SECTION - I INTRODUCTION

Background

Recent rapid urban development in India has resulted in transport problems, such as traffic congestion and an increase in traffic accidents. Although the national and state governments have made substantial efforts to improve urban transport, problems have been exacerbated by the rapidly increasing number of private vehicles.

Existing local government capacity for urban transport planning is still insufficient. Specifically, the following problems are noted:

- Although many proposals have been submitted by local bodies for the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) fund to implement various urban transport projects, including Mass Rail Transit (MRT), Bus Rapid Transit (BRT), flyovers, roads etc., some proposals contained inadequate information and incomplete analyses, therefore the justifications drawn from them for project implementation were not always acceptable.
- One of the main planning issues is that 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 have prepared urban transport master plans by conducting Comprehensive 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 Urban Development (MoUD) 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 in metropolitan regions.

Role of CMPs in the JNNURM Process

The CMP is a key document providing the rationale for transport proposals. Therefore, within the overall planning hierarchy, the CMP can be considered as a prerequisite for the submission of DPR (Level 1) for JNNURM funding. Although it is not mandatory, all cities considering a funding application to central government are recommended to submit the CMP and to obtain approval from MoUD. A separate study for Alternative Analysis is required for major projects with the cost greater than or equal to 5 billion rupees (Rs 500 Crore) in 2008 prices. The Alternative Analysis may be included as part of the CMP or DPR for projects less than 5 billion rupees.

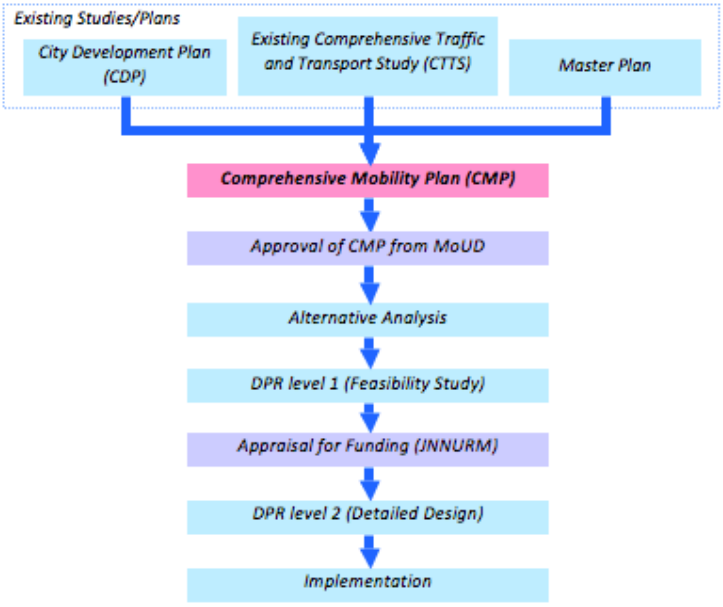


Figure 1 Role of a CMP in the JNNURM Process

Use of Guidelines and Toolkits

The Ministry of Urban Development recommends that the preparation of CMPs and feasibility studies, including DPRs (Level 1), should follow suggested methodologies and approaches as shown in the 'Guidelines and Toolkits for Urban Transport Development.' These guidelines and toolkits are, however, not necessarily complete, therefore, it is up to each city to develop their methodology and to provide the Ministry with their comments to be reflected in future versions of the guidelines and toolkits. The Ministry intends to refine and update these documents to reflect progress in research and technology in the urban transport sector in India and worldwide.

What is a CMP?

Objectives of CMPs

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

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

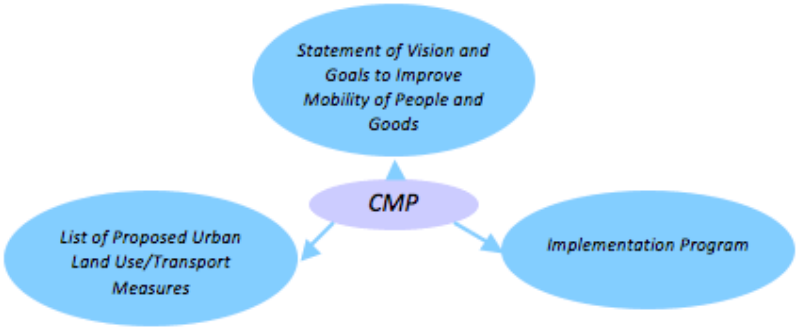


Figure 2 Objectives of a CMP

Main Features of CMPs

The main features of CMPs are the following:

1. To optimize the "mobility pattern of people and goods" rather than of vehicles;
2. To focus on the improvement and promotion of public transport, NMVs and pedestrians, as important transport modes in Indian cities;
3. To provide a recognised and effective platform for integrating land use and transport planning; and
4. To focus on the optimization of goods movement.

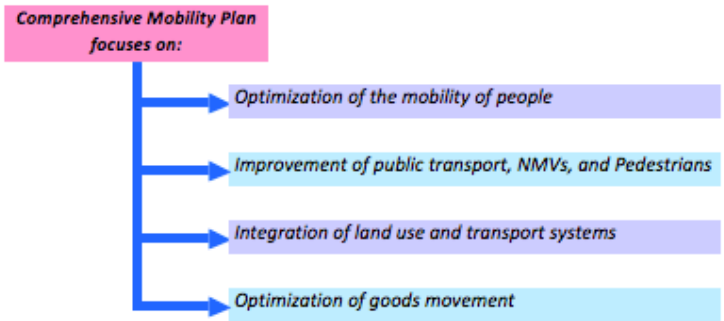


Figure 3 Main Features of CMPs

A CMP focuses on the mobility of people rather than that of vehicles: Conventional urban transport plans focused on addressing issues relating to vehicles and often recommended extensive infrastructure development such as road networks and flyovers. The improvement of vehicle flows in this approach, however, is often achieved though decreased mobility of pedestrians, NMV and public transport users. Consequently, mobility of people as a whole has not been appropriately addressed. The CMP, on the other hand, focuses on mobility of people to address urban transport problems, to promote better use of existing infrastructure, improvement of public transport, pedestrian and NMV facilities. It also emphasizes integration of land use and transport development.

A CMP focuses on improvement and promotion of public transport, NMVs and pedestrians as important city transport modes: Promotion of the use of public transport, NMVs and pedestrians is vital for improving the mobility of people in urban areas. Public transport and NMVs are widely recognized internationally as environmentally friendly transport means and should be promoted to reduce the rate of increase in the number of vehicles.

A CMP provides a platform for integrating land use and transport planning: Since land use patterns directly influence travel patterns, it is essential to examine desirable land use patterns in cities from the viewpoint of urban transport development. For instance, commercial and residential area development should be integrated with mass transit development, in pursuit of transit-oriented development, reducing dependence on private vehicles. Such integration of land use planning and urban transport planning is urgently required in Indian cities (and in cities everywhere).

A CMP develops an urban transport strategy that is in line with the National Urban Transport Policy (NUTP): Since the NUTP is the upper-level strategy on urban transport development, all CMPs should pursue the concept of the NUTP, contribute to introducing NUTP strategy into each city and propose specific measures to realize the NUTP concept.

Key Outcomes of CMPs

In accordance with the objectives set out above, a CMP includes the following major outcomes: long-term visions and goals, a preferred form of urban growth and a list of proposed urban transport measures and priority projects. As a long-term strategy document, a CMP should include a clear statement of visions and goals consistent with the NUTP, as CMPs follow the concepts of the NUTP. It should also detail comprehensive transport development measures including high priority projects and project sheets. Indicative costing and implementation schedules need to be provided in the CMP. The primary objective of the recommended measures is to improve the mobility of people in the short, medium and long term.

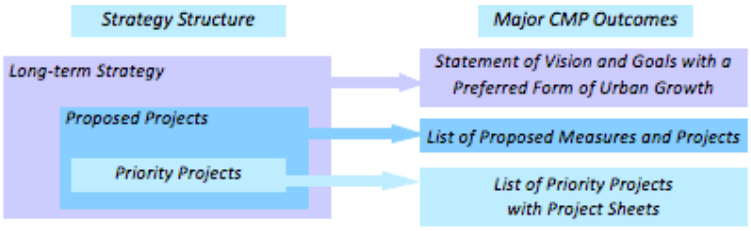


Figure 4 Key Outcomes of CMPs

Relationships between a CMP and Other Existing Plans

There are a few important plans and studies that need to be referred to when a CMP is prepared: **City Development Plans (CDPs)** and **Master Plans** and **Comprehensive Traffic and Transportation Studies (CTTS)**. A comparison of the tasks involved in these plans and studies is summarized in Table 1 and the relationship with the CMP is explained below.

Table 1 Illustrative Comparison of Major Tasks of CMPs and Other Existing Transport Plans

Major Tasks	Existing CDP	Existing Master Plan	Existing CTTS	CMP
Review of Existing Transport System	✓		✓	✓
Transport Demand Survey			✓	✓
Review of Land Use Plan		✓		✓
Analysis of Urban Transport Situations			✓	✓
Preparation of Future Land Use Scenario		✓		✓
Future Transport Network Scenario				✓
Transport Demand Forecast Model			✓	✓
Network Evaluation				
Preparation of Mobility Framework				✓
Formulation of Urban Transport Measures	✓	✓	✓	✓
Social and Environmental Impact Assessment				✓
Institutional Scheme for Project Implementation				✓
Preparation of Implementation Programs	✓		✓	✓
Stakeholder Consultation	✓	✓	✓	✓
Periodical Update and Maintenance		✓		✓

Relationship with the CDP

A City Development Plan (CDP) is prepared by each city in advance of requesting JNNURM funds from MoUD. The CDP addresses various urban development sectors, including urban transport. Usually, CDPs include project proposals for both infrastructure and regulatory measures, but the development of urban transport measures is not comprehensive. CDPs rarely adopt a transport modelling approach and do not include a clear strategy regarding long-term urban transport development and the 'mobility' concept. Comprehensive Mobility Plans (CMPs) will review transport sector programs and integrate them into more comprehensive transport sector programs that focus on integration of land use and transport and improvement of the mobility of people. A CDP also provides valuable information regarding the existing and future development of the urban area.

Relationship with the Master Plan

A Master Plan (or Development Plan) is a statutory document for guiding and regulating urban development. It is prepared by urban development authorities in each metropolitan area, defines the future area for urbanisation, and addresses planning issues for various sectors. The transport sector plan, however, is one of the most important sectors, and contains development measures such as road network (arterials, collectors, and distributors etc.), parking facilities and MRT systems. In preparing a CMP in target cities, where a Master Plan is available, it should serve as an input to the CMP. In this process, the CMP reviews the future land use patterns in the Master Plan from the mobility optimization point of view and selects a preferred pattern of land use/transport integration if necessary. If the recommendation by the CMP on urban growth pattern differs from the one in the Master Plan, the CMP recommendation may be reflected in a future version of the Master Plan. For cities where a Master Plan is not available, a CMP must be prepared first and used as an input for the preparation of the Master Plan.

Relationship with the CTTS

Some cities have already conducted CTTSs by examining traffic and transport issues and recommending improvement measures. Some of these documents concerned mainly roads and flyovers, while others proposed MRT systems. While existing CTTS documents focus on vehicle flows, the CMP will concentrate on the mobility of people. A CMP addresses a wider range of land use/transport issues and investigates a wider spectrum of policy options to bring the city towards its desired mobility patterns. As the CTTS is a transport sector study, the information, methodology (including demand modelling) contained and recommended projects/programs are highly relevant to the CMP tasks. All of these findings are, however, carefully reviewed in the process of CMP preparation so as to achieve vision and goals to optimize the mobility pattern of the metropolitan region.

FAQs on Comprehensive Mobility Plan

What is a CMP?

A CMP presents a long-term vision of desirable mobility patterns (people and goods) for a city and provides strategy and policy measures to achieve this vision. It should follow the NUTP, which emphasizes the importance of pedestrian facilities, non-motorized transport measures, and public transport systems, including buses and sustainable mass rapid transit systems.

Who should use this toolkit?

Targeted users of this CMP toolkit include policy makers, city authorities and consultants. The toolkit provides: (i) guidance in setting CMP visions/objectives for policy makers; (ii) the structure and process of CMP development for city authorities, and (iii) detailed tasks to be performed by consultants.

Why is it called a Comprehensive Mobility Plan (CMP)?

Existing CTTS documents typically focus on mobility needs of car users, while CMPs are to address the mobility needs of all people and the infrastructure requirement for all modes, as

well as to integrate both the land use (i.e., the spatial distribution of activities) and transport systems. The “comprehensive” in CMP conveys this all-encompassing scope. Existing CTTS documents allocate the majority of resources to “solving” vehicle congestion, while CMPs will focus on providing “mobility” for all people, the most important issue to be addressed for effective and sustainable urban development.

Who should be responsible for the preparation of CMP?

City authorities should be responsible for the preparation CMPs. During the process of the CMP preparation, it is recommended to establish an advisory committee consisting of key stakeholders and to organize seminars and workshops to obtain feedback from a wider audience.

Is a CMP different from a CTTS?

Yes, a CMP differs from a CTTS. While the focus of a CTTS is on the mobility of vehicles, a CMP concentrates on the mobility of all people. CMPs address a wider range of land use/transport issues and investigate a wider spectrum of policy options to bring the city towards desired mobility patterns.

Do we need a CMP when a CTTS has already been prepared and approved?

Yes. Cities with an approved CTTS should also prepare a CMP in order to reexamine the effectiveness and sustainability of policy measures. However, if the existing CTTS follows closely the tasks required for a CMP, the Ministry may ask only for an improved CTTS and may not require the city to prepare a wholly new CMP.

What should a city do when the preparation of a CTTS has already started?

If the city has made significant progress, it should continue preparing the CTTS and later prepare a CMP reflecting the findings of the CTTS. If CTTS preparation is still at an early stage, the city may modify the terms of reference and commence preparation of a CMP instead.

Who should be involved in the preparation of a CMP?

Preparation of a CMP should involve not only the engineering division, which is responsible for building roads, but also the municipal/state passenger transport authority, as well as the city development authority. In addition, other relevant agencies and stakeholders should be consulted throughout the planning process.

Why do CMPs need to be prepared BEFORE feasibility studies of specific projects?

The Ministry of Urban Development has been receiving a number of DPRs for specific projects from many cities that fail to examine the wide range of policy options available. The projects often represent preconceived “solutions” and the documents try only to justify such “solutions”. The Ministry considers that the submission of a CMP is a prerequisite for the submission of DPRs, because any projects or policy measures recommended should effectively contribute to the attainment of “comprehensive mobility” visions that are effective and sustainable from the long-term perspective of future city development.

How much detail is required in recommended policy measures included in a CMP?

Although a CMP serves as a visionary document, it should provide a clear and logical methodology. As such, any project recommended in a CMP should be broadly defined in its characteristics, such as basic concepts, form, area covered, components, preliminary estimation of costs, financing options, implementation organization and social/environmental implications. A further level of detail required for feasibility assessment and detailed design should be performed after the CMP is approved.

Is the application of demand modelling always necessary to prepare a CMP?

It is recommended that the strategy for land use and transport development be based on a scientific approach. For cities where demand models have already been developed, for example within the existing CTTS, the models should be utilized to in preparing the CMP. For cities with limited time and resources, a simplified approach to transport demand modeling may be applied. A simplified modeling technique adopts techniques, such as a reduced sampling rate for the OD survey, use of larger traffic zones, use of strategic transport network, which help resource and time required for transport demand modeling.

What are the planning horizons of a CMP?

The typical CMP planning horizon will be 20 years, but CMPs should also cover actions to be taken within 5 and 10 years.

Do CMPs need to be updated regularly?

Yes. Since cities are constantly changing, it is recommended that every city update its CMP at least once every five years.

SECTION - II CMP PREPARATION PROCESS

Understanding Key CMP Tasks

The major tasks to develop a CMP are set out below and shown in Figure 6. Detailed task descriptions are found in Section III.

- **Task 1 Identification of Scope**
- **Task 2 Data Collection and Analysis of the Existing Urban Transport Environment**
- **Task 3 Preparation and Evaluation of the Urban Transport Development Strategy**
- **Task 4 Development of Urban Mobility Plan**
- **Task 5 Preparation of the Implementation Program**

Task 1 Defining Scope of the CMP

As a preparatory task, the scope of the CMP should be clearly defined. Specifically, the document should indicate:

- Planning Area; and
- Target Year or Planning Horizons (long, medium and short term).

Planning Area

The target area should be clearly described at the beginning of the CMP. The planning area of a CMP should cover the "Agglomerated Area," rather than the area within the municipal boundary. The planning area for CMP can be adopted from the Master Plan.

A CMP must be prepared not only catering for city transportation needs, but also to the need for connectivity with satellite towns and Special Economic Zones (SEZs). Since the future limits of the city will be influenced by the development of transport corridors, CMPs must take into consideration the entire planning area in relation to major activity areas outside the planning area. If implemented in isolation, it will be difficult to optimize mobility patterns as addressed in the vision and goals statements.

Planning Horizon

The CMP planning horizon is to be 20 years from the base year. In addition, 5 years and 10 years should be defined as the short-term and medium-term target years, respectively. Since the social and economic situation in Indian cities is rapidly changing, a CMP should be updated at least every five years.

Task 2 Data Collection and Analysis of the Existing Urban Transport Environment

To better understand the existing urban transport system, data collection and analysis is required. Necessary data and information can be obtained through a literature review (secondary data collection) of previous studies or field surveys (primary data collection). In particular, the following categories of data/information should be collected and analyzed, in addition to more conventional highway and automobile related information: (i) land use planning, (ii) NMVs; and (iii) public transport.

For the analysis of urban transport characteristics, transport indices such as those formulated by Traffic and Transportation Policies and Strategies in Urban Areas in India (MoUD, 2008) can be used to compare the subject city with other cities applying the same standards. As each city has its own characteristics, specific issues should be identified and presented based on the data/information obtained. (An example application of information is shown in Annex 5)

- **Task 2-1 Review of the City Profile**
- **Task 2-2 Review of Land Use Pattern**
- **Task 2-3 Review of the Existing Transport Systems**
- **Task 2-4 Transport Demand Surveys**
- **Task 2-5 Analysis of Existing Traffic/Transport Conditions**

Task 2-1 Review of the City Profile

A brief description of the profile of the planning area should be presented. The relevant section may include:

- Location;
- Recent population trends;
- Land area;
- Regional linkages;
- Demographic information;
- Socio-economic data; and
- Environmental issues, such as natural conservation areas.

The description in this section may be simpler if the required information/data are retrieved from existing planning/study documents.

Task 2-2 Review of Land Use Pattern

Data on existing land use pattern and land use plans should be collected and presented in the CMP, through a detailed review of existing development plans, including the Master Plan and/or the City Development Plan (CDP). Such plans show existing land use patterns and planned growth scenario, as well as the location and relationship between/among different land uses e.g., residential, slum, commercial, industrial, utility, recreational, transportation, agriculture, wasteland, forest and body of water.

In particular, new development areas that will affect future transport demand should be thoroughly reviewed and summarized in Survey Form 4-1 in Annex 1.

Task 2-3 Review of the Existing Transport Systems

It is important to properly understand the existing transport situation in order to develop a rational land use and transport plan and mobility improvement measures in a CMP. Types of information required at this stage include the following (suggested data items to be collected are shown as survey forms included in Annex 1):

(1) Review of Existing Studies, Reports and Proposals

All existing transport-related studies, plans, proposals, laws and standards should be compiled and be briefly summarized. All projects related to urban transport under construction, design, planning and preparation, as well as institutional and organizational measures, should be summarized and listed.

Review of Existing Studies, Reports and Plans:

- City Development Plan
- Master Plan
- Comprehensive Transport and Traffic Studies
- Industry Development Plan
- Detailed Project Reports (DPRs) related to Transport Measures
- Any other related plans/studies

A table is to be prepared to compare problems and analyses addressed in each report/study. A sample form is shown in Survey Form 1-1A of Annex 1.

Review of Existing Legal Framework and Standards:

- Laws and regulations related to transport/traffic
- Engineering design standards
- Environmental standards
- Regulations related to social issues such as involuntary resettlement

Inventory of Planned/Proposed and Ongoing Projects: Literature reviews, as well as an inventory of projects proposed or planned in the existing reports or studies, or by relevant agencies, should be listed and summarized in Survey Form 1-1B included in Annex 1.

(2) Review of Existing Transport Infrastructure

Review of existing transport infrastructure and facilities includes: roads, flyovers/ underpasses, intersections, parking, safety facilities, traffic signals, pedestrian and NMV facilities, and traffic calming facilities. Critical areas of the existing system should be identified for more detailed analysis. Some of this information will be used in preparing a network model for demand forecasting and in assessing road capacity and flow/capacity, in addition to providing essential geometric data for potential improvements. Suggested review

items for existing transport infrastructure are listed in Table 3 and example survey forms are shown in Annex 1.

Table 3 Suggested Review Items for Existing Transport Infrastructure

Survey Items	Description	Sample Form
Outline of Road Network	In order to provide a comprehensive outline of the city's road network, collect information such as road length, right of way, and road density.	Survey Form 1-2A
Inventory of Arterial Road Network	Compile inventory of the arterial road network of the city to be used for subsequent development of a transport demand model.	Survey Form 1-2B
Inventory of Flyovers and Underpasses	Identify all existing flyovers at intersections, railway over bridges (ROBs), and railway underpasses.	Survey Form 1-2C
Inventory of Major Intersections	Identify and inventory critical intersections and roundabouts, in particular those intersections that are important from the viewpoint of the entire road network or that are heavily congested.	Survey Form 1-2D
Parking Facilities	Review of the city's existing parking facilities for both on-street and off-street parking.	Survey Form 1-2E
Traffic Control Facilities	Compile a list of traffic control facilities such as signals.	Survey Form 1-2F
Pedestrian Facilities	Summarize data on pedestrian facilities.	Survey Form 1-2G
NMV Facilities	Facilities for non-motorized vehicles (NMVs), such as bicycles and cycle-rickshaws are recognized as an important component of a sustainable transport plan.	Survey Form 1-2H
Level Crossing	Collect data on level crossings as level crossings are not only major bottlenecks of the network, but also cause accidents for both road traffic and the railway.	Survey Form 1-2I
Public Transport and Paratransit Facilities	Prepare a list for bus stops, paratransit stops, parking and terminals.	More details in the next section
Maps of road infrastructure and facilities	Based on the above inventories, prepare maps indicating locations of infrastructure measures.	

(3) Review of Public Transport Systems

The existing public transport system (bus services) in terms of infrastructure (e.g., bus lanes, stops, and terminals), fleet size/types, fare structure and regulatory and institutional framework is to be reviewed at this stage (Table 4). This task aims at identifying the areas where services are inadequate and there is scope for improving existing services. The task requires, for example, interviewing public transport operators to obtain information on operational characteristics, route structure, financial status and opinions on required improvements.

