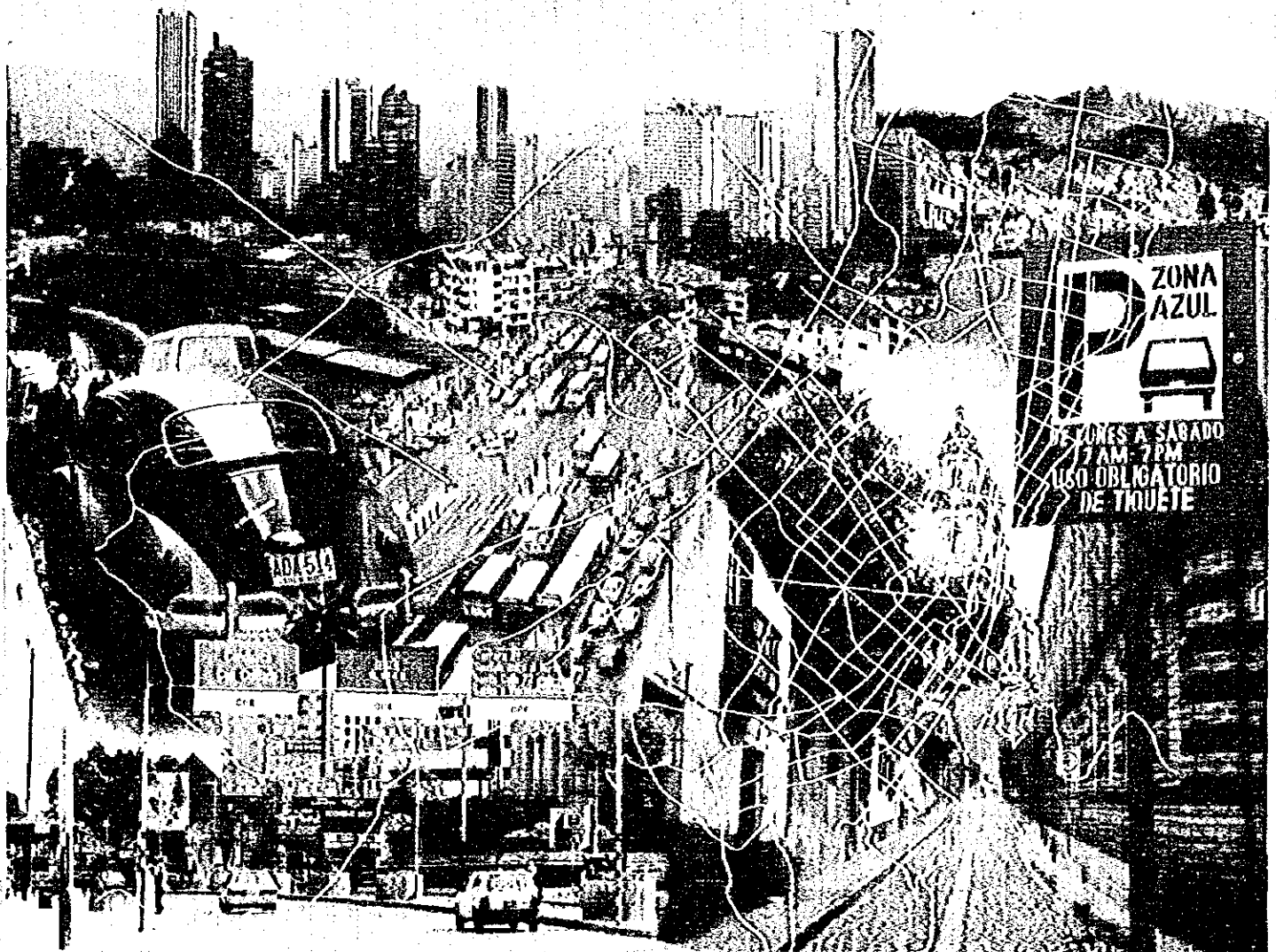


社会開発調査部報告書
Japan International Cooperation Agency (JICA)
Santa Fe de Bogota
The Republic of Colombia

No.


The Study on the Master Plan for Urban Transport of Santa Fe de Bogota in the Republic of Colombia

Final Report (Urban Transport Planning Manual)



The Study on the Master Plan for Urban Transport of Santa Fe de Bogota in the Republic of Colombia

December 1996

JICA LIBRARY

J 1133889(4)

Chodal Co., Ltd.
In Association with
Yachlyo Engineering Co., Ltd.

SSF
JR
96-143

LIBRARY



1133889 [4]

Japan International Cooperation Agency (JICA)
Santa Fe de Bogota, The Republic of Colombia

The Study on the Master Plan
for Urban Transport of Santa Fe de Bogota
in the Republic of Colombia

Final Report
(Urban Transport Planning Manual)

December 1996

Chodai Co., Ltd.
in Association with
Yachiyo Engineering Co., Ltd.

Letter of Transmittal

December, 1996

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Dear Sir.

It is a great honor for me to submit herewith the final reports of the Study on the Master Plan for Urban Transport of Santa Fe de Bogota in the Republic of Colombia.

A study team, which consists of Chodai Co., Ltd. and Yachiyo Engineering Co., Ltd., headed by myself, conducted field surveys, data analysis and planning works of urban transport master plan in Colombia based on the terms of references instructed by the Japan International Cooperation Agency (JICA) from July, 1995 to December, 1996.

The study team held thorough discussions and investigations with officials concerned of the Government of Colombia, accordingly, conducted various traffic surveys, present condition analysis, future socioeconomic framework, travel demand, planning policy, and finally composed a comprehensive urban transport master plan. The results were collected in the final reports, main and urban transport training manual reports.

On behalf of the team I wish to express my heartfelt appreciation to the Officials concerned of the Government of Colombia for their warm friendship and cooperation extended to us during our stay in Colombia.

Also, I wish to express my sincere appreciation to JICA, the Ministry of Foreign Affairs, the Ministry of Construction, the Ministry of Transport, the Embassy of Japan in Colombia and other concerned government authorities for their valuable advice and cooperation given to us in the course of the site surveys and preparation of the final reports.

Yours Faithfully,

都筑 弘一

Koichi Tsuzuki

Team Leader
The Study on the Master Plan for
Urban Transport of Santa Fe de Bogota
in the Republic of Colombia

Preface

In response to a request from the Government of the Republic of Colombia, the Government of Japan decided to conduct the Study on the Master Plan for Urban Transport of Santa Fe de Bogota in the Republic of Colombia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Colombia a study team headed by Mr. Koichi Tsuzuki, Chodai Co., Ltd., from July 1995 to December 1996.

The Team held discussions with the officials concerned of the Government of Colombia, and conducted a field survey at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Colombia for their close cooperation extended to the team.

December 1996



Kimio Fujita

President

Japan International Cooperation Agency

TABLE OF CONTENTS

1. TRANSPORT PLANNING	1
1.1 Purpose and Coverage of the Transport Plan	1
1.1.1 Purpose of the Transport Plan	1
1.1.2 Coverage of the Transport Plan	1
1.2 Process of Plan Preparation	2
1.3 Contents and Method of the Study on the Transport Master Plan	7
1.3.1 Collection and Analysis of Related Data	7
1.3.2 Execution of Traffic Survey	9
1.3.3 Road Inventory Survey	11
1.3.4 Survey on Public Transport Facilities	12
1.3.5 Identification of Future Development Scenario	13
1.3.6 Grasping of Characteristics and Problems of Current Traffic Situation ..	14
1.3.7 Preparation of Planning Policy	14
1.3.8 Identification of Future Social and Economic Framework	16
1.3.9 Forecast of Future Traffic Demand	18
1.3.10 Preparation of Alternative Plans	19
1.3.11 Evaluation of Plan	23
1.4 Evaluation of Master Plan	24
1.4.1 Introduction	24
1.4.2 Economic Evaluation	24
1.4.3 Financial Evaluation	29
1.4.4 Environmental Impact Assessment	31
2. TRAFFIC SURVEY	35
2.1 Person Trip Survey	35
2.1.1 Introduction	35
2.1.2 Home Interview Survey Method	35
2.1.3 Filling Of The Survey Form	37
2.2 Cordon Line Survey	43
2.2.1 Objectives	43
2.2.2 Survey Method	43
2.2.3 Preparation	44
2.2.4 Survey Contents	44
2.3 Screen Line Survey	49
2.3.1 Objectives	49
2.3.2 Survey Method	49
2.3.3 Preparation	49
2.3.4 Survey Contents	49
2.4 Traffic Volume Count on Road Sections	51
2.4.1 Objectives	51
2.4.2 Survey method	51
2.4.3 Preparation	51
2.4.4 Traffic Volume Counts	52
2.5 Intersection Traffic Volume Count Survey	52
2.5.1 Objectives	52
2.5.2 Survey Method	52
2.5.3 Preparation	52
2.5.4 Survey Contents	53
2.6 Travel Time Survey	53
2.6.1 Objectives	53
2.6.2 Survey Method	53

2.6.3 Preparation	53
2.6.4 Survey Contents.....	54
2.7 Airport Passenger OD survey	54
2.7.1 Objectives.....	54
2.7.2 Survey Method	54
2.7.3 Preparation	54
2.7.4 Survey Contents.....	55
2.8 Company Interview Survey.....	56
2.8.1 Objectives.....	56
2.8.2 Survey Method	56
2.8.3 Preparation	56
2.8.4 Survey Items	57
2.9 Taxi Passenger Survey.....	59
2.9.1 Objectives.....	59
2.9.2 Survey Method	59
2.9.3 Preparation	59
2.9.4 Survey Items	59
2.10 Bus Passenger Interview Survey at Major Bus Terminal.....	60
2.10.1 Objectives.....	60
2.10.2 Survey Method.....	60
2.10.3 Preparation	61
2.10.4 Survey Items.....	61
3. TRAVEL DEMAND ANALYSIS.....	63
3.1 General	63
3.2 Estimation of Future Motorized Households	71
3.2.1 Total Number of Motorized Households.....	71
3.2.2 Motorized Households by Zone.....	73
3.3 Trip Generation and Attraction Model.....	74
3.3.1 Total Trip Production	75
3.3.2 Trip Generation And Attraction By Zone	75
3.3.3 Modal Split Model.....	77
3.3.4 Projection of Trips by Mode in 2020.....	80
3.3.5 Projection of Trip Generation and Attraction in 2020.....	80
3.4 Trip Distribution Model	90
3.4.1 General.....	90
3.4.2 Interzonal Trips.....	90
3.4.3 Intrazonal Trip Model.....	90
3.4.4 Projection of Trip Distribution.....	92
3.4.5 Travel Demand for Non-Residents Who Dwell outside the Study Area ..	95
3.5 Traffic Assignment.....	95
3.5.1 Traffic Assignment Model	95
3.5.2 Average Occupancy and Passenger Car Unit (PCU)	96
3.5.3 Modal Split.....	97
3.5.4 Traffic Assignment Model for Private Mode	97
3.5.5 Traffic Assignment Model for Public Mode (Bus Transportation).....	99
3.5.6 Traffic Demand on Road Network.....	100
4. USER'S MANUAL FOR THE TRAVEL DEMAND MODEL.....	101
4.1 Introduction.....	101
4.2 Part I Module	102
4.2.1 Modification of Input data	102
4.2.2 Future Travel Demand.....	106

4.3 Part II Module	111
4.3.1 Traffic Assignment	112
4.3.2 Output of Graphical Network	114

List of Tables

Table 1.3-1	Formulation of Transport Network Alternative Plan for Master Plan
Table 3.1-1	Model Structure
Table 3.1-2	Zone Code Table
Table 3.1-3	Zone Code Table
Table 3.1-4	Zone Code Table
Table 3.3-1	Summary of Socioeconomics and Travel Demand
Table 3.3-2	Parameter of Trip Generation and Attraction Model
Table 3.3-3	Equations and Parameters of Modal Choice Model
Table 3.3-4	Trip Ratio of Car and Truck
Table 3.3-5	Trip Comparison by Mode in 1995 and 2020
Table 3.3-6	Trip Generation and Attraction in 2020
Table 3.3-7	Trip Generation and Attraction in 2020
Table 3.4-1	Parameters of Trip Distribution Model
Table 3.4-2	Parameters of Intra-zonal Model
Table 3.5-1	Average Occupancy and PCU
Table 3.5-2	Modal Share of Vehicle Trips
Table 3.5-3	Speed-Flow Curves
Table 4.2-1	Sample of Output List
Table 4.2-2 (1)	Trip Generation and Attraction by Modes
Table 4.2-2 (2)	Trip Generation and Attraction by Modes
Table 4.2-3	Data Format for OD Tables
Table 4.3-1	Contents of Transport Network Data

List of Figures

- Figure 1.2-1 Study on Urban Transport Master Plan for Bogota, Colombia
Figure 1.2-2 Study on Urban Transport Master Plan for Cartagena, Colombia
Figure 1.2-3 Study on Urban Transport Master Plan for Belem, Brazil
Figure 1.2-4 Study on Urban Transport Master Plan for Guatemala City, Guatemala
Figure 1.3-1 Items to be Considered in Transport Planning Policy
Figure 1.4-1 Overall Work - Flow of Benefit /Cost Analysis
Figure 1.4-2 General Work-flow of Financial Evaluation
- Figure 3.1-1 Flowchart of Forecasting Model
Figure 3.1-2 Zoning Map inside the Study Area
Figure 3.1-3 Zoning Map outside the Study Area
Figure 3.1-4 Integrated Zoning Map
Figure 3.2-1 Relation between Car Ownership and Household Income
Figure 3.2-2 Relation between One Car and Multi-Car Ownership by Household Income
Figure 3.2-3 The Future Income Distribution
Figure 3.2-4 Relationship between Zonal Car Ownership (cars/1000 persons) and Income
Figure 3.2-5 Estimated Motorized Households by Zone
Figure 3.3-1 Procedure of Modal Split Model
Figure 3.3-2 Diversion Curve for "To Work" Purpose of Motorized Household
Figure 3.3-3 Relationship Between Travel Distance and the Ratio of Modal Choice of Public
Figure 3.3-4 Trip Generation and Attraction in 1995 and 2020
Figure 3.3-5 Trip Generation and Attraction in Motorized Households (1995/2020)
Figure 3.3-6 Trip Generation and Attraction in Non-Motorized Households (1995/2020)
Figure 3.3-7 Trip Generation by Public Mode (1995/2020)
Figure 3.3-8 Trip Attraction by Public Mode (1995/2020)
Figure 3.3-9 Trip Generation by Private Mode (1995/2020)
Figure 3.3-10 Trip Attraction by Private Mode (1995/2020)
Figure 3.4-1 Comparison to Present Actual and Estimated OD Trips
Figure 3.4-2 Trip Desire Lines by All Purposes and Modes (1995 /2020)
Figure 3.4-3 Trip Desire Lines by Public and Private Modes (1995/ 2020)
Figure 3.5-1 Capacity Restraint Trip Assignment
Figure 3.5-2 Speed-Flow Curves
Figure 3.5-3 Basic Iteration Loop
Figure 3.5-4 Traffic Demand on Present Road Network in 1995 and 2020
- Figure 4.1-1 Outline of Part I and Part II Modules
Figure 4.2-1 Selection of Data Files to be Modified
Figure 4.2-2 Work Sheet on Microsoft Excel
Figure 4.2-3 Dialog Box for Saving Data
Figure 4.2-4 Warning Message for Data Save
Figure 4.2-5 Warning Message for Reconfirmation
Figure 4.2-6 Showing Submenu Tree
Figure 4.2-7 Conditions of Execution of Program

- Figure 4.2-8** Showing Submenu Tree for Output Lists (GETATT)
- Figure 4.3-1** Execution of Program
- Figure 4.3-2** Dialog Box for Inquiring the Target Year
- Figure 4.3-3** Optional Project List
- Figure 4.3-4** Dialog Box for Choice of Trip OD Table
- Figure 4.3-5** Dialog Box for Importing the Output File for Traffic Assignment
- Figure 4.3-6** Dialog Box for Save of the Imported File
- Figure 4.3-7** Displaying the Transport Network Data
- Figure 4.3-8** Sample for Browser of Traffic Volume (Lines by Traffic Volume Ranks)
- Figure 4.3-9** Sample for Browser of Traffic Volume (Figures beside Lines)

1. TRANSPORT PLANNING

1.1 Purpose and Coverage of the Transport Plan

1.1.1 Purpose of the Transport Plan

The Transport Plan is formulated, as its basic purpose, with the intention to contribute to the achievement of the smooth transport of people and goods, efficient and effective traffic operation, economic development of the area, and improvement of public health and culture.

In each individual traffic plan, however, the above-mentioned purposes are not always indicated directly. The concrete purpose is more often intended to the subject commanded by the plans in its upper stream such as the urban development or the land use plan. The said purpose can be roughly classified into the following three plans.

(1) Transport Plan Indirectly Intended to Develop and Improve the Community

The main issue of this transport plan, which is a part of the regional or the urban development plan, is to define the outline of the traffic functions and the traffic facilities to support the said such a function to achieve the purpose of the Transport Plan.

(2) Transport Plan to Handle Issues Existing in the Traffic System

This transport plan is formulated to solve traffic service issues already pending in the existing transport system. It is also requested to prepare the transport facilities necessary for the smooth maintenance and support to the community's activities, which is considered an exogenous condition.

(3) Transport Plan Intended to Construct Traffic Facilities

This transport plan is made to execute the traffic facility planning to satisfy the functions of the traffic facilities that are planned by the above plans (1) and (2). Therefore, by placing main importance on the function, this plan is made for adequate locations, alignments, scales and forms of the traffic facilities.

