

*JAPAN INTERNATIONAL COOPERATION AGENCY
MUNICIPALITY OF ASUNCION, REPUBLIC OF PARAGUAY*

*AFTERCARE STUDY
ON URBAN TRANSPORTATION PLANNING
IN ASUNCION METROPOLITAN AREA*

FINAL REPORT

October 1999

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(April, 1999)

Preface

In response to a request from the Government of the Republic of Paraguay, the Government of Japan decided to conduct the Aftercare Study on Urban Transportation Planning in Asunción Metropolitan Area and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yoshinori Tanaka of Yachiyo Engineering Co., Ltd., to Paraguay, two times between August 1998 and August 1999. In addition, JICA set up an advisory committee headed by Dr. Hisao Uchiyama, Professor of Science University of Tokyo between August 1998 and August 1999, which examined the study from specialist and technical points of view.

The Team held discussions with the officials concerned of the Government of Paraguay, and conducted a field survey at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

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

October, 1999



Kimio Fujita

President
Japan International Cooperation Agency

Letter of Transmittal

October, 1999

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 Aftercare Study on Urban Transportation Planning in Asunción Metropolitan Area.

A study team, which consists of Yachiyo Engineering Co., Ltd. and Central Consultant Inc. and headed by myself, conducted field surveys, data analysis and planning works of feasibility study in Asunción based on the terms of references instructed by the Japan International Cooperation Agency (JICA) from August, 1998 to August, 1999.

The study team held thorough discussions and investigations with officials concerned of the Government of Paraguay, accordingly, various traffic surveys, present condition analysis, preliminary engineering design, conduct of environmental impact assessment, preparation of implementation program and project evaluation. The results were collected in the final reports, main and summary reports.

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

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 Paraguay 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.

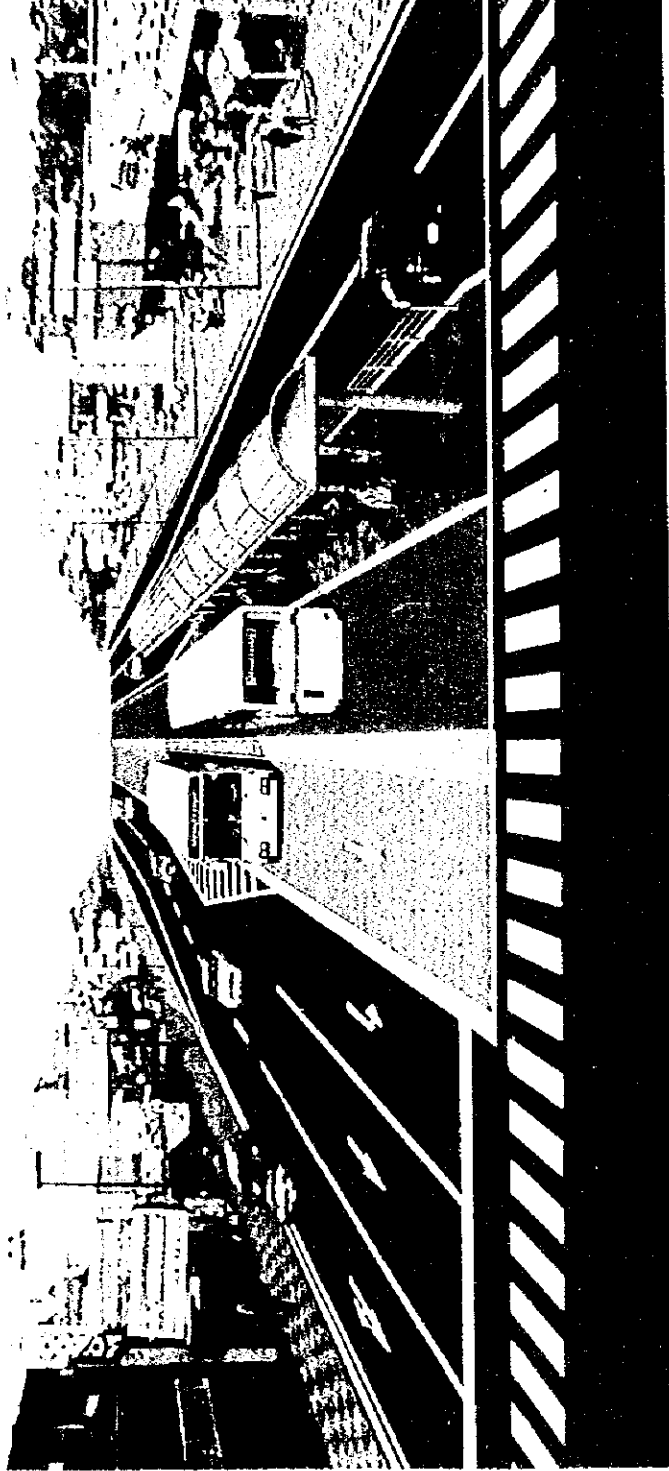
Yours Faithfully,



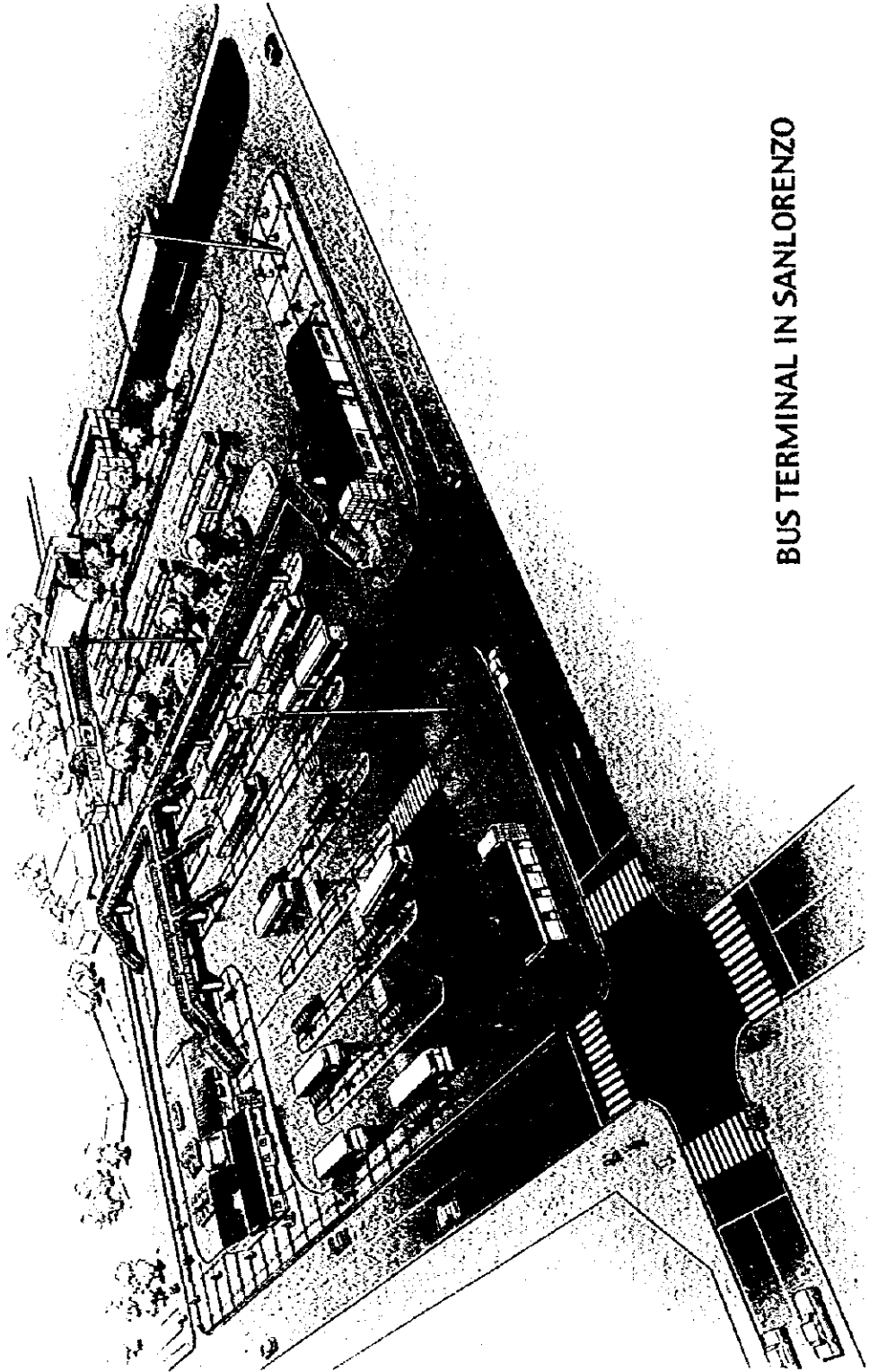
Yoshinori Tanaka

Team Leader

The Aftercare Study on Urban
Transportation Planning
in Asunción Metropolitan Area in the
Republic of Paraguay



