3.2 | 11.5 |
| 13 | Railway Station to Indora Chowk | 3.1 | 11 | 43 | Ganeshpeth to Chatrapati Chowk | 5.8 | 20 |
| 14 | Railway Station to Ambedkar Chowk | 5.1 | 20.5 | 44 | Ganeshpeth to Khamla | 5.6 | 19 |
| 15 | Railway Station to Baidhyanath Chowk | 2.9 | 10.5 | 45 | Ganeshpeth to Dikshabhoomi | 4.1 | 14.5 |
| 16 | Railway Station to Shakkardhara Chowk | 5 | 17 | 46 | Ganeshpeth to Variety Chowk | 2.9 | 10.5 |
| 17 | Railway Station to Ganeshpeth Bus Stand | 2.4 | 9 | 47 | Ganeshpeth to Law College | 5 | 17 |
| 18 | Medical Chowk to Ajni Chowk | 3 | 11 | 48 | Ganeshpeth to Vidhyapeeth | 7.4 | 25 |
| 19 | Medical Chowk to Cotton Market/Railway Station | 2.1 | 8 | 49 | Ganeshpeth to Gaddigoddam | 7.5 | 25 |
| 20 | Medical Chowk to Mayo Hospital | 3.3 | 12 | 50 | Ganeshpeth to Medical Hospital Chowk | 5.5 | 22.5 |
| 21 | Ajni Railway Station to Chatrapati Chowk | 2.4 | 9 | 51 | Ganeshpeth to Railway Station | 2.5 | 9.5 |
| 22 | Ajni Railway Station to Airport | 5.1 | 17.5 | 52 | Ganeshpeth to Indora Chowk | 5 | 20.5 |
| 23 | Ajni Railway Station to Khamla | 3 | 11 | 53 | Ganeshpeth to Mayo Hospital | 2.5 | 9.5 |
| 24 | Ajni Railway Station to Medical Chowk | 2.2 | 8 | 54 | Ganeshpeth to Ambedkar Chowk | 5.5 | 22 |
| 25 | Ajni Railway Station to Manewada Chowk | 5.7 | 22.5 | 55 | Ganeshpeth to Manewada Chowk | 5.1 | 17.5 |
| 26 | Ajni Railway Station to Shakkardhara Chowk | 4.4 | 15.5 | 56 | Ganeshpeth to Shakkardhara Chowk | 2.5 | 9 |
| 27 | More Bhawan to District Administrative Office | 2.2 | 8 | 57 | Mayo Hospital to Ajni Chowk | 5.3 | 18 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **28** | More Bhawan to High Court | 3.9 | 13.5 | **58** | Mayo Hospital to More Bhawan | 3.1 | 11 |
| **29** | More Bhawan to Airport | 5.9 | 23.5 | **59** | Mayo Hospital to Ganeshpeth Bus Stand | 2.7 | 10 |
| **30** | More Bhawan to Khamla | 4.2 | 14.5 | **60** | Mayo Hospital to Medical College Chowk | 4.7 | 15 |

Even though these routes have been identified by the Regional Transport Office, Nagpur, yet majority of the shared auto services do not operate on the above identified routes and extend their services directionally across the city.

As per the Motor Vehicles Rules of Maharashtra State, Even though the battery operated vehicles were exempted from the MV Tax, neither can they be registered by the RTO nor permits be issued by the RTO under the same. However, with the recent directions from the central and state governments, the state government of Maharashtra has made provisions under the Motor Vehicles Act of 1988 and Maharashtra Motor Vehicles Rules of 1989 for registration of the e-rickshaws. As of 2016, approximately 1000 battery operated e-rickshaws are operating within Nagpur City.

Radio Taxi and App based Taxi services such as Ola and Uber have made their presence felt in Nagpur. These services offer world class experience meeting the expectations of non-residents of Nagpur City, Tourists and Local residents alike.

With an intention of promoting electric vehicles within the country, Ola has also taken up a pilot initiative of introducing a fleet of 200 electric vehicles, including taxis, buses, e-rickshaws and auto within the city in cooperation with Mahindra and Mahindra.

## 2.6. EXISTING TRAFFIC CHARACTERISTICS

The salient features of the traffic and travel characteristics in the city based on the primary surveys executed are explained in the following sub sections.

### 2.6.1 MODE SHARE

Table 19 and

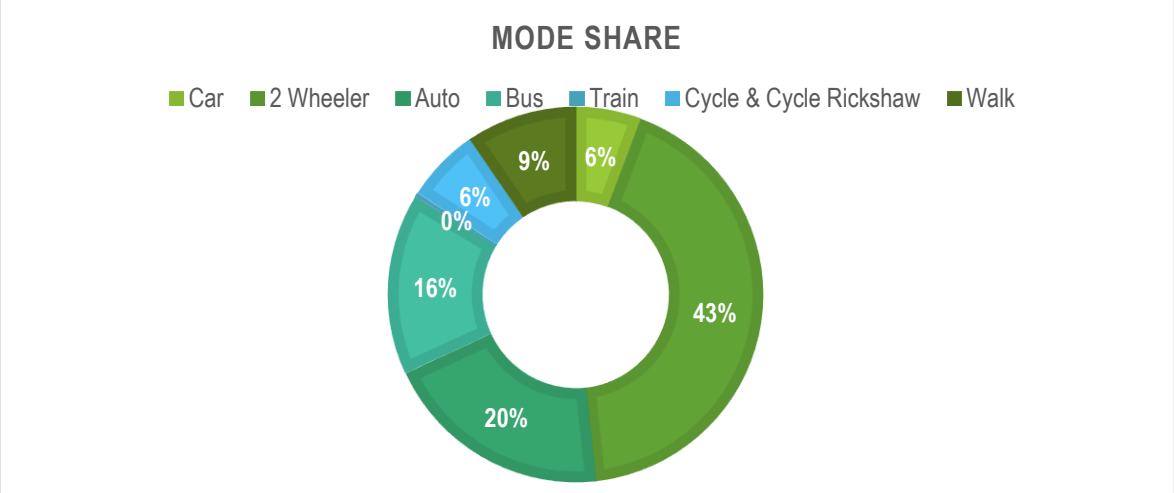
Figure 13 represents the Mode Share of Nagpur City; it can be observed that the share of 2 wheelers is the highest at 42.6% followed by Auto rickshaws at 19.8% and Bus at 15.6%. Whereas cars have the lowest mode share at 5.7%

Table 19: Mode Share – Nagpur

| Sl. No | Mode | Percentage Share |
|---|---|---|
| 1 | Car | 5.70% |
| 2 | 2 Wheeler | 42.60% |
| 3 | Auto | 19.80% |
| 4 | Bus | 15.60% |
| 5 | Train | 0.40% |
| 6 | Cycle & Cycle Rickshaw | 6.40% |
| 7 | Walk | 9.50% |

*Source: Primary Survey, 2017-18*

Figure 13: Mode Share in Nagpur




*Source: Primary Survey, 2017-18*

### 2.6.2 SPEED AND DELAY CHARACTERISTICS

It is observed from that about 54% of the total road network has journey speed upto 30 kmph and 28% of network has journey speed more than 40 kmph during peak hours. About 40% of surveyed network has journey speed upto 30 kmph and 32% of network has journey speed more than 40 kmph during off-peak hours. Average Journey Speed during peak and off-peak period for city as a whole is observed to

be 23.4 kmph and 27.1 kmph respectively. It is also observed that journey speed in core area is about 19 kmph and 34 kmph in outer area during peak hours.

### 2.6.3 TRIP PURPOSE

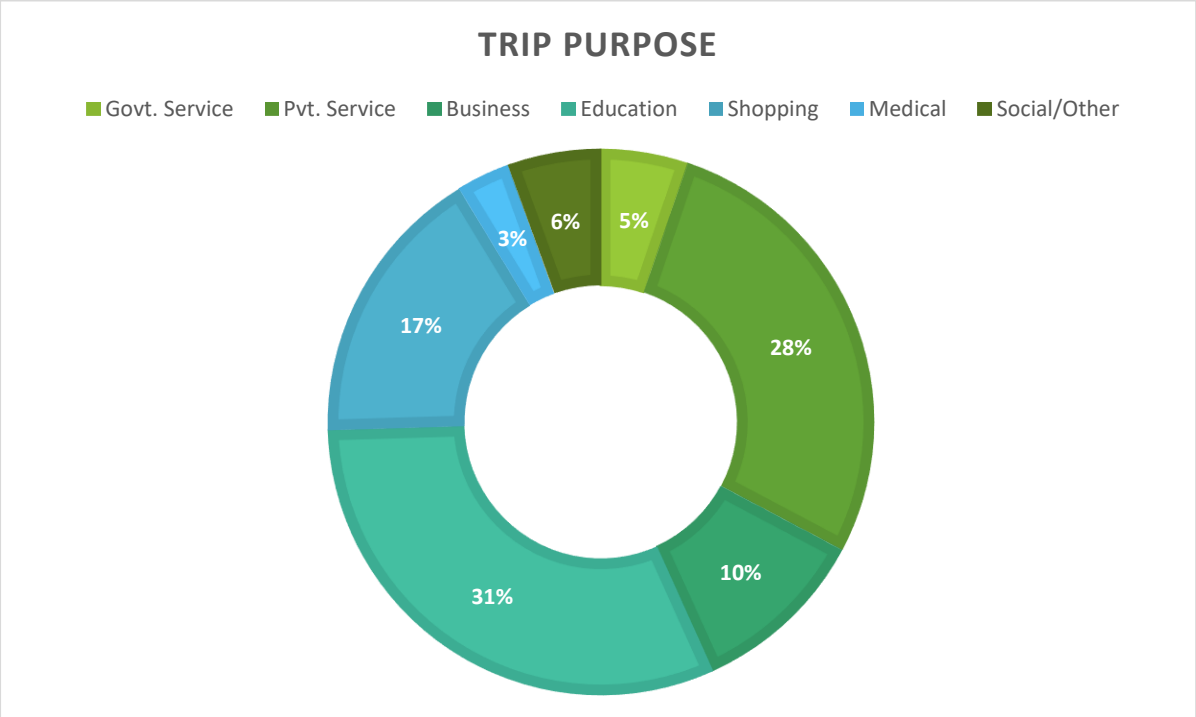
The total daily trips are estimated at 51,20,650 as derived from the household survey, of which the majority trips (43.3%) are for Work and Business whereas education accounts for 31.3% trips. Table 20 and Figure 14 reflect the distribution of trip purpose.

Table 20: Trip purpose

| S.No. | Trip Purpose | Total Trips | % |
|---|---|---|---|
| 1 | Govt. Service | 264873 | 5.2 |
| 2 | Pvt. Service | 1415503 | 27.6 |
| 3 | Business | 537292 | 10.5 |
| 4 | Education | 1602557 | 31.3 |
| 5 | Shopping | 857985 | 16.8 |
| 6 | Medical | 162954 | 3.2 |
| 7 | Social/Other | 279486 | 5.5 |
| | Total | 5120650 | 100 |

*Source: Primary Survey, 2017-18*

Figure 14: Distribution of trips by purpose



## 2.6.4 PER CAPITA TRIP RATE

The total daily trips are estimated at 51,20,650 as derived from the household survey. Distribution of daily trips by modes is presented in Table 21. About 90% of these are vehicular trips while 10% are walk trips. The per capita trip rate for motorized trip in the study area is 1.3.

Table 21: Daily passenger trips by mode

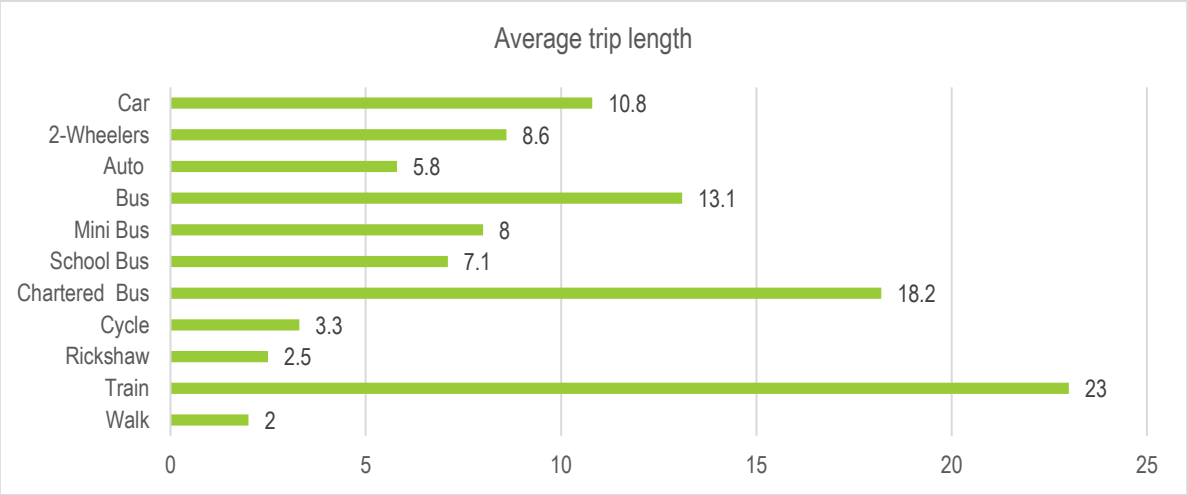
| Mode | No. of Trips | Percentage | |
|---|---|---|---|
| Car | 292557 | 5.7 | 90.5 |
| 2- Wheeler | 2181173 | 42.6 | |
| Auto | 1015885 | 19.8 | |
| Bus | 503656 | 9.8 | |
| Mini Bus | 51838 | 1 | |
| School Bus | 238904 | 4.7 | |
| Chartered Bus | 4688 | 0.1 | |
| Cycle | 307865 | 6 | |
| Rickshaw | 18731 | 0.4 | |
| Train | 17152 | 0.3 | |
| Walk | 488202 | 9.5 | 9.5 |
| Total Trips | 5120650 | 100 | 100 |
| Total Motorized Trips | 4305853 | | |
| PCTR for Motorized Trips | 1.3 | | |

*Source: Primary Survey, 2017-18*

## 2.6.5 TRIP LENGTH

In Nagpur the average trip lengths are observed to be 7.6 km (including walk trips) and 8.2 km (excluding walk). The analysis of trips lengths by different modes estimates the average trip length by trains to be 23 km, whereas by cars and 2 wheelers to be 10.8 km and 8.6 km respectively. Figure 15 shows the mode-wise average trip lengths, as observed NMT modes such as walk, cycle and cycle rickshaws have an average trip length of 2 km, 3.3 km and 2.5 km respectively.

Figure 15: Mode wise average trip length




*Source: Primary Survey, 2017-18*

## 2.6.6 TRAVEL TIME

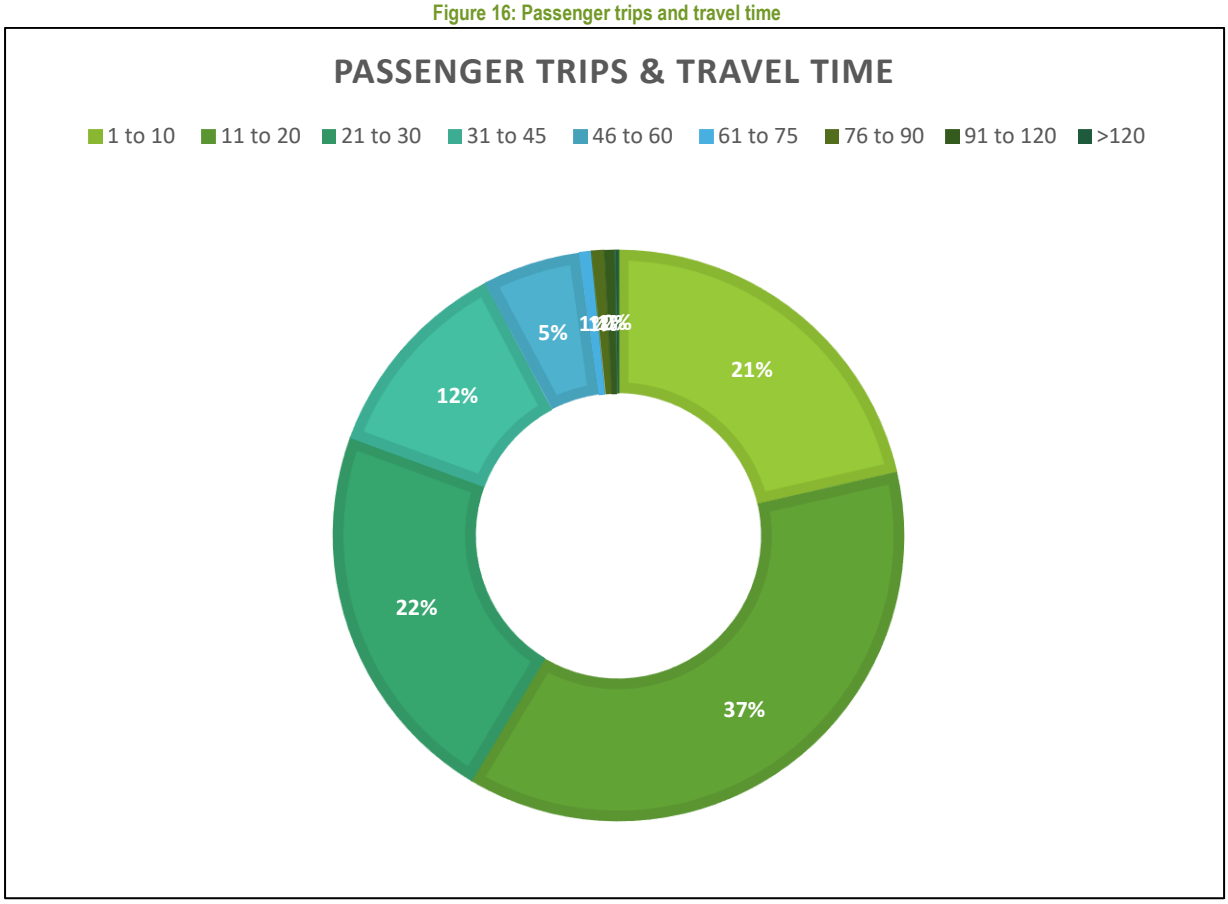
Distribution of trips by travel time and mode is presented in Table 22 and Figure 16. The analysis of trips by all modes reveals that maximum trips i.e. 37% are made in 11-20 minutes and about 21% in 1-10 minutes.

Table 22: Passenger trips by travel time

| Travel Time (minutes) | 1 to 10 | 11 to 20 | 21 to 30 | 31 to 45 | 46 to 60 | 61 to 75 | 76 to 90 | 91 to 120 | >120 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| % | 21.4 | 37.2 | 22 | 11.7 | 5.5 | 0.7 | 0.7 | 0.6 | 0.2 | 100 |

*Source: Primary Survey, 2017-18*

Figure 16: Passenger trips and travel time




## 2.6.7 TRAVEL COST

It is observed that a major % of trips (32%) cost between Rs 6 to Rs 10, 15% of trips cost between Rs 21 to Rs 30 where as 6% of the trips cost upto Rs.5 for travelling in Nagpur. The details are as in Table 23.

Table 23: Trip distribution by travel cost

| Travel Cost (Rs) | 1 to5 | 6 to 10 | 11 to 15 | 16 to 20 | 21 to 30 | 31 to 45 | 46 to 70 | 71 to 100 | >100 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| % Trips | 5.7 | 32 | 17.6 | 16.4 | 14.7 | 6.8 | 4.8 | 1.6 | 0.6 | 100 |

## 2.7. SERVICE LEVEL BENCHMARKING

Benchmarking is a tool used by public agencies to make more informed decisions regarding the performance, make comparisons internally and with other organizations and continuously improve performance using the lessons learned through this comparison process. Benchmarking allows public agencies to direct limited resources to the program. Benchmarking helps to establish baseline measures of performance, and helps monitor the agency's individual performance over time, and also how it compares with the other organizations, and also improving performance by sharing of lessons learnt from different entities.

### 2.7.1 NEED FOR BENCHMARKING FOR NAGPUR

The National Urban Transport policy (NUTP) 2006 highlights the crucial link between transport demand and land use planning and the need to develop an integrated mobility plan for each city. Accordingly, each city should develop comprehensive mobility plan during the 12th five year plan with focus on accessibility, mobility and traffic flow (in that order). Rather than the present approach of "predict and provide" it has to be "Planning for the desirables". However, there need to be some yardstick to measure and compare the effectiveness of policies and urban projects across cities. Urban agencies in India currently do not have any system for measuring performance of urban transport activities, assessing impacts of projects and taking further action on them. Nagpur City is no exception to this. The service level benchmarks (SLB) issued by MoHUA specify parameters to measure the effectiveness of land use-transport planning in Nagpur. The SLBs describe the levels of transport performance like safety and access, pollution, accidents, congestion etc. in Nagpur currently. They indirectly reflect the state of governance in the city. Above all, these benchmark indicators allow stakeholders to quantify the past, present and changes in transport and its sustainability

### 2.7.2 PERFORMANCE BENCHMARKS FOR URBAN TRANSPORT

In Service Level Benchmark, four levels of Service (LoS) have typically been specified. They are LOS1, LOS2, LOS3 and LOS4. The LOS1 represents the highest performance level whereas LOS4 represents the Lowest. This section describes the computation process for all the indicators for Nagpur City. Service level benchmarks have been identified for the following parameters by the MoHUA:

4.3.1 Public Transport Facilities

4.3.2 Pedestrian Infrastructure facilities

4.3.3 Non-Motorized Transport (NMT) facilities

4.3.4 Level of usage of Intelligent Transport System (ITS) facilities

4.3.5 Travel speed (Motorized and Mass Transit) along major corridors

4.3.6 Availability of parking spaces

4.3.7 Road Safety

4.3.8 Integrated land use transport system

4.3.9 Sustainability of Public Transport

## PUBLIC TRANSPORT FACILITIES

### PRESENCE OF ORGANIZED PUBLIC TRANSPORT SYSTEM IN URBAN AREA (%)

Nagpur's public transportation system is operated and maintained by Maharashtra State Road Transport Corporation (MSRTC). At present, the city has 370 buses operated on 132 routes.
A = Total Number of Buses in the City operating – 370 buses
B = Total Number of operating Buses under the ownership of STU/SPV - 370 buses
Presence of Organized Public Transport System in Urban Area (%) = (B/A)*100
= 100 %, therefore corresponds to LoS 1

### EXTENT OF SUPPLY AVAILABILITY OF PUBLIC TRANSPORT (AVAILABILITY OF PUBLIC TRANSPORT / 1000 POPULATION)

The Population of study area for the year 2018 is 34,30,000.
A = Total Number of Buses in the City – 270 buses
B = Total Population of the Study area – 34,30,000.
Availability of Public Transport / 1000 Population = A/ (B/1000)= 0.10, Therefore corresponds to LoS = 4

### AVERAGE WAITING TIME FOR PUBLIC TRANSPORT USERS (MINS)

The average headway for each bus route is about 28.4minutes. Therefore the average waiting time is half the headway 1.e. 14 minutes, Therefore corresponds to LoS 4.

### SERVICE COVERAGE OF PUBLIC TRANSPORT IN THE CITY

The study area is 1550 sq.km. The total road length on which public transport system is plying is 316 km.
A=Total length of road Kms of the corridors on which the PT systems ply in study area= 316 kms (in Road Kilometers) for metropolitan area
B = Area of the Urban Limits (study area) = 1550 (in Square Kilometers)
Service Coverage of public transport in the city is 1550/316 =4.95, therefore corresponds to LoS 1

### LEVEL OF COMFORT IN PUBLIC TRANSPORT (FROM PREVIOUS CMP)

Load factor was calculated for different routes (Peak and Off peak hours). From the calculated load factor distribution table was prepared. The average value obtained from the distribution is about 0.80. Therefore corresponds to LoS 1.

**% of fleet as per urban bus specification**

A = Total Number of Buses in the City operating – 370 buses
B = Total number of buses as per the Urban Bus specifications in the city operating – 237 buses
% of fleet = (B/A)*100 = (237/370)*100 = 64%, Therefore corresponds to LoS 2.

***The overall LoS of Public Transport Facilities is obtained by summing up the LoS of individual parameters, Overall Level of Service of Public Transport facilities in Nagpur. Thus overall LoS corresponds to '2'.***

## PEDESTRIAN INFRASTRUCTURE FACILITIES

### SIGNALIZED INTERSECTION DELAY (%) FROM PREVIOUS CMP

A = Total Number of signalized intersections in the city = 140
B = No of intersections having average waiting time of pedestrian more than 45 seconds = 0%
(Desired average waiting time for a pedestrian is not more than 45 seconds)
Signalized intersections delay (%) = (B/A) =0%
Therefore corresponds to LoS 1

### STREET LIGHTING (LUX) FROM PREVIOUS CMP

It is estimated that the LoS for the city is 3.

