THE URBAN TRANSPORT STUDY IN ASUNCION METROPOLITAN AREA OF THE REPUBLIC OF PARAGUAY

INCEPTION REPORT

AUGUST 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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1. Introduction

In response to the request by the Government of the Republic of Paraguay, the Japanese government has agreed to extend technical cooperation to undertake the execution of an urban transportation study in the Metropolitan Area of Asuncion City.

Japan International Cooperation Agency dispatched a mission in March 1984 to conduct a reconnaissance survey and to finalize the scope of works for the study which was subsequently agreed upon by the two parties.

The study is to be conducted jointly by Japan International Cooperation Agency (JICA), which is responsible for technical cooperation programs of the Japanese Government, and the Paraguayan authorities represented by the Ciudad de Asuncion.

This Inception Report is to clearly set forth the general principles, components, procedure and time schedule for the successful achievement of the Study.

2. Outline of the Study

2-1 Background

The population of Asuncion Metropolitan Area has grown at an average annual rate of 3.1% in the last 10 years. The said demographic growth was absorbed mainly by the peripheral cities of Asuncion, particularly Fernando de la Mora, Lambare, San Lorenzo and Luque. Such phenomena as a) decline of the demographic share of Asuncion City with regard to the peripheral cities, b) demographic growth of Fernando de la Mora City and Lambare City and their conurbation with Asuncion City and c) progress of urbanization in San Lorenzo City took place as a result of the said process.

The skeleton of the road network of the Asuncion Metropolitan Area was constructed in conformity with the said form of development. The framework of the said road network consists of the 6 radial roads mentioned below.

- Avenida Eusebio Ayala (to San Lorenzo City)
- Avenida Jose Bogado (to Lambare City)
- Avenida Espana, Avenida General Aquino (to Luque City)
- Avenida Fernando de la Mora (to Nemby City, San Antonio City)
- Ruta Transchaco (to Alonzo City, Limpio City)
- Avenida Mariscal Lopez (interconnected with Ruta 1 and Ruta 2, via San Lorenzo City)

The most important means of public transportation in the Asuncion is by bus. There are 1400 buses in operation in the Metropolitan Area, and the number of passengers transported per day is 980,000. Approximately a half of the buses in operation is travelling around closed routes in Asuncion City, and the remaining half is travelling in routes interconnecting the capital city with the adjacent cities. The said situation is a result of the development of the residential quarters outside the city area of Asuncion as a consequence of the demographic growth, while the workplaces are concentrated principally in the downtown area of Asuncion City. This situation is expected to remain unchanged henceforth.

Asuncion is growing beyond its city area. Under the circumstances, a form of relationship different both qualitatively and quantitatively from the conventional pattern must be shaped between Asuncion City and the peripheral cities.

It is indispensable to depict a clear-cut future image of the Metropolitan Area in the aggregate and to draw up the land use scheme and transportation scheme that will be the pillars providing concrete support to the said image.

2-2 Purposes

This study has the purpose of drawing up such master plans as the public transportation plan, land use plan and road network related to the consolidation of the urban transportation system in the Asuncion Metropolitan Area. Furthermore, this study aims at examining the possibility of utilizing electric power for public transportation.

2-3 Study area

The study area comprises, Asuncion, Lambare, Luque, San Lorenzo, Mariano Roque Alonso, Fernando de la Mora, Villa Elisa, Nemby, Limpio, San Antonio and Villa Hayes (urban area). (Refer to Figure 1-1).

2-4 Target year

The target year of the short-term plan is 1990.
The target year of the long-term plan is 2000.

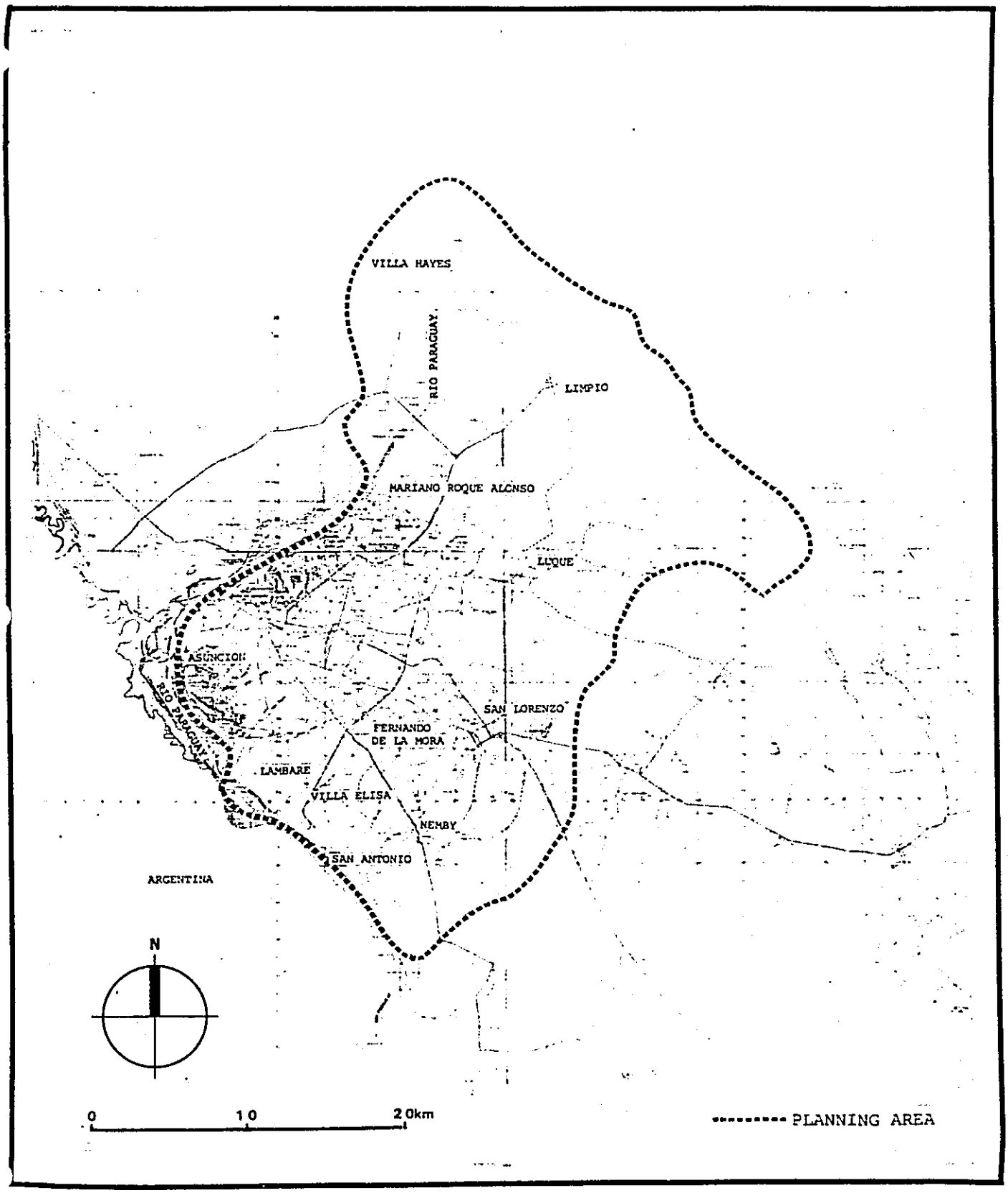
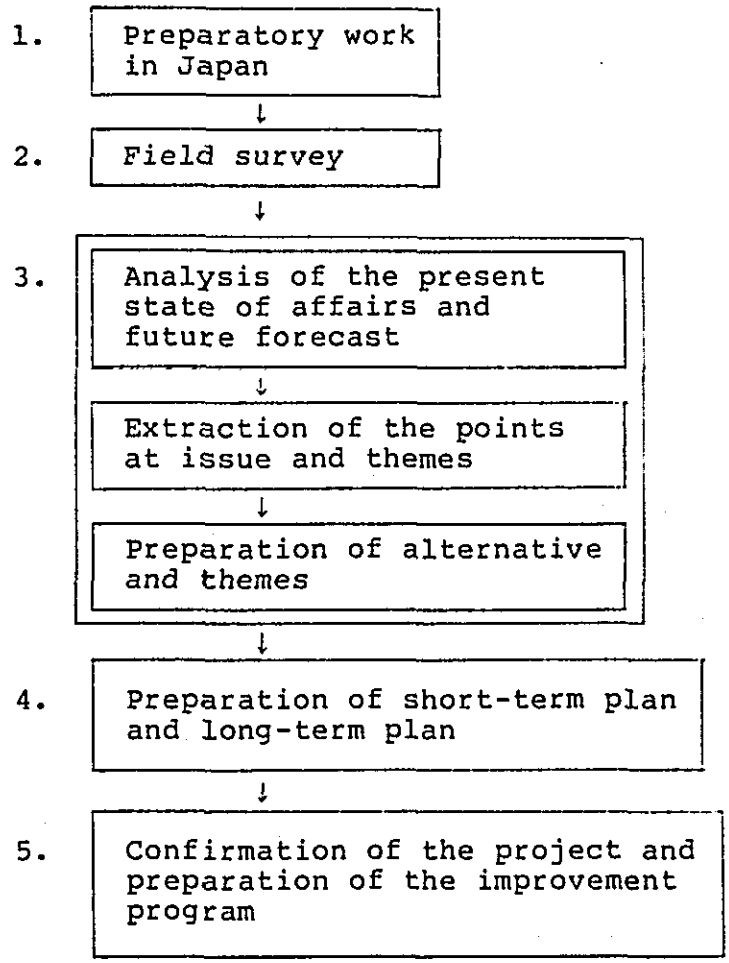
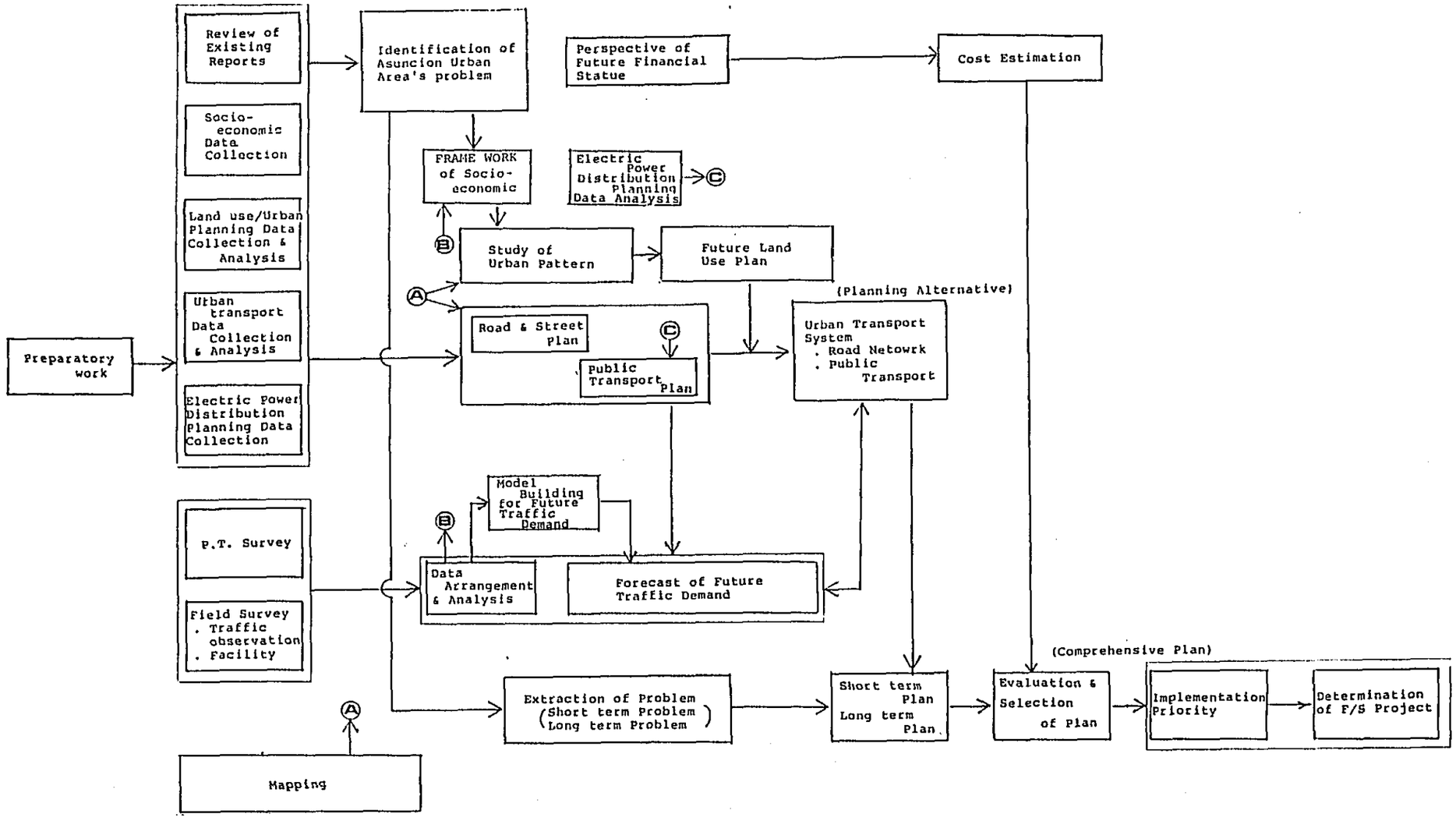


FIG. 1-1 PLANNING AREA

3. Method of implementation of the work

The implementataion flowchart referring to the concrete steps of procedure of the study, prepared in conformity with the general principles for implementation of the work, is shown in Figure 3-1. The study consists of five major steps of work.