With the increase of the vehicle traffic, traffic congestions are caused at many places in Bogota City, which disturbs the city functions and unfavorably affects the sound activities of the city. The Study, namely "The Study on the Master Plan for Urban Transport of Santa Fe de Bogota", has an intention, as its main purpose, to solve the traffic congestion problem and recover sound functions of the city. From this point of view, the purpose of the Study corresponds to (2), above.

1.1.2 Coverage of the Transport Plan

The Transport Plan should be prepared according to its purpose. The contents of the plan may vary, however, depending on the phase and the contents of the plan. The coverage of the Transport Plan is roughly divided into the following four phases.

(1) Master Plan Study

The master plan study studies and analyzes the long term issues, and prepares a plan to satisfy the purposes and functions to be achieved by the Master Plan. Project or measures are planned only for checking its possibility; details are to be defined by later

studies. In this sense, the important issues of this study are to be defined in relation to comparatively broader traffic network on the national or regional scale, and also from the viewpoint of the development of the community. Therefore, a vision and a plan concept for a long-range course are requested.

(2) Feasibility Study

The feasibility study studies and analyzes whether or not the projects proposed by the master plan are technically and economically, and financially feasible. Compared with the master plan study, this study is requested to find details with higher accuracy. This study is very important since its result significantly affects the decision on whether or not to execute the projects.

(3) Basic Design

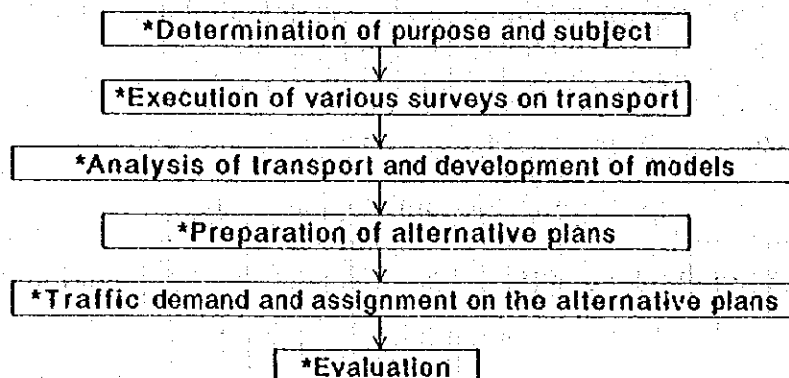
The basic plan is made for the projects judged feasible by the feasibility study, and makes the concept of the plan in a concrete form to be executed in the environment community. It is defined as the transport plan to achieve the specified functions. In the basic design of a road project, route locations, cross sections, dimensions, and locations and materials of the road facilities are examined. Similar plans should be prepared for the bus and railway projects.

(4) Detail Design

In the detail design, design drawings are prepared to execute the construction specified by the projects according to the basic design. Priority of execution, techniques, environments, funds, objections by inhabitants, etc. are taken into consideration as important factors to judge the possibility of execution.

1.2 Process of Plan Preparation

The process of plan preparation varies depending on each phase of the individual plan. General planning process of the Master Plan of the Transport Plan is shown below. The transport plan in general is often prepared in the following sequence.



The flow charts for planning are shown below. Present planning processes of the studies are made on urban transport plans actually executed in Middle and South American countries. Although the process varies slightly depending on the regional characteristics and existing transport facilities, most of the executions follow the above indicated process.

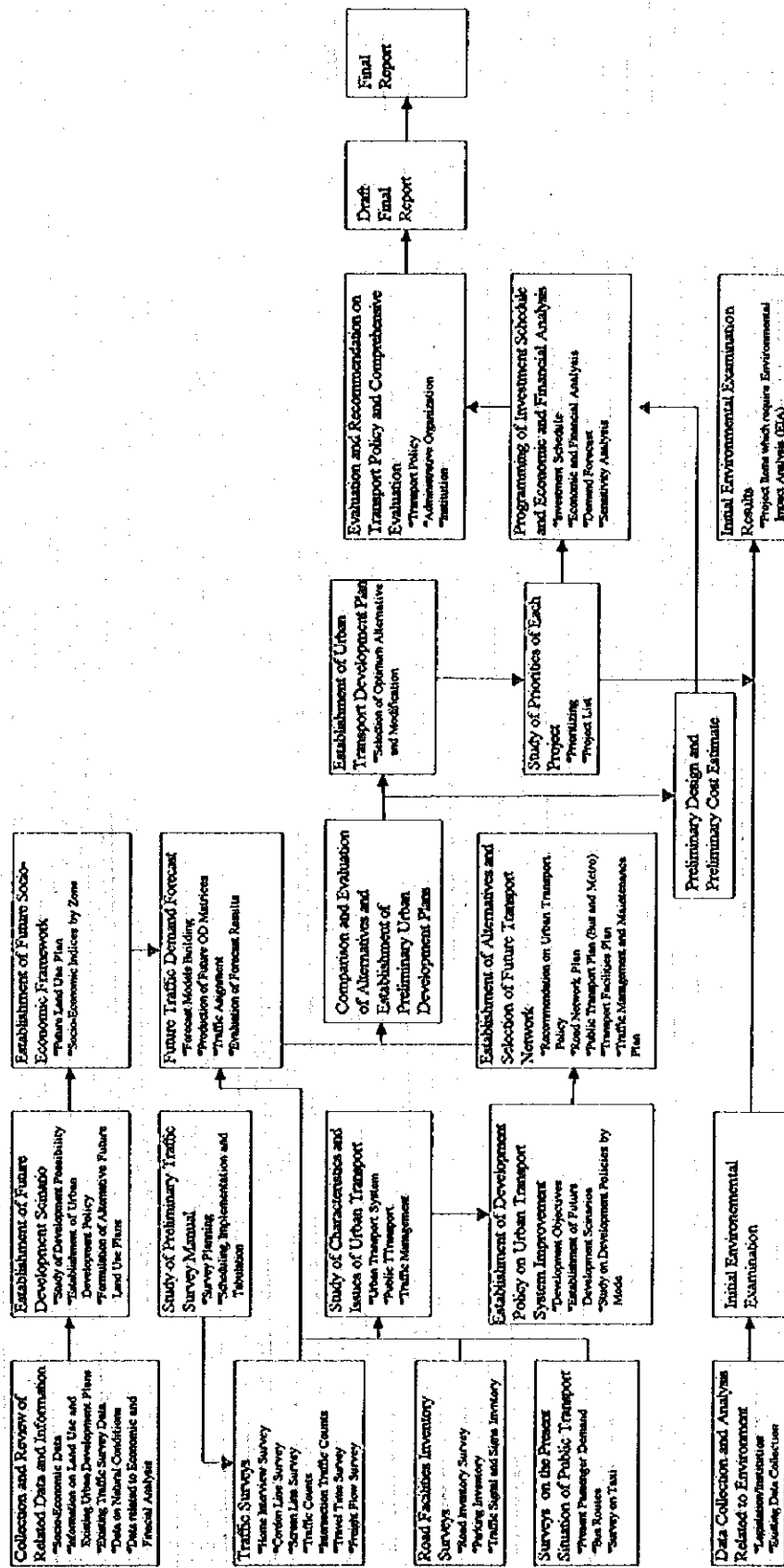


Figure 1.2-1 Study on Urban Transport Master Plan for Bogota, Colombia

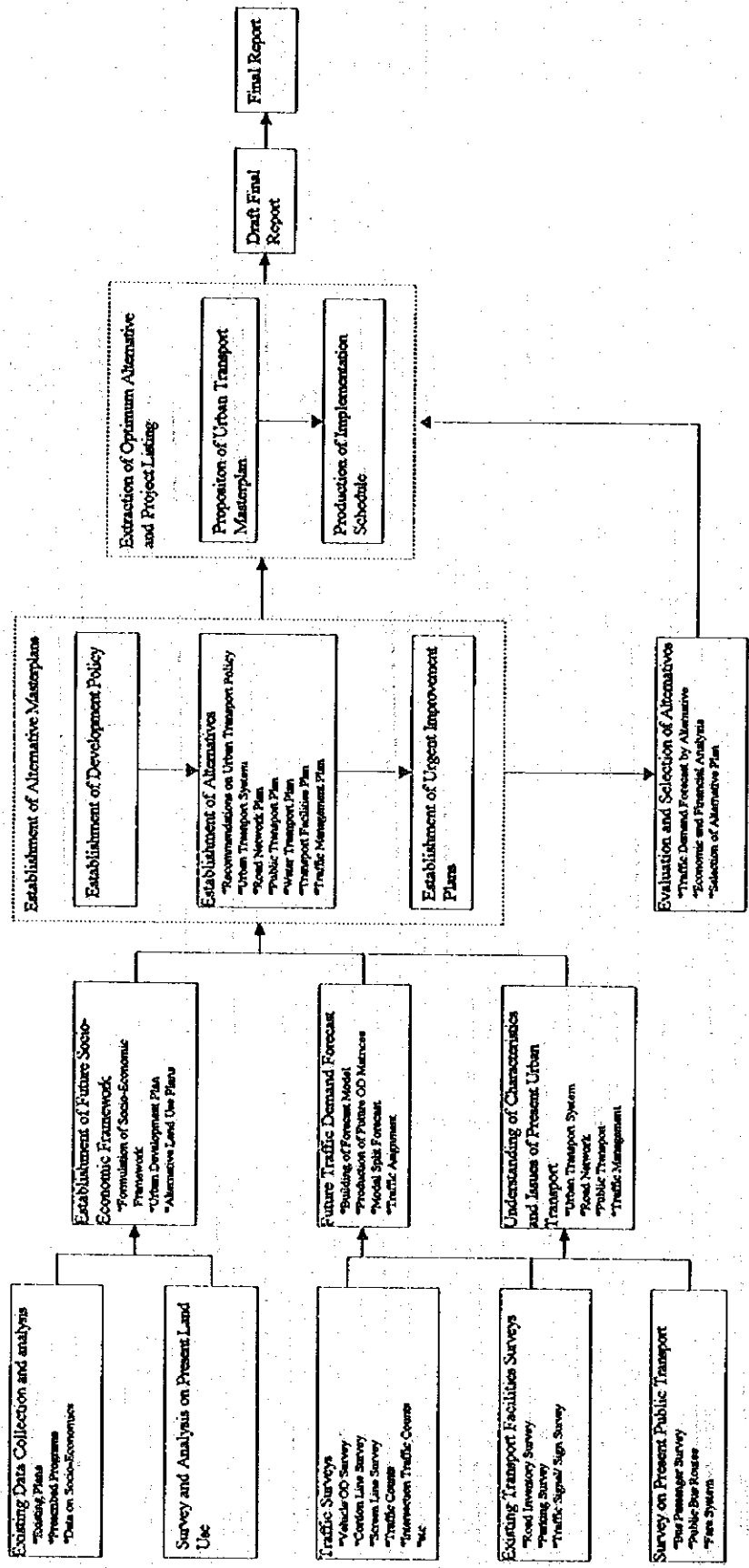


Figure 1.2-2 Study on Urban Transport Master Plan for Cartagena, Colombia

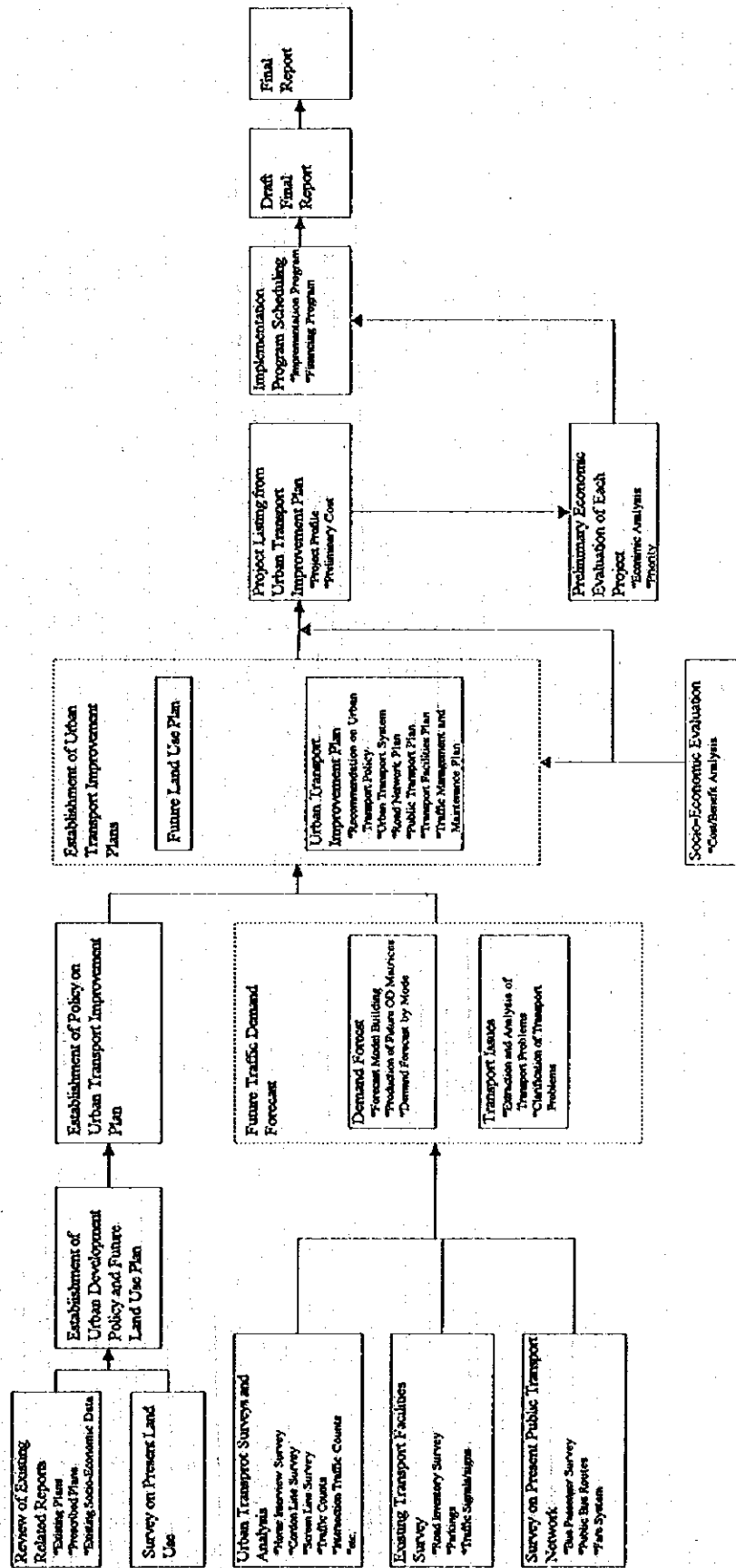


Figure 1.2-3 Study on Urban Transport Master Plan for Belém, Brazil

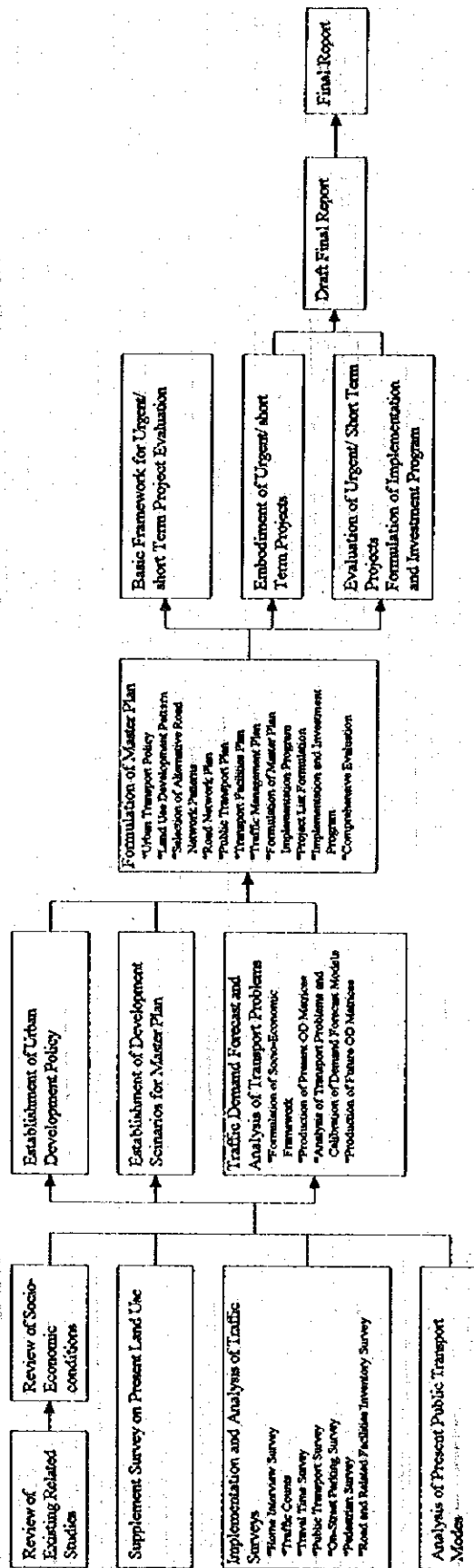


Figure 1.2-4 Study on Urban Transport Master Plan for Guatemala City, Guatemala

1.3 Contents and Method of the Study on the Transport Master Plan

Contents, process and method of the Transport Master Plan are explained following the work flow chart of "Study on Urban Transport Master Plan for Bogota, Colombia" (Figure 1.2-1).