### % OF CITY COVERED

Almost 14% of surveyed network has a paved footpath. Some of the network has footpath on the both side but the width was less than 1.8m.
A = Total length of road network in the city and multiplied by 2 = 1534 kilometers (Surveyed)
B = Total length of the footpath having minimum width of 1.8 m and available on both sides = 213 in Kilometers. (Surveyed)
Percentage of the city covered = (B/A)*100
= (213/1534)*100 = 14%, Therefore corresponds to LoS=4
***Overall Level of Service of pedestrian Infrastructure facilities city wide = LoS1+ LoS2 + LoS3 = 3+3+4= 9***
***Therefore corresponds to LoS 3.***

## NON-MOTORIZED TRANSPORT (NMT) FACILITIES

NUTP recommends that cities should have NMT tracks on all major roads within a year. In view of above said this indicator reflects the availability of dedicated cycle track along all the arterial, sub arterial roads and public transport corridors, its encroachment and parking facilities.
In Nagpur, the NMT parking facility is present at places such as railway station, and at bus stands. As an overall percentage this value is negligible and is taken as zero. Hence, for this performance indicator the level of service for all the above said three sub divisions are below the least level of service category (Normally zero for all).

## LEVEL OF USAGE OF INTELLIGENT TRANSPORT SYSTEM (ITS) FACILITIES

### AVAILABILITY OF TRAFFIC SURVEILLANCE (%)

A = Total no of bus stations on BRTS, major bus stops, terminals, metro stations and signalized intersection having CCTVs = 14 (8 Bus terminal, 5 Railway terminal, 1 airport) + 140 signalized junctions = 150
B = Total no of bus stations, terminals, metro stations and signalized intersections = 190 (Bus shelter – City Bus)+ 8 Bus terminal, 5 Railway terminal, 1 airport + 140 junctions = 344
Availability of traffic surveillance (%) = (A/B)*100 = 150/344 = 44%. Therefore corresponds to LoS 3.

### PASSENGER INFORMATION SYSTEM (PIS) (%)

A = Total no of bus stops, terminals, metro stations having Passenger Information System facility = 14 (8 Bus terminal, 5 Railway terminal, 1 airport)
B = Total no of bus stops, terminals, metro stations > 204
Passenger Information System= (A/B)*100 = (14/204)*100 = 7. Therefore corresponds to Los 4

### GLOBAL POSITIONING SYSTEM (GPS)/ GENERAL POCKET RADIO SERVICE (GPRS) (%)

A = No of public transport vehicles and IPT with functional on board GPS/GPRS and connected to common control center = 370
B = Total no of public transport vehicles = 370 (in No)
Global Positioning System = (A/B)*100
= (370/370)*100
= 100 %, Therefore LoS 3 = 1

### SIGNAL SYNCHRONIZATION (%)

In Nagpur, so far no signals have been synchronized.
A = No of signals synchronized = 0 (in No.)
B = Total number of signalized intersections = 140 (in No.)
Signal Synchronization (%) = (A/B)*100
= (0/140)*100
=0 %, Therefore LoS 4 = 4.

### INTEGRATED TICKETING SYSTEM (%)

Integrated Ticketing System is absent in Nagpur. So the level of service for this benchmark is 4.
**Overall Level of Service of ITS facilities city wide = LoS1+ LoS2 + LoS3 + LoS4 + LoS5 = 3+4+1+4+4= 16. This corresponds to LoS 4.**

## TRAVEL SPEED (MOTORIZED AND MASS TRANSIT) ALONG MAJOR CORRIDORS

### AVERAGE TRAVEL SPEED OF PERSONAL VEHICLES (KMPH)

From the speed and delay survey for private vehicles, the average journey speed for major corridors for the private vehicles = 23 Kmph. Therefore corresponds to LoS 3.

### AVERAGE TRAVEL SPEED OF PUBLIC TRANSPORT (KMPH)

From the speed and delay survey for public transport, the average journey speed for major corridors for the public transport =18 Kmph. Therefore corresponds to LoS 2.
Overall Level of Service of Travel Speed facilities city wide =3+2 = 5 (score) = LOS 3

**The overall LOS= 3+3 =6 (score) this corresponds to LoS 3**

## AVAILABILITY OF PARKING SPACES

This indicator represents the availability of paid on-street parking spaces for all vehicles in the Nagpur. Paid on-street parking facility is not yet introduced in Nagpur city except in some off-street locations like Bus stands and railway stations. In some places like Market complexes, parking is maintained by private people. As the percentage is negligible it is considered as <25 %. Therefore LoS 1= 4.
The ratio of maximum and minimum parking fee is 1 for Nagpur city. Therefore LoS 2 = 4.
**Overall score: 4+4 = 8 this corresponds to LoS 4.**

## ROAD SAFETY

Fatality rate per lakh population
Fatality Rate per Lakh of Population (%)
Accident Data for the entire city was collected from Traffic police, Calculation was done only based on 2018 data and the corresponding year population.
A = Total number of fatalities recorded in road accidents within city limits in the given calendar year = 21 (in nos.)
B = Population of the Nagpur urban limits in 2018 year – 34.3(Estimated) (in Lakhs)
Fatality rate per 100000 Population (ratio)
= (A )/( B/100000)
= 0.61
This corresponds to LOS 1.

## POLLUTION LEVELS

The indicator indicates the level of air pollutants in the city i.e., average level of pollution in urban areas. The indicator to calculate the pollution level is Mean Concentration Range.

The pollution data that needs to be collected includes:

1. Sulphur Dioxide (SO2)
2. Oxides of Nitrogen
3. Suspended Particle matter (SPM)
4. RSPM (Size less than 10 microns)

The level of service for the pollutants is divided into four categories i.e., low, moderate, high and critical. The level of service for each of the above parameters is determined using the table below as recommended by MoUD /MoHUA

For Nagpur city, the pollution levels data is available for the year 2010 and is as shown below

Oxides of Sulphur: 4, this corresponds to LoS 1
Oxides of Nitrogen: 17, this corresponds to LoS 1
SPM: 89, this corresponds to LoS 1
RSPM (Size less than 10 microns): 151, This corresponds to LoS 4

Overall level of service of pollution city wide = LoS 1+ LoS 2+ LoS 3 + LoS 4 = 1+1+1+4=7, this corresponds to LoS 2.

## INTEGRATED LAND USE TRANSPORT SYSTEM

### POPULATION DENSITY – GROSS (PERSONS/DEVELOPED AREA IN HECTARE)

A = Area (in Hectare) of study area= 1,55,000 hectares
B = Population of the year (2018) for which data is available = 34.3 lakhs
Population density (No.) = B/A
= 34,30,000 /1,55,000 = 22.12. Therefore corresponds to LoS 4.

### MIXED LAND-USE ON MAJOR TRANSIT CORRIDORS / NETWORK (% AREA UNDER NON-RESIDENTIAL USE)

A= Mixed use Development along Transit corridors=815 kms
B=Total road length (Transit corridor) = 1534 km
A/B*100= (815/1534)*100= 53%, Therefore corresponds to LoS 1.

### INTENSITY OF DEVELOPMENT – CITY WIDE (FSI)

As per the Development plan Floor Space Index (FSI) as applicable to the developed area lies in the range of 1.00 - 1.5. Normally, FSI varies due to plot size, ground coverage and road width.

Floor Space Index is between 1.0 to 1.5, Therefore corresponds to LoS 3.
The entire network in Nagpur city has a somewhat clear pattern (hybrid grid) but somewhat incomplete network as many the peripheral locations are not well connected.
Hence LoS 5 = 2.

### INTENSITY OF DEVELOPMENT ALONG TRANSIT CORRIDOR (FSI TRANSIT CORRIDOR/FSI)

A = Floor Space Index (Applicable to most part of the city as per master plan is 1.0 to 1.5.
B = FSI for the proposed transit corridor is also 1.0 TO 1.5
Intensity of development along transit corridor = B/A= 1,
Therefore corresponds to LoS 3.

### % OF AREA UNDER ROADS (%)

As per master plan, the average area under transport and communication for Nagpur City area is around 12%- 14%. If we consider area only under roads it is in the range of 7%.
Therefore. LoS 6 = 4

### % NETWORK WITH EXCLUSIVE ROW FOR TRANSIT (FOR >1 MILLION AS PER 2001 CENSUS)

A = total Length of roads= 1534 km
B = Total length of road having exclusive transit = 0 kms
% network with exclusive ROW for transit = B/A*100 = 0 , Therefore LoS 7 = 4
**Overall Level of Service of Integrated Land use system= LoS 1+ LoS 2 + LoS 3 + LoS 4 + LoS 5 + LoS 6 + LoS 7= 4+ 1+3 +2+3 +4 +4 = 21, this corresponds to overall LOS 3.**

## SUSTAINABILITY OF PUBLIC TRANSPORT

### EXTENT OF NON FARE REVENUE (%)

Performance of Napur City Transport Services Limited had been collected as a secondary data collection.
A = Revenue collections per annum from non-fare related sources (i.e. excluding tariff box collections) less than 5 %
B = Total revenue per annum from all the sources i.e. majorly fare 100%
Extent of non-fare revenue (%) = A/B * 100
= <5 %, Therefore LoS 4

### STAFF /BUS RATIO

A = Total staff of bus operation and maintenance – > 370+370 > 740
B = Total number of buses – 370 (in Number)
Staff / Bus Ratio (ratio) = A/B = 2, Therefore LoS 1
**Overall score: 4+1 = 5 this corresponds to overall LoS 2.**

## SUMMARY TABLE

Summary table of LoS calculated for study area (Overall LoS) is presented in Table 24

Table 24: Service Level Benchmarking Summary

| | Existing LoS | Remarks |
|---|---|---|
| **Public Transport Facilities** | 2 | The city has a public transport system which may need considerable improvements in terms of supply of buses/coaches. The network coverage is good but frequency of services available may need improvements. |
| **Pedestrian Infrastructure facilities** | 3 | The city has very poor pedestrian facilities which need significant improvements. The pedestrian facilities at intersections, footpaths etc. needs improvement as also many parts of city are not served by it. |
| **Non-Motorized Transport (NMT) facilities** | 4 | The city lacks adequate NMT facilities. |
| **Level of usage of Intelligent Transport System (ITS) facilities** | 4 | The city lacks adequate ITS facilities. |
| **Travel speed (Motorized and Mass Transit) along major corridors** | 3 | Significant approach delays and average travel speed of 1/3 the free flow speed or lower. Such condition causing combination of one or more reasons such as high signal density, extensive queuing at critical intersection and appropriate signal timing. |
| **Parking spaces** | 4 | The city authority need to initiate immediate actions with respect to providing paid parking spaces and demand management for parking. |
| **Road Safety** | 1 | Level of fatality rate in a city is very low. |
| **Pollution levels** | 2 | Need some improvement in emission standards, checking pollution etc. |
| **Availability of parking spaces** | 4 | The city authorities need to initiate immediate actions with respect of providing paid parking spaces and demand management for parking |
| **Integrated land use transport system** | 3 | Faint coherence between study area structure and public transport system. |
| **Sustainability of Public Transport** | 2 | The public transport is financial sustainable but need significant improvements |

# FUTURE TRAFFIC AND TRANSPORT CHARACTERISTICS

# 3. TRAVEL DEMAND MODELLING AND FORECASTING

An urban transport model to replicate the Study area transportation system is developed with a state-of-the-art software and modelling technology. This model can be used for forecasting, using altered model inputs to reflect future year conditions. By simulating roadway conditions and travel demand on those roadways, deficiencies in the system can be assessed. Potential major future network enhancements such as introduction of Public Transport, land use modifications and Other Transport Strategies can be analysed by this tool and its efficacy can be established at a planning level. Several software programs are available for developing travel demand models. The Nagpur transport model is developed using Cube software (a state-of-the-art Travel Demand Modelling software).

## 3.1. PRE MODELLING ANALYSIS

### 3.1.1. STUDY AREA AND DELINEATION

The study area comprises of Nagpur Municipal Corporation and Other Areas such as Kamptee, Kalmeshwar, Hingna and surrounding villages making a total of 1550 sq.km. It has been subdivided into smaller physical units, termed as Traffic Analysis Zones (TAZs) to facilitate understanding of travel pattern within the study area. Consultant have chosen current municipal wards as TAZs for which demographic, socio-economic and other planning data is readily available from secondary sources.

### 3.1.2. INTERNAL ZONES

The study area is divided into 182 TAZs as per prevailing demarcation of municipal wards. These wards are taken as internal zones

### 3.1.3. EXTERNAL ZONES

The Regions beyond the study area have been delineated into external zones based on the catchment of the existing transport links feeding into the study area. A total of 12 external zones are considered representing the world outside the study area. In summary, study area is divided into total 194 TAZs.

### 3.1.4. HORIZON PERIOD

Year 2018 is considered as Base Year. The travel demand forecasts is to be prepared up to 2041. Therefore for the purpose of sequential planning and design of the systems, these travel demand forecasts are presented for the years 2021, 2031 and 2041.

### 3.1.5. PREPARATION OF DATA BASE

Data required for the analysis of travel demand can be categorized into three types.

1. Planning variables
2. Transport network
3. Travel Demand and Characteristics

The base year data is summarized in the following sections.

**Planning Variables**

Planning variables i.e. population and employment are some of the important data required for estimating the travel demand generated at zonal level. Base year demographic data is obtained from the Census database. Zone wise employment is collated from various published reports.

**Transport Network**

The transport network in the study area includes road network and public transport network. All the characteristics of the road links are collected by network inventory and, speed and delay surveys. Link characteristics collected include length, carriageway type (divided/ undivided), type of circulation (one-way/ two-way), number of lanes, average speed, capacity etc. Public Transport Network includes all roads on which public transport buses operate. Details of bus routes, frequencies, seating capacities, maximum load factor, and fares have been collected and coded. In addition, in this study, Auto rickshaw is considered as an intermediate public transport and is made available on the road links. The road network is properly connected to all zone centroids by means of dummy links.

## 3.2. STRATEGIC MODEL DEVELOPMENT

The model is based on a conventional 4-stage transport modelling approach which includes:

**Trip Generation** - calculation of the number of origins and destinations for each zone.

**Trip Distribution** - attaching the origins and destinations for complete trips.

**Mode Choice** - determination of the mode for each trip (TW, car, Intermediate Public Transport (IPT), Public transport).

**Assignment** - assigning passengers to their respective highway and transit networks.

### 3.2.1. TRIP GENERATION

The analysis and the model building phase starts with the step commonly known as Trip Generation. This is the term used in the transportation planning process to estimate the number of trip ends in a given area (i.e., how much travel; for example either from homes or workplaces). The objective of the trip generation stage is to understand the reasons behind the trip making behaviour and to produce mathematical relationships to synthesize the trip making behaviour and to analyse the trip making pattern on the basis of observed trips, land use data and the household characteristics.

For this study:-

• All the existing trips on the project stretch have been considered for the base year. This is arrived through the Household Survey (travel diary), Volume count survey and Road side interview conducted in the study area.

• All the proposed developments and their scale of developments have been captured to estimate future trip generations within the study area.

Trips are usually divided into two types i.e. home-based and non-home based trips

Home-based trips are those having one end of the trip either origin or destination at home, of the persons making the trip, The home based trips are further classified as home based work trips, home based education trips and Home based other trips

Non home based trips are those having neither start nor end at home of the person making the trip.

(The volume of non-home based trips was less than 1%, therefore these trips are not considered in regression exercise). The base year planning variables and Trip generated are shown in table below:

Table 25 Base Year (2018) Planning Variable

| Base Year (2018) Planning Variables | |
|---|---|
| **Population 2018** | 34.3 Lacs |
| **Employment 2018** | 12.7 lacs |
| | |
| Trips Produced in Base Year | |
| **Home Based Work** | 22,18,499 |
| **Home Based Education** | 16,04,408 |
| **Home based Others** | 12,97,743 |

Based on the correlation between the Planning Variables and the trips produced, the trip production and attraction equations are developed. They are shown in table below:

Table 26 Correlation equations / Trip End Models

| Trip Type | Productions/Attraction Model | $R^2$ value |
|---|---|---|
| Production | | |
| **Nagpur Urban Area** | Trip Production =0.118 * Population+16 | 0.78 |
| **Nagpur Rural** | Trip Production =0.033 * Population + 28 | 0.70 |
| Attraction | | |
| **Nagpur Urban Area** | Trip Attraction = 0.3055 * Employment + 317 | 0.76 |
| **Nagpur Rural** | Trip Attraction =0.2 * Employment – 91 | 0.84 |

### 3.2.2. TRIP DISTRIBUTION

The Second stage is Trip distribution or interchange. In this stage the spatial interchange of trips is modelled (from where to where). Trip distribution modelling is done based on the observed travel pattern which was analysed from the OD survey and passenger survey. OD matrix for the entire horizon year was developed at this stage. In this study doubly constrained gravity model has been used.
This model originally generated from an analogy with Newton's gravitational law. Newton's gravitational law says, F= GM1M2/d2, Analogous to this Tij=C OD/Cij, introducing some balancing factors

***Tij=Ai Oi Bi Di f(Cij),***

where Ai and Bi are the balancing factors, F(Cij) is the generalized function of the travel cost.

This function is called deterrence function because it represents the disincentive to travel as distance (time) or cost increases. For calculation of deterrence function the 'combined function' i.e. combination of exponential and power function is used in this study. The form of the model is such that power (α=0) or exponential (β=0) functions may be used for the deterrence function. The inclusion of both α and β represents a gamma function, sometimes called a Tanner function.

The base year (2018) Productions and Attractions obtained from the corrected O-D matrices, skim matrices from network and the calibrated function parameters were used to generate synthetic matrices in Cube.

### 3.2.3. MODAL SPLIT

Third stage is related to modal split (which modes are used). This depends upon the observed relationship between modes used in relation to personal characteristics, trip characteristics and mode characteristics.

• For base year model, the existing Modal share (as derived in Household Survey) has been used.

• For horizon year models, the modal share as derived from 'willingness to pay and shift', PT & IPT Stated Preference Surveys etc. was used.

Table 27 Modal Share (Base Year 2018)

| Code | Mode | HBW | HBE | HBO |
|---|---|---|---|---|
| **1** | Car | 10.23% | 1.34% | 3.32% |
| **2** | 2-Whlr | 69.48% | 22.08% | 21.17% |
| **3** | Auto | 5.28% | 14.66% | 36.25% |
| **4** | Bus | 5.95% | 21.18% | 17.52% |
| **5** | Mini Bus | 0.21% | 3.02% | 0.06% |
| **6** | School Bus | 0.15% | 14.88% | 0.07% |
| **7** | Chartered Bus | 0.19% | 0.02% | 0.00% |
| **8** | Cycle | 3.27% | 14.01% | 0.73% |
| **9** | Rickshaw | 0.30% | 0.34% | 0.52% |
| **10** | Train | 0.66% | 0.06% | 0.18% |
| **11** | Walk | 4.27% | 8.40% | 20.17% |

### 3.2.4. TRAFFIC ASSIGNMENT

The Network was coded in the Cube model with the network attributes as captured through road inventory surveys and traffic and transit details from primary and secondary sources. The traffic volume originating from every zone in the network in terms of PCUs are given as per the site survey. The other properties such as free flow speed, vehicular speeds, permitted network speeds, lane capacities etc were provided. The calibrated model is validated by comparison of field results and model output results. The 'Multi criterion' approach was followed for model validation. The zone to zone travel time at aggregate level were analysed in all the trials till the error of below 5% is achieved. The second criteria was traffic concentration at roads, quantitatively measured by flow at the mid blocks. This was validated by comparison of model outputs and field survey outputs (traffic volume survey at mid blocks).

Table 28 Observed and Modelled Traffic Volume at some locations

| Location Name | Peak Hour Traffic (PCU)- Observed | Peak Hour Traffic (PCU) - Modelled | Error |
|---|---|---|---|
| **Screen Line** | | | |
| Ring Road Rly. Crossing near Mankapur Chowk | 1573 | 1463 | 7% |
| Kamptee Road RUB near Gurudwara Singh Sabha | 4070 | 4192 | -3% |

| | | | |
|---|---|---|---|
| Ramjhoola ROB | 3673 | 3526 | 4% |
| Khapri Road ROB near TCS | 708 | 694 | 2% |
| Outer Ring Road ROB near Gavsi Mandir | 611 | 648 | -6% |
| Itwari Railway Station Road ROB | 1772 | 2002 | -13% |
| Old Kamptee Road ROB near Kawadapeth | 1381 | 1436 | -4% |
| | | | |
| Mid-Block | | | |
| Ring Road near MIDC Hingna | 1669 | 1535.48 | -8% |
| Ambazari Road near Shankar Chowk | 2507 | 2832.91 | 13% |
| Kamptee Road near Automotive Sqr. | 2788 | 2927.4 | 5% |
| Katol Road near Buddha Vihar | 2769 | 2713.62 | -2% |
| Wardha Road near Zero Mile Chowk | 5410 | 4814.9 | -11% |
| Wardha Road near AjniSquare | 5321 | 494.853 | -7% |
| Tajbagh Road near Sakkardara Sqaure | 3156 | 3250.68 | 3% |
| Ring Road near Dighori chowk | 2171 | 2279.55 | 5% |
| Buti Bori Railway Station Road | 249 | 258.96 | 4% |
| Near Kapsi BK | 117 | 109.98 | -6% |

The existing network was modelled, calibrated and validated based on real data from the field, including network geometry, traffic and transit operations. Table 28 shows the validation results. The final output from this process was a validated and calibrated simulation model of the existing conditions for peak hour.

### 3.2.5. BASE YEAR TRAVEL DEMAND MODEL

The base year scenario represents the present road network and current travel demand of the city. The interaction between traffic analysis zones based on the mode people choose will give fair idea about the travel behaviour. This information allows transport agency / stakeholders to comprehend travel patterns and characteristics; measure trends; provide input to travel demand model development, forecasting, and planning for city wide transportation infrastructure needs and monitor progress and changes due to implementation of transportation systems. The trunk network length modelled is 767 kms.
The trips shown in tables below were assigned to the base model to assess the network efficacy.

Table 29 Number of trips Purpose-Wise Trips Modelled

| Mode | Number of Trips |
|---|---|
| Home based Work | 20,29,672 |
| Home based Education | 12,38,254 |
| Home based Others | 10,17,307 |

Table 30 Number of Mode-Wise Trips Modelled (Motorized modes only)

| Modal Split 2018 | HBW | HBE | HBO |
|---|---|---|---|
| Car | 226934 | 21477 | 43144 |
| 2-Whlr | 1541498 | 354181 | 274735 |
| Auto | 117078 | 235202 | 470403 |
| Bus | 132093 | 339831 | 227409 |
| Mini Bus | 4561 | 48466 | 760 |
| School Bus | 3231 | 238718 | 855 |
| Chartered Bus | 4276 | 380 | 0 |

**Inferences:**

Base year model stands validated and V/C ratios along some of the major roads have been compiled and presented in Table 31.

Table 31 V/C and Average Network Speed for various Corridors

| Sno | Name Of Road | V/c Ratio - Maximum | V/c Ratio- Average | Average Network Speed |
|---|---|---|---|---|
| 1 | Ajini Road | 0.94 | 0.49 | 25 |
| 2 | Ambazari Lake Road | 0.70 | 0.63 | 22 |
| 3 | Amaravathi Road | 0.49 | 0.25 | 26 |
| 4 | Central Avenue Road | 0.80 | 0.36 | 25 |
| 5 | Ghat Road | 0.78 | 0.47 | 22 |
| 6 | Umred Road | 0.59 | 0.30 | 24 |
| 7 | Wardha Road | 0.51 | 0.25 | 23 |

## 3.3. HORIZON YEAR TRAVEL DEMAND MODELLING

### 3.3.1. SCENARIOS SPECIFICATIONS AND TRAVEL DEMAND

The section provides the description and analysis for the scenarios for understanding of the transport network and indicators while describing the travel pattern. As per ''trip generation model zoning'' the framework for understanding of interaction (trips) between the zones is created i.e. scenarios are developed as discussed below:

***Business as Usual/Do nothing scenario***: Scenario describe the future year (2021, 2031 and 2041) and future demand with minimum investments done on public transportation sector, this will help in analysing the efficacy of the existing network, and how it perform under given traffic demand. The problems (congestion and congested network, increased travel time etc.) can be identified and possible solutions/ interventions can be proposed to mitigate the same. The population and employment for horizon years have been projected based on the parameters such as potential density and highway connectivity. The projected population and employment figures for the horizon years are shown in the Table 32:

Table 32 Planning Variables for study area in BAU Scenario

| Year | Population | Employment |
|---|---|---|
| 2018 | 3430000 | 1270000 |
| 2021 | 3613307 | 1364484 |
| 2031 | 4334357 | 1709181 |
| 2041 | 5035375 | 2033464 |

With the help of the base year transport model developed for the study area, travel demand has been estimated for the horizon years 2021, 2031 and 2041 for BAU scenarios and listed in Table 33.