IC/R — P/R(I) — P/R(II) — P/R(III) — IT/R — DF/R — F/R

INCEPTION REPORT

1. Methodology
2. Schedule

August 1984

PROGRESS REPORT I

1. Progress of Traffic Survey
2. Progress of Data Collection Survey

December 1984

PROGRESS REPORT II

1. Analysis of Traffic Characteristic
2. Socio-economic Data Analysis
3. Land Use (Present / Future)
4. Forecast of Future Traffic Demand

March 1985

PROGRESS REPORT III

1. Future Land Use Plan
2. Forecast of Future Traffic Demand
3. Electric Use Analysis
4. Urban Transport System
5. Planning Alternative (Short term & Long term)

October 1985

INTERIM REPORT

1. Evaluation & Selection of Plans
2. Comprehensive Plan
3. Implementation Priority
4. Determination of F/S Project

February 1986

DRAFT FINAL REPORT

May 1986

FINAL REPORT

July 1986

Figure 3-1 WORK FLOW OF STUDY

3-1 Preparatory work in Japan

The inception report has been prepared after examining the basic policy, procedures and principal subjects for discussion relevant to the study.

3-2 Field survey

1) Objectives of the survey

The survey to be carried out in this stage of the work must satisfy the following requirements.

(1) To identify accurately the present state of affairs in the Asuncion Metropolitan Area.

(2) To provide the necessary information required to extract accurately the short-term and long-term points at issue and themes necessary for the preparation of a global transportation plan.

2) Relationship between the survey items and the survey work and data

The relationship between the survey items and the data collecting work and fact-finding survey to be carried out in this stage of work is shown in Table 3-1.

Table 3-1 Study Items and Study Data (1)

Study Items			Maps	Climatic Data	Rivers Survey	Census	Population Statistics	National Economics	Lahour Statistics	Production Statistics	Land Use Study	Person Trip Survey	Facilities Survey	Housing Statistics	Income Survey	Others
Regional Back Ground	Nature	Location	○													
		Climate		○												
National		Geogrphy	○													
		Fluvial Basins	○		○											
Urban Areas	Population	Sex, Age				○										
		Population Change					○									
		Households				○								○		
	Employment	Workers by industry				○			○							
		Economic Active Population, unemployment Ratio				○			○							
	Productive Activities	GDP by Industries						○								
		Visible Shipment by Industry								○						
	Income	National Income Distributed						○							○	
		Income Level							○						○	
Urban Structures	Land Use	Urban Present Land Use	○								○					
		Rural Present Land Use	○								○					
		Procedure of urban Growth	○													○
	Housing Facilities Generating Certain Traffic Volume	Housing Units by Districts									○			○		○
		Airport, Port, Railway Station, Bus Terminal etc.											○			
		Market Place (Handling Volume, Size, Consumer)											○			
		Schools (Teachers, Students)											○			
		Distribution Center (Volume,											○			
	Population	Population by District				○						○				
		Households by District	○			○						○				
		Density by District				○					○	○				
	Employment	Worker by Industry (by District)				○						○				
		Matrics by Workers and Employees				○						○				
	Products	Visible Shipment by Industry								○						
	Income	Income Levels by District				○								○	○	○
	Administration	Administration Units	○													○

Study Items and Study Data (2)

Study Items \ Data and Statistics				Maps	Soil Survey	Climatic Data	River Survey	Vegitation Survey	National Development Plan	Statistics for Population and Economic Forecast	Department Development Plan	Study Area Development Plan	Development Project Study	Land Owners Survey	Data for Municipal Financial Conditions	Development Lawa	Urban Planning Standards	Electric Use Conditions
Planning Basis	Possibility of Urban Development	(Natural Conditions)	Topography	○														
			Siols		○													
			Water			○	○											
			Plants					○										
		(Land-Use)	Evaluation of Agriculture Suitability		○													
			Agricultural Investment Condition									○	○					
								○				○			○			
			Environmental Regulation						○	○	○	○						
	(Existing Dev. Plan)		Population (Households) Sex, Age						○	○	○	○						
			Population Variation						○	○	○	○						
			Households						○	○	○	○						
			(Employment) Workers by Industry						○	○	○	○						
			Economic Active Population,						○	○	○	○						
			(Productive Activities) GDP by Industry						○	○	○	○						
			Visible Shipment by Industries						○	○	○	○						
			(Income) National Income Distributed						○	○	○	○						
		(Land Demand)	Land Use Demand by Use						○		○	○						
			(Landuse) Land Use Area by Use						○		○	○						
	Existing Development Projects		Hydrologic Electric Power Development									○	○					○
			Residential Area Development									○	○					
			Industry Development									○	○					
			Commercial Area Development									○	○					
			Airport, Port, Rail Station, Bus Terminal etc.									○	○					
			Recreation Area Development									○	○					
			Urban Renewal Projects									○	○					
	Development Standard and Each Unit		(Pop., Household) Birth Rate, Death Rate						○	○	○	○						
			Number of Family						○	○	○	○						
			(Employment) Economic Active Population Rate						○	○	○	○						
			unemployment rate						○	○	○	○						
			(Productive Activities) GDP per Capita						○	○	○	○						
			Labour Productivity by Industry						○	○	○	○						
			(Income) National Income Distributed						○	○	○	○						
		(Land Use)	Employees Density by Industry									○					○	
			Density of Residents									○					○	
	Regulations		Land Use Regulation									○				○		
			Land Use Conditions									○		○				
			Regulations Related to Project Implementation									○			○	○		
			Financial System and Public Investment Capability									○			○			

Study Items and Study Data (3)

Study Items			Traffic Statistics	White Paper of Traffic Accident	Accident Records	Traffic Volume Survey	Driving Survey	Traffic Facilities Record	Traffic Facilities Survey	On-Road Parking Survey	Off-Road Parking Survey	Parking Capacity Survey	Road Inventry	Traffic Control Survey	Person Trip Survey	Public Transport Study
Traffic Flow		Intersection Traffic Volume	○			○										
		Traffic Volume	○			○										
	Speed	Travel Time					○									
		Average Speed					○									
		Increase Rate of Traffic Volume	○													
Pedestrian Traffic Flow		Intersection Traffic Volume	○			○										
		Traffic Volume				○										
Traffic Facilities	Singnal	Control System							○							
		Cycle Split System							○							
		Control Facilities							○							
	Parking	On-Road Parking Volume								○						
		Off-Road parking Volume								○						
		Average Parking Time								○						
		Parking Cycle Ratio								○						
		On-Road Parking Density by Zone								○		○				
		Parking Capacity						○				○				
		Peak Ratio of Parking								○		○				
	Sign	Variety of Facilities														
		Facilitation Density						○					○			
	Safety Facilities	Road Crossing Facilities						○					○			
		Channelization						○					○			
		Marking						○					○			
		Guard Rail, Cats-eye						○					○			
Traffic Control		Regulations by Route						○						○		
Traffic Accidents	Accident Rate	Accidents Ratio by Route (per Km)		○	○											
		Accidents Ratio by Zone		○	○											
		Accident Ratio by Car Class		○	○											
	Frequency of Accidents	No. of Accidents by Car Class		○	○											
		Frequent Accidents Points		○	○											
	Causes	Calssification of Illigality by Accidents														
		Accidents Condition Map		○	○											
Public Transport		Bus Route, Service Frequency														○
		Distance for Bus Stops													○	
		O - D Between Bus Stops													○	
		Bus Fare													○	○
		Others (includ. Railways)													○	○
Others	Congestion Rate	Intersection Traffic Capacity				○	○									
		Cogestion Frequency by Route					○									

There is pronounced insufficiency of data referring to commerical and industrial statistics, but they will be complemented by implementing a business establishment survey.

3) Person trip survey

This survey covers 8500 households, which corresponds to approximately 5% of the total. The scheme of survey is planned by assuming that the results of the census carried out in 1982 can be utilized in this connection. Figure 3-2 shows the implementation process, Figure 3-3 the progress schedule and Figure 3-4 the basic premises of the progress schedule plan.

Figure 3-2 Survey implementation process

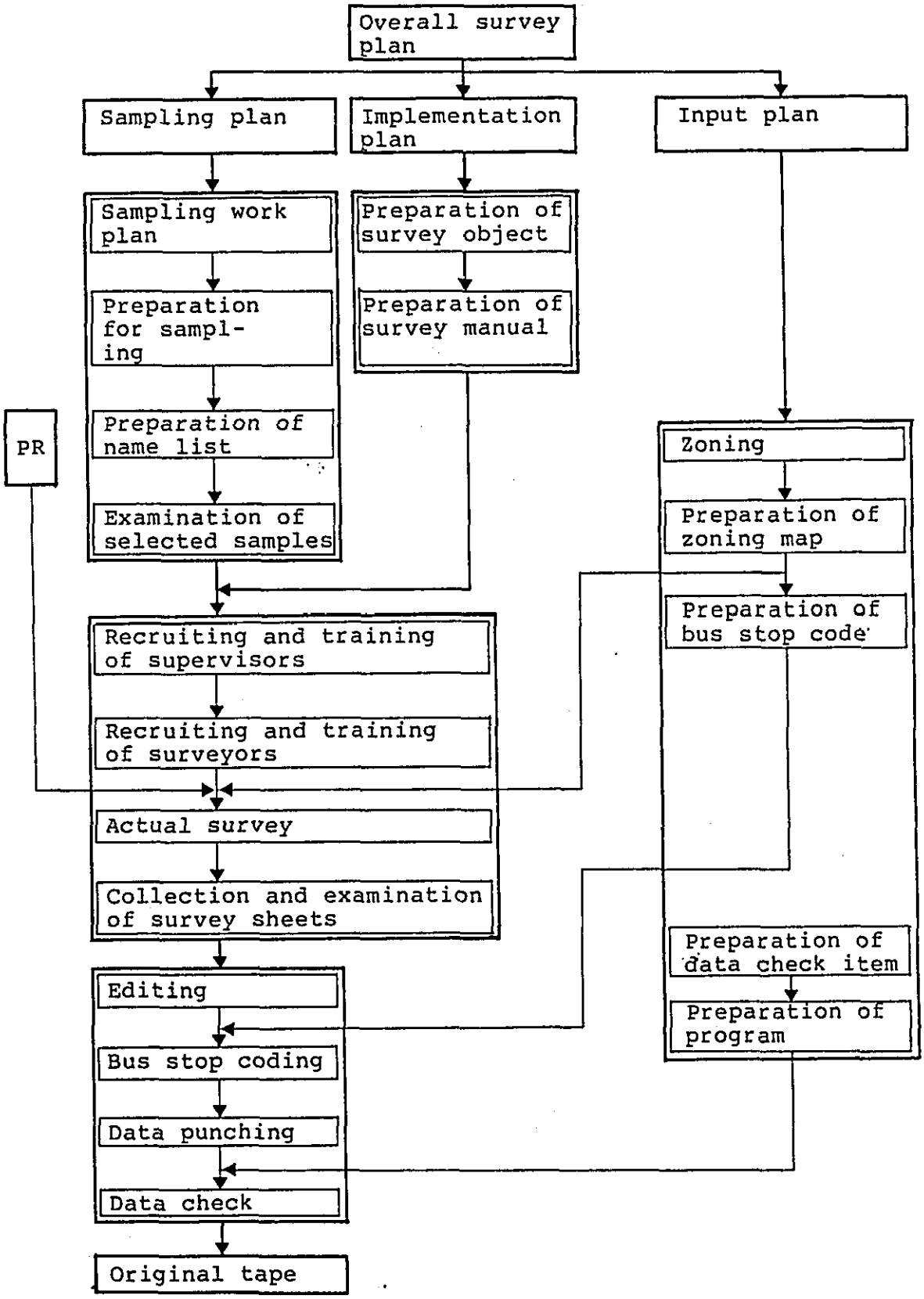


Figure 3-3 Progress schedule of household visit survey

Grand item	Work item	1 m (1 W 2 3 4)	2 (1 W 2 3 4)	3 (1 W 2 3 4)	4 (1 W 2 3 4)	5 (1 W 2 3 4)	6 (1 W 2 3 4)
Sampling	1. Planning of sampling work 2. Preparation for sampling 3. Sampling work 4. Preparation of name list 5. Examination of extracted samples						
Preparation for actual survey	1. Planning of actual survey work 2. Preparation of object of actual survey 3. Preparation of actual survey manual 4. Setting of object of actual survey						
PR	1. Posters 2. Mass-communication media						
Actual survey	1. Recruiting and training of supervisors 2. Recruiting and training of surveyors 3. Actual survey 4. Collection and examination of survey sheets						
Input	1. Planning of input work 2. Preparation of zone map and bus stop code 3. Editing 4. Coding 5. Punch 6. Error check						

Figure 3-4 Premises for planning of PT survey

①	Population setting: Asuncion Metropolitan Area		
	Population	:	Approximately 710,000 (excluding population under age 5)
	Households	:	Approximately 170,000 households
	Area	:	674 km^2
②	Sampling		
	Sampling ledger:		Survey form of Census implemented in 1982
	Sampling rate	:	Random systematic sampling
	Items	:	Address Name of the head of household (age, sex) Others
③	Actual sampling		
	Method	:	Interview survey
	Surveyors	:	University students or persons with equivalent capacity
④	Input		
	OD coding	:	Entry in the zone map on the occasion of the visit
	Bus stop coding:		Entry in the bus stop code list after the actual survey
	Punch	:	Direct punch from the original survey sheet
	Machine check	:	Scope, logic and off code check

(Sampling)

Totalization by zone, by age group, by sex, etc., should be carried out in advance, by taking into consideration the possibility of using the sampling data as population data.