1.3.1 Collection and Analysis of Related Data

Documents and data Study reports, various survey documents, draft plans of project area and its surrounding areas as well as data and materials of related master plans are collected and analyzed. Based on the result of analysis, the study approach is planned, the current status is recognized, and the current problems are analyzed. The materials mentioned below must be collected and analyzed.

(1) Collection and Analysis of Existing Reports

Before planning, reports of past transport plan studies should be collected. Analyses must be made on the following contents, by taking consideration of these contents for preparing the Transport Plan.

a) Main documents to be collected

- * Laws and regulations related to traffic and transport
- * Documents related to the of national government and municipal government traffic and transport policies.
- * Reports on traffic and transport plans and development plans executed by the national government
- * Reports on traffic and transport plans and development plans executed by the municipal government
- * Reports on traffic and transport plans and development plans executed by the private sector.

b) Main contents and items to be analyzed

- * Basic policy for preparing traffic and transport plans
- * What traffic and transport plans are being prepared in which area?
- * Progress of traffic and transport plan preparation by year (past 10 to 15 years)
- * Status of traffic and transport plans already put into practice and analyses of projects already determined to be executed
- * Status of plans not executed yet, and the reason for not being executed.

(2) Collection and Analysis of Data Related to Social and Economic Indexes

The collection and analysis of social and economic indexes will provide basic data for estimating traffic demand; namely, it will make basic data for a future frame to prepare the Transport Plan. Especially, collection and analysis of data on population and economic growth are important.

a) Main data to be collected

- * Data on population of provinces, cities and villages of the project area and its surrounding areas
- * Data on production activities
- * Data on the progress of economic growth (past 10 years)
- * Data on labor and wages
- * Data on social facilities

b) Main contents and items to be analyzed

- * Social and economic features of the country, province and project area
- * Economic growth of the project area and progress by year
- * Population of the project area and its progress by year (approx. past 10 years)
- * Social and educational features of the project area

(3) Collection and Analysis of Data on Traffic and Transport

The collection and analysis of data on traffic and transport will enable us to grasp the characteristics, volume, and problems of existing traffic and transport. It will also form the basic data to study the basic policy of and the method of preparing the Transport Plan. The transport facilities, include ground transport, marine (river) transport, and air transport. Selection of the type of transport depends on the feature of the project area.

a) Main data to be collected

- * Data on laws, regulations and policies of traffic and transport
- * Data on traffic volume by the type of transport facility
- * Progress of traffic volume and record of vehicle registration by year (approx. past 10 years)
- * Data on progress of commodity distribution by year

Data on traffic accidents

b) Main contents and items to be analyzed

- * Progress of traffic volume by the type of transport facility
- * Extraction of features and problems of transport facilities by mode
- * Progress of the record of vehicle registration by year
- * Progress of the number of traffic accidents, causes of accidents and places of frequent accidents

(4) Collection and Analysis of Data on the Land Use

The main purpose of collecting and analysing such data is to recognize the current status of land use and study the relationship between traffic and transport to the land use, as well as the future trend of the land use.

a) Main data to be collected

- * Laws and regulations on land use and buildings
- * Chart of areas and norms of land use
- * Area maps made by plotting major buildings by use
- * Current status of land use
- * Land use (residential, commercial, industrial, tourism, etc.)

b) Main contents and items to be analyzed

- * Preparation of building location map
- * Preparation of charts for current land use
- * Grasping the details of development plan (scale, construction period, population, etc.)
- * Night-time population, day-time working population, etc., by type of land use.

(5) Collection and Analysis of Data on Economic and Financial Analysis

a) Main data to be collected

- * Documents on national currency, foreign currencies, tax and duty on construction costs
 - * Documents for calculating traffic cost
 - * Documents for calculating time benefit
 - * Documents for financial analysis
 - * Reference for evaluating a project of toll facility.
 - * Reference for the executing organization of the project
- b) Main contents and items to be analyzed
- * Conversion of financial cost into economic cost
 - * Calculation of vehicle operating cost by vehicle type
 - * Calculation of unit time value
 - * Study on the possibility of employing toll system
 - * Extraction of problems on the current organization and operation

1.3.2 Execution of Traffic Survey

The main purpose of performing a traffic survey is to actually check the traffic conditions and the volume in the project area to grasp the traffic volume and characteristics on the spot. The result of analysis will provide basic data for the future traffic volume estimation.

Study items may differ slightly depending on the type of plan and the transport facility. When studying public transport facilities (bus system, railway system), the under-mentioned types of traffic survey are often performed. In preparing a road network improvement plan intended for vehicle transport, however, a road-side origin and destination (OD) survey is performed more often than the person trip (PT) survey. This is because PT survey requires much time and cost, while an OD survey is performed on a comparatively small scale and more easily. It is to be noted, however, that an OD survey cannot go into detail of the characteristics of peoples' trip activity.

The Study on the Transport Plan for Bogota was conducted in 1995 and 1996 for the purpose of preparing the comprehensive transport master plan covering the transport facilities such as vehicle, bus and railway systems. The flow of people was an important factor in the Transport Plan. From this point of view, a PT survey and related surveys described below were conducted.

- a) PT survey
- b) Cordon line survey
- c) Screen line survey
- d) OD survey at airport
- e) Freight-vehicle behavior survey
- f) Traffic account survey
- g) Travel speed survey

Detailed methods of performing PT survey, cordon line survey, screen line survey and traffic volume observation survey are referred in Chapter 2 for the traffic survey manual. Here, only an outline of each survey method is described.

(1) PT Survey

A PT survey is conducted to grasp the characteristics of people's trip activity. To grasp people's trip activity, a survey is performed on why (trip purpose), when (time), where (place), with what transport facility (transport mode), and in what route (passage) people travel. The PT survey not only serves for grasping the actual state of traffic and transport, but also offers basic data for preparing models for the future traffic

volume estimation, which is useful for preparing a future urban traffic and transport plan.

PT survey includes an interview system. In this system, the interviewers visit individual homes and make hearings according to the specified questions on the survey chart. Another survey method is to send questionnaires and have them filled in and returned. But the home visiting method is considered effective for obtaining higher accuracy. The PT survey conducted in Bogota employed the home visiting method. Before performing a PT survey, the following items should be closely checked.

- a) Determination of population
- b) Determination of sampling rate
- c) Determination of traffic zone (zoning)
- d) Determination of the contents of survey chart

(2) Screen Line Survey

A screen line survey is performed to raise the accuracy of traffic volume estimated from the analytical result of a PT survey. Generally, the screen line is drawn by crossing the project area where traffic flow is divided into two, near the central part of the project area it is divided in two, and near the central part it is not divided. A screen line survey includes the following as main items.

- a) Traffic volume by type of vehicle (12 & 24 hour traffic)
- b) Observation of the number of passengers
- c) It is important to define the types of vehicle depending on the estimation method and the past survey results.

(3) Cordon Line Survey

A cordon line survey is performed to raise the accuracy of the results obtained through the screen line and the PT surveys. At the same time, it is used to grasp the actual states of the incoming and outgoing traffic flow of the project area. Cordon lines are set on the outer rim of the project area and survey stations, and located on the roads passing the cordon lines. Traffic volume in the project area can be estimated from the PT and screen line surveys, but traffic volume flowing out from the project area is estimated from the cordon line survey. A cordon line survey includes the following items.

- a) Road side OD survey
- b) Observation survey of vehicles by type
- c) Survey of the number of passengers
- d) Survey of the number of bus passengers
- e) Survey of freight transport

(4) OD Survey From Airport

If there is an airport in the project area, an OD survey is performed to grasp the volume, origin and destination of people and freight flowing in and out of the airport. The OD survey can raise the accuracy of the analyzed results of the PT survey. At the same time, it is useful for grasping the characteristics of the traffic flow and providing makes data for studying the modal split. The OD survey from the airport should be performed in the same manner and for the same contents as those of the cordon line survey.

(5) Freight Vehicle Survey

Freight vehicle survey is performed to grasp the flow of freight. A PT survey cannot grasp the flow of freight, while a cordon line survey has difficulty in grasping the whole

status of freight flow. However the PT survey can be used for judging the freight volume. Therefore, an interview survey is performed at offices and factories as to freight, number of vehicles, and destinations. The main survey items include the following.

- a) Shipment volume, kinds of articles
- b) Origin and destination of freight
- c) Incoming and outgoing traffic volume of motor lorries
- d) Size and number of offices employees

(6) Traffic Count Survey

A traffic count survey is performed to grasp the current traffic conditions and analyze the traffic characteristics. This survey observes the vehicle traffic volume by type at the road side. A vehicle observation survey is performed on ordinary roads and at intersections. At intersections, traffic volume by direction is observed. A traffic volume observation survey is often performed on main roads, and it is important to get sufficient existing data for selecting the survey place. Observation time is as follows.

- a) 15-minute traffic volume by vehicle type
- b) 1-hour traffic volume by vehicle type
- c) 24-hour traffic volume by vehicle type
- d) Traffic volume by direction (at intersections)

(7) Travel Speed Survey

A travel speed survey is made to grasp the current traffic service level and status of traffic congestion, and to collect basic data to find traffic problems. This survey should be performed at peak hours (morning and evening) and off-peak hours depending on the traffic characteristics. The survey should be made 3 to 5 times, and the results should be indicated in mean values.

1.3.3 Road Inventory Survey

A road inventory survey is made to check the status of the roads and related facilities in the project area to prepare basic data for finding traffic characteristics and problems of the project area. It will provide basic data for preparing a transport plan. Items to be checked by this survey are listed below. Analyzed results are available in basic data in many countries. This kind of data is often used for the maintenance of roads.

a) Road facility inventory

- * Geometric structure of individual roads (vertical and horizontal alignments)
- * Structures, forms and dimensions of road crossing of each road
- * Forms, dimensions and status of maintaining the of pavement and drainage of each road
- * Location, form and status of maintaining the of bridges

b) Traffic signals and signs

- * Organization and operation of traffic signals and signs
- * Location and forms of traffic signals and signs
- * Traffic control system
- * Status of maintenance

c) Parking lot inventory

- * Organization and operation of parking lot
- * Parking lot capacity (sufficient/insufficient)
- * Occupancy of parking lots and parking charge system

1.3.4 Survey on Public Transport Facilities

This survey is made to check the characteristics of the public transport facilities such as bus, taxi and railway systems, find problems, and serve for the preparation of the transport plan. To grasp the characteristics of the public transport facilities, the following surveys are mainly performed.

- a) Survey of the number of operated buses
- b) Survey of the number of bus passengers
- c) Survey of the number of passengers getting-on and -off bus (at bus terminals)
- d) Survey on the use of taxis

(1) Survey of Number of Operated Buses

To check the status of bus operation, the following surveys are performed for each current bus route. In the surveys, data and information are obtained from the bus operating organizations and analyzed. It is requested that surveyors ride buses to perform the average speed survey.

- a) Bus route location and extension
- b) Survey on the number, types and special types of buses
- c) Survey on bus operation including average running speed and operating hours
- d) Number of operating buses by route
- e) Interview survey to bus operators

(2) Survey on the Number of Bus Passengers

The main bus routes are sampled, and a survey is made on the number of bus passengers passing such points. To maintain consistency with other surveys, it is advisable to select the same checking locations used for the vehicle traffic volume surveys. Private transport users and public transport users should be handled separately in checking the number of passing passengers so that share can be analyzed. The analyzed results should be cross checked with those of the PT survey to find the current share of use of transport by type.

(3) Survey on Number of Getting-on/off Bus Passengers

This survey is performed to grasp the characteristics of bus passengers. Survey methods include interviewing passengers on busses, and interviewing getting-on and -off passengers at bus stops and terminals. At bus terminals, the functions, facilities and operations of terminals are checked. The main survey items are as follows.

- a) Attributes, origin and destination of passengers
- b) Number of getting-on and -off passengers
- c) Function and characteristics of bus terminals
- d) Facility and capacity of bus terminals
- e) Maintenance, operation and organization

(4) Survey on Use of Taxis

The main purpose of this survey is to grasp the status of using taxis, which is one of the public transport facilities. The analyzed results are used for preparing a public transport plan. The survey is made by interviewing taxi drivers directly and visiting taxi companies to obtain data and information for analyzes. The main survey items include the following.

- a) Organization and operation of taxi companies
- b) Size of taxi companies and the number of taxi cabs owned by the companies

- c) Number of taxi passengers, area of use and mileage
- d) Taxi fare, rate of operating mileage with passengers, financial conditions.

1.3.5 Identification of Future Development Scenario

Identification of future development scenario offers basic data and information to estimate future traffic volume of a specified year.

Preparation of the scenario is equivalent to the preparation of a future image of the project area. It usually forecasts future population, economic growth and land development. For preparing the scenario, the following approaches are necessary.

- a) Evaluation of current problems and development feasibility
- b) Preparation of land development plan
- c) Preparation of land use plan
- d) Examination of future population and economic growth

(1) Evaluation of Current Problems and Development Possibility

The problems of the current land use causing traffic congestion should be studied and analyzed, and the ideal status of future land use should be examined. Evaluation is made on the capacity of the land to accommodate the increasing population. This evaluation offers basic data for the future population distribution.

(2) Preparation of Land Development Plan

It is desirable that the future land use plan is prepared before the transport plan. The future land use plan should not be managed in the transport plan, but it should be handled by the national government, municipal government or public offices of the surrounding areas. Sufficient discussions should be made on the policy of using the land, and future land use should be determined.

In practice, however, there are many cases where no land use plan is definite before preparation of the transport plan. In that case, the following items must be checked and analyzed for planning the future land use. It is important to obtain consensus on the land use plan among all the organizations concerned.

- a) Future prospect of the existing development projects
- b) Study of additional projects necessary for preparing future frame
- c) Activation of usable resources
- d) Study on the constraints of land use, geographical features, and water systems

(3) Examination of Land Use Plan

As mentioned above, the future land use plan should have been completed before making the transport plan. If the land use plan is not ready, however, it will become necessary to study a land use plan within the preparation of the transport plan. In that case, it is necessary to define the land use plan as a basic material to set a frame necessary for making transport plan.

When making a future land use plan, the important matter is to examine approximately three alternatives for the land use plan, discuss fully with related organizations, then establish the final plan. For the land use plan, the following alternatives are often examined.

- a) Alternative to follow the one center development pattern
- b) Alternative to follow the multi-center development pattern.
- c) Alternative to follow the belt-type development pattern.

Based on the examinations and the discussions mentioned above, the final land use plan should be prepared in combination with the improvement of traffic facilities.

1.3.6 Grasping of Characteristics and Problems of Current Traffic Situation

The characteristics and problems of the current traffic situation should be found out from analytical results of the PT survey and other traffic surveys and then examined. To grasp the traffic characteristics, the following items should be examined.

- a) Traffic volume by route
- b) Traffic volume by type of vehicle
- c) Traffic congestion rate by route
- d) Running speed by route
- e) Saturation rate at intersections with heavy traffic
- f) Traffic volume variation by hour
- g) Traffic volume by hour and by route
- h) Record of vehicle registration
- i) Characteristics of traffic trips
- j) Characteristics of trips by area

After examining the above items, traffic problems should be grasped. Traffic problems are classified as follows.

- a) Problems regarding traffic phenomena
- b) Problems regarding traffic facilities
- c) Problems regarding traffic regulations
- d) Problems regarding transport facilities
- e) Problems regarding traffic and transport policies

1.3.7 Preparation of Planning Policy

Automobiles allow individuals to freely move at their will. With rapid growth of a city accompanying the changes of urban service requirements and industrial structure, the limited space in the city is occupied by a rapidly increasing traffic volume, which causes traffic congestions, accidents and pollution, and prevents healthy and sound functioning of the city.

To solve such problems, it has been regarded important to improve traffic and transport facilities to increase the traffic volume. It is requested, however, to invest a tremendous amount of budget to improve such facilities. Under these circumstances, it has become difficult for the government investment to improve the traffic and transport facilities to handle the ever increasing traffic volume satisfactorily and smoothly. To evade such a situation, it is currently requested as an important issue to switch the policy of increasing traffic capacity to a policy of controlling traffic demand.

From the above viewpoint, the characteristics and the problems of the project area should be clarified, and a policy should be established for the transport plan to solve such traffic problems by means of adequate traffic policies. It is important to study employment of the public transport priority policy and the traffic demand controlling policy. To establish the policies for preparing the transport plan, the following items shown in Figure 1.3-1 should be studied.