Table 33 Total Trips in BAU Scenario

| Total Trips | 2018 | 2021 | 2031 | 2041 |
|---|---|---|---|---|
| **Home based Work** | 2218499 | 2360431 | 2859779 | 3355529 |
| **Home based Education** | 1604408 | 1707053 | 2068179 | 2426703 |
| **Home based Others** | 1297743 | 1380769 | 1672870 | 1962866 |
| **Total** | 5120650 | 5448252 | 6600828 | 7745098 |

Table 34 Details of Trips in BAU Scenario

| Trips % Classification | % |
|---|---|
| **Home based Work** | |
| **PT** | 7% |
| **IPT** | 6% |
| **PVT** | 80% |
| **NMT** | 8% |
| **Home based Education** | |
| **PT** | 39% |
| **IPT** | 15% |
| **PVT** | 23% |
| **NMT** | 22% |
| **Home based Others** | |
| **PT** | 18% |
| **IPT** | 37% |
| **PVT** | 24% |
| **NMT** | 21% |

***A Sustainable Urban Transport* Scenario *(Transit Oriented Development Scenario)*** is a compact high density mixed use development that is planned along public transit stations (or corridors) which provide housing, employment, entertainment and civic functions within the walking distance. In this scenario, it is assumed that a population density of 400 persons per hectare will be achieved in the zones along transit corridors by the year 2041. With the help of the base year transport model developed for the study area, travel demand has been estimated for the horizon years 2021, 2031 and 2041 for Sustainable Urban Transport scenarios listed in Table 35.

Table 35 Counts of Trips in SUT Scenario

| Trips Count Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 631021 | 883022 | 1178690 |
| **IPT** | 91885 | 106796 | 116455 |
| **PVT** | 1459468 | 1654237 | 1807264 |
| **NMT** | 178056 | 215724 | 253120 |
| | **2360431** | **2859779** | **3355529** |
| **Home based Education** | | | |
| **PT** | 843977 | 1055827 | 1285055 |
| **IPT** | 176034 | 204178 | 221785 |
| **PVT** | 304338 | 344509 | 375821 |
| **NMT** | 382704 | 463665 | 544043 |
| **IIPT** | **1707053** | **2068179** | **2426703** |
| **Home based Others** | | | |
| **PT** | 481737 | 622328 | 789825 |
| **IPT** | 347518 | 402844 | 437103 |
| **PVT** | 262842 | 297958 | 325570 |
| **NMT** | 288671 | 349739 | 410368 |
| | 1380769 | 1672870 | 1962866 |
| **Total** | **5448252** | **6600828** | **7745098** |

Table 36 Details of Trips in SUT Scenario

| Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 27% | 31% | 35% |
| **IPT** | 4% | 4% | 3% |
| **PVT** | 62% | 58% | 54% |
| **NMT** | 8% | 8% | 8% |
| **Home based Education** | | | |
| **PT** | 49% | 51% | 53% |
| **IPT** | 10% | 10% | 9% |
| **PVT** | 18% | 17% | 15% |
| **NMT** | 22% | 22% | 22% |
| **Home based Others** | | | |
| **PT** | 35% | 37% | 40% |
| **IPT** | 25% | 24% | 22% |
| **PVT** | 19% | 18% | 17% |
| **NMT** | 21% | 21% | 21% |

Sustainable Urban Transport Scenario comprises of transport network incorporating committed projects along with major proposed projects. The section 'Mobility Improvement Measure' describes each in detail.

# 3.4. TRAFFIC CHARACTERISTICS – HORIZON (2041)

## 3.4.1. BUSINESS AS USUAL SCENARIO

It has been observed that the share of Public Transport (Bus) and IPT in Business As Usual Scenario is 24% and 19% respectively. Table 37 below shows the modal share for various trip purposes.

Table 37 Modal Share (purpose wise) in BAU scenario

| Motorized Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 8% | 8% | 8% |
| **IPT** | 6% | 6% | 6% |
| **PVT** | 86% | 86% | 86% |
| | | | |
| **Home based Education** | | | |
| **PT** | 50% | 50% | 50% |
| **IPT** | 19% | 19% | 19% |
| **PVT** | 30% | 30% | 30% |
| | | | |
| **Home based Others** | | | |
| **PT** | 23% | 23% | 23% |
| **IPT** | 46% | 46% | 46% |
| **PVT** | 31% | 31% | 31% |

Table 38 gives the estimated modal split at aggregate level for study area for Business as Usual scenario.

Table 38 Total trips in BAU scenario (modal spilt aggregate)

| Mode Split | 2021 | 2031 | 2041 |
|---|---|---|---|
| **PT** | 24% | 24% | 24% |
| **IPT** | 19% | 19% | 19% |
| **Pvt (Car +Two Wheeler)** | 57% | 57% | 57% |

## 3.4.2. SUSTAINABLE URBAN TRANSPORT SCENARIO

It has been observed that the share of Public Transport (High capacity MRTS, Medium capacity MRTS, Bus Trips) in Sustainable Urban Transport Scenario has increased by 20 % in comparison to Scenario 1 (Business As Usual Scenario). The modal split is given in Table 39.

Table 39 Modal Share(purpose wise) in SUT scenario

| Motorized Trips % Classification | 2021 | 2031 | 2041 |
|---|---|---|---|
| **Home based Work** | | | |
| **PT** | 29% | 33% | 38% |
| **IPT** | 4% | 4% | 4% |
| **PVT** | 67% | 63% | 58% |
| | | | |
| **Home based Education** | | | |
| **PT** | 64% | 66% | 68% |
| **IPT** | 13% | 13% | 12% |
| **PVT** | 23% | 21% | 20% |
| | | | |
| **Home based Others** | | | |

| | | | |
|---|---|---|---|
| **PT** | 44% | 47% | 51% |
| **IPT** | 32% | 30% | 28% |
| **PVT** | 24% | 23% | 21% |

Table 40 gives the estimated modal split at aggregate level for study area for SUT scenario.

Table 40 *Total trips in SUT scenario*

| Mode Split | 2021 | 2031 | 2041 |
|---|---|---|---|
| **PT** | 43% | 46% | 50% |
| **IPT** | 13% | 13% | 12% |
| **Pvt (Car +Two Wheeler)** | 44% | 41% | 38% |

### 3.4.3. COMPARISON OF NETWORK CHARACTERISTICS IN VARIOUS SCENARIOS

Network characteristics for Base year (2018) and Horizon year (2041) for various scenarios during peak hour are presented in Table 41.

Table 41 Comparison of Network Attributes (Aggregate level) on links for Various Scenarios

| Network Characteristic | Base Year (2018) | Horizon Year (2041) | |
|---|---|---|---|
| | | Scenario-I: Business As Usual Scenario | Scenario-II: Sustainable Urban Transport Scenario |
| **Avg. Network Speed (kmph)** | 23.4 | < 20 | 30 |
| **Avg. V/C Ratio** | 0.72 | > 0.90 | 0.70 |

It is observed that, in comparison to BAU 2041, average V/C ratio has reduced to 0.7 and average network speed has increased by 25 % in Sustainable urban transport scenario. Scenario-II is selected for proposing various transport improvement proposals.

Table 42 Comparison of Network Attributes (Link wise) on links for Various Scenarios

| Major Road | V/C Ratio comparison | |
|---|---|---|
| | Scenario-I: Business As Usual Scenario | Scenario-II: Sustainable Urban Transport Scenario |
| **Ajni Road** | 0.94 | 0.80 |
| **Ambazari Lake road** | 0.70 | 0.60 |
| **Amaravati Road** | 0.49 | 0.42 |
| **Central Avenue** | 0.80 | 0.68 |
| **Ghat Road** | 0.78 | 0.66 |
| **Umred Road** | 0.59 | 0.50 |
| **Wardha Road** | 0.51 | 0.44 |

# MOBILITY VISION AND GOALS

# 4. MOBILITY VISION AND GOALS

## 4.1. INTRODUCTION

The present situation in Nagpur will only continue to worsen if nothing is done. Business as Usual Scenario forecasts also show low network speeds and increased emissions. The city has indeed been, slowly strangling itself because of the unrestrained use of personalized modes of transport, lack of adequate public transport and its inability to respond the challenges of ever-increasing traffic. In light of these persistent and exasperating transport problems, NIT has prepared Nagpur Comprehensive Mobility Plan 2013 which focused on making Nagpur a "planned city with the best performing transport system that addresses the needs and concerns of the City". However, even after 6 years of CMP, the desired development in the urban mobility is still deteriorating. In this context, it is necessary to further strengthen the strategies of CMP-2013 according to the CMP guidelines of MoHUA.

The concept of Comprehensive Mobility Plan (CMP) is to have a long-term vision for desirable accessibility and mobility pattern for people and goods in the urban agglomeration. It focuses on the mobility of people to address urban transport problems and promote better use of existing infrastructure, which as such leads to the integration of land-use and transport and is essential to build smart cities.

*Focus of CMP is*

- ✓ *to optimize the "mobility pattern of people and goods" rather than of vehicles*
- ✓ *to focus on the improvement and promotion of public transport, NMVs and pedestrians as important modes*

## 4.2. VISION

As stated earlier, the CMP is a long term vision for desirable accessibility and mobility pattern for people and goods in Nagpur to provide safe, secure, efficient, reliable and seamless connectivity that supports and enhance economic, social and environmental sustainability. In order to provide the same for the citizens of Nagpur, the vision of Comprehensive Mobility Plan for Nagpur as adapted from Comprehensive Mobility Plan of 2013 is:

***"To ensure that Nagpur 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 liveability."***

## 4.3. GOALS

To ensure that Mobility solutions for Nagpur that 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, liveable 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*

Each goal can be achieved by meeting the following objectives:

### GOAL 1

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

***Objectives***

- Provide good quality public transport system that is accessible, efficient and effective.
- Develop strategy to integrate public transport system with existing IPT System.
- Develop strategies to encourage people to use public transport system to discourage use of private vehicles.

### 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***

- To improve pedestrian facilities in areas of pedestrian concentration
- To provide facilities to pedestrians and ensure safety to segregate their movement from vehicles along major corridors
- To encourage pedestrian movement in heavy pedestrian movement areas and restrict use of private vehicles
- To provide safe pedestrian facilities along major public transport nodes and transfer points
- To provide segregated facilities for movement of cyclist in Nagpur
- To develop a Pedestrian policy for safe and efficient movement of people within the city

## 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***

- Develop immediate / short term strategies such as traffic management and engineering solutions to ease flow of traffic at major congestion points within the city
- Develop medium / long term measures such as ring roads, new links, road network development, to ease traffic flow along major roads within the city

The goals and objectives set for the mobility needs of Nagpur 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 Nagpur. 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.

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


Figure 17 Public Transport System in Bogota

**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 cyclists and ensure safety to segregate their movement from vehicles along major corridors

(c) To encourage pedestrianization 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 develop a Pedestrian policy for safe and efficient movement of people within the city

Figure 18 London Cycle Superhighway no.7

**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 ring roads, new links, road network development, flyovers, underpasses, ROBs and RUBs to ease traffic flow along major roads within the city

Figure 19 VDL Evolans Electric Buses

**Goal 4:** Develop a Parking Policy that discourage 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 in the city

(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 Nagpur 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 Nagpur

Figure 20 Multi-level stack parking NYC

This CMP study also attempts to integrate NUTP principles in its approach.

***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

Nagpur 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 Nagpur.

### *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 atleast LOS 2 .
- Nagpur has a significant share of cycle users and care must be taken to preserve and encourage it further. The observed 6% cycle share of total trips can be improved. Cycling strategy hence will focus on developing a strong bi-cycle network.


Figure 21 London Cycling

### 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.

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

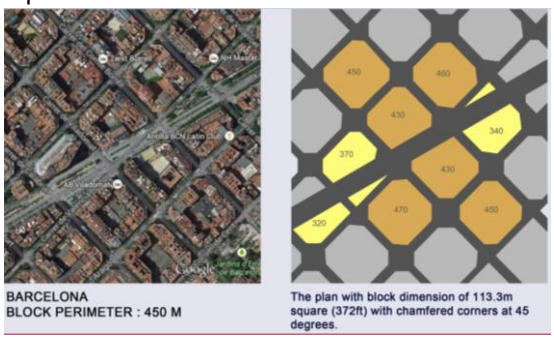



Figure 22 Barcelona Urban Block Perimeter

**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 Metro along with bus transit systems are proving able to keep pace with the rapid motorization and metropolitan growth. Buses 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 greatr than 15 buses per hour.

The system requires detail route rationalization with well-defined integration of main haul and feeder services.

Figure 23 London underground – Metro System *(Source: Wikimedia Commons)*

**Build dense - people and transit oriented cities; mix people and activities**

The first step to accommodate 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

Integrating residential, work, retail and entertainment activities into one area makes for better cities. Trip lengths and travel times can be reduced. The average trip length for cycle is 2.5-3.0 km which is ideal.

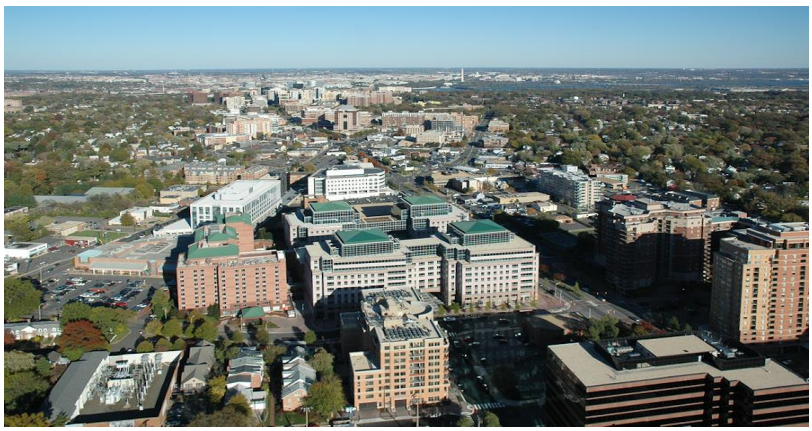


Figure 24 Arlington County(Densified area along transit corridor) in Virginia

**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.

No parking fees are charged in the city. As a strategy we must adopt the levy of parking charges. Also there is requirement of providing off-street parking facility which can help in increasing the effective road capacity.

**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.

## 4.4. 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 AMRUT 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 CMP study also attempts to integrate these principles in its approach.

## 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 centers, recreation centers, 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

## CREATE BETTER 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 high 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 make urban transport sustainable.

The following indicators have been recommended for pedestrian facilities:

NMT network should be 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.

Nagpur has a significant cycling population and every care must be taken to preserve and better it. The observed 5% cycle share of total trips can be improved.

## CONNECT THE BLOCKS

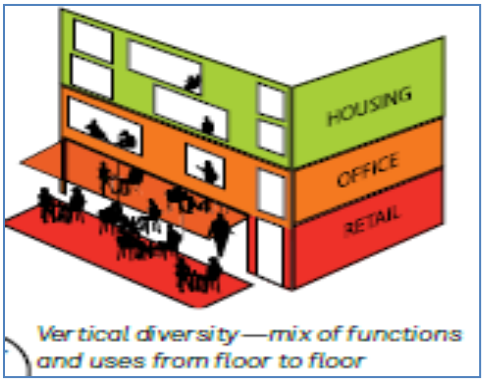
Cities that are pleasant to walk and bicycle typically have large number of short streets and many intersections per unit area. This makes the traffic slow down while walking becomes more direct, varied, interesting and attractive. The tighter the street grid, the fewer detours to a destination. Detours 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 kilometre be 50.

## 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



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

It is observed that city bus services in Nagpur accounts for 9 buses per lakh population within the Nagpur City, which is extremely lower when compared to the other cities with similar population size. The modal share of public transport in Nagpur is ranging between 8 to 10%. As per the desirable modal split in the Indian cities as defined by the MoUD, GoI, for a city with 20 to 50 lakhs of population should ideally have a modal share in the range of 60-70%.

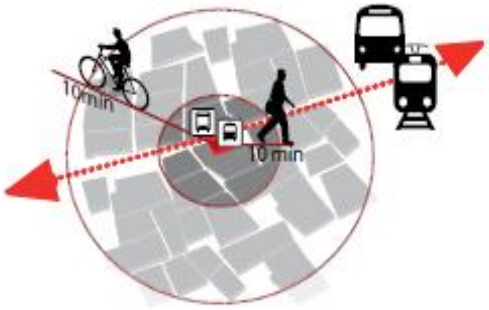
It is also seen that city bus services in Nagpur are "Destination Oriented Services or Direct Services", leading to less no. of buses per route (6 to 7 buses per route) & decreased frequencies (average 30 mins). Whereas of the 263 buses on 38 routes, 175 buses and 29 routes overlap over the proposed metro corridor which accounts for the 66% of the total city bus services operating within Nagpur city.

## BUILD DENSE - PEOPLE AND TRANSIT ORIENTED CITIES; MIX PEOPLE AND ACTIVITIES

The first step to accommodate 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




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

## 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.

## 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.

## 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.

# MOBILITY IMPROVEMENT MEASURES

# 5. MOBILITY IMPROVEMENT MEASURES

## 5.1. INTRODUCTION

The mobility goals for Nagpur 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 Nagpur:

- *Land Use and Transport Strategy*
- *Road Network Development Strategy*
- *Public Transit Improvement Strategy*
- *Non-Motorized Transport Strategy*
- *Freight Management Strategy*
- *Traffic Engineering Measures*
- *Travel Demand Management Strategy*

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 fulfil the goals and objectives of the CMP. The sections below discuss these strategies.

## 5.2. PUBLIC TRANSPORT PROPOSALS

### MASS RAPID TRANSIT CORRIDORS

High demand mobility corridors which are eligible for a Mass Rapid Transit Systems are identified and presented in Table 43.

Table 43 Proposed Transit corridors

| Sno | Mass Transit Corridors | Length (km) |
|---|---|---|
| 1 | Automotive Square to Khapri Station | 19.7 |
| 2 | Pardi to Mount View (Hingna) | 20.1 |
| 3 | Automotive Square to Kanhan River | 13 |
| 4 | Prajapati Nagar to Transport Nagar | 5.6 |
| 5 | MIHAN to MIDC ESR | 18.5 |
| 6 | Lokmanya Nagar to Hingna | 6.7 |
| 7 | Vasudev Nagar to Dattawadi | 4.5 |
| 8 | Katol Road | 5.8 |
| 9 | Koradi Road | 2.6 |
| 10 | Umred Road | 5.5 |
| 11 | Amaravathi Road | 8.2 |
| 12 | Vasudev Nagar to Dattawadi on Inner Ring Road connecting Katol Rd. Amravati Rd. Hingana Rd, Wardha Rd., Umred Rd., Bhardara Rd & Kamptee | 34 |

Based on the future transit demands estimated through 4-stage model the above mobility corridors are categorized into High capacity MRTS Corridors and Medium Capacity MRTS Corridors.

Table 44 Proposed High Capacity Mass Rapid Transit Corridors

| SN | High Capacity MRTS Corridors | Length (km) | Phase |
|---|---|---|---|
| 1 | Automotive Square to Khapri Station | 19.7 | 1 |
| 2 | Pardi to Mount View (Hingna) | 20.1 | 1 |
| 3 | Automotive Square to Kanhan River | 13 | 2 |
| 4 | Prajapati Nagar to Transport Nagar | 5.6 | 2 |
| 5 | MIHAN to MIDC ESR | 18.5 | 2 |
| 6 | Lokmanya Nagar to Hingna | 6.7 | 2 |
| 7 | Vasudev Nagar to Dattawadi | 4.5 | 2 |

The appropriate mode for proposed mass transit corridors can be selected based on detailed alternative analysis of the available mode options. The Daily trips by High Capacity MRTS Corridors calculated for Nagpur and presented in Table 46 assumes that the overall transportation infrastructure of the city is developed in line with all the proposals made as part of the CMP.

Table 45 Proposed Medium Capacity Transit System corridors

| Medium Capacity MRTS Corridors | Length (km) |
|---|---|
| Katol Road | 5.8 |
| Koradi Road | 2.6 |
| Umred Road | 5.5 |
| Amaravathi Road | 8.2 |
| Vasudev Nagar to Dattawadi on Inner Ring Road connecting Katol Rd. Amravati Rd. Hingana Rd, Wardha Rd., Umred Rd., Bhardara Rd & Kamptee | 34 |

Table 46 Daily trips (In Lacs) in Mass Rapid Transit system

| | 2021 | 2031 | 2041 |
|---|---|---|---|
| Daily trips in High Capacity MRTS Corridors | 5.01 | 6.33 | 7.74 |
| Daily trips in Medium Capacity MRTS Corridors | 0.64 | 0.81 | 0.99 |
| Total Public Transport Ridership | 5.65 | 7.14 | 8.73 |

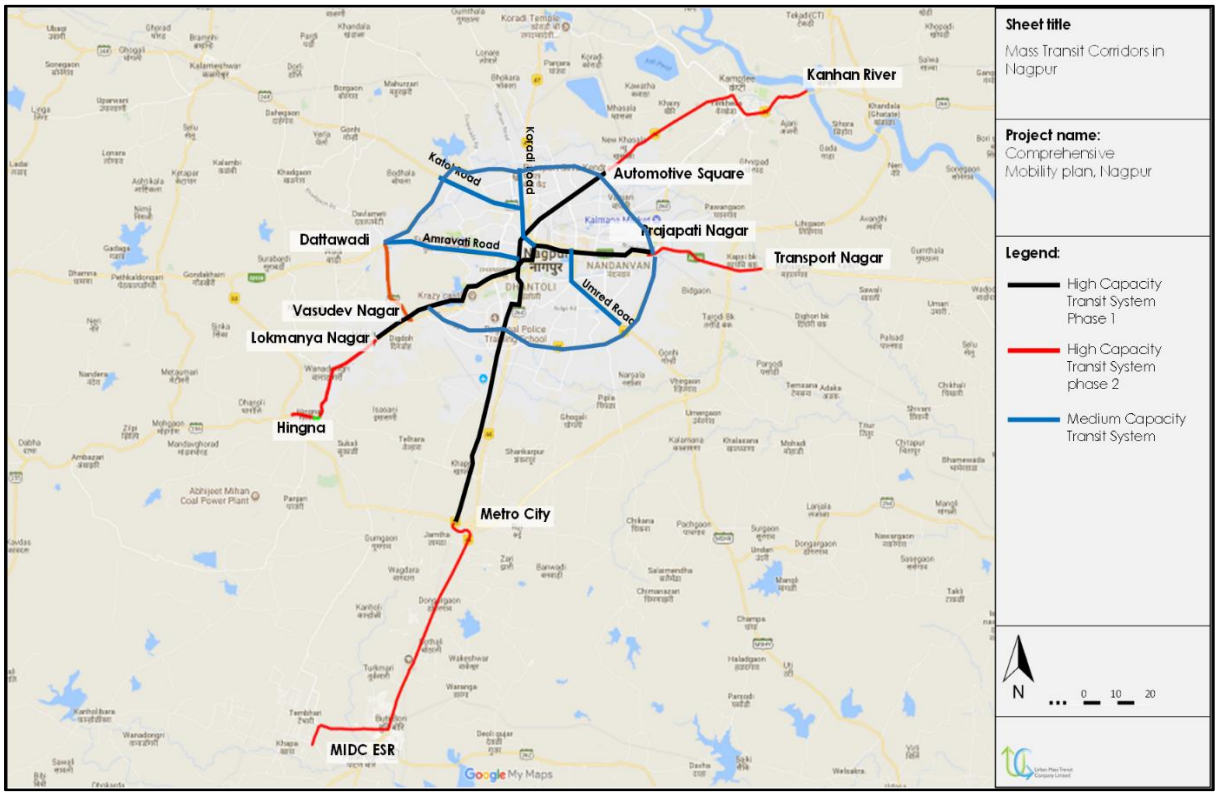



Figure 25 Proposed Transit Corridors

The urban transport model developed for Nagpur has evaluated the PPHPD values for phase-2 corridors, accordingly the PPHPD values on mass transit corridors are presented in Table 47.

Table 47: PPHPD numbers along proposed High Capacity MRTS corridor

| Mass Transit Corridors | Length (in km) | PPHPD Values 2021 | 2031 | 2041 |
|---|---|---|---|---|
| Automotive Square to Metro City via MIHAN | 19.7 | 12,500 | 13,000 | 15,000 |
| Prajapati Nagar to Lokmanya Nagar | 20.1 | 9,000 | 11,000 | 16,500 |
| Automotive Square to Kanhan River | 13 | 8,300 | 8,900 | 10,500 |
| Prajapati Nagar to Transport Nagar | 5.6 | 3,100 | 3,800 | 5,100 |
| MIHAN to MIDC ESR | 18.5 | 3,000 | 4,400 | 5,600 |
| Lokmanya Nagar to Hingna | 6.7 | 3,150 | 3,800 | 5,100 |
| Vasudev Nagar to Dattawadi | 4.5 | 3,300 | 4,800 | 5,800 |

## CITY BUS SYSTEM IMPROVEMENT

The current city bus services in Nagpur are radial in nature, wherein the city has strong central core around which the development has taken place directionally. As in case of Nagpur, the string central core is Sitabuldi, wherein the city bus routes are connected to the major fringe areas around the city which are; Kamptee, Pardi, Kharbi, Piplafata, Buti Bori, MIDC Hingana, Defence, Gorewada, Suradevi, Khaparkheda etc.

To achieve the optimum level of service in Public Transport for Nagpur city, rationalization of the city bus routes has been recommended based on the “Hub & Spoke Model”. The trunk routes would operate along the major transit corridors, direction wise connecting the major activity centers within the city (designed as Hubs) whereas the feeder routes would operate from hubs to the minor activity centers. Figure 26 represents the typical Hub and Spoke Model.