(Survey items)

The form of residence and the state of possession of residence, that can be diverted from the sampling ledger (Census survey sheet) are excluded from the questionnaire. The question about members of the family aged 5 or more is included in the survey with the purpose of identifying the most recent population, because 2 years have elapsed since the period of implementation of the Census. (Refer to Figure 3-5.)
The final survey items will be decided by September 20.

(Coding)

The actual address, origin and destination will be coded on the occasion of the interview, in conformity with the zone map.
As for the bus stops and stations, sequential bus stop codes will be prepared in addition to the zone code with the purpose of identifying the OD between bus stops and stations, and the coding will be carried out after collecting the sheets from the surveyors.

Figure 3-5 Survey Items

Household Attribute	Address	○
	Number of Family	○
	Number of Family over 5 years old	○
	Type of Housing	●
	House Owing Conditions	●
	Number of Car Owing by Car Type	○
Individual Attribute	Sex	○
	Age	○
	Place for Community	○
	Place for Study	○
	Occupation	○
	Industries	○
	Income	○
Trip Characteristics	Survey Date	○
	Trip Purpose	○
	Place of Origin and Destination	○
	Time of Origin and Destination	○
	Modes of Trip	○
	Station and Bus Stop for Trans-Modes	○
	Vehicle Operating Condition	○
	Number of Car Users	○
	Parking Conditions	○
	Loading Type and Weight	▲

○ Survey Item

● Transfer from Census

▲ Aquire from Other Study

(Punch)

Direct punching from the survey sheet will be adopted in this study.

(PR)

Such mass-communication media as newpapers, TV, radio, etc., will be used in addition to posters as means of PR in order to obtain the cooperation of the households to be surveyed.

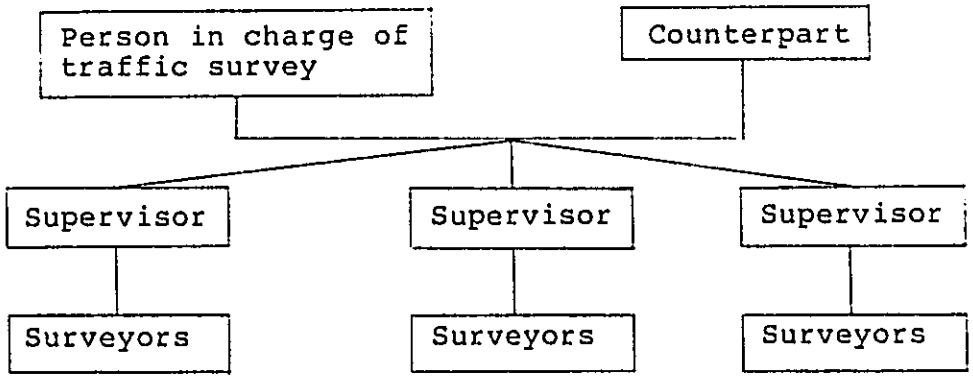
(ID card of surveyors)

Each surveyor should carry an ID card to be issued by the municipality of Asuncion.

(Survey organization)

The organization to carry out the PT survey is shown in Figure 3-6.

Figure 3-6 Organization for PT survey



Members of the survey team

-	Person in charge of traffic survey	1
-	Counterpart	1
-	Supervisor	10
-	Surveyor	122

(Complementation of the PT survey)

Cordon line survey: Survey points will be established in the principal roads crossing the periphery of the person trip ((PT) survey) and approximately 20% of the vehicles passing through the said points will be sampled for survey through roadside interview (trucks .... OD, transported commodity, transported quantity, etc.; other vehicles .... OD, purpose, number of passengers, etc.).

The observation of the volume of traffic will be carried out at the same time. The volume of traffic will be measured at approximately 10 survey points, as shown in Figure 3-7. This survey will be carried out at 24-hour basis. Particular attention will be paid to checking the number of passengers of each surveyed vehicle, including buses.

Screen line survey

The screen line survey will be implemented with the purpose of checking the results obtained by the person trip survey and cordon line survey. In principle, it consists of the traffic volume survey at the points shown in Figure 3-8, where the roads cross rivers. This survey will be carried out at approximately 20 points. The survey points will be decided after field investigation.

In addition to the aforementioned ones, taxi survey (hearings with the various organizations concerned) and ferry survey (interviews at the ferry landing places) will be required as complementary surveys.

Physical distribution survey

The existing conditions regarding the physical distribution between cities can be identified through the cordon line survey. These conditions will be

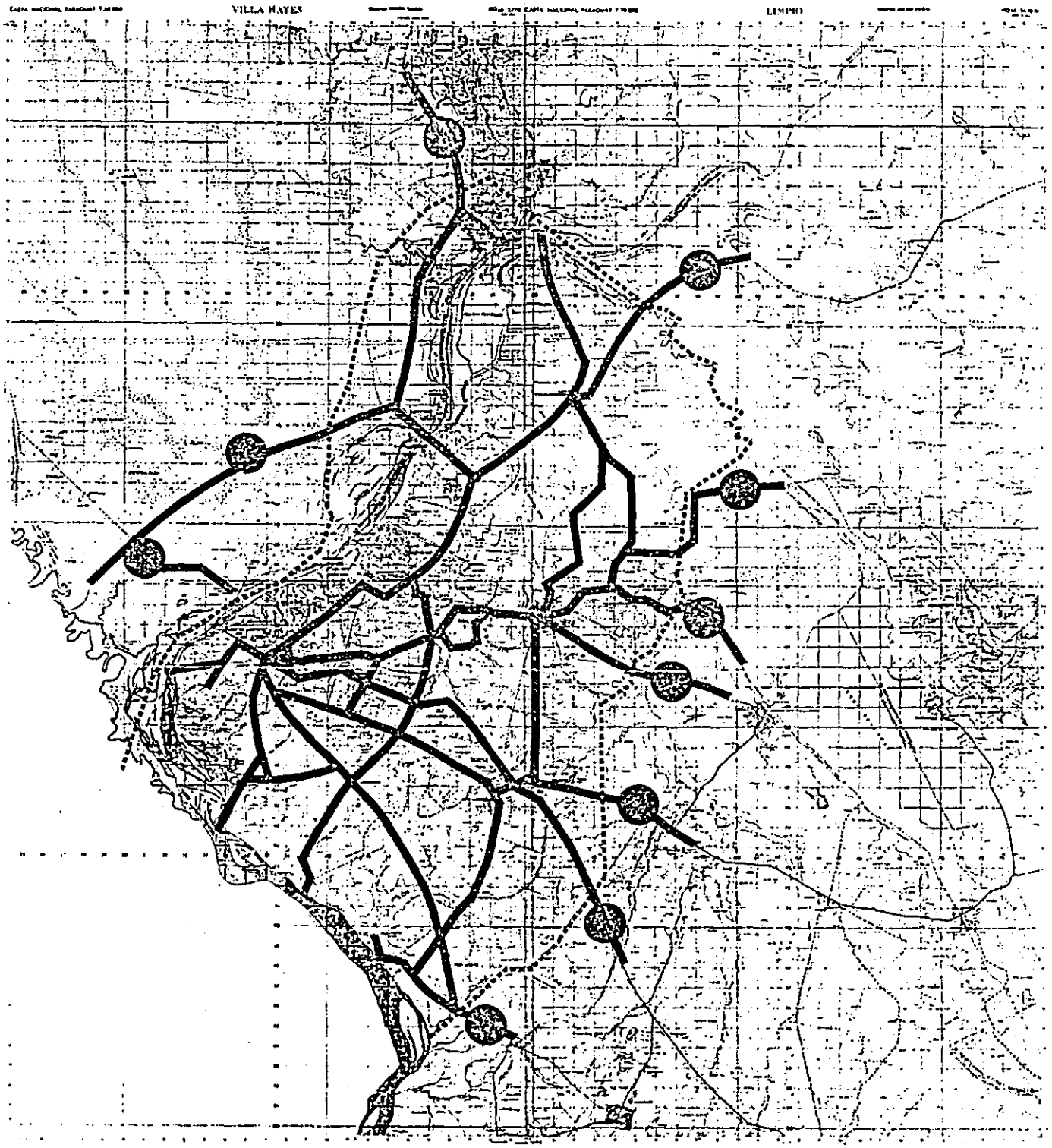


Figure 3-7 Cordon Line Survey Points

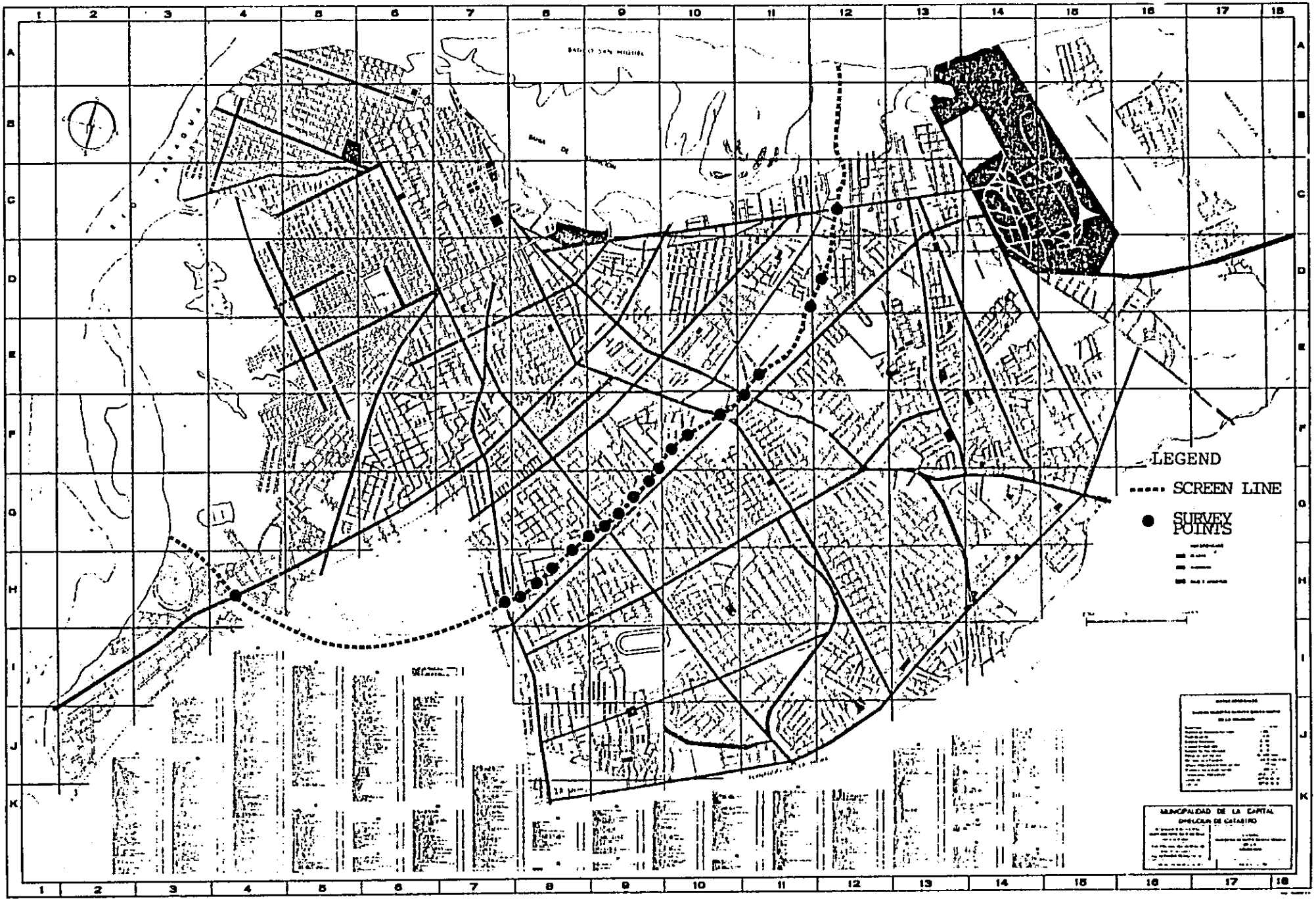


Fig. 3-8 SCREEN LINE SURVEY POINTS

examined by interview survey to be carried out with trucks accessing such points of origin of massive physical distribution as harbours and public markets.

The items of the physical distribution survey are as follows.

(1) List of articles

(2) Weight

(3) Destination after landing at harbours

4) Road traffic survey

The Road traffic survey to be carried out in the principal avenues will cover the following items.

- Survey of the volume of traffic of automotive vehicles
- Survey of the volume of traffic at intersections
- Travelling speed survey
- Survey of the existing conditions regarding traffic control and parking

The key points of these survey items are mentioned hereunder.