- a) To induce to the appropriate transport system
 - * Policy of public transport strength
 - * Improvement of bus service

- b) To create the functional transport networks
 - * To develop the Transport Terminal
 - * To develop the Terminal of Transit
- c) To increase the traffic and transport capacity
 - * To develop the road network
 - * To control the traffic demand
 - * To conduct the traffic management
- d) To use the existing transport facilities
 - * To improve the intersections
 - * to wide the existing roads
- e) To mitigate the traffic environment
 - * To develop the pedestrian facilities
 - * To develop the traffic signs and signals

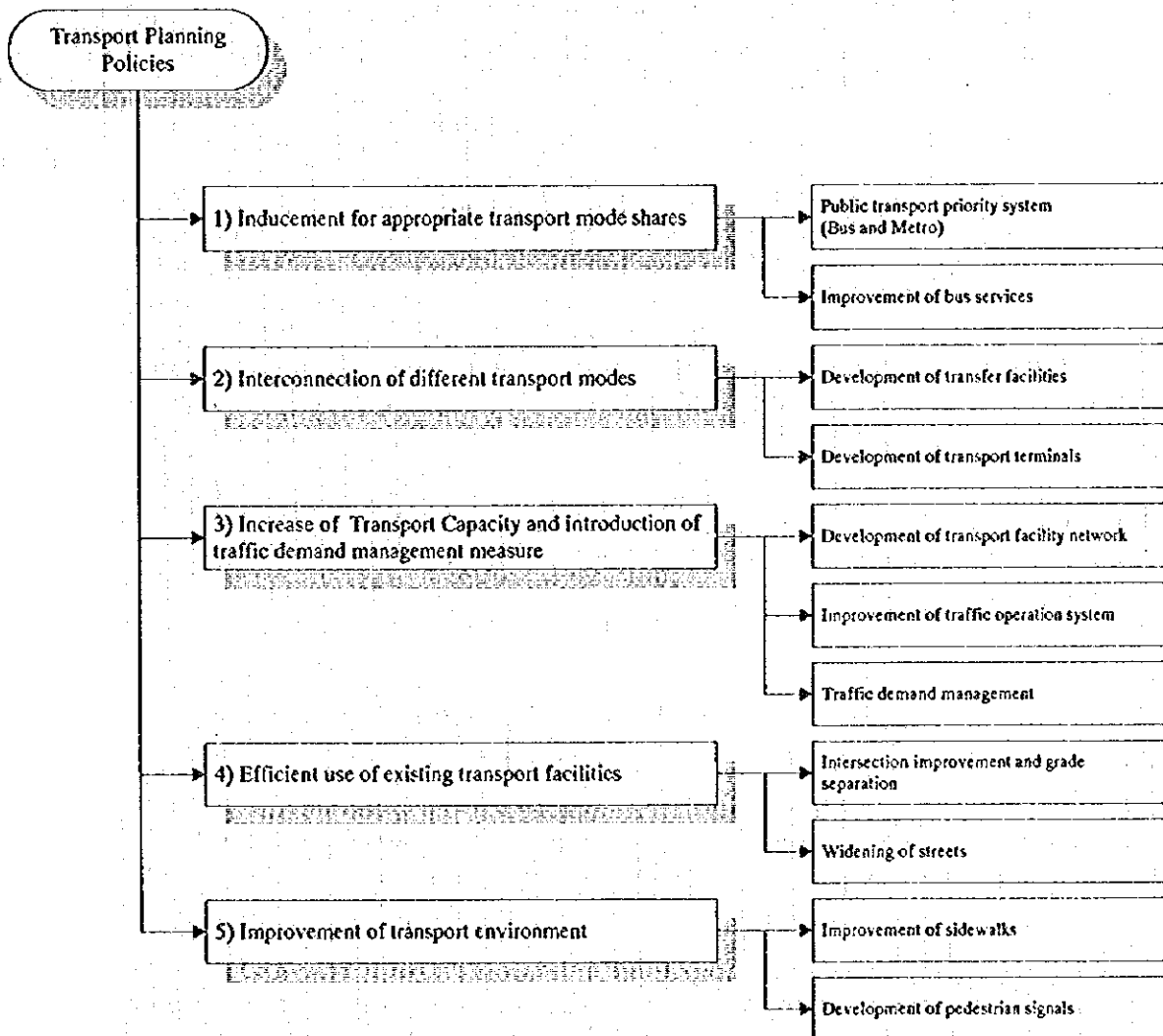


Figure 1.3-1 Items to be Considered in Transport Planning Policy

1.3.8 Identification of Future Social and Economic Framework

(1) General

Establishment of a future social and economic framework is utilized to forecast the future of the project area, and will create basic data and materials to estimate future traffic volume of the project year. To study the social and economic framework, social and economic forecast of the project area and the rate of national economic growth are taken into consideration, and future population and economic structure (GRDP, industrial output, labor productivity, employment, etc.) are estimated. The concrete items to be studied are as follows.

- a) Estimation of GDP and GRDP as a whole and by sector
- b) Estimation of population in project year by year and by sex
- c) Estimation of future population by sector and by zone.
- d) Estimation of working population and employment
- e) Estimation of incoming and outgoing population of the project area
- f) Distribution of works and employment to traffic zone
- g) Estimation of social and economic status by traffic zone

(2) The Results of Socioeconomic Framework in Studying the Master Plan for Urban Transport of Santa Fe de Bogota

1) Long-term future perspective of Colombia

The Colombian economy has been growing at an annual average rate of 4.5% during the 25-year period of 1970-95. For the future, the government insists on a continuation of high growth of more than 5% based on the discovery of new oil fields in the Department of Casanare. According to British Petroleum, in an area of 500 Km², there is crude oil sufficient for 15-year-long production and export, and Natural gas sufficient for consumption until 2050. The government expects foreign investment to the oil fields and refinery plants, and export of crude oil and derivatives. But the private sector (FEDESARROLLO) is not so optimistic (especially in the near future) and does not expect a 5% growth until 2000.

In this study, it is determined to adopt an annual average rate of 5% as the target for future long-term economic growth of Colombia, considering that 6% economic growth is required for Colombia to catch up with the Asian tigers, and that it is not possible to maintain a high growth if the social and political struggles are settled and education becomes widespread.

2) Population of Bogota city (study area) and Metropolitan area.

* Population of the study area

The future population of the study area will reach 8.6 millions in 2020. The net migration into the study area will decrease from 300,000 persons per 5 years (60,000 person per year) to almost the balanced level because of the lack of urbanizable land.

* Population of Metropolitan Area

Based on the changing trend of demographic indicators (fertility rate and survival rate) and the net migration into the Bogota Metropolitan Area, future population by sex and age is projected until 2020, and the population Bogota Metropolitan Area will reach 11 million in 2020. The net migration into the area will continue at the rate of 400,000 person per 5 years (80,000 person per year) until 2010, but the number will gradually decrease with the declining tendency of the National population growth.

3) Employment of Bogota Metropolitan Area

Table 8.1-6 shows the projected results of the number of employed persons in the study area and its surrounding municipalities. It is assumed that the labor force participation rates of the study area and the surrounding municipalities will gradually increase from 54.8% and 57.5% in 1995 to 59.0% and 60.0% in 2020, respectively. The unemployment rates are expected to decline from 10.2% and 7.5% in 1995 to 5.0% and 4.0% in 2020 respectively.

4) GRDP

The future economic growth rate of the study area is determined 5.2% as the target for the improvement of the total urban environment of the Capital City. The share of the Nation GDP will go up to 22%.

The primary sector is assumed to decrease to 10% of its present level in 2020. As for the secondary and tertiary sectors, it is assumed that tertiary sector will grow a little more rapidly than the secondary one.

The job opportunity in the study area is for the residents of the Bogota Metropolitan area a whole, that is, for the residents of the study area and the residents of surrounding municipalities. Table 8.1-2 shows the future number of employed persons commuting to the study area. It is assumed that the percentage of commuters to Bogota will increase from 30.6% in 1995 to 31.5% in 2005, but will decrease to 30.0% in 2020. This is because at first residential zones will be developed in the municipalities, and later some job centers like industrial estates or multipurpose zones will be developed. The economically active population will be absorbed there

5) Urban Development Pattern and Land use Plan.

a) Conceptual Urban Structure of Bogota Metropolitan Area.

The present Urban structure of Bogota Metropolitan Area (BMA) can be called a mono-nucleated Pattern, although the business/commercial district is extending to the North through Chapinero towards Usaquen.

As the future urban pattern of BMA, the following three could be considered.

- i) Mono - nucleated Pattern
- ii) New Town Pattern
- iii) Poly - nucleated Network Pattern

i. Mono nucleated Pattern

A greater part of economic activities in BMA are concentrated in the present Central Business District (CBD). Residential areas are conurbated to the surrounding cities as bed towns. Suburban cares are not sufficiently developed, so many people are forced to go the CBD for working, shopping and cultural activities.

The transportation network is characterized by strong radial corridors with congested traffic of long trips all day.

ii. New Pattern Town

This Pattern creates several "New Towns" around Bogota, which are self-sufficient in socioeconomic activities. They are created by developing the existing surrounding urban areas and new ones. For the assurance of self-sufficient, it is necessary to develop large-scale and high-quality commercial/business districts in addition to

industrial zones.

The transportation network of this pattern is a interconnection of independent networks (mainly radial/ring road system) of "new Towns" and Bogota. Trip length is generally short and traffic on each network of "New Town" and Bogota is balanced with the capacity. The number of Long trips on Inter-city routes is comparatively small.

iii. Poly-nucleated Network Pattern

This pattern is a connection of various employment cores within and outside Bogota with a strengthened network of transportation and communications. Employment cores are developed by incubating existing small cores and by creating new industrial and multipurpose zones.

The transportation network is a lattice pattern locating employment cores on the nodes. Compared with the new patterns mentioned above, trip length is medium.

The mono-nucleated pattern will worsen the existing problems. On the other hand, the New Town Pattern is very difficult to realize, and it is feared that the economic activity of BMA will lose its vitality if mobility of the area will decline too much.

It is considered that the poly-nucleated network pattern is the most realistic pattern and can be created by strengthening the present policies on planning and development.

b) Basic Policies for making Land Use Plan

DAPD has an authorized land use regulation plan for the existing urban areas and a development guideline for the transition areas. The surrounding municipalities also have land use regulation plans for the urban areas, but in some municipalities the planned urban areas are too small to accommodate the future population projected for 2020.

Considering the above mentioned fact, the land use plan for 2020 is prepared by adding new urban areas based on the use zoning category to the existing land use regulation plan.

The basic policies for making the land use plan are as follow:

- * To locate many job centers such as industrial zones and multipurpose zones as much as possible in new urban areas.
- * To create the riverside green zone with a width of 300 meters on both sides of rivers
- * To create the preservation zone with a planned maximum population density of 15 persons per hectare for the hilly area.
- * To locate the residential zones for 2.4 million people by considering the size of the developable land and transportation network in the surrounding municipalities.
- * To prepare a map showing an outline of land use and size of urban area with a population density of 150 persons/ha for the surrounding municipalities.
- * To prepare a map showing the use zoning by traffic zone and to make a table showing the area of each use category by zone for the study area.

1.3.9 Forecast of Future Traffic Demand

Future traffic volume estimation serves as the basic data and the information to study the scale of each individual plan of the transport plan of the project year and the

expected effect of development. There are many analytical methods for traffic demand estimation on each depending type, phase and scale of the plan. However, the 4-step estimation method is employed in most cases. In this method, the following four steps of estimation are proceeded in sequence: 1) trip generation, 2) trip attraction, 3) modal split, and 4) traffic assignment. This 4-step method was employed for the Study on the Transport Plan in Bogota, and executed in the following manner.

(1) Estimation of Trip Generation and Attraction

Based on the social and economic indicators such as population, employment by industry, employees by industry, and student population, the current generation and attraction by zone and by purpose were estimated by means of the multiple regression model. Variables were defined considering the use of land and social conditions of the project area.

(2) Estimation of Trip Distribution

A gravity model was employed to estimate the trip distribution.

(3) Modal Split

Split of the private mode and the public mode is closely related to household income. High income households have a high rate of using passenger cars, and low income households have a high rate of using public transport facilities. The current modal split was estimated from the PT survey result.

(4) Trip Assignment

The above estimated traffic volume was assigned to the traffic network by the types of transport and vehicle.

The details of the future traffic demand estimation methods used for the Study of the Transport Plan in Bogota are included in Chapter 3 as a manual.

1.3.10 Preparation of Alternative Plans

(1) Meaning of Preparing Alternative Plans

The Transport Plan handles an extremely wide range of items such as regional coverage (nationwide, city), type of traffic systems (comprehensive traffic, air transport, railway system), type of traffic facilities (network, terminal), target period (short term, intermediate term, long term) and phase of plan (M/P, F/S, B/D, D/D). Not only facility plan, but operation plan, operation entity, and fund raising plan may also have to be handled.

From this point of view, it is quite important to clarify the objectives of the plan, fundamental concept of the plan (what should be done) and the framework through the process of studies for establishing the target. Since the framework may include innumerable alternatives, it is requested to select a few alternatives that allow detailed evaluation in a limited time. In the process of selection, some alternatives are to be deleted because they do not go through detailed evaluation and would not match the purpose, or they may not satisfy the planning constraints. In the process of such consideration, it is necessary to reconfirm the purpose of the plan and the variability of consciousness and restrictive conditions.

(2) How to Prepare Alternatives

As stated above, preparation of alternatives may differ depending on the type of plan.

The following alternatives are available.

1) Alternatives for traffic network

Traffic network planning includes planning a totally new network for the project area, and partial modification or addition. In the former case, a network is set up on the principle of network pattern, hierarchy, and density.

2) Alternatives for transport facility

In ordinary cities, road system as well as bus and railway traffic systems are available as the transport facilities. A water transport system may be added sometimes. It is therefore requested that the plan should be consistent with the existing traffic and transport systems. The alternative should be such that it can harmoniously be coordinated with the traffic demand, land use plan, and the existing traffic and transport systems. Since each individual transport facility has its own function, characteristic and capacity, these factors should be taken into consideration for alternatives.

3) Alternatives for selecting suitable locations for traffic facilities

Alternatives for selecting suitable locations for traffic facilities such as railway stations, highway interchanges, bus terminals, and truck terminals are prepared after considering users' convenience, relation with other traffic and transport facilities, the possibility of securing spaces, environmental effect on surrounding places, and construction costs. Mostly, therefore, only a limited number of alternative may be prepared.

4) Alternatives for traffic and transport policies

Traffic and transport policies include many policies, such as fare and freightage policy, traffic regulation policy, traffic demand management policy, traffic safety policy, etc. Due to their variety, alternatives are determined not on physical conditions like the cases shown above, but on a question of whether consensus can be obtained with regard to legal and social restrictions.

5) The Results of Preparation of Alternative Plan in the Study of Master Plan for Urban Transport of Santa Fe de Bogota

a) Urban Transport Issues in Bogota

Based on the existing traffic conditions and the forecasted future travel demand, the transport issues in the city of Bogota are identified. The main points of issues are as follows;

- * Future traffic flows concentrate on the Central Business District (CBD) which is covered by Avenida Quito and Avenida 7a according to the future traffic desire lines. This pattern is similar to the present one. Therefore, in these areas, the traffic congestion is heavier in the year 2020.
- * From the analysis of the person trip survey data, the trip characteristics between motorized and non-motorized households are different in travel mode, i.e., the member of the motorized house holds mainly use passengers car, while those of the non-motorized households use public bus transport. Approximately 75% of total trips are by use the bus transport in 1995 in contrast to about 60% in 2020. The majority of transport modes in future is still the public transport. Therefore, it is indispensable to plan for both road network and public transport network.

- * At present, the level of the bus transport service is low. It is indispensable to improve the service level of the public transport.

In 2020, the traffic volume in the study area will rise to 1.55 times of the present one, while the population in Bogota will increase to 1.45 times. At present, there is the formulated future road network plan in Bogota by DAPD. In the previous section, the future road network plan was roughly examined in terms of traffic volume/capacity ratio by traffic assignment. It is obvious that road network development plans only will not be suffice to increased future traffic volume, i.e., demand and capacity is not balanced. It is indispensable to do the traffic management plan as a traffic demand control and a traffic flow control in the future.

b) Basic Concept for the Formulation of Master Plan

Considering the future transport conditions and the present issues in the city of Santa Fe de Bogota, the following basic concept for a preparation of Urban Transport Master Plans is show.

- * The traffic congestion will concentrate at the existing CBD in 2020, and this area is required to improve the existing road network, as well as and transport network and systems. However, it is very difficult to widen these existing roads because there is not room for widening these roads. In this area, grade separated transport network systems, improvement plans of small size roads and traffic management plans should be prepared considering the above mentioned conditions.
- * An Urban Transport Master Plan is examined based on the combination plan of three (3) different types of transport system, which are a road network development plan, busway network and railway networks development plans.
- * Considering the future transport demand in the city of Bogota and its surrounding areas, a powerful public transport plan should be formulated.

c) Transport Network Plans

The three (3) transport Network development plans are studied for preparation of the Urban Transport Master Plan. The Master Plan alternatives were prepared by combination plans of the public transport development plans, road network development plan and traffic management plans.

d) Road Network Plan

The following three (3) road Network plans are employed, by taking into account the future Land Use, the traffic characteristics, the existing road network, and future travel demand.

- * Road Network Development Plan (Base Network)
- * Road Network Development Plan (RO-1)
- * Urban Expressway Network Development Plan (RO-2)

e) Public Transport Network Plan

Two (2) public transport alternative network plans are employed to strengthen the public transport plan by taking into account the functions and characteristics of the public transport systems and the future travel demand.

- * Introduced Busway Development plan
 - Busway Route-1 (BS-1)
 - Busway Route-2 (BS-2)

- Busway Route-3 (BS-3)
- * Introduced Railway Development Plan
- Railway Route-1 (RL-1)
- Railway Route-2 (RL-2)
- Railway Route-3 (RL-3)

f) Traffic Management Plan

Various traffic management plans are examined. Major Traffic management plans are employed taking account of traffic flows characteristics, the existing traffic manners and regulations, and the existing road facilities. The major traffic management plans are shown below;

- * Car parking development plan
- * Intersection and short length of road improvement plan
- * Traffic signals and regulations improvement plan
- * Traffic safety development plan.

g) Formulation of Transport Network Alternatives for Master plan.