Table 4 Survey Items for Public Transport

Survey Items	Description	Sample Form
Inventory of Available Public Transport	In a city where buses are operating, the CMP will clarify the public bus situation, including that of mini buses, but excluding inter-city bus services.	Survey Form 1-3A
Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators		Survey Form 1-3B
Map of All Public Bus Routes	An initial survey will be undertaken to identify and map all public bus routes in the city and vicinity, including the neighbouring towns, for public bus operators licensed by the state government. The contents of these bus network route maps may include, but not be limited to, the following: • Designated bus routes; • Terminals and transfer points; • Names of bus stops (for those that have a name); • Names of final destinations; • Major street names and common destinations; and • Route coverage area (area within 500m from bus routes).	
Inventory of Paratransit	Paratransit modes such as auto rickshaws, cycle rickshaws, and taxis, are an important component of public transport operations in most Indian cities, especially in cities where bus services are not provided.	Survey Form 1-3C
Inventory Intermodal Facilities	Intermodal facilities including bus terminals, railway stations, airports, and ferry ports are essential elements in the public transport system.	Survey Form 1-3D
Inventory of River Transport	River transport, including ferry transport, fulfils an important role in some Indian cities, e.g., where a major river cuts across the city centre.	Survey Form 1-3E

(4) Review of Urban Goods Distribution

A review of urban goods distribution includes: location and function of major freight terminals, markets; regulation, and practices relating to heavy goods vehicles, transporting hazardous goods movement, such as petroleum products.

(5) Review of Traffic Safety and Enforcement

Traffic safety is one of the most important urban transport issues. A review of accident data collection methods and analysis should be made (Table 5) and potential improvement measures should be identified. It is recommended that targets for accident reduction and measures to improve safety in the areas of engineering, education and enforcement be included in the CMP.

Table 5 Survey Items for Traffic Safety and Enforcement

Survey Items	Description	Sample Form
Inventory of Traffic Accidents	Collect statistics on traffic accidents and outline trends.	Survey Form 1-4A
Hazard Map of Traffic Accidents	Prepare a map showing the number of accidents and locations to identify accident-prone spots. Locations with a high number of accidents may indicate deficiencies in the network, such as problems related to geometric design, signalling, engineering and provisions for vulnerable road users.	
Enforcement	Enforcement is a key aspect in realizing an efficient urban transport system.	Survey Form 1-4B

(6) Review of Institutional and Financial Situation

Information regarding institutional arrangements for planning, implementation and coordination of urban transport development should be reviewed (Table 6).

Table 6 Survey Items for the Institutional and Financial Situation

Survey Items	Description	Sample Form
Inventory of Agencies/Organizations Active in Relation to Urban Transport	Review the overall organization and hierarchy of the government in relation to land use and transport systems development.	Survey Form 1-5A
Assessment of Planning, Implementation and Coordination Capacity	Capacity in planning, implementation and coordination of urban transport measures are important issues for	Survey Form 1-5B

	Indian cities.	

(7) Review of Environmental and Social Conditions

Motor vehicles directly contribute to air pollution and cause social problems. In order to understand the current situation, initially, existing information, standards and monitoring data should be collected through a literature review.

Environmental Conditions and Issues: Urban transport affects several environmental parameters, including air pollution (including CO2 emissions), noise and vibration. Data should be sought on these parameters from relevant environmental agencies and further sampling be carried out where data are inadequate, missing, or out of date. In this way, the importance of these issues can be reviewed and appropriate mitigation measures be recommended. The following items should be summarised and presented in the CMP:

- Issues on air pollution, noise and vibration;
- Issues on regulations and standards on air pollution, noise and vibration;
- Regulations and standards on vehicle emissions and vehicle inspection; and
- Other major city environmental issues relating to urban transport.

Social Conditions: Urban transport is strongly related to social problems such as involuntary resettlement and urban poverty. Data should be collected on these issues from relevant agencies and further sampling carried out where data are inadequate, missing, or out of date. In this way, the importance of these concerns can be reviewed and appropriate mitigation measures be recommended. The following items should be summarised and presented in the CMP:

- Poverty situation;
- Resettlement issues;
- Mobility and accessibility issues for the poor; and
- Other major city social issues.

Task 2-4 Transport Demand Surveys

Traffic demand data such as traffic volume and origin-destination (O-D) data are essential for urban transport planning. The following surveys should be carried out.

(1) Collection of Transport Demand Data

Information such as population and employment distribution, is essential in transport demand modelling. This type of information relates to the land use pattern of the metropolitan area. The following data (Table 7) should be collected.

Table 7 Survey Items for Transport Demand Data

Survey Items	Description	Sample Form

Population and Socio-Economic Conditions	Collect population and socio-economic indices by zone, which should be as small as possible. Zones may consist of one or more census districts.	Survey Form 2-1A
Vehicle Ownership Survey	Collect vehicle ownership data for the same zones as above.	Survey Form 2-1B

(2) Traffic Volume Surveys

Traffic volumes should be inventoried on all major roads by reference to existing traffic counts and by new surveys. Since traffic data are also necessary for developing and calibrating a transport demand model as well as updating it, the survey should not be conducted on an ad hoc basis, but systematically. Required traffic surveys are described in Table 8 and the concepts of screen-line and cordon-line surveys are shown in Figure 8.

Table 8 Survey Items for Traffic Volume Surveys

Survey Items	Description	Sample Form
Screen Line Survey (optional)	A screen line survey identifies major traffic movements between two areas divided by a screen line such as a river or railway.	Survey Form 2-2A
Cordon Survey	A cordon survey is a traffic count survey on a major cordon line that shows the volume of traffic entering/departing a target area or a city centre.	Survey Form 2-2A
Intersection Turning Movement Survey	Measures turning movements at key intersections during the morning and evening peak hours.	Survey Form 2-2B
Queue Length Survey	A queue length survey at major bottlenecks can show the severity of traffic congestion quantitatively	Survey Form 2-2C
Travel Speed and Time Survey	Conduct travel speed and time surveys on main corridors and strategically important roads in order to assess the efficiency of the road network at both peak and off-peak times.	Survey Form 2-2D

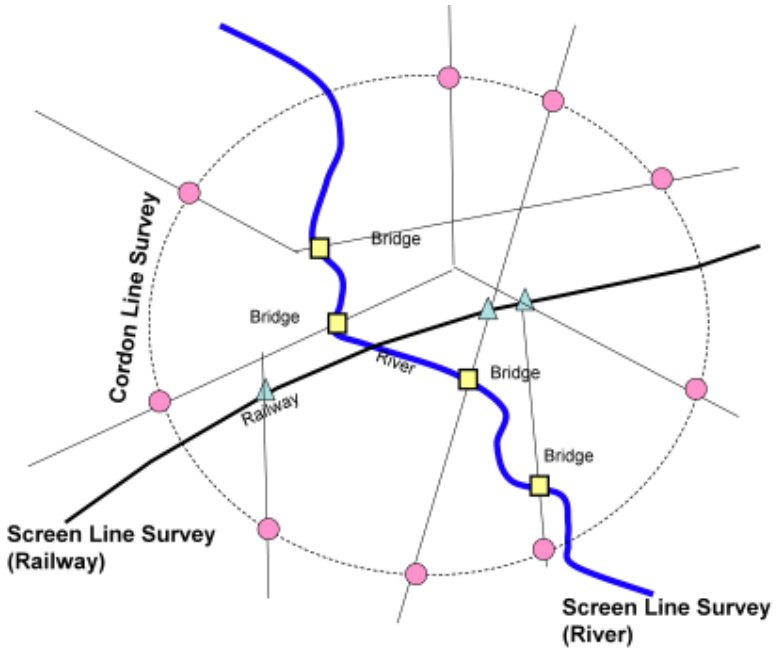


Figure 8 Concept of Screen Line Survey and Cordon Line Survey

(3) Implementation of an Origin-Destination (O-D) Survey

O-D surveys to establish travel patterns (where people are moving to/from) can be carried out by a household interview survey, a commercial vehicle survey and a roadside interview survey. The results of these surveys are used to develop O-D matrices, to calibrate a transport demand model (Annex 4 describes the tasks involved in the four step transport demand modelling).

Household and roadside O-D surveys should be conducted. Table 9 summarizes the characteristics of these surveys.

Table 9 Outline of Origin-Destination Survey

	Household O-D Survey	Roadside O-D Survey
Objective	To identify the travel activities of residents.	To clarify the travel movements between locations outside and inside the metropolitan area.
Methodology	Interview survey of each household.	Interview survey of drivers on target roads.
Survey Area and	The whole CMP target area.	On major roads on the border of the target area (the same as the cordon line traffic count survey).
Zoning	The survey zones should basically follow the census district pattern. A zone may consist of one or more census districts.	Zoning should be consistent with that in the household O-D survey.

Questionnaire Forms	Survey Form 2-3A(1) and (2)	Survey Form 2-3B
Sampling Rate	A sampling rate of 4% in each zone is preferable. If there are significant time and cost constraints, the sample rate may be reduced to 1%.	A sampling rate of 20% of all traffic on the road is recommended. The rate can be reduced on roads with heavy traffic.

(4) Implementation of a Traffic Movement Survey

To complement the above surveys, the survey shown in Table 10 should also be conducted.

Table 10 Outline of Traffic Movement Survey

	Public Transport Vehicle Movement Survey	Freight Vehicle Movement Survey
Objective	To identify the travel movements of buses, taxis and rickshaws	To identify truck movements
Methodology	Interview survey of public transport vehicle drivers, including drivers of buses and rickshaws	Interview survey of truck drivers
Questionnaire Forms	Survey Form 2-4A	Survey Form 2-4A
Sampling Rate	A sampling rate equal to 20% of the total number of registered vehicles is preferable.	A sampling rate equal to 20% of the total number of registered vehicles is preferable.

(5) Development of Base-Year Transport Demand Model

In the CMP preparation process, transport demand modelling is used to analyse/evaluate urban land use and the transport system. The modelling technique provides a quantitative and scientific approach to improving mobility. The CMP modelling technique emphasizes person-based travel patterns, along with vehicle movements. It includes more NMV/pedestrian movements than conventional modelling approaches. It also enables integrated planning of urban land use and the transport system.

In this task, a base-year demand model will be developed by using the results of the O-D survey. Key steps in the demand modelling are elaborated in Annex 4.

Task 2-5 Analysis of Existing Traffic/Transport Conditions

Based on the information/data collected and analyzed above, a basic analysis of existing transport and traffic conditions should be carried out to identify the characteristics and issues for each city.

(1) Analysis of Travel Characteristics

Based on the results of the traffic surveys, the travel characteristics of the metropolitan region should be analysed:

Major Travel Pattern: Major travel patterns must be identified from the results of the base-year modelling analysis. The following drawings may be prepared:

- Desire line drawings: Desire lines can be used to represent travel demand. Through such drawings, major travel corridors can be identified.
- Drawings of major traffic corridors: The major movements should be shown as traffic corridors. Usually such corridors follow the trunk road network, such as along national highways.

Trip Characteristics: The following trip indices should be presented in the CMP:

- Trip length distribution;
- Average trip length;
- Average cost of trip;
- Trip rate (trips/person/day);
- Modal share (with and without walking); and
- Average occupancies for each mode.

(2) Analysis of Vehicular Traffic and Bottlenecks

Vehicle Traffic Characteristics: The following information may be summarized, based on the output of the base-year transport demand analysis:

- Drawing showing volume/capacity (V/C) ratios on the road network;
- Drawing showing travel speeds on the road network; and
- Average travel speed in the city.

Bottleneck Analysis: Bottleneck road sections, intersections and level crossings should be identified. Bottleneck sections on roads are usually identified by examining V/C ratios. Roads with the highest V/C ratios are most likely to suffer from bottlenecks. The reasons for the bottlenecks identified should be analyzed, e.g., insufficient road capacity, lack of alternative routes. It should be noted that this analysis is mainly for vehicle trips and not for trips by NMVs and public transport.

(3) Analysis of Social Conditions

Social considerations are an essential part of urban transport development. Urban transport for the poor should be considered at all stages of development. The following indices, which can derived from the household O-D survey, may be useful to assess social conditions:

- Distribution of income level;
- Average trip length by income level by purpose;
- Per capita trip rate by income level; and

- Vehicle ownership rate (bicycle, motorcycle and car) by income level.

(4) Identification of Issues

From the data collection and analysis described above, a comprehensive list of issues and problems concerning the transport network should be compiled, with an indication of severity. These issues will form the basis for further study and recommendations, in devising appropriate, strategic and sustainable solutions.

Survey Form 6-1A shows typical problems or issues that may arise within a city's urban transport system. The list is by no means exhaustive and other specific issues in each city should be described.

(5) Comparative Analysis of Urban Transport Environment

Extensive data collection and analysis in 30 cities was carried out by Ministry of Urban Development. The statistical information contained in this study provides an opportunity to compare mobility conditions of various cities and therefore to identify specific mobility issues of the concerned city. The indices shown in Table 11 can be used to diagnose mobility issues.

Table 11 Index for Comparative Analysis

Index	Description	Average Value	Data Source
Congestion	1 - (Average travel speed/30)	0.25	Base-Year Traffic Model
"Walkability"	(Footpath length / Length of major roads in the city) x 0.5 + (rate estimated based on estimates of available pedestrian facilities) x 0.5	0.52	Road Infrastructure Survey
City Bus Transport	Number of public and private city buses per 100,000 people	14	Public Transport Survey
Safety	(Number of annual traffic accident deaths per 100,000 people) x 0.5 + (Number of fatalities per 100,000 people) x 0.5	0.10	Traffic Safety Survey
Paratransit	Number of paratransit vehicles per 100,000 people	61	Public Transport Survey
Slow Moving Vehicles	Slow moving vehicle share in total trips	0.07	Household O-D Survey
Trip Distribution	Average trip length (km)	5.2	Household O-D

			Survey
NMVs	Number of NMVs per 100,000 people	To be prepared	Socio-economic survey
Passenger Vehicle	Number of passenger vehicles per 100,000 people	To be prepared	Vehicle Ownership Survey

Based on the above, a diagnosis of transport conditions in the subject city can be undertaken. The flowchart and checklists shown in Annex 5 may be used to identify high priority measures.

Task 3 Development of Integrated Urban Land Use and Transport Strategy

The urban transport strategy should be presented in the CMP. Upper-level strategy visions and goals should be developed. Also, several strategic scenarios for urban growth and the trunk network should be developed. Through the evaluation of these scenarios, preferred future urban growth and trunk transport networks should be identified.

To properly evaluate scenarios, a transport demand forecasting model should be developed. This will be a strategic model, providing an overview of travel behaviour; it need not be as precise and detailed as will be required for the Detailed Project Report.

- **Task 3-1 Development of Vision(s) and Goals**
- **Task 3-2 Preparation of Urban Growth Scenarios**
- **Task 3-3 Future Transport Network Scenarios**
- **Task 3-4 Development of Urban Land Use and Transport Strategy**

Task 3-1 Development of Vision(s) and Goals

It is essential that transport interventions form a coherent package with a consistent vision and goals for the desirable direction of city urban transport. Vision(s) and goals should be developed that clarify how transport measures will comprehensively benefit urban transport and these should be presented clearly in the CMP.

(1) Vision Statement

As a long-term strategy document, a CMP should include a clear statement of visions and goals, based on a review and diagnosis of the urban transport environment. The visions and goals define the desired long-term urban transport system. While visions are statements of the desirable direction of urban transport development, goals are quantitative/qualitative targets for major indices, to be achieved within the planning horizons. Such indices include average travel speeds and average volume/capacity (V/C) ratios. The emphasis should be on the improvement of specific measures for NMVs and pedestrians. Visions and goals should be consistent with the NUTP, as CMPs follow the concepts of the NUTP.

Box 1 Example of CMP Vision and Goals Statement

Example Vision Statement:

1. To improve connectivity and travel throughout the city and its region.
2. To improve mobility within neighbourhoods, wards, zones and satellite towns to address inner- and inter-city transportation needs.
3. To achieve efficient arrangement of land use and transport systems to minimize overall travel cost.
4. To offer viable and reliable transportation options that aim at reducing dependence on cars, with widespread use of non-motorized modes and mass rapid transit systems.

Example Goals Statement:

1. Sixty percent of trips are made by public transport, with one (or two) modal changes.
2. Ninety percent of the population is served by public transport. Trip origins and destinations will be within 500 m of public transport terminals and stops. For those who do not have access to public transport within walking distance, safe bicycle lanes should be provided to reach the public transport system, with secure bicycle parking provided.
3. Safe and convenient pedestrian/NMV facilities are provided throughout the urban area. These facilities exist particularly in residential, educational and commercial areas.
4. Motor vehicle restricted streets are provided in commercial and market areas.
5. Integrated urban land use and transport systems result in efficient and sustainable mobility for everyone, and provide greater accessibility to opportunities (e.g., employment, education, health, goods, and other services).

(2) Context and Strategies

The aim of a CMP is to address the issues identified in Task 2-5, while creating a sustainable and efficient environment. Projects may not only be technically and economically feasible, but they also should be packaged in a way that supports a realistic way forward for the city. The rationale for a proposed strategy should be fully described by the evaluation of alternative concepts.

As each city has different characteristics, visions and goals specific to each city's environment may have to be developed. Key documents identified from the review process in Task 2, including the City Development Plan (CDP), can be used to formulate a framework built on the visions and goals set out in these documents. The framework could focus on the following strategies, which aim to ensure integrated or linked solutions rather than piecemeal measures; consider the movement of people rather than vehicles; and begin a process of replication of successful solutions throughout the network:

Strategy 1: Transit-Oriented Development (TOD);

Strategy 2: Adaptive Transit;

Strategy 1: Transit-Oriented Development (TOD): Transit-Oriented Development arises from investment in infrastructure that guides the urban growth of the city. Typically, TOD involves implementing or strengthening a mass transit system with development focused on major transport nodes. This strategy supports the objective of achieving a desirable modal split of 50-70% as advised by MoUD. Mass transit can be strengthened by:

- Enhancing the public transport network by careful and robust selection of an optimum mass transit system, including bus service improvements, bus rapid transit (BRT), and/or rail-based solutions; and
- Developing an integrated public transport system that combines modes and services through interchanges and feeder services, rationalises existing services, and improves passenger dispersal at terminals

Cities with strong central business districts (CBDs) are generally good candidates for transit-oriented development. Trips can take place along radial axes between the CBD and suburban communities, with concentrated mixed use development around the suburban nodes.

TOD can be facilitated by identifying major corridors and investing in them as primary mass transit corridors. This can be undertaken with reference to analysis of travel demand and desire line patterns from the modelling exercise.

Strategy 2: Adaptive Transit: Adaptive transit refers to the development of transport systems that can be adapted to the existing city structure, typically for cities with low density and spread out development patterns. Decentralization of workplaces and commercial premises within cities causes high levels of cross-town and lateral trip movements, often on infrastructure that was not originally designed for such demand. In such situations paratransit, such as minivans, motorcycles, and rickshaws, is often popular as it offers the advantage of door-to-door convenience.

Adaptive transit typically involves:

- Implementing a public transport system that adequately caters to the multiple desire lines of the population; and
- Creating a Functional Road Hierarchy (FRH), defining roads according to their function, rather than by their design standards or physical characteristics, using traffic management methods

Many cities have road networks that do not present a reasonable FRH, with most roads performing mixed functions for through traffic, local traffic and roadside activities, such as hawkers. A FRH provides a framework for developing a road network that can serve the needs of pedestrians, passengers, cyclists and drivers. Without it, a road network tends to favour motor vehicles at the expense of other users. With a FRH, the city can better meet the needs of all transport users and address growing traffic and urban development demand.

Paratransit can be an effective alternative to private vehicles; it is a popular mode and does not require public subsidy. However, paratransit is only effective up to a threshold demand level. The strategy of adaptive transit is not without merit if appropriate land use planning is implemented, i.e., planning that does not promote travel. For example, while it may not be possible to change land use in the short-medium term, it is possible to adapt transit.

As cities do not always develop a structure that is conducive to one particular strategy, in some cases it is preferable to seek a combination of transit-oriented development and adaptive transit. Whichever strategy is selected, it is important to consider an optimal mix of modes. Trip length is an important factor in the selection of appropriate measures. Table 12 shows desired transport modes for different trip lengths.

Table 12 Desired Transport Modes by Trip Length

Trip length (km)	0-2	2-5	5-10	10-15	>15
Share of trips	25–50	20–25	15–20	10–15	>15
Desired travel modes	Walk, cycle,2-wheelers, rickshaw	Cycle, 2-wheelers, cars, rickshaws	Cycle, 2-wheelers, cars, 3-wheelers, bus, taxi	Car, bus, taxi, metro/rail	Car, express bus, metro/rail, taxi

Source: Geetam Tiwari, Urban Passenger Transport: Framework for an Optimal Modal Mix, INRM Policy Brief No.1, Asian Development Bank, 2006.

Task 3-2 Preparation of Urban Growth Scenarios

In this task, optimal land use and transport systems will be examined. For analytical purposes, urban growth scenarios will be developed in combination with strategic level transport networks. Box 2 provides typical urban development forms.

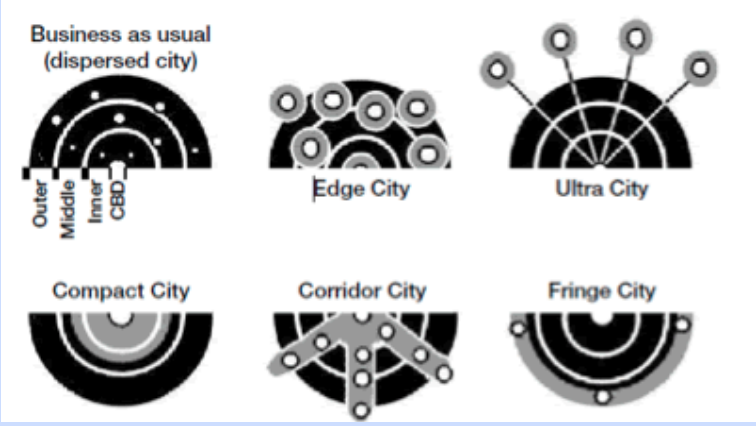
Master Plans regulate land use pattern, but the CMP could provide a preferred growth scenario from the viewpoint of an optimal urban land use and transport development pattern. If the preferred urban growth pattern differs from that specified in the Master Plan, such changes may be reflected in future versions of the Master Plan.

Box 2 Basic Prototypes of Urban Development Forms

(This box is extracted from Module 2a Land Use Planning and Urban Transport, Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities, GTZ, 2002.)

- Business-as-usual-city – simply an extension of current development practices.
- Compact city – increased population in the inner suburbs
- Edge city – growth in population, housing density and employment at selected nodes, and increased investment in freeways linking these nodes.
- Corridor city – growth along arteries arising from the central business district, radial links and upgraded public transport
- Fringe city – growth predominantly on the outskirts
- Ultra city – growth in regional centres within 100 km of the CBD. High-speed trains link the regional centres to the city heart.