(1) Survey of the volume of traffic of automotive vehicles (Refer to Figures 3-9 and 3-10)

This survey will be carried out with the purpose of identifying the volume of traffic of automotive vehicles in the principal arterial streets of the city, and the observation of the

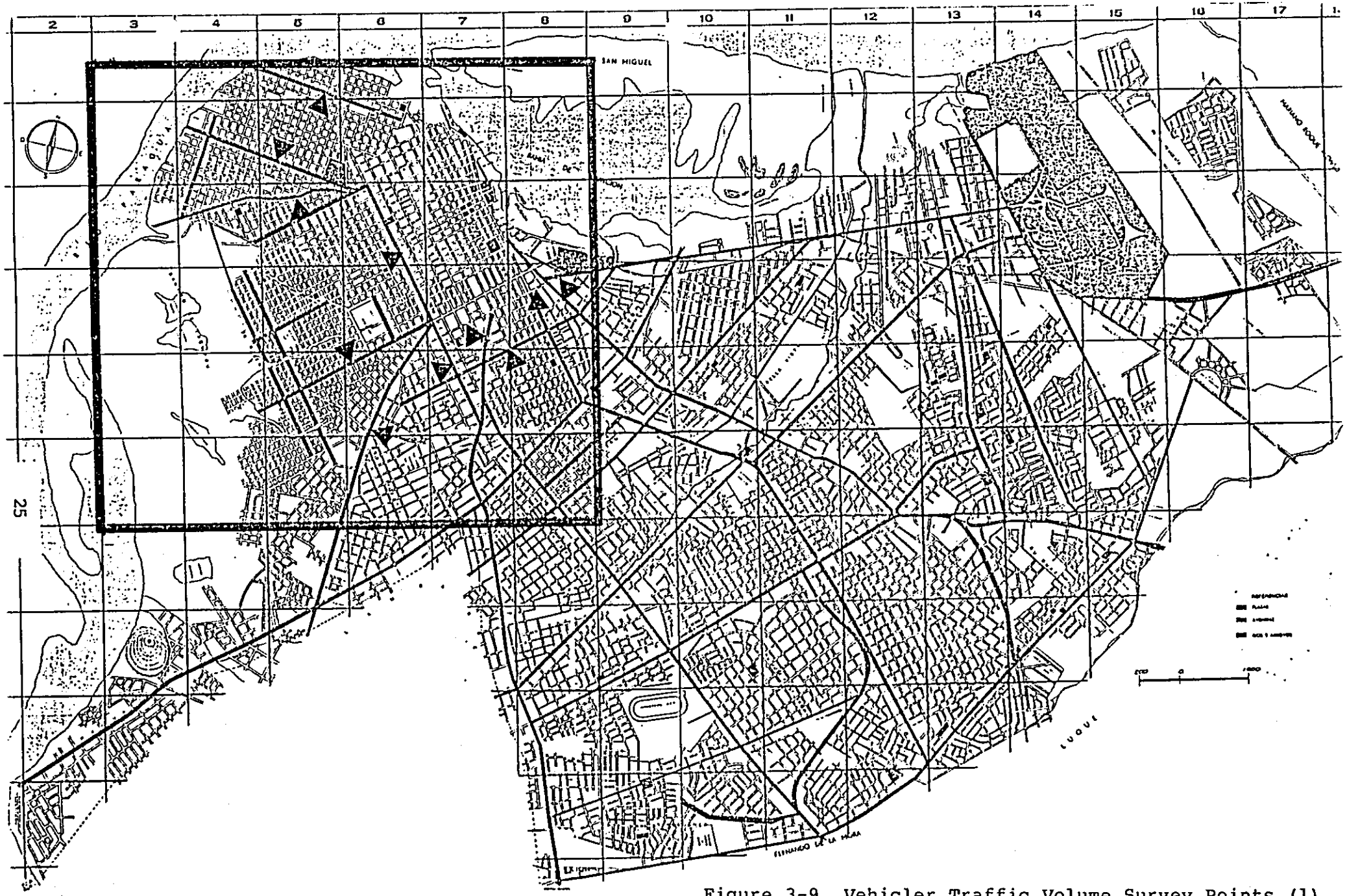


Figure 3-9 Vehicler Traffic Volume Survey Points (1)

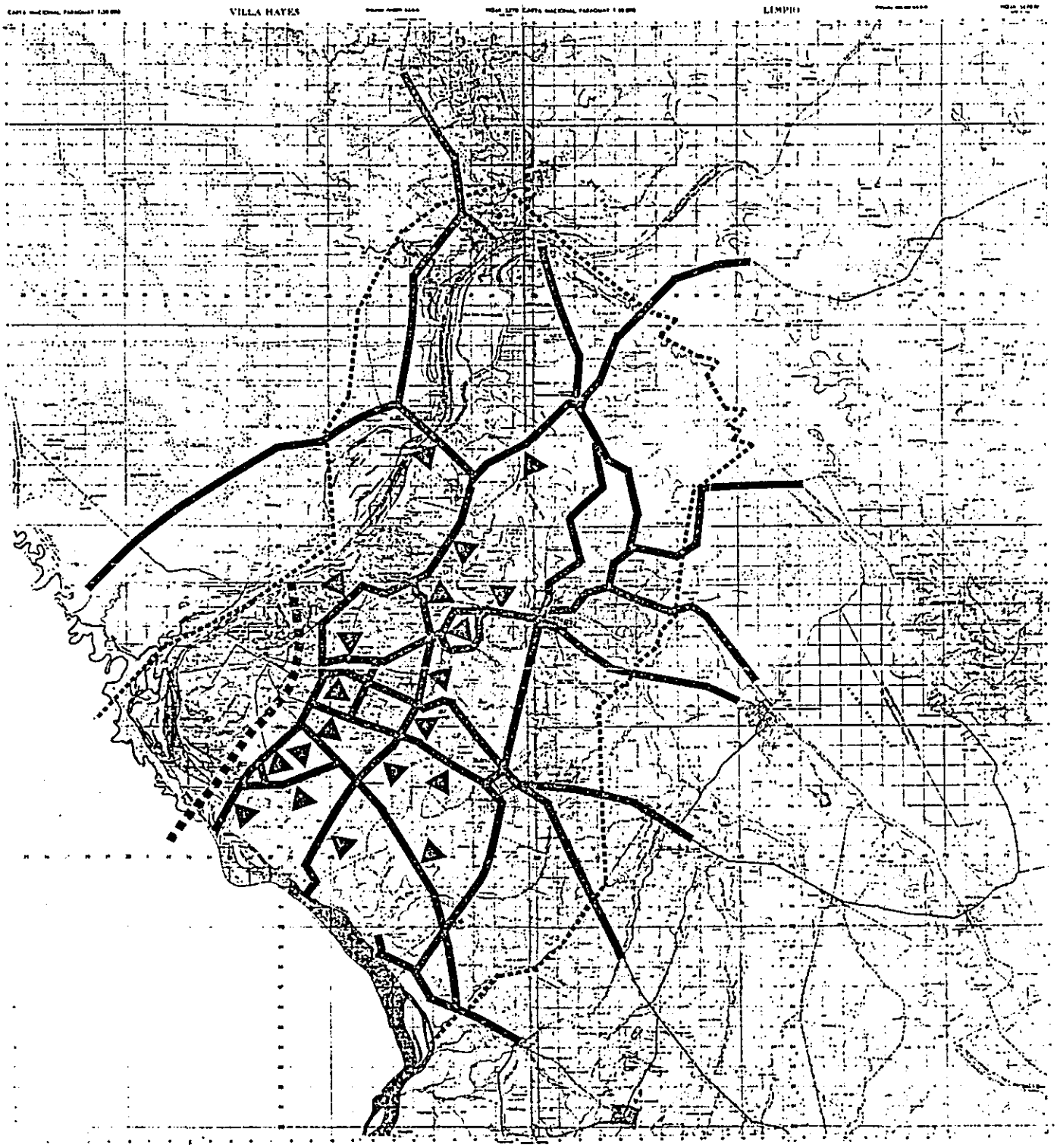


Figure 3-10 Vehicler Traffic Volume Survey Points (2)

volume of traffic by type of vehicle will be carried out during 14 hours, by selecting approximately 30 survey points. The observation of the volume of traffic will be carried out during 24 hours at the most important survey points.

(2) Survey of the volume of traffic at intersections (Refer to Figure 3-11)

The observation of the volume of traffic by direction and type of vehicle will be carried out during 14 hours (including 24-hour observation at some strategic intersections) at the principal intersections of the city. As for the areas where the street network simulation analysis will be carried out, the input data required to create the relevant model will be collected during the additional survey time.

In the surveys (1) and (2), the types of vehicles will be classified in such a manner as to make possible the obtainment of data referring to bus classification (distinguished from school bus).

(3) Travelling speed survey

The survey of the travelling speed will be carried out in various sections of the principal arterial roads, in order to identify the relationship between the average speed by type of

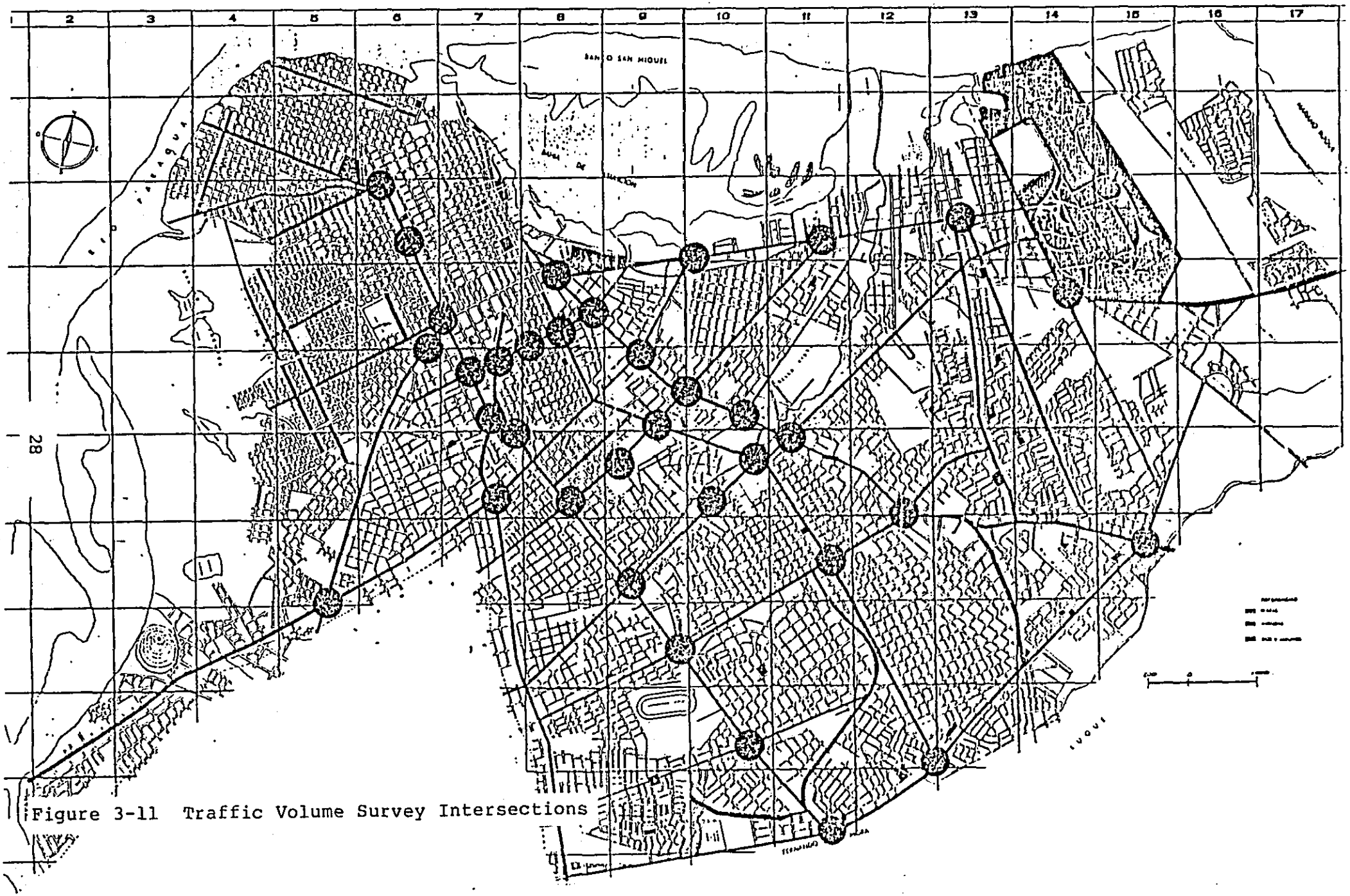


Figure 3-11 Traffic Volume Survey Intersections

vehicle and the volume of traffic. Therefore, the travelling speed survey will be carried out simultaneously with the survey of the volume of traffic. The surveyors will travel through the roads in question during the peak hour and the off-peak hours to record the travelling time and the travelling distance. Approximately 15 routes will be selected as objects of this survey.

(4) Parking survey

This survey is aimed at identifying the existing conditions of parking of automotive vehicles and the capacity of parking facilities at the center of the city. This survey comprises the following items.

① State of distribution of car parks (on street and off street), area of the car parks, form and state of management of the car parks.

② Actual state of the car parks (state of use, average parking time, purpose of the users, etc.)

(5) Survey of the existing conditions regarding traffic control

① Inventory of traffic markings and traffic signs:

The traffic markings and traffic signs of the principal streets of the center of the city will be investigated in this item of survey.

② Traffic light survey (the traffic light survey will be carried out on the occasion of the survey of the volume of traffic at intersections):

The location and type of traffic lights will be investigated in this item of survey.

③ Survey of the actual state of traffic control:

The state of implementation of such traffic controls as one-way traffic, right-turn control, left-turn control, etc., will be investigated in this item of survey.

5) Survey of the present conditions of the public transportation system

This item of survey will principally comprise collection of data and person trip survey, but such aspects as number of passengers, operation speed, operation hour and other details of the bus transportation system will be examined in the additional survey. The survey of the number of passengers transported by bus must be carried out with particular accuracy becuase it will be used to convert the volume of traffic in terms of passengers into the volume of traffic in terms of vehicles.