AVDA. EUSEBIO AYALA
TYPICAL CROSS SECTION WITH INTERSECTION



BUS TERMINAL IN SAN LORENZO

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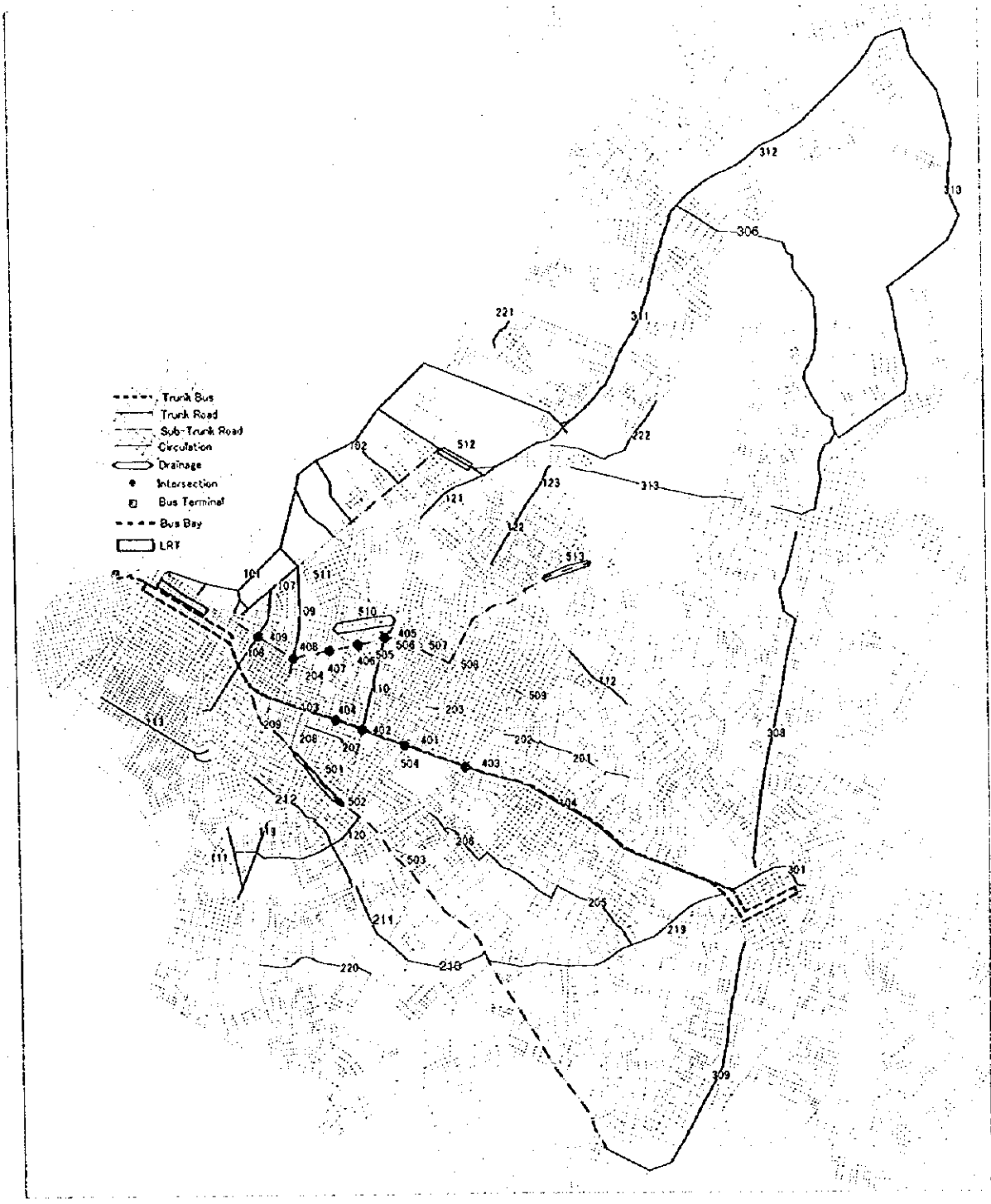
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LOCATION OF THE PROPOSED PROJECTS



LIST OF THE PROPOSED PROJECTS

	Number	Name	Lanes	Length	Cost (1000US\$)		
					-2005	-2015	Total
Av. E. Ayala	103	Av. Eusebio Ayala (General Aquino-Calle Ultima)	Widening	6	6.45	31,683	31,683
	104	Av. Eusebio Ayala (Calle Ultima-San Lorenzo)	Widening	6	4.54	24,793	24,793
Public Transportation	111	Av. J. F. Bogado (Tro. de Marzo)	Widening	4	1.65		2,353
	113	Av. Itá Ybaté	Pavement	4	3.22	2,613	2,613
From the South	101	Northern Esplanade	Detour	6	4.88		20,000
	102	Northern Esplanade	Detour	4	16.32		40,000
	107	Av. Artigas	Widening	4	1.68		2,396
	121	Gral. Rafael Franco	Widening	4	2.04	3,970	3,970
	122	Julio Corría	Widening	4	1.61	3,376	3,376
	123	Tte 2do M. Pino Gonzalez	Widening	4	0.99	2,076	2,076
From the North	112	Av. Sta. Teresa	Widening	4	1.75		2,496
	108	Av. Perú	Widening	4	3.28		4,677
From the East	109	Av. Gral Santos	Widening	4	2.41	5,002	5,002
	110	Av. Chof. del Chaco	Widening	4	2.09	3,656	3,656
	119	Av. Bruno Guggiari	Widening	4	1.62		2,310
	120	Rca. Argentina	Widening	4	3.22		4,592
	201	Las Residentas	Pavement	2	1.59		472
Circulation Road	202	Avelino Martínez	Pavement	2	1.11		330
	203	Sub-Trunk Road	Pavement	2	0.27		80
	204	Sub-Trunk Road	Connection	2	0.14		335
	205	Avelino Martínez - Calle Ultima	Pavement	2	5.05		1,500
	206	Calle Ultima - De la Victoria	Pavement	2	1.11		330
	207	Sub-Trunk Road	Pavement	2	0.77		229
	208	Sub-Trunk Road	Pavement	2	0.55		163
	209	Sub-Trunk Road	Pavement	2	0.09		27
	210	Fdo de la Mora - Av. Def del Chaco	Connection	2	2.44		5,836
	211	Sub-Trunk Road	Pavement	2	1.44		538
	212	Defensores del Chaco	Pavement	2	3.70		1,099
	219	Avelino Martínez	Pavement	2	5.71		1,696
	220	Av. San Isidro	Pavement	2	2.68		796
	221	Esplanade of Fatima	Pavement	2	0.77		229
	222	Av. 3 de Defebrero	Pavement	2	3.06		909
Widening of the Arteries	301	Ruta 2 (San Lorenzo)	Detour	4	2.66		9,418
	302	Road 1 (San Lorenzo)	Detour	4	8.62		29,644
	306	M. R. Alonzo - Luque	Detour	4	7.47		25,689
	308	Luque-San Lorenzo	Widening	4	7.79		11,109
	309	San Lorenzo - Nemby	Widening	4	6.84		9,754
	310	Luque-Limpio	Widening	4	10.98		15,657
	311	Ruta Trans Chaco	Widening	6	7.45		14,647
	312	Ruta 3 (Limpio-M. R. Alonzo)	Widening	4	6.54		9,326
	313	Autopista Desvío (Luque-Mme Lynch)	Detour	4	5.43		18,674
	Connection of the Cities	701	Signal Control System				2,497
702		Road and Traffic Signs				206	206
703		LRT in Micro-Centro	Renewal				11,340
704		Parking Restriction					11,340
Traffic Control	401	Av. Eusebio Ayala / Av. Rca. Argentina		6x4(2)		2,729	2,729
	402	Av. Eusebio Ayala / Av. Chof. del Chaco		6x4(2)		2,531	2,531
	403	Av. Eusebio Ayala / De La Victoria		6x4(2)		2,167	2,167
	404	Av. Eusebio Ayala / Kubitscheck		6x4(2)		2,921	2,921
	405	Av. Mcal. López / Av. Chef. del Chaco		4x4		71	71
	406	Av. Mcal. López / Venezuela		4x2			71
	407	Av. Mcal. López / Av. Kubitscheck		4x4			71
	408	Av. Mcal. López / Av. Gral. Santos		4x4		71	71
409	Av. Mcal. López / Av. Perú		4x4			71	
Intersection	501	Av. Fdo. de la Mora / Bartolomé de las Casas		4x2			18
	502	Av. Fdo. de la Mora / From Kubitscheck to Gral. Santos		4			18
	503	Av. Fdo. de la Mora / San Martín		4x4			18
	504	Av. Eusebio Ayala (General Aquino - San Lorenzo)		6	10.99	11,548	11,548
	505	Av. Mcal. López / Sta. Rosa		4x2		1,338	1,338
	506	Av. Mcal. López / Av. Chof. Del Chaco		4x4		1,337	1,337
	507	Av. Mcal. López / Gral. Garay		4x2		716	716
	508	Av. Mcal. López / Av. San Martín		4x4		2,130	2,130
	509	Av. Mcal. López / Bernardino Caballero		4x2		3,328	3,328
	510	Av. España / From Kubitscheck to Sacramento		2(4)			18
	511	Av. Artigas / Av. Gral. Santos		4x4			18
	512	1er. Presidente / From Artigas to Transchaco		4			18
	513	Av. Aviadores del Chaco		4			18
	Drainage	601	Bus Bay / Av. Artigas				
602		Bus Bay / Av. Mcal. López					564
603		Bus Bay / Av. Fdo. De la Mora					828
604		Bus Terminal / San Lorenzo				4,421	4,421
605		Bus Terminal / Centro				1,665	1,665
606		Parking for Trunk Bus				766	766
Transport Facility						117,611	251,116
							368,727