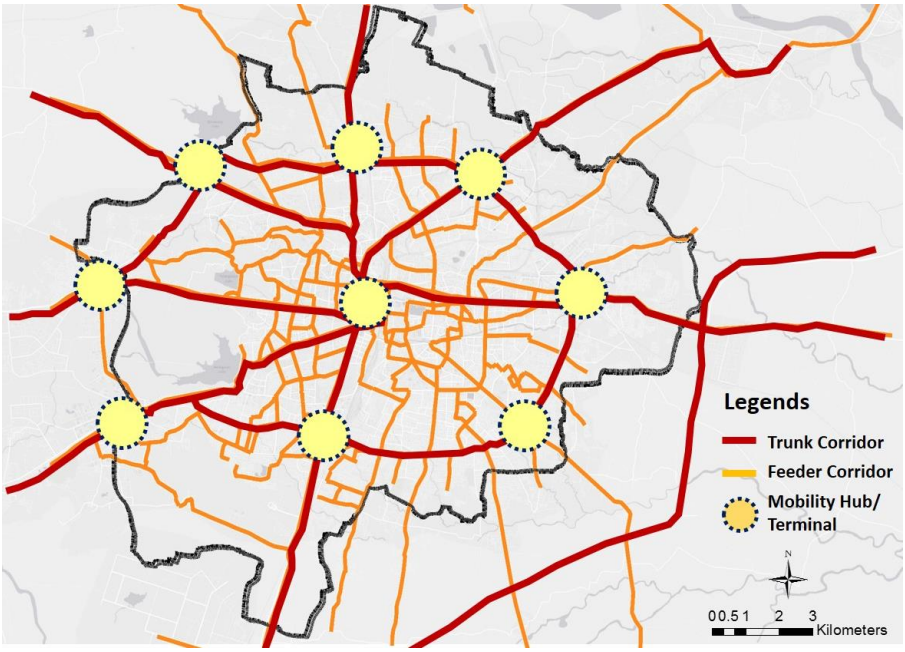



Figure 26 Proposed Hub and Spoke Model for City Bus Services

Based on the Rationalization of the City Bus Services in Nagpur, 76 City Bus Routes have been recommended for introduction and operations in Phase wise manner. Table 48 and Figure 27 represents the list of 76 city bus routes to be introduced in Nagpur along with PHPDT and Ridership.

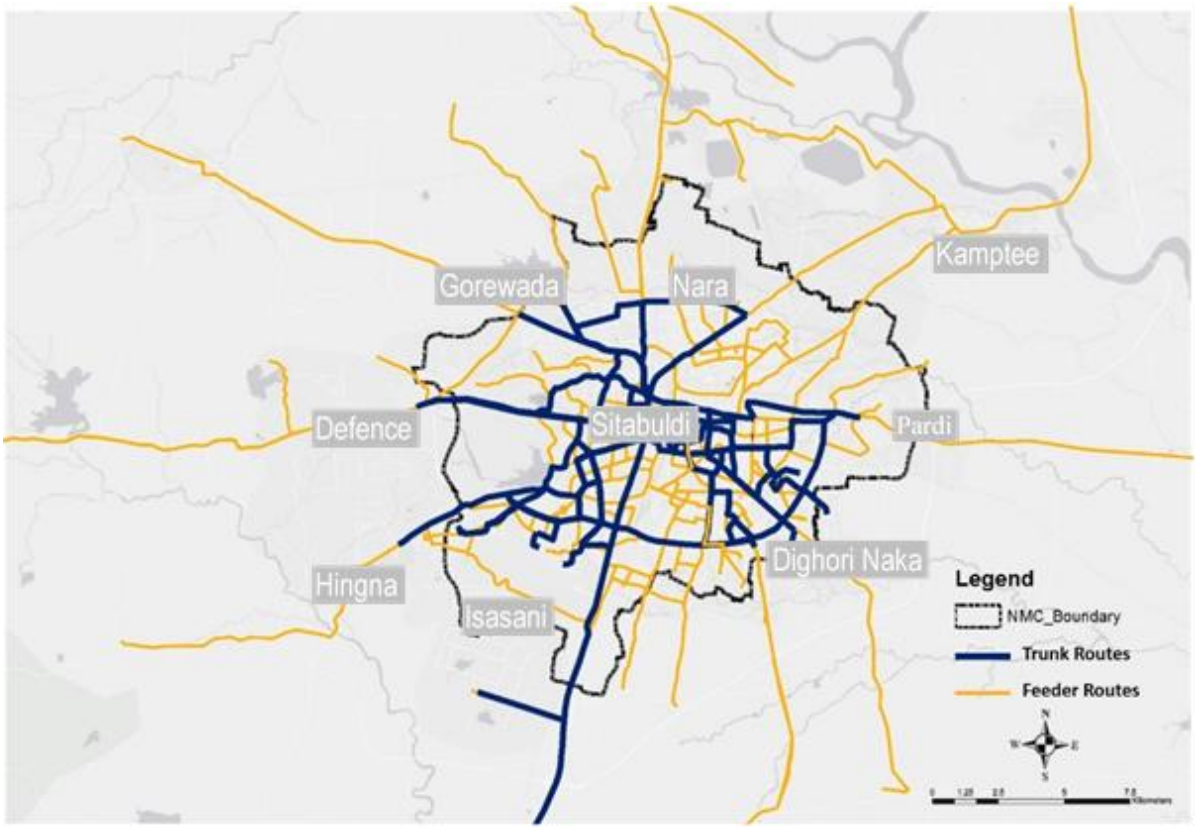



Figure 27 Recommended Truck and Feeder Network of the Rationalized City Bus Routes

Table 48: List of Rationalized City Bus Routes

| Sl. No. | Row Labels | Route Description | Route Length (km) | Typology of Routes | PHPDT | | | Peak Hour Ridership | | | Daily Ridership | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 |
| 1 | CBS-001-T | Pardi to Vaishali Nagar | 20.94 | Trunk | 873 | 1,538 | 1,954 | 1,107 | 2,396 | 3,044 | 14,417 | 31,204 | 39,640 |
| 2 | CBS-002-T | Kharbi to Pannasay Layout | 23.13 | Trunk | 1,126 | 2,266 | 2,878 | 1,666 | 3,277 | 4,162 | 21,697 | 42,663 | 54,196 |
| 3 | CBS-003-T | Sitabuldii to Katol Naka | 9.5 | Trunk | 119 | 185 | 235 | 308 | 240 | 304 | 4,008 | 3,120 | 3,963 |
| 4 | CBS-004-Fa | Dighori To Piplafata | 4.47 | Feeder | 60 | 170 | 216 | 45 | 283 | 360 | 580 | 3,689 | 4,687 |
| 5 | CBS-004-T | Dighori to Dattawadi | 18.64 | Trunk | 536 | 1,129 | 1,434 | 620 | 1,768 | 2,246 | 8,068 | 23,025 | 29,249 |
| 6 | CBS-005-T | Ashirwad Nagar to Gandhibagh | 6.32 | Trunk | 424 | 949 | 1,205 | 503 | 1,791 | 2,275 | 6,549 | 23,321 | 29,625 |
| 7 | CBS-006-F | Surya Nagar to Mahalgaon | 13.88 | Feeder | 94 | 156 | 198 | 153 | 267 | 340 | 1,988 | 3,483 | 4,424 |
| 8 | CBS-006-T | Sitabuldi to Surya nagar | 12.05 | Trunk | 707 | 817 | 1,038 | 1,537 | 1,493 | 1,897 | 20,009 | 19,441 | 24,697 |
| 9 | CBS-007-F | Dighori to Wadad | 11.95 | Feeder | 60 | 206 | 262 | 39 | 358 | 455 | 511 | 4,666 | 5,927 |
| 10 | CBS-008-T | Pardi to Mahindra & Mahindra | 26.32 | Trunk | 1,426 | 1,654 | 2,101 | 3,693 | 2,837 | 3,604 | 48,088 | 36,940 | 46,927 |
| 11 | CBS-009-T | Sitaburdi to Defence | 12.87 | Trunk | 1,053 | 2,355 | 2,991 | 1,296 | 3,965 | 5,037 | 16,873 | 51,627 | 65,584 |
| 12 | CBS-011-F | Tekanaka to Jn Hospital | 26.44 | Feeder | 609 | 707 | 898 | 1,319 | 1,210 | 1,537 | 17,170 | 15,758 | 20,018 |
| 13 | CBS-011-T | Sitabuldi to Tekanaka | 6.54 | Trunk | 832 | 1,282 | 1,628 | 1,082 | 2,172 | 2,759 | 14,091 | 28,278 | 35,923 |
| 14 | CBS-013-F | Mankapur to Khaparkheda | 19.25 | Feeder | 361 | 725 | 921 | 355 | 1,325 | 1,683 | 4,624 | 17,254 | 21,919 |
| 15 | CBS-013-T | Sitabuldi to Mankapur | 6.29 | Trunk | 402 | 683 | 868 | 730 | 1,133 | 1,439 | 9,510 | 14,751 | 18,739 |
| 16 | CBS-014-F | Mankapur to Itangodi | 21.17 | Feeder | 90 | 549 | 698 | 158 | 812 | 1,031 | 2,059 | 10,571 | 13,429 |
| 17 | CBS-015-F | Surya Nagar to Pawangaon | 4.83 | Feeder | 103 | 179 | 227 | 150 | 338 | 429 | 1,957 | 4,397 | 5,586 |
| 18 | CBS-017-F | Sitaburdi to Vela hari | 13.18 | Feeder | 327 | 413 | 525 | 797 | 659 | 837 | 10,378 | 8,579 | 10,898 |
| 19 | CBS-017-T | Sitabuldi to Gorewada | 8.88 | Trunk | 351 | 468 | 594 | 783 | 697 | 886 | 10,196 | 9,079 | 11,533 |
| 20 | CBS-018-F | Chatrapati to Belatarodi | 9.59 | Feeder | 256 | 494 | 628 | 404 | 669 | 849 | 5,262 | 8,706 | 11,060 |
| 21 | CBS-021-T | Sitaburdi to Morarji | 34.01 | Trunk | 992 | 1,882 | 2,391 | 1,717 | 2,992 | 3,801 | 22,351 | 38,958 | 49,490 |
| 22 | CBS-023-F | 10 no Puliyai to Nagsengao | 7.88 | Feeder | 428 | 962 | 1,222 | 414 | 1,653 | 2,100 | 5,388 | 21,526 | 27,345 |
| 23 | CBS-025-F | Mankapur to Lonara | 7.88 | Feeder | 67 | 122 | 155 | 152 | 218 | 276 | 1,983 | 2,832 | 3,598 |
| 24 | CBS-027-F | Sitaburdi to jaywant Nagar | 10.77 | Feeder | 91 | 150 | 191 | 237 | 256 | 325 | 3,091 | 3,331 | 4,232 |
| 25 | CBS-029-F | Dighori to Banwadi | 16.56 | Feeder | 28 | 92 | 116 | 20 | 176 | 223 | 255 | 2,289 | 2,908 |

| Sl. No. | Row Labels | Route Description | Route Length (km) | Typology of Routes | PHPDT | | | Peak Hour Ridership | | | Daily Ridership | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 |
| **26** | CBS-031-F | Sitabuldi to Wayusena | 7.62 | Feeder | 189 | 527 | 670 | 265 | 936 | 1,190 | 3,444 | 12,194 | 15,491 |
| **27** | CBS-032-T | Sitabuldi to Hingna | 8.12 | Trunk | 301 | 492 | 625 | 421 | 782 | 994 | 5,485 | 10,186 | 12,939 |
| **28** | CBS-037-F | Indora chowk to Kapil Nagar | 3.88 | Feeder | 234 | 325 | 412 | 375 | 457 | 580 | 4,884 | 5,946 | 7,553 |
| **29** | CBS-039-F | Hingna T Point to Hingna | 9.36 | Feeder | 111 | 254 | 323 | 86 | 429 | 546 | 1,116 | 5,591 | 7,103 |
| **30** | CBS-043-T | Tekanaka to Mahindra & Mahindra | 21.29 | Trunk | 143 | 211 | 269 | 254 | 390 | 496 | 3,309 | 5,084 | 6,458 |
| **31** | CBS-044-F | Gandhibagh to Kamptee | 11.14 | Trunk | 1,266 | 1,278 | 1,623 | 2,132 | 1,544 | 1,961 | 27,762 | 20,102 | 25,536 |
| **32** | CBS-047-F | Chatrapati Sq to CRPF | 9.5 | Feeder | 64 | 84 | 106 | 79 | 151 | 192 | 1,025 | 1,964 | 2,495 |
| **33** | CBS-048-F | Indora Sq to Nara | 3.77 | Feeder | 348 | 628 | 798 | 588 | 1,139 | 1,447 | 7,661 | 14,836 | 18,847 |
| **34** | CBS-049-F | Indora Sq to Nari | 4.26 | Feeder | 154 | 257 | 326 | 113 | 402 | 510 | 1,467 | 5,232 | 6,646 |
| **35** | CBS-050-F | Sitaburdi to Wanjari | 8.67 | Feeder | 41 | 104 | 132 | 47 | 165 | 209 | 616 | 2,146 | 2,726 |
| **36** | CBS-052-T | Sitaburdi to Narsala | 13.5 | Trunk | 547 | 933 | 1,185 | 1,013 | 1,139 | 1,447 | 13,190 | 14,834 | 18,844 |
| **37** | CBS-063-F | Tukdoji Sq to Nari | 15.06 | Feeder | 100 | 260 | 330 | 75 | 368 | 468 | 972 | 4,793 | 6,088 |
| **38** | CBS-064-F | Tukdoji sq to Nara | 14.57 | Feeder | 387 | 674 | 856 | 610 | 831 | 1,056 | 7,949 | 10,826 | 13,752 |
| **39** | CBS-065-F | Katol Naka to Khadgaon | 7.99 | Feeder | 23 | 106 | 135 | 20 | 150 | 191 | 257 | 1,956 | 2,484 |
| **40** | CBS-070-F | Sitabuldi to Shesh nagar | 9.2 | Feeder | 264 | 1,176 | 1,494 | 161 | 2,136 | 2,713 | 2,099 | 27,811 | 35,330 |
| **41** | CBS-071-F | Buldi to Hazaripahad | 13.62 | Feeder | 78 | 340 | 431 | 80 | 639 | 812 | 1,046 | 8,322 | 10,572 |
| **42** | CBS-072-F | Dattawadi to Alesur | 8.9 | Feeder | 30 | 100 | 127 | 20 | 188 | 239 | 262 | 2,448 | 3,109 |
| **43** | CBS-074-F | Surya Nagar to Nandanwan | 7 | Feeder | 73 | 204 | 259 | 122 | 362 | 460 | 1,590 | 4,714 | 5,988 |
| **44** | CBS-075-F | Buldi to Karve Nagar | 10.79 | Feeder | 64 | 179 | 228 | 134 | 207 | 262 | 1,749 | 2,690 | 3,417 |
| **45** | CBS-078-F | Sitaburdi to Wayusena | 8.77 | Feeder | 88 | 195 | 248 | 113 | 302 | 383 | 1,467 | 3,928 | 4,990 |
| **46** | CBS-102-F | Sitabuldi to Ambazari garden | 6 | Feeder | 111 | 141 | 179 | 288 | 226 | 287 | 3,746 | 2,938 | 3,733 |
| **47** | CBS-103-F | Mankapur to Koradi Yatra_Seasonal | 11.31 | Feeder | 169 | 670 | 852 | 135 | 1,016 | 1,290 | 1,753 | 13,223 | 16,798 |
| **48** | CBS-106-F | Dighori to Panchgaon | 13.22 | Feeder | 9 | 392 | 498 | 15 | 596 | 757 | 193 | 7,757 | 9,854 |
| **49** | CBS-109-T | Sitabuldi to MIHAN | 14.62 | Trunk | 1,820 | 2,138 | 2,716 | 3,493 | 3,330 | 4,230 | 45,484 | 43,353 | 55,073 |
| **50** | CBS-121-F | Kamptee to Koradi_Seasonal | 15.8 | Feeder | 532 | 1,597 | 2,028 | 487 | 2,406 | 3,057 | 6,342 | 31,331 | 39,801 |
| **51** | CBS-131-F | Sitabuldi to Swaraj nagar Wathoda | 8.53 | Feeder | 122 | 214 | 272 | 69 | 362 | 460 | 902 | 4,714 | 5,988 |

| Sl. No. | Row Labels | Route Description | Route Length (km) | Typology of Routes | PHPDT | | | Peak Hour Ridership | | | Daily Ridership | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 | 2021 | 2031 | 2041 |
| **52** | CBS-142-F | Defence to Dahegaon | 21.69 | Feeder | 44 | 152 | 193 | 51 | 216 | 275 | 658 | 2,817 | 3,578 |
| **53** | CBS-143-T | Wardhaman Nagar to Dahegaon | 23.17 | Trunk | 137 | 130 | 165 | 673 | 238 | 302 | 8,763 | 3,096 | 3,933 |
| **54** | CBS-162-F | Rahate Colony to Shitla mata mandir | 5.15 | Feeder | 421 | 2,158 | 2,742 | 132 | 2,353 | 2,989 | 1,714 | 30,640 | 38,923 |
| **55** | CBS-163-F | Binaki Layout to Panjara Colony | 11.05 | Feeder | 64 | 92 | 117 | 216 | 104 | 132 | 2,809 | 1,352 | 1,717 |
| **56** | CBS-166-F | Sadbhavna Nagar to Ghuti | 23.77 | Feeder | 97 | 73 | 92 | 248 | 124 | 158 | 3,233 | 1,618 | 2,055 |
| **57** | CBS-167-F | Bajaria to Yogeshwar Nagar | 9.65 | Feeder | 348 | 333 | 423 | 1,087 | 500 | 635 | 14,151 | 6,505 | 8,263 |
| **58** | CBS-168-F | Pragati nagar to Sidheshwar Nagar | 18.16 | Feeder | 352 | 1,012 | 1,285 | 213 | 1,142 | 1,450 | 2,774 | 14,864 | 18,882 |
| **59** | CBS-171-F | Gorewada sq to Sadguru Nagar | 14.75 | Feeder | 140 | 177 | 225 | 358 | 268 | 340 | 4,663 | 3,489 | 4,432 |
| **60** | CBS-172-F | Sitabuldi to Purani basti Buti buri | 37.14 | Feeder | 150 | 663 | 842 | 140 | 794 | 1,009 | 1,819 | 10,339 | 13,134 |
| **61** | CBS-173-F | Sitabuldi to Natraj Talkies | 9.95 | Feeder | 143 | 54 | 68 | 407 | 83 | 106 | 5,300 | 1,084 | 1,377 |
| **62** | CBS-174-F | Sitabuldi to Vaishnavmata nagar | 10.87 | Feeder | 178 | 232 | 294 | 343 | 308 | 391 | 4,470 | 4,007 | 5,090 |
| **63** | CBS-176-F | Gandhi Bagh to Kamala Nagar | 15.2 | Feeder | 200 | 198 | 252 | 425 | 346 | 440 | 5,530 | 4,510 | 5,729 |
| **64** | CBS-177-F | Jai Hind Society to Dhoke Layout | 15.35 | Feeder | 42 | 143 | 182 | 84 | 235 | 299 | 1,095 | 3,064 | 3,892 |
| **65** | CBS-178-F | Jaitala to Kharbi Road | 16.82 | Feeder | 301 | 1,263 | 1,605 | 313 | 1,948 | 2,474 | 4,081 | 25,360 | 32,216 |
| **66** | CBS-182-F | YCCE College to Pardi Octroi Naka | 28.1 | Feeder | 103 | 1,154 | 1,466 | 229 | 2,165 | 2,750 | 2,986 | 28,188 | 35,809 |
| **67** | CBS-184-F | Swawlambi Nagar to Kendriya Vidyalay | 14.41 | Feeder | 68 | 154 | 196 | 136 | 206 | 262 | 1,767 | 2,686 | 3,413 |
| **68** | CBS-188-F | Seminary Hills to Kharbi road Ishwar nagar | 12.22 | Feeder | 262 | 814 | 1,034 | 194 | 927 | 1,177 | 2,526 | 12,067 | 15,330 |
| **69** | CBS-191-F | Deekshabhumi to Shankar Pur | 15.35 | Feeder | 224 | 603 | 766 | 324 | 864 | 1,098 | 4,223 | 11,251 | 14,292 |
| **70** | CBS-192-F | Dindayal upadhyay Chowk to Sai Sewashram Society | 12.22 | Feeder | 37 | 515 | 654 | 48 | 584 | 742 | 631 | 7,608 | 9,665 |
| **71** | CBS-194-F | Sitabuldi to Manewada Chowk | 6.88 | Feeder | 288 | 1,339 | 1,701 | 106 | 1,820 | 2,312 | 1,377 | 23,694 | 30,100 |
| **72** | CBS-196-T | Shakti mata mandir to Jaitala | 15.39 | Trunk | 125 | 140 | 178 | 142 | 197 | 250 | 1,855 | 2,561 | 3,253 |
| **73** | CBS-197-F | Dahegaon to Kamgar Nagar | 22.13 | Feeder | 243 | 1,470 | 1,867 | 58 | 1,604 | 2,037 | 760 | 20,883 | 26,528 |
| **74** | CBS-198-F | Wandongri to Shiv Shakti Nagar | 24.12 | Feeder | 187 | 205 | 260 | 430 | 354 | 449 | 5,600 | 4,604 | 5,849 |
| **75** | CBS-201-F | CRPF to Maya Nagar | 30.47 | Feeder | 189 | 605 | 768 | 400 | 1,051 | 1,335 | 5,212 | 13,685 | 17,385 |
| **76** | CBS-203-F | Sitabuldi to Ambe | 12.58 | Feeder | 246 | 728 | 924 | 171 | 1,307 | 1,660 | 2,226 | 17,016 | 21,617 |
| | Total | | | | | | | 37,409 | 73,374 | 93,210 | 4,87,098 | 9,55,394 | 12,13,677 |

Estimation of Fleet Size is quite essential for any public transport system. Surplus fleet often leads to underutilization and eventually increase the capital and operation costs. On the other hand, insufficient fleet drives the users to adopt a different mode leading to the reduction in the ridership values. So, it is important that an optimal fleet size is determined and such a system needs to be developed which ensures enough fleet size to meet the ridership demand at the same time being self-sustainable. Based on the above mentioned demand, the city bus fleet augmentation is proposed based on the LoS-1 benchmark requirement of SLB Handbook. The proposed city bus fleet size for the future years is represented in the Table 49.

Table 49: Bus Augmentation

| Year | Ridership | No. of Buses (A) | No. of Spare Buses (B) | Total No. of Buses (C = A+B) |
|---|---|---|---|---|
| **2018** | 3,60,363 | 577 | 30 | 607 |
| **2021** | 4,87,098 | 780 | 40 | 820 |
| **2031** | 9,55,394 | 1814 | 91 | 1904 |
| **2041** | 12,13,677 | 2303 | 115 | 2418 |

NMC has been currently operating 237 diesel fueled standard buses, 10 ethanol fueled standard buses, i.e; a total of 248 buses. NMC has also made plans to introduce a total of 487 buses into the system including the already operational buses, in coordination with the 3 city bus operators. As the GoI is actively promoting electric vehicles through its National Electric Mobility Mission Plan 2020, it is recommended to include 10% of the total fleet to be electric buses into the city bus fleet, i.e; 54, 74, 171 and 215 buses in 2018, 2021, 2031 and 2041. These buses would be fully electric that shall be based on Battery, Pantograph, Articulated arm or Inductive charging. These technologies have zero tail pipe emission, thereby reducing the emissions to almost negligible.

To support the proposed augmented city bus services, the support infrastructure/allied infrastructure to facilitate operations with proposed augmented fleet size, which are;

4. Bus Stops/Bus Q Shelters
5. Bus Depots
6. Bus Terminals/Interchanges

**Bus Stops/Bus Q Shelters:**

Total no. of 900 Bus Q Shelters would be required to be developed on 225 Km of road network in Nagpur, considering an average distance of 500 M between two consecutive bus Q shelters on either side of the road network. Since NMC already developed and maintains 190 bus Q shelters, additionally 710 bus Q shelters needs to be developed.

**Bus Depot and Terminal**

In Nagpur, there are 4 depots (i.e, Zero Mile, Tekanaka, Hingana and Patwardhan) which are already in operation. Based on the outcomes of the CMP, it is very essential to upgrade the current depot infrastructure covering both civil infrastructure as well as depot equipment, which will have a huge impact on the quality of city bus operations in Nagpur city.

The intra city terminal facilities in Nagpur are concentrated only at Mor Bhawan terminal, which is located in the city core area. Based on the routing pattern of the city bus services in Nagpur, the tentative location of the terminals/mobility hub has been identified.

In addition to the existing 4 depots in the city, 6 new depot locations have been identified tentatively in the city outskirts along the inner ring road to facilitate decongestion of city bus services at the city center, minimize the dead mileage and increase operational efficiency. It is also proposed to have integrated depot and terminal, which would facilitate decongestion of the city bus services from the city center and enabling direction-oriented transfer facilities. However, the urban local bodies would be either required to identify potential new sites for depot development or allocate appropriate land space in identified potential depot locations accommodating minimum of 2418 buses by 2041. The tentative locations of proposed new depots and terminals are as under; (Refer to Figure 28).