6) Mapping

(1) OBJECTIVE

The purpose of the Topographic Survey is to prepare necessary topographic data for the Urban Transport Study in Asuncion Metropolitan Area Project.

Field work in Paraguay :

a)	Control Station Survey	9 Stations,	113 km
b)	Levelling		107 km
c)	Classification		120 km^2

Home work in Japan :

d)	Aerial Triangulation	124 Model
e)	Topographic Mapping	120 km^2

(2) FIELD SURVEY (WORK IN PARAGUAY)

① Photograph processing work

Using existing 1:10,000 and 1:40,000 aerial photograph, processing work shall be done. One set of positive film, two sets of contact print, two times enlargement photos shall be made.

② Control Station Surveying

Control Station Surveying shall be done by traversing and tied to National Triangulation Stations. Standard deviation is 1/6,000. Control point necessary for the aerial triangulation should be pricked on the enlarged aerial photographs.

③ Levelling

Levelling should be started from a National Bench Marks and close to a National Bench Marks. The accuracy requirement of $\pm$ 6 cm $\sqrt{S}$ shall be satisfied. (S = one-way distance expressed in kilometer.) The total levelling length is approximately 107 km. Elevation points should be pricked every 400 meters on enlarged aerial photographs.

④ Classification

Field information necessary for the preparation of the Topographic Map should be collected based on Paraguay Topographic Map Symbols. All field data collected during field classification shall be shown on the enlarged aerial photos with overlay.

(3) MAPPING (WORK IN JAPAN)

① Aerial triangulation

Aerial trinangulation will be carried out by analytical method using stereo-comparators and electronic computers.

② Topographic mapping scale of 1:5,000

The plotting instrument shall be a precision photogrammetric instrument such as a Wild A8 or equivalent type. "Paraguay Topographic Map Symbols" should be used for drafting.

(4) FINAL DATA

Following final data will be completed until end of January, 1985.

a) Aerial Photography

1.	Positive film	1 set
2.	Contact print	2 sets
3.	Two times enlargement photos	1 set

b) Mapping

1.	Field survey data	1 set
2.	Data of aerial triangulation	1 set
3.	Topographic Map (a scale of 1:5,000)	1 set

Figure 3-12 : MAPPING PLAN

LEGEND Map scale 1:50,000

MAPPING AREA
Mapping scale 1:5,000

NEAT LINE
(100cm. x 70cm.)

3-3 Analysis of the present conditions and forecast of the future

1) Analysis of the present conditions

The analysis of the present conditions has two purposes, which are to understand the present state in the Asuncion Metropolitan Area and to find out the short-term and long-term points at issue and themes regarding urban traffic.

(1) Regional positioning of the city (sphere) object of study objective:

The regional positioning of the city (sphere) object of study aims at comprehending the role it plays within the country in the aggregate, and at enabling the matching between the numerical values of various kinds referring to the city (sphere) in question and those ones referring to the nation as a whole on the occasion of drawing up the frame of future plans and forecasting the future.

Natural location:

This part of the study comprises the clear definition of the geographical location of the city (sphere) object of study, analysis of the background of the process of natural and man made

formation of the area in question, including climate, topography, fluvial basin, etc., and examination of the future course of regional development.

- Climate (climatic classification): This aspect will be examined principally in connection with the course of development of agriculture, forestry, cattle breeding and recreation.
- Topography (macroscopic topography): This aspect will be examined in connection with the ease of urban development from the physical standpoint and course of development of the agriculture, cattle breeding and forestry.
- Fluvial basins (classification of the major fluvial basins): Identification of the spheres of influence related to the water.

Population and employment:

This part of the study aims at identifying the relationship between the demographic and employment trends on a nationwide scale and those ones referring to the city (sphere) in question, in order to provide the basis for forecast of the future of the city (sphere) object of study, founded on the future demographic and employment trends on a nationwide scale. The following data will be used as basis of the said forecast.

- Population by sex and age:

  It is desirable to have the population by sex and by 5-year age groups referring to the last 20 years.

- Demographic movement:

  The social movement rate of the city (sphere) object of study can be estimated by using the birth rate and mortality on the nationwide basis. However, it is desirable to have the said data on regional basis.

- Examination of the influence exerted by the changes of birth rate and mortality on the composition of the national population by age and by sex as well as the result of the said process. Examination of the influence exerted by the changes in the working population, scholar age population and aged population on the social and economic aspects of the country. Elucidation of the role played by the city (sphere) in question (creation of jobs, creation of opportunities of entrance to school, provision of labour, etc.) in connection with the social movement.

- Employed population by trade

  In the first place the distribution of the employed population will be examined by major classification of trade or at least by each one of the three economic sectors.

Furthermore, the employment rate (or unemployment rate) will be examined by comparing it with the proportion of the population engaged in econimic activities. In the city (sphere) object of study the analysis will be carried out not only on dwelling place basis but also on workplace basis.

Production activity and income:

This part of the study is aimed at elucidating the economic foundation which the city (sphere) object of study is based on. The said economic foundation consists of the production income brought about by the production activity as well as the income distributed to the local population.

- The part played by the city (sphere) in question within the production activity of the nation is elucidated by identifying the composition of the gross domestic product (GDP) by sector and the corresponding gross regional product of the city (sphere) object of study.

  Normally, however, the gross regional product is not given in most of the cases, and therefore it is estimated by using the production statistics by sector (agricultural, forestry & fishery

statistics, industrial statistics, commercial statistics) that give the production amount (volume) by region. If it is difficult to estimate the gross regional product even by means of the said method, the principal individual indices will be compared in order to obtain the necessary data.

. It is difficult to identify the income level. It is desirable to have the distribution of income per inhabitant, but if the said data is not available, the worker's wage level and other subsidiary data will be used for this purpose.

(2) City planning conditions

Objective:

Such factors as the physical restraint conditions, existing plans and development projects, planning level, related regulations, etc., of the city (sphere) object of study will be elucidated in connection with the preparation of plans and forecast of the future, in order to provide the base to improve the effectiveness of the planning (forecasting) work.

Possibility of urban development:

The extent and conditions of future urbanization process will be examined, within the natural conditions and state of land use of the city (sphere) object of study.

- Natural conditions:

  Such factors as topography, geology, foundation, water, vegetation, etc., will be indicated on the maps by using the existing data in order to fully comprehend the conditions restricting (or to be taken into consideration in connection with) the future urban development.

- Land use:

  The importance of the land use, seen from the standpoint of the agriculture and other activities practiced in the rural areas surrounded, is evaluated in connection with the certain aspects. These include appropriateness of the soil for agriculture, present condition of the agriculture investment, state of demarcation of mining lots, border regulation, etc.

Existing development plans and forecast of the future:

The existing future plans referring to the nation in the aggregate, state (prefecture) and city (sphere) object of study (including the future forecasts related to the said plans), as well as the individual forecasts (prospects) related to the undermentioned items will be examined in order to improve their suitability with the survey plan in question.

- Population and employment:

  Sorting of data referring to the future forecast of the population by sex and age group as well as birth rate, mortality, social mobility, household size, etc., that endorse the said demographic data.

  Economically active population and unemployment rate corresponding to the demographic composition by age group and by sex as well as prospect and future plan of the working population by trade

- Economic activity and income:

  Future outlook and plan referring to the GDP (GRDP) by trade or amount of shipment by trade, shipment volume distribution income and other data related to the calculation of the national economy

. Land:

Future demand of land use and land use plan to cope with the said demand (area by use)

Existing development projects:

The undermentioned aspects related to the deveopment projects of various kinds (housing land development, industrial development, commercial development, terminal facilities such as airport, etc., recreational development, redevelopment, etc.) planned or conceived for the city (sphere) object of study will be examined in order to coordinate them with the survey project in question.

. Housing land development:

Development area, planned number of houses, planned population, related public use and public benefit facilities, classes object of development (selling prices and wages, annual plan)

. Industrial development:

Development area, types of industry taken into consideration, number of lots to be sold, expected number of employees, related facilities to be used in common, expected cargo handling volume (number of trucks), expected value of shipment, planning years

- Commercial development:
  Development area, types of business taken into consideration, expected number of employees, related facilities, expected turnover, expected number of customers, sphere of commerical influence, planning years
- Airport and other terminal facilities:
  Development area, expected number of flights, expected number of employees, planning years
- Recreational development:
  Development area, contents of the plan, expected number of employees, expected number of users, territory, planning years.
- Redevelopment project:
  Redevelopment area, other contents of the plan, planning years

Levels of various kinds, basic units, etc.:

The undermentioned aspects related to the present state of indices of various kinds, trends of future changes, plan setting values etc., will be examined in connection with the setting of project target levels, relationship between numerical values of indices of various kinds used

for the sake of forecast, etc., in order to provide the basis for estimation of the survey project in question.

- Population and employment:
  Birth rate, mortality, social mobility, size of houshold, economically active population rate, unemployment rate
- Production activities and income:
  GDP (GRDP) per capita, labour productivity by trade
- Land use:
  Number of workers by use, demographic density of residential area

Institutional aspects:

The institutional aspects of the nation, state (prefecture) and city (sphere) object of study, related to the implementation of projects concerning land and city planning, finance, etc., will be examined in order to devise means for their effective use in connection with the survey project in question, as well as to devise countermeasures to cope with the restrictive conditions.

- Regulations related to land use:
  Land use zoning, development permit, border regulation, etc.

- State of affairs regarding land possession:
  Distribution of state-owned land, public land, etc.
- Institutional aspects related to the implementation of projects:
  Forcible expropriation system, land evaluation system, etc.
- Financial system and public investment capacity:
  Record of amounts invested by the administrative units concerned, subsidy system, etc.

(3) Analysis of the present conditions of the urban structure

Objective:

The present conditions and the past trend of the internal structure of the city (sphere) object of study will be clarified from the standpoints of physical conditions comprising land use pattern, etc., and the socio-economic conditions comprising demographic distribution, employment distribution, etc., in order to sort the points at issue and to obtain basic information required to examine the future urban structure of the city (sphere) object of study.

Land use and housing:

In the first place, the city (sphere), object of study, will be divided into two major areas, i.e., urban area and rural area. The urban area will be divided into zones in terms of such forms of land use of urban type as housing, industry, commerce, etc., while the rural area will be zoned in terms of types of crops, types of livestock, etc.

- Present conditions of the urban type land use:

  The zoning will be carried out on site basis in conformity with the standard international land use classification, by using scales of the order of 1/10000 to 1/25000, depending on the size of built-up area.

  The areas will be totalized by use, in conformity with the zoning criteria used in the PT survey.

- Present conditions of the agricultural land use:

  The zoning will be carried out on a map with appropriate scale, in terms of type of crop in the case of agricultural area, type of livestock in the case of stock farm area and type of trees in the case of forest area.

  The areas will be totalized by use, in conformity with the zoning criteria used in the PT survey.

- Built-up area expansion map:

  The evolution of the urbanization process will be mapped from the period of formation of the central area of the city (sphere) object of study to the present time, in conformity with the chronological succession determined by the availability of the relevant data. If possible, data referring to the development area, entity responsible for the development project, land use, number of houses constructed, etc., will be plotted on the said map.

- Housing area:

  Hosuing land accounts for the largest portion of the built-up area, and its quality determines the urban environment. Furthermore, housing areas are the largest concentrations of person trip sources, and the peculiarities of the said trips exert decisive influence on the quality of the residence (reflecting the income and social class). Information regarding the size, form and entity in charge of the housing project of each zone of the city (sphere) object of study will be examined in connection with the said aspect.

Facilities generating large-scale traffic:

Such facilties as transportation terminals, markets, schools, etc., must be investigated with particular care because they are traffic nodes of the city (sphere) with concentration of massive traffic of both passengers and goods.

- Airports, harbours, railway stations, bus terminals, etc.:

  Identification of the arrival and departure of airplanes, vessels, trains, buses, etc., as well as the volume of commodities and number of passengers handled therein by destination and origin, in chronological order.

  Furthermore, the size of these facilities as well as the number of employees must be investigated at the same time.

- Market:

  The quantity of cargo by item of handled commodity, scale of the facilities, number of employees and other relevant data will be identified in this part of the study.

  Furthermore, data referring to investigation of the actual conditions of the number of users, number of incoming and outgoing automotive vehicles, etc., must be collected as well, if they are available.

- Schools:

  The schools are among the destinations of the person trip survey. Therefore, it is necessary to prepare the list of schools located in the city (sphere) object of study in order to examine the certain items. These comprise type of school, size of the facilities, number of teaching staff, number of students.

- Physical distribution centers:

  The volume of cargo by type of handled commodity, number of incoming and outgoing trucks, scale of the facilities, number of employees, etc., should be investigated in connection with this kind of facility.

Population and employment:

The present conditions regarding distribution of demographic density and commuting of workers, which are the indices showing the zonal distribution of population and employment, will be examined in correspondence to the land use pattern in the city (sphere) object of study, in order to pick up and sort the points at issue related to the urban structure.

- Population and number of households by zone:

  The existing data referring to these aspects will be sorted out by putting together or

subdividing their zoning scheme in accordance with the zoning criteria of the PT survey. The relevant data must be identified in chronological order in connection with future forecasting and planning procedure. Data referring to the number of households is not as fundamental as those referring to population, but anyway they are important indices required to examine the aspect of housing as well as the possession of private cars by zone.