Structural options for urban growth



Source: Newton, 1999

Task 3-3 Future Transport Network Scenarios

(1) Modal Split Scenarios

The future modal spilt should be prescribed by the modelling specialist if an aggregated model is used for modal split. The modal split ratio is usually estimated by trip length and purpose. When it is difficult to estimate future modal split based on available data, it is recommended that several case studies be conducted by using different modal split scenarios:

The following scenarios are generally useful for analyzing future transport demand:

- Do Nothing Scenario: In this scenario it is assumed that private vehicle users will increase at the current growth rate and a certain proportion of current public transport users will shift to private vehicles in the future. For example, 10-20% of public transport users may be assumed to use private vehicles in 10 years due to economic growth.
- Moderate Public Transport Improvement Scenario: Through implementation of public transport improvement measures, in this scenario it is assumed that no more public transport users will shift to private vehicles, i.e., the current modal split rate applies.
- Significant Public Transport Improvement Scenario: Through implementation of public transport improvement measures, as well as private vehicle restriction measures such as Traffic/Transportation Demand Management (TDM), in this scenario some private vehicle users shift to public transport, for example 5-10%.

(2) Transport Network Scenarios

The road network in the target year should be prepared. The following cases are typically used:

- Do Minimum Case: The future transport network includes the existing network and ongoing MRT and arterial development projects. No other transport systems (corridors) are assumed to be constructed.

- Do Maximum Case: The future transport network consists of the existing network and future alternative network. If new MRT systems are to be proposed, locations of their corridors need to be specified in relation to the future growth scenarios in Task 3-2. Appropriate MRT systems will be examined in detail in Task 4-1.

Task 3-4 Development of Urban Land Use and Transport Strategy

Each combination of transport network and urban growth scenario developed in the previous tasks should be assessed using the transport demand model. Land use patterns will be included in the modelling analyses, in terms of a specific distribution of residential population and employment. This information is required for each of the growth scenarios. Based on these results, a desirable urban development strategy will be proposed. Figure 9 illustrates the process.

A reduction in travel demand can be achieved by various land-use planning measures in relation to transport development strategies. Examples of such policies are shown below:

- Major developments should be located in areas served by public transport, or public transport provision will be required as part of major land use development.
- The planning agency and developers ensure adequate facilities are provided for pedestrians and NMVs. Footpaths and NMV lanes/parking/waiting areas should be provided within the planned areas, and, in particular, for schools, activity centres, commercial zones and around public transport stops/stations.

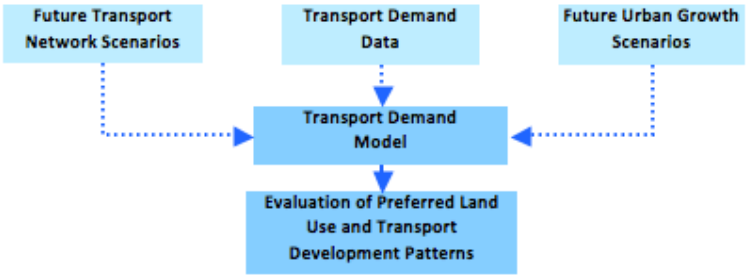


Figure 9 Indicative Process for the Evaluation of Preferred Development Scenarios

The following criteria may be used when evaluating the alternative development scenarios and for selecting a preferred scenario:

Potential for Developing Public Transport System: A preferred pattern of land use and transport system should possess a high potential for developing public transport. If the city is large enough, the potential for MRT development can be measured by the demand density along major corridors. Physical characteristics of these corridors should be suitable for MRT. In general, where the land use pattern has high density development along corridors, it is recommended to provide other forms of public transport as well. Improvement to NMT facilities will be made cost effective under such a development pattern, which leads to improved mobility for all.

Total Travel Time and Average Travel Speed: Total travel time and average travel speed are important indices for evaluating mobility. A preferred system would have a lower value for the total travel time and higher values for travel speeds on the network. The total travel time can be calculated on the basis of person trips as well as vehicle trips to better understand the mobility implications.

V/C Ratio: This index is often used for the analysis of vehicle mobility. The V/C ratio is one of the most widely used indices for measuring the degree of congestion on the network. The V/C ratios on links can be compared and analyzed. Through an analysis of V/C ratios and traffic volumes, bottleneck sections and intersections should be identified. It is often found that the road network around new development areas is very congested, with bottlenecks caused by large increases in traffic volume.

Economic Indices: An economic analysis of each development scenario may be performed to develop a preferred solution with the lowest net economic cost. If a detailed demand model is available, travel time savings, vehicle operating cost savings and required infrastructure may all be incorporated in this analysis.

Task 4 Development of Urban Mobility Plan

Based on the preferred land use and transport development scenario, a more detailed urban transport development plan will be prepared. The list of existing/ongoing transport projects, prepared in Task 1, could serve as a starting point for project preparation. Some projects will be added and others may be deleted through this process. Throughout, the integration of land use and the transport network should always be taken into consideration.

- **Task 4-1 Formulation of the Public Transport Improvement Plan**
- **Task 4-2 Preparation of Road Network Development Plan**
- **Task 4-3 Preparation of NMT Facility Improvement Plan**
- **Task 4-4 Preparation of Mobility Management Measures**
- **Task 4-5 Preparation of Regulatory and Institutional Measures**
- **Task 4-6 Development of Fiscal Measures**
- **Task 4-7 Mobility Improvement Measures and NUTP Objectives**

Task 4-1 Formulation of the Public Transport Improvement Plan

The public transport improvement plan should be developed through the following procedures.

(1) Preparation of a Service Improvement Plan for Buses, Tram, and Paratransit Systems

In medium-sized cities, conventional bus services will play a primary mobility role. They could also serve as a feeder mode to MRT systems. A Bus Service Improvement Plan includes the following components:

- Overview of the existing situation
- Issues and problems
- Proposed strategy
- Explanation of proposed strategy in terms of land use patterns
- System Integration with other modes (Integrated fare policy)
- Intermodal facilities
- Recommendations for infrastructure (busways, terminals)
- Improvement in operations (routes, service level, fare structure, regulatory changes)
- Costs and benefits

A detailed methodology for planning bus service improvements can be found in Module 3: Bus Service Improvement: Policy and Options.

Similarly, service improvement plans for paratransit should be prepared. If a tram system exists, a strategy to improve or upgrade it should be examined in relation to the MRT development plan.

(2) Preparation of an MRT Development Plan

Mass rapid transit can achieve reduced travel times through the provision of widely accessible networks, higher speed vehicles, exclusive right-of-way infrastructure, special limited-stop or express services, efficient fare collection systems, and/or faster boarding and alighting. Higher capacities may be achieved through larger vehicles, multiple sets of vehicles (i.e., a bus platoon or a train) and/or more frequent services (although there are limits on headways). Each major city has, according to its structure, one or more major corridors with mass transit requirements or that can be developed to be suitable for mass transit. Selection of MRT systems should be undertaken by considering corridor characteristics and the technical parameters of available MRT systems.

Mass Rapid Transit (MRT) refers to a public transport system carrying passengers within and between urban areas. It is designed for high capacity. Many designations are used applied MRT systems, three are covered in this report: Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Metro.

Bus Rapid Transit (BRT): A variety of concepts have been developed in many cities to improve bus services. These are designated, for example, Busway System, High Capacity Bus System, or Integrated Transport System. They are slightly different in focus, as well as in specification and performance. The term Bus Rapid Transit includes these variations, but with the following characteristics:

- corridors are mainly segregated (with a minimum mix with general traffic in non-segregated sections);
- rapid boarding and alighting at customer-oriented stations;
- new bus technology (low floor, wider doors and articulated); and
- routes are organized in a trunk-and-feeder system.

A detailed methodology for a BRT study can be found in Module 2: Bus Rapid Transit (BRT):Toolkit for Feasibility Studies.

Light Rail Transit (LRT): LRT is a railway system characterized by its flexibility in operation and technology compared to heavy rail system. It can operate in single cars or short trains along exclusive rights-of-way on an elevated structure, at grade (sometimes on-street), or underground. The system can be designed with a shorter distance between stations, and with relatively steeper/sharper curves horizontally/vertically, providing relative flexibility in route alignment. As such, designed operating speed and line capacity is lower than for metro systems.

Metro: Metro is a heavy rail system, often referred to as a subway or underground, although part of the route may be at-grade or elevated. The term here refers to urban grade-separated heavy rail systems, with the highest capacity among MRTs.

Table 13 shows a summary of the technical parameters of Metro, LRT and BRT, in relation to other mode of public transport systems.

NUTP summarizes the relative characteristics of available public transport technologies, including heavy and light rail systems, high capacity bus systems, and conventional buses on shared rights of way. It briefly notes the advantages and disadvantages of each type of technology and the conditions where the technology is most appropriate (see Table 14).

Table 13 Technical Parameters of Public Transport Options

Table 13 Technical Parameters of Public Transport Options

	Metro	LRT	Tramways	HCBRT	BRT	Bus Priority Lanes	City Bus
Line Capacity (PAX/hr/dir.)	40,000 – 75,000	15,000 – 45,000	5,000 – 15,000	20,000 – 35,000	7,500 – 15,000	5,000 – 7,500	Below 1,000
Cost per km (Infrastructure, vehicles, OCC, Maintenance)	Very high	High	Medium/high	Medium/high	Medium	Low	Very Low, only bus stops and maintenance shop required
Alignment	Double-track railway	Double-track railway, elevated, a-grade or in tunnels	Double track tramway, at-grade	4 Bus Lanes (2 per direction)	2 to 3 Bus Lanes	2 Bus Lanes	Use public roads
Segregation	100 % segregated in tunnels, elevated or at-grade	High degree of segregation preferred, but sections with shared right of way possible	Uses public roads, but may have reserved right of way on sections with higher demand	All Bus Lanes must be segregated to achieve high capacity	Bus Lanes must be in general segregated, exceptions possible, reduce capacity and speed	Bus Priority Lanes must be exclusively for busses	None
Road space required	None	None in case of elevated and tunnel alignment, 2 lanes at-grade, additional space required for stations and terminals	2 Lanes, additional space may be required for stations and terminals, tracks can be shared with public roads or pedestrian roads	4 Lanes; more linear space for Interchanges and Terminals	2 Lanes, possibly 3 or 4 at Stations and Interchanges, space for major Interchanges and Terminals	2 to 3 Lanes (3 to 4 Lanes at Bus Stops)	Shared with cars and pedestrian
Vehicles	High capacity EMU	Medium to high capacity EMUs (upgraded trams as an option)	Trams, articulated and or with wagons as an option	Special articulated bus with st-floor boarding and wide doors	Articulated buses; pre-paid boarding required	Standard City Bus, articulated as option	Standard City Bus
Passengers per Vehicle/Train	1,200 – 2,500	250 – 1,500	Depends on length	180-240	150-180	75 - 100	75
Traction	Electric	Electric	Electric	Diesel	Diesel (Electric as an option)	Diesel	Diesel
Feeder System	Necessary	Necessary	Not necessary	Necessary	Desired	Not necessary	Not necessary
Flexibility of route changes	Very low	Low	Low	Very low	Medium	Medium	Very high
Ticketing System	Closed	Closed	Open	Closed	Closed or open	Open	Open

Table 14 Advantages, Disadvantages and Applicable Corridors for MRT Options

Table 14 Advantages, Disadvantages and Applicable Corridors for MRT Options

	Heavy Rail Systems – Underground, Elevated or At grade	Light Rail Transit (LRT)	High Capacity Bus Systems (HCBS) on Dedicated Lanes, or BRT	Normal Buses on Shared Right of Way
Advantages	• Very high carrying capacity • High speed • Very low pollution in operation • Needs very little urban space	• Capital costs are less than for heavy rail systems • Per unit operating costs are less than for heavy rail systems • Low pollution levels • Needs less urban space than bus-based systems • Needs limited urban space if elevated or underground (however capital costs increase)	• Capital costs lower than for rail-based systems • Low operation and maintenance costs • Higher capacity than normal bus services • Operational planning and capacity expansion are more flexible than rail-based systems • As the distance between stations are shorter, it requires a less extensive feeder network than rail-based systems • Relatively simple technology with easy availability of personnel for operations and maintenance	• Very low capital cost • Low operating costs • Highly flexible • Does not need feeder system
Disadvantages	• Very high capital costs • High per unit operating costs if capacity utilization is low • Inflexible • Long gestation period • Needs extensive feeder network or very dense captive area • Complex interconnectivity with feeder system • Relatively complex technology requiring highly specialized manpower for operation and maintenance	• Capital costs higher than for bus systems • Inflexible • Per unit operation costs higher than for bus systems if capacity utilization is low • Needs substantial urban space if at grade • Carrying capacity is lower than for heavy rail systems though comparable to high capacity bus systems • Needs extensive feeder network or dense captive area • Complex interconnectivity with feeder system • Relatively complex technology requiring specialized skills for operations and maintenance	• Capacity not as high as that of heavy rail systems although comparable to that of light rail systems • More polluting than rail-based systems in operation • Needs imported fuel • Needs urban space for dedicated corridors	• Very low capacity • Polluting (if not run by cleaner energy) • Low speeds • Poor social image (without improving the system performance and its image)
	Heavy Rail Systems – Underground, Elevated or At grade	**Light Rail Transit (LRT)**	**High Capacity Bus Systems (HCBS) on Dedicated Lanes, or BRT**	**Normal Buses on Shared Right of Way**
Applicable Corridors	• Very high-density corridors, where road space is very limited • Well suited for densely populated cities that have low sprawl and few spinal, long-haul corridors • At-grade systems are very good for suburban systems and the fringe areas of a city where space is more easily available	• Medium density corridors where space availability is adequate for supporting elevated structures or at grade tracks • Medium density cities with limited sprawl	• Medium density corridors where space availability is adequate for supporting the dedicated right of way • Medium density cities with limited sprawl	• Low density corridors where local pollution is not a critical issue • Feeder to higher capacity systems

Source: Based on *National Urban Transport Policy for India*, Ministry of Urban Development, Government of India, April 2006.

(3) Selection of Appropriate MRT Options

Every city is different and requires its own study of the potentially realistic options. The guidelines shown in Table 15 are to assist decision makers in narrowing down the applicable options. As can be seen in the table, population density is an important criterion. City shape/form (linear or circular) also influences the concentration of demand, therefore, this factor may be incorporated when selecting appropriate MRT options.

Table 15 Suggested Approach for Selecting Appropriate MRT Options

MRT Options	City Requirements
BRT	• Cities with a medium- to high-density urban area • BRT should be one of the first considerations in MRT system development in any city. • BRT system can be developed as trunk systems as well as feeders to an existing (or planned) MRT system • Suitable for cities where an MRT system needs to be developed quickly and incrementally as conditions and funding allow • A well-developed traffic planning/management capability should be available (this may be brought in initially) • Existing bus and paratransit operations can be regulated/restructured • Road space is available for BRT development (2-4 lanes from existing roads)
LRT	• Cities with a medium- to high-density urban area • Cities where environmental issues are critical and there is a need to attract car users to use public transport systems; however, if the core requirements are operational effectiveness, BRT system should be developed that is more flexible and costs less • Appropriate for cities with an existing tram operation, which may be cost-effectively enhanced. • A well-developed traffic planning/management capability should be available • Existing bus and paratransit operations can be regulated/restructured • Road space is available for LRT development (2-3 lanes from existing road) or existing tram track can be converted to an LRT route
Metros	• Preferably a national/provincial capital city or a major regional commercial centre • Existing public transport flows on the main corridor of the order of 10,000-15,000 passengers per hour per direction with more than 15km trip length • City incomes that are not low (typically at least US$1,800 per person) • Prospects for sustained economic growth and an expanding centre • Existence of a low-cost metro alignment • Fares policy – a fares policy on metro and bus systems to encourage ridership yet limit the need for financial support • A well-developed traffic planning/management capability should be available • Existing bus and paratransit operations can be regulated/restructured • Strong and largely autonomous management of metropolitan region, with clear objectives

(4) Examining Potential to Develop a Trunk and Feeder Public Transport Network

Where MRT systems are to be introduced, the potential for re-organizing the public transport system should be examined. If existing buses or paratransit are to compete with the proposed MRT, the situation will create excessive congestion, which will lower MRT viability. Ideally, existing buses and paratransit should serve as feeders to the MRT to form a 'Trunk and Feeder System' of public transport. Such an arrangement will maximize the value of the MRT, increase its catchment area and improve mobility for more people.

The concept of a Trunk and Feeder System is shown graphically in Figure 10. Potential trunk corridors and feeder links as well as major interchange locations may be included in the CMP. This form of public transport, however, is suitable for relatively large cities with a higher dependence on public transport to reach city centres. For smaller cities with lower density development, some other pattern of public transport may have to be considered.

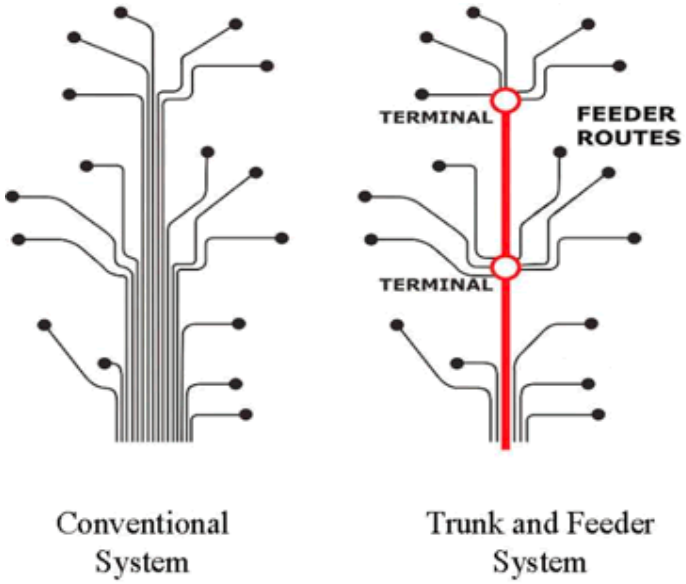


Figure 10 Concept of Trunk and Feeder System

(5) Preparing Intermodal Facility Plan

To promote public transport network, provision of intermodal facilities is essential. Public transport is generally able to work more efficiently if there is a good network and connections with other modes are provided. This is because public transport usually requires access transport from users' origination and egress transport to their final destination, via walk, NMV, and auto-rickshaw. Therefore intermodal facilities can provide substantial benefits in time savings as well as comfort. The following facilities should be examined together with the public transport network plan.

- Bus stops (with seat, shelter, and information board)
- Bus terminal (for transfer between urban and intercity buses)
- Intermodal facilities at existing on proposed MRT stations
- Paratransit facilities
- Pedestrian facilities around bus stops and terminals

Task 4-2 Preparation of Road Network Development Plan

Road projects will be developed and listed in the CMP, including the following:

- Hierarchical Road Network;
- Arterial Road Construction/Widening Projects;
- Secondary Road Construction/Widening Projects;
- Intersection Improvement Projects;
- Flyover Projects; and
- Railway over Bridge (ROB) or Underpass Projects.

Road projects may appear to be the most obvious solution to city congestion problems. However, as noted by many observers, more roads attract more traffic and new flyovers transfer bottlenecks to neighbouring intersections. As such, road projects will not solve traffic congestion forever.

With an understanding of the above, generally the following road projects are especially effective and should be prioritized in medium sized cities:

- Introduction of Hierarchical Road Network;
- Ring Road (with strict regulation of roadside land use);
- Intersection Improvement;
- Road construction/widening only to provide space for public transport and NMV, such as exclusive bus lanes or NMV lane.

The Road Network Plan should include the following aspects: (i) existing and future traffic bottlenecks, (ii) explanation of proposed strategy in terms of land use pattern, (iii) public transport network, (iv) role and benefit of each project within the Road Network Plan, (v) recommendations for infrastructure, (vi) operations and maintenance on existing and proposed road networks, (vi) provision of sidewalks and NMV lanes, and (viii) estimated costs of proposed projects.

Task 4-3 Preparation of NMT Facility Improvement Plan

Walking, cycling and other NMVs provide a large part of the mobility needs in medium sized cities in India. Thus, planning for pedestrians, bicycles and cycle rickshaws will be one of the most important tasks in CMP preparation. As the CMP sets out vision/goals for the metropolitan region and serves as a strategic level plan for urban land use and transport systems, the NMT policy level planning may be accepted. However, detailed NMT improvement plans and traffic management measures can be worked out for CBD, commercial centres, and other major activity centres, which refine NMT policy for the whole region and provide the costing basis to implement such policy.

A methodology for planning NMT facilities can be found in Module 5: Non-motorized Transport (NMT) Measures: Policy and Options.

Task 4-4 Preparation of Mobility Management Measures

In general, traffic management measures are cost-effective as compared to infrastructure development projects, but they may not function without proper regulation and enforcement. In the CMP, a traffic management plan should be developed with implications for regulation and enforcement. The topics to be covered in this plan include:

- Parking Plan;
- Traffic Control Measures;
- Intersection Improvement Projects (at-grade improvements only);
- Intermodal Facilities (public transport terminals and truck terminals)
- TDM Measures;
- Traffic Safety Plan;
- Paratransit Facility Plan; and
- Intelligent Transport System (ITS) and User Information.

Guidelines for planning parking measures can be found in Module 4: Parking Measures: Policy and Options.

Task 4-5 Preparation of Regulatory and Institutional Measures

Effective development of urban land use and the transport system often requires regulatory and institutional changes. Such requirement should be thoroughly worked out and documented in the CMP. These measures can be developed region-wide or be project specific. The regulatory and institutional plan should include the following:

Regulatory measures in relation to:

- Bus service improvement (concession, privatization, and lease contract);
- Traffic safety improvement (traffic regulation, mandatory road user education, enforcement systems);
- Introduction of Transport Demand Management (TDM) measures ;
- Vehicle emissions (focus on non-fuel based vehicles and compressed natural gas/CNG vehicles); and
- Public-Private Partnerships

Institutional measures in relation to:

- Coordination mechanism to integrate public transport operation and to integrate fares;
- Establishment of Unified Metropolitan Transport Authorities (UMTA);
- Establishment of SPVs for the implementation of proposed projects; and
- Other changes necessary to promote Public-Private Partnerships (PPPs).

Task 4-6 Development of Fiscal Measures

Fiscal measures should also be considered to achieve balanced modal split, and to secure the budget necessary to implement urban transport projects. As fiscal measures usually correspond to institutional and regulatory measures, the following aspects may have to be examined in the CMP document:

- Fare policy for public transportation, and parking;
- Subsidy policy for public transport operators;
- Taxation on private vehicles and public transport vehicles; and
- Potential for road congestion charging.