7. Mankapur Chowk (junction on Koradi road and inner ring road)
8. Junction on Katol Road and Inner Ring Road
9. Junction on Amravati road and Inner Ring Road Dattawadi
10. Octroi Chekpost
11. Junction on Umred Road and Inner Ring Road Dighori
12. Surya Nagar

After detailed assessment of location of the existing depots in Nagpur, it has been noted that the Zero Mile Depot is located right in the heart of the city covering an area of 0.5 acres. Considering the activities undertaken in the depots, during the day and night, the depot shall create disturbance/noise pollution for the surrounding areas. Since the area is only 0.5 acres, depot doesn't have adequate space to accommodate enough no. of buses. Under the mentioned circumstances, it is recommended to shut down the depot at the aforementioned location and requisite land space be utilized for the other services of City Buses.

Table 50 Proposed New Bus Depot and Terminal Locations

| SN | Proposed Location | Facility |
|---|---|---|
| 1 | **Dattawadi** | Depot/Terminal Proposed |
| 2 | **Babulkheda** | Depot/Terminal Proposed |
| 3 | **Hingana** | Depot Existing, Terminal Proposed |
| 4 | **Katol Naka** | Depot/Terminal Proposed |
| 5 | **Takli** | Depot/Terminal Proposed |
| 6 | **Octroi Checkpost** | Depot/Terminal Proposed |
| 7 | **Patwardhan** | Depot Existing, Terminal Proposed |
| 8 | **Wathoda** | Depot/Terminal Proposed |
| 9 | **Teka Naka** | Depot Existing, Terminal Proposed |

At the proposed location, the land required for a depot would be approximately 5 acres for 100 buses and some additional area would be required for terminal facility. In absence of sufficient land, the possibility of multistory bus parking could be explored through a detailed technical and financial feasibility study.

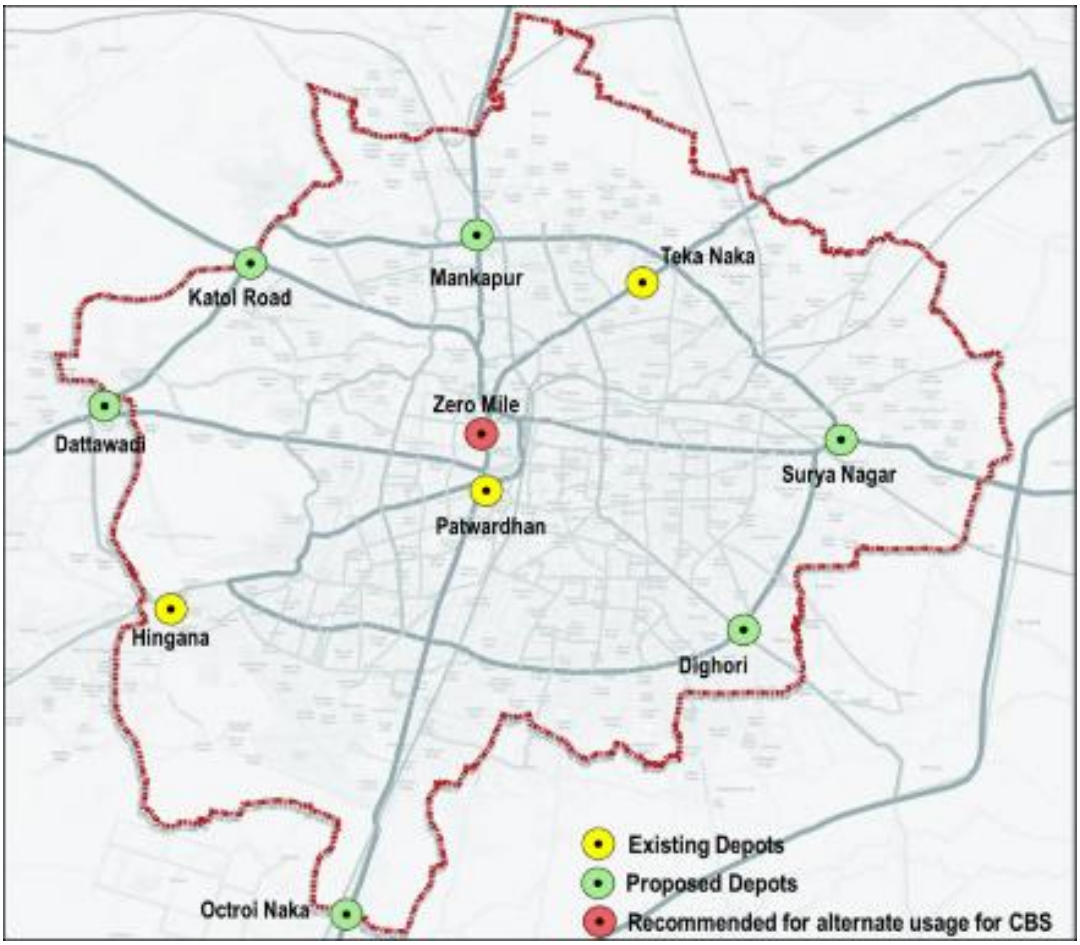



Figure 28 Proposed New Bus Depot and Terminal Location

## MULTI MODAL TRANSIT HUBS

Various transport modes must function in a coordinated manner to provide seamless mobility to the people. Inter-modal integration is a strategy proposed for Nagpur which will ensure efficient and effective coordination across various transport modes. Multi Modal Hubs are transit facilities provided at the interaction points of different modes to facilitate seamless transfer of commuters across different modes. Important Multi Modal Hub locations were identified during the planning of mobility corridors in Nagpur and listed in Table 51. Apart from physical integration it is also proposed that fare integration and information integration must also be achieved.

Table 51 List of Multi Modal Hubs

| Type | Proposed Multi-Modal Hub Location | Number of modes | Modes |
|---|---|---|---|
| **Level 1 City Transport Modes Only** | Mor Bhawan Bus Terminal | 3 | • High Capacity Mass Rapid Transit system<br>• IPT Connectors<br>• City Bus Service |
| | Sitabardi Bus Terminal | 3 | • High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT Connectors |
| **Level 2 Regional Transport Modes +** | Ganesh Peth Bus Terminal | 2 | • Regional Bus Service<br>• City Bus Service<br>• IPT Connectors |

| Type | Proposed Multi-Modal Hub Location | Number of modes | Modes |
|---|---|---|---|
| **City Transport Modes** | Chhatrapati Bus Terminal | 2 | • Regional Rail<br>• City Bus Service |
| | Ravi Nagar Bus Stop | 2 | |
| | Nagpur Railway Station | | • Regional Rail<br>• High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT System |
| | Ajni Railway Station | 3 | • Regional Rail<br>• City Bus Service<br>• IPT System |
| | Kamptee Railway Station | 3 | • Regional Rail<br>• High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT System |
| | Nagpur Airport | 2 | • High Capacity Mass Rapid Transit system<br>• City Bus Service<br>• IPT/Airport Connectors |

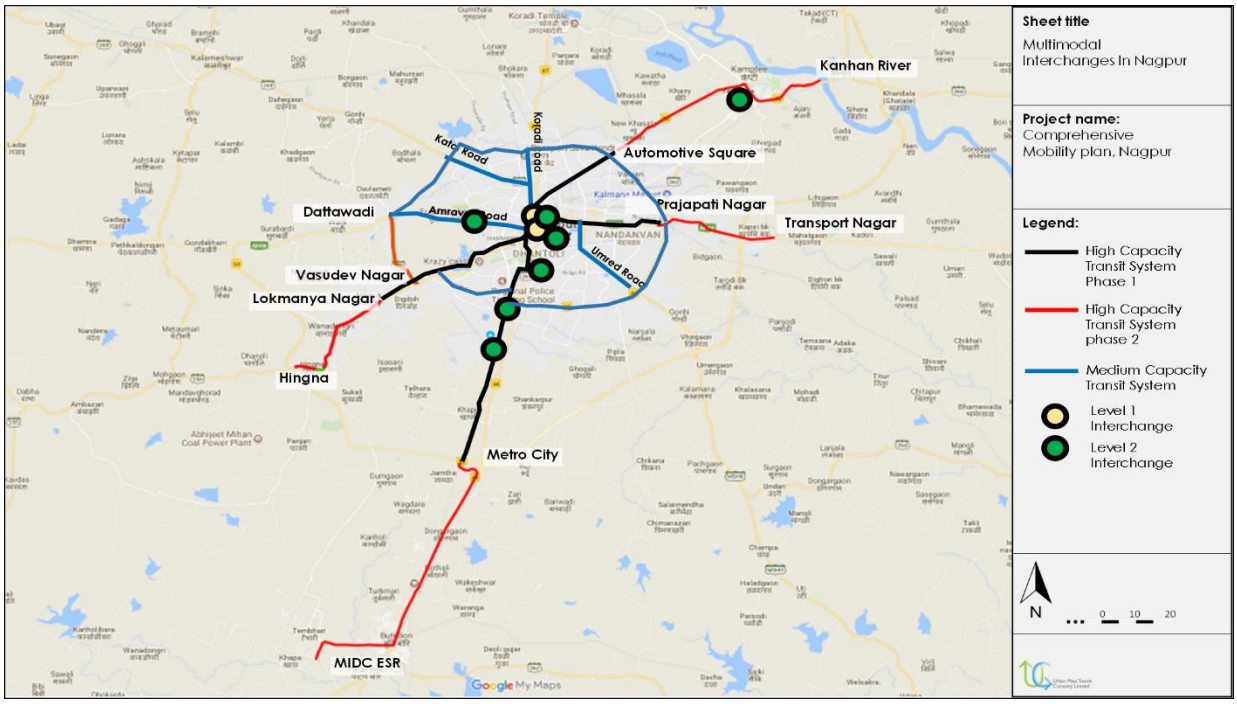



Figure 29 Interchanges and Terminals for Multimodal Integration

## INTELLIGENT TRANSPORT SYSTEM (ITS)

Intelligent Transportation System (ITS) proposed for Nagpur essentially offers a highly capable and automated transit management platform, which shall enable modern city bus services to provide high level of service along with high operational efficiency. Proposed ITS will play a key role in improving the efficiency of City Bus Services.

The critical sphere of ITS is given as under:

### 1. Automatic Fare Collection (AFCS) system

The proposed AFCS system consists of the following sub-systems:

- Card Issuer Module
- the AFCS backend sub-system
- Depot Stock Management System
- Point of Sale Terminal sub-system
- the interconnectivity between the above sub-systems
- Any other module which can be specified at a later stage
-

**2. Validators (One per bus)**

One Validator located at a suitable place inside a bus with a fire resistant wired interconnection is proposed in Nagpur city buses. The Validators possess suitable non-volatile memory for storing the captured AFC transactions as well as the fare structures and other necessary parameters.

**3. Electronic Ticketing Machine (ETM)**

The Electronic Ticketing Machine proposed will be used by the conductor on-board

- To issue paper tickets
- To validate Smart Cards for trip and passes and deduct money from the e-wallet of the AFCS card based on the concept of fare stages.

Further, the ETM possesses a GPRS interface for communication to the AFCS backend via a suitable service provider's infrastructure.

**4. Security Access Modules (SAM)**

In order to ensure the security of the transactions being captured, the ETM and Validator support the use of Security Access Modules (SAM) in slots for SIM cards.

**5. Integrated Control Unit (ICU)**

The primary function of the proposed ICU is to establish communication between the bus onboard AFCS equipment and the concerned backend equipment. It has the following features:

- GPRS connectivity to connect to the AFCS backend through a suitable service provider's infrastructure
- USB port, as a backup, for communicating with a computer at the bus terminus/depot for uploading transactions and downloading new fare structures and other important parameters

**6. Proposed Backend Sub-System**

The backend sub-system typically consists of the following:

- The Communication/transaction server that connects to the GPRS service provider's infrastructure for
- Acquiring AFCS related transactions from the ETMs/ validators of all buses and sending it to the CSTC server.
- Sending the necessary new fare structures and parameters available on the CSTC server to the ETMs and Validators.

The components are as follows:

- a) The Centralized Data Server, which holds the complete AFCS system's database.

- b) The CCC workstations that are used to obtain information and generate reports relevant for the CSTC from the AFCS server
- c) The backend sub-system provides a wide variety of MIS reports.
- d) The AFCS backend includes a software module, which interfaces with the backend server for mapping the initialized smart card data.

## 5.3. ROAD NETWORK PROPOSALS

In the previous chapter Ring radial road network pattern was proposed for Nagpur. Based on the road network envisaged some semi-ring and radial roads are proposed to be completed/constructed to achieve the desired overall road network in the city. The proposed complete road network for Nagpur including new links is shown in Figure 30 and all the semi-ring and radial roads are listed below:

**Major Rings**

**A**. Chandrapur Nagur road – Tekdi Road
**B.** W High Court Road – Mescobagh raod – Dr Ambedkar raod – Ajni Road
**C.** Inner Ring road
**D.** Outer New ring* (Existing part ring = Gondakkhairi – Hingna – Gavsi Manapur – Umergaon – Kapsi BK, Proposed part ring = Gondakkhairi – Dahegaon – Mahadula - Kamptee )

**Major Radials**

1. Koradi Road
2. Kamptee road
3. NH-6 (Donargarh – Nagpur Road)
4. Taj Bagh Road
5. Wardha Road
6. Hingna Road
7. Amravati Road
8. Katol Road

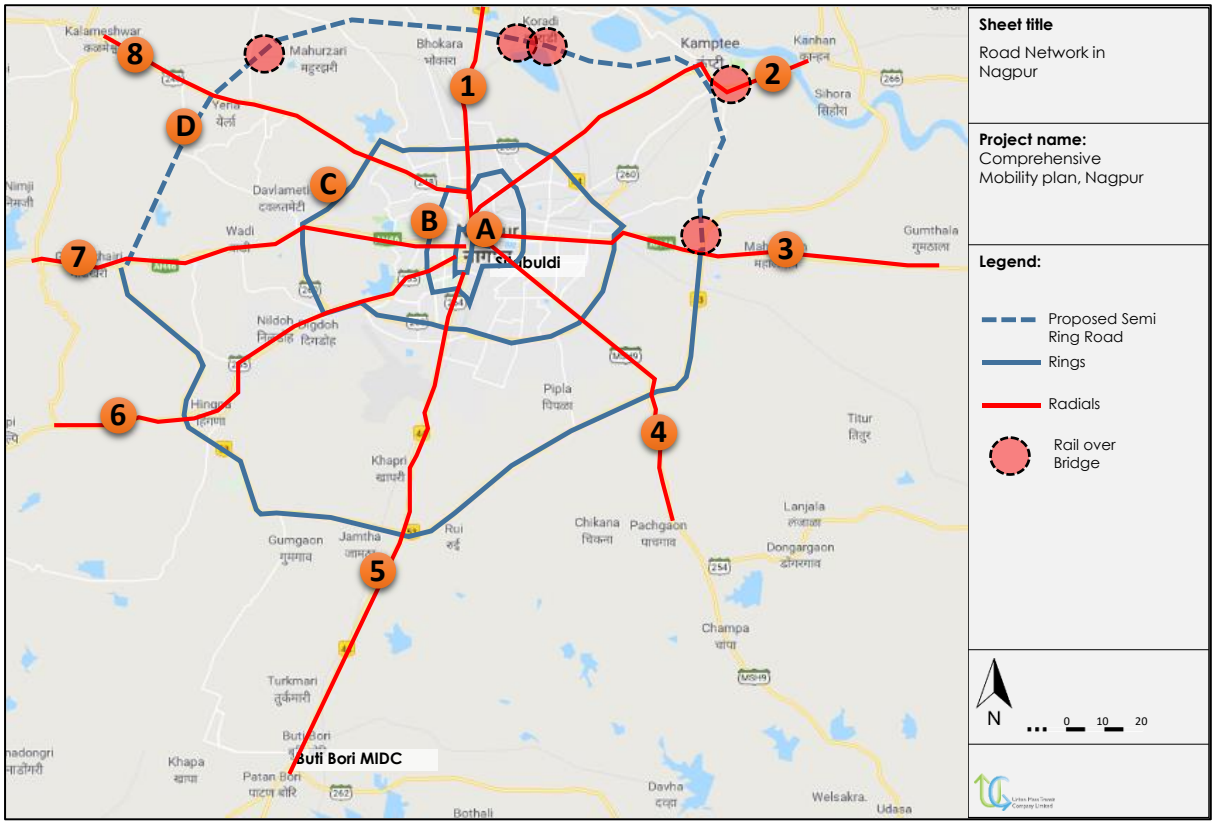



Figure 30 Proposed semi ring radial network in Nagpur

The Five Rail over bridge namely, Boregaon, Mahadula, Suadevi, kamptee and Kapsee are required while completing this ring road.

## 5.4. NON-MOTORIZED TRANSPORT PROPOSAL

### CONSTRUCTION OF FOOTPATHS

As observed from surveys it is learned that about 80% of the road network does not have footpaths, thus it is proposed to construct these footpaths. Apart from the proposed new roads 664 kms (614 kms + 50 kms) must also have proper footpaths. The proposed footpath network is shown in Figure 31.

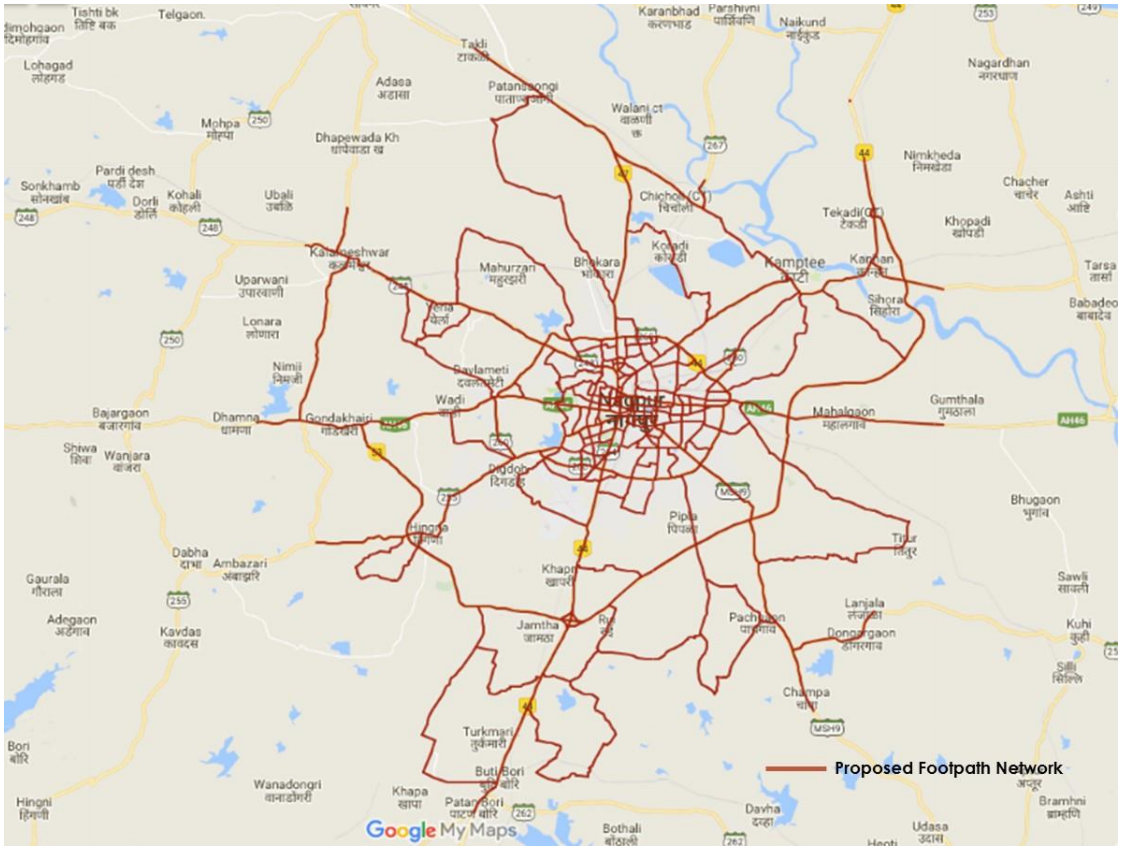



Figure 31: Proposed Footpath Plan

### CONSTRUCTION OF CYCLE TRACK

The corridors identified as mobility corridors in Nagpur are proposed as priority corridors for providing cycle track on both side of the road. The cycle tracks are proposed to be constructed along with the construction of proposed Mass Transit System along these corridors. Phase-1 Cycle Track network is proposed along High Capacity MRTS Corridors. Apart from phase-I cycle track corridors some mobility corridors and several other roads are identified for construction of cycle tracks in Phase-2.

The total road length proposed for cycle track provision is 146 kms, 87km is proposed to be constructed in Phase-I and the remaining shall be constructed in Phase-2. The proposed cycle track network is as in Figure 32 and detailed out in Table 52.

Table 52: Proposed Bicycle Network

| No | Road Name | Starting Point | End Point | | Road Length ( in KM) | |
|---|---|---|---|---|---|---|
| 1 | Wardha Road | LIC Square | Inner Ring Road | Outer Ring Road | 5.1 | 10 |
| 2 | Hingna Road | Rani Jhasi Chowk | Inner Ring Road | Outer Ring Road | 7.7 | 9.5 |
| 3 | Amravati Road | Sitabuldi Police Station | Inner Ring Road | Outer Ring Road | 8.2 | 6.5 |
| 4 | Katol Road | LIC Square | Inner Ring Road | Outer Ring Road | 6.5 | 5.2 |
| 5 | Koradi Road | LIC Square | Inner Ring Road (Mankapur) | Outer Ring Road | 3.6 | 8.4 |
| 6 | Kamptee Road | LIC Square | Inner Ring Road | Kamptee | 5 | 10 |
| 7 | C.A Road | LIC Square | Inner Ring Road (Pardi) | Outer Ring Road | 7.2 | 4 |
| 8 | Umred Road | C.A Road | Inner Ring Road | Outer Ring Road | 5.4 | 5.1 |
| 9 | Inner Ring Road | Circular loop from Mankapur Chowk to Mankapur Chowk | | | 38.5 | - |
| | | **Total (Km)** | | | 87.2 | 58.7 |

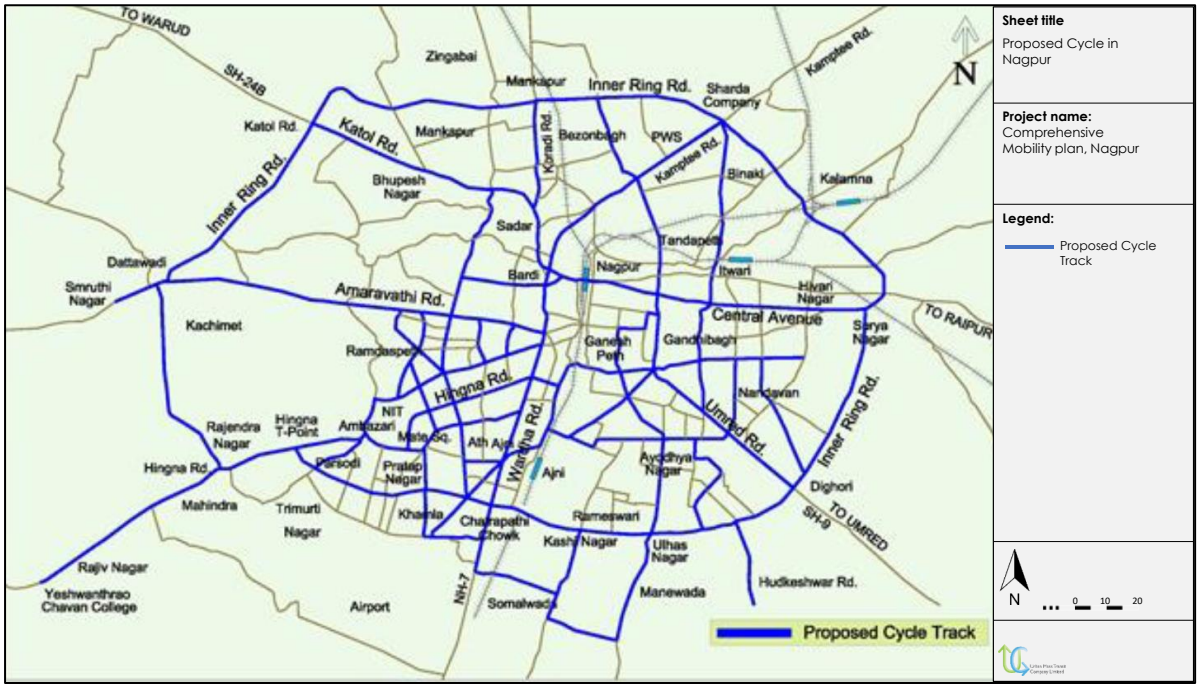



Figure 32: Proposed Bicycle Network

## PUBLIC BIKE SHARING SCHEME

PBS is a public transportation system based on cycles. The central concept of this system is to provide affordable access to cycles for short-distance trips in urban areas as an alternative to motorized public transportation or private vehicles. PBS encourages its users to rent cycles for a shorter time period which range from a few minutes to a few hours. Users are economically incentivized to return cycles at the earliest by making usage free for the first thirty minutes or so. Moreover, while traditional systems

use cycles which are commercially available, PBS make use of cycles which are specially designed for the system and hence unique.