Master Plan Alternatives are formulated in consideration of the followings;

- * To increase the capacity of transport facility in accordance with the future traffic flow and the volume of the private and public transport passengers, and
- * To introduce the public transportation with high service level as well as traffic demand control to divert the traffic from the passenger car to the public transport.

The alternatives are composed of the followings; three (3) Road Network Plans (Base Network, RO-1 and RO-2) oriented to the road network, two (2) Public Transport Network Plans (Busway and Railway) oriented to the public transport, and four (4) major traffic management Plans (Car Parking, Intersections Improvement, Etc.) For mitigation of the traffic congestion on the certain areas.

The year 2020 is the target year for the Long Term Plan on the "Master Plan For The Urban Transport of Santa Fe de Bogota" as For short - and Mid - Term Plan or an Urgent implementation plan, the traffic management plan for improvement, or betterment of the existing traffic conditions is mainly formulated. The comprehensive Urban Transport Master Plan which includes from Short - Term to Long Term Plans is formulated by combination Plans from the above network plans.

Alternative A is the formulated future road network plan in Bogota planned by DAPD, which is employed as the base case to estimate the effectiveness of alternatives. In Alternative B, several major roads are added to the alternative A's road network, based on the analysis of the traffic assignment on the road network in alternative A. Alternative C has the Urban Expressway system composed of ring roads around the Central Business Areas and roads radiating in the direction of major traffic flows, adding to the alternative B's Network.

Alternative P, D, and E have three segregated busway routes on the alternative A's network, B's and C's Networks, respectively. These segregated busways are planned on the great roads with 4 lanes in both directions. On these roads with busway, the right of way served for the private vehicles is reduced to improve the bus service level.

As for alternatives Q, F, and G, three rapid railway routes are planned on the alternative A's network, B's and C's networks respectively. The railway routes pass

through the same route as that of busway with elevated structure over at-grade roads. These alternatives are quite different from busway system. The railway system does not disturb the lanes for the private vehicles.

Alternative H to O are combination Plans of three routes among busway and railway routes. That is combined with one or two busways, and two or one railways.

Do-nothing case without any future plan is also set as a ground case to evaluate the alternatives. It is because alternatives are evaluated differently for a certain alternative and the do-nothing case in terms of VOC and Time Saving.

1.3.11 Evaluation of Plan

A plan is evaluated from three viewpoints including service level (technical evaluation), economic evaluation, and environmental evaluation. The service level evaluation evaluates how the service level has been improved after the plan is executed. The economic evaluation evaluates whether the draft plan is reasonable from the viewpoint of the national economy, and checks if the plan can be executed in practice. How far the construction expenses would have a multiplier effect is also checked. What effect is given to the project area by the execution of the plan is also examined.

To ensure that no unfavorable effect is given to the local environment, the plan is evaluated from the viewpoint of natural and social environments.

(1) Service Level Index

Service level may be expressed by subjective indexes to indicate individual user's conscious or integral evaluation of a single service or combined services. More often, however, it is expressed by objective indexes to indicate the concrete condition of physically measurable services. To verify a service level, many-sided analyses of traffic conditions are often used. Besides the traffic-related items, a) safety, b) economy, c) convenience, and d) comfort are evaluated.

(2) Economic Evaluation

Economic evaluation is usually made to compare the benefit of traffic costs between the cases with and without the project. Social benefit, which is difficult to measure quantitatively, is also evaluated qualitatively. Details of economic analysis are stated later.

(3) Environmental Evaluation

This evaluation checks what effect is expected on the natural and social environments when the project is executed. Evaluated items may vary depending on the natural and social environments in the project area. The items often checked in recent urban transport projects are noise, air pollution, and protection of the natural environment. The removal of inhabitants is also studied.

Table 1.3-1 Formulation of Transport Network Alternative Plan for Master Plan

Public Transport Development Plans	Existing Public Transport	Bus Network Plan, Busway (1)+(2)+(3)	Railway Network Plan, Railway (1)+(2)+(3)	Combination Plan (1), Busway (2) Railway (1)+(3)	Combination Plan (2), Busway (1)+(3) Railway (2)	Combination Plan (3), Busway (1)+(3) Railway (2)	Combination Plan (4), Busway (2)+(3) Railway (1)
Road Network Development Plans							
Existing Road Network	Do-nothing						
Road Network Plan (1) (DAPD net)	Plan-A Base Case	Plan-P	Plan-Q				
Road Network Plan (2) (DAPD net + Additional Roads)	Plan-B	Plan-D	Plan-F	Plan-H	Plan-J	Plan-L	Plan-N
Road Network Plan (3) ((2) + Expressway)	Plan-C	Plan-E	Plan-G	Plan-I	Plan-K	Plan-M	Plan-O

1.4 Evaluation of Master Plan

1.4.1 Introduction

This manual is prepared as one of the supplemental materials of technology transfer especially in the process of "project evaluation" through the Master Plan Study for Urban Transport of Santa Fe de Bogota, Colombia.

In the course of the study, various project-evaluations have been conducted at several stages of the planning in accordance with its purpose; for example:

- Evaluation of transport Network alternatives: a comparative analysis of the proposed alternative network plans composed of trunk road improvements, bus-way systems, introduction of railway mass-transit system, etc., in order to select a basic future transport network plan.
- Evaluation of projects/ project -packages in order to formulate an implementation program and investment plan for each term of the targets; short-, medium- and long-term.
- Evaluation of financial viability: an example feasibility analysis on proposed projects from the viewpoint of financial operation.

In addition to these economic and financial feasibilities, an initial environmental assessment has been also conducted in order to evaluate the proposed plan from integrated and comprehensive viewpoints.

1.4.2 Economic Evaluation

(1) General Methodology

'Benefit / Cost (B/C) analysis' is applied for an evaluation of the alternative transport network plans from the general economic viewpoints. This methodology is very common for this purpose, and overall work-flow of B/C analysis is illustrated in Figure 1.4-1.

The benefits and cost, which would be brought by the implementation of the proposed

projects, are measured at economic price, and compared between 'with project' and 'without project' cases

As the benefits accruing from a project and contributing to the National/Regional economy, some quantifiable factors are examined, such as reductions of vehicle operating cost, travel time cost and so on. On the other hand, the cost is the monetary expression of real consumption of goods and service to implement the project. Therefore, all the transfer cost, such as tax and subsidy, will be deducted from the benefit and cost.

(2) Economic Benefits

A variety of benefits, direct or indirect, can be expected by the implementation of urban transport improvement projects. For example, mitigation of traffic congestion and improvement of travel speed are significant as direct benefits, and the following benefits are also recognized; such as improvements of accessibility, safety and comfort for urban transport users, and moreover an encouragement of urban development potential.

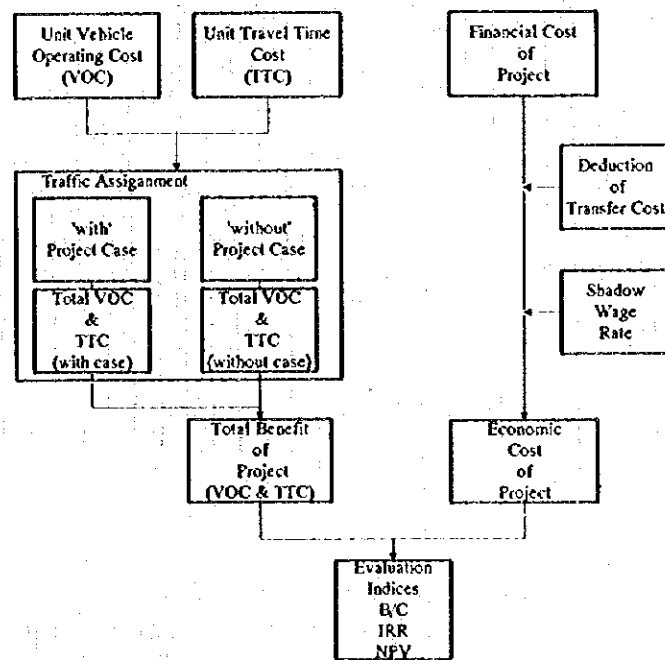


Figure 1.4-1 Overall Work - Flow of Benefit /Cost Analysis

In this study, however, two items of quantifiable benefits which are definitely known to exist are well-studied to quantify and examined. That is, savings in vehicle operating cost (VOC) and savings in passengers' travel time cost (TTC).

Benefits of the project are measured through a so-called 'with project' and 'without project' comparison. Based on the results of the traffic assignment to the both transport networks; with project (with improvement) and without project (do-nothing), the total of VOC and TTC in each case is calculated and compared. And the benefit of the project is obtained as the difference between the two cases; savings of

costs = total cost of 'without' case minus (-) 'with' case.

For this calculation, usually both unit costs of VOC and TTC are examined .

VOC: Vehicle operating cost per unit distance and per unit time by type of vehicles, and

TTC: Travel Time cost per unit of time by passenger/trip purpose.

They are expressed as a function of running speed, and total transport cost is obtained as the sum of VOCs and TTCs at each link of transport network, where the running speed is estimated, with reference to the assigned /estimated traffic volume.

As an example of unit cost analysis is attached in the Appendix, the procedure is summarized as follows:

1) Vehicle Operating Cost

This is a main source of economic benefits of a transport project and is estimated by type of vehicles such as passenger car, taxi, small-bus, bus, light truck, and truck.

VOC is usually composed of the following items;

- a) Fuel cost
- b) Oil cost
- c) Tire cost
- d) Maintenance cost
- e) Depreciation cost
- f) Capital opportunity cost, and
- g) Crew and overhead cost

a) Selection of Representative Vehicle

Though there are many different makes and models of vehicle actually running in the study area and unit VOCs vary by makes/models and also vehicle age, one of the most popular models is selected as a representative and its VOCs are examined for the convenience of the analysis.

Economic cost of each representative vehicle is calculated; financial cost (market price) less taxes, together with some necessary characteristics such as tire type, fuel type, vehicle life, etc.

b) Fuel Cost

Fuel price in economic cost is calculated by type of fuel such as regular gasoline, premium, diesel, LPG, etc., deducting taxes from market prices. Since fuel consumption rate depends on vehicle running speed, fuel cost per kilometer at each level of running speed is estimated based on the fuel consumption rate by vehicle type.

c) Oil Cost

Lubricant oil cost, in economic price, is also estimated in the same manner as the fuel cost calculation.

d) Tire Cost

Tire Cost is estimated as one of the representative consumable parts of vehicles. Since this depends also on running speed, average tire life and road surface condition, the estimation is conducted based on some experiential rate of consumption by running speed.

e) Maintenance cost

The rate of annual maintenance cost against the vehicle price (without tire price) is assumed based on experiences, and maintenance cost per kilometer can be calculated in consideration of annual running distance.

f) Depreciation Cost

Depreciable amount of vehicles is defined as the vehicle economic cost less salvage cost after the vehicle life period and salvage value is estimated under local condition. This amount is also divided in two; depreciation subject to use and subject to time.

g) Capital Opportunity Cost

This cost is not affected by use but only as time passes, and is determined by vehicle price, life period, salvage value rate, and interest rate.

h) Crew and Overhead Cost

This cost is also affected only by time, consisting of taxi/bus/truck drivers' wages and their overhead.

The unit VOC is finally obtained only by time, in two different categories; distance related cost and time related cost, as a result aggregating above-explained each item.

2) Travel Time Survey

In general, Traveler's time value is defined based on the productivity. The time value of people in the study area is estimated using households income data obtained by a person trip survey.

In this study, it is analyzed by car-ownership purpose, etc., and the future cost is estimated in accordance with the estimated growth of per capita GDP.

3) Economic Cost of proposed project

Investment amount of each transport project, at first, is estimated in market price, so-called financial cost. It is necessary to convert it into economic cost in order to compare with the economic benefit. Major processes of conversion are;

- a) Break down of construction cost into three items: material cost, equipment cost, and labor cost.
- b) Deduction of the taxes such as import duty, value added tax and consumption tax out of the material and equipment cost.
- c) Apply of shadow wage rate, if necessary.
- d) Addition of land acquisition cost, in case that the project contains a public-owned land which is not included in the price market.
- e) Necessary consideration on contingency preparing for future information.

In case of transport projects, in general, economic cost might be about 85 to 95% against financial cost.

Annual profit estimated for the project life period is compared with the investment cost in the form of cash flow. As the result of this analysis, three indices such as benefit-cost ratio(B/C), net present value (NPV) and economic internal rate of return (EIRR) are calculated under certain discount rate.

4) Cost-Benefit Analysis

Cost-benefit analysis in the Study of Bogota as an example is shown here. Annual profit estimated for the project life period is compared with investment in the form of cash flow. As a result of this analysis, three indices such as benefit-cost ratio (B/C), net present value (NPV) and economic internal rate of return (EIRR) are calculated under certain discount rates (in case of this study 12% per year is applied).

A total amount of 9,706 billion pesos is required to accomplish all the projects of the Master Plan and to maintain them, in economic costs at 1996 price. These projects consist of traffic management projects, bus troncal, mass transit, terminal, existing road improvement, new road construction and the urban expressway. And they would be implemented from 1997 to 2020. When all the projects are completed, total travel cost (both VOC and TTC) would amount to 7,400 billion pesos (at 1996 price) in the year of 2020. However, that would be 18,260 billion pesos if the present transport network remains as it is, without any projects. Therefore, the economic benefit in 2020 derived by the master plan is estimated to be 10,860 billion pesos. Out of this, 26% is attributed to VOC savings and 74% to TTC savings.

Annual cash flow (benefit - cost) is analyzed during the master plan/project life period, as shown in Table 1.4-1. Under the discount rate of 12%, the benefit cost ratio (B/C) is 5.33 and the net present value (NPV) is 12,100 billion pesos, which assures quite high economic returns for the master plan. The economic internal rate of return (EIRR) is also very high at 42.40%.

Table 1.4-1 Benefit-Cost Analysis of Master Plan as a Whole

Year	Cost			Benefit		
	Investment	O/M	Total	VOC	TTC	Total
1996	0	0	0	0	0	0
1997	196	0	196	0	0	0
1998	349	0	349	17	68	84
1999	422	0	422	33	136	169
2000	478	0	478	66	271	337
2001	343	0	343	132	543	675
2002	245	54	298	151	609	760
2003	205	54	259	172	683	855
2004	220	54	274	196	767	963
2005	233	54	287	224	860	1,085
2006	225	54	279	256	966	1,221
2007	299	54	353	292	1,083	1,375
2008	253	54	307	333	1,216	1,549
2009	338	54	392	380	1,364	1,745
2010	345	54	399	496	1,718	2,214
2011	360	137	498	589	2,006	2,595
2012	311	137	448	700	2,341	3,042
2013	339	137	476	833	2,733	3,566
2014	337	137	474	990	3,190	4,180
2015	334	137	471	1,176	3,724	4,900
2016	359	137	496	1,398	4,347	5,745
2017	379	137	516	1,662	5,074	6,736
2018	379	137	516	1,975	5,923	7,898
2019	432	137	569	2,348	6,914	9,262
2020	470	137	607	2,791	8,066	10,857
Total	7,852	1,854	9,706	17,210	54,603	71,813

EIRR 42.40
B/C 5.33
NPV 12,100

1.4.3 Financial Evaluation

For the purpose of analyzing the project condition whether it is profitable or financially feasible, a financial evaluations were conducted according to the general procedure illustrated in Figure 1.4-2. As the method of financial evaluation is almost same as that of economic evaluation and it is actually not conducted in this study, a general work - flow is shown without detailed explanation.