Task 4-7 Mobility Improvement Measures and NUTP Objectives

The land use and transport measures proposed in the CMP will improve mobility in the metropolitan area and cover the critical issues addressed in the NUTP. A table can be prepared summarizing the relationship between the NUTP objectives and the measures proposed in the study, together with a classification of the measures according to their implementation time frame (short, medium and long term). Table 16 shows an example of such a summary in relation to NUTP objectives.

Table 16 Summary of Mobility Improvement Measures in Relation to NUTP: Example

NUTP Objectives	Proposed Mobility Improvement Measure
Priority for Pedestrians	• Pedestrian paths are recommended in all residential and commercial areas and on major corridors. • Pedestrian crossings are proposed in all commercial areas and school zones. • Pedestrian underpasses are recommended at critical locations.
Priority for Non-motorized Vehicles	• Recommended bicycle tracks on major corridors and in school zones. • Requirement for bicycle parking is recommended for offices, railway stations, schools and all markets and shopping centres. • Rickshaw stands are proposed at critical locations.
Priority for Public Transport	• Development of an MRT system is proposed. • Recommended improvements to existing bus services and necessary regulatory/institutional changes.
Parking	• On-street parking facilities are proposed for critical locations. • Recommended regulatory changes in building permits to secure parking demand. • Construction of off-street parking is proposed for several locations, and a funding mechanism is developed including the possibility of private sector participation. • Changes in parking tariff policy are proposed to optimize the use of existing off-street parking facilities.

Integration of Land Use and Transport Planning	• A preferred urban growth scenario is recommended in the CMP document and its compatibility with the Master Plan is analyzed. • Land use control principles to minimize the mobility requirement are presented. • Proposed MRT corridors with feeder modes of transport cover major residential, commercial and industrial areas in metropolitan areas. • High-density residential and commercial development around proposed MRT stations is recommended.
Equitable Allocation of Road Space	• MRT corridors and bus priority lanes are proposed. • Pedestrian and NMV lanes are recommended.
Integrated Public Transport Systems	• Recommended that inter-city bus terminals be moved to peripheral areas of the city and integrated with inner-city bus services. • Intermodal (taxi/rickshaw stands, vehicle, NMV parking, and bus-loading/unloading) facilities are proposed at MRT stations.
Introduction of Paratransit Services	• Recommended the introduction of paratransit services to supplement the existing/new public transport services.
Freight Traffic Improvement	• Truck terminals proposed. • Entry restrictions for heavy vehicles during peak hours recommended.

Source: based on Comprehensive Mobility Plan for Coimbatore, 2007.

Task 5 Preparation of the Implementation Program

Detailed procedures for implementing proposed measures should be shown in an Implementation Program, which includes timeframe, financing options and implementation agencies/organizations for each project. General project information will be required at this stage, such as project title, location and estimated cost. Proposed projects will then be evaluated and prioritized based on pre-determined criteria and classified into short-term (high priority), medium-term, and long-term. For the High Priority Projects, slightly more detailed project descriptions will be required, in the form of Project Profile Sheets (or simply Project Sheets).

Once the CMP is approved, feasibility studies in the form of Detailed Project Reports (DPR-1) may be developed to fully assess technical, financial and economic feasibility.

- **Task 5-1 Preparation of Implementation Programs**
- **Task 5-2 Social and Environmental Impact Assessment**
- **Task 5-3 Preparation of Project Profile Sheets**

Task 5-1 Preparation of Implementation Programs

(1) Preparation of Project List

The CMP includes the list of all proposed urban transport projects and this list can be called a Project Long List. The long list will be prepared by reviewing existing and ongoing projects which will become potentially effective measures to approach the vision(s) and goals stated at the outset of the CMP. The long list will include a very brief summary of each project, as shown in Survey Format 7-1A in Annex 1.

(2) Selection of Priority Measures

When considering the implementation timeframe of proposed measures, a selection process should be developed to screen prime candidates based on certain critical criteria, such as their importance and any constraints to implementation. The criteria that make up these two conditions are described in Table 17.

Table 17 Criteria for Selection of Priority Measures

Criteria	Description
Project Importance	
(i) Consistency with Overall Policy Framework	Assessment of the degree of consistency between a project and the existing development policy in the city, such as the NUTP, CDP, Land Use Plan, and other master plans.
(ii) Consistency with Strategic Framework for Transport Network:	Assessment of the level of consistency with the strategic framework described above.
(iii) Impact on Reducing Traffic Congestion	Assessment of the anticipated impact on reducing traffic congestion. This impact should be considered from the viewpoint of the whole road network. Therefore, a locally limited impact, such as congestion reduction at only one intersection, should not be given a high score.
(iv) Promotion of Public Transport	Projects that promote public transport should be given high scores. Not only public transport projects, but also some road infrastructure and traffic management projects can promote public transport.
(v) Enhancement of Traffic Safety	Projects that enhance traffic safety should be given high scores. Traffic safety includes not only road traffic safety, but also railway safety.
(vi) Cost Effectiveness	Comparison of project costs with project benefits.
(vii) Level of Commitment by Implementing Agency	Projects that local government is strongly committed to implement should be given high scores. The stronger the support for the project, the higher the score.
(viii) Degree of Support from Transport Users	This involves an assessment of the support from transport users. Projects with stronger user support should be evaluated highest and ideally based on the results of a transport user interview survey.

Constraints
(i) Whether the transport measure can be implemented within the timeframe of the CMP
(ii) Whether land acquisition/resettlement is manageable
(iii) Whether the environmental impact is adverse

The long list projects should be prioritized in a systematic manner. Qualitative scoring is one productive method for prioritization. The scoring methodology may be decided in discussions in each city. Table 18 shows a sample methodology for scoring in consideration of the above criteria. The scoring form is shown in Survey Form 7-4A.

Table 18 Example Methodology for Scoring/Selecting High-Priority Projects

Project Importance Criteria	**Score**	**Weight (Example)**
Consistency with Overall Policy Framework	1~3 (S_1)	1 (W_1)
Consistency with Future Framework for Transport Network	1~3 (S_2)	1 (W_2)
Impact on Reducing Traffic Congestion	1~3 (S_3)	2 (W_3)
Promotion of Public Transport	1~3 (S_4)	3 (W_4)
Impact on Enhancing Safety	1~3 (S_5)	1 (W_5)
Cost Effectiveness	1~3 (S_6)	1 (W_6)
Level of Commitment by Relevant Agencies	1~3 (S_7)	3 (W_7)
Degree of Support from Transport Users	1~3 (S_8)	1 (W_8)
Constraint Criteria	Score	Weight
(i) Whether the transport measure can be implemented within the timeframe of the CMP	0, 1 (C_1)	
(ii) Whether land acquisition and resettlement are manageable	0, 1 (C_2)	
(iii) Whether environmental impact is adverse	0, 1 (C_3)	

The total score can be calculated as shown below.

Total Score = $\sum_i Si W_i \times C_1 \times C_2 \times C_3$

Through the above evaluations, all projects should be classified into at least three categories: (i) high-priority, (ii) medium-priority and (iii) low-priority projects. The evaluation results should be presented in the CMP.

(3) Implementation Agencies/Organizations

Implementation and operating agencies for each project should be identified, together with other relevant organizations that require a coordinated approach. In addition, considering existing implementation capacity, new agencies may be proposed. Usually implementation of an MRT system requires a new agency. A unified metropolitan transport agency (UMTA) can be implemented to strengthen coordination between concerned agencies.

(4) Identification of Possible Financing Options

Financing options for each project, in particular for high-priority projects, should be assessed. The options outlined below should be considered. Some projects could use a combination of options. The evaluation form is shown in Survey Form 7-5A:

- funding by the Local Government;
- funding by the Central Government (including from the JNNURM fund);
- private sector financing (or PPP); and
- funding by international development partners (donor agencies).

In addition, the financial constraints of the local body should be clarified. The possible budget for the transport sector for 5, 10 and 20 years should be considered.

(5) Implementation Program

Based on the above examination, the implementation program should be summarized. While certain projects such as improvement of NMV facilities, design and implementation of transport demand measures, or bus service development may be completed within a relatively short-term, some other projects such as development of MRT systems or major highway projects will require longer periods to complete. Considering the timeframe of each project, prepare an implementation program can be prepared which indicates a realistic schedule for implementing all recommended projects and measures. Such an implementation program includes:

- assumed growth patterns (maps) after 5, 10 and 20 years;
- implementation schedule of all proposed projects/measures (with indication of inter-dependence) over the entire planning period; and
- funding requirement for the projects in each planning periods.

Through the preparation, the mobility improvement projects and measures should be classified into the following three categories according to the planned implementation schedule: (i) Short-Term Projects (to be implemented within 5 years), (ii) Medium-Term projects (within 10 years), and (iii) Long-Term Projects (within 20 years)

Task 5-2 Social and Environmental Impact Assessment

In the CMP document, it is not necessary to include Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA reports). However, very preliminary social and environmental impact assessments of each priority project may have to be performed and the results and implications be fully reflected in the recommended projects. Also, it would be beneficial to conduct a Strategic Environmental Impact Assessment (SEIA) in order to examine and evaluate the project justification within the national/regional and/or municipal planning framework. Table 19 shows the outline tasks of the SEIA:

Table 19 Outline of SEIA Tasks

Category	Task
A. Screening	1. Decide on need for SEA and create commitment
B. Scoping	2. Find stakeholders and announce start of plan process 3. Develop shared vision on problems/objectives/alternatives 4. Perform consistency analysis: new vs existing objectives
C. Assessment	5. Set ToR for SEA report, based on results of scoping 6. Perform assessment, document and disseminate 7. Organize (independent) quality assurance
D. Decision Making	8. Discuss with all stakeholders, present alternative 9. Substantiate (policy) decision in writing
E. Monitoring	10. Monitor implementation and discuss results.

Task 5-3 Preparation of Project Profile Sheets

A Project Profile Sheet will be prepared for each High Priority Project. The project sheet should include the project outline *with project rationale and justification*, along with conceptual drawings (if necessary) to facilitate the understanding of readers. The next stage of project implementation, i.e., DPR 1, should commence from this project sheet. The project sheet should include the following items:

- Project Code;
- Project Name;
- Categories;
- Location;
- Rationale and Justification;
- Objectives;
- Status;
- Anticipated Timeframe;
- Project Description ;
- Social and Environmental Impacts;

- Implementation Arrangements;
- Cost;
- Implementation Schedule; and
- Conceptual Site Location and Physical Plan.

Sample project sheets are found in Annex 2.

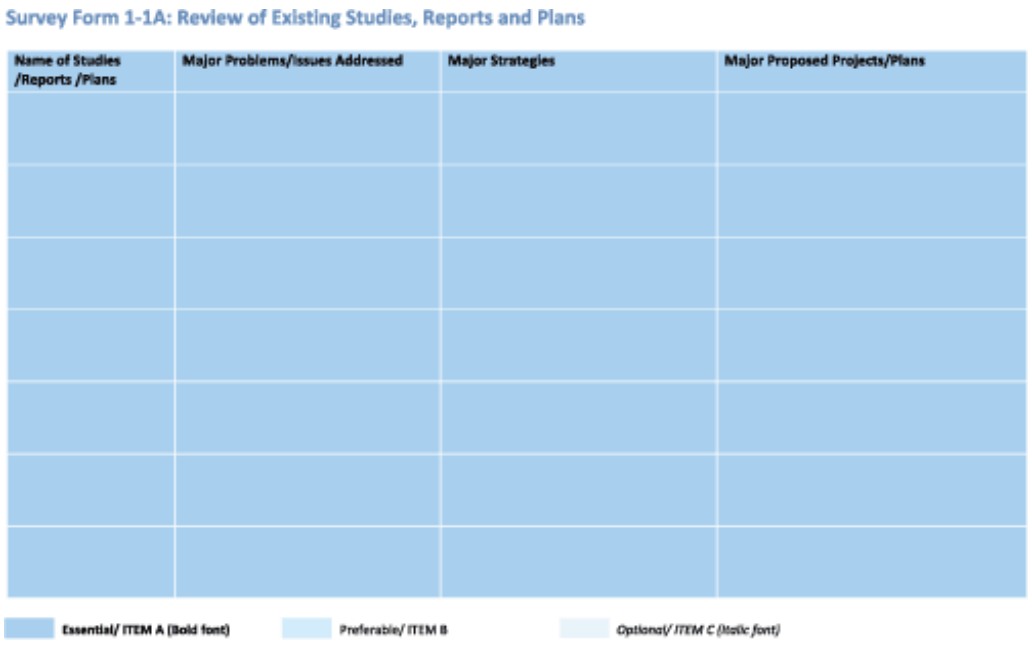
SECTION IV ANNEXES

- Annex 1 Sample Survey Forms
- Annex 2 Sample Project Sheets
- Annex 3 Tentative Checklist for Evaluating CMPs
- Annex 4 Modelling Approach in CMP Process
- Annex 5 Approaches to Selecting Priority Measures
- Annex 6 Sample TOR for CMP Preparation

Annex 1 Sample Survey Forms

This section includes sample survey forms for the preparation of a Comprehensive Mobility Plan (CMP). The survey forms cover various information/data items. However, it is often very difficult or costly to gather all the information/data items. Therefore, all data items are classified by priority: Essential, Preferable and Optional. “Essential” items should be collected by all cities. “Preferable” items should on the whole be collected by all cities, but if a city considers the information is not important, or it is difficult to collect given time and cost constraints, then it can be excluded. “Optional” items should be collected by cities that consider them important for their particular circumstances.

Survey Form 1-1A: Review of Existing Studies, Reports and Plans



Survey Form 1-1B: Ongoing and Planned Projects

Description: Ongoing, planned and proposed projects in the existing reports or studies, or identified by relevant agencies, should be summarized and listed.

Survey Methods: Literature review and interview survey with relevant agencies

Survey Form 1-1B: Ongoing and Planned Projects

Description: Ongoing, planned and proposed projects in the existing reports or studies, or identified by relevant agencies, should be summarized and listed.
Survey Methods: Literature review and interview survey with relevant agencies

Project/Program	Cost Estimation	Implementing Agency	Brief Description of Project (such as road length or capacity)	Project Status						
				Completed	Ongoing / Under Construction	D/D Stage (Fund Committed)	Waiting Fund	Planning (F/S) Stage	On Pipeline or Some Movement	No Progress

Note: Major projects should be depicted in a single project.

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Options/ ITEM C (Italic font)*

Survey Form 1-2A: Outline of Road Network

Survey Form 1-2A: Outline of Road Network

		Metropolitan Area	Municipal Area	City Core
Road Length	**National Highway Length (km)**			
	State Highway Length (km)			
	Other Arterial Road Length (km)			
	Secondary Road Length (km)			
Road Density by Road Type	**Road Density of Arterial Road (km/km^2)**			
	Road Density of All Roads (km/km^2)			
Major Road Infrastructure	**Number of Rotaries**			
	Number of Signalized Intersections			
	Number of Flyovers			
	Number of Railway over Bridge			
	Number of Railway Underpass			
	Number of Railway Level-Crossings			

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Options/ ITEM C (Italic font)*

Survey Form 1-2B: Inventory of Arterial Road Network

Survey Form 1-2B: Inventory of Arterial Road Network

Name of Road	Section		Length (Km)	Right of Way (M)	Width of Carriage way (M)	No of Lanes	Width of Footpath		Traffic Volume (PCU/Day)	Parking regulations along roadway	Abutting Land use	Road Surface (G/F/P)*	Remarks Encroachment Existence of roadway hazards, etc.
	FROM	TO					Left	Right					

* G:GOOD, F:FAIR, P:POOR

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2C: Inventory of Flyovers and Underpasses

Survey Form 1-2C: Inventory of Flyovers and Underpasses

Name of Flyover/ Underpass	Location/ Direction of Flyover/ Underpass	Length (m)	Width (m)	No of Lanes	Width of Footpath (m)		Traffic Volume (PCU/Day)
					Left	Right	

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2D: Inventory of Major Intersections

Survey Form 1-2D: Inventory of Major Intersections

Name of Intersection	Geometric characteristics (shape of intersections, number of lanes, etc.)	Inflow Traffic Volume (PCI/day)	Traffic control devices (such as signalized, etc.)	Existence of pedestrian crosswalks	Existence of Traffic Calming Measures (such as rumble strips, etc.)	Existence of intersection hazards (such as obstructed signals/signs, unregulated intersections that are unsafe for pedestrians, etc.)

Note: Critical intersections should be identified and inventoried, in particular those intersections that are important from the viewpoint of the entire road network or that are heavily congested. It is anticipated that approximately 10-30 intersections will be selected. Available traffic counts should be included or referenced and the requirement for new or updated surveys identified.

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2E: Inventory of Parking Facilities

Survey Form 1-2E: Inventory of Parking Facilities

Location	Ownership of facility Public/Private/Informal	The number of parking spaces/ Vehicle Types	Parking Tariff	Occupancy rate during peak hours	Condition of street markings	Type of restriction (e.g. for on-street)

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2F: Inventory of Traffic Control Facilities

Survey Form 1-2F: Inventory of Traffic Control Facilities

	Metropolitan Area	Municipal Area	City Core
Number of Traffic Signals			
Existence of Area Traffic Control System			
Type of Signal Operation (Automatic or Manual by Police)			

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2G: Inventory of Pedestrian Facilities

Survey Form 1-2G: Inventory of Pedestrian Facilities

Location (Street)	Type of Facility (Footpath, Overpass, Underpass)	Length (m)	Width of Footpath		*Obstructions (if any)*	*Continuity of the walkway*	*Existing pavement conditions*	*Adequate drainage facilities*	*Clear markings*
			Left	Right					

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2I: Inventory of NMV Facilities

Survey Form 1-2I: Inventory of NMV Facilities

Location (Street)	Type of Facilities (NMV Path, overpass, underpass)	Description	*Obstructions (if any)*	*Existing pavement conditions*	*Adequate drainage facilities*	*Clear markings*	*Adequacy of signage/ signaling*	*Existence of parking restrictions to safeguard pedestrian right-of-way, etc.*	*Adequacy of NMV and Pedestrian and Vehicle Flow Separation (such as on-street lanes, etc.)*

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-2I: Inventory of Level Crossings

Survey Form 1-2I: Inventory of Level Crossings

Location (Street)	TVU	Traffic Volume (vehicle/day)	Road Width (m)	Number of Lanes	*Number of Closures per day*	*Total time of Closures*	*Average Time of Closures*	*Total Number of Stopped Vehicle*	*Average Number of stopped vehicles per closures*

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3A: Availability of Public Transport Types/Para-Transit Modes

Survey Form 1-3A: Availability of Public Transport Types/Para-Transit Modes

	City Core	Urban Area	Suburban Area
Inter-City Bus	(Available or Not-available)		
Large Bus			
Mini Bus			
Taxi			
Auto Rickshaws			
Cycle Rickshaws			
Hand-pull Rickshaws			

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3B (1): Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators

Survey Form 1-3B (1): Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators

Outline of Bus Operation							
Bus Operator:	**Type of Operator (Public, Private, or Association of Independent drivers)**	**Number of Bus Vehicles by Vehicle Types**	**Number of Bus Routes**	Operating Vehicle- Distance (Vehicle-km)	Number of Bus Stops	Number of Bus Terminals	Fare structure

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3B (2): Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators

Survey Form 1-3B (2): Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators

Bus Operation and Maintenance						Economic and Productivity Indicators				
Bus Operator	Vehicle loads	Vehicle headways	Service period	Typical route speeds	Service reliability	**Passengers per vehicle-hour or vehicle-km**	**Cost for employees per vehicle-hour or vehicle-km**	Cost recovery	Passenger transfers	Passenger comfort and safety

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3B (3): Economic and Productivity Indicators and Operator Safety Concerns

Survey Form 1-3B (3): Economic and Productivity Indicators and Operator Safety Concerns

Operator Safety Concerns						
Bus Operator	Adequacy of safety training programs sponsored or operated by the transport provider	Degree of driver proficiency	Adherence to road regulations	Commitment of management to safety and driver training	Effect of in-vehicle disturbances upon driver performance	Existence of incentives to encourage safe driving and conduct.