1. Background and Objectives of the Study

In order to recommend policy measures to the urban transport problems in the Asunción metropolitan area, the Japan International Cooperation Agency (hereinafter referred to as "JICA") conducted a master plan study in 1986 and a feasibility study in 1988 based on a predicted socioeconomic framework of year 2000. By now, however, they are already incongruent with the current socioeconomic conditions because the population in 1998 surpassed the figure projected for 2000 in the Master Plan, and there was an unpredicted trend of urbanization in suburban areas.

Purposes of the Study are as follows.

- 1) To revise, with 2015 as a new target year, the "Urban Transportation Master Plan in the Asunción Metropolitan Area (CETA 84)" completed in 1986 by the JICA.
- 2) To formulate short-term development plans up to the year 2005 and select high-priority projects.
- 3) To conduct feasibility studies for the high-priority projects.
- 4) To transfer technology to the counterpart team during the course of the Study.

The study area covers the Municipality of Asunción and its metropolitan area including Fernando de la Mora, Lambaré, Luque, Limpio, Mario Roque Alonso, Nemby, San Antonio, San Lorenzo, Villa Elisa, Villa Hayes. It is the same as the study area of CETA 84.

2. Project and its Recommendations

(1) Public Transport Plan

Up to the target year of 2015, the public transport plan proposes the use of buses as the most important policy measure. During this time, it is one of the most critical issues of this Study how to promote conversion from private to public transport. In doing so, a trunk bus system will be introduced to Av. Ayala, which has the highest concentration of bus lines, in order to improve the operating speed and comfort of riding. Moreover, the existing bus routes will be restructured to improve the efficiency of bus transport. Considering that air conditioning, in-bus congestion, and cleanliness are very influential to mode choice, the plan also proposes measures to encourage renovation of bus vehicles, such as an inspection system, the provision of common workshops, and so forth.

(2) Road Network Plan

This Plan proposes measures to resolve bottlenecks that exist in the current road network, the improvement of drainage facilities and intersections, and the promotion of asphalt pavement.

(3) Traffic Management Plan

It makes proposals for improving the system of traffic signals and revision of the parking fare policy in Micro Centro. These projects are not very costly but effective. In particular, the parking fare policy should be accompanied with the trunk bus system to realize a public transport priority policy in the metropolitan area.

(4) Summary of the Master Plan

A comparative evaluation of the two alternatives, public transport priority and auto priority, has been conducted to select a preferred option for the urban transport master plan in the Asunción metropolitan area. In terms of investment efficiency, resultant urban structure brought about in future, and future traffic, the alternative for public transport has been found to be the better choice. The Master Plan has been formulated, placing public transport at its center, and the total project cost amounts to US\$369 million.

(5) Evaluation of the Master Plan

The economic internal rate of return is calculated to be 29.4%, derived from the estimation of costs of implementing these projects and benefits from savings of travel time and vehicle operating costs, which are, respectively, estimated for each year during the project period. From the perspective of the national economy, therefore, the projects are proved to be economically feasible.

3. Priority Projects

Priority projects have been selected for their importance in promoting the use of public transport in the metropolitan area, and the selection criteria include effects, implementability, and environmental friendliness. The following describes the priority projects.

(1) Trunk Bus Project

Under the conditions of the future transport network of 2015, the introduction of a trunk bus system is proposed as an emergency project in the section on Av. Ayala and Mcal. Estigarribia widened into six lanes with the width of 35.0m.

- Vehicle: two-section, four-door bus with the capacity of 160 passengers
- Vehicle structure: 18m in length, 3.1m in height, and 2.5m in width
- Exclusive lane: two lanes on each side of the median strip on Av. Ayala and Mcal Estigarribia with the width of 3.5m each.
- Bus terminal: one in San Lorenzo and Micro Centro, respectively

(2) Operation of the Trunk Bus Project

- The project period spans 20 years from 2000 to 2020. Operation starts in 2005.
- 49 two-section trunk buses (10 years of lifetime)
- 311 feeder buses (10 years of lifetime)
- Total annual running distance: 6.9 million km for the trunk bus and 29.3 million km for the feeder.
- Users of the trunk bus: 220,000 passengers per day (in 2005)
- Operating organization: an integrated body of the existing private bus companies (or cooperative)

(3) Financial Conditions of the Trunk Bus

Financial analysis of the trunk bus project is conducted with assumptions that the capital is 10% of the total construction cost, the interest rate of long-term borrowings at 8%, the trunk bus fare at Gs. 1,000, and the fare of the feeder only at Gs. 850. Operation of the trunk bus only will produce a surplus from the first year of the operation, but the feeder bus only will never produce any profits before 2020. If the two projects are combined, the operation will

yield some surplus in 2018, or 14 years after the launch of the project. The financial internal rate of return for this case is 7.9%.

(4) Project of Widening Av. E. Ayala

Av. E. Ayala will be installed with exclusive lanes for the trunk bus in order to maintain a smooth operation of the new bus system between Micro Centro and San Lorenzo. This "Project of Widening Av. E. Ayala" is described below.

- Widening of Av. E. Ayala and Mcal Estigarribia into six-lanes roads
- Installation of exclusive lanes for the trunk bus
- Improvement of major intersections for the smooth operation of the trunk bus
- Construction of four flyovers at intersections with major trunk roads
- Improvement of drainage facilities

(5) Improvement Plan of Other Roads

Improvement plans of roads other than Av. E. Ayala are described below.

- Plan of widening four major trunk roads
- Plan of improving intersections with major trunk roads which currently pose as bottlenecks
- Plan of road drainage
- Plan of pavement improvement

(6) Traffic Management Plan Project

The Plan will propose an improvement of the traffic signal system through the central control and an introduction of a new parking fee policy in Micro Centro in order to encourage conversion from private to public transport.