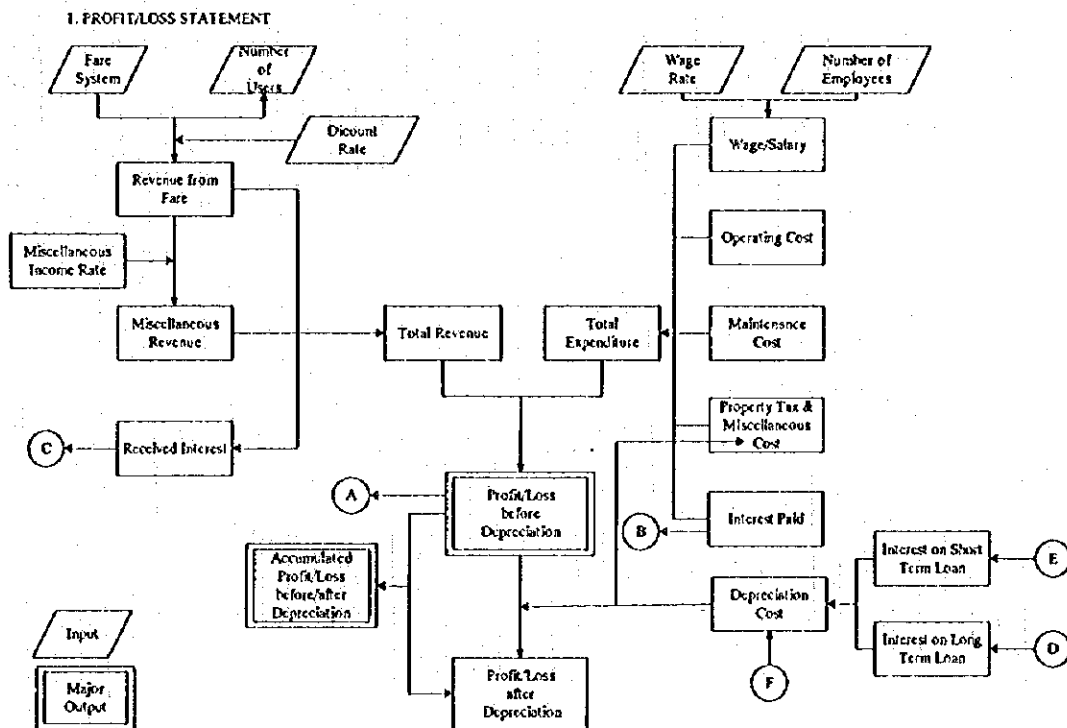


Figure 1.4-2 General Work-flow of Financial Evaluation (1)

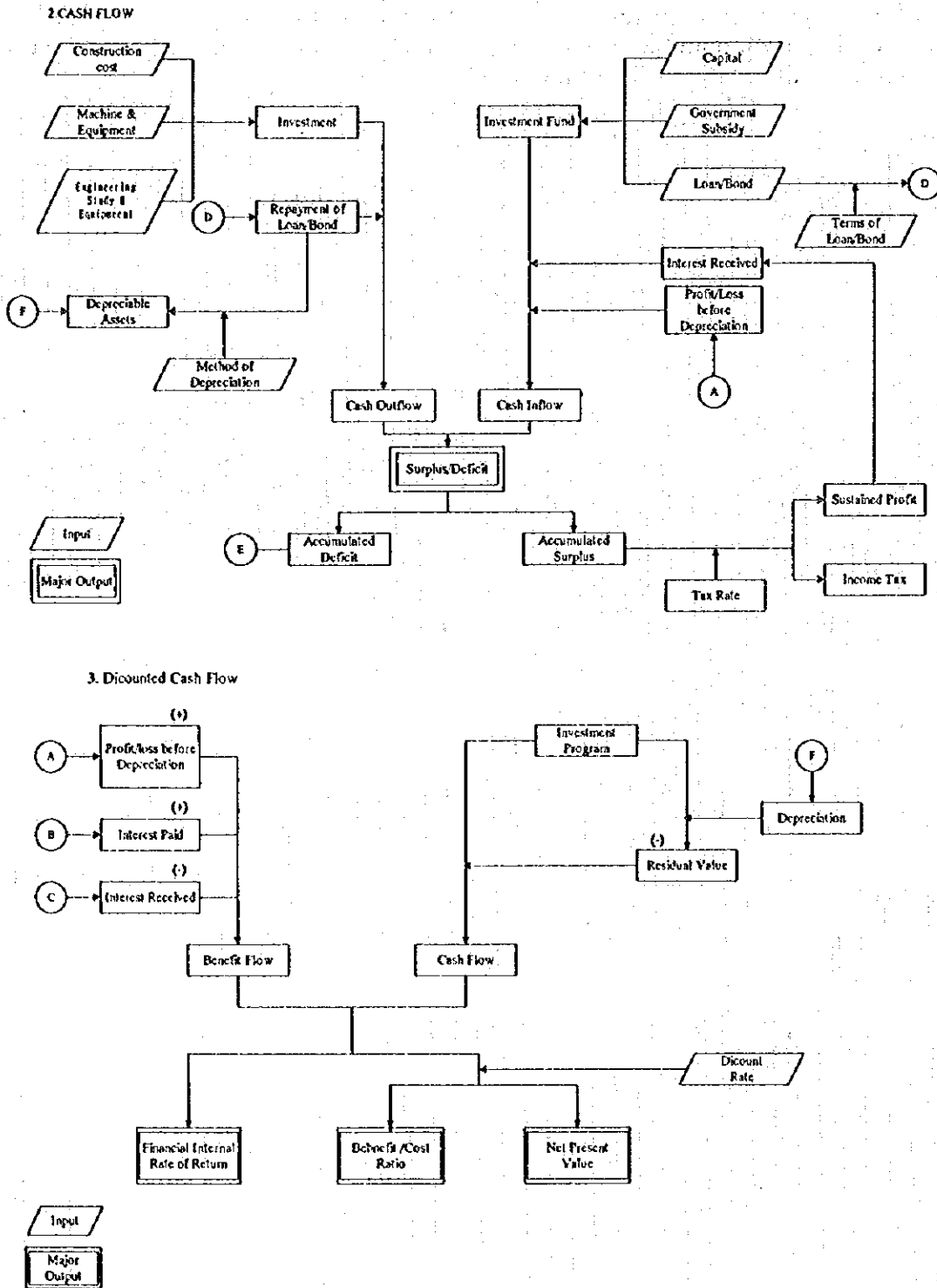


Figure 1.4-2 General Work-flow of Financial Evaluation (2,3)

1.4.4 Environmental Impact Assessment

(1) Introduction

The environment is of importance to the human life and other creatures, as well as to economic, cultural and social development of the country and mankind as a whole. This is exactly true in Bogota metropolitan area, and necessary assessment should be conducted in the course of Urban Transport Master Plan stage.

At the beginning, major items for initial environmental examination (IEE) are examined according to the local condition and proposed projects.

The items for IEE in this study resulted from prior studies are:

- a) Socio-economic environment
 - * Resettlement,
 - * Cultural Property,
 - * Waste
- b) Natural Environment
 - * Groundwater,
 - * Hydrological situation,
 - * Flora and Fauna
 - * Landscape
- c) Environmental Pollution
 - * Soil contamination,
 - * Noise and vibration,
 - * Ground

(2) Present Conditions And Problems

The present conditions regarding the above-mentioned items are examined together with the environmental legislation such as institutional management, law/guidelines and environmental standards. General environmental issues/problems are pointed out as the result of this analysis.

(3) Screening / Scoping

Based on the result of analysis on present condition, screening and scoping are carried out by environmental item, as shown in Tables 1.4-2 and 1.4-3

Table 1.4-2 Example of Screening

UN: unknown

Environmental items		Content	Evaluations	Remarks(Basis)
Socioeconomic Environment	1	Resettlement	Resettlement by occupancy of proposed land (removal of rights of residence and land ownership)	YES/NO/UN Residences exist in projective area.
	2	Economic activities	Loss of a productive opportunity such as land, and change of economic structure	YES/NO/UN Change of economic activities will not occur.
	3	Traffic and public facilities	Influence of existing traffic such as congestion, accidents on schools and hospitals	YES/NO/UN Schools, hospitals, churches, graveyards and parks exist in project area.
	4	Split of communities	Split of communities by obstruction of traffic	YES/NO/UN Project with split of communities will not planned.
	5	Cultural property	Loss of cultural property and falling of value	YES/NO/UN Lots of important cultural properties exist in the city.
	6	Water right and right of common	Obstruction of fishing rights, water rights, common rights of forest	YES/NO/UN Water right and right of common are not established.
	7	Health and sanitation	Deterioration of a hygienic environment by production of refuse and noxious insect	YES/NO/UN Lots of refuse will not be produced.
	8	Waste	Occurrences of waste dumps and solid waste	YES/NO/UN A little waste dumps will be produced by construction.
	9	Hazards	Increase of possibility of danger of landslide and accident	YES/NO/UN Sections of project are mainly plain.
Natural Environment	10	Topography and geology	Change of valuable topography and geology by digging or fill	YES/NO/UN Valuable topography and geography do not exist.
	11	Soil erosion	Flow of surface soil by rainwater after land development and forest felling	YES/NO/UN Forest and slanting surface do not exist in project.
	12	Groundwater	Pollution by drainage or leach water by digging construction	YES/NO/UN Groundwater will not be pumped.
	13	Hydrological situation	Change of flux and riverbed by reclamation and inflow of drainage	YES/NO/UN Constructions in rivers will not be planned.
	14	Coast and sea area	Change of beach erosion and vegetation by a change of reclamation or sea condition	YES/NO/UN There are not sea areas.
	15	Flora and fauna	Breeding obstruction and extinction of species by a change of an inhabitable condition	YES/NO/UN Habitat of valuable flora and fauna do not exist, but marsh is important to ecosystem.
	16	Climate	Change of temperature and wind conditions by the large-scale land development and architectures	YES/NO/UN Large-scale felling and construction of high building will not be planned.
Environmental Pollution	17	Landscape	Change of topography by land development and harmonious obstruction by structural objects	YES/NO/UN Landscape of important area with cultural properties exist.
	18	Air pollution	Pollution by emission gas and dust from vehicles	YES/NO/UN Impact by emission gas from increasing motor car will occur.
	19	Water pollution	Pollution by inflow of earth and sand and industrial water waste	YES/NO/UN Impact by contamination will not occur.
	20	Soil contamination	Pollution by dust and asphalt emulsion	YES/NO/UN There will be no action which causes soil contamination.
	21	Noise and vibration	Occurrence of noise and vibration by vehicles	YES/NO/UN Impact by noise and vibration during and after construction will occur.
	22	Ground subsidence	Subsidence by change of ground and fall of groundwater level	YES/NO/UN There is weak ground, but groundwater won't be pumped.
	23	Offensive odors	Occurrence of exhaust gas and offensive odors	YES/NO/UN There is no factors of producing offensive odors.

Table 1.4-3 Example of Scoping

Environmental items		Evaluation	Grounds	
Socioeconomic Environment	1	Resettlement	B	Resettlement will occur due to construction of new roads, improvement of roads.
	2	Economic activities	D	Large change of economic activities will not occur.
	3	Traffic and public facilities	B	There is a necessity of consideration for schools and hospitals in urban city.
	4	Split of communities	D	Split of community will not occur.
	5	Cultural property	B	There is a necessity of consideration for cultural property in urban city.
	6	Water right and right of common	D	Water rights and rights of common do not exist.
	7	Health and sanitation	D	Large amounts of refuse will not occur.
	8	Waste	B	A little waste dump will be produced by construction.
	9	Hazards	D	Development on a slanting surface will not be planned.
Natural Environment	10	Topography and geology	D	Valuable topography and geology do not exist.
	11	Soil erosion	D	Large-scale changes of lands such as land development and forest felling will not be planned.
	12	Groundwater	D	Construction caused contamination of groundwater will not planned.
	13	Hydrological situation	D	Construction along the river will not planned.
	14	Coast and sea area	D	There is not sea area.
	15	Flora and fauna	B	Valuable flora and fauna do not exist in project area. However there is a necessity of consideration for marshes as ecosystem.
	16	Climate	D	Large-scale felling and construction of high buildings will not be planned.
Environmental Pollution	17	Landscape	B	There is a necessity of harmony with conservation areas such as Cerros Orientales.
	18	Air pollution	B	There is a necessity of traffic control for jam.
	19	Water pollution	D	Construction along the river will not planned.
	20	Soil contamination	D	There will be no action which causes soil contamination.
	21	Noise and vibration	B	There is a necessity of traffic control and countermeasures of control for traffic noise from overbridges.
	22	Ground subsidence	B	There is a necessity of consideration for construction due to weak ground.
	23	Offensive odors	D	There is no factors of producing offensive odors.

Classification of evaluation:

- A- Serious impact will be anticipated.
- B- Impact will be more or less anticipated.
- C- Unknown (it is necessity of investigation)
- D- No impact will be anticipated.

2. TRAFFIC SURVEY

This Traffic Survey Manual is made based on the survey manual prepared on the Study on The Master Plan for Urban Transport of Santa Fe de Bogota in the Republic of Colombia. The Traffic Survey Manual is composed of the following survey items;

- 1) Person Trip Survey
- 2) Cordon Line Survey
- 3) Screen Line Survey
- 4) Traffic Volume Count / Bus Passenger Count on Road Sections
- 5) Intersection Traffic Volume Count Survey
- 6) Travel Time Survey
- 7) Airport Passenger OD Survey
- 8) Company Interview Survey
- 9) Taxi Passenger Survey
- 10) Bus Passenger Interview Survey at Major Bus Terminals

Out of 10 traffic surveys, the first three surveys were mainly carried out in Person Trip Survey additionally with the items from 7) to 10) to make a comprehensive urban transport plans. In a traffic management planning, traffic counting, and travel time surveys were mainly carried out to know current traffic conditions.

The traffic survey shall be selected from above-mentioned surveys depending on the purposes of the study.

The detailed survey contents are described in the following Sections.

2.1 Person Trip Survey

2.1.1 Introduction

This instruction manual has been prepared to guide those who will work in Person Trip Survey for the urban transport plan.

This survey aims to identify trip movement and the socioeconomic characteristics in the Study Area which are fundamental factors to forecast and plan the supply and demand for urban transport in the future.

2.1.2 Home Interview Survey Method

The field work of the home interview will be conducted by interviewers. Surveyor's works should be oriented by supervisors. Each supervisor will be responsible for about 5-6 surveyors (interviewers).

The survey will be supported by office people who will be in charge of preparation, initial quality control, codification, and final quality control.

(1) Supervisor

The supervisor is the general leader of the platoon in field. He is in charge of the following:

- a) To receive the necessary materials for field work from the office workers and hand the materials over the interviewers who will be under his/her responsibility. To collect the material from the interviewers and return them back to the office.

- b) To deliver the forms to the interviewers once a week and collect these forms everyday.
- c) To explain about completing the forms to the interviewers in case some doubts occur.
- d) To explain the interviewers the exact locations of sampled addresses with helping a location map.
- e) To solve the problems occurring during the field survey which can not wait for posterior solution.
- f) To review all the written forms. If necessary, to enforce the surveyor revisiting of the interviewed residence for completion of the form.

(2) Interviewer

The interviewer will visit the sampled households and write down all the information in the survey form. If it is impossible for the interviewer to implement, he/she should check the items which contain the reason.

(3) Office Staff

The office working group will be divided into four (4) teams which will be done different kinds of tasks as follows.

a) Group 1: Preparation

This team is in charge of the material preparation for field usage and have the following roles.

- a) Elaborate the survey itinerary that is prepared to the supervisor.
- b) Prepare the necessary material(s) for the implementation of the interview.

b) Group 2: Initial Quality Control

This team reviews and verifies the forms written in field. They should detect all the mistakes and incoherence and expose them to the survey coordination.

c) Group 3: Editing

The surveyors who are assigned to Group 3 review filled forms and identify the traffic zone of origin and destination. The roles of Editing are explained in Section (4).

d) Group 4: Final Quality Control

This team is in charge of reviewing all the questionnaires which have been coded. From this activity, the team does final numeration of the questionnaires which have been completed.

(4) Roles of Editing

- a) Make a second review of the filled questionnaire
- b) Convert actual address to the traffic zone for the questionnaire which has passed the detecting of the Group 2.

The editing basically consists of finding the "Traffic Zone" which is equivalent to "the addresses" which are the origin and destination of the "individual trip". The number equivalent to this zone should be written in the column of "Zone Code".

2.1.3 Filling Of The Survey Form

(1) Introduction

All the information given by the interviewee must be treated confidentially and used only for purposes of urban transport plan.

Name of households should never be registered in the interview form.

From the view point of survey purpose, a residence is the place utilized as the habitat by a "FAMILY UNIT".

(2) Interview items for person trip survey

Interview items are classified into two parts: one is for family characteristics, the other is for personal trip information. The Person Trip survey form is shown in the PT-Form. The interview form is shown in Form-PT of Appendix.

1) Family Characteristics

I. Characteristics of the Residence

This section is designed to the survey of family unit for the surveyed households.

- 1) Number of families living under the same residence or address
- 2) Total number of peoples living under the same address
- 3) Number of interviewed family members

II. Estrato Socioeconomic Probarrio (98 : No Answer, 99 : Don't know)

III. Monthly Family Gross Income

_____, 000 pesos (0 : No Answer, If don't answer)

IV. Number of Vehicles by type and type of ownership

This block should be completed with the number of vehicles available in the residence. In case there is no type, the correspondent column will be filled zero (0).

In case of the company or government owned vehicles that are privately used by family, the vehicles are supposed to belong to this family. The correspondent colume which is in the type of ownership will be filled in.

The registered place ofvehicles belonging to the family should be completed in the correspondent colume with "code = 1 for Bogota" or "code = 2 for Not Bogota".

	Private	Company/Government	Registered Place ¹⁾
Passenger Car	_____	_____	_____
Pick up / Van	_____	_____	_____
Taxi	_____	_____	_____

Motorcycles _____
Bicycles _____

Note : *) Bogota or Outside Bogota

2) Social Indicators of the Residents

This part of the questionnaire aims to identify the social characteristics of all the people. The family composition of all family members is identified by the questionnaire.

A. Sequential numeration of households

A number will be given to each permanent household member in a decreasing order of age, corresponding to the oldest one being the number one (1).

We suppose that the number of persons in family will not exceed thirteen (13), but, if such thing happens, write "continuation" on the first form and prepare the second sheet. In this form, the person number will be 14, 15, etc.

In this number, the housemaid, if living in for her job, should also be included in the household members. The visitors and guests should be excluded from the forms, as they do not live there.