All the mobility corridors are recommended for dedicated cycle tracks on both side of the roads. As part of their infrastructure requirement and bike sharing scheme, the major docking stations are proposed at each Transit station (MRTS station, major bus station and Interchanges etc). The detail list of docking stations is presented in the Table 53.

Table 53 Proposed Docking Station List

| Type | Docking Station Name |
|---|---|
| **Major Docking Station Level 1 and 2 Interchange** | Mor Bhawan Bus Terminal |
| | Sitabardi Bus Terminal |
| | Ganesh Peth Bus Terminal |
| | Chatterpati Bus Terminal |
| | Ravi Nagar Bus Stop |
| | Nagpur Railway Station |
| | Ajni Railway Station |
| | Kamptee Railway Station |
| | Nagpur Airport |
| **Minor Docking Station** | All Metro Stations<br>Major Bus Terminals |

## 5.5. PEDESTRIAN ZONES

Considering the heavy pedestrian movement, following areas are proposed as a vehicle free zones in Nagpur (Figure 33).

1. Sitabuldi
2. Mahal
3. Itwari
4. Sadar

The restriction on vehicular movement has to be decided after careful consultations among concerned agencies including Traffic Police. The restriction could be during evening hours every day or during the weekends or at all times. Central Bazaar Road (Lokmat Square to Humpy Yard and Lokmat Square to Kalpna Apt.) can be considered for vehicle free zone or vehicle restriction zone for limited period in a day.


Figure 33: Proposed Pedestrian Zones

## 5.6. FREIGHT MANAGEMENT

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.

Nagpur city has a wide catchment area for truck traffic. The city connects major national and state highways. The analysis indicated that there is lack of terminal facilities for trucks and multi-axle vehicles. Most of the trucks and multi axle vehicles are parked outside Chungi Naka (Octroi Naka) on all important radial roads. The city road network profile itself invites high number of truck movements to pass through the city on NH6, NH69, NH9, SH260 and MSH 9 roads.

The entry of heavy commercial vehicles into the city will interfere with the easy traffic flow. Hence the action plans are prepared such that the freight movement will not interfere the traffic movement.

Freight has always remained as an unnoticed transportation policy. The word “FREIGHT” should be considered in all the planning and policy documents to give considerable recognition to its management. Management of freight within the city, periodic stakeholder consultations should be held.

Nagpur being a city experiences heavy freight vehicle movement through the day. This has led to heavy road congestion and severe accident along the existing corridors and requires proper freight corridor network in the city. A comprehensive freight network has been envisaged and proposed for Nagpur. All road improvement/ development proposals for the road links falling in the freight network was already proposed in the previous sections regarding road widening and new road proposals and shall only be reproduced in the following sections. The proposed freight network is shown Figure 34 and the proposed freight management plan is described as under

2) **Freight Corridor:** The network of roads identified as freight corridors in Nagpur are listed in Table 54.

Table 54 Proposed Freight corridors

| Sn | Freight Corridors | Length | Lanes |
|---|---|---|---|
| 1 | Inner ring road | 40 | 6 |
| 2 | Outer New ring* (Existing part ring = Gondakkhairi – Hingna – Gavsi Manapur – Umergaon – Kapsi BK,<br>Proposed part ring = Gondakkhairi – Dahegaon – Mahadula - Kamptee ) | 110 | 6 |

For freight management of the city, the proposal has been worked out in phases.

**Phase # 1**

**Improvement of existing Transport Nagar –**

- Segregating loading/unloading lanes
- Road Improvement
- Parking Bays
- Terminal facilities like public utilities, rest rooms for drivers and labours
- Weighing Machines

**Movement Restrictions of heavy vehicles in the city** from 09:00am – 07:00pm, these restrictions may be relaxed for Ring Roads.

**Movement restrictions for animal carts on all Orbital and Radial roads from 09:00am - 06:00pm**

**Phase # 2**

1) Development of new goods/truck terminal near Kapsi in proximity to the Outer Ring Road.

2) Identification of a Mobility Corridor for Goods Vehicles, movement to be restricted completely on all other roads

3) Complete ban on all animal carts being used for goods movement

**Phase # 2-3**

1) Setting up of truck terminals at the following locations

- Koradi
- Kamptee
- Kapsi
- Gumgaon
- Gondakhari

2) Segregated high speed goods vehicle lane on Ring Road

3) Promotion of Use of small and medium size vehicles with modern emission controls in the central city areas

4) Adjoining table indicates the types of facilities required inside the upcoming freight terminals along with area requirement.

5) Location of new freight terminals is indicated in Figure 34.

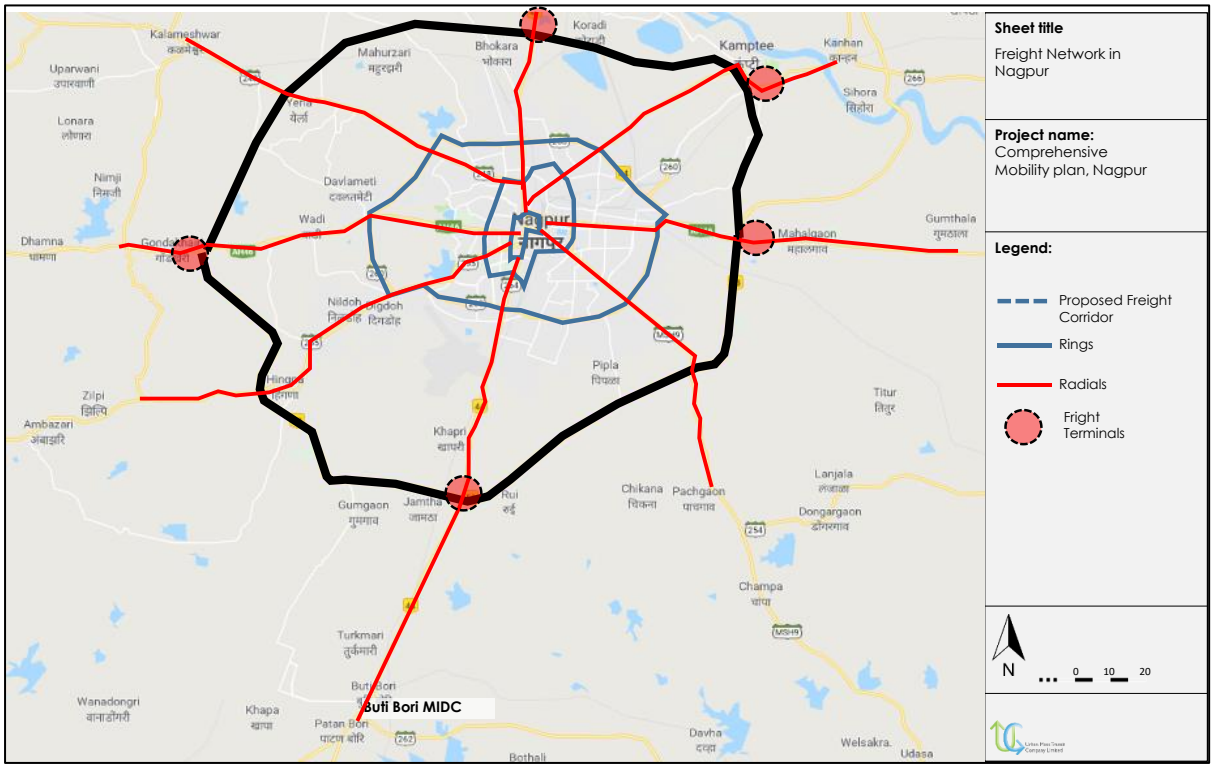



Figure 34 Proposed Freight corridors and Freight Terminal

## 5.7. PARKING MANAGEMENT

Development of a parking strategy is necessary in order to shape the framework for the future provision, management and maintenance of parking facilities. The development of this Parking Strategy has been based on an understanding of the parking supply and demand position in Nagpur City.
The parking strategies that would be considered for Nagpur include

- *Off Street parking facilities*
- *On Street Parking Pricing*
- *Restriction of on street parking on certain corridors*

As one of the tools to enhance the quality of transportation in the city, NMC decided to develop the "Parking Policy and Parking Master Plan for the city" with an aim of closing down the demand-supply gap and manage the future parking demand. In this regard, the following proposals were put forth NMC developed Parking Policy and Parking Master Plan for the city of Nagpur.

### A). Notification by Nagpur Municipal Corporation

As proposed in the policy, concept of paid parking mechanism will be used and applied along the mobility zone- metro corridors and major corridors in the city with row 24 or more, Central Business District (Commercial areas*) and Mixed zone
*Commercial area with the business district, core city area ex. Sadar, Sitabuldi, Itavari, Lakadganj, Mahal, Dharampeth, Congress Nagar, Ganeshpeth, etc. are included.
Table 55 is the finalized base rate for the aforementioned 3 zones.

Table 55 Parking rates as per NMC' Notification

| Sno | Type of vehicle | Rate/time |
|---|---|---|
| 1 | Cycle | Rs 2/ 2 hours, Rs 5/ 8 hours |
| 2 | 2-wheeler | Rs 5/2 hours, Rs 10/ 8 hours |
| 3 | 4-wheeler | Rs 10/ 2 hours, Rs 20/ 8 hours |
| 4 | 3 wheeler, 5-wheeler commercial vehicles | Rs 5/ 2 hours, Rs 10/ 8 hours |

Mixed zone will include areas everything after excluding the above given areas. It will include residential and public institutional areas too. As proposed in the parking policy, considering the shortage of parking and availability of parking in 3 given zones, the parking rate per hour and off-street and on-street parking rate were finalized as per the high court's decision - 4-wheeler: Rs 20/day, 2-wheeler: Rs 10/day; monthly pass- 4-wheeler: Rs 250, 2-wheeler: Rs 100.
The listed areas need to have pay and park
1. Gaurakshan Rahate colony
2. Indian Gymkhanna ground
3. Panchsheel chowk to lokmat chowk (Area above and below tha fly over)
4. Area in front of Yashvant stadium
5. Kachipura chowk to Creams Hospital (south)

## 5.8. TRAFFIC ENGINEERING AND MANAGEMENT PROPOSALS

Traffic Engineering Measures generally qualify as short term measures for bringing in immediate relief from traffic problems. A combination of several measures can prove to be effective means of problem solving. These measures are generally not very capital intensive and give instant results.

**Proposed junctions for improvement**

- Shankar Nagar Chowk
- Golibar Chowk
- Indora Chowk
- Chatrapati Chowk
- Variety Chowk
- Cotton Market Chowk
- Ashok Chowk
- RBI Chowk
- Medical Chowk
- Jaystambh chowk near railway station

The aforementioned junctions to be considered for Foot over bridges for grade separated pedestrian crossing. Typical junction improvements at selected locations are shown in Figure 35. These are indicative, suggested improvements diagrams only. Exact improvements can be shown after conducting the necessary topographic surveys at the locations. However the traffic level at these junctions has already reached the rage of 7000 to 9000 pcu during peak hour. The situation will become more considerable within a year or two. Based on this, the junction improvement plan can be considered as a part of short term improvement plan. The construction or widening of rail over bridges can also be given consideration as a part of short term improvement measures.

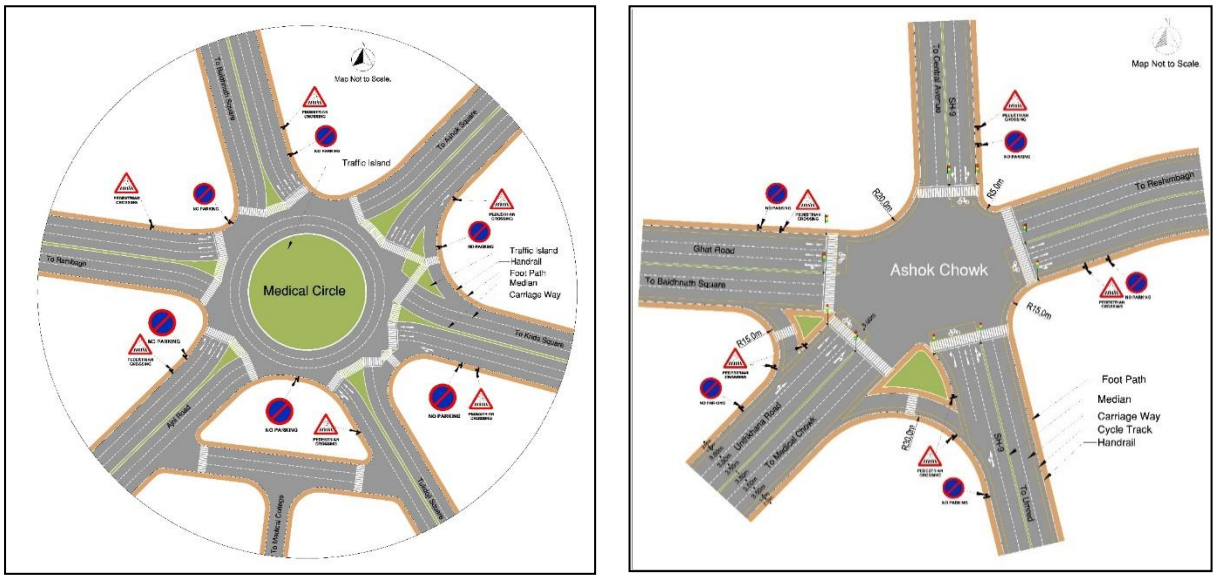



Figure 35 Typical Junction Improvement proposals

## 5.9. IMPACT OF PROPOSALS

### ANTICIPATED IMPACT OF PROPOSED PROJECTS

Projects evolved in CMP will help to achieve sustainable development goals by means of reducing private mode share, emission levels and travel time.

### SOCIAL IMPACT

The impact of the proposed projects from the social angle is analysed at a broader perspective. It is found that most of the projects have significantly less impact with respect to Rehabilitation and Resettlement. Land acquisition for some of the projects is inevitable. The proposed projects significantly improve mobility with reduced travel time. The broad impacts have been compiled in Table 56.

Table 56 Social Impacts of Proposed Projects

| Project | Right of way / Land Acquisition | Requirement of Rehabilitation and 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 |
| Freight Terminals | Yes | Yes | Yes | NA |
| Bus Shelters & Bus bays | Yes | No | Yes | Yes |
| ROBs / New Roads | Yes | Yes | Yes | Yes |
| Ring Roads | Yes | No | Yes | Yes |
| Foot Paths | No | No | Yes | NA |
| Cycle Tracks | No | No | Yes | NA |
| Major Junction Improvements | No | No | Yes | Yes |
| Smart Signals | No | No | Yes | Yes |
| Area Traffic Control Centers | No | No | Yes | Yes |

## ENVIRONMENTAL IMPACTS

Environmental and social screening is intended to provide inputs into identification of potential impacts with the implementation of the CMP. Screening is conducted by identifying the interaction of environmental components on the project activities for various projects. Screening conducted for the identified projects and respective impacts identified are presented in the Table 57.

Table 57 Environmental Impact of Projects

| Broad Project category | Activities / Sub Components | Impacts |
|---|---|---|
| Regional Hubs based on Transit Oriented Development principles | • Development of serviced land for high density development<br>• Public transport interchange hubs | • Land acquisition<br>• Construction activity around the highway |
| Pedestrian / NMT Infrastructure Improvement | • Land acquisition for road widening and creation of service lane wherever necessary | • Removal of squatters and encroachers from the footpaths<br>• Causing livelihood losses even though they are illegal<br>• Loss of shelter for temporary shops / residences for squatters and encroachers |
| | • Construction of new footpaths | • Improvement in safety of pedestrians due to measures proposed |
| | • Segregated Cycle Tracks | • Improvement in pedestrian safety<br>• Slowing of traffic at the time of constructing and erecting structures across major intersections<br>• Encourage use of NMT and hence reduction in pollution |
| Public Transport Planning | • Dedicated public transport network | • Land acquisition for dedicated lanes will cause Rehabilitation and Resettlement issues<br>• 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<br>• Construction / reconstruction / improvement of bus lanes/MRT systems will be causing construction issues as:<br>▪ Generation of noxious gases during construction, increasing air pollution<br>▪ Temporary increase in noise pollution during construction<br>▪ Contamination of road runoff with construction material stacked on road side<br>▪ Traffic safety during construction<br>▪ Traffic diversions causing lengthening of routes increasing air emissions and exposing previously unexposed neighbourhoods to noise<br>• Reduction of additional lane width for other traffic if existing road width is used for demarcating the dedicated bus lanes<br>• Reduction in private vehicles causing reduction in air / noise pollution |
| | • Terminals/Depots/TTMC/ Transport Hubs/ Commuter Amenity Centers | • Acquisition of land for the facilities causes Rehabilitation and Resettlement issues as loss of livelihood, loss of shelter, severance of community & social ties<br>• Increase of noise and air pollution in the areas of terminals and depots<br>• Improvement in approaches to the terminals and depots causing impacts on adjacent land uses and land acquisition<br>• Additional land acquisition, if any for the approach road improvement will lead to R and R issues along the roads and cause impacts on livelihood and shelter<br>• Construction stage impacts include the increase in air and noise pollution<br>• Contamination of road runoff with stacked construction materials<br>• 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<br>• Temporary increase of noise levels due to idling and traffic snarls<br>• Alternate traffic diversion routes increasing route length and consequently emissions<br>• Alternate traffic diversion routes exposing previously low traffic routes to higher urban traffic and increasing air / noise pollution<br>• Removal of squatters and encroachers from the footpaths causing livelihood losses at approaches to the sub-ways / FOBs<br>• 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 and Encroachers.<br>• Air and noise pollution from construction impacts<br>• 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<br>• Banning of use of animals for movement of goods in the city may result in<br>▪ Animal welfare and safety<br>▪ Improved speeds in CBD area due to reduction in congestion |
| | • Relocation of Activity inside existing freight terminal | • Resistance by operators for relocation<br>• Improved air quality in the surrounding residential areas |
| | • Creation of new freight terminal | • Acquisition of land in the peripheries<br>• Contamination of runoff from road with construction material as sand / cement / silt from stacked excavated earth |

# IMPLEMENTATION PLAN

# 6. IMPLEMENTATION PLAN

The chapter on strategies and proposals discusses the way forward for improving urban transport in Nagpur from which we have established a large number of options that are of short term, medium term and long term in nature. This chapter details out the costs associated with each of the proposed improvements, along with the phasing of the projects. The implementation plan also provides various financial options to be looked at towards implementing the proposed projects. A proper Institutional Frame Work is of utmost importance for the successful implementation and monitoring of all the schemes. In this regard, an Institutional set up is also recommended.

## 6.1. PRIORITIZATION OF PROJECTS

All the proposals discussed so far can be broadly grouped under three categories:

- Long Term Improvements: the usefulness of these improvements will last for more than 10-15 years
- Medium Term Improvements: the usefulness of these improvements will last for about 5-10 years
- Short Term Improvements: these are short term proposals that need to be reviewed and revised within 5 years as per the requirement.

Accordingly, long term, medium term and short-term proposals for Nagpur are shown in Table 58 to Table 60.

Table 58 Short Term Improvement Projects

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| **1** | Traffic and Pedestrian Management measures | Km | 664 | 0.05 | 33.2 |
| **2** | Junction Improvements and Management Measures | Nos | 10 | 20 | 200 |
| **3** | Construction of Footpaths | Km | 664 | 0.2 | 132.8 |
| **4** | Provision of Cycle Tracks | Km | 146 | 0.5 | 73 |
| **5** | Provision of Pedestrian Zones and Pedestrian Infrastructure | Nos | 4 | 2 | 8 |
| ***Cost of Development of Short-Term Improvement Plan*** | | | | | ***447*** |

Table 59 Medium Term Projects

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| **6** | FOB/ Walkways (10 Junctions) | Nos | 10 | 10 | 100 |
| **7** | **Bus Augmentation** | ***Nos*** | **1904** | | ***1359*** |
| **7a** | *Midi* | *Nos* | *474* | *0.45* | *213* |

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| **7b** | *Standard - B* | *Nos* | *280* | *1.15* | *322* |
| **7c** | *Standard - D* | *Nos* | *980* | *0.63* | *613* |
| **7d** | *Standard E* | *Nos* | *170* | *1.24* | *211* |
| **8** | Bus Q Shelter | Nos | 710 | 0.06 | *45* |
| **9** | Off Street Parking Locations | Nos | 5 | 10 | 50 |
| **10** | ITS (Control room / PIS and Traffic Information System) | Ls | 1 | 25 | 25 |
| **11** | Development and Upgradation of Bus Depot and Workshop | Nos | 9 | 20 | 180 |
| **12** | Redevelopment of Bus Terminal - Multi Mobility Hub at Mor Bhawan | Nos | 1 | 100 | 100 |
| **13** | Rail Over Bridges | Nos | 5 | 25 | 125 |
| **14** | Bike Sharing Plan : Main Docking Station | Nos | 9 | 0.5 | 4.5 |
| **15** | Bike Sharing Plan : Substations | Nos | 75 | 0.1 | 7.5 |
| | ***Cost of Development of** Medium-Term **Improvement Plan*** | | | | ***1993*** |

Table 60 Long Term Proposals

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) |
|---|---|---|---|---|---|
| **16** | Medium Capacity Mass Transit System | Km | 56.5 | 20 | 1130 |
| **17** | High Capacity Mass Transit System | | | | |
| **17a** | Under Construction (Cost as per DPR) | Km | 40 | - | 8680 |
| **17b** | Proposed extension | Km | 48.1 | 400 | 19240 |
| **18** | Road Network Improvement Plan (New Roads) - Long Term | Kms | 50 | 10 | 500 |
| **19** | Freight terminals | Nos | 5 | 20 | 100 |
| **20** | Development of New Bus Terminals | Nos | 9 | 10 | 90 |
| | ***Cost of Development of Long Term Improvement Plan*** | | | | ***29740*** |

Table 61 Total Project Cost

| Project Priority | Total Cost (Crores - INR) |
|---|---|
| Short Term Projects | 447 |
| Medium Term Projects | 1993 |
| Long Term Projects | 29740 |
| Total Cost | **32180** |

## 6.2. PHASING PLAN AND PPP POTENTIAL

The projects identified in the earlier section are divided into three categories based on the urgency and duration of the implementation. Some of the long term projects have potential to enter into Public Private Partnership (PPP); however, case to case project reports are required for validating the feasibility of each project. The cost of all the recommended projects is around **22500*** Crores. It is important to highlight that the CMP serves only to identify schemes and the costs presented are only BLOCK COST estimates for decision makers. Detailed cost estimates need to be worked out at further stages.