(7) Project Cost

(Unit: US\$1,000s)

Project	Construction	Land Acquisition	Total
Widening of Ayala	68,174	10,198	78,372
San Lorenzo Bus Terminal	3,156	1,265	4,421
Centro Bus Terminal	942	723	1,665
Trunk Bus Parking Facilities	211	555	766
Widening of Other Trunk Roads	13,199	5,023	18,222
Road Drainage	8,849	-	8,849
Pavement Improvement	2,613	-	2,613
Traffic Management Projects	2,703	-	2,703
Total	99,847	17,764	117,611

(8) Evaluation of the Priority Projects

Project	EIRR	NPV (US\$1,000s)	B/C
Project Total	29.3	157,949	2.38
Trunk Bus Project on Av. Ayala	42.3	558,767	8.36
Road Improvement from the North	63.1	93,317	11.72
Circulation Road Improvement in Asunción	49.7	48,338	7.04
Pavement Projects	40.6	10,864	4.76

(9) Environmental Impact Assessment

Compared to the case without the project implementation, the project will bring about the reduction in the total running distance of automobiles and total travel time. This further contributes to the reduction in adverse environmental impacts of automobiles, such as air pollution and noise. On the other hand, it will produce some resettlement.

At the intersection of Av. E. Ayala and Chf. del Chaco, the value of NO_x will decrease from 0.11ppm to 0.06ppm in 2015 with the implementation of the project. Similarly, the noise level (Leq) will be reduced from 82.2 to 81.1. On the other hand, according to the results of the social survey, many samples of the households along Av. E. Ayala agree with the widening project, but they are very reluctant about resettlement, which suggests the importance of paying a close attention in formulating a resettlement plan.

4. Conclusions and Recommendations**(1) Need for Public Transport Priority Policy**

During the 14 years after CETA84, the population concentration in the metropolitan area has increased more rapidly than projected, and low-density urban sprawl has taken place. Population has been growing in suburban cities more rapidly than in Asunción. This phenomenon seems to have a correlation with the recent trend of rapid motorization where shares of transport modes of the residents have changed, and the use of private modes surged from 39% in 1984 to 50% in 1998. If this tendency is left untouched, urban sprawl continues, and the metropolitan area accelerates its dependence on private vehicles. It is evident that trunk roads and Centro will be even more congested, and that environmental deterioration will further progress.

Without policies that limit the use of private vehicles and prioritize public transport, travel speed of vehicles on trunk roads will be as slow as walking during peak hours in 2015, which inhibits efficient urban activities. Therefore, it is imperative to make a decision on these transport policies now.

(2) Implementation of Master Plan

One of the reasons for rapid motorization in the metropolitan area is that political and economic problems in Paraguay since 1989 impeded the implementation of major projects proposed in the 1984 Master Plan. The Master Plan of this Study emphasizes priority policies for public transport and proposes important programs and projects that will determine the destiny of the metropolitan area. They are worth implementing because not only will they produce significant economic impact on the area but bring about positive social impact such

as the prevention of environmental degradation. Accordingly, it is strongly recommended that this Master Plan be adopted as a guideline, and that its proposed projects be carried out as scheduled.

(3) Early Implementation of Trunk Bus Project

The trunk bus project on Av. E. Ayala is the most important among the priority projects and should be executed promptly to show that the city is striving for public transport priority policies. Since the execution requires, among other things, to secure funding sources, revise institutions, and acquire right-of-ways, as described later, the decision needs to be made first now. In addition, it is necessary for the public sector and bus operators together to establish a commission or task force to examine the introduction of the trunk bus project on Av. E. Ayala and examine various measures to actually implement the project.

(4) Provision of Infrastructure Supporting Trunk Bus Project

For the trunk bus project to be successful, it is indispensable to carry out required works on Av. E. Ayala, such as widening and construction of viaducts. In the meantime, however, as measures to support public transport priority policies and manage road traffic in an orderly fashion, it is necessary to carry out other priority projects such as installing a centralized traffic signal control system.

(5) Traffic Demand Management

It is possible to impose restrictions on the use of vehicles, especially in particular districts, as they are carried out in Europe. In Micro Centro of Asunción, parking fees and fines for illegal parking should be raised by substantial amounts. Traffic control measures should be carried out with clear and specific purposes and strong determination and, if necessary, modified through many trials. It is recommended that stricter restrictions on vehicles driving into Centro, such as area pricing, be introduced eventually.

(6) Funding Sources

With the scale of municipal budgets in the metropolitan area, it is difficult to implement large-scale transport infrastructure projects. Each city, therefore, needs to secure its own fund from such sources as an increase in inspection fees by strengthening the inspection system and a raise in parking fees in order to provide transport facilities. In order to collect enough funds in a short period of time, it is also necessary to obtain grants and loans from international and bilateral assistance organizations that impose low interest rates. This requires the central government to promote this scheme and guarantee the repayment of loans. Furthermore, some projects need to consider private financing schemes such as BOT and PFI.

(7) Institutional Reform

The introduction of the trunk bus system requires revisions of the existing institutions, such as relevant laws and organizations. First, it is necessary to establish an organization that plans, promotes, regulates, and oversees projects. The surface transportation act currently under discussion in the parliament needs to be passed soon to promote this institutional reform. This act is aimed at establishing a committee that consists of MOPC, municipalities, and private enterprises to resolve various problems associated with bus transport from a comprehensive

point of view. It also attempts to consolidate authorities to give permissions for bus operation, which are currently held separately by MOPC and the municipalities. The committee needs to clarify roles of the public and private sectors, respectively, and propose institutional reforms to secure funding sources. Finally, it is necessary to establish an organization that can plan, implement, and monitor urban transportation, including private transport, in the metropolitan area from a comprehensive standpoint and at the same time provide education and training on transport.

(8) Understanding and Cooperation of Citizens

Restructuring of the bus lines and a new ticket system introduced along the new trunk bus system will cause some confusion and questions among citizens. It is necessary, if such things occur, to help them understand that the benefits of the project and ask for their cooperation. Deeper understandings among citizens requires periodic disclosure of information and public hearings where they can express their opinions.

(9) Further Study

CETA98 has examined how the future urban transport system should be in the Asunción metropolitan area. It has also proposed an urban transport master plan for the target year of 2015 and priority projects necessary to be implemented before 2005. The implementation of the priority projects requires further considerations. They include:

- 1) Establishment of an operating body of the trunk bus and restructuring of bus lines
- 2) Bus ticket systems in the metropolitan area
- 3) Methods of securing funding sources
- 4) Establishment, form, and authority of an organization that deals with urban transport problems
- 5) Concrete measures of traffic demand management

When the Paraguayan economy recovers from the current recession, the Franja Costera project may launch soon, and if so, further studies and planning are required on coastal roads.

Chapter 1 Introduction

1.1 Background of the Study

The Republic of Paraguay, a land locked country neighboring Brazil, Argentina, and Bolivia, has a total area of 406,752 Km² and a population of 4,955,000 in 1996. The country is administratively divided into 17 departments, and Asunción city, the capital of the country, is adjacent to the Central Department. The Department consists of 20 municipalities.

In August 1984, "the Urban Transport Study in Asunción Metropolitan Area", conducted by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), was started, and the final report was submitted to the Asunción Municipality in August 1986. Following the conclusion of the study, "the Feasibility Study on the Transportation Facilities Improvement Projects in the Asunción Metropolitan Area," also conducted by JICA, was started in September 1987 to study the detailed feasibility of (1) North – East corridor improvement including Av. R. Francia, the connecting viaduct between Av. R. Francia and Av. E. Ayala, Av. E. Ayala, and Av. Mcal. Estigarribia, (2) Av. Mme. Lynch improvement, (3) Av. España extension, (4) improvement of traffic flow in Micro Centro, and (5) establishment of a Bus Terminal under the connecting viaduct between Av. R. Francia and Av. E. Ayala. The study results were submitted to the Asunción Municipality in October 1988.