- Demographic denisty by zone:
  The demographic density will be calculated not only in correspondence to the total area of each zone, but also in terms of area of housing land in connection with the land use pattern.
- Working population by zone and by trade:
  It is necessary to examine the working population by trade corresponding to the resident population (residential area in terms of land use zoning) on place-of-residence-basis as well as the working population by trade corresponding to the commercial zone and industrial zone on workplace basis. As for the basic information referring to the classification of trades, it is desirable to subdivide them

down to the major trade classification level (9 types), and the relevant data should be provided by sector (primary, secondary, tertiary) of the economy.

- Working population, place-of-residence/ workplace matrix:
  It is desirable to have the cross-correlation table between the aforementioned working population by trade. Otherwise, the said cross-correlation table will be prepared in connection with the total working population, in order to identify the degree of relationship between the zones and corroboration of the results of the PT survey.

Production activity and income:

The production activities of the principal trades that compose the economic foudation of the highway object of study will be fully clarifyed in connection with the land use pattern, with the purpose of examining such aspects as generation of traffic of passengers and commodities accompanying the production (sales) activities, restrictive conditions related to the land use, influence on the environment, etc. On the other hand, the causes of occurrence of problems related to residential environment will be examined by identifying the income distribution

by zone and by analyzing its relationship with the quality of the residential areas. Furthermore, the distribution of manpower involved in the aforementioned production (sales) activities will be examined in connection with the employment structure.

. Amount and volume of shipment by zone and by trade:

  The amounts and volumes of shipments by zone will be examined as minutely as possible, by focusing principally on the agriculture, stockbreeding, forestry and fishery (amount of production and volume of shipment by item), industry (amount of production and volume of shipment by item), commerce (turnover).

. Population by zone and by calss of income (household and house):

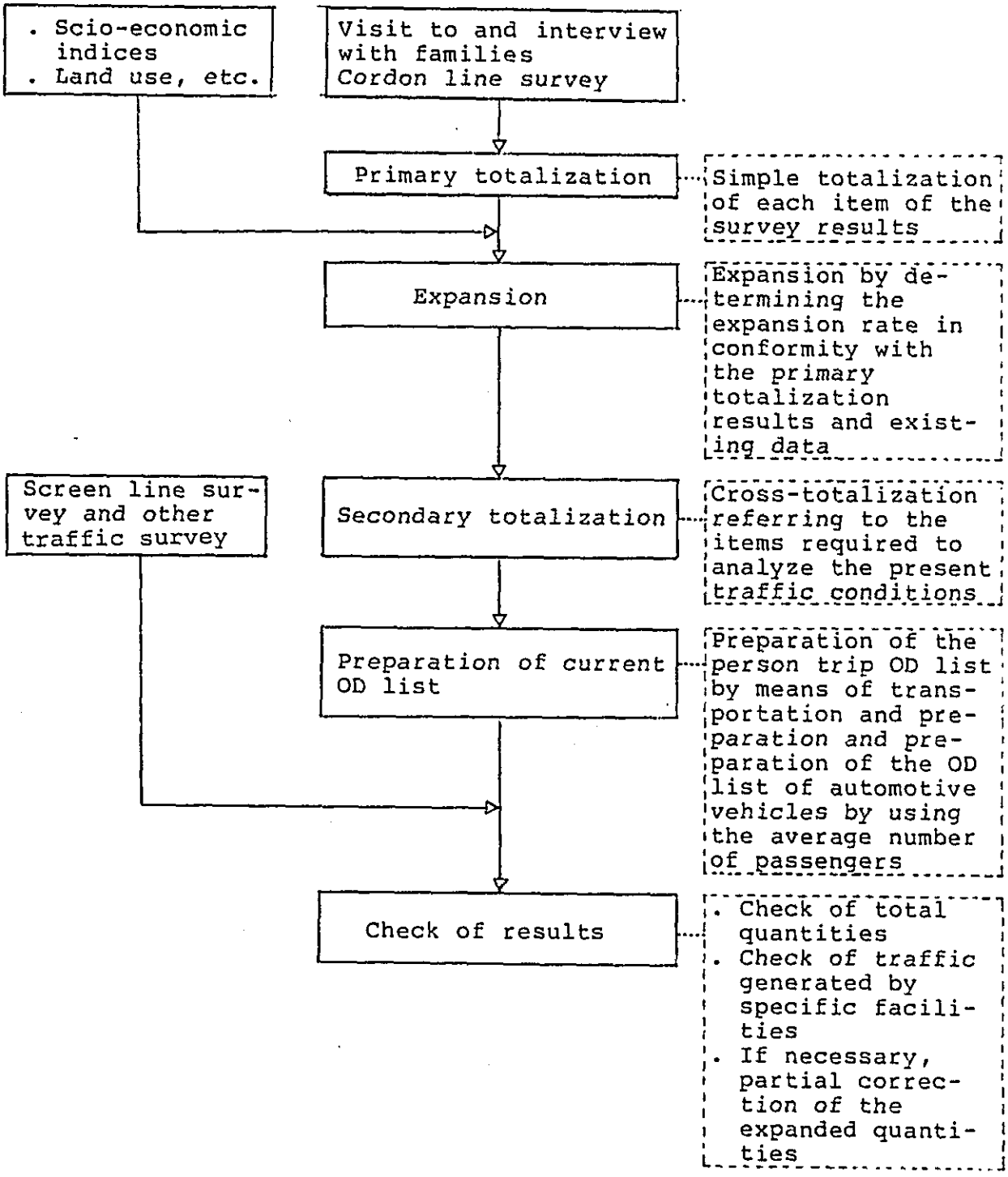
  The population will be classified by zone for each class of annual income (monthly income) (if data about income is not available, the population should be classified by using other subsidiary data, e.g., quality of the residence available on the occasion of the survey).

Administrative system:

In this part of the study the administrative units with jurisdiction over the roads object of study will be investigated and arranged in accordance with their hierarchic structure, in order to examine the role played by the administrative system within the urban structure and the role they will play in connection with future projects.

(4) Analysis of the traffic movement

The results of the person trip survey will be totalized in conformity with the following steps of procedure.


. Scio-economic indices
. Land use, etc.
Visit to and interview with families
Cordon line survey
Primary totalization
Simple totalization of each item of the survey results
Expansion
Expansion by determining the expansion rate in conformity with the primary totalization results and existing data
Screen line survey and other traffic survey
Secondary totalization
Cross-totalization referring to the items required to analyze the present traffic conditions
Preparation of current OD list
Preparation of the person trip OD list by means of transportation and preparation and preparation of the OD list of automotive vehicles by using the average number of passengers
Check of results
. Check of total quantities
. Check of traffic generated by specific facilities
. If necessary, partial correction of the expanded quantities

The following items will be analyzed by using the aforesaid results.

- Total number of trips
- Number of trips by purpose
- Number of trips by means of transportation used by the passengers (purpose of trip and trip list by zone)
- Individual attributes and trip generation frequency
- Trip generation frequency by sex and by age group
- Trip generation frequency by profession and by trade
- Relationship between possession of automotive vehicle and generation of trip
- Trip characteristics by zone (generation/concetration, accessed zones)
- Chronological change of trip concentration
- Characteristics of bus traffic quality of service (trip generation frequency, trip pattern, distance between bus stops, OD, trip cost)

According to our experience, there are conspicuous distinctions between the behaviour patterns of the class possessing private car and the class without that means of transportation.

The analysis of the trend of evolution of the private car possession rate and the determination of the future possession rate of private cars exert decisive influence on the traffic planning. The future possession rate of private cars must be estimated in a convincing way by appropriately combining the analysis of the possession and desire of possession of private cars with the trend analysis and future change of social structure.

(5) Analysis covering the urban traffic in the aggregate

The analysis will be implemented by taking into consideration the results of traffic fact-finding surveys of various kinds, surveys of urban traffic facilities, surveys related to means of public transportation, electricity use survey, etc., in addition to the aforesaid surveys. Most of the points at issue and themes identified as a result of the analysis are short-term ones. The facts to be taken into consideration in connection with short-term traffic problems are mentioned in Table 3-2.

Table 3-2 Relationship between traffic problems and traffic management

Traffic problems	Classification of traffic management		
Mobility and accessibility problems . Private car . Means of public transportation . Pedestrians, bicycles, etc.	1. Place of origin of traffic	(1) Parking control (distinctions depending on the size of the zone in question) (2) Improvement and rearrangement of terminals and physical distribution facilities	. Influence on the share by means of transportation
Safety problem . Cars, bicycles and pedestrians . Street/road structure . Daytime, night time	2. Traffic generation time	(1) Flex-time commuting (2) Traffic control by period of time (special lanes for large-size vehicles and bus) (3) Additional charge by period of time	. Washington DC
Problem of profitability of means of public transportation . Increase of personnel expenditures . Reduction of users . Traffic congestion, etc.	3. Selection of means of transportation	(1) Improvement of the service provided by the means of transportation (Frequency of operation, time, information, station, vehicle, charge, parking lot, rearrangement of lanes, priority traffic light) (2) Restriction of use of automotive vehicles (Parking control and regulation) (3) Restriction of the possession of automotive vehicles (Increase of taxes, control of garages) (4) Encouragement of collective use (Collective use of private cars) (5) Collective gathering and distribution of cargo	. Labour condition, influence to related transportation . Obligated charge (Singapore) . Rare experience of execution
Energy problem . Increase of the number of cars . Fuel, etc.	4. Measures to produce smoother traffic	(1) Control and sophistication of traffic light systems (2) Traffic information system (3) Traffic control (4) Improvement of highways and crossings	
Environmental problems . Noise, vibration and exhaust gas . Economic situation . Analysis by zone, etc.	5. Traffic safety	(1) Installation of traffic safety and traffic management facilities (automotive vehicles, bicycles and pedestrians.) (2) Improvement of highways and crossings (3) Traffic safety education	
	6. Environmental improvement	Contents of the items 1 to 5 referring to traffic management	

2) Forecast of the future traffic demand and its allotment to road projects

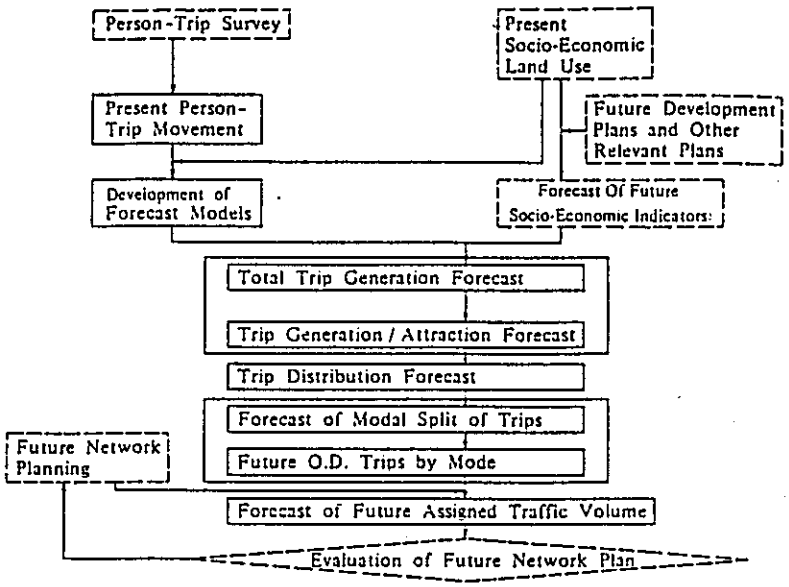
This work consists of two distinct parts, i.e., the stage up to the preparation of the draft of the urban traffic plan and the forecast of the future traffic demand.

Stage up to the preparation of the draft of the urban transportation plan:

Prior to planning the urban traffic scheme, it is necessary to prepare the master plan for land use and urban development by conceiving the future scheme for land use and by preparing and evaluating the pertinent alternatives. The draft of the plans for urban transportation system and public transportation system will be prepared by assuming the said master plan as a premise for planning.

Forecast of the future traffic demand corresponding to the draft of the urban traffic plan:

The future traffic demand will be forecasted in correspondence to the proposed alternatives of urban traffic plans. The estimation process is carried out in conformity with the procedural steps shown hereunder. The estimation years are 1990 and 2000.



The following study will be carried out in connection with the introduction of electrically powered means of transportation.

- Revision of the formation of built-up areas and demographic distribution
- Revision of the location of road to be newly constructed and their necessity.
- Coordination with the contents of the bus transportation system (terminals, routes, etc.).

3-4 Preparation of short-term plan and long-term plan

1) Preparation of short-term plan

The short-term plan comprises the undermentioned items, and its target year is 1990.

(1) Projects to be completed by that year and capable of bringing about positive effects without the help of other subsidiary projects.

(2) Intermidiate stages of long-term projects whose target year is 2000.

The short-term plan consists principally of traffic management projects, road improvement projects and traffic facility & equipment projects. The short-term plan should be delineated by taking into consideration the relationship with the report (1982) written with technical aid from Brazil. It is presumed that the most important items of the short-term plan will be the one-way traffic of the circular route located at the central part of the city, two-dimensional control of the traffic lights of the strategic points of the central part of the city, improvement of strategic crossings of each radial avenue and improvement of the traffic light system.

The relevant check list is shown in Table 3-3.

The short-range plan will be verified by means of the traffic flow analysis to be carried out through street network simulation.