**-Excluding the Cost of Phase I MRTS System*

Table 62 Project Phasing and PPP Potential

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) | Quantity Phase 1 | Quantity Phase 2 | Quantity Phase 3 | Cost(In Cr) Phase 1 | Cost(In Cr) Phase 2 | Cost(In Cr) Phase 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Short Term Improvements*** | | | | | | | | | | |
| **1** | Traffic and Pedestrian Management measures - | Km | 664 | 0.05 | 33.2 | 614 | 50 | 0 | 30.7 | 2.5 | 0 |
| **2** | Junction Improvements and Management Measures | Nos | 10 | 20 | 200 | 10 | 0 | 0 | 200 | 0 | 0 |
| **3** | Construction of Footpaths | Km | 664 | 0.2 | 132.8 | 614 | 50 | 0 | 122.8 | 10 | 0 |
| **4** | Provision of Cycle Tracks | Km | 146 | 0.5 | 73 | 87 | 59 | 0 | 43.5 | 29.5 | 0 |
| **5** | Provision of Pedestrian Zones and Pedestrian Infrastructure | Nos | 4 | 2 | 8 | 4 | 0 | 0 | 8 | 0 | 0 |
| | ***Cost of Development of Short Term Improvement Plan*** | | | | ***447*** | | | | ***405*** | ***42*** | ***0*** |
| | ***Medium Term Improvements*** | | | | | | | | | | |
| **6** | FOB/ Walkways (10 Junctions) | Nos | 10 | 10 | 100 | 10 | 0 | 0 | 100 | 0 | 0 |
| **7** | **Bus Augmentation** | ***Nos*** | **1904** | | ***1359*** | ***607*** | ***213*** | ***1084*** | ***433*** | ***152*** | ***774*** |
| **7a** | *Midi* | *Nos* | *474* | *0.45* | *213* | *151* | *53* | *270* | *68* | *24* | *122* |
| **7b** | *Standard - B* | *Nos* | *280* | *1.15* | *322* | *89* | *31* | *160* | *102* | *36* | *184* |
| **7c** | *Standard - D* | *Nos* | *980* | *0.63* | *613* | *313* | *109* | *558* | *196* | *68* | *349* |
| **7d** | *Standard E* | *Nos* | *170* | *1.24* | *211* | *54* | *20* | *96* | *67* | *25* | *119* |
| **8** | Bus Q Shelter | Nos | 710 | 0.06 | *45* | 0 | 710 | 0 | 0 | 45 | 0 |
| **9** | Off Street Parking Locations | Nos | 5 | 10 | 50 | 5 | 0 | 0 | 50 | 0 | 0 |
| **10** | ITS (Control room / PIS and Traffic Information System) | Ls | 1 | 25 | 25 | 1 | 0 | 0 | 25 | 0 | 0 |
| **11** | Development and Upgradation of Bus Depot and Workshop | Nos | 9 | 20 | 180 | 3 | 3 | 3 | 60 | 60 | 60 |
| **12** | Redevelopment of Bus Terminal - Multi Mobility Hub at Mor Bhawan | Nos | 1 | 100 | 100 | 0 | 1 | 0 | 0 | 100 | 0 |
| **13** | Rail Over Bridges | Nos | 5 | 25 | 125 | 0 | 5 | 0 | 0 | 125 | 0 |

| Sl.No | Projects | Unit | Quantity (Total) | Rates (in Cr) | Total Cost (in Cr) | Quantity Phase 1 | Quantity Phase 2 | Quantity Phase 3 | Cost(In Cr) Phase 1 | Cost(In Cr) Phase 2 | Cost(In Cr) Phase 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **14** | Bike Sharing Plan : Main Docking Station | Nos | 9 | 0.5 | 4.5 | 9 | 0 | 0 | 5 | 0 | 0 |
| **15** | Bike Sharing Plan : Substations | Nos | 75 | 0.1 | 7.5 | 31 | 44 | 0 | 3 | 0 | 0 |
| | ***Cost of Development of Medium Term Improvement Plan*** | | | | ***1993*** | | | | ***676*** | ***483*** | ***834*** |
| | ***Long Term Improvements*** | | | | | | | | | | |
| **16** | Medium Capacity Mass Transit System | Km | 56.5 | 20 | 1130 | 22.5 | 34 | 0 | 450 | 680 | 0 |
| **17** | High Capacity Mass Transit System | Km | 88.1 | | | | | | | | |
| **17a** | Under Construction (Cost as per DPR) | Km | 40 | - | 8680 | 40 | 0 | 0 | 8680 | 0 | 0 |
| **17b** | | | 48.1 | 400 | 19240 | 0 | 48.1 | 0 | 0 | 19240 | 0 |
| **18** | Road Network Improvement Plan (New Roads) - Long Term | Kms | 50 | 10 | 500 | 50 | 0 | 0 | 500 | 0 | 0 |
| **19** | Freight terminals | Nos | 5 | 20 | 100 | 0 | 5 | 0 | 0 | 100 | 0 |
| **20** | Development of New Bus Terminals | Nos | 9 | 10 | 90 | 4 | 5 | 0 | 40 | 50 | 0 |
| | ***Cost of Development of Long Term Improvement Plan*** | | | | ***29740*** | | | | ***9670*** | ***20070*** | ***0*** |
| | ***Total Cost (Short, Medium and Long term Projects)*** | | | | ***32180*** | | | | ***17991*** | ***20665*** | ***834*** |

*- Including the cost of Phase-I MRTS System

## 6.3. FINANCING OPTIONS

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 the 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 an indispensable goal of the governance.

The key funding sources besides GBS and fare box can be dedicated levies, land monetization, recovery from non-user beneficiaries, debt and private investments. The paradigm of financing has to clearly move towards non-users pay principle and the polluters pay principle. There is a need for long-term sustainable dedicated 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.

### PUBLIC PRIVATE PARTNERSHIP (PPP)

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 types of project to be developed are 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 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.

## 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.

## 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 instalments, 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

## DEDICATED URBAN TRANSPORT FUND AT CITY LEVEL

For the projects, which are not admissible under 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 and 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 the 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 are explained in following sub sections:

## 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.

## 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 center 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 capitalize on the use of their land.

### 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.

### ADVERTISING

This is another important source of revenue for the city. When properly utilized 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 utilized 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 good for the society from these overpasses is minimal.

## 6.4. INSTITUTIONAL FRAMEWORK

City transport system generally involves several organizations that look after various forms and aspects of the transport system and network and have overlapping functions and areas of work. Therefore to delineate areas and to remove ambiguity of functions the institutional framework has been proposed.

With the formation of a State level UMTA, part of the problem has been sorted. However, this would have a macroscopic view of resolving policy issues for all urban centres within the state. There still remains a need to set up a localized organization that results in coordinated strategic level planning at the city level and deal with more day to day issues of urban transport.

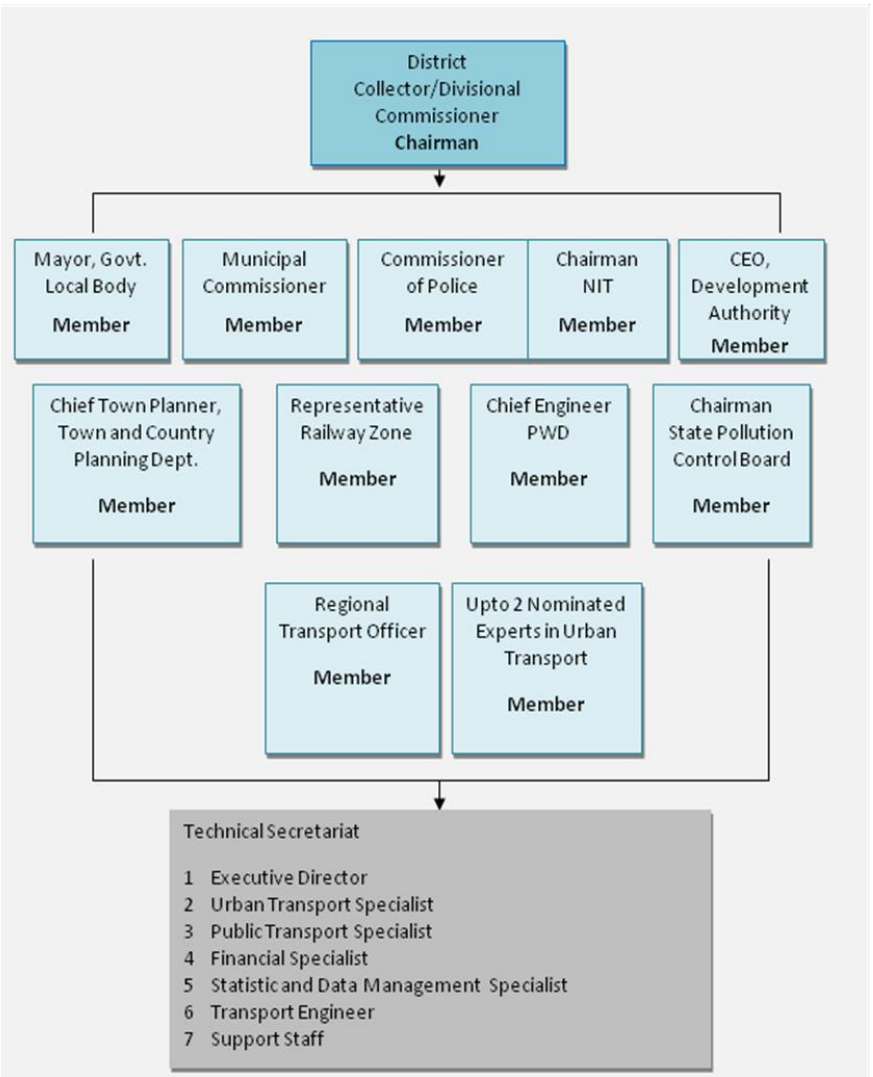
Following is the list of departments and Organizations involved in urban affairs and urban transport in Nagpur.

- Housing and Urban Planning Department
- State Urban Development Department
- Public Works Department
- National Highway Authority of India (NHAI)
- Superintendent of Police-Traffic Nagpur
- Nagpur Development Authority (NDA)
- District Urban Development Agency (DUDA)
- Maharashtra State Road Transport Corporation (MSRTC)
- Railways
- State Pollution Control Board, Nagpur
- Regional Transport Office (RTO)

In view of bringing the institutional setup in a proper structure, it is important to understand the Issues with the present Institutional set up, listed below.

- No clear segregation between the planning and implementing bodies
- Lack of coordination amongst all the departments in the urban transport sector.
- All departments related to urban transport do not function in coherence.
- 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.
- No control over mushrooming IPT modes in the city, which lead to issues of congestion along with contesting with the buses for passengers.
- Operation issues in public transport due to poor route and service planning.
- No dedicated organization that is in charge of long term urban transport planning for the city.

With a view to coordinate all urban transport activities in the city, it is recommended that a UMTA be set up at the city level that acts as a planning and decision making body for all matters related to urban transport in the city.
It is recommended that the city level UMTA be set up on an executive order for the ease of formation however, it must be given a legal backing so that it's functioning falls under an act and commands greater authority


District Collector/Divisional Commissioner
Chairman
Mayor, Govt. Local Body
Member
Municipal Commissioner
Member
Commissioner of Police
Member
Chairman NIT
Member
CEO, Development Authority
Member
Chief Town Planner, Town and Country Planning Dept.
Member
Representative Railway Zone
Member
Chief Engineer PWD
Member
Chairman State Pollution Control Board
Member
Regional Transport Officer
Member
Upto 2 Nominated Experts in Urban Transport
Member
Technical Secretariat
1 Executive Director
2 Urban Transport Specialist
3 Public Transport Specialist
4 Financial Specialist
5 Statistic and Data Management Specialist
6 Transport Engineer
7 Support Staff

## FUNCTIONS AND POWERS OF AUTHORITY

- Prepare Comprehensive Mobility Plans and a Transport Master Plans, including but not limited to public transportation, and non-motorised transportation within the Urban Mobility Area
- Prepare Transport Investment Programmes of the Urban Mobility Area to achieve the goals of the approved Comprehensive Mobility Plan and Transport Master Plan and in a manner that such Transport Investment Programme can give guidance and directions to the various ·agencies engaged in provision of the Urban Transport and the Urban Transport Ancillary Services to prepare their own investment programmes and projects in alignment with the overall Transport Investment Programme.
- Plan for financing, construction, and operation of facilities and services related to the Urban Transport and the Urban Transport Ancillary Services in the Urban Mobility Area.
- Promote or undertake development of integrated facilities and systems for Urban Transport within Urban Mobility Area including developing systems for seamless transport access within an Urban Mobility Area.
- Develop, construct, repair re-construct, and operate and manage any integrated or stand-alone transport facilities and services that aid and enhance the efficiency or service levels of the Urban Transport to the consumers, in the Urban Mobility Area, either suo-motu or through agencies appointed for this purpose.
- Adopt existing standard and guidelines provided by State and Central Government from time to time and as necessary develop, publish, and issue their own standards and guidelines relating to the development and operation of Urban Transport facilities and services within Urban Mobility Area in accordance with the requirements, including those required for physically challenged, elderly, women and children and take measures that compliance of the same by various relevant public and private transport operators in the Urban Mobility Area is ensured.
- Develop and disseminate performance indicators for Urban Transport services within its jurisdiction.
- Regulate and enforce technical and performance standards on all strategic and operational matters that have a direct effect on the levels of service provided to the users of Urban Transport.
- Regulate and enforce environmental standards for all aspects related and/or incidental to the Urban Transport and the Urban Transport Ancillary Services.
- Set up and operate an operation control centre, a web based user information system, and a helpline to provide integrated information to the users of Urban Transport in the Urban Mobility Area.
- Set up and operate a smart card based ticketing system for payment of user charges for Urban Transport and Urban Transport Ancillary Services.
- Promote technology-based solutions for traffic management, transport planning, and design of transport systems and selection of mode of transport.
- Collate information on urban transportation within Urban Mobility Area and provide the same to the relevant agencies with a view to contributing to the national database on urban transport.

- Promote consumer awareness in relation to the integrated urban transport, and ensure that information is appropriately publicized and displayed for users of various urban transport services within the Urban Mobility Area;
- Undertake activities for the purpose of advancing the skills of persons employed by the Authority or the efficiency of the equipment of the Authority or the manner in which the equipment is operated including the provision of facilities of training, education and research.
- Fund and/or facilitate financing of all transport related investment seeking funds managed by the Authority, for the implementation of the projects, plans, schemes and proposals included in the Transport Investment Programme.
- Approve all major Transport Projects proposed for or in the Urban Mobility Area by any State/Central/any other agencies from the perspective of alignment with Transport Master Plan.
- Issue permits/licences for public transport services.
- Monitor and audit compliance with the Transport Master Plan, the Comprehensive Mobility Plan, and the Transport Investment Programme.
- Prescribe fees and charges for roads, public transport, parking, and other public transport facilities and services and regulate fares for all Urban Transports as may be prescribed from time to time.
- Monitor use of funding for urban transport activities and ensure Audit of accounts and loans.

However, the various authorities under UMTA should perform their individual function under the purview of UMTA.

# OUTCOMES

# 7. OUTCOMES

## 7.1. IMPROVEMENTS IN THE MOBILITY CHARACTERISTICS OF THE CITY

The comprehensive mobility plan has focused on making Nagpur a vibrant city. The mobility plan has been prepared with the objective of achieving a balanced modal mix and to discourage personalized transport. The plan has proposed to introduce various transport initiatives in terms of road network development, non-motorized transport and mass transit systems, especially to improve the first and last mile connectivity for the existing mass transit systems to reverse the trend of decreasing public transit share. The CMP hence has reviewed the suggestions made by previous transportation studies, and augmented to best suit for the upcoming years so that the transport vision of the city is in line with the National Urban Transport Policy and Sustainable Transport. Though it has been 5 years since earlier CMP was envisaged, not much transport improvements in the sustainable direction has happened and hence, the thrust of the strategies and the plans thereof and its outcomes are as follows:

| | | |
|---|---|---|
| Improvement in Non-motorized transport | • Improvement in footpaths<br>• Development of bicycle friendly streets<br>• Provision of public bike sharing | - Reduction in pollution<br>- Increased safety for pedestrians and cyclists<br>- Improved access facilities<br>- Increase in public transport share |
| Public Transport Improvement | • Mass Transit Systems<br>• Bus Augmentation<br>• Intermodal Integration | - Increase in Public transport share<br>- Reduced pollution<br>- Reduced travel time<br>- Ease of access |
| Road Network Development | • New Roads | - Better access facilities<br>- Reduction in congestion and hence travel time |
| Freight Management | • Freight Policy<br>• Freight Corridor<br>• Freight Terminals | - Reduced congestion<br>- Reduction in accidents<br>- Reduction in emissions |
| Traffic Management | • Junction Improvements<br>• Pavement Designs and Markings | - Increased safety |
| Technology Measures | • Smart Signals<br>• ATCC | - Better access to information<br>- Safe junction movements and hence reduction in accidents and delays |
| Travel Demand Management | • Policy Measures | - Reduced traffic<br>- More awareness on public transport |

## 7.2. CONCLUSION

Nagpur as a city is experiencing increased dependency on private motor vehicles for personal trips, leading to increased vehicular congestion and emissions. The existing traffic and transportation characteristics conducted for the city indicate inadequate existing transportation infrastructure to serve the future travel demand and a high growth in the private vehicle share in the city and surrounding region. A Comprehensive Mobility Plan is needed to address the mobility needs of the people focusing on non-motorized and public transport, rather than catering to the needs of private automobiles. A CMP optimizes the "mobility pattern of people and goods" and act as an effective platform for integrating land use and transport planning.
In line with the vision for Nagpur, CMP has laid down eight different strategies namely,

- Integrated Land Use and Transport Strategy
- Road Network Development Strategy
- Public Transport Strategy
- Non-Motorized Transport Strategy
- Freight Management Strategy
- Traffic Engineering Strategy
- Technological Strategy
- Demand Management Strategy

Each of these strategies have further been translated to action plans in terms of proposals.

To conclude, the CMP has drawn up the transport roadmap for Nagpur for 2041 including transport investment program containing short, medium and long term projects. The plan has focused on the mobility of the people, and encouraging systems that maximize the throughput of people. The CMP for Nagpur envisaged a total transport investment of about **41964 Crores** for a period of 20 years.

Table 63 Project Priority and Costing

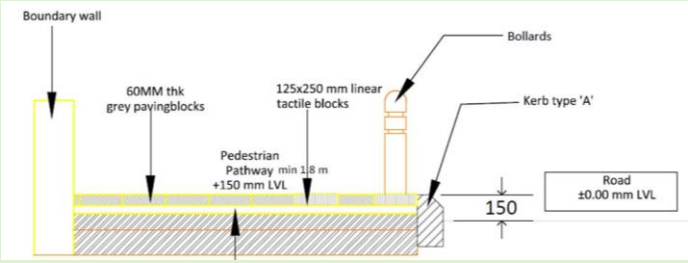
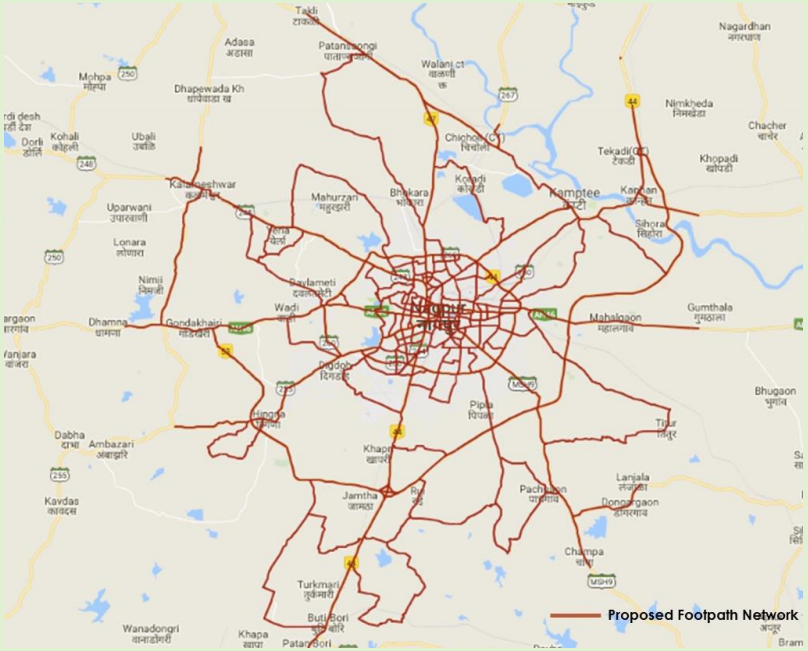
| Project Priority | Cost( Crores)(INR) |
|---|---|
| Short Term Projects | 447 |
| Medium Term Projects | 21057 |
| Long Term Projects | 21140 |
| **Total Cost** | **42644** |

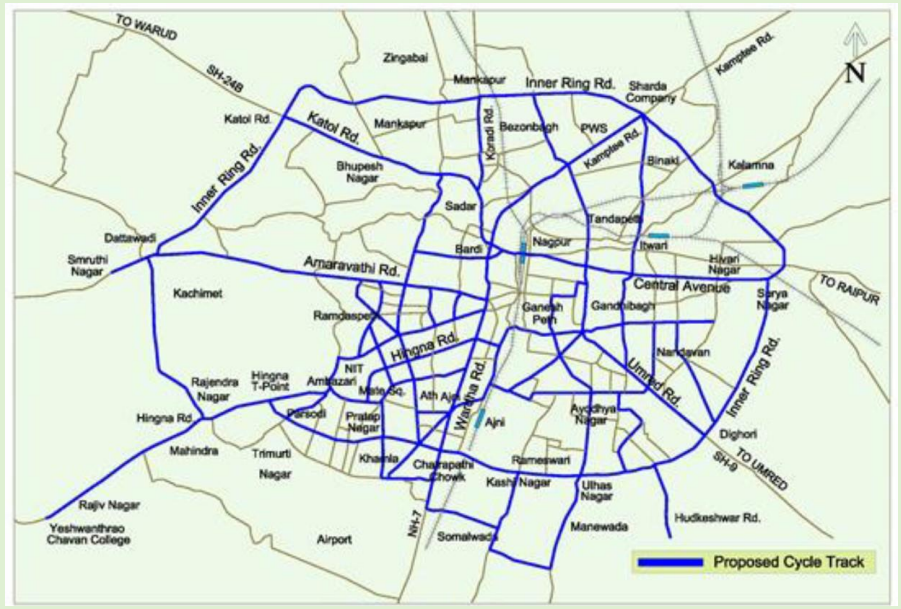
The mobility goals for Nagpur need to be addressed through a multipronged approach. It is important to note that each of the above strategies is equally important and the order of listing does not imply priority. The strategies when implemented through specific projects shall fulfil the goals and objectives of the CMP.

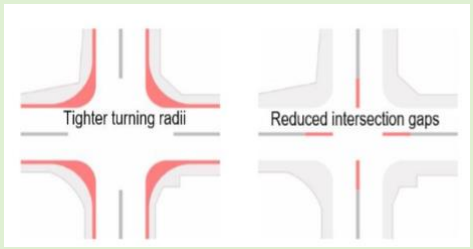
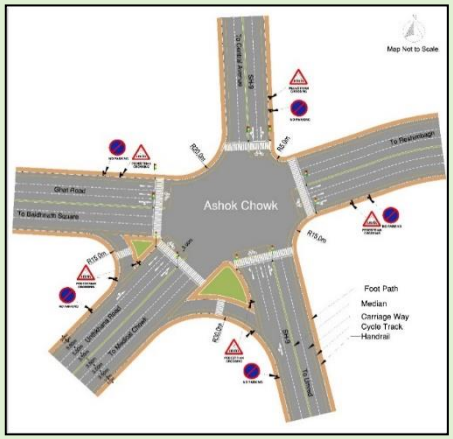
# ANNEXURES

# ANNEXURE-1

## *PROJECT PROFILE SHEETS*

| **Project No: 1** | **Project Title: Development of Footpaths** |
|---|---|
| Project Type: Short Term | Length: 664 Km |
| Location:<br>- All major mobility corridors suggested for the city<br>- Roads maintained by Highways Department<br>- Bus Route Roads | Block Cost: Rs 33.2 Crores |
| Detailed Description:<br>  <br><br>Depending on the volume of pedestrians, the area requires footpaths with minimum width of 1.8m and maximum height of 150mm from the finished road surface. In certain cases, where the available road RoW makes it difficult to provide 1.8 m barrier free space for footpaths, the widths can be reduced to a minimum of 1.2 m. However, the maximum height of 150 mm cannot be compromised in any circumstance. Increasing the footpath height to more than 150 mm makes them unusable by pedestrians, thereby defeating the purpose of providing the footpaths. |  <br> |
| Implementation Period:<br>2018-2021 | Potential Benefits:<br>• Improves the accessibility and safety of pedestrians<br>• Provides comfortable environment to pedestrians |

| **Project No: 2** | **Project Title: Development of Cycle Tracks** |
|---|---|
| Project Type: Short Term | Length: 146 Km |
| Location:<br>- Proposed for all the major Mobility Corridors | Block Cost: Rs 73 Crores |
| Detailed Description:<br><br>• **NMT Only Corridors-** Only pedestrians and cyclists will be permitted in the corridor<br>• **Dedicated NMT Corridors** with provision of dedicated footpaths and bicycle tracks of minimum clear widths of 1.8M on both sides of roads.<br>• **Shared NMT Routes** where the Bicycle users will share the carriageway with mixed traffic. Appropriate road signs and lane marking will also be provided. Shared NMT Routes should give high priority for NMT users in terms of pavements, signages, lane markings, sign boards etc. depending upon the characteristics of the road. |  |
| Implementation Period:<br>• 87 Kms (i.e; 60%) in 2018-2021<br>• 59 Kms (i.e; 40%) in 2021-2031 | Potential Benefits:<br>• Improves the safety of cycle users in the city and encourages the use of bi-cycles<br>• Reduced Pollution and emissions |

| **Project No: 3** | **Project Title: Junction Improvements** |
|---|---|
| Project Type: Short Term | Quantity: 10 Nos |
| Location:<br>- Major 10 Junctions in the city as mentioned in the report | Block Cost: Rs 200 Crores |
| Detailed Description:<br>• Closure of medians at certain intersections<br>• Prohibition of free right turns<br>• Provision of adequate sight distance<br>• Providing adequate corner radii<br>• Providing sufficient turning radii<br>• Flaring approaches towards intersections<br>• Providing channelizers/division islands<br>• Providing pedestrian and cyclist crossing facilities<br>• Bus stops near junctions to be re-located<br>• Providing signs/lane-markings/lighting |  <br>  |
| Implementation Period:<br>• 2018-2021 | Potential Benefits:<br>The proposed traffic management measure will reduce traffic conflicts and delay at junction, ensure smooth traffic manoeuvring, enable safe pedestrian movements and crossing with minimum cost |

| **Project No: 4** | **Project Title: Traffic and Pedestrian Management Measures** |
|---|---|
| Project Type: Short Term | Length: 664 Km |
| Location:<br>- All mobility corridors | Block Cost: Rs 132.8 Crores |
| Detailed Description:<br>- Traffic control devices such as:<br>• Centre line,<br>• Traffic lane lines,<br>• Stop lines,<br>• Pedestrian crossings,<br>• Parking space limit,<br>• Kerb marking for visibility,<br>• Obstruction marking etc<br>All the traffic signs should be facilitated as per the guidelines provided in IRC:67-2001. |  |
| Implementation Period:<br>• 92% in 2018-2021<br>• Remaining in 2021-2031 | Potential Benefits:<br>Benefits include smooth traffic flow, vehicle safety especially for night time driving and pedestrian safety. |