After these two studies, the policy of the Republic of Paraguay changed. After the subsequent restructuring period, some of the projects proposed in these studies were implemented by private funds. However, most of the projects to influence the traffic flow in the Asunción Metropolitan Area have not been implemented because of the lack of funding sources and others. In the meantime, the transport demand in the Metropolitan Area increased more rapidly than expected, and transportation problems became more serious. In view of this situation, Asunción Municipality requested JICA to up-date the data and information of the previous studies to establish a transportation improvement program for the Asunción Metropolitan Area.

1.2 Study Area

The study area covers the Municipality of Asunción and the surrounding nine cities, in the central department, of Fernando de la Mora, San Lorenzo, Luque, Mariano Roque Alonso, Limpio, Lambaré, Villa Elisa, Ñemby and San Antonio, and one city in the department of Presidente Hayes, Villa Hayes. The area is called the Asunción Metropolitan Area with an area of about 71,000 ha and population of 1,457,000 (1998) which is about 29% of the country (See Fig. 1-2-1).

1.3 Target Year of the Study

The target year of the master plan has been set at 2015, and that of the short-term development plans of the priority projects at 2005.

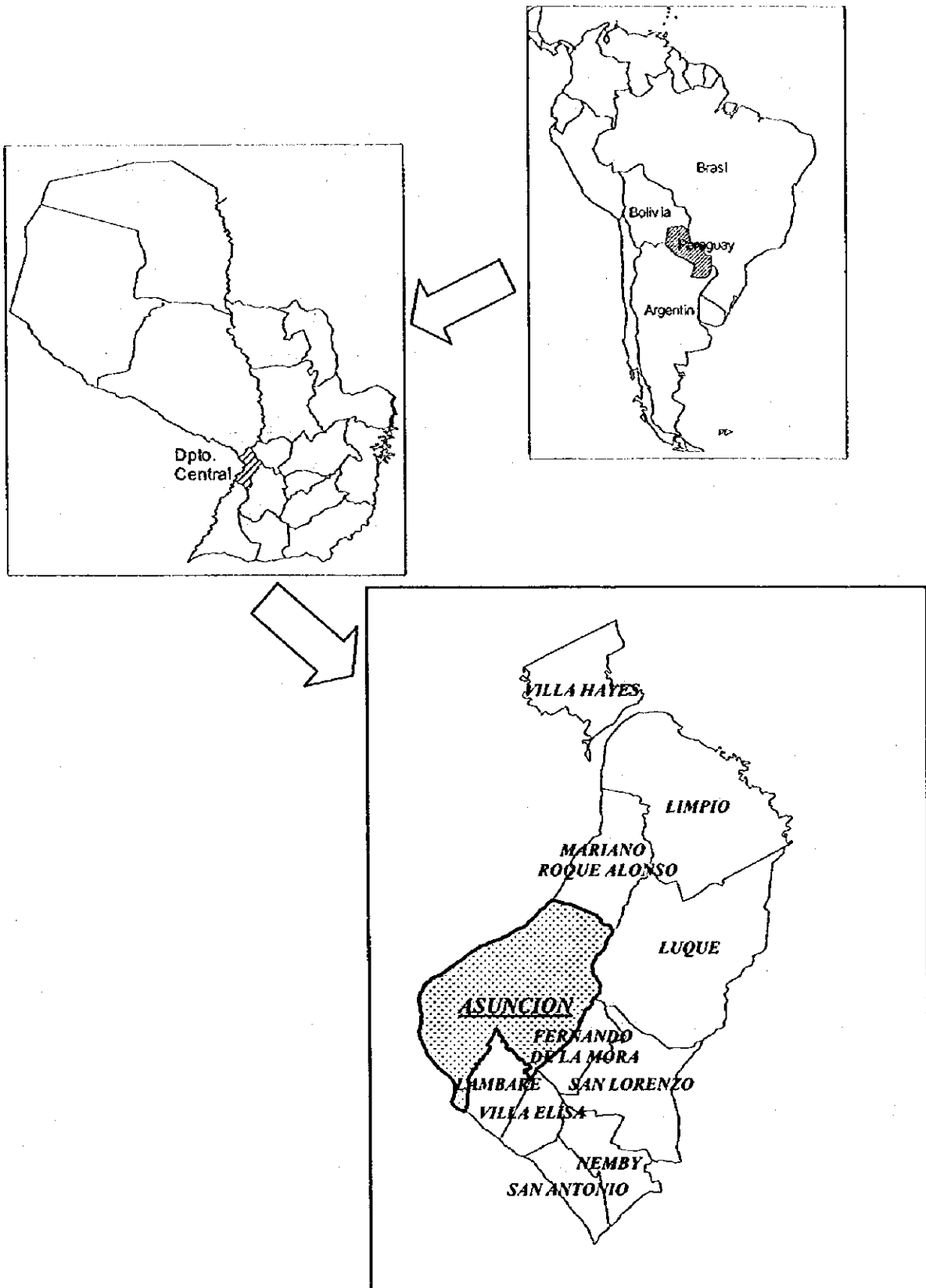


Fig. 1-2-1 Study Area

1.4 Structure of the Study

The Study is divided into three parts, current conditions, basic plan, and implementation plan.

The first part clearly identifies current conditions of the road network, transport facilities, and transportation management facilities in the Asunción metropolitan area. At the same time, it also conducts a detailed field study on conditions of bus operation and use, operating characteristics of bus companies, and others. In addition, it makes a comparison with the conditions predicted in the 1984 Master Plan and clarifies the differences between them and the current social and road traffic conditions.

Second, the basic plan forecasts the future socioeconomic framework and traffic demand, formulates plans for road network, public transportation, and traffic management, and finally conducts economic analysis of these plans. Consequently, priority projects targeting the year 2005 are selected, and their execution programs are formulated.

The third section conducts feasibility studies of the selected priority projects, including execution plans, design, cost estimates, environmental assessment, and economic and financial analysis, and then formulates a project implementation plan. Fig. 1-4-1 shows the study schedule.

Year	1998					1999									
	Aug	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Aug	Sep	Oct
Data Collection	■														
Field Survey		■		■											
Data Processing			■												
Formulation of Master Plan				■		■									
Feasibility Study of Priority Projects							■								
Report	Δ						Δ						Δ		Δ
	IC/R						IT/R						DF/R		F/R

Fig. 1-4-1 Study Schedule

The following reports were prepared and submitted to Paraguay.

- Inception Reports
Five (5) copies in English and thirty (30) copies in Spanish at the beginning of the Study in Paraguay.
- Progress Report
Five (5) copies in English and thirty (30) copies in Spanish within 5 months after the beginning of the Study.
- Interim Reports
Five (5) copies in English and thirty (30) copies in Spanish within 9 months after the beginning of the Study.
- Draft Final Report
Five (5) copies in English and thirty (30) copies in Spanish within 11 months after the beginning of the Study.
- Final Report
Five (5) copies in English and fifty (50) copies in Spanish within two (2) months after the receipt of the written comments in the Draft Final Report from Paraguay.

1.5 Study Organization

JICA has selected a joint consulting team of *Yachiyo Engineering Co., Ltd.* and *Central Consultant Inc.* to conduct “the Aftercare Study on Urban Transportation Planning in Asunción Metropolitan Area” (hereinafter referred to as “the Study”). The study team started the work in Paraguay in August 1998. JICA also convened a Japanese Advisory Committee in Japan to oversee the Study. The Government of the Republic of Paraguay designated the Municipality of Asunción as a counterpart and organized a steering committee chaired by Enrique J Marin Fernandez and a counterpart team under it. These organizations were requested to provide advice, judgment, and cooperation necessary to conduct the Study at administrative and technical levels. Fig. 1-5-1 shows the study organization.