Table 3-3 Check list of short-term projects

Project	Contents
1. Improvement of the traffic system 1 Pedestrians 2 Automotive vehicles (general) 3 Bus and taxi	If there are problems in the contents and enforcement of the traffic regulations, becoming causes of traffic accidents and traffic congestion, propositions will be presented in connection with the traffic system. Thorough observance of the laws, driving license system, safe crossing method of pedestrians, passsing method, parking method, etc.
2. Traffic safety education project	(1) Curriculum of the official educational institutions (2) Driving courses (3) Traffic parks
3. Traffic control project 1 Speed control 2 One-way traffic control 3 Prohibition of left-turn at the crossing and other controls 4 Parking control 5 No-passing control · Large-sized vehicles, · Areas for exclusive use of pedestrians 6 Creation of bus lanes	. If the speed limit is not appropriate for the characteristics of the roads, it should be changed. . Producing smoother street traffic at the vicinity of bottle necks . Elimination of congestion by roundabout traffic . Parking control in congestion zones and producing smooth traffic flow . Control of passing-by traffic in congestion zones and zones with frequent traffic accidents, control of the access of large-sized vehicles and conversion of streets of the central business districts into malls . Smoothening of bus traffic and ordinary traffic
4. Traffice sign project 1 Installation of additional traffic signs ·Warning signs ·Guidance signs	. Installation of traffic control sings in conformity with the traffic control project when the said signs are insufficient . Installation of guidance signs in conformity with the traffic control project when the said are insufficient

Project	Contents
2 Street marking · Centerline · Lane demarcation line · Marking at crossings · Marking at pedestrian's crossings	. Study of the necessity of providing street marking for traffic safety and smoothening at places with problems. . Creation of new pedestrian's crossings.
5. Signal control project 1 Installation of more traffic lights 2 Systematization of the traffic lights 3 Improvement of the traffic lights	· Investigation of the installation of more traffic signal and introduction of linear traffic control instead of punctual traffic control in order to produce smoother traffic at problem points and problem sections · Investigation of the installation of detectors for traffic signal control and purchase of new equipment · Investigation of the possibility of Area traffic control in the central part of the city from a long-term standpoint
6. Safety facilities 1 Protection facilities 2 Overhead pedestrian's crossing bridges 3 Illumination	. Demarcation of sidewalks and driveways, prohibiton of street crossing by pedestrians, clear definition of bus stops . Investigation of overhead pedestrian's crossing bridges . Monitoring and guidance of automotive vehicle traffic in arterial streets, lighting for the sake of safety and prevention of crimes
7. Improvement of crossings 1 Improvement of traffic signals, sings and markings 2 Channelization 3 Enlargement of the access ways	Improvement of traffic signals, sings markings, etc., at the crossing and channelization of the traffic in addition to the study of the traffic light project, in order to produce smooth traffic flow Preparation of a list of places where it is desirable to construct solid crossing on medium- and long-term basis

Project	Contents
8. Improvement and construction of new streets and roads	
1 · Repair of the road surface · Installation of drainage facilities	. Improvement of bad places of the road structure
2 Improvement and construction of new sidewalks	. Study from the standpoints of safety and comfort of pedestrians
3 Construction of bus bays	. Study of the construction of bus bays in addition to the bus stop improvement project in order to produce smoother traffic flow and to improve the bus service
4 · Widening of lanes · Construction of central reserve	. Widening of the driveway in congestion sections
5 Construction of new highways	. New highway construction projects included in the existing schedule
9. Improvement and construction of new car parkings and terminal facilities	
1 Improvement and construction of new parking facilities	. Guarantee of future use of existing parking lots and parking spaces
2 Improvement of bus terminals	. Study of obligation of construction of bus terminals
3 Improvement of bus starting points	. Study of alternatives to cope with car parking control, Improvement of terminals in order to upgrade the bus service and improve the operation efficiency
10. Improvements related to the bus operation	. Proposition of improvement bus route network within concretely practicable limits
1 Improvement of the bus route network	. Proposition of measures to improve the operation scheme with the purpose of realizing regularity

Project	Contents
2 Rationalization of the bus operation 3 Bus tariff policy 4 Bus administration system 5 Improvement of the bus company mangement	. Conception of a system making it possible to objectively comprehend the complete operation of bus companies
11. Bus and related facilities 1 Improvement of the vehicle maintenance system 2 Reinforcement of the fleet and introduction of large-sized vehicles	. Construction of new vehicle inspection and maintenance centers . Estimation of the effects of introduction of large-sized vehicles and proposition of the appropriate vehicle size . Clarification of the relationship between annual growth of demand and cooperation, and determination of the appropriate type of vehicle, by year, by taking into consideration the income and outgo of bus companies

2) Preparation of the long-term plan

The long-term plan comprises the following aspects.

- Land use plan
- Traffic management and operation plan
- Road network plan
- Public transportation system plan
- Built-up area redevelopment plan
- Traffic facilities plan

The target year of the long-term plan is 2000.

(1) Land use plan

The land use plan must be coordinated with the traffic plan, facilities plan, green zone plan, downtown redevelopment plan, etc. Various alternatives should be proposed for the land use plan, and the ultimate alternative should be selected by taking into consideration the opinion of the Government of Paraguay.

The following items should be examined in connection with the land use plan.

① Future prospect and appropriate layout of the commercial and business center.

② Future prospect and appropriate layout of the central commercial district.

③ Plan for, and trend of, development of the metropolitan area including peripheral cities.

④ Course of improvement and rearrangement of the harbour and related facilities.

⑤ Relationship between the traffic facilities (means of transportation, bus terminals, etc.) and the development of peripheral areas.

⑥ Revision of the land use control

Furthermore, the following items should be examined in addition to the aforementioned ones, in order to draw up a map of the land use plan in 1990 and 2000.

- Population allocation scheme
- Employment allocation scheme
- Development and improvement schedule

(2) Traffic management and operation scheme

Generally speaking the traffic management and operation scheme is regarded as a short-term problem. It must be borne in mind however, that in the case of proposing a area traffic signal control system, it is indispensable to tackle the problem from a long-term standpoint in order to devised appropriate solution for the problems of the control scheme to be adopted, type of equipment to be introduced, etc.

(3) Road network plan

The road network plan, comprised within the master plan prepared in the form of an urban traffic plan, covers the following aspects.

① Functional classes of roads;
Major arterial roads, arterial roads, subsidiary arterial roads, etc.

② Classification of roads based on functional classes;
Freeways, national routes, municipal roads, etc.

③ Basic structure of roads

④ Proposed road network based on the aforesaid items

⑤ Estimation of the road construction cost

(4) Public transportation plan

The public transportation plan consists principally of the bus service. However, the possibility of introducing systems with larger capacity (trolley bus, monorail, tramway, etc.) will be examined for the arterial routes. Data referring to the forecast of public transportation demand obtained from the forecast of the overall transportation demand and results of allotment of traffic volume will be used in this part of the study.

This plan covers the following aspects.

① Bus transportation:

Reorganization of the route network

Operation system

Vehicles & maintenance

Tariff system

Form of operation of bus companies

Bus transportation policy

② Other transportation system (trolley bus, monorail, tramway, etc.)

Routes

Operation system

Vehicles

Tariff system

Form of operation of transportation companies

Possibility of introduction of the system

(5) Built-up area development plan

The future development course and development plans for the built-up area of Asuncion, including the existing central business district, will be examined in this part of the study. In this connection the relevant work will be carried out by adjusting the built-up area development plan with other related plans such as land use plan in the built-up area, traffic plan, plans of facilities of various kinds, redevelopment plans,

and by paying attention to the coordination with the higher hierarchy plans of various kinds and with the Government of Paraguay.

Particularly in connection with the central business district, the future form of the central business area will be proposed by defining clearly the future development course and the policy to induce the development, and by integrating the tramways, historical monuments and buildings, etc., in the most effective way.

The following aspects will be investigated in this part of the study.

① Coordination between the future development plan and the traffic system
② Coordination between the central area redevelopment plan and the future land use
③ Coversion of tramway routes into malls
④ Course of improvement of public facilties of various kinds

The built-up area development plan will be prepared on the basis of the results of the said studies. Perspective drawings and other illustration will be provided for the mall routes.

6) Plan for improvement of facilities

This plan consists principally of the plan for improvement of intersections and car parking plan. The contents of each plan are as follows.

Plan for improvement of intersections:

- Identification of the points at issue from the analysis of the intersections
- Draft of the plan for improvement of intersections

Attention should be paid to the following points in this part of the study.

- Degree of saturation of the traffic flow as things now stand
- Restriction imposed by the land use in peripheral areas
- Characteristics and landscape of the routes
- Topographical conditions

Car parking plan:

- Identification of the points at issue from the fact-finding analysis of the car parkings
- Car parking demand
- Supply of car parking (future land use plan, central area redevelopment plan)
- Improvement of car parkings
- Car parking plan

Attention should be paid to the following points in this part of the study.

- Legislation referring to the construction of car parking
- Attitude of the people to car parking control
- Influence on other means of transportation (bus, tramway)
- Restrictions related to the land use

3-5 Evaluation of the project and preparation of the improvement program

Generally speaking, there are two distinct yeardsticks to evaluate the project.

(1) Measurement of the benefits brought about by the project

(2) Measurement of the losses that would occur as a result of elimination of implementation of the project in the form of benefits. (Refer to Figure 3-13)

The latter yardstick is adopted in this case, by assuming that the master plan is practicable.

However, it must be borne in mind that this evaluation system has its shortcomings, i.e., a distinct evaluation may result when it becomes necessary to calculate the extent of improvement after the implementation of some specific projects (e.g. evaluation in the F/S), and as a

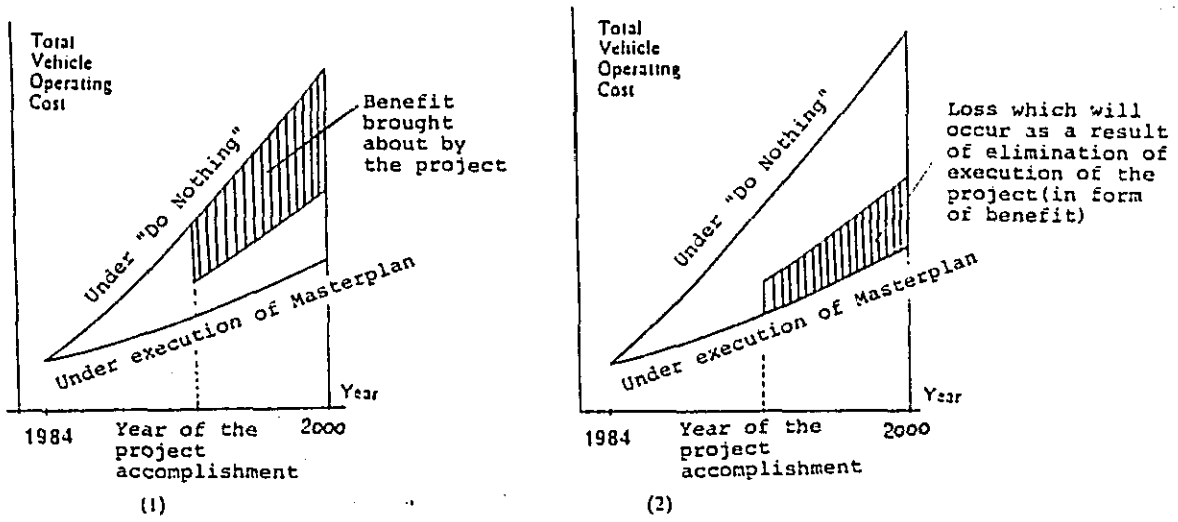


Figure 3-13 ECONOMIC BENEFIT OF THE MASTERPLAN AND A PROJECT

consequence not only the coordination of the project in question with the master plan, but also the very accuracy of the survey technique may be questioned. Therefore, in the case of occurrence of a project expected to be evaluated by means of the method (1), partway along the master plan preparation work, the benefits of the projects in question should be calculated by using the method (1) as well, and the results of the calculation and the distinct philosophies of the methods of calculation should be mentioned clearly in order to avoid confusion.

In this part of the work the project will be developed in correspondence to each year of the implementation period, but in the program it will be indicated in more round form. In other words, the program will be divided in initial stage up to 1990, middle stage from 1991 to 1995 and final stage from 1996 to 2000, with indication of the projects to be implemented in each stage.

4. Report

The contents of the reports to be presented during the survey period are as follows.

Report	Contents	Date of presentation
1. Inception Report	. Policy and contents of investigation . Implementation schedule	August 1984
2. Progress Report (I)	. Traffic fact-finding . surveys of various kinds . General data collection	December 1984
3. Progress Report (II)	. Analysis of the current situation of the traffic . Socio-economic analysis . Current state of land use . Future land use concept . Future framework . Forecast of demand	March 1985
4. Progress Report (III)	. Future land use plan . Forecast of demand . Survey and analysis of the use of electricity . Alternatives of short-term and long-term plan . Draft of the traffic management plan	October 1985

Report	Contents	Date of presentation
	. Draft of road network plan . Draft of public transportation plan . Draft of street plan . Draft of built-up area development plan	
5. Interim Report	. Evaluation of alternatives . Evaluation of the project . Preparation of the master plan . Improvement program	February 1986
6. Draft Final Report	1. Analysis of the present conditions . Socio-economic aspects . Road facilities . Volume of traffic in roads . Characteristic of the roads . Public transportation . Traffic supervision 2. Future forecast and planning . Land use plan . Demand of traffic . Traffic supervision plan . Alternative of road plans . Master plan for roads . Alternatives for public transportation plan	May 1986
7. Final Report		July 1986

Report	Contents	Date of presentation
	. Master plan for public transportation . Economic and financial evaluation . Plan for implementation of the project . Organization	

5. Study Organization and Schedule

5-1 Study Organizaion

The study organization is shown in Figure 5-1. The list of members of the JICA survey mission is shown in Table 5-1.