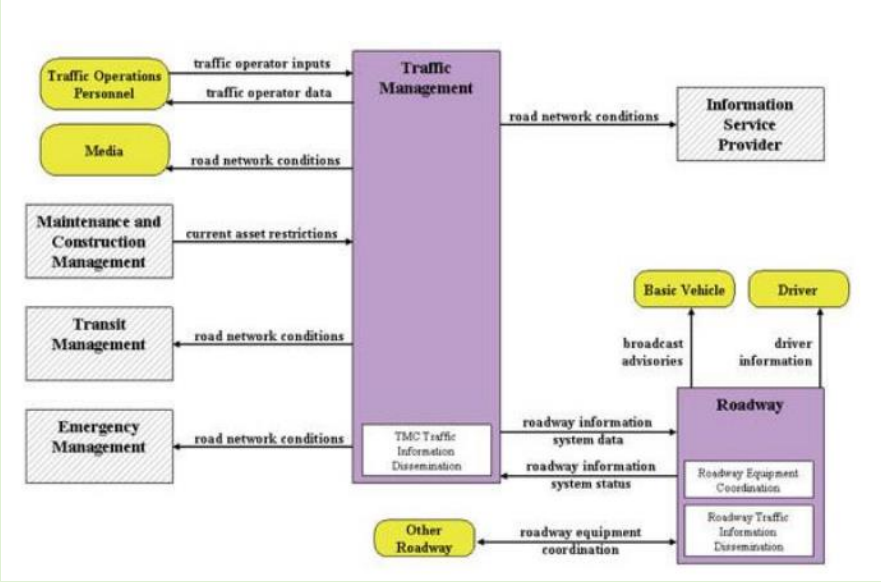
| **Project No: 5** | **Project Title: Provision of Pedestrian Zones and Pedestrian Infrastructure** |
|---|---|
| Project Type: Short Term | Quantity: 4 Nos |
| Location:<br>- Sitabuldi<br>- Mahal<br>- Itwari<br>- Sadar | Block Cost: Rs 8 Crores |
| Detailed Description:<br><br>The restriction on vehicular movement partially or consider it for vehicle free zone or vehicle restriction zone for limited period in a day. |  |
| Implementation Period:<br>• 2018-2021: 1905 | Potential Benefits:<br>Benefits include pedestrian safety, and community based development. |

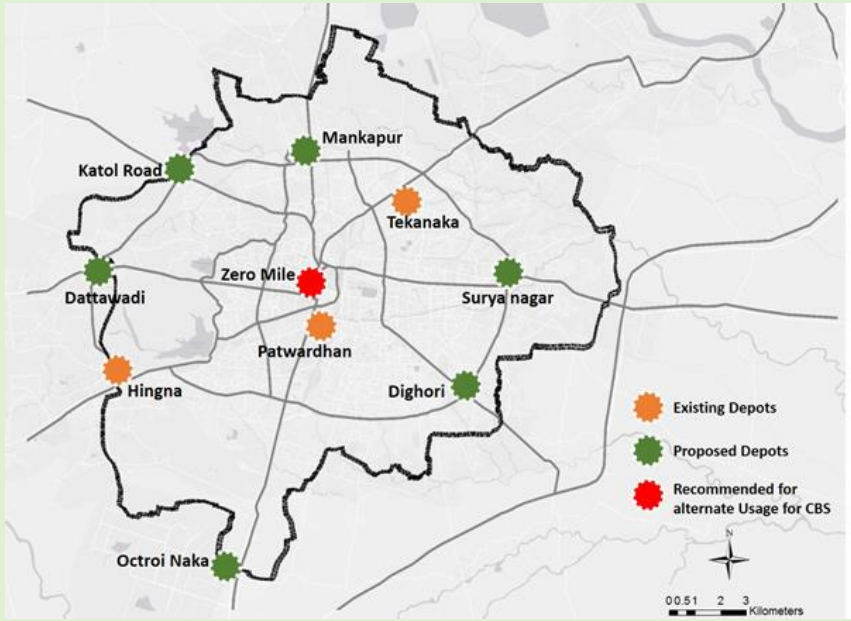
| **Project No: 6** | **Project Title: Bus Augmentation** |
|---|---|
| Project Type: Medium Term | Quantity: 1904 |
| Location:<br>- NMC | Block Cost: Rs 1359 Crores |
| Detailed Description:<br><br>Augmenting the buses based on population and phasing out of old buses<br><br>100% Electric buses |  |
| Implementation Period:<br>Phase I: 2018-2021: 607<br>Phase II: 2021-2026: 820<br>Phase III: 2026-2035: 1904 | Potential Benefits:<br>Benefits include smooth traffic flow, reduced dependency on private vehicles, reduction in pollution. |

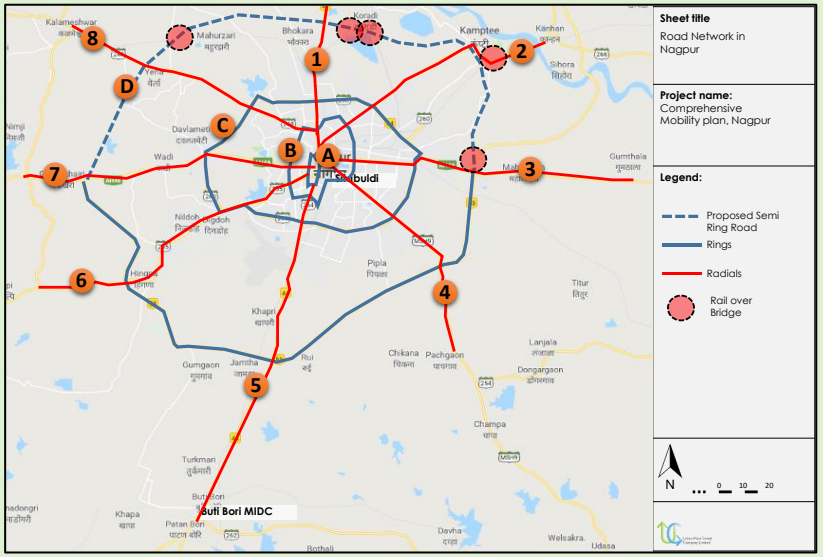
| **Project No: 7** | **Project Title: FOB/ Walkways** |
|---|---|
| Project Type: Medium Term | Quantity: 10 Nos |
| Location:<br>- NMC | Block Cost: Rs 100 Crores |
| Detailed Description:<br><br>Providing safe pedestrian crossing. |  |
| Implementation Period: 2018-2021 | Potential Benefits:<br>Safe Pedestrian Facilities |

| **Project No: 8** | **Project Title: Bus transport Plan - Bus shelters (City bus service)** |
|---|---|
| Project Type: Medium Term | Quantity: 710 Nos |
| Location:<br>- At multiple locations in the city | Block Cost: Rs 45 Crores |
| Detailed Description:<br><br>Well designed and integrated bus shelters to improve the connectivity as well as the integration of different public transit modes. |  |
| Implementation Period: 2021-2031 | Potential Benefits:<br>Increased accessibility to public transport modes |

| **Project No: 9** | **Project Title: Off Street Parking** |
|---|---|
| Project Type: Medium Term | Quantity : 5 Nos |
| Location: | Block Cost: Rs 50 Crores |
| Detailed Description: |  |
| Implementation Period: 2018-2021 | Potential Benefits:<br>When the project is implemented, it is possible to ban parking on the roads in the vicinity. This will improve the traffic circulation in the CBD areas. |

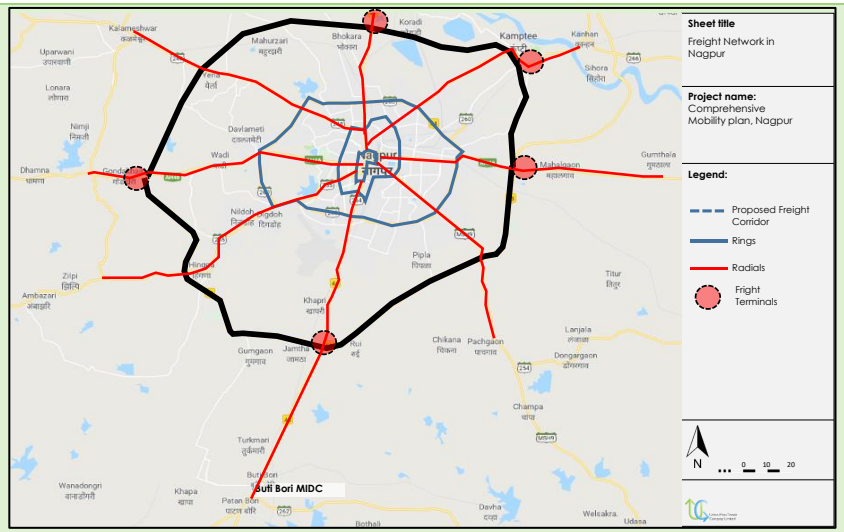
| **Project No: 10** | **Project Title: ITS (Control room / PIS and Traffic Information)** |
|---|---|
| Project Type: Medium Term | Quantity : 1 No |
| Location: | Block Cost: Rs 25 Crores |
| Detailed Description:<br>Shall offer a highly capable and automated transit management platform, which shall enable modern city bus services to provide high level of service along with high operational efficiency |  |
| Implementation Period: 2018-2021 | Potential Benefits:<br>: Improved Safety, efficiency, mobility and accessibility |

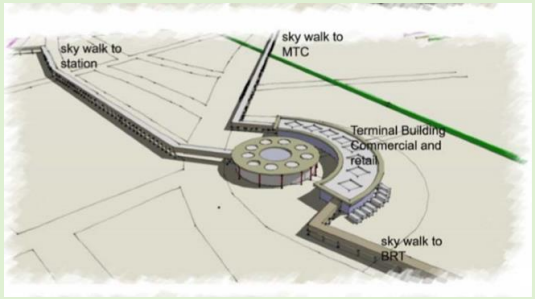
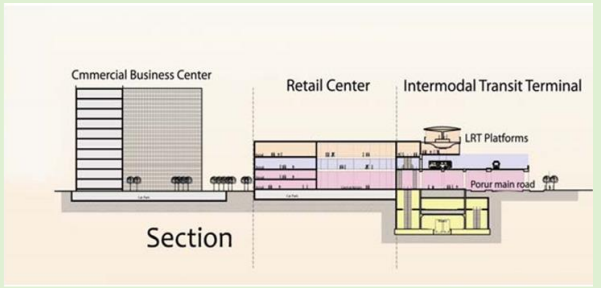
| **Project No: 11** | **Project Title: Development and Upgradation of Bus Depot and Workshop** |
|---|---|
| Project Type: Medium Term | Quantity : 9 Nos |
| Location:<br>- Various locations in the city | Block Cost: Rs 180 Crores |
| Detailed Description:<br><br>Modernization of existing bus depots and terminals and provision of new depots and terminals shall be taken up for efficient operations. The proposed depots shall also have an integrated terminal facility thus acting as origin or destination points for the future routes and minimizing dead mileage. |  |
| Implementation Period: 2021-2031 | Potential Benefits:<br>Upkeep and maintenance of public buses, Increased efficiency of the bus system. |

| **Project No: 12** | **Project Title: ROBs** |
|---|---|
| Project Type: Medium Term | Quantity : 5 Nos |
| Location:<br>Boregaon, Mahadula, Suadevi, Kamptee and Kapsee | Block Cost: Rs 125 Crores |
| Detailed Description:<br>Elimination of rail crossings by providing rail over bridges |  |
| Implementation Period: 2021-2026 | Potential Benefits:<br>Enables continuous traffic movement |

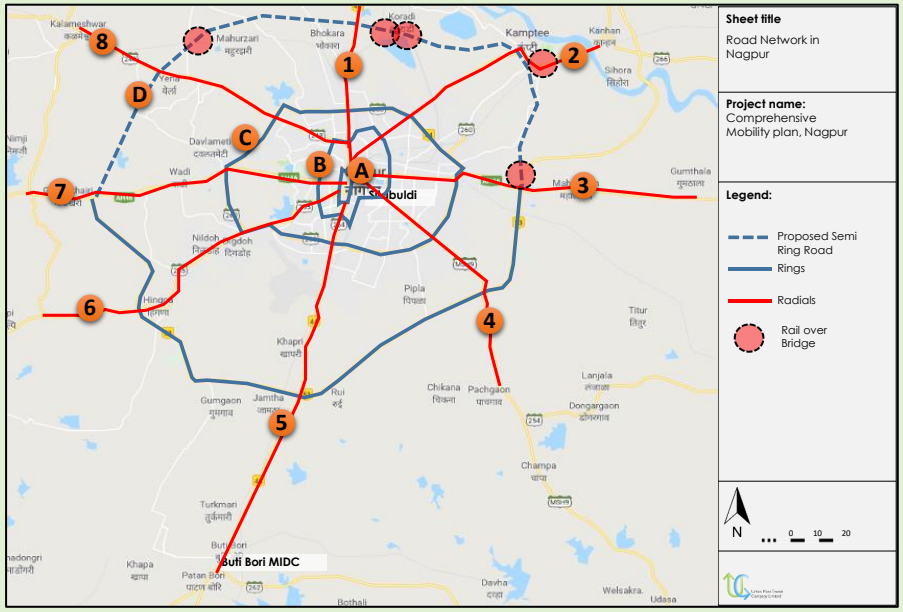
| **Project No: 13** | **Project Title: Redevelopment of Bus terminals – Multi Mobility Hub at Mor Bhawan ans** |
|---|---|
| Project Type: Medium Term | Quantity : 1 Nos |
| Location:<br>At multiple locations in the city | Block Cost: Rs 100 Crores |
| Detailed Description: |  |
| Implementation Period:<br>2021 - 2031 –1 Nos | Potential Benefits:<br>The project is intended to organize/manage the public transport buses traffic in the town in a better way. This proposal will help to avoid haphazard parking on the roads as well as reduces delays and queuing . |

| **Project No: 14** | **Project Title: Bicycle Sharing Scheme - Docking Stations** |
|---|---|
| Project Type: Medium Term | Quantity:<br>Main Docking Station - 9 Nos<br>Sub Docking Stations – 75 Nos |
| Location:<br>- At multiple locations in the city and at metro stations | Block Cost: Rs 12 Crores |
| Detailed Description:<br><br>Public Bike sharing systems are required so that the cycle users can rent the bicycles and travel across the city |  |
| Implementation Period:<br>2018-2021: 9 Main Docking Stations and 31 Sub docking Stations<br>2021-2031: 44 Sub docking stations | Potential Benefits:<br>Easy access to metro users and hence increase in metro ridership |

| **Project No: 15** | **Project Title: Truck Terminals** |
|---|---|
| Project Type: Long Term | Quantity : 5 Nos |
| Location:<br>• Koradi<br>• Kamptee<br>• Kapsi<br>• Gumgaon<br>• Gondakhari | Block Cost: Rs 100 Crores |
| Detailed Description:<br>The fright terminals should have atleast 50 truck parking spaces and all ancillary facilities |  |
| Implementation Period: 2021-2031 | Potential Benefits:<br>The project is intended to organize/manage commercial traffic in the town in a better way. This proposal will help to avoid haphazard parking of trucks on the roads. Also it will add economic benefits to the surrounding area. |

| **Project No: 16** | **Project Title: Multi modal transit hubs** |
|---|---|
| Project Type: Long Term | Quantity : 9 Nos |
| Location:<br>1. Mor Bhawan Bus Terminal<br>2. Sitabardi Bus Terminal<br>3. Ganesh Peth Bus Terminal<br>4. Chatterpati Bus Terminal<br>5. Ravi Nagar Bus Stop<br>6. Nagpur Railway Station<br>7. Ajni Railway Station<br>8. Kamptee Railway Station<br>9. Nagpur Airport | Block Cost: Rs 90 Crores |
| Detailed Description:<br>• An integrated terminal facility with adequate facilities and amenities to cater to the requirements of all user groups.<br>• A mixed-use development with shopping, office spaces and other commercial activity to enable people to fulfill all the needs by using public transport.<br>• Provision of Park-and-Ride facility to encourage the use of public transport. |  <br>  |

| | |
|---|---|
| Implementation Period: 2018-2021 | Potential Benefits:<br>Reduction in Vehicular traffic, congestion on roads, vehicular emissions and therefore increase in speed |

| **Project No: 17** | **Project Title: Missing Links/New Links** |
|---|---|
| Project Type: Long Term | Length ; 50 Km |
| Location: Outer ring road | Block Cost: Rs 500 Crores |
| Detailed Description:<br><br>Major Rings<br>A. Chandrapur Nagur road – Tekdi Road<br>B. W High Court Road – Mescobagh raod – Dr Ambedkar raod – Ajni Road<br>C. Inner Ring road<br>D. Outer New ring* (Existing part ring = Gondakkhairi – Hingna – Gavsi Manapur – Umergaon – Kapsi BK,<br>Proposed part ring = Gondakkhairi – Dahegaon – Mahadula - Kamptee ) |  |

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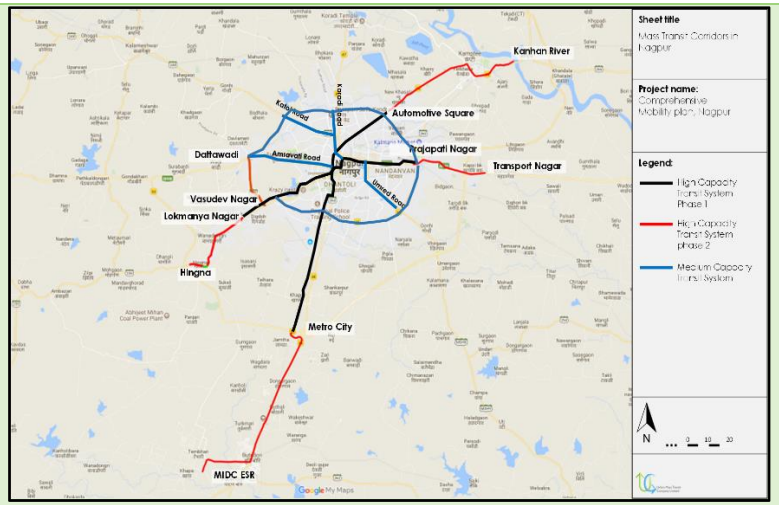
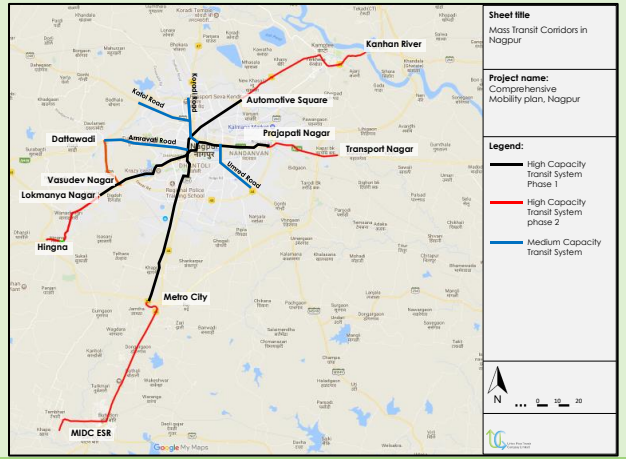
|---|---|
| Implementation Period:<br>2018-2021 | Potential Benefits:<br>Addition of few missing links and widening of the mobility corridors will help to reduce the traffic volume and hence to increase the travel speed. |

| **Project No: 18** | **Project Title: Medium Capacity Mass Transit System** |
|---|---|
| Project Type: Long Term | Length: 56.5 Km |
| Location:<br>1. Katol Road<br>2. Koradi Road<br>3. Umred Road<br>4. Amaravathi Road | Block Cost: Rs 1130 Crores |
| Detailed Description:<br>A bus based (medium capacity) transit system to connect the regions to the city. |  |

| | |
|---|---|
| Implementation Period:<br>2018-2021 | Potential Benefits:<br>Identified mobility corridors will help to reduce the traffic volume and hence to increase the travel speed, increase dependency on public transport. |

| **Project No: 19** | **Project Title: High Capacity Mass Transit System** |
|---|---|
| Project Type: Long Term | Length ; 88.1 Km |
| Location:<br>1. Automotive Square to Khapri Station<br>2. Pardi to Mount View (Hingna)<br>3. Automotive Square to Kanhan River<br>4. Prajapati Nagar to Transport Nagar<br>5. MIHAN to MIDC ESR<br>6. Lokmanya Nagar to Hingna<br>7. Vasudev Nagar to Dattawadi | Block Cost: Rs 35240 Crores |
| Detailed Description:<br>A rail based (high capacity) transit system to connect the major destinations in the city. |  |

| | |
|---|---|
| Implementation Period:<br>2018-2021: 39.8 Km<br>2021-2031: 48.3 Km | Potential Benefits:<br>Identified mobility corridors will help to reduce the traffic volume and hence to increase the travel speed, increase dependency on public transport. |

**Urban Mass Transit Company Limited**
2nd Floor, Corporate Tower, Ambience Mall, Gurgaon 122002, Tel: +91 124 4716300 Fax: +91 124 4716248
Email: umtc@ilfsindia.com Website: www.umtc.co.in

**Nagpur Metropolitan Region Development Authority**
**Station Road,Sadar, Nagpur 400 001**
**Tel No. 2533202, P.B.X. 2531431,32, Fax:0712-2531431**

No. CMP(R) / DDTP(NMRDA)/ 879 Nagpur, Dt. 25 / 12 /2018.

To,

The Director Project,
Maharashtra Metro Rail Corporation Ltd.,
Metro House, 28/2, Anand Nagar, C.K.Naidu
Road, Civil Lines, Nagpur-440001.

Subject :- Updated Comprehensive Mobilty Plan (CMP) of Nagpur city and Nagpur Metropolitan Region.

Refrence:- Your letter No. Maha-Metro/Plg/CMP/NC/2018/287/13608, dated 21/08/2018.

With reference to the above cited letter dated 21/08/2018, it is to inform you that **'Executive Committee'** of the 'Nagpur Metropolitan Region Development Authority', in meeting dated 15/11/2018, has given approval for submission of **Comprehensive Mobilty Plan (CMP)** to the Government for sanctioning on the condition that Nagpur Metropolitan Region Development Authority will not have any financial contribution for the implementation of the said plan.

So the **'Nagpur Metropolitan Region Development Authority'** is giving consent for submission of the Updated Comprehensive Mobilty Plan (CMP) to the Government for sanctioning on the condition that Nagpur Metropolitan Region Development Authority will not have any financial contribution for the implementation of the said plan.

Metropolitan Commissioner
Nagpur Metro Region Development Authority,
Nagpur.

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# NAGPUR MUNICIPAL CORPORATION NAGPUR

MAHANAGARPALIKA MARG, CIVIL LINES NAGPUR – 440 001

No. :- 191 / E.E.(Tr)/2019. Date :- 09/01/ 2019.

To,

Addl. GM/Planning
Maharashtra Metro Rail Corporation Limited
Metro House, 28/2, Anand Nagar,
C.K. Naidu Road. Civil Lines,
Nagpur – 440001

**Kind Attention : Mr. Rajiv Yelkawar**

**Sub :-** Update of Compressive Mobility Plan for Nagpur 2013.

In the above context, the Comprehensive Mobility Plan for Nagpur is herewith approved by General Body meeting of NMC on dated 20/12/2018. Copy of Resolution No. 311 dated 20/12/2018 is enclosed herewith for reference.

**Encl** – Resolution No. 311.

Executive Engineer (Traffic)
Nagpur Municipal Corporation

**Copy Submitted to –**

1) Hon'ble Commissioner, NMC, Nagpur.
2) Hon'ble Chief Engineer, NMC, Nagpur.
3) Superintending Engineer, NMC, Nagpur.

**Copy to :-**

Executive Engineer, Public Works Division-1, Sadar, Nagpur.
For necessary action

# कार्यालय, नागपूर महानगरपालिका, नागपूर

(सचिवालय)

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**नागपूर महानगरपालिकेच्या दिनांक 20/12/2018 गुरूवार रोजी भरलेल्या साधारण सभेच्या कार्यवृत्तातून घेतलेला उतारा.**

ठराव क्रमांक 311:– नागपूर महानगरपालिका ठराव क्र. २८५ दि. २९.०९.२०१८ {वाहतूक विभाग} अन्वये गणेश टेकडी उड्डानपूल तोडण्यास विषयाला लावण्यात आलेल्या उपसुचनेसह विषय मंजूर करण्यात आला असुन Comprehensive Mobility Plan सभागृहाच्या पुढच्या सभेत ठेवण्यात यावा, या मा. सत्तापक्ष नेते श्री. संदीप जोशी यांनी केलेल्या सुचनेसह ठराव मंजूर आहे.

उपरोक्त अनुषंगाने महानगरपालिका सभागृहापूढे Comprehensive Mobility Plan सादर करण्याचा प्रश्न सभागृहाने विचारात घेवून मंजुर मंजुरच्या आवाजाने एकमताने मान्यता प्रदान केली.

सत्य प्रतिलीपी

अधिक्षक
समिती विभाग