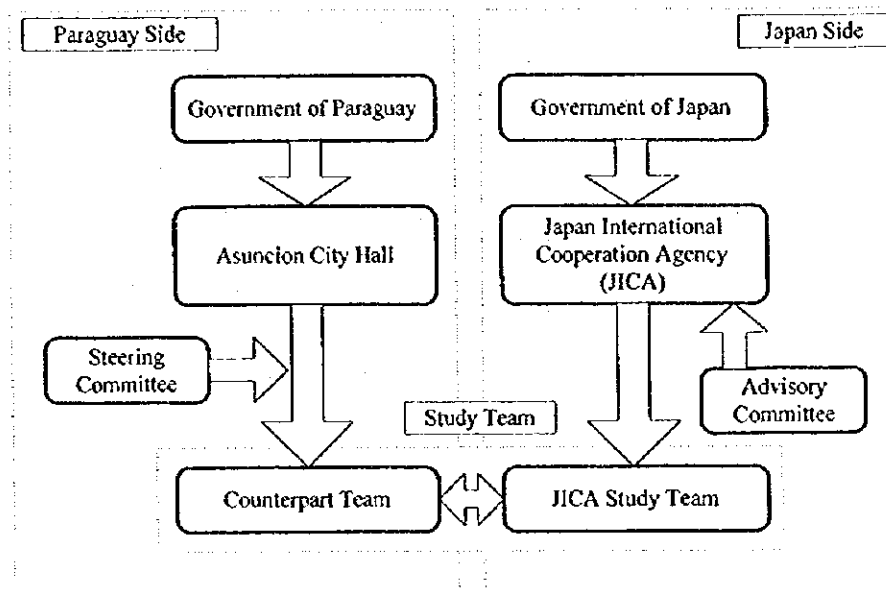


Fig. 1-5-1 Study Organization

Study Organization Members

(1) JICA Study Team

Mr. Yoshinori TANAKA
 Dr. Yoshiko RYU
 Mr. Toshiaki HORII

Mr. Takeharu KOBA
 Mr. Tetsuo KAWAMURA
 Mr. Yoshimasa ISHII
 Mr. Kazuhiro FUJITA
 Mr. Yoshitaka HIGUCHI
 Mr. Katsuyuki OHNO

Mr. Takeshi YOSHIDA
 Ms. Minako SATO

Project Manager
 Urban Planning/Land Use Plan
 Socio-Economy/Economic and Financial
 Evaluation
 Traffic Survey/Analysis/Demand Forecast
 Public Transportation Planning
 Public Transportation Planning
 Urban Street/Road Network Planning
 Public Transportation Facility Planning
 Road Design/Natural Condition Survey/Cost
 Estimate
 Public Transportation Management Plan
 Environmental Analysis

(2) JICA Advisory Committee

Prof. Hisao UCHIYAMA	Chairman
Mr. Kenji KIYOMIZU	JICA Development Specialist
Mr. Yoshiharu KIMURA	Technology Research Center for Riverfront Development
Mr. Masanori HASHIMOTO	Ministry of Transportation

(3) JICA Headquarters

Mr. Takao KAIBARA	Director, Social Development Study Department
Mr. Masaei MATSUNAGA	Deputy Director, Social Development Study Department
Ms. Eri HONDA	Deputy Director, Social Development Study Department
Mr. Yukihiro KOIZUMI	Staff, Social Development Study Department

(4) JICA Paraguay Office

Dr. Nobutetsu ENOSHITA	Resident Representative
Ing. Satoshi MUROSAWA	Resident Assist Representative
Ing. Arg. Mikio Daniel TOKUNAGA	Cooperation Coordinator

(5) Paraguay Counterpart Team

Arq. Enrique Marin	General Coordinator
Ing. Dror Elazar	Team Leader
Ing. Jose Tomas Rivarola	Traffic and Public Transport
Ing. Rafael Cassanello	Road Planning
Arq. Julio B. Ramirez	Environment
Arq. Estanislao Arrua	Land Use
Lic. Florentín Zayas	Economic and Financial Planning
Ing. Florentín Gimenez	Municipality Traffic Police

(6) Paraguay Steering Committee Members

Ing. Celso Ayala	Technical Planning Secretariat (STP)
Ing. Osvaldo Rodriguez	Central Prefecture
Ing. Gustavo Candia	Central Prefecture
Ing. Genaro A. Paredez	Transport Integral Planning Office (OPIT), MOPC
Arq. Jose Luis Gonzalez V	Road Transport Department, MOPC
Ing. Miguel Angel Espinola	Vice Ministry of Public Work
Ing. H. Samuel Gonzalez S.	Autonomous Government Association (AGA)
Ing. Ruben del Puerto	Autonomous Government Association (AGA)
Arq. Beatriz Chase	Environmental Assessment Bureau (DOA), MAG
Dr. Federico Franco	AMUAM
Arq. Andres Ramos	AMUAM

1.6 Technology Transfer

During the course of the Study, the study team transferred various technologies to the counterpart team in terms of methods for traffic demand forecast, plan formulation, and others. At the same time, it also helped counterpart team members to acquire techniques to formulate urban transportation plans and implementation plans through counterpart meetings, workshops, seminars, and counterpart training.

(1) Counterpart Meeting

Throughout the Study in Paraguay, the study team had a series of meetings with the counterpart members at the end of every month, discussing important issues of the Study and Plan as described below.

- Contents and methodology of the field studies
- Collection and analysis of various data
- Methodology of traffic demand forecast
- Selection of priority projects
- Implementation plan of the feasibility study
- Planning and operation of the trunk bus project
- Evaluation of the economic and financial analysis of the planned projects
- Formulation of the Draft Final Report
- And others

(2) Workshop and Seminar

In March 1999, the study team opened a workshop and vigorously attempted to transfer technology. The workshop was aimed at explaining issues of great importance to the counterpart team, such as the study process up to the Interim Report, the methodology of traffic demand forecast including the JICA STRADA, analytical methods, and case studies of Japan. It hosted about 50 participants from the counterpart team, public organizations, and academic and research institutions.

In August 1999, the counterpart team and other institutions hosted a seminar for the purpose of implementing the project smoothly.

The seminar took a form of panel discussion and debated issues centered around the urban transport master plan, including the plan, effects, and case studies of the implementation. It drew a panel of experts from the counterpart team and the steering committee on the Paraguayan side and the study team and the JICA advisory committee on the Japanese side. About 200 persons participated in the seminar, and they came from the municipalities in the Asunción metropolitan area, national institutions, the IDB, universities, bus companies, and other relevant organizations.

- Implementation measures of the urban transport master plan
- Implementation of urban transport projects in Asunción
- Improvement measures of public transport
- Explanation of the Study
- Plan for the introduction of the trunk bus system and its implementation measures
- Environmental problems associated with the projects
- Effects expected from the projects

(3) Counterpart Training

During the course of the Study, two members of the counterpart team were sent to Japan for field investigation of issues related to the Study. The purpose of the training was to introduce the current conditions of urban transport in Japan and to teach how to study, analyze, and plan urban transport and transfer technology on management skills for project implementation.

Chapter 2 Present Socioeconomic Conditions

2.1 Introduction

The 1992 census enumerated a population of slightly more than 4.45 million. Demographers suggested annual growth rates from 2.6 to 2.7 percent in the late 1990s. Assuming a yearly increase of between 2.6 and 2.7 percent until the end of the century, Paraguay would have a population of 5.5 million by the year 2000. Paraguay's population is distributed unevenly throughout the country. The vast majority of the people live in the eastern region, most within 160 kilometers of Asunción. The Chaco, which accounts for about 60% of the territory, is home to less than 2% of the population.

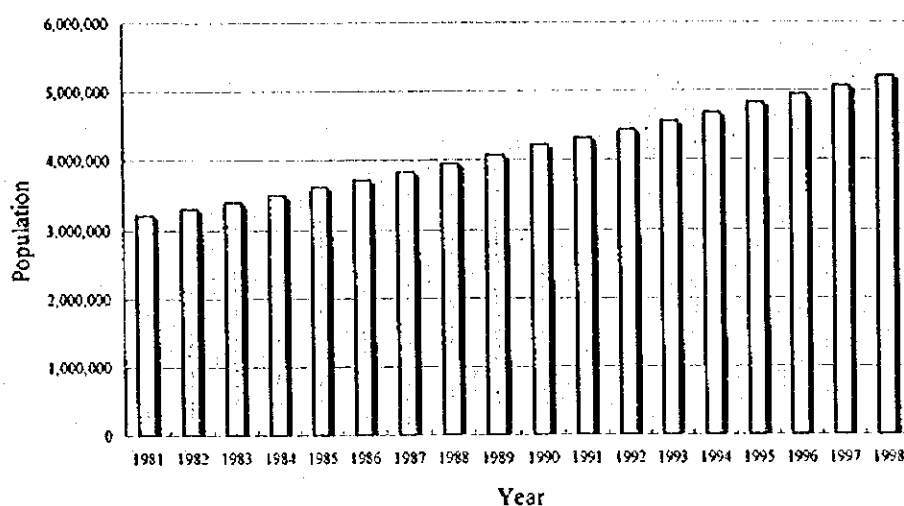


Fig. 2-1-1 Trend of Population in Paraguay

Table 2-1-1 shows movements in the gross domestic product (GDP) since 1991, following the period of structural adjustment that took place between 1989 and 1991. A high rate of growth, ranging between 3.1% and 4.7% was achieved between 1993 and 1995, however, growth in 1996 was rather low at 1.3%. In terms of the sector-based composition of GDP, commerce and finance account for a high share at 25.4%, followed by agriculture, which accounts for 16.0%. Per capita GDP in 1996 stood at US \$ 1,634 which, although not a very low figure, is still inferior to the corresponding figure in neighboring Brazil (US \$ 3,619) and Argentina (US \$ 8,248).