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3C: Inventory of Para-Transit

Survey Form 1-3C: Inventory of Para-Transit

Name of Operators	**Number and Type of registered vehicles**	Fare	Revenue	Cost (operating and fixed)	Operating distance and hours (km and hour)	Average age of vehicles	Condition of vehicles	Type of ownership and degree of regulation	Jurisdictional areas of operators (if any)	License fees and franchise costs

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3D (1): Inventory of Major Intermodal Interchanges

Survey Form 1-3D (1): Inventory of Major Intermodal Interchanges

Name of interchange facilities	**Location**	**Layout and size of facilities**	Determination of capacity and geometric characteristics of pedestrian walkways	Number of daily and hourly (peak) passengers	Number of hourly/daily vehicle movements	Number of transport operators housed	**Number of loading berths**	Ability of loading berths to accept various bus types

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3D (2): Inventory of Major Intermodal Interchanges

Survey Form 1-3D (2): Inventory of Major Intermodal Interchanges

Name of interchange facilities	**Number of routes serviced**	**Condition of waiting areas**	Level of passenger convenience and comfort	Existence of passenger amenities	**Provision of passenger information (static)**	**Provision of passenger information (real-time)**	Clarity of transfer directions	Directness of required transfer movements	Identification of management authority

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-3E: Inventory of River Transport

Survey Form 1-3E: Inventory of River Transport

Name of Ferry Operator	Type of Operator (public, private, or association of independent drivers)	Boat/Ferry types	Number of Boat/Ferry by Vehicle Types	Number of Boat/Ferry Routes	Number of Passenger by Routes	Number and location of Boat/Ferry Jetties	Fare structure of boat operators

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-4A: Summary of Traffic Accidents

Survey Form 1-4A: Summary of Traffic Accidents

	5 years ago	4 years ago	3 years ago	2 years ago	1 year ago
Total number of accidents					
Involving pedestrians					
Involving cyclists					
Involving cars					
Involving buses					
Number of injured or dead					
Number of dead					
Number of injured					
Identification of hazardous locations					
Major accident causes					

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-4B: Summary of Enforcement

Survey Form 1-4B: Summary of Enforcement

	Municipality Area	Metropolitan Area
Number of Traffic Police		
Existing Traffic Regulations		
Costs and types of violations		
Fines for traffic violations		
Number of police trap activities		
Manner of enforcement		
Organizational structure of enforcement body		

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-5A: Inventory of Agencies/Organizations Relating to Urban Transport

Survey Form 1-5A: Inventory of Agencies/Organizations Relating to Urban Transport

Name of agency/department	Function and responsibility of agency/ department	Relationship to other agency	Organization chart	Number of staffs	Annual budget	Profitability and financial sustainability (only for operators)
State Government						
- Transport Department						
- Public Works Department						
- Regional Transport Authority						
- State Transport Company						
Municipality						
Metropolitan Development Authority						
State Government						
Transport Department						
Bus operators						
Associations of Rickshaws or Taxis						
Ferry operators						
Other relevant agencies (if any)						

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-5B: Assessment of Planning, Implementation and Coordination Capacity

Survey Form 1-5B: Assessment of Planning, Implementation and Coordination Capacity

	Assessment
Planning and Implementation Capacity:	
- Staffing capacity for urban transport planning	
- Data capture capability e.g. systems for periodic traffic data collection	
- Financial resources to implement planned transportation projects	
- Experience in Public-Private Partnerships (PPP)	
Coordination Capability:	
- Control over small private developers in planning supporting infrastructure	
- Systems or processes to integrate transport and urban planning agencies	
- Systems or process to integrate land use plans with transport plans	
- Role and impact of workers/transport operator's unions	
- Division of duties between State Government and Urban Local Bodies (ULB)	
- Planning and Implementation Capacity:	

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-6A: Inventory of Environmental Monitoring Data

Survey Form 1-6A: Inventory of Environmental Monitoring Data

	Standard	Location 1	Location 2	Location 3	Location 4	Location 5
Ambient Air Quality Data						
NOx						
SOx						
Pb						
Noise						
Water Quality						

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 1-7A: Typical Urban Transport Issues

Survey Form 1-7A: Typical Urban Transport Issues

Issue	Severity
Traffic Congestion	
City-Wide Traffic Congestion	
Traffic Congestion on Major Roads at Peak Hours	
Narrow Streets Contributing to Congestion	
Waiting or Parked Vehicles Contributing to Congestion	
Slow Vehicles (Bicycle, Cycle Rickshaw, Auto Rickshaw, Two wheeler) Contributing to Congestion	
Existing Bus Systems	
Lack of (Public) Bus Operator	
Lack of Bus Routes (i.e. bus routes are far from residence/commercial area)	
Lack of Bus Vehicles	
Poor Maintenance of Publicly Operated Bus Vehicles (e.g. level of breakdowns and pollution generation)	
Poor Maintenance of Privately Operated Bus Vehicles	
Proliferation of Disorganized Private Bus Services (including mini buses)	
Low Profitability of Bus Operators	
Lack of Bus Driver Training	
Parking	
Major Streets are too Narrow for Parking	
Problems Caused by Parking of Private Vehicles	
Problems Caused by Parking/Waiting of Rickshaws and Auto-Rickshaws	
Lack of Parking Areas at Station/Bus Terminals	
Lack of Land for Off-Street Parking Lots	
Lack of Regulations for Parking Measures (including development control standards)	
Parking Policy and Guidelines	
Traffic Safety	
Vehicle-Vehicle Accidents	
Accidents Involving Pedestrians	
Accidents Involving Cyclists	
Accidents Involving Auto/Cycle Rickshaws	
Level of Driver Education Training/Licensing	
Enforcement	
Enforcement of Illegal Traffic Movements or Speeding	
Enforcement of Illegal Traffic Parking	
Enforcement of Unlicensed Private Vehicle Motorists	
Enforcement of Illegal Bus/Para-Transit Operators	
Lack of Enforcement Resources (traffic police and equipment)	
Environmental	
Air Pollution	
Traffic Noise	
Planning and Implementation Capacity	
Guidance for Making City Transport Policy/Plans	
City Master Plans Do Not Reflect Actual Situation on the Ground	
Lack of Sufficient Urban Transport Planners within the City Government	
City Officials Dealing with Transport Planning Lack Experience or Training in Transport Planning	
Lack of Data Collection Capability e.g. Periodical Traffic Surveys (inc. traffic volume survey)	
Lack of Financial Resources to Implement Planned Transportation Projects	
Lack of Knowledge of Public-Private Partnerships (PPP)	

Survey Form 2-1A: Population and Socio-Economic Situation

Survey Form 2-1A: Population and Socio-Economic Situation

	Total in Metropolitan Area	Total in Municipality Area	Ward 1	Ward 2	Ward 3	Ward 4……
Population						
Number and size of household						
Population growth trend						
Population density						
Number of Workers by category						
Main Workers						
Cultivator						
Agriculture						
Labour						
Household industry						
others						
Marginal Workers						
Non workers						
Average personal income						
Average Household income						
Fuel Price		-	-	-	-	-

Essential/ ITEM A (Bold font) **Preferable/ ITEM B** *Optional/ ITEM C (Italic font)*

Survey Form 2-1B: Vehicle Ownership Data

Survey Form 2-1B: Vehicle Ownership Data

	Total in Metropolitan Area	Total in Municipality Area	Ward 1	Ward 2	Ward 3	Ward 4……
Number of Registered Vehicles by Type						
Passenger Vehicle						
Small Passenger Vehicle						
Small Truck						
Heavy Truck						
Auto Rickshaws						
Cycle Rickshaws						
Buses						
Mini Bus						
Motorcycles (two wheeler)						
Number of households having Bicycle						
Number of households having Scooter, Motorcycle, Mope						
Number of households having Car, Jeep, Van						
Number of Licensed Drivers by License Type						

Essential/ ITEM A (Bold font) **Preferable/ ITEM B** *Optional/ ITEM C (Italic font)*

Survey Form 2-2A: Traffic Count Surveys (Screen Line Survey and Cordon Survey)

Survey Form 2-2A: Traffic Count Surveys (Screen Line Survey and Cordon Survey)

Location:	**Section (To/From):**		**Date/Month/Year:**
Count Station No.	**Direction:**		**Day:**
	Road Name & No:		

	PASSENGER VEHICLES								GOOD VEHICLES				GRAND TOTAL
	HEAVY FAST	LIGHT FAST				SLOW			HEAVY FAST	LIGHT FAST		TOTAL	
	BUS	MINI BUS	CAR	2-WHEEL	3-WHEEL	CYCLE	OTHERS	TOTAL	TRUCK	LCV	OTHERS		
6-7 am													
7-8 am													
8-9 am													
9-10 am													
10-11 am													
11-12 am													
12-1 pm													
1-2 pm													
2-3 pm													
3-4 pm													
4-5 pm													
5-6 pm													
……													

Survey Form 2-2B: Traffic Count Survey (Intersection Turning Movement Survey)

Survey Form 2-2B: Traffic Count Survey (Intersection Turning Movement Survey)

Location:	**Direction From:**		**Date/Month/Year:**
Count Station No.	**Direction**	**Right Turn/Straight/Left Turn**	**Day:**
Road Name & No:			

	PASSENGER VEHICLES								GOOD VEHICLES				GRAND TOTAL
	HEAVY FAST	LIGHT FAST				SLOW			HEAVY FAST	LIGHT FAST		TOTAL	
	BUS	MINI BUS	CAR	2-WHEEL	3-WHEEL	CYCLE	OTHERS	TOTAL	TRUCK	LCV	OTHERS		
6-7 am													
7-8 am													
8-9 am													
9-10 am													
10-11 am													
11-12 am													
12-1 pm													
1-2 pm													
2-3 pm													
3-4 pm													
4-5 pm													
5-6 pm													
.....													

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 2-2C: Queue Length Survey

Survey Form 2-2C: Queue Length Survey

Queue Length Reading in Meters					
Sequence of Reading*	Queue Length (m)	(hr.)	Hour (min)	(sec)	Elapse Time (sec)

*G = Start of Green, R = Start of Red, ZS = Start of Zero Queue, ZE = End of Zero Queue

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 2-2D: Travel Speed and Time Survey

Survey Form 2-2D: Travel Speed and Time Survey

Name of Road :	From	To
From Km :	To km :	No. of Trip:
		Date :
		Time:

Sl. No.	Distance		Control Points	First Stop Watch		Second Stop Watch		Cause of Delay
	Km	M		Journey Time		Delay Time		
				Min.	Sec.	Min.	Sec.	

Essential/ ITEM A (Bold font) **Preferable/ ITEM B** *Optional/ ITEM C (Italic font)*

Survey Form 2-3A (1): Household O-D Survey

Survey Form 2-3A (1): Household O-D Survey

Household Summary

Date/Day :_____	Enumerator :_____					Sample No:
1.Address	2. Head Of The Household:					
	3.Numbers Of Family Members					
	4.Vehicles Owned:	Passenger Car	2- Wheeler	Bicycle	Auto	Others
	5 Years Ago					
Pin No: Tel.:	Present					

5. Details Of Household Members										
Member No	Sex M/F	Age	Occupation*	Monthly Income (Rs.)		Monthly Expenditure On Transport (Rs.)		Availability of Driver License	Working/School Location	
				5 Years Ago	Present	5 Years Ago	Present			
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

*Occupation: 1.Govt.Service, 2.Pvt. Service, 3.Business, 4.Student, 5.House-Wife, 6.Retired Person, 7. Unemployed

Essential/ ITEM A (Bold font) **Preferable/ ITEM B** *Optional/ ITEM C (Italic font)*

Survey Form 2-3A (2): Household O-D Survey

Survey Form 2-3A (2): Household O-D Survey

Trip Summary

6. Details of Each Trip								
Serial No	Member No.[1]	Traffic Mode[2]	No. in Vehicle	Where did this trip begin?[3]	Where did this trip end?[3]	Trip Purpose[4]	Travel Time	Travel Cost

Note: [1]Referring to the numbers described in "5. Details of Household Members"
[2]1.Bus, 2.Mini Bus, 3.Car, 4.Two-wheeler (motorcycle), 5.Three-wheeler (Auto-rickshaw), 6.Bicycle, 7.Railway, 8.Walk
[3] Put zone number
[4] 1.Going to work, 2.Going to school, 3.Going home, 4.Shopping, 5.Leisure, and 6.Business

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 2-3B: Roadside O-D Survey

Survey Form 2-3B: Roadside O-D Survey

Serial No	Direction (Inbound or outbound)	Time	Traffic Mode[1]	No. of Passenger	Where did this trip begin?[2]	Where did this trip end?[2]	Trip Purpose[3]

Note: [1]1.Bus, 2.Mini Bus, 3.Car, 4.Two-wheeler (motorcycle), 5.Three-wheeler (Auto-rickshaw), 6.Bicycle, 7.Railway, 8.Walk
[2] Put zone number
[3]1.Going to work, 2.Going to school, 3.Going home, 4.Shopping, 5.Leisure, and 6.Business

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 2-4A: Public Transport and Freight Vehicle Movement Survey

Survey Form 2-4A: Public Transport and Freight Vehicle Movement Survey

Serial No	Name of Company	Location	Parking Location	Vehicle Type	Where did this trip begin?[1]	Where did this trip end?[1]	Number of Passengers or Type of Cargo

Note: [1] Put zone number

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 4-1: New Development Areas

Survey Form 4-1: New Development Areas

Name of Development Area	Land Area (km^2)	Target Year	Number of Future Residential Population	Number of Future Labour Force

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 7-1A: Longlist of Proposed Projects

Survey Form 7-1A: Longlist of Proposed Projects

Project Code	Project Title	Implementing Agency	Estimated Cost	Current Status	Project Description

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 7-4A: Scoring of Longlist Projects

Survey Form 7-4A: Scoring of Longlist Projects

		Project Importance (1-3)									Constraints (0,1)				
Code	Project/Program	Consistency with Overall Policy Framework	Consistency with Future Framework for Transport Network	Impact on Reducing Traffic Congestion	Promotion of Public Transport	Impact on Enhancing Safety	Cost Effectiveness	Level of Commitment by Relevant Agencies	Degree of Support from Transport Users	Score	Whether the transport measure can be implemented within the timeframe of the CMP	Whether land acquisition and resettlement are manageable	Whether environmental impact is adverse	Total Score	Priority (low, Medium, High)

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Survey Form 7-5A: Examination of Financing Options

Survey Form 7-5A: Examination of Financing Options

				Financial Options				
Code	Project Title	Implementing Agency	Estimated Cost (Million Rupee)	Funding by the Local Government	Funding by the Central Government	Private Sector Finance	Funding by Donor Agencies	Remarks

Essential/ ITEM A (Bold font) Preferable/ ITEM B *Optional/ ITEM C (Italic font)*

Annex 2 Sample Project Sheets

The sample project sheets are shown below.

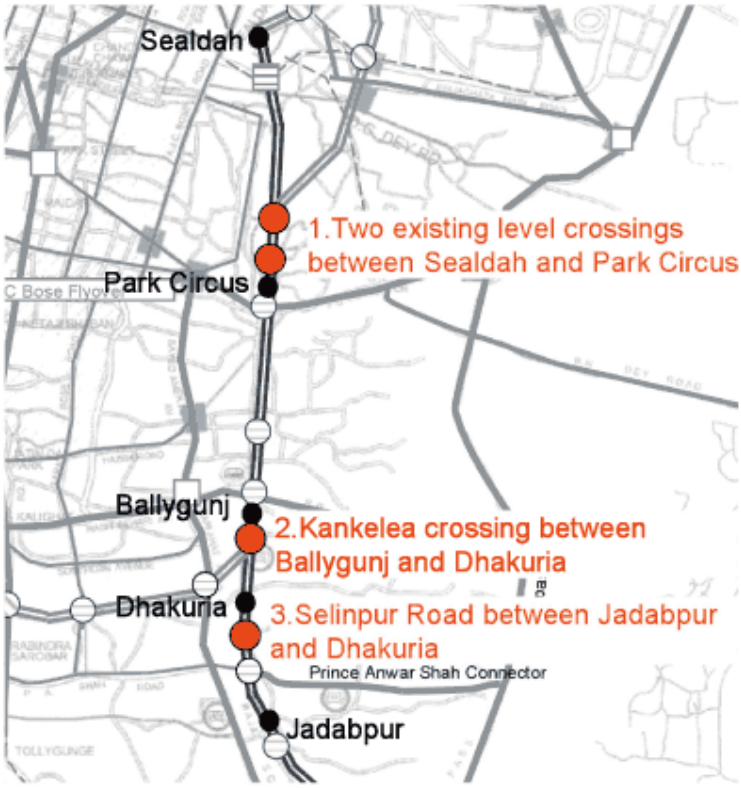
Project Code	Project Name	Categories	Location
R18 (RF27)	Construction of Railway Underpasses for Light Vehicles	Road/Railway Underpass	KMC

Project Rationale and Justification:	- At-grade railway crossings disturb traffic flows and become traffic bottlenecks - Illegal pedestrian and vehicle crossings are dangerous and slow trains. - Segregation of road traffic and rail lines will contribute not only to enhancing the traffic safety, but will also improve railway services by increasing travel speed. - There are two level crossings, which have more than 500,000 TVU, but there are difficulties in constructing railway overbridges due to land acquisition issues because the two underpasses are located between Sealdah and Park Circus and both roads are narrow secondary roads. - In addition to the above, it is often observed that many people illegally cross railways. Even in locations where there are railway overbridges, pedestrians and rickshaws usually prefer level crossings to the bridge. This situation not only endangers people, but also reduces train speeds. - Underpasses for light vehicles and pedestrians will contribute to improving this situation, because people prefer to use underpasses. The Study Team proposes the following four railway underpasses for light vehicles. 1. Two level crossings between Sealdah and Park Circus 2. Kankelea crossing between Ballygunj and Dhakuria 3. Selinpur Road between Jadabpur and Dhakuria
Project Objectives:	- To enhance safety of pedestrian, vehicles and trains - To remove traffic bottleneck and reduce traffic congestion - To increase travel speed of trains
Project Status:	Concept Stage.
Anticipated Timeframe:	Short-term
Project Description:	**Construction of Railway Underpasses** Locations: 1. Two existing level crossings between Sealdah and Park Circus 2. Kankelea crossing between Ballygunj and Dhakuria 3. Selinpur Road between Jadabpur and Dhakuria Length Around 400-500m Construction component: - Underground construction for Underpass. Issues to be solved - Water drainage during the rainy season should be considered at the engineering design stage of underpasses and subways
Social and Environmental Impact:	- Air and noise pollution during construction phase. - Reduction in noise and air pollution on the project corridor. Stricter enforcement of vehicular emission and noise pollution standards would further reduces air and noise pollution levels. - For protection of the trees within a rural settlement, road design is very important. - Construction should be avoided over water bodies to protect the aquatic environment. - For aesthetic reasons, green belt development is necessary.
Implementation Arrangements:	Eastern Railway and Transport Department will implement. The two agencies will share the cost.

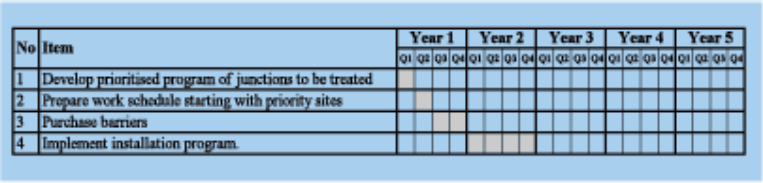
Project Cost:	**JBIC Loan:** None **Domestic Fund: Rs. 180 million** **Construction of Railway Underpass** Rs. 45 million for underpass Total Cost = 45 x 4 = Rs. 180 million **Total Cost = Rs. 180 million**
Implementation Schedule:	

No.	Item	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Conduct Feasibility Study												
2	Prepare DPR												
3	Project Preparation/Procure contractor												
4	Land Acquisition and Clearance												
5	Construction of Underpass												

Site Location & Physical Plan



Project Code	Project Name	Categories	Location
T7 (NT4)	Pedestrian barriers at selected locations	Traffic Management and Road Safety	Kolkata

Project Rationale and Justification:	Pedestrians are not well provided for in the city and they tend to have poor road user behaviour. Conflicts between pedestrians and vehicles are very frequent, especially where footways are so crowded and encroached upon that pedestrians have to walk on the road. There is a need for safety barriers at selected locations to help segregate pedestrians from motor vehicles
Project Objectives:	Improved traffic efficiency and road safety outcomes for all road users including pedestrians
Project Status:	Concept Stage
Anticipated Timeframe:	Short-term (2-3 years)
Project Description:	Implementation of Pedestrian Barriers at Sites with Large Pedestrian Volumes Provision and implementation of pedestrian safety barriers at sites in KMA where there are large pedestrian volumes and pedestrian safety outcomes are poor. The Tasks are: (1) Develop prioritised program of junctions to be treated; (2) Prepare work schedule starting with priority sites; (3) Purchase barriers: (4) Implement installation program.
Social and Environmental Impact:	Beneficial social and environmental impacts with vulnerable road users being better protected and having high quality, convenient, well-located and well-designed facilities.
Implementation Arrangements;	GWB TD and KMDA
Project Cost:	**JBIC Loan** None **Local Funds** GOI Mega City Funds Physical Works Rs. 42 million **Total cost: Rs. 42 million**
Implementation Schedule:	

No	Item	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Develop prioritised program of junctions to be treated																				
2	Prepare work schedule starting with priority sites																				
3	Purchase barriers																				
4	Implement installation program.																				

Project Code	Project Name	Categories	Location
P9 (PD1)	Improvement in Pedestrian Access to Rail and Metro Stations	Infrastructure/ Transportation	Kolkata (City-Wide)

Project Rationale and Justification:	- Facilities for pedestrians are poor and this is reflected in the number of fatalities: 64% of road accident fatalities in 2005 were pedestrians. - Footways are encroached by street hawkers and other activities and pedestrians frequently have to walk in the road. - Footway surfaces are very poor. - There are very few pedestrianised areas and no pedestrian streets. - There are not enough pedestrian phases at traffic signals and few pedestrian safety islands. Where there are such phases, they operate simultaneously with conflicting vehicle turning movements - An area where improved pedestrian facilities would be particularly beneficial is along BB Ganguly Street between Sealdah Station and BBD Bag where vast streams of commuters surge along the street at peak times.
Project Objectives:	To improve the pedestrian environment to improve pedestrian safety; encourage walking as a sustainable mode of transport; and to encourage access to the public transport network.
Project Status:	Conceptual
Anticipated Timeframe:	Short-term
Project Description:	The tasks to be carried out for pedestrian improvements may be summarized as: (i) Assess City-Wide Pedestrian Facilities (ii) Develop Plan for Pedestrian Network (iii) Upgrade Pedestrian Network (iv) Identify Areas for Pedestrian Road Overbridges (v) Design Pedestrian Road Overbridges (vi) Construct Pedestrian Overbridges (vii) Identify Mid-Block Pedestrian Crossing Sites (viii) Identify Sites for Pedestrian Phases at Traffic Signals (ix) Tender Equipment (x) Install Equipment In order to develop the plan for the pedestrian network, an assessment for pedestrian demand and required facilities would include the following: - Assess the context of the related land-use developments, including the level of predominant pedestrian activities - Identify pedestrian generators/attractors, including important transport nodes and pedestrian catchment areas and desire lines - Quantify access, interchange and street-to-street movements which can be channelized and fed to a pedestrian network, probably using modeling/trip rate methods for such demand estimation - Assess the operational performance, external impacts (traffic, construction, etc), and costs of implementing alternative schemes - Conclude what links/spaces should be constructed/provided
Social and Environmental Impact:	Land acquisition is expected to be minimal and social benefits would be positive due to the encouragement of safe walking.
Implementation Arrangements:	GWB TD and KMDA

Project Cost:	Pedestrian areas: 50 sites @ Rs. 10.50 million each = Rs. 525 million Pedestrian signals: 25 sites @ Rs. 6.30 million each = Rs. 157.5 million Mid-block pedestrian crossings: 20 sites @ Rs. 0.84 million each = Rs.16.8million Pedestrian overbridge: 10 sites @ Rs. 12.60 million each = Rs. 126 million TOTAL: Rs. 825.30 million
Implementation Schedule:	

No.	Tasks	Year 1				Year 2			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Assess City-Wide Pedestrian Facilities								
3	Develop Plan for Pedestrian Network								
5	Upgrade Pedestrian Network								
7	Identify Areas for Pedestrian Road Overbridges								
8	Design Pedestrian Road Overbridges								
9	Construct Pedestrian Overbridges								
10	Identify Mid-Block Pedestrian Crossing Sites								
11	Identify Sites for Pedestrian Phases at Traffic Signals								
12	Tender Equipment								
13	Install Equipment								

Source: This Study, 2007

Annex 3 Tentative Checklist for Evaluating CMPs

This annex provides a tentative checklist of the main points to be presented in a CMP. It is designed to assist with the CMP evaluation process.

	YES	PARTIAL	NONE
Scope of CMP			
• Are the target areas and planning horizons clearly identified?			
Existing Land Use Plan			
• Does the CMP fully review the existing land use plans? • Have land use issues in relation to mobility improvement been identified			
Existing Transport System			
• Does the CMP review the existing reports, plans and proposals?			
• Does the CMP review and summarise the existing transport infrastructure?			
• Does the CMP review and summarise the existing public transport system?			
• Does the CMP review existing traffic safety and enforcement?			