B. Age:

Years

C. Sex:

- 1: Male
- 2: Female

D. Education level (finished)

- 1: None (No-Education)
- 2: Primary / Elementary School
- 3: Secondary / High School
- 4: Technical School
- 5: University / Business School
- 6: Graduate School
- 7: Others
- (8: No Answer : If don't answer)

(a) Primary Activity

E. Primary occupation

- 1: Working Person
- 2: Student
- 3: Housewife
- 4: Retired
- 5: Unemployed or Person seeking a job but not employed

F. Position of Occupation (only those persons who answer No. 1 in Question No. E)

- 1: Employee and Laborer
- 2: Domestic Service
- 3: Employer

- 4: Self-employed Worker
- 5: Non Paid Family Worker

G. Activity (only those persons who answer No. 1 in Question No. E)

- 1: Agriculture / Fishery / Forestry
- 2: Mining
- 3: Industrial Manufacture
- 4: Electricity / Gas / Water
- 5: Civil Construction
- 6: Trading / Commercial Business
- 7: Transportation / Communication
- 8: Financial / Business / Real-estate
- 9: Community / Private Service
- 10: Government Service

H. Primary Working / School Address

: Zone Code Number

(b) Secondary Activity

J. Secondary Occupation

- 1: Working Person
- 2: Student
- 3: Housewife
- 4: Retired
- 5: Unemployed or Person who seeks a job but not employed

K. Level of Occupation (only those persons who answer No. 1 in Question No. J)

- 1: Employee and Laborer
- 2: Domestic Service
- 3: Employer
- 4: Self-employed Worker
- 5: Non Paid Family Worker

L. Activity (only those persons who answer No. 1 in Question No. 9)

- 1: Agriculture / Fishery / Forestry
- 2: Mining
- 3: Industrial Manufacture
- 4: Electricity / Gas / Water
- 5: Civil Construction
- 6: Trading / Commercial Business
- 7: Transportation / Communication
- 8: Financial / Business / Real-estate
- 9: Community / Private Service
- 10: Government Service

M. Secondary Working / School Address

: Zone Code Number

N. Only those Answer on Student(s)

- 1: None (No-Education)
- 2: Primary / Elementary School
- 3: Secondary / High School
- 4: Technical School
- 5: University / Business School

- 6: Graduate School
- 7: Others
- (8: No Answer: If don't answer)

O. Condition of Person When Interviewed

- 1: Stay home
- 2: Not stay home

3) Trip Information

This part of questionnaire aims to collect information about the weekday trips made by household members who are five (5) years old or more on or before the day of interview day.

Trips are the movements of persons between two points by an individual phase without interruption. The extreme points of the movements will be the origin and the destination.

The different movements made to each of the household members should be registered sequentially, using a row in the form by each movement.

P. Order Number of the Person

This number is equivalent to Block A used to identify the household members. For instance, the person identified with number 1 in Block A should be given the same number 1 coded in Block A.

Q. Origin

In this block, the complete address of the beginning point of the trip should be written. In case someone does not know the exact address, it should be written as the name of the closest point of reference. This point should be of easy identification, such as cinemas, churches, banks, stores, etc. or even the name of the stores, shops, school, etc. Whenever possible, indicate also the names of the closest streets.

R. Departure time

Enter the approximate time when the trip started. The time should be given in hour and minutes under the 24 hours system. The interviewer can ask indirect questions to obtain the needed information. Assuming that the interviewee is a student, the interviewer can ask the time when the class starts and the usual time required to travel from the interviewee's residence to school. The interviewer can, thus, approximately determine the time when the interviewee leave the house. Be tactful. Do not forget to enter "DEPARTURE TIME" for every trip.

S. Destination

The address in the place of destination should be completed according to the concepts previously adopted in Block Q "ORIGIN".

T. Arrival Time

In this block, the arrival time should be written down in the same way as "Departure Time".

U. Trip Purpose

Fill in with the code number corresponding to the trip purpose. The detailed classification of Trip Purpose is listed below.

1: To Home

Movement to the place where the person or family lives.

2: To Work

Movement to the place where the interviewed person works, usually to main office.

a) Taxi Driver (employed by an enterprise)

All their movements with passengers from home to work (main office) and vice-versa should be written down.

b) Taxi Driver (company owner)

Every trips exclusive of last trip (i.e., "To Home" trip) is of "Business" purpose.

c) Mailman, Sales Worker, Collector, etc.

All trips related to working such as mail delivery, goods delivery and collection charged, as well as trips from home to office and vice-versa should be written down.

3: To School

Includes all movements to school, universities, special schools for those who are enrolled in schools.

4: Business

Includes all movements which refer to the benefit of his own work.

Examples;

a) Visiting of clients for the benefit of his own work.

b) Going to the meetings of related companies or governments which is of interest to his own work.

5: Return to Work

(1) When someone working needs to go out of one's office for some reason and, return there.

Examples;

a) Going to the bank privately and returning to work.

- to go from work to the bank : Purpose "Private Matter/Others"
- to go from the bank to work : Purpose "To return to work"

(2) In case someone returns to work from the travel of school, bank, shopping, private matter, etc., the trip to the office should be classified as having the purpose of "To return to work".

Examples;

- to go from home to school : Purpose "To school"
- to go from school to work : Purpose "To return to work"
- to go from home to shopping : Purpose "Shopping"
- to go from shopping to work : Purpose "To return to work"

6: Shopping

Involve the movements to all private shopping

7: Private Matters/Others

Involve the movements to the place where private matter is done, such as banks, notary's offices, governmental institutions, enterprises, religious activities and those not included in the category number 4, Business; to all entertainment places, clubs, cinemas, bars, sports etc., and also visits of cordiality and all organizations related to health, such as hospitals, laboratories, doctors, dentists, etc.

Involves all purposes not considered as other categories.

Note: For the mother or father who takes his/her child(ren) to school and returns home right away, the trip purpose will be "Private Matters/others".

8: Transfer

Movements to the points of transfer of the trip with or without involving the change of transport mode. For instance, when someone leaves home and walks to the bus stop, the purpose is "Transfer". Later, when this person catches the bus and gets off at another bus stop, this movement is still classified as "Transfer". Finally, where this person walks from the bus stop to the office, the purpose is now classified as "To work".

Note : When someone gets off the bus to transfers to the other bus at the same bus stop, this imaginary trip at the same bus stop, i.e., origin and destination are in the same bus stop, should not be written down in the column.

V. Trip Period

Each trip should be associated with its period of duration with an approximate accuracy of 5 minutes. This information should be obtained by the following type of question: "How long does it take for you to get to destination from origin?"

_____ minutes

W. Transport Mode

Check the transport mode used for the trip by using the printed codes in the form. Only one alternative should be used. When someone changes the mode several times between origin and destination such as "walking to bus", "bus to walking", etc., it is defined as a trip if the mode is changed 2 or 3 times. In this case, a TRANSFER of the mode, reserved in the trip purpose, occurs during the change of transport mode.

Note: The imaginary trip, i.e., when someone gets off the bus to transfers to the other bus at the same bus stop, should not be written down in the column, since origin and destination are in the same bus stop.

- 1: Walking
- 2: Bicycle
- 3: Motorcycle
- 4: Passenger car / Van (Driver)
- 5: Passenger car / Van (Passenger)

- 6: Taxi
- 7: Bus Corriente
- 8: Bus Ejectivo
- 9: Busetas Corriente
- 10: Busetas Ejectivo
- 11: Colectivo
- 12: Private Bus/ Company Bus
- 13: School Bus
- 14: Truck
- 15: Others

X. Number of Passengers including the driver

(only the person who uses transport mode No. 4, 5, or 6 in Question W)

Enter the corresponding number of passengers including the driver of the vehicle for each trip. In case there is no other passenger, enter one (1) for the driver.

_____ persons

Y. Parking Place at the Destination (only the person who uses transport mode No. 4 in Question W)

This block should be completed only with the data obtained from the vehicle owner by using the printed codes in the form, mentioned before and redefined as follows:

- 1: Own Garage
- 2: Parking on Roadside
- 3: Private Parking Lot
- 4: Public Parking Lot
- 5: Vacant Lot

Parking Charge (only the person who uses transport mode No. 4 in Question W)

- 1: Charge
- 2: Free

2.2 Cordon Line Survey

2.2.1 Objectives

The cordon line survey aims to describe the trips originated outside the Study Area, as well as to check the data obtained from the Person Trip Survey. The characteristics and the total of vehicles which pass through the cordon line from the Study Area to the outside of it will be obtained based on this survey.

2.2.2 Survey Method

Cordon Line Survey consists of roadside interview and traffic volume count which are conducted simultaneously at the cordon line survey stations. The roadside interview is done to obtain O-D data of passengers, not residing inside the study area but traveling to/from the study area.

The Cordon Line Survey covers all type of vehicles and passengers on board. Vehicles will be tentatively classified into 8 types as shown below. Bus passengers are counted in manner of percentage figures to full sheets and standing because of difficulty of counting for each passenger.

2.2.3 Preparation

(1) The Survey Forms

1) Location

Roadside interview and traffic count will be carried out on the Cordon Line which is located at the boundary of the Study area.

2) Period

Roadside interview shall be carried out for 12 hours between 7:00 a.m. and 7:00 p.m. as well as traffic count be done for 12 hours. Important major roads, however, shall be carried out for 24 hours counting.

Typical survey shifts are shown as follows;

① 24 hour survey

- 06:00 ~ 13:00
- 13:00 ~ 23:00
- 23:00 ~ 06:00

② 12 hour survey

- 07:00 ~ 13:00
- 13:00 ~ 19:00

3) Sampling

The target sampling rate should be approximately 20~30% of the total traffic volume by each type of vehicle. As for bus passengers, the target sampling rate is also 20~30% of the total bus passengers.

2.2.4 Survey Contents

The Cordon Line Survey consists of the origin/destination interview survey, the traffic volume count survey and the occupancy rate vehicles survey.

(1) The Origin and Destination Interview Survey

The Origin and Destination Interview Survey aims to obtain data for movements of vehicles, passengers and loads outside the Study Area.

For such purposes, the interviewer will directly interview the vehicle owners or drivers and fill in the columns provided in the form.

The following instructions show the appropriate way to complete the interview form:

1) Preparation Prior to Interview

a) Completion of the form

Number of interviews

Only useful samples interviewed can be numbered after punching and reviewing of the questionnaires in the office.

Cordon Line Number

The survey location number in the Cordon Line will be given by the

coordinators.

Date

The month and the day of the survey conducted should be written down with 2 digits, respectively.

Example: 05/03 (March 5th)

Hour

Hour interval on which the form is being completed should be written. These intervals are always counted by the hour.

Example: 17-18 (from 17:00 to 18:00)

Direction

Check the direction of traffic, inbound or outbound Centro/Bogota.

- 1): Inbound Centro/ Bogota
- 2): Outbound Centro/ Bogota

Type of Vehicle

This part should be completed before interview with the driver, by the visual verification of vehicle when it gets close to the Cordon Line, and by checking an "No.1~8" in the columns provided.

2) Completion during the Interview

For the completion of the data to be described below, it is indispensable to conduct a direct interview with the vehicle owners (or passengers in case of taxi). Up to this point, the interviewer should have completed all the preceding data.

a) Person to Interview

- 1) Car : driver
- 2) Truck : driver
- 3) Taxi : passenger
- 4) Bus, Buseta, Colectivo, Inter.Bus, Inter. Colectivo: passenger

b) Completion of the form

Residential Address

If the interviewee lives inside the Study Area, it is requested to write the full address of his/her residence (street, number, "Bairro" or place of reference), while only the name of the city should be written, if he/she lives outside the Study Area.

Origin and Destination

The origin will be considered as the beginning point of the trip, while the destination being as the end point of movement by the driver.

In case of round trip having the same origin and destination point, the destination is the most further point from origin.

As for the address of the origin and destination inside of the Study Area, the full address or approximate description of the place, or even the name of an office or a well known building, should be written for the purpose of identifying the location.

On the other hand, as to the origin and the destination from outside the Study Area only the name of the city should be written (if O/D is out of Cundinamarca, record the name of department).

Purpose

Only one trip purpose should be written. In case it involves more than one purpose, the most important one (from the interviewee's point of view) should be written.

The following trip purposes are considered.

1) To home

Trip to the place where the interviewee lives (his/her residence)

2) To work

Trip to the place where the interviewee works, usually the main office of his/her working.

3) To school

Involves all trips to school, university, others, etc.

4) Business

Involves all trips for the interest of his/her own work.

5) To return to work

Involves all trips returning to work.

6) Shopping

Involves all trips to all places for shopping.

7) Personal matter/others

Involves all purposes that are not included in the above categories.

Number of passengers

Write down the number of passengers on board, including the driver.

Load

This block only refers to vehicles of load.

- Description

The kind of load transported should be written. If it is a mixed load, check the one which occupies greater volume (amount). If the classification of cargo type is not clear, the cargo name should be written in the space besides the column.

1. Agriculture or Fishery

Rice, potato, onion, egg, milk, vegetable, farm animals

2. Timber or Wood Product

Wood, furniture

3. Minerals

Sand, stone, limestone, metallic minerals, iron, manganese, aluminum

4. Metal Product & Machinery

Electric material, automobile, rubber goods

5. Daily Consumer Goods

Food products, vegetable/fruit cans, sugar, coffee, alcohol beverages, cigarette, textiles, clothing, textile goods

6. Chemical Products

Gas, oil, gasoline, asphalt, plastic, paint

7. Others

Medical products, medicines, accessories, others

- Weight

Write down the total weight (ton) of transported load in the second block provided in the form (the first block should not be filled in field).

3) Survey Form

The survey form for the of interview survey origin and destination, the traffic volume count surveys are shown in Forms 1, 2, and 3 of Appendix.

(2) Traffic Volume Count Survey**a) Survey Direction**

The count will be carried out by direction:

- 1) Incoming to the Study Area
- 2) Outgoing from the Study Area

b) Types of Vehicles

The vehicles are classified into the following types:

- 1) Car : Passenger Car, Jeep, Van, Pick-up
- 2) Taxi : Taxi
- 3) Truck : Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity of 45 seats
- 5) Buseta : Passenger capacity of 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

The count should be recorded every 15 minutes according to the form indicator. The surveyors use the manual counter in the sets of 4 counters. The counting method using counters is an accumulation manner meaning that the counters should not be cleared at the end of each interval.

(3) Occupancy Rate of Vehicle Survey

The occupancy rate of vehicle survey is conducted to count the passengers on board. Bus passengers are counted in percentage figures to full seats and standing due to difficulty of counting for each passenger.

a) Survey Direction

The survey will be carried out by the following traffic direction:

- 1) Incoming to the Study Area
- 2) Outgoing from the Study Area

b) Types of Vehicles

The vehicular types are classified into the following:

- 1) Car: Passenger Car, Jeep, Van, Pick-up
- 2) Taxi: Taxi
- 3) Truck: Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity of 45 seats
- 5) Buseta: Passenger capacity of 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

c) Completion of the Form

It should be verified, before starting the survey, if the data location, direction and location number are correct.

The passengers on board should be counted according to the following instructions:

- 1) Passenger Car
- 2) Pick-up, Light Truck
- 3) Truck

The total number of passengers including the driver of the car, pick-up, light truck, and truck should be written down.

4) Taxi

The total number of taxi passengers including the driver should be written.

5) Bus

The surveyor should also record the number of passengers assessed by the following way:

- 0 % : Empty
- 30 % : 30% seats occupied
- 50 % : Half seats occupied
- 70 % : 70% seats occupied
- 100 % : All seats occupied
- 150 % : All seats occupied + standing passengers occupy half of the bus
- 200 % : All seats occupied + standing passengers fully occupy the bus

The above standard is employed for the estimation of bus passengers.

- 6) Buseta
- 7) Inter. Buses
- 8) Inter. Colectivos

The survey is carried out under the same standards as that of Bus.

2.3 Screen Line Survey

2.3.1 Objectives

The purpose of this survey is to collect traffic volume data in the locations of the screen line to examine the accuracy of OD trip data obtained from the Person Trip Survey in terms of comparison with traffic volumes estimated on the OD trip data and the one counted on the screen line.

2.3.2 Survey method

Both vehicle traffic volume and passenger counts are carried out in the same method as that of the Cordon Line survey.

2.3.3 Preparation

(1) The Survey Forms

1) Locations

The screen line will be located in the middle of CBD where major roads run through.

2) Period

The period of counting shall be carried out for 12 hours between 7:00 a.m. and 7:00 p.m. Important major roads, however, shall be carried out for 24 hours counting.

Typical survey shifts are shown as follows;

① 24 hour survey

1) 06:00 - 13:00

2) 13:00 - 20:00

3) 20:00 - 06:00

② 12 hour survey

1) 07:00 - 13:00

2) 13:00 - 19:00

3) Sampling Rate

The target sampling rate for the occupancy rate of vehicles should be approximately 20~30% of the total traffic volume by each type of vehicles. As for bus passengers, the target sampling rate is also 20~30% of the total bus passengers.

4) Survey Sheet Form

The survey forms for the traffic volume count survey and the occupancy rate of vehicles survey are the same form as Form 2 and Form 3 of the Cordon Line Survey.

2.3.4 Survey Contents

The screen line survey consists of the traffic volume survey and the occupancy rate of vehicles survey.

(1) Traffic Volume Count Survey

The traffic volume by the type should be written every 15 minutes interval in the form.

As for the vehicle count, the surveyors use the manual counter in sets of 4 counters. The counting method used the counter is accumulation manner which means that the counters should not be cleared at the end of each interval.

a) Survey Directions

The survey carries out counting for two directions.

b) Vehicle Type Classification

The vehicular types are classified according to the following:

- 1) Car: Passenger Car, Jeep, Van, Pick-up
- 2) Taxi: Taxi
- 3) Truck: Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity of 45 seats
- 5) Buseta: Passenger capacity of 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

(2) Occupancy Rate of Vehicles Survey

The occupancy rate of vehicles survey (passenger counting) should be carried out on the same location as that of the counting survey, using the appropriate forms. The occupancy survey should be carried out at the same time in the same period as that of the counting survey. At the 24 hour counting locations, passenger counting is carried out only for 12 hours during day time.

a) Survey Directions

The survey carries out counting for two directions.

b) Vehicle Type Classification

The vehicular classification is shown as follows:

- 1) Car: Passenger Car, Jeep, Van, Pick-up
- 2) Taxi: Taxi
- 3) Truck: Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity of 45 seats
- 5) Buseta: Passenger capacity of 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

c) Completion of the Form

It should be verified, before starting of the survey, if the data on location, direction and location number are correct.