The Asunción Metropolitan Area (Area Metropolitana de Asunción) comprises of Asunción, the capital of Paraguay, and 10 cities (Fernando de la Mora, Lambaré, Limpio, Luque, Mariano Roque Alonso, Ñemby, San Antonio, San Lorenzo, Villa Elisa and Villa Hayes) belonging to the two departments of Central and Presidente Hayes. The metropolitan area in the 1984 study was defined as approximately 71,000 ha, of which 11,700 ha or 17% is accounted for by the city of Asunción.

Table 2-1-1 Movements in GDP

Unit: Million Gs. (1982 fixed prices)

Economical Activity Items	1991	1992	1993	1994	1995	1996	Share(%)	1996/ 1991
Agriculture	152,080	150,061	161,465	156,562	174,643	176,564	16.0	1.16
Livestock	74,108	75,066	77,114	79,441	81,901	83,293	7.6	1.12
Forest Exploitation	26,319	27,562	28,252	29,201	30,108	30,409	2.8	1.16
Hunting and Fishing	1,285	1,324	1,370	1,404	1,437	1,479	0.1	1.15
Sub-Total	253,792	254,013	268,201	266,608	288,089	291,745	26.5	1.15
Mining	4,515	4,741	4,683	4,917	5,058	5,134	0.5	1.14
Industry	150,654	151,287	154,313	156,628	161,327	157,778	14.3	1.05
Construction	49,940	52,437	53,853	55,792	58,023	59,764	5.4	1.20
Sub-Total	205,139	208,465	212,849	217,337	224,408	222,676	20.2	1.09
Electricity	28,686	32,355	36,885	44,631	51,326	54,406	4.9	1.90
Water & Sanitary Facilities	4,026	3,894	4,486	5,249	5,879	6,291	0.6	1.56
Transport and Communications	44,673	45,790	47,327	49,191	50,907	52,180	4.7	1.17
Commerce and Finance	255,425	256,958	266,795	278,209	282,584	279,758	25.4	1.10
General Government	43,027	46,382	48,393	51,546	55,155	60,671	5.5	1.41
Household	24,944	26,690	27,357	28,315	29,164	30,039	2.7	1.20
Other Services	90,496	92,765	95,084	97,461	99,897	103,393	9.4	1.14
Sub-Total	491,277	504,834	526,327	554,602	574,912	586,738	53.3	1.19
Total	950,208	967,312	1,007,377	1,038,547	1,087,409	1,101,159	100.0	1.16
Growth Rate		1.018	1.041	1.031	1.047	1.013		
GDP per capita (in US\$ Constant from 1982)	1,612	1,597	1,619	1,625	1,656	1,634		1.01

Source: "Estadísticas Economicas", BANCO CENTRAL DEL PARAGUAY

2.2 Present Land Use and Urban Development Plans

2.2.1 The Land Use Structure by Category

The total Study area in 1984 was about 71,000 ha., which included the agricultural land and water area in Villa Hayes, and if these are excluded, the area becomes 83.7% or 59,442 ha. The area of Asunción city is 19.8% of the total, which places it second. Luque has the largest area at 25.7%, the third is Limpio at 18.8%, the fourth is San Lorenzo at 9.5%, and fifth is M.R. Alonso at 6.1%. The area of the rest of the six cities indicated below is 5% of the total study area.

Table 2-2-1 Area by Category (1)

Unit: hectares

City	Total	Residential				Commercial	Industrial	Institutions			
		High	Medium	Low	Subtotal			Public	Education	Military	Subtotal
Asunción	11,740	717	4,459	1,954	7,130	556	70	144	142	581	867
Lambaré	2,198	262	1,387	246	1,896	24	8	24	4	2	31
Fdo Mora	2,130	0	1,453	344	1,797	121	11	14	6	3	23
Luque	15,246	0	352	1,892	2,243	127	250	41	123	879	1,044
M.R. Alonso	3,629	0	63	1,795	1,858	35	24	3	52	17	72
Villa Hayes	1,196	0	0	111	111	4	18	0	0	0	1
Limpio	11,150	0	57	537	594	15	19	7	1,841	4	1,852
San Lorenzo	5,650	0	1,886	1,802	3,688	183	97	8	267	103	378
Nemby	2,677	0	1,012	648	1,660	28	4	5	2	57	64
San Antonio	2,105	0	370	840	1,211	129	11	4	1	1	5
Villa Elisa	1,721	0	483	692	1,174	81	86	9	14	1	24
Total	59,442	979	11,521	10,861	23,361	1,302	598	258	2,453	1,648	4,359

Table 2-2-1 Area by Category (2)

Unit: hectares

City	Parks	Recreation	Circulation	Urban Area	Open Space	Agricultural and Livestock	Flood Area
Asunción	352	187	1,151	10,314	633	0	792
Lambaré	3	59	73	2,093	71	0	34
Fdo Mora	4	6	160	2,120	10	0	0
Luque	178	57	731	4,630	6,616	3,858	143
MR Alonso	0	6	193	2,187	1,264	13	166
Villa Hayes	0	0	44	177	48	808	164
Limpio	4	7	643	3,134	3,586	3,216	1,214
San Lorenzo	37	14	272	4,669	849	87	46
Nemby	2	4	129	1,889	763	25	0
San Antonio	18	0	131	1,505	493	0	107
Villa Elisa	7	9	139	1,519	182	0	20
Total	606	348	3,664	34,238	14,513	8,006	2,685

Source: Information were obtained individually city by city in September 1998.

Note: Villa Hayes is only for Barrio Villa Hayes

The urbanization of the metropolitan area has further progressed and the growth of neighboring cities is significant. The urbanized areas of Lambaré, Fdo de la Mora are more than 90% of the total, which were also about 90% in 1984. The urbanization of Villa Elisa and San Antonio has been accelerated since the access roads were improved. The land use by categories for the study area is composed of 39.3% of residential, 2.2% of commercial, 1.0% of industrial, 7.3% of public use, 1.6% of open space and 6.2% of circulation, as shown in Table 2-1-2.