• Does the CMP review the institutional and financial situation of the transport sector?			
• Does the CMP review environmental and social conditions?			
Existing Transport Demand			
• Have the necessary data for existing transport demand been collected, based on the specified formats?			
• Has the base-year transport demand model been developed with the proper methodology?			
• Does the base-year transport demand model estimate traffic volumes with a high correlation to observed traffic volumes?			
Analysis of the Existing Traffic/Transport Environment			
• Does the CMP show adequately traffic characteristics?			
• Has an analysis of the road network been carried out, based on the results of a base-year transport demand model?			
• Have specific issues for the city been identified, based on comparative analyses with data from other cities?			
• Have issues with the existing traffic/transport environment been addressed, with reference to compiled information and data?			
Land Use Scenarios			
• For cities with a Master Plan: Has the land use scenarios assumed in the CMP reflected the growth pattern indicated in the Master Plan?			
• For cities without a Master Plan: Have realistic and feasible land use scenarios been developed, considering the existing situation?			
Transport Network Scenarios			
• Have realistic and feasible transport network scenarios been developed?			
Evaluation of Strategic Land Use and Transport Patterns			
• Is there appropriate consistency between the model and future transport network/land use scenarios?			
• Has each scenario been evaluated and compared with the indicators listed in the toolkit?			
• Has the network evaluation been conducted with scenarios based on the proposed measures?			
Mobility Framework			
• Does the mobility framework properly describe the future mobility strategy?			
• Does the mobility framework focus on integration of transport development and land use planning?			
• Have the mobility framework and associated proposed measures been revised,			

based on the results of the network evaluation?			
• Does the mobility framework include consideration of non-motorized transport (NMT), including pedestrian traffic?			
Mobility Improvement Measures			
• Are the proposed urban transport measures based on the mobility framework?			
• Does the CMP avoid overemphasizing road improvement measures?			
• Have sufficient public transport measures been included?			
• Have sufficient traffic management measures been included?			
Social and Environmental Considerations			
• Have the social and environmental consideration been addressed appropriately?			
Implementation Program			
• Has the project long list been prepared?			
• Have the identified priority projects been selected applying clear and reasonable criteria?			
• Have the feasible financing options for the priority measures been indicated?			
• Has an implementation program been developed?			

Annex 4 Modelling Approach in CMP Process

Introduction

The modelling technique provides a quantitative and scientific approach to improving the mobility of people. The approach enables an integrated planning of urban land use and transport systems. The detailed methodology for transport demand modelling is described in a number of references. Several major references are shown at the end of this Annex.

It is recommended, however, that the use of the modelling technique should be limited to project evaluation purposes, rather than plan generation. In the past, many studies made a common mistake in that modelling approaches were used to generate extensive infrastructure projects, such as highways or flyovers, without considering a comprehensive range of options, including the use of public transport systems, NMTs, or various traffic management and/or demand management measures.

It is also proposed that a simplified model should be developed for the purpose of CMP development. As widely recognized, modelling requires substantial cost, workforce and time. Though it is of course true that a detailed model is expected to provide more accurate results, considering the CMP objective to develop a long-term vision and goals for entire city development, the simplified model can provide adequate results with a shorter period and lower cost. Therefore, the following description shows the development methodology for a simplified model as part of CMP preparation.

Methodology of Developing a Transport Demand Model

The overall methodology for a transport demand model comprises two major steps: 1) Developing a Base Year Transport Demand Model, and 2) Developing a Future Transport Demand Model. The following sections show the details of each step.

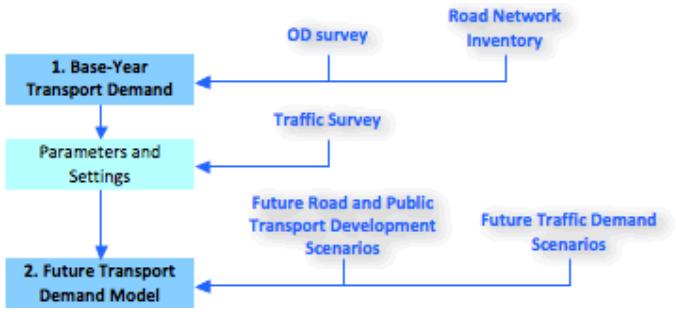


Figure 1 Work Flow to Develop Transport Demand Model

1. Development of a Base-year Transport Demand Model

As the initial step in the demand modeling, a base-year model may be developed. The methodology for model calibration is given in Figure 2.

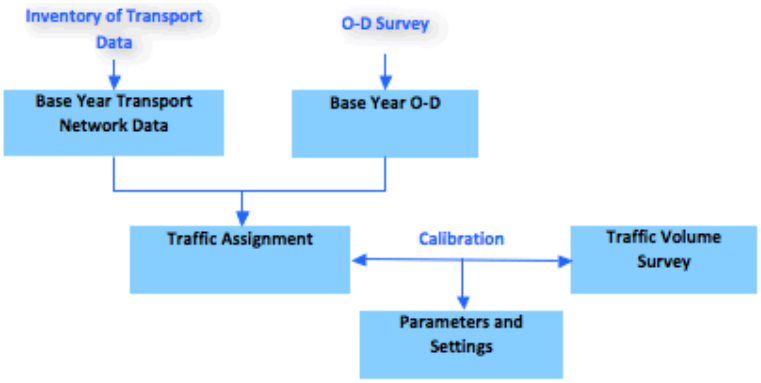


Figure 2 Base-Year Transport Demand Model Calibration

Preparation of Base-Year Origin-Destination (O-D) Matrices: The trip generation/ attraction, distribution and modal split can be estimated simultaneously in the base-year model. Person-trip O-D matrices by vehicle type are directly estimated from the O-D survey mentioned above, with the number of person-trip generations and attractions in each zone divided by the sample rate in each zone.

The number of zones is typically around 20 to 40 for the simplified model and a single zone is expected to have around 50,000 – 100,000 population. To estimate modal spilt, the major

modes must be classified, but the workload of this step will increase significantly as the number of modes increases. For Indian cities, it is recommended that the trips by the following modes be estimated separately (other modes such as motorcycle or taxi can be included depending on the situation in each city):

- passenger vehicle;
- auto and cycle rickshaws;
- bus;
- truck; and
- bicycle.

The main data required and outputs are as follows:

- Required Input Data
  - The number of trips between each zonal pair by vehicle mode, from the results of O-D surveys
  - Sample rate in each zone
- Output
  - Person-trip O-D matrices by vehicle mode (i.e., private vehicle including passenger car, motorcycle, and bicycle, and public transport)

Preparation of Base-Year Transport Network Data: The transport network data should include the road and public transport networks. For the simplified model, the network should include only trunk routes, such as national and state highways, and roads with high traffic capacity or volume. The network data should consist of a number of link data, including the following:

- coordination;
- traffic capacity;
- free flow speed; and
- road regulations (e.g., one-way, heavy truck ban)

Traffic Assignment: With O-D matrices and road network data, traffic volumes in each road section will be estimated. Two types of O-D matrix will be used: person-trip O-D and vehicle-trip O-D matrices in passenger car units (PCUs), obtained from person-trip O-D matrices divided by both average number of passengers in each vehicle type and the PCU factor for each vehicle type. While assignment of person-trip O-D will show the person travel pattern and major corridor demand in person-trip units, assignment of vehicle-trip O-Ds will show the Volume-Capacity Ratio (V/C ratio) in each road link, indicating the level of congestion and identifying road network bottlenecks. Road network data can be obtained from the road network inventory described above. Required input data and outputs follow:

- Required Input Data
  - Person-trip O-D matrices by vehicle mode
  - Average number of passengers in each vehicle type
  - PCU factor for each vehicle type
  - Road network data

- Output
  - Traffic volume on each road section
  - Vehicle/Capacity ratio on each road section
  - Average travel time on each road section

Calibration of the Model: Calibration of the traffic model is essential to ensure accuracy and reliability. The results of the assignment step in the base year should be compared with actual observed traffic count data, such as screen line and cordon line data. The parameters should be adjusted to provide a better match. These parameters will be used for the model in the target year.

2. Development of a Future Transport Demand Model

Development of a transport demand model is an important task in the CMP. The base-year model will be developed based on the surveys conducted above and it should be calibrated using the existing traffic flow. The model for the target year will then be developed, with the future transport network and land use scenarios. After the development of the model, alternative scenarios and projects will be evaluated with the transport demand model.

A flowchart for developing the model is shown in Figure 3.

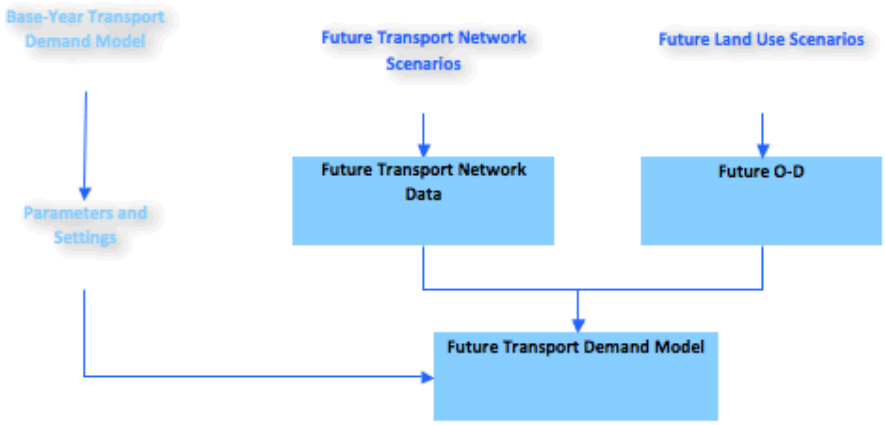


Figure 3 Work Flow to Develop Transport Demand Model

The transport demand model includes the following four sub-components:

(i) Trip generation/attraction: This step estimates the volume of person-trips generated/ attracted to/from each zone.

(ii) Trip distribution: The trip distribution step calculates the number of person-trips travelling between zones and develops an O-D matrix.

(iii) Modal split: The modal split step estimates the number of trips by each mode and provides vehicle O-D matrices for each mode.

(iv) Assignment: The assignment step distributes O-D trips onto the road network and estimates the traffic volume on each road.

Estimation of Transport Demand for the Target Year

Step 1: Trip Generation/Attraction: A function that estimates future person-trip generation and attraction should be prepared through a regression analysis from the number of base-year person-trips and explanatory variables, such as population, number of employees and number of non-employees. The function should be estimated by trip purpose.

Next, future trip generation/attraction in each zone are estimated through the function described above, using socio-economic data such as forecast population and employment, which are to be clarified for the future land use scenario described in the previous section.

Required data and outputs are as follows:

- Required Data
  - Socio-economic data for each zone
  - Trip generation/attraction function
- Output
  - Number of trip generations/attractions in each zone

Step 2: Trip Distribution: The number of trips between zonal pairs is estimated from the volume of trip generation/attraction in each zone. Among several methods of estimating trip distribution, the gravity method is most widely used. Required data and output are as shown below.

- Required Data
  - Number of trip generations/attractions in each zone
  - Trip distribution function
  - Distance matrices between each two zones
- Output
  - Person-trip O-D matrices for target year

Step 3: Modal Split: Using the modal split scenario and the average number of passengers carried by each vehicle type, the O-D matrix for each vehicle type is estimated from the person-trip O-D.

Required data and output are as follows:

- Required Data
  - Modal split
  - Trip distribution function
  - Distance matrices between each two zones
- Output
  - Person-trip O-D matrices for target year

Box 1 summarizes the modal split models.

Box 1 Modal Split Models

There are two major types of model to calculate the modal split rate: aggregate and disaggregate:

- Aggregate Model: An aggregate model uses aggregated data, such as modal choice rate by trip distance based on the O-D survey. An aggregate model can be developed relatively easily, but is not suitable for evaluating specific public transport projects, such as MRT projects, since it does not forecast modal shift from private vehicles to public transport. The future modal share can be provided from policy targets, although there is no certainty that it will be achieved.
- Disaggregate Model: The disaggregate model is based on individual preferences in modal choice. The disaggregate model requires additional data and specialized knowledge to develop and use the model. In particular, it is relatively complicated to develop a model for more than two modes. The advantage of a disaggregate model is that it can assess both modal shift from private vehicles to public transport and the benefits of a public transport project, such as an MRT.

An aggregate model is recommended for the CMP. However, a disaggregate model for a limited corridor should be developed for the Detailed Project Report of a major public transport project, such as an MRT project.

Step 4 Assignment: Using the same methodology as applied in the base-year model, the traffic volume on each road section should be calculated. Future vehicle-trips, person-trip ODs, and the road network will be required as input data.

References on Transport Demand Forecast Modelling

1. Fundamentals of Transportation and Traffic Operations, Carlos F. Daganzo
2. Highway Traffic Analysis and Design, R.J.Salter
3. Traffic Assignment Techniques, Royal Thomas
4. Traffic Engineering, Mc Shane
5. Traffic Flow Fundamentals, Adolf. D.May
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7. Transportation Engineering and Planning (III Edition), C.S. Papacostos and P.D.Prevedours
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9. Urban Transportation Networks, Yusaf Sheffi

Introduction

The modelling technique provides a quantitative and scientific approach to improving the mobility of people. The approach enables an integrated planning of urban land use and transport systems. The detailed methodology for transport demand modelling is described in a number of references. Several major references are shown at the end of this Annex.

It is recommended, however, that the use of the modelling technique should be limited to project evaluation purposes, rather than plan generation. In the past, many studies made a common mistake in that modelling approaches were used to generate extensive infrastructure projects, such as highways or flyovers, without considering a comprehensive range of options, including the use of public transport systems, NMTs, or various traffic management and/or demand management measures.

It is also proposed that a simplified model should be developed for the purpose of CMP development. As widely recognized, modelling requires substantial cost, workforce and time. Though it is of course true that a detailed model is expected to provide more accurate results, considering the CMP objective to develop a long-term vision and goals for entire city development, the simplified model can provide adequate results with a shorter period and lower cost. Therefore, the following description shows the development methodology for a simplified model as part of CMP preparation.

Methodology of Developing a Transport Demand Model

The overall methodology for a transport demand model comprises two major steps: 1) Developing a Base Year Transport Demand Model, and 2) Developing a Future Transport Demand Model. The following sections show the details of each step.

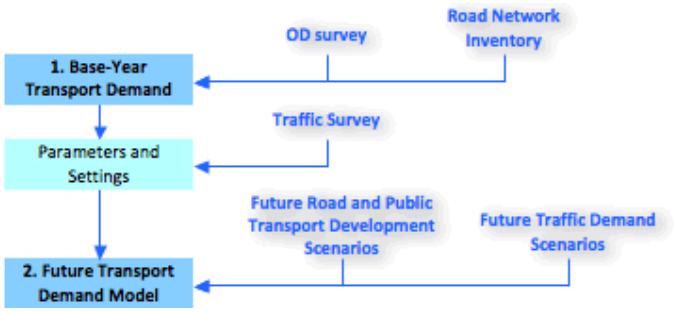


Figure 1 Work Flow to Develop Transport Demand Model

1. Development of a Base-year Transport Demand Model

As the initial step in the demand modeling, a base-year model may be developed. The methodology for model calibration is given in Figure 2.

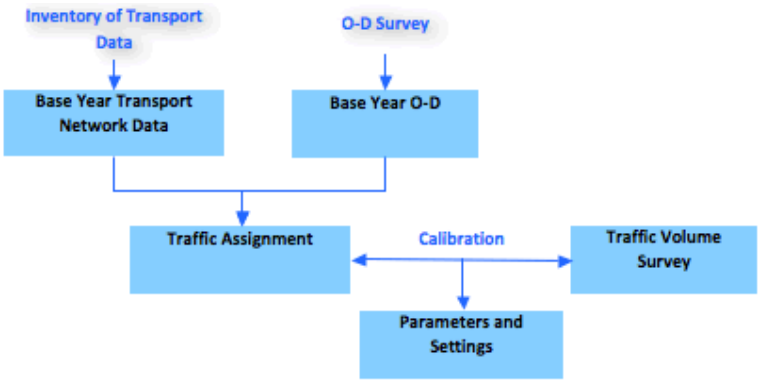


Figure 2 Base-Year Transport Demand Model Calibration

Preparation of Base-Year Origin-Destination (O-D) Matrices: The trip generation/ attraction, distribution and modal split can be estimated simultaneously in the base-year

model. Person-trip O-D matrices by vehicle type are directly estimated from the O-D survey mentioned above, with the number of person-trip generations and attractions in each zone divided by the sample rate in each zone.

The number of zones is typically around 20 to 40 for the simplified model and a single zone is expected to have around 50,000 – 100,000 population. To estimate modal spilt, the major modes must be classified, but the workload of this step will increase significantly as the number of modes increases. For Indian cities, it is recommended that the trips by the following modes be estimated separately (other modes such as motorcycle or taxi can be included depending on the situation in each city):

- passenger vehicle;
- auto and cycle rickshaws;
- bus;
- truck; and
- bicycle.

The main data required and outputs are as follows:

- Required Input Data
  - The number of trips between each zonal pair by vehicle mode, from the results of O-D surveys
  - Sample rate in each zone
- Output
  - Person-trip O-D matrices by vehicle mode (i.e., private vehicle including passenger car, motorcycle, and bicycle, and public transport)

Preparation of Base-Year Transport Network Data: The transport network data should include the road and public transport networks. For the simplified model, the network should include only trunk routes, such as national and state highways, and roads with high traffic capacity or volume. The network data should consist of a number of link data, including the following:

- coordination;
- traffic capacity;
- free flow speed; and
- road regulations (e.g., one-way, heavy truck ban)

Traffic Assignment: With O-D matrices and road network data, traffic volumes in each road section will be estimated. Two types of O-D matrix will be used: person-trip O-D and vehicle-trip O-D matrices in passenger car units (PCUs), obtained from person-trip O-D matrices divided by both average number of passengers in each vehicle type and the PCU factor for each vehicle type. While assignment of person-trip O-D will show the person travel pattern and major corridor demand in person-trip units, assignment of vehicle-trip O-Ds will show the Volume-Capacity Ratio (V/C ratio) in each road link, indicating the level of congestion and identifying road network bottlenecks. Road network data can be obtained from the road network inventory described above. Required input data and outputs follow:

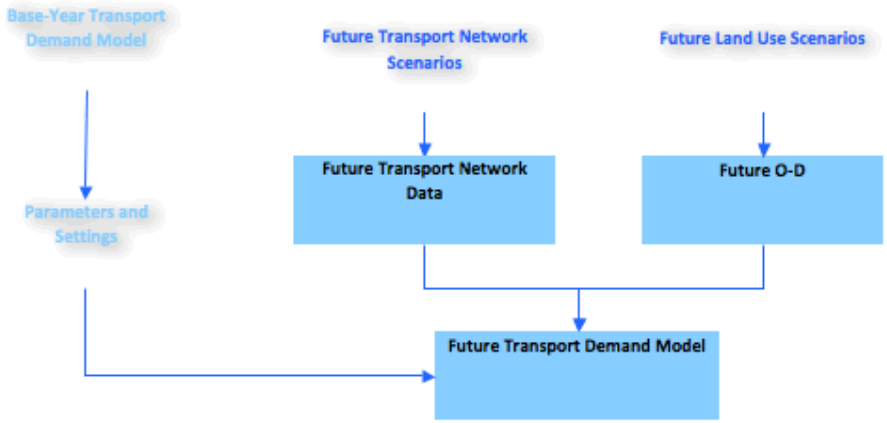
- Required Input Data
  - Person-trip O-D matrices by vehicle mode
  - Average number of passengers in each vehicle type
  - PCU factor for each vehicle type
  - Road network data
- Output
  - Traffic volume on each road section
  - Vehicle/Capacity ratio on each road section
  - Average travel time on each road section

Calibration of the Model: Calibration of the traffic model is essential to ensure accuracy and reliability. The results of the assignment step in the base year should be compared with actual observed traffic count data, such as screen line and cordon line data. The parameters should be adjusted to provide a better match. These parameters will be used for the model in the target year.

2. Development of a Future Transport Demand Model

Development of a transport demand model is an important task in the CMP. The base-year model will be developed based on the surveys conducted above and it should be calibrated using the existing traffic flow. The model for the target year will then be developed, with the future transport network and land use scenarios. After the development of the model, alternative scenarios and projects will be evaluated with the transport demand model.

A flowchart for developing the model is shown in Figure 3.



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Estimation of Transport Demand for the Target Year

Step 1: Trip Generation/Attraction: A function that estimates future person-trip generation and attraction should be prepared through a regression analysis from the number of base-year person-trips and explanatory variables, such as population, number of employees and number of non-employees. The function should be estimated by trip purpose.

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  - Trip generation/attraction function
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- Required Data
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  - Distance matrices between each two zones
- Output
  - Person-trip O-D matrices for target year

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Required data and output are as follows:

- Required Data
  - Modal split
  - Trip distribution function
  - Distance matrices between each two zones
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Box 1 summarizes the modal split models.

Box 1 Modal Split Models

There are two major types of model to calculate the modal split rate: aggregate and disaggregate:

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Annex 5 Approaches to Selecting Priority Measures

Based on the indices developed in Task 2-5, a diagnosis of the transport situation in the subject city can be undertaken. The flowchart and checklists may be used to identify high priority public transport measures.