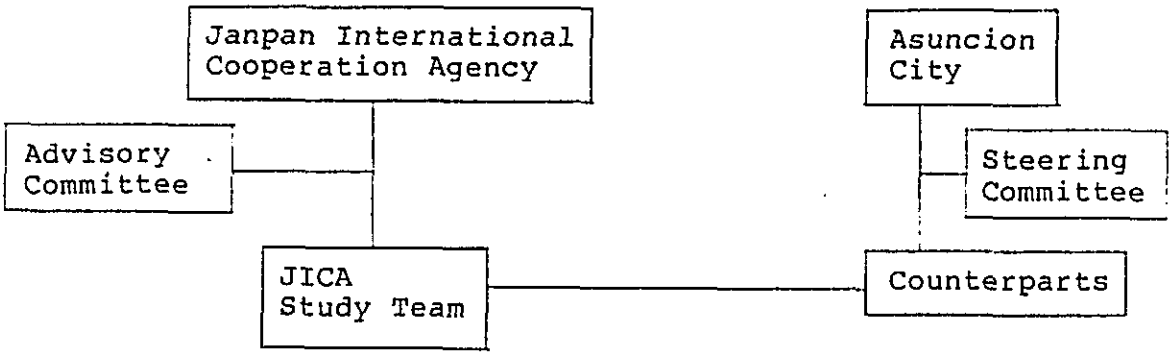


Fig. 5-1 Study Organization

Member of Advisory Committee

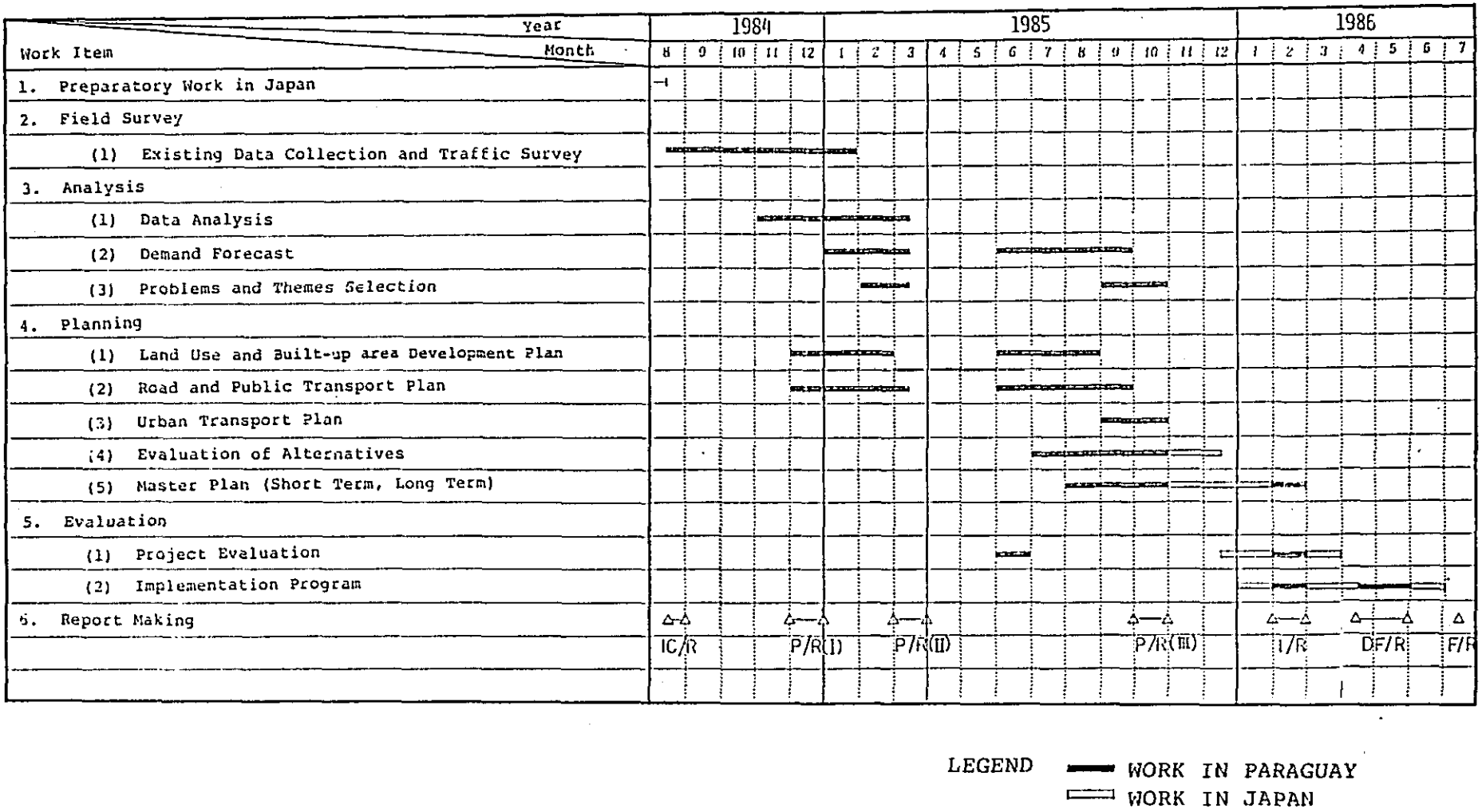
- Team Leader	Ph.D.	Takashi Inoue
- Urban Regional Planning		Takayoshi Hotta
- Transportation Planning		Hiroshi Yamano
- Pablic Transportation		Kazuyoshi Matsumoto
- Transportation Facirities		Yoshitaka Taura

Member of Study Team	Name	
Urban Transport Project Team		
Team Leader	Jyuro Kodera	(Ph.D)
Land Use Planning	Iwane Mizuno	(M.S.)
City Planning	Ryuzo Hasegawa	(M.A.)
Transportation Planning	Shigeru Okutsu	(B.S.)
Traffic Management	Kimio Kaneko	(B.S.)
Traffic Analysis (Coordination)	Mamoru Shibata	(B.S.)
Traffic Survey	Shigeru Yoshijima	(B.S.)
Transportation Demand Forecast	Takeshi Yoshida	(B.S.)
Road Planning	Tetsuo Kawamura	(B.S.)
Road Planning	Kazuhiro Fujita	(B.S.)
Public Transport (Duputy Team Leader)	Hajime Tanaka	(M.S.)
Public Transport	Toshiaki Horii	(B.S.)
Project Evaluation	Tetsuo Wakui	(M.S.)
System Analysis	Yoshio Yoshida	(B.S.)
Mapping Project Team		
Team Reader	Keikichi Yosida	(B.S.)
Survey	Chifuyu Horiuchi	(B.S.)
Survey	Tatsunobu Miura	(B.S.)
Survey	Masayuki Senzaki	(B.S.)
Survey	Eiji Tanaka	(B.S.)
Survey	Yutaka Suzuki	(B.S.)
Survey	Shuzo Sekiguchi	(B.S.)

5-2 Work plan

The work plan is shown in Table 5-2, Table 5-3.

Figure 5-2 Work Schedule



	Description of Activities	Month / Quarity	1984						1985	
			7	8	9	10	11	12	1	2
1	Photograph Processing									
2	Control Station Surveying	113 km								
3	Levelling	107 km								
4	Classification	120 km^2								
5	Aerial Triangulation (in Japan)	124 Model								
6	Topographic Mapping (in Japan)	120 km^2								
7	Quality Check (in Japan)	Final Result								

LEGEND
Work in Paraguay
Work in Japan

Figure 5-3 SCHEDULE (Mapping)

Appendix :

Scope of Works

SCOPE OF WORK

FOR

THE URBAN TRANSPORT STUDY

IN ASUNCION METROPOLITAN AREA

OF THE REPUBLIC OF PARAGUAY

AGREED UPON BETWEEN

MUNICIPALIDAD DE LA CIUDAD DE ASUNCION

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Asuncion, March 14, 1984

.....

Prof. TAKASHI INOUE

Leader of the Preliminary Survey Team

Japan International Cooperation Agency

.....

PORFIRIO PEREIRA RUIZ DIAZ
Gral. de Brigada

Municipalidad de la Ciudad de Asuncion

I. INTRODUCTION

In response to the request of the request of the Government of the Republic of Paraguay (hereinafter referred to as "Paraguay"), the Government of Japan decided to implement The Urban Transport Study in Asuncion Metropolitan Area of the Republic of Paraguay (hereinafter referred to as "the study"), within the general framework of technical cooperation between Japan and Paraguay, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of Paraguay.

The Japan International Cooperation Agency (hereinafter referred to as "JICA") the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in accordance with the relevant laws and regulations in force in Japan in close cooperation with the authorities of Paraguay.

The Municipalidad de la Ciudad de Asuncion (hereinafter referred to as "M.C.A.") shall act as counterpart body to the Japanese study team and also as coordinating body to other relevant organization to reach the conclusion of the Study.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to formulate a masterplan on the urban transport system in Asuncion Metropolitan Area.

In the masterplan, the use of the hydroelectric energy to the public transportation system will be considered.

III. SCOPE OF THE STUDY

1. Study Area

The Study area covers the urbanized and to be urbanized area in Asuncion Metropolitan Area, which includes: Asuncion, Lambare, Luque, San Lorenzo, Mariano Roque Alonso, Fernando de la Mora, Villa Elisa, Nemby, Limpio, San Antonio, and Villa Hayes(Urban Zone).

2. Target Year

The target year of the long term plan is the year 2000. In addition, the short term programs e also to be formulated for the urgent countermeasures for the year 1990.

3. Main items of the study

3-1 Review of existing reports

3-2 Review of land use plan

3-3 Review of electric power distribution plan of the study area

3-4 Data collection and analysis on the socio-economic aspects of the study area (Analysis of trend and forecast)

1) Population
2) Commerce and industries
3) Number of cars registered
4) Other socio-economic factors

3-5 Data collection and analysis on urban transport

1) Person trip survey
2) Traffic survey
3) Urban transport facilities survey
4) General review of existing public transport system
5) Transportation industry
6) Fuel and electric power consumption

3-6 Identification of problems

3-7 Preparation of alternatives

1) Long term plan
   (a) Road network
   (b) Public transport system and facilities
   (c) Traffic control and management
2) Short term programs

   The urgent improvement projects will be studied among the following aspects, such as main crossings, traffic and parking control of congestion area, parking spacies, etc.

3-8 Formulation of optimum projects, in the view of economic and technical aspects.

3-9 Project evaluation

1) Technical evaluation
2) Economic-financial evaluation
3) Social environment evaluation
4) Screening of recommendable projects

3-10 Implementation schedule

IV. STUDY SCHEDULE

The whole work will be conducted in accordance with the attached tentative study schedule.

V. REPORTS

JICA will prepare and submit the following reports in English to the Government of Paraguay at each time of the tentative study schedule.

1.	Inception Report	30 copies
2.	Progress Report (I)	30 copies
3.	Progress Report (II)	30 copies
4.	Progress Report (III)	30 copies
5.	Interim Report	30 copies
6.	Draft Final Report	30 copies
7.	Final Report	50 copies

VI. UNDERTAKING OF THE GOVERNMENT OF PARAGUAY

1. In accordance with the Article II, stipulated in the Agreement on Technical cooperation between the Government of Japan and the Government of Paraguay, the Government of Paraguay shall accord benefits to the Japanese study team and, through the authorities concerned, take necessary measures to facilitate the conclusion of the Study.

2. M.C.A. shall make necessary arrangements (take necessary measures) with the cooperation of other relevant organization for the followings:

   (1) to secure the safety of the Study team,

   (2) to permit the members of the Japanese study team to enter, leave and sojourn in Paraguay for the duration of their assignment therein, and exempt them from alien registration requirements (and consular fees).

   (3) to exempt the members of the Japanese study team from taxes, duties and other charges on equipment, machinery and other charges on equipment, machinery and other materials brought into Paraguay for the implementation of the Study.

   (4) to exempt the members of the Japanese study team from income tax and other charges of any kind imposed on or in connection with any emolument or allowance paid to the members of the Japanese study team for their services in connection with the implementation of the Study.

   (5) to provide medical services as needed. Its expenses will be chargeable on the member of the Japanese study team.

   (6) to secure permission to take all data and documents (including photographs) related to the Study out of Paraguay to Japan by the Study team.

3. M.C.A. shall, at its own expense, provide the Japanese study team with the followings, in cooperation with other relevant organizations;

   (1) available data and information related to the Study,

   (2) counterpart personnel,

   (3) suitable office space with necessary equipment in Asuncion,

   (4) credentials or identification cards,

   (5) necessary number of Jeeps or Pick-Ups with drivers for the team to carry out the field survey,

   (6) interpreters, typists and laboures necessary for the conduct of the Study.

4. The Government of Paraguay shall bear claims, if any arises against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese Study team.

VII. UNDERTAKINGS OF THE GOVERNMENT OF JAPAN

For the implementation of the Study, JICA shall, in accordance with the relevant laws and regulations in force in Japan, take the following measures:

1. to dispatch, at its own expense, study teams to Paraguay.
2. to perform technology transfer to the Paraguay counterpart personnel in the course of the Study.

VIII. JICA and M.C.A. will consult with each other in respect of any matter that may arise from or in connection with the Study.

TENTATIVE STUDY SCHEDULE

Report \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Inception Report	▲																								
Progress Report (I)					▲																				
Progress Report (II)										▲															
Progress Report (III)															▲										
Interint Report																			▲						
Draft Final Report																						▲			
Final Report																								▲	