The passengers on board should be counted according to the following instructions:

- 1) Passenger Car
- 2) Pick-up, Light Truck
- 3) Truck

The total number of passengers including the driver on passenger car and pick-up, light truck and truck should be written down.

4) Taxi

The total number of taxi passengers including driver should be written down.

5) Bus, Private/School Bus

This survey should also record the number of passengers assessed by the following way;

- 0% : Empty
- 30% : 30% seats occupied
- 50% : Half the seats occupied
- 70% : 70% seats occupied
- 100% : All seats occupied
- 150% : All seats occupied + standing passengers occupy half of the bus
- 200% : All seats occupied + standing passengers fully occupy the bus

6) Buseta**7) Intercity Bus****8) Inter. Colectivos**

Buseta, Intercity Bus and Intercity Colectivo are also recorded in the same manner as that of Bus.

2.4 Traffic Volume Count on Road Sections**2.4.1 Objectives**

The aim of this survey is to update the existing traffic data, as well as to check the traffic volume at roadside.

2.4.2 Survey method

Vehicle traffic volume is carried out in the same method as that of the screen line survey.

2.4.3 Preparation**(1) The Survey Forms****1) Locations**

The locations shall be located on major roads to study the current traffic conditions.

2) Period

The period of counting shall be carried out for 12 hours between 7:00 a.m. and 7:00 p.m. Important major roads, however, shall be carried out for 24 hours counting.

Typical survey shifts are shown as follows;

① 24 hour survey

- 1) 06:00 - 13:00
- 2) 13:00 - 20:00
- 3) 20:00 - 06:00

② 12 hour survey

- 1) 07:00 - 13:00
- 2) 13:00 - 19:00

3) Survey Sheet Form

The survey sheet form for the traffic volume count survey is the same as Form 2 in the Cordon Line Survey.

2.4.4 Traffic Volume Counts

The traffic volume by the type should be written every 15 minute interval in the form. As for the vehicle count, the surveyors use the manual counter in sets of 4 counters. The counting method using the counter is an accumulation manner meaning that the counters should not be cleared at the end of each interval.

a) Survey Directions

The survey carries out counting for two directions.

b) Vehicle Type Classification

The vehicular classification is shown as follows:

- 1) Car : Passenger Car, Jeep, Van, Pick-up
- 2) Taxi : Taxi
- 3) Truck : Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity 45 seats
- 5) Buseta : Passenger capacity 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

2.5 Intersection Traffic Volume Count Survey

2.5.1 Objectives

The objectives of traffic volume count is to obtain the traffic movement at main intersections as well as to update the existing data.

2.5.2 Survey Method

Traffic volume by direction and type of vehicles at main intersections is counted with manual counters.

2.5.3 Preparation

(1) Completion of Survey form

1) Locations

The locations of the survey points will be selected mainly according to the following criteria;

- 1) Representative intersections in the study area.
- 2) Crossings of two main streets
- 3) Points with merging and diverging
- 4) General traffic flow features in the city
- 5) Others

2) Period

The counts shall mainly be carried out for 12 hours between 7:00 a.m. and 7:00 p.m.

Typical survey shift is shown as follows;

a) 07:00~13:00

b) 13:00~19:00

3) Survey Form

The survey form for the intersection traffic volume count survey is shown in Form 4 of Appendix.

2.5.4 Survey Contents

The traffic volume by the type of vehicle and by the direction should be written every 15 minutes. The surveyors use the manual counter in sets of 4 counters. The counting method used for the counter is an accumulation manner which means that the counters should not be cleared at the end of each interval.

1) Survey Direction

The counting should be carried out by the direction such as left turn, right turn, and straight.

2) Type of Vehicles

The vehicles are classified according to the following types;

- 1) Car (Passenger car, Jeep, Van, Pick-Up, Taxi, Light Truck)
- 2) Bus (Bus, Intercity Bus, Busetta)
- 3) Truck (Large Truck, Trailer, Dump Truck)

2.6 Travel Time Survey

2.6.1 Objectives

The objectives of travel time survey are to grasp the travel speed characteristics on major roads as well as to identified the bottlenecks.

2.6.2 Survey Method

The travel time survey is conducted by the test car, which travels along the traffic flow and make one round trip during the designated time period. The surveyors record the time of check points and the reasons of congestion. The check points are set at the center of the main intersections.

2.6.3 Preparation

(1) Completion of Survey Forms

1) Locations

The survey routes shall be on the major roads to obtain the travel speed characteristics.

2) Period

The survey period shall be in the peak periods shown below;

- 1) Morning hours 7:00 - 8:30

- 2) Midday hours 11:30 - 12:30
- 3) Evening hours 17:30 - 19:00

2.6.4 Survey Contents

1) Completion of the form

The survey items for the travel time survey are shown below.

a) Departure time and arrival time

Record exact time at which test car departs and arrives at the destination.

b) Reasons for stop

Observe main reasons for stop by each section of trip and record the frequency of stops. The check items to be recorded are shown as follows.

- 1) Waiting for traffic light to change
- 2) Traffic accident
- 3) Crossing of pedestrians
- 4) Congestion of buses near buses
- 5) Traffic congestion (Traffic spilled back condition)
- 6) Merging from alley
- 7) Diverging to alley
- 8) Influence of the cars turning to the left
- 9) Others (Parking on street, poor pavement maintenance, under construction, etc.)

2) Survey Direction

The test car makes one round trip during the designated time period.

2.7 Airport Passenger OD survey

2.7.1 Objectives

The information obtained from the origin/destination interview aims to collect data of trips which have their origin outside the Study Area and arrive at an International/Domestic Airport.

The characteristics and the number of trips made by the airport passengers who come to the Study Area are obtained from the survey.

2.7.2 Survey Method

Interviews shall be carried out at the airport terminal. Interviews shall be conducted in the same way as those for the Cordon Line survey.

2.7.3 Preparation

(1) Completion of survey form

1) Locations

The survey facilities are the international/domestic Airport and the detailed locations to be interviewed shall be at the terminals for arrival and departure.

2) Period

The roadside interview shall be carried out for 12 hours between 7:00 am and 7:00 pm.

3) Sampling Rate

The target sampling rate should be approximately 20 ~ 30% of the total passengers arriving or departing at the airport.

2.7.4 Survey Contents

The airport passengers' origin/destination survey is the origin/destination interview survey at the airport terminal.

The survey items for airport passenger OD survey is shown as below.

(1) Origin and Destination interview survey

1) Preparation Prior to Interview

Numbering of the Form

The forms must be numbered in the office.

Location Number

The location code number should be written down.

Date

The month and the day of the survey conducted should be written with 2 digits, respectively.

Example: 05/03 (March 5th)

Hour

Exact time of interview should be recorded.

Arrival or departure

The interviewer should write the number corresponding to arrival (1) or departure (2) in the interview form.

2) Completion during the Interview

For the completion of the data to be described below, it is indispensable to have a direct interview with the airport passengers.

Transport mode used for departure or arrival

- 1) Car : Passenger Car, Jeep, Van, Pick-up
- 2) Taxi : Taxi
- 3) Truck : Truck, Trailer, Dump Truck, Light Truck
- 4) Bus: Passenger capacity of 45 seats
- 5) Buseta : Passenger capacity of 12 - 35 seats
- 6) Colectivos: 12 - 15 seats, all seated
- 7) Inter.Bus: Intermunicipal Bus and Intercity Bus
- 8) Colectivos Intermunicipal

Residential Address

If the interviewee lives inside the Study Area, the full address of his/her residence (street, number, "Bairro" or place of reference) is necessary, while only the name of the city should be written, if he/she lives outside the Study Area (if his/her

address is not in Cundinamarca, then record the name of the department).

Origin and Destination

The origin will be considered as the beginning point of the trip, while the destination being as the end point of movement by the passengers. In case of round trip having the same origin and destination point, the destination is the most further point from the origin.

As for the address of the origin and the destination inside of the Study Area, the full address or approximate description of the place, or even the name of an office or a well known building, should be written to be able enable the identification of the location.

On the other hand, as to the origin and the destination from outside the Study Area only the name of the city should be written (if O/D is out of Cundinamarca, record the name of department).

Purpose

Only one trip purpose should be written down. In case it involves more than one purpose, the most important one (from the interviewee's point of view) should be written.

The trip purposes should be considered the same as those of the Cordon Line interview survey.

2.8 Company Interview Survey

2.8.1 Objectives

The objective of Company Survey is to obtain the trip information of goods vehicles, especially heavy trucks, as well as the cargo trip production ratio.

2.8.2 Survey Method

The interviewers visit a company and get information directly on trips made by their owned vehicles.

The procedure of interview is shown below as shown in the work flows.

- (a) To visit a company
- (b) To meet a person in charge of vehicles
- (c) To explain the purpose of this survey
- (d) Interviewers make an interview and fill in a questionnaires

If the company refuses to answer to the questions in questionnaires, the interviewers should explain it that the information is strictly confidential, that it will not be available to any person except for certain members of the study team, and that it is to be used only for transport planning purpose. However, when they refuse to answer after all efforts, the interviewer must mark "Refuse to Answer" and report this matter to the supervisor.

2.8.3 Preparation

(1) Team Staff for Survey Activities

In principle, the configuration of team staff for the survey activities shall be the same as that of the person trip survey.

(2) Completion of Survey Forms**1) Locations**

The companies to be interviewed are selected by random sampling method from the company list.

2) Period

The trip information of goods vehicles shall be covered at the designated day.

2.8.4 Survey Items

The survey items for company interview shows as below.

1) Company Body CharacteristicsCompany Name

Enter the company name

Address

Enter the complete company address

Type of Business

Circle the corresponding code number of "Type of Business"

Number of Employees

Enter the number of employees who are working in this company

Number of Vehicles Owned by Company

Enter the number of vehicles by type owned by the company.

2) Trip Information For Each VehiclesPeriod to collect Trip Information

The 24-hour period for each trip information to be collected begins at midnight and finishes at midnight the following day.

Sheets Number

Enter the sheet number corresponding to the number of collected data, i.e., when trip data of 3 vehicles is obtained, the number is entered from "1" to "3".

Type of Vehicles

Circle the corresponding code number of "Type of Vehicles".

Frequency of Vehicles Use Per Week

Ask the person in charge of the vehicle on the number of days when the vehicle is used in a week. Enter the corresponding code number of "Frequency of Vehicles Use Per Week".

Origin

Ask the person/driver of the origin of his/her first trip for that day i.e. the place where he/she started his/her journey. Record the name and address of the place. If the owner is unsure of the exact name of the place, identify the place with the nearest facility indicating the area (if the origin is not in Cundinamarca, then record the name of department).

Departure Time

Obtain the exact time at which he/she started the journey. If the person is not sure, ask him/her for the approximate hour. Specify the time as a.m. or p.m.

Destination

Ask the person/driver where he/she finally finishes his/her journey for the first trip and put the name of the place. The same attention given to the item (origin) should be also given.

Note for Origin and Destination

When complete questionnaires are collected, the origin and destination will be converted into the zone codes by using maps and zone code tables. Therefore, the origin and the destination written in the columns must be followed by detailed addresses of the place. If the person/driver is not sure of the address, then ask him/her further for the nearby landmarks, famous buildings or nearest identifiable roads.

The interviewer should be careful on the 'origin' which is defined as the first movement of the vehicle made.

In case the vehicle owned by a company, if the first movement is made from the employee's home to his/her company, the interviewer should record that the origin and the destination are the home and the company. The interviewer should not neglect this trip if exists.

Arrival Time

Ask the person/driver the exact time he/she arrived at the destination for each trip and fill in the time, either a.m. or p.m.

Number of Passenger is Including the Driver

Ask the person/driver the number of passengers including the driver in the vehicle. Put the the column (6). In case there is no other passenger, put (1) as the driver number in himself into the corresponding column.

Load

This block only refers to the vehicles of load.

- Description

The kind of load transported should be written. If it is a mixed load, check the one which occupies greater volume (amount). If the classification of cargo type is not clear, the cargo name should be written down in the space besides the column.

1. Agriculture or Fishery
Rice, potato, onion, eggs, milk, vegetable,
farm, animals
2. Timber or Wood Product
Wood, furniture
3. Minerals
Sand, stone, limestone, metallic minerals,
iron, manganese, aluminum
4. Metal Product & Machinery
Electric material, automobile, rubber
goods
5. Daily Consumer Goods
Food products, vegetable/fruit cans,
sugar, coffee, alcohol beverages, cigarette,
textiles, clothing, textile goods

6. Chemical Products

Gas, oil, gasoline, asphalt, plastic, paint

7. OthersMedical products, medicines, accessories,
others**- Weight**

Write down the total weight (in ton) of transported load in the second block provided (the first block should not be filled in field).

a) Type of Vehicles

Vehicles shall be classified into 2 types such as pick-up/light truck and truck.

2.9 Taxi Passenger Survey**2.9.1 Objectives**

The objectives of Taxi Passenger Survey is to obtain taxi characteristics which include number of passengers, travel distance, and so on.

2.9.2 Survey Method

The interviewers visit a company or an owner and directly get information for trips made by their owned vehicles.

The procedure of interview survey is same as that for the company interview.

2.9.3 Preparation**(1) Completion of Survey Forms****1) Locations**

The taxi company to be interviewed are selected by random sampling method from the taxi company list.

2) Period

Taxi passenger interview shall be carried out for 12 hours between 7:00 am and 7:00 pm.

2.9.4 Survey Items

The survey items for taxi passenger survey are shown below.

(1) Taxi Passenger Interview**Period to collect the Trip Information of Taxi Passengers**

The 12-hour period for each trip information must be collected between 7:00 am and 7:00 pm.

Number of Vehicles for Sampling

A company may have many vehicles. When the companies have 5 or less vehicles, the interviewers must collect the trip data of passenger corresponding with the number of vehicles owned by them.

If they own 6 or more vehicles, the interviewers should sample 5 vehicles.

Number of Passenger for Sampling

The taxi driver shall record trip information data of all passengers.

Sheet No.

Enter the sheet No. corresponding to the number of collected data, i.e., when trip data of 3 vehicles are obtained, the number is entered from "1" to "3".

Frequency Of Vehicle Use Per Week

Ask the driver in charge of the vehicle on the number of days when the vehicle is used in a week. Enter the number corresponding to "Frequency of Vehicles Use per Week".

Origin

Record the name and the address of the place where each passenger started his/her journey.

Departure Time

Record the exact time at which he/she started the journey.

Destination

Record the name and the address of the place where each passenger finished his/her journey.

Arrival Time

Record the exact time at which he/she started the journey and each passenger arrived at destination.

Number of Passenger

Record the number of passengers including the driver on the vehicle for each trip.

Fare

Record the fare of each passenger.

Distance

Record the exact distance using the trip meter installed in the car between the place where he/she started the journey and the place each passengers arrived at destination.

2.10 Bus Passenger Interview Survey at Major Bus Terminal

2.10.1 Objectives

The origin/destination interview aims to collect data of trips which have their origin outside the Study Area and come to Bogota, and of trips which have their origin in Bogota. The interview survey at the bus terminal obtains the characteristics and the number of trips made by Intercity bus passengers which cross the Cordon Line.

2.10.2 Survey Method

The interview will be conducted with the intercity bus passengers who are arriving at or departing from the bus terminals. The interview with passengers who are departing will be conducted at the entrance gates, while the one with the passengers arriving are conducted at exit gates.

2.10.3 Preparation

(1) Team Staff for Survey Activities

The team staff for Bus Passenger Interview Survey consists of the supervisors and interviewers. Two parties carry out the survey in which one party is made up of one(1) supervisor and five(5) interviewers.

(2) Completion of Survey Form

1) Location

Major intercity bus terminals and major local bus terminals.

2) Period

Bus passenger interview survey shall be carried out for 12 hours between 7:00 am and 7:00 pm.

2.10.4 Survey Items

The survey items for bus passenger survey is shown below.

Numbering of the Form

The forms will be numbered in the office.

Hour

The bus departing from the terminal should be written down for hour interval on which the form is being completed. As for the arrived buses, the arrival time should be written down. These intervals are always by an hour.

Arrival or Departure

The interviewer should fill in the interview form with the number corresponding to departure(1) or arrival(2).

Residential Address

If the interviewee lives inside the Study Area, the full address of his/her residence(street, number, "Bairro" or place of reference), while only the name of the city should be written, if he/she lives outside the Study Area (if his/her address is not in Cundinamarca, then record the name of department).

Origin and Destination

The origin will be considered as the beginning point of the trip, while the destination is considered as the end point of movement by the passengers on the intercity buses. In case of round trip having the same origin and destination point, the destination is the most further point from the origin.

As for the address of the origin and the destination inside of the Study Area, the full address or approximate description of the place, or even the name of an office or a well known building, should be written to be able enable the identification of the location.

On the other hand, as for the origin and the destination from outside the Study Area only the name of the city should be written (if O/D is out of Cundinamarca, record the name of department).

Purpose

Only one trip purpose should be written. In case it involves more than one purpose, the most important one (from the interviewee's point of view) should be written.

The trip purpose should be considered same as that of the roadside interview.

Transport Mode used for departure or arrival

The question concerning this matter should be asked as follows:

Departure : How did you get to this terminal?

Arrival : How do you get to your destination point?