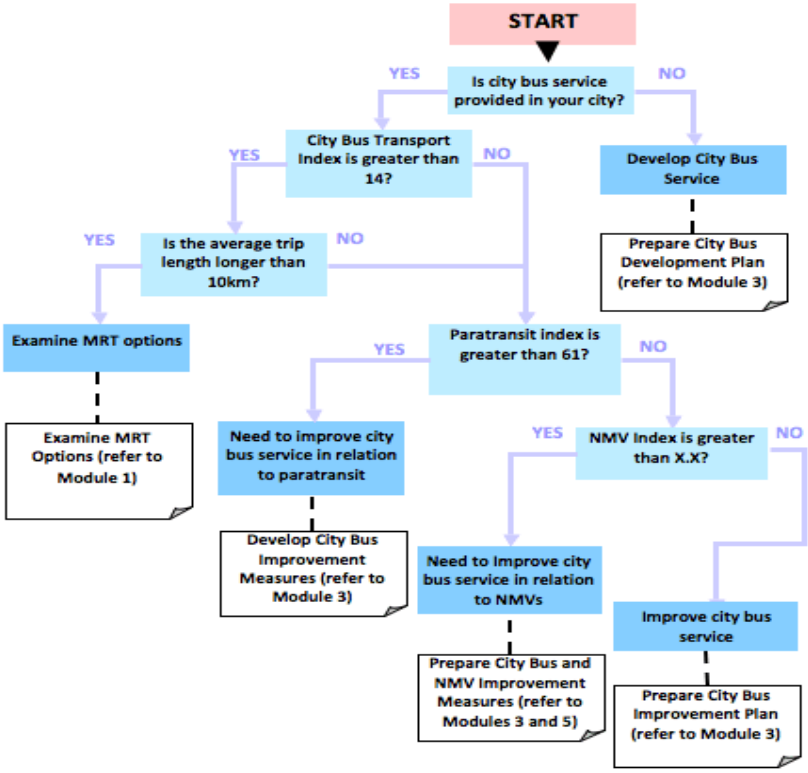


Figure 1 Selection of Priority Measures: An Example Approach

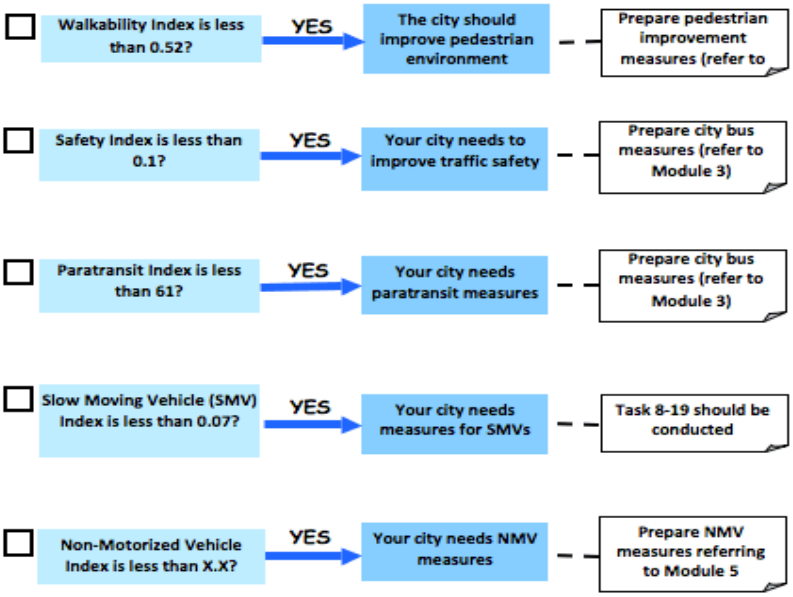


Figure 2 Identification of Additional Mobility Improvement Measures

Annex 6 Sample TOR for CMP Preparation

This annex provides a sample terms of reference (TOR) for use in appointing consultants to assist with the preparation of a CMP. The TOR should be amended where necessary to reflect each city's characteristics.

Sample TOR for the Preparation of a CMP

1. BACKGROUND

Rapid development is exacerbating urban transport problems, such as traffic congestion and accidents. Substantial efforts are being made, but cities have difficulty coping with the rapid increase in the number of private vehicles while improving personal mobility and goods distribution. There is insufficient transport planning capacity within local government. In particular:

- Although many proposals have been submitted for the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) fund to implement various urban transport projects (including Mass Rapid Transit (MRT), Bus Rapid Transit (BRT), flyovers and road improvements) there is often inadequate information and incomplete analysis and the proposals are not grounded in a comprehensive urban transport strategy or integrated either with land use or transport plans.
- Although some cities have prepared urban transport master plans and undertaken comprehensive transport and traffic studies, these focused mainly on catering for vehicles and did not pay enough attention to personal mobility or goods distribution.

It is important to focus on personal mobility to achieve cost-effective and equitable urban transport measures within an appropriate and consistent methodology. This is in line with the National Urban Transport Policy (NUTP). Accordingly, the Ministry of Urban Development (MoUD) encourages each city to prepare a Comprehensive Mobility Plan (CMP) as part of long-term urban transport strategy to provide for a sustainable improvement in the mobility of people and goods in metropolitan regions.

The CMP is a key document providing the rationale for transport proposals. Therefore, within the overall planning hierarchy, the CMP may be considered a prerequisite for the submission of DPR (Level 1) for JNNURM funding. All cities considering a funding application to central government are recommended to submit a CMP and to obtain approval from MoUD.

Guidelines and Toolkits for Urban Transport Development were prepared in 2008 under Technical Assistance on Urban Transport Strategy (TA 4836-IND), funded by the Asian Development Bank. They are designed for decision makers and practitioners in states and municipal governments concerned with urban transport development in medium-sized cities and for use when appraising projects for funding by the JNNURM.

The initial set of Guidelines and Toolkits (others are being prepared) comprises the following modules:

Module 1: Comprehensive Mobility Plan: Preparation Toolkit (which is attached as an Annex to the TOR)

Module 2: Bus Rapid Transit (HCBRT): Toolkit for Feasibility Studies

Module 3: Bus Service Improvement: Policy and Options

Module 4: Parking Measures: Policy and Options

Module 5: Non-motorized Transport (NMT) Measures: Policy and Options

The Guidelines and Toolkits focus on the planning process and on developing policy options. They do not provide technical guidelines for the development of detailed transport measures, for which references are given in each case.

Module 1 provides the toolkit for CMP preparation, defining the tasks and providing general guidelines on key issues. The consultants should closely adhere to the methodology and content of the CMP, as described in Module 1.

2. SCOPE OF WORK

The tasks to be carried out are detailed below. The consultants should also refer to Module 1 and its Annexes for further details.

- Task 1 Confirm Scope and Timeframe
- Task 2 Collect Data and Analyze Urban Transport Environment
- Task 3 Prepare and Evaluate Urban Transport Development Strategy
- Task 4 Develop Urban Mobility Plans
- Task 5 Prepare Implementation Programme
- Task 6 Stakeholder Consultations

Task 1 Confirm Scope and Timeframe

As an initial task, the area covered by the CMP and the planning horizons should be clearly defined, in association with all agencies concerned.

- CMP planning area, typically the metropolitan area (or agglomerated area) including satellite towns (e.g. jurisdictional area of metropolitan Development Authority); and
- Target years and planning horizons (long, medium and short term). Generally the short and medium term target years should be 5 and 10 years from the base year respectively and the long term planning horizon should extend to 20 years. The base year should be the latest year for which data are widely available at the start of work. This will typically be the year preceding the study.

Task 2 Collect Data and Analyze Urban Transport Environment

Task 2-1 Review City Profile

Prepare a brief profile of the CMP planning area from available documents, including:

- Location
- Population and demographic data
- Land area

- Regional linkages
- Socio-economic data; and
- Environmental issues, such as natural conservation areas.

Task 2-2 Collect Data and Review Urban Transport System

Collect and review all relevant reports, with particular attention to the City Development Plan (CDP). Data on socio–economic characteristics, vehicle ownership, the transport network, transport policy and other available engineering parameters relevant to the CMP shall be collected. All other relevant information relating to accidents, land use planning, mapping, rights of way on key corridors shall be collected. Any inconsistency or deficiency in the information shall be addressed.

In addition to the above the consultants shall collect the following items (as available):

- Small-scale maps land use maps
- SPOT-satellite images
- Socio-economic data.

Prepare a database more specifically relative to land-use and topography of the area. Of special importance in the process of traffic model development and generating engineering solutions is the evaluation of SPOT satellite imagery, providing an updated picture of land use.

To review the existing urban transport systems, the consultants should collect and review the following data and information, through literature review, interview survey and field surveys. Details are given under this task in Module 1, the Annexes to which contain sample forms.

- Existing studies, reports and proposals
- Existing transport infrastructure
- Public transport
- Traffic safety and enforcement
- Institutional and financial situation
- Environmental and social condition.

Task 2-3 Traffic Surveys and Inventories

Traffic and other surveys, as defined below, shall be carried out in the form of surveys, data collection, assessment, analysis and evaluation. The objective is to determine:

- Traffic flow and composition by link
- Assessment of level of service
- Vehicle characteristics for determination of vehicle operating costs

Proposed traffic survey locations should be identified during Task 1 and be listed in the Inception Report.

Task 2.3.1 Manual Classified Counts

Classified volume counts will be conducted at critical links and intersections for a period of 8 hours (4 in the morning and 4 in the evening) including the morning and evening peak hours. The following data will be collected:

- Category wise hourly flow
- Category wise hourly turning movement
- Variation in flow before, during and after the peak.

Task 2.3.2 Parking Survey

Work and business centres, shopping complexes and tourist attractions are major generators of parking demand. Parking demand should be established by a manual count of each vehicle type where there is significant on-street parking occurs. The survey will be conducted for a period of 12 hours continuously in such areas.

Task 2.3.3 Origin-Destination Survey

Origin-destination surveys will be conducted through roadside interviews on an outer cordon i.e. major entry/exit points and on corridors where important activity locations are situated. The tentative number and location of survey stations, the survey time in hours per day, will be confirmed after detailed discussions with the client. The location and timing of the roadside interviews will coincide with that of traffic counts to facilitate adjustment for sampling. The information shall be obtained by trained enumerators and experienced supervisors and include: type of vehicle, make, type of commodity carried, origin and destination, trip purpose, place of residence and employment of road user and frequency of travel.

Task 2.3.4 Speed and Delay Surveys

These surveys will establish road capacity and extent of congestion on key sections to determine possible improvements: widening, intersections, traffic control, traffic management etc. The consultants shall carry out speed delay surveys in both peak and anti-peak directions during peak and off-peak hours.

The free speed shall be observed and impact of the prevailing traffic on running speed during peak and off-peak hours for each section shall be established to indicate the level of congestion. Typical delays and causes shall be identified.

Task 2.3.5 Mass Transit and Passengers Survey

The survey will be conducted on routes within the city and at terminal areas for a period of 24 hours. The basic purpose of the survey will be to collect information regarding origin, destination, trip purpose, frequency of travel and other particulars. The random survey sampling technique will be adopted to survey the passengers and will cover all modes.

Task 2.3.6 Commuter Survey

Public and private trips by all modes which originate/terminate outside the city planning area with destination/origin within the city will be surveyed. The survey will be planned for 24 hours at railway stations, river banks, seaports, airport etc. and at an outer cordon.

Task 2.3.7 Household Survey

This survey will collect data on travel characteristics of household residents and general characteristics of the household influencing trip making. The study area will be divided into zones. A sample size of a minimum of 2 % of households will be covered. Based on the survey, travel demand characteristics will be established.

Task 2.3.8 Vehicle Operators' Survey

A sample survey of operators of taxis, auto rickshaws, goods vehicles along with slow moving goods vehicles will be conducted inside the city area with assistance from the vehicle owners' associations. Information on vehicle and operating characteristics will be collected. In the case of slow moving goods vehicles, operating cost, socio-economic characteristics of operators and routes of operation will be determined.

Task 2.3.9 Terminal Area Survey

This survey will collect information on movement patterns of persons/goods at major terminal and market areas: vehicle (goods and passenger) entry/exit, including commodity/occupancy etc. The survey is to be undertaken at main railway stations, bus terminals, port/river bank, airport etc.

Task 2.3.10 Pedestrian Survey

Pedestrian surveys will be carried out to assess flows/demand at identified major intersections and road corridors. The survey will be from 06:00 to 22:00 on a normal working day and will detail the number of pedestrians moving along and across the road at mid block and at intersections.

Task 2.3.11 Road Inventory

An inventory will be conducted along all major roads in adequate detail, including link lengths, cross-sectional details, type and general surface condition, street furniture, intersections, control devices, drainage condition, abutting land use etc.

Task 2.3.12 Topographic Surveys at Key Sections/Junctions

The consultants shall conduct plane table surveys to prepare base plans for critical sections and junctions to facilitate improvements. Total station survey will also be conducted for major terminals (bus and rail), based on the prevailing traffic circulation pattern and parking demand etc. and appropriate improvement proposals will be established.

Task 2.3.13 Develop Base-Year Transport Demand Model

In this task, a base-year transport demand model will be developed using the results of the O-D survey. Key steps in demand modeling are elaborated in Module 1 Annex 4.

The CMP should apply traffic demand modeling to analyse/evaluate urban land use and the transport system. Modeling provides a quantitative and scientific approach to improving mobility. The modeling should emphasize person-based travel patterns, along with vehicle movements and include more NMV/pedestrian movements than conventional modeling

approaches. It should also enable integrated planning of urban land use and the transport system.

Task 2-4 Review Land Use Plan

Data on existing land use and land use plans should be collected and presented, through a detailed review of existing development plans, including the Master Plan and/or the City Development Plan (CDP). In particular, new development areas that will affect transport demand in the planning area should be inventoried and summarized (Module 1 Annex 1 Survey Form 4-1 should be used).

Task 2-5 Analyse Traffic/Transport Situation

Based on the information/data collected, a basic analysis of the transport and traffic situation should be carried out identifying characteristics and issues for the city. The following should be carried out (further details are given in Module 1 under this task):

- Comparative analysis of urban transport situation
- Diagnosis of urban transport situation
- Analysis of traffic characteristics
- Analysis of traffic
- Analysis of social conditions

Task 3 Prepare and Evaluate Urban Transport Development Strategy

Task 3-1 Visions and Goals

It is essential that the mobility improvement measures in CMP form a coherent package with a consistent vision and goals for the desirable direction of city urban transport. The visions and goals define the desired form of long-term urban transport system in the city. While visions are statements of the desirable direction of urban transport development, goals are quantitative/qualitative targets for major indices, to be achieved within the planning horizons.

Task 3-2 Urban Growth Scenarios

In this task, optimal land use and transport systems will be examined. For analytical purposes, urban growth scenarios will be developed in combination with strategic level transport networks. Master Plans regulate land use pattern, but the CMP could provide a preferred growth scenario from the viewpoint of an optimal urban land use and transport development pattern.

Task 3-3 Future Transport Network Scenarios

The future transport network consists of the existing network and additional network. Future modal split (ratio of trips made by public and private transport modes) needs to be estimated by the use of modelling analysis. When the detailed modelling method is not applied, it is recommended to set several modal split scenarios that will be used in generating alternative transport networks to meet the future travel demand.

Task 3-4 Development Urban Land Use and Transport Strategy

Each combination of transport network and urban growth scenario developed in the previous tasks should be assessed using the transport demand model. Land use patterns will be included in the modelling analyses, in terms of a specific distribution of residential population and employment. Various land-use planning measures should be considered in relation to transport development strategies. The alternative development scenarios will be evaluated by using criteria, such as potential for developing public transport systems, total travel time, average travel speed, and economic indices. Based on the evaluation, a desirable urban development strategy will be proposed.

Task 4 Develop Urban Mobility Plans

Urban transport projects should be identified which would support the CMP vision and goals and the development scenario. The existing project list, summarized in Task 2, will be a starting point. Example projects include:

Task 4-1 Public Transport Improvement Plan

A public transport improvement plan should be developed, that covers:

- Development of Bus Service or Bus Improvement Plan
- Development of Trunk and Feeder Public Transport Network
- MRT Options

Mass Rapid Transit (MRT) refers to a public transport system carrying passengers within and between urban areas. Selection of MRT appropriate systems should be undertaken by considering corridor characteristics and the technical parameters of available MRT systems. Module 1 (CMP Toolkit) shows a suggest approach for selecting MRT options.

Task 4-2 Road Network Development Plan

Road projects will be developed and listed in the CMP, including the following:

- Hierarchical Road Network;
- Arterial Road Construction/Widening Projects;
- Secondary Road Construction/Widening Projects;
- Intersection Improvement Projects;
- Flyover Projects; and
- Railway over Bridge (ROB) or Underpass Projects.

The Road Network Plan should include the following aspects: (i) existing and future traffic bottlenecks, (ii) explanation of proposed strategy in terms of land use pattern, (iii) public transport network, (iv) role and benefit of each project within the Road Network Plan, (v) recommendations for infrastructure, (vi) operations and maintenance on existing and proposed road networks, (vi) provision of sidewalks and NMV lanes, and (viii) estimated costs of proposed projects.

Task 4-3 NMT Facilities

Planning for pedestrians, bicycles and cycle rickshaws will be one of the most important tasks in CMP preparation. As the CMP sets out vision/goals for the metropolitan region and serves as a strategic level plan for urban land use and transport systems, the NMT policy level planning may be accepted. However, detailed NMT improvement plans and traffic management measures can be worked out for CBD, commercial centres, and other major activity centres, which refine NMT policy for the whole region and provide the costing basis to implement such policy.

Task 4-4 Mobility Management Measures

Measures for mobility management should be developed with implications for regulation and enforcement. The topics to be covered in this plan include:

- Pedestrian Facilities
- NMV Facilities
- Traffic Control Measures
- Parking Plan
- Intersection Improvement Projects (in parallel with Road Network Development Plan)
- Demand Management Measures
- Traffic Safety Plan
- Para-Transit Plan
- Intelligent Transport System (ITS) and User Information

Task 4-5 Regulatory and Institutional Measures

Effective development of urban land use and the transport system often requires regulatory and institutional changes. Such requirement should be thoroughly worked out and documented in the CMP. The regulatory and institutional plan should include the following:

- Bus service improvement (concession, privatization, and lease contract);
- Traffic safety improvement (traffic regulation, mandatory road user education, enforcement systems);
- Introduction of Transport Demand Management (TDM) measures ;
- Vehicle emissions (focus on non-fuel based vehicles and compressed natural gas/CNG vehicles); and
- Public-Private Partnership
- Coordination mechanism to integrate public transport operation and to integrate fares;
- Establishment of Unified Metropolitan Transport Authorities (UMTA);
- Establishment of SPVs for the implementation of proposed projects; and
- Changes necessary to promote Public-Private Partnerships (PPPs).

Task 4-6 Fiscal Measures

Fiscal measures should also be considered to achieve balanced modal split, and to secure the budget necessary to implement urban transport projects. The following aspects may have to be examined in the CMP document:

- Fare policy for public transportation, and parking;
- Subsidy policy for public transport operators;
- Taxation on private vehicles and public transport vehicles; and
- Potential for road congestion charging.

Task 4-7 CMP Measures and NUTP Obligations

Prepare a table summarizing the relationship between the NUTP objectives and the measures proposed in the CMP, together with a classification of the measures according to their implementation time frame (short, medium and long term).

Task 5 Prepare Implementation Programme

Task 5-1 Implementation Programme

An implementation programme including practical procedures to implement the proposed measures, in terms of timeframe, financing options and implementation agencies, should be prepared. A brief summary of project information is required, including project title, location, estimated cost etc. Proposed projects should be evaluated and prioritized against clear criteria and classified into short, medium and long-term.

Specifically, the following tasks should be conducted.

- Preparation of Project Longlist
- Selection of Priority Measures
- Prioritization Methodology
- Identification of Implementation Agencies
- Identification of Possible Financing Options
- Development of Implementation Programme

Task 5-2 Social and Environmental

Perform preliminary social and environmental impact assessments of each priority project and the results and implications be fully reflected in the recommended projects. Conduct also a Strategic Environmental Impact Assessment (SEIA) in order to examine and evaluate the project justification within the national/regional and/or municipal planning framework.

Task 5-3 Project Profile Sheets

Project profile sheets should be prepared for short term projects.

Task 6 Stakeholder Consultations

The CMP should be discussed with stakeholders throughout the study. An advisory committee and workshops/seminars should be organized to coordinate and develop a consensus. In particular workshops/seminars should be held at: (i) Inception Report, (ii) Interim Report and (iii) Draft Final Report stages. The primary objective of (i) should be to develop a working relationship with stakeholders and to obtain their views on the CMP.

The primary stakeholder, the Municipality and its concerned officials should be fully involved throughout the work, such that all aspects of the CMP development process and its subsequent updating are within the capacity of such officials by the end of the study.

3. STUDY DELIVERABLES AND PAYMENT SCHEDULE

Deliverables

The study is to be completed within xx (note: this will vary with city, but should be not more than 12) months. The deliverables are listed below. The consultant may also submit working papers for comment as required.

Deliverable	Submission Date (Maximum No. of Months from Start of Work)	No. of Copies
Inception Report and Detailed Work Plan	1	X
Interim Report	6	X
Draft Final CMP	11	X
Final CMP with Executive summary	Within 1 month of receipt of comments	X

A soft copy including database material (in PDF and Word /Excel /PPT/Dwg format) shall be submitted with each of the above.

Inception Report and Work Plan: This report shall cover Task 1 and provide the consultants' initial assessment, a review of problems encountered (if any) and proposed solutions and confirmation of the work plan for the remainder of the study.

Interim Report: This report shall cover Task 2 (Data Collection, Analysis of Existing Urban Transport Environment and Development of Transport Model) and will detail the necessary surveys/studies, data collection and analysis for the short term traffic management plan and proposals that need to be implemented. The report shall also contain conceptual insight for the medium/long term.

Draft Final CMP: This shall contain the Comprehensive Mobility Plan (Tasks 3, 4, 5, and 6) and recommendations. The Interim Report database and traffic model shall be included as an Annex, updated if required.

Final CMP and Executive Summary: This shall contain the final CMP and an Executive Summary including responses to comments from the Ministry of Urban Development.

Report formats shall be proposed in the Inception Report and after agreement with the client, subsequent reports shall be submitted in the agreed format. A sample table of contents for the CMP is given in Module 1 (CMP Toolkit).

Payment Schedule

Payment shall be made according to the following Schedule, which is based on the submission of deliverables.

Submission/Acceptance of:	Payment as % of total
1. Inception Report and Work Plan	x%
2. Interim Report	x %
3. Draft CMP	x %
Sub total	x%
4. Acceptance of Draft CMP	x%
5. Acceptance of Final CMP and Executive Summary	x%
Total	100%

4. INFORMATION ON FIRM AND PROPOSED STAFFING

The consultants shall provide details of relevant experience in carrying out similar work along with a copy of client certificates/testimonials. CVs for proposed staff should be included with the Technical Proposal. Staff should have experience in the following disciplines:

Team Leader/Urban Transport Planner
Public Transport Planner
Land Use Planner
NMT Planning and Traffic Management Specialist
Highway Engineer
Traffic Survey and Modeling Specialist
Environmental and Social Expert

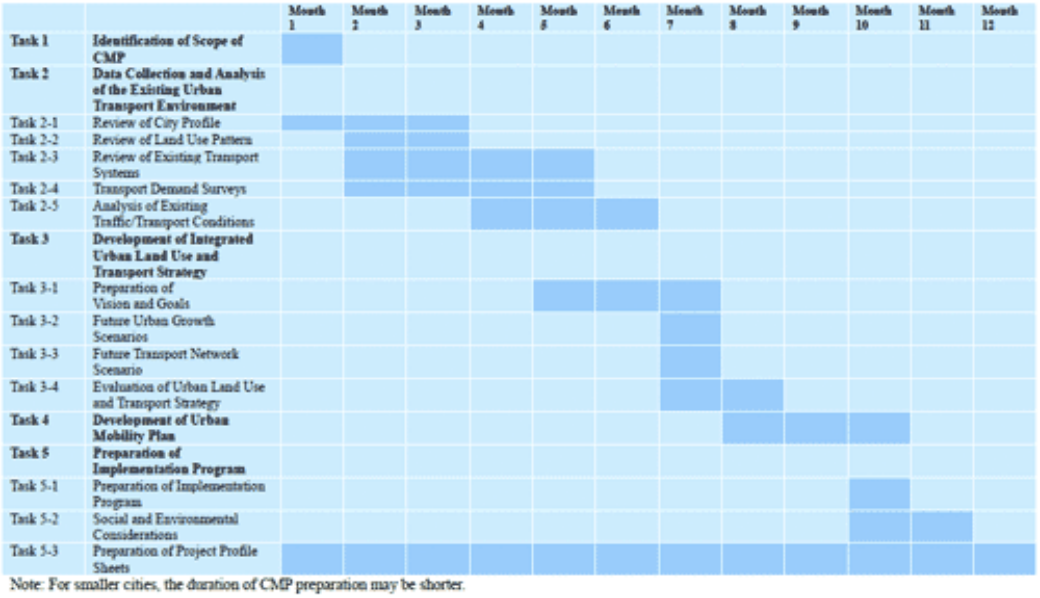
List of Tables

Table 1 Illustrative Comparison of Major Tasks of CMPs and Other Existing Transport Plans

Major Tasks	Existing CDP	Existing Master Plan	Existing CTTS	CMP
Review of Existing Transport System	✓		✓	✓
Transport Demand Survey			✓	✓
Review of Land Use Plan		✓		✓
Analysis of Urban Transport Situations			✓	✓
Preparation of Future Land Use Scenario		✓		✓
Future Transport Network Scenario				✓
Transport Demand Forecast Model			✓	✓
Network Evaluation				
Preparation of Mobility Framework				✓
Formulation of Urban Transport Measures	✓	✓	✓	✓
Social and Environmental Impact Assessment				✓
Institutional Scheme for Project Implementation				✓
Preparation of Implementation Programs	✓		✓	✓
Stakeholder Consultation	✓	✓	✓	✓
Periodical Update and Maintenance		✓		✓

Table 2 Example Work Schedule for Preparation of a CMP

Table 2 Example Work Schedule for Preparation of a CMP



		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task 1	**Identification of Scope of CMP**												
Task 2	**Data Collection and Analysis of the Existing Urban Transport Environment**												
Task 2-1	Review of City Profile												
Task 2-2	Review of Land Use Pattern												
Task 2-3	Review of Existing Transport Systems												
Task 2-4	Transport Demand Surveys												
Task 2-5	Analysis of Existing Traffic/Transport Conditions												
Task 3	**Development of Integrated Urban Land Use and Transport Strategy**												
Task 3-1	Preparation of Vision and Goals												
Task 3-2	Future Urban Growth Scenarios												
Task 3-3	Future Transport Network Scenario												
Task 3-4	Evaluation of Urban Land Use and Transport Strategy												
Task 4	**Development of Urban Mobility Plan**												
Task 5	**Preparation of Implementation Program**												
Task 5-1	Preparation of Implementation Program												
Task 5-2	Social and Environmental Considerations												
Task 5-3	Preparation of Project Profile Sheets												

Note: For smaller cities, the duration of CMP preparation may be shorter.

Table 3 Suggested Review Items for Existing Transport Infrastructure

Survey Items	Description	Sample Form
Outline of Road Network	In order to provide a comprehensive outline of the city's road network, collect information such as road length, right of way, and road density.	Survey Form 1-2A
Inventory of Arterial Road Network	Compile inventory of the arterial road network of the city to be used for subsequent development of a transport demand model.	Survey Form 1-2B
Inventory of Flyovers and Underpasses	Identify all existing flyovers at intersections, railway over bridges (ROBs), and railway underpasses.	Survey Form 1-2C
Inventory of Major Intersections	Identify and inventory critical intersections and roundabouts, in particular those intersections that are important from the viewpoint of the entire road network or that are heavily congested.	Survey Form 1-2D
Parking Facilities	Review of the city's existing parking facilities for both on-street and off-street parking.	Survey Form 1-2E
Traffic Control Facilities	Compile a list of traffic control facilities such as signals.	Survey Form 1-2F
Pedestrian Facilities	Summarize data on pedestrian facilities.	Survey Form 1-2G

NMV Facilities	Facilities for non-motorized vehicles (NMVs), such as bicycles and cycle-rickshaws are recognized as an important component of a sustainable transport plan.	Survey Form 1-2H
Level Crossing	Collect data on level crossings as level crossings are not only major bottlenecks of the network, but also cause accidents for both road traffic and the railway.	Survey Form 1-2I
Public Transport and Paratransit Facilities	Prepare a list for bus stops, paratransit stops, parking and terminals.	More details in the next section
Maps of road infrastructure and facilities	Based on the above inventories, prepare maps indicating locations of infrastructure measures.	

Table 4 Survey Items for Public Transport

Survey Items	Description	Sample Form
Inventory of Available Public Transport	In a city where buses are operating, the CMP will clarify the public bus situation, including that of mini buses, but excluding inter-city bus services.	Survey Form 1-3A
Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators		Survey Form 1-3B
Map of All Public Bus Routes	An initial survey will be undertaken to identify and map all public bus routes in the city and vicinity, including the neighbouring towns, for public bus operators licensed by the state government. The contents of these bus network route maps may include, but not be limited to, the following: • Designated bus routes; • Terminals and transfer points; • Names of bus stops (for those that have a name); • Names of final destinations; • Major street names and common destinations; and • Route coverage area (area within 500m from bus routes).	
Inventory of Paratransit	Paratransit modes such as auto rickshaws, cycle rickshaws, and taxis, are an important component of public transport operations in most Indian cities, especially in cities where bus services are not provided.	Survey Form 1-3C

Inventory Intermodal Facilities	Intermodal facilities including bus terminals, railway stations, airports, and ferry ports are essential elements in the public transport system.	Survey Form 1-3D
Inventory of River Transport	River transport, including ferry transport, fulfils an important role in some Indian cities, e.g., where a major river cuts across the city centre.	Survey Form 1-3E

Table 5 Survey Items for Traffic Safety and Enforcement

Survey Items	Description	Sample Form
Inventory of Traffic Accidents	Collect statistics on traffic accidents and outline trends.	Survey Form 1-4A
Hazard Map of Traffic Accidents	Prepare a map showing the number of accidents and locations to identify accident-prone spots. Locations with a high number of accidents may indicate deficiencies in the network, such as problems related to geometric design, signalling, engineering and provisions for vulnerable road users.	
Enforcement	Enforcement is a key aspect in realizing an efficient urban transport system.	Survey Form 1-4B

Table 6 Survey Items for the Institutional and Financial Situation

Survey Items	Description	Sample Form
Inventory of Agencies/Organizations Active in Relation to Urban Transport	Review the overall organization and hierarchy of the government in relation to land use and transport systems development.	Survey Form 1-5A
Assessment of Planning, Implementation and Coordination Capacity	Capacity in planning, implementation and coordination of urban transport measures are important issues for Indian cities.	Survey Form 1-5B

Table 7 Survey Items for Transport Demand Data

Survey Items	Description	Sample Form
Population and Socio-	Collect population and socio-economic indices by zone, which should be as small as possible. Zones may consist of one or more census	Survey

Economic Conditions	districts.	Form 2-1A
Vehicle Ownership Survey	Collect vehicle ownership data for the same zones as above.	Survey Form 2-1B

Table 8 Survey Items for Traffic Volume Surveys

Survey Items	Description	Sample Form
Screen Line Survey (optional)	A screen line survey identifies major traffic movements between two areas divided by a screen line such as a river or railway.	Survey Form 2-2A
Cordon Survey	A cordon survey is a traffic count survey on a major cordon line that shows the volume of traffic entering/departing a target area or a city centre.	Survey Form 2-2A
Intersection Turning Movement Survey	Measures turning movements at key intersections during the morning and evening peak hours.	Survey Form 2-2B
Queue Length Survey	A queue length survey at major bottlenecks can show the severity of traffic congestion quantitatively	Survey Form 2-2C
Travel Speed and Time Survey	Conduct travel speed and time surveys on main corridors and strategically important roads in order to assess the efficiency of the road network at both peak and off-peak times.	Survey Form 2-2D

Table 9 Outline of Origin-Destination Survey

	Household O-D Survey	Roadside O-D Survey
Objective	To identify the travel activities of residents.	To clarify the travel movements between locations outside and inside the metropolitan area.
Methodology	Interview survey of each household.	Interview survey of drivers on target roads.
Survey Area and	The whole CMP target area.	On major roads on the border of the target area (the same as the cordon line traffic count survey).
Zoning	The survey zones should basically follow the census district pattern. A zone may consist of	Zoning should be consistent with that in the

	one or more census districts.	household O-D survey.
Questionnaire Forms	Survey Form 2-3A(1) and (2)	Survey Form 2-3B
Sampling Rate	A sampling rate of 4% in each zone is preferable. If there are significant time and cost constraints, the sample rate may be reduced to 1%.	A sampling rate of 20% of all traffic on the road is recommended. The rate can be reduced on roads with heavy traffic.

Table 10 Outline of Traffic Movement Survey

	Public Transport Vehicle Movement Survey	Freight Vehicle Movement Survey
Objective	To identify the travel movements of buses, taxis and rickshaws	To identify truck movements
Methodology	Interview survey of public transport vehicle drivers, including drivers of buses and rickshaws	Interview survey of truck drivers
Questionnaire Forms	Survey Form 2-4A	Survey Form 2-4A
Sampling Rate	A sampling rate equal to 20% of the total number of registered vehicles is preferable.	A sampling rate equal to 20% of the total number of registered vehicles is preferable.

Table 11 Index for Comparative Analysis

Index	Description	Average Value	Data Source
Congestion	1 - (Average travel speed/30)	0.25	Base-Year Traffic Model
“Walkability”	(Footpath length / Length of major roads in the city) x 0.5 + (rate estimated based on estimates of available pedestrian facilities) x 0.5	0.52	Road Infrastructure Survey
City Bus Transport	Number of public and private city buses per 100,000 people	14	Public Transport Survey

Safety	(Number of annual traffic accident deaths per 100,000 people) x 0.5 + (Number of fatalities per 100,000 people) x 0.5	0.10	Traffic Safety Survey
Paratransit	Number of paratransit vehicles per 100,000 people	61	Public Transport Survey
Slow Moving Vehicles	Slow moving vehicle share in total trips	0.07	Household O-D Survey
Trip Distribution	Average trip length (km)	5.2	Household O-D Survey
NMVs	Number of NMVs per 100,000 people	To be prepared	Socio-economic survey
Passenger Vehicle	Number of passenger vehicles per 100,000 people	To be prepared	Vehicle Ownership Survey

Table 12 Desired Transport Modes by Trip Length

Trip length (km)	0-2	2-5	5-10	10-15	>15
Share of trips	25–50	20–25	15–20	10–15	>15
Desired travel modes	Walk, cycle,2-wheelers, rickshaw	Cycle, 2-wheelers, cars, rickshaws	Cycle, 2-wheelers, cars, 3-wheelers, bus, taxi	Car, bus, taxi, metro/rail	Car, express bus, metro/rail, taxi

Table 13 Technical Parameters of Public Transport Options

Table 13 Technical Parameters of Public Transport Options

	Metro	LRT	Tramways	HCBRT	BRT	Bus Priority Lanes	City Bus
Line Capacity (PAX/hr/dir.)	40,000 – 75,000	15,000 – 45,000	5,000 – 15,000	20,000 – 35,000	7,500 – 15,000	5,000 – 7,500	Below 1,000
Cost per km (Infrastructure, vehicles, OCC, Maintenance)	Very high	High	Medium/high	Medium/high	Medium	Low	Very Low, only bus stops and maintenance shop required
Alignment	Double-track railway	Double-track railway, elevated, a-grade or in tunnels	Double track tramway, at-grade	4 Bus Lanes (2 per direction)	2 to 3 Bus Lanes	2 Bus Lanes	Use public roads
Segregation	100 % segregated in tunnels, elevated or at-grade	High degree of segregation preferred, but sections with shared right of way possible	Uses public roads, but may have reserved right of way on sections with higher demand	All Bus Lanes must be segregated to achieve high capacity	Bus Lanes must be in general segregated, exceptions possible, reduce capacity and speed	Bus Priority Lanes must be exclusively for busses	None
Road space required	None	None in case of elevated and tunnel alignment, 2 lanes at-grade, additional space required for stations and terminals	2 Lanes, additional space may be required for stations and terminals, tracks can be shared with public roads or pedestrian roads	4 Lanes; more linear space for Interchanges and Terminals	2 Lanes, possibly 3 or 4 at Stations and Interchanges, space for major Interchanges and Terminals	2 to 3 Lanes (3 to 4 Lanes at Bus Stops)	Shared with cars and pedestrian
Vehicles	High capacity EMU	Medium to high capacity EMUs (upgraded trams as an option)	Trams, articulated and or with wagons as an option	Special articulated bus with st-floor boarding and wide doors	Articulated buses; pre-paid boarding required	Standard City Bus, articulated as option	Standard City Bus
Passengers per Vehicle/Train	1,200 – 2,500	250 – 1,500	Depends on length	180-240	150-180	75 - 100	75
Traction	Electric	Electric	Electric	Diesel	Diesel (Electric as an option)	Diesel	Diesel
Feeder System	Necessary	Necessary	Not necessary	Necessary	Desired	Not necessary	Not necessary
Flexibility of route changes	Very low	Low	Low	Very low	Medium	Medium	Very high
Ticketing System	Closed	Closed	Open	Closed	Closed or open	Open	Open

Table 14 Advantages, Disadvantages and Applicable Corridors for MRT Options

Table 14 Advantages, Disadvantages and Applicable Corridors for MRT Options

	Heavy Rail Systems – Underground, Elevated or At grade	Light Rail Transit (LRT)	High Capacity Bus Systems (HCBS) on Dedicated Lanes, or BRT	Normal Buses on Shared Right of Way
Advantages	• Very high carrying capacity • High speed • Very low pollution in operation • Needs very little urban space	• Capital costs are less than for heavy rail systems • Per unit operating costs are less than for heavy rail systems • Low pollution levels • Needs less urban space than bus-based systems • Needs limited urban space if elevated or underground (however capital costs increase)	• Capital costs lower than for rail-based systems • Low operation and maintenance costs • Higher capacity than normal bus services • Operational planning and capacity expansion are more flexible than rail-based systems • As the distance between stations are shorter, it requires a less extensive feeder network than rail-based systems • Relatively simple technology with easy availability of personnel for operations and maintenance	• Very low capital cost • Low operating costs • Highly flexible • Does not need feeder system
Disadvantages	• Very high capital costs • High per unit operating costs if capacity utilization is low • Inflexible • Long gestation period • Needs extensive feeder network or very dense captive area • Complex interconnectivity with feeder system • Relatively complex technology requiring highly specialized manpower for operation and maintenance	• Capital costs higher than for bus systems • Inflexible • Per unit operation costs higher than for bus systems if capacity utilization is low • Needs substantial urban space if at grade • Carrying capacity is lower than for heavy rail systems though comparable to high capacity bus systems • Needs extensive feeder network or dense captive area • Complex interconnectivity with feeder system • Relatively complex technology requiring specialized skills for operations and maintenance	• Capacity not as high as that of heavy rail systems although comparable to that of light rail systems • More polluting than rail-based systems in operation • Needs imported fuel • Needs urban space for dedicated corridors	• Very low capacity • Polluting (if not run by cleaner energy) • Low speeds • Poor social image (without improving the system performance and its image)
	Heavy Rail Systems – Underground, Elevated or At grade	**Light Rail Transit (LRT)**	**High Capacity Bus Systems (HCBS) on Dedicated Lanes, or BRT**	**Normal Buses on Shared Right of Way**
Applicable Corridors	• Very high-density corridors, where road space is very limited • Well suited for densely populated cities that have low sprawl and few spinal, long-haul corridors • At-grade systems are very good for suburban systems and the fringe areas of a city where space is more easily available	• Medium density corridors where space availability is adequate for supporting elevated structures or at grade tracks • Medium density cities with limited sprawl	• Medium density corridors where space availability is adequate for supporting the dedicated right of way • Medium density cities with limited sprawl	• Low density corridors where local pollution is not a critical issue • Feeder to higher capacity systems

Source: Based on *National Urban Transport Policy for India*, Ministry of Urban Development, Government of India, April 2006.

Table 15 Suggested Approach for Selecting Appropriate MRT Options

MRT Options	City Requirements
BRT	• Cities with a medium- to high-density urban area • BRT should be one of the first considerations in MRT system development in any city. • BRT system can be developed as trunk systems as well as feeders to an existing (or planned) MRT system • Suitable for cities where an MRT system needs to be developed quickly and incrementally as conditions and funding allow • A well-developed traffic planning/management capability should be available (this may be brought in initially) • Existing bus and paratransit operations can be regulated/restructured • Road space is available for BRT development (2-4 lanes from existing roads)
LRT	• Cities with a medium- to high-density urban area • Cities where environmental issues are critical and there is a need to attract car users to use public transport systems; however, if the core requirements are operational effectiveness, BRT system should be developed that is more flexible and costs less • Appropriate for cities with an existing tram operation, which may be cost-effectively enhanced. • A well-developed traffic planning/management capability should be available • Existing bus and paratransit operations can be regulated/restructured • Road space is available for LRT development (2-3 lanes from existing road) or existing tram track can be converted to an LRT route
Metros	• Preferably a national/provincial capital city or a major regional commercial centre • Existing public transport flows on the main corridor of the order of 10,000-15,000 passengers per hour per direction with more than 15km trip length • City incomes that are not low (typically at least US$1,800 per person) • Prospects for sustained economic growth and an expanding centre • Existence of a low-cost metro alignment • Fares policy – a fares policy on metro and bus systems to encourage ridership yet limit the need for financial support • A well-developed traffic planning/management capability should be available • Existing bus and paratransit operations can be regulated/restructured • Strong and largely autonomous management of metropolitan region, with clear objectives

Table 16 Summary of Mobility Improvement Measures in Relation to NUTP: Example

NUTP Objectives	Proposed Mobility Improvement Measure
Priority for Pedestrians	• Pedestrian paths are recommended in all residential and commercial areas and on major corridors. • Pedestrian crossings are proposed in all commercial areas and school zones. • Pedestrian underpasses are recommended at critical locations.
Priority for Non-motorized Vehicles	• Recommended bicycle tracks on major corridors and in school zones. • Requirement for bicycle parking is recommended for offices, railway stations, schools and all markets and shopping centres. • Rickshaw stands are proposed at critical locations.
Priority for Public Transport	• Development of an MRT system is proposed. • Recommended improvements to existing bus services and necessary regulatory/institutional changes.
Parking	• On-street parking facilities are proposed for critical locations. • Recommended regulatory changes in building permits to secure parking demand. • Construction of off-street parking is proposed for several locations, and a funding mechanism is developed including the possibility of private sector participation. • Changes in parking tariff policy are proposed to optimize the use of existing off-street parking facilities.
Integration of Land Use and Transport Planning	• A preferred urban growth scenario is recommended in the CMP document and its compatibility with the Master Plan is analyzed. • Land use control principles to minimize the mobility requirement are presented. • Proposed MRT corridors with feeder modes of transport cover major residential, commercial and industrial areas in metropolitan areas. • High-density residential and commercial development around proposed MRT stations is recommended.
Equitable Allocation of Road Space	• MRT corridors and bus priority lanes are proposed. • Pedestrian and NMV lanes are recommended.
Integrated Public Transport Systems	• Recommended that inter-city bus terminals be moved to peripheral areas of the city and integrated with inner-city bus services. • Intermodal (taxi/rickshaw stands, vehicle, NMV parking, and bus-loading/unloading) facilities are proposed at MRT stations.
Introduction of Paratransit Services	• Recommended the introduction of paratransit services to supplement the existing/new public transport services.

Freight Traffic Improvement	• Truck terminals proposed. • Entry restrictions for heavy vehicles during peak hours recommended.

Table 17 Criteria for Selection of Priority Measures

Criteria	Description
Project Importance	
(i) Consistency with Overall Policy Framework	Assessment of the degree of consistency between a project and the existing development policy in the city, such as the NUTP, CDP, Land Use Plan, and other master plans.
(ii) Consistency with Strategic Framework for Transport Network:	Assessment of the level of consistency with the strategic framework described above.
(iii) Impact on Reducing Traffic Congestion	Assessment of the anticipated impact on reducing traffic congestion. This impact should be considered from the viewpoint of the whole road network. Therefore, a locally limited impact, such as congestion reduction at only one intersection, should not be given a high score.
(iv) Promotion of Public Transport	Projects that promote public transport should be given high scores. Not only public transport projects, but also some road infrastructure and traffic management projects can promote public transport.
(v) Enhancement of Traffic Safety	Projects that enhance traffic safety should be given high scores. Traffic safety includes not only road traffic safety, but also railway safety.
(vi) Cost Effectiveness	Comparison of project costs with project benefits.
(vii) Level of Commitment by Implementing Agency	Projects that local government is strongly committed to implement should be given high scores. The stronger the support for the project, the higher the score.
(viii) Degree of Support from Transport Users	This involves an assessment of the support from transport users. Projects with stronger user support should be evaluated highest and ideally based on the results of a transport user interview survey.
Constraints	
(i) Whether the transport measure can be implemented within the timeframe of the CMP	
(ii) Whether land acquisition/resettlement is manageable	

(iii) Whether the environmental impact is adverse

Table 18 Example Methodology for Scoring/Selecting High-Priority Projects

Project Importance Criteria	Score	Weight (Example)
Consistency with Overall Policy Framework	1~3 (S1)	1 (W1)
Consistency with Future Framework for Transport Network	1~3 (S2)	1 (W2)
Impact on Reducing Traffic Congestion	1~3 (S3)	2 (W3)
Promotion of Public Transport	1~3 (S4)	3 (W4)
Impact on Enhancing Safety	1~3 (S5)	1 (W5)
Cost Effectiveness	1~3 (S6)	1 (W6)
Level of Commitment by Relevant Agencies	1~3 (S7)	3 (W7)
Degree of Support from Transport Users	1~3 (S8)	1 (W8)
Constraint Criteria	Score	Weight
(i) Whether the transport measure can be implemented within the timeframe of the CMP	0, 1 (C1)	
(ii) Whether land acquisition and resettlement are manageable	0, 1 (C2)	
(iii) Whether environmental impact is adverse	0, 1 (C3)	

Table 19 Outline of SEIA Tasks

Category	Task
A. Screening	1. Decide on need for SEA and create commitment
B. Scoping	2. Find stakeholders and announce start of plan process 3. Develop shared vision on problems/objectives/alternatives 4. Perform consistency analysis: new vs existing objectives

C. Assessment	5. Set ToR for SEA report, based on results of scoping 6. Perform assessment, document and disseminate 7. Organize (independent) quality assurance
D. Decision Making	8. Discuss with all stakeholders, present alternative 9. Substantiate (policy) decision in writing
E. Monitoring	10. Monitor implementation and discuss results.

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