Table 2-2-2 Area by Land Use

Unit: %

City	Urban Area								Open Spaces	Agricultural & Livestock	Flood Area
	Residential	Commercial	Industrial	Governmental	Parks	Recreation	Circulation	Total			
Asunción	60.7	4.7	0.6	7.4	3.0	1.6	9.8	87.9	5.4	0.0	6.7
Lambaré	86.2	1.1	0.4	1.4	0.2	2.7	3.3	95.2	3.2	0.0	1.6
Fdo Mora	84.4	5.7	0.5	1.1	0.2	0.3	7.5	99.5	0.5	0.0	0.0
Luque	14.7	0.8	1.6	6.8	1.2	0.4	4.8	30.4	43.4	25.3	0.9
MR Alonso	51.2	1.0	0.7	2.0	0.0	0.2	5.3	60.3	34.8	0.3	4.6
Villa Hayes	9.3	0.3	1.5	0.1	0.0	0.0	3.6	14.8	4.0	67.6	13.7
Limpio	5.3	0.1	0.2	16.6	0.0	0.1	5.8	28.1	32.2	28.8	10.9
San Lorenzo	65.3	3.2	1.7	6.7	0.7	0.2	4.8	82.6	15.0	1.5	0.8
Nemby	62.0	1.0	0.2	2.4	0.1	0.1	4.8	70.6	28.5	0.9	0.0
San Antonio	57.5	6.1	0.5	0.2	0.9	0.0	6.2	71.5	23.4	0.0	5.1
Villa Elisa	68.2	4.7	5.0	1.4	0.4	0.5	8.0	88.3	10.6	0.0	1.1
Total	39.3	2.2	1.0	7.3	1.0	0.6	6.2	57.6	24.4	13.5	4.5

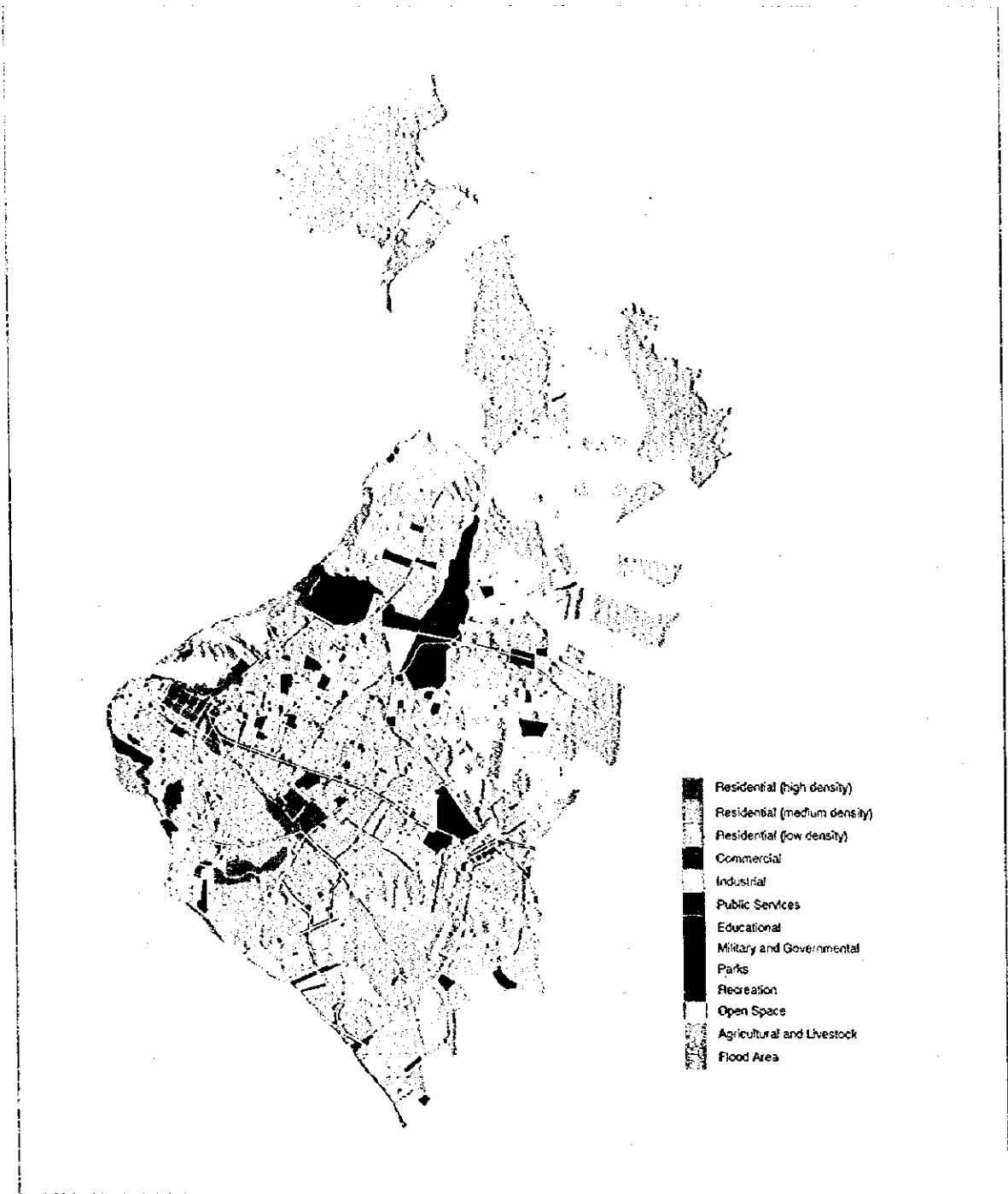


Fig. 2-2-1 Present Land Use

2.2.2 Urban Structure Change in Asunción

(1) High Rise Residential Buildings

Fig. 2-2-2 shows the locations of high rise buildings (over 10-storied buildings) in Asunción. Most of the high rise business and commercial buildings are located within Micro Centro, while residential buildings are located in the surroundings of Micro Centro. The locations of residential buildings are expanding towards the East along Av. Mcal. López and Av. España. Most of them were constructed in the early 1990's, when Paraguay enjoyed a growing economy compared with neighboring countries.

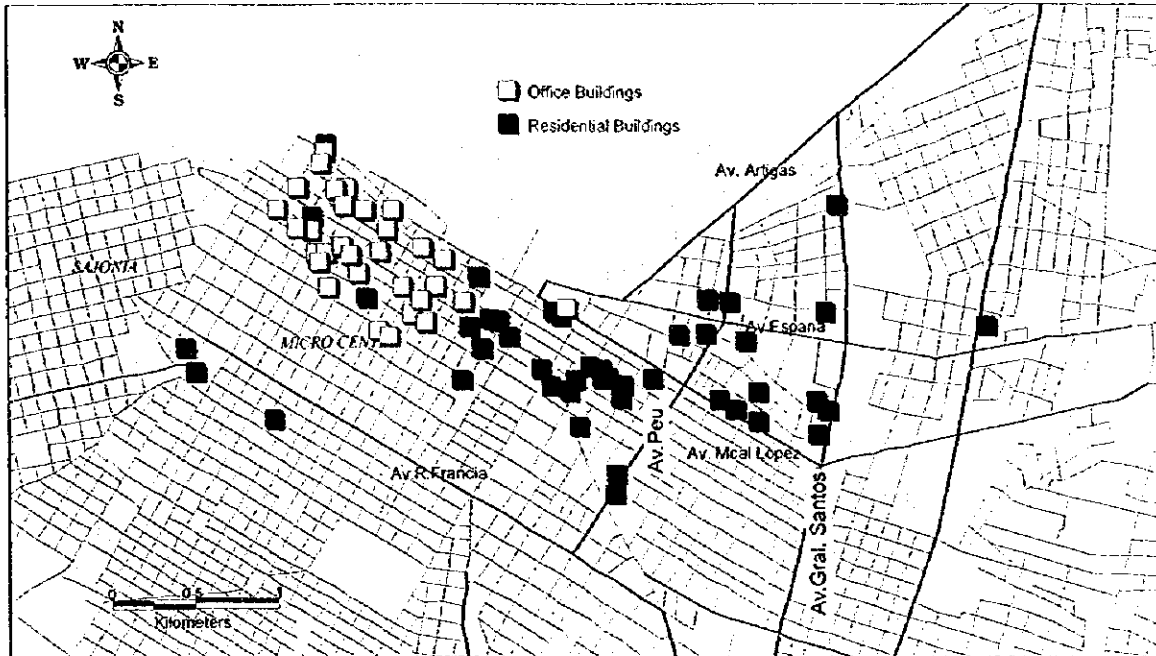


Fig. 2-2-2 Locations of High Rise Buildings

(2) Commercial Activities

Fig. 2-2-3 shows the locations of large scale commercial activities. In Micro-Centro, the large scale commercial activities such as Galería, shopping centers, and so on are concentrated on medium – high class consumers and relatively small scale shops are concentrated in Mercado 4 area. Recently, larger scale commercial activities were established in the city's East of Villa Mora and San Martín areas, for relatively high class consumers who own vehicles. Also large scale, western style supermarkets are located in Fdo. de la Mora city along Av. Mcal. López and Av. Mcal. Estigarribia, which is the extension of Av. E. Ayala. These newly established large scale commercial activities are mainly for consumers who own cars, while the commercial activities in Mercado 4 area are for consumers who do not own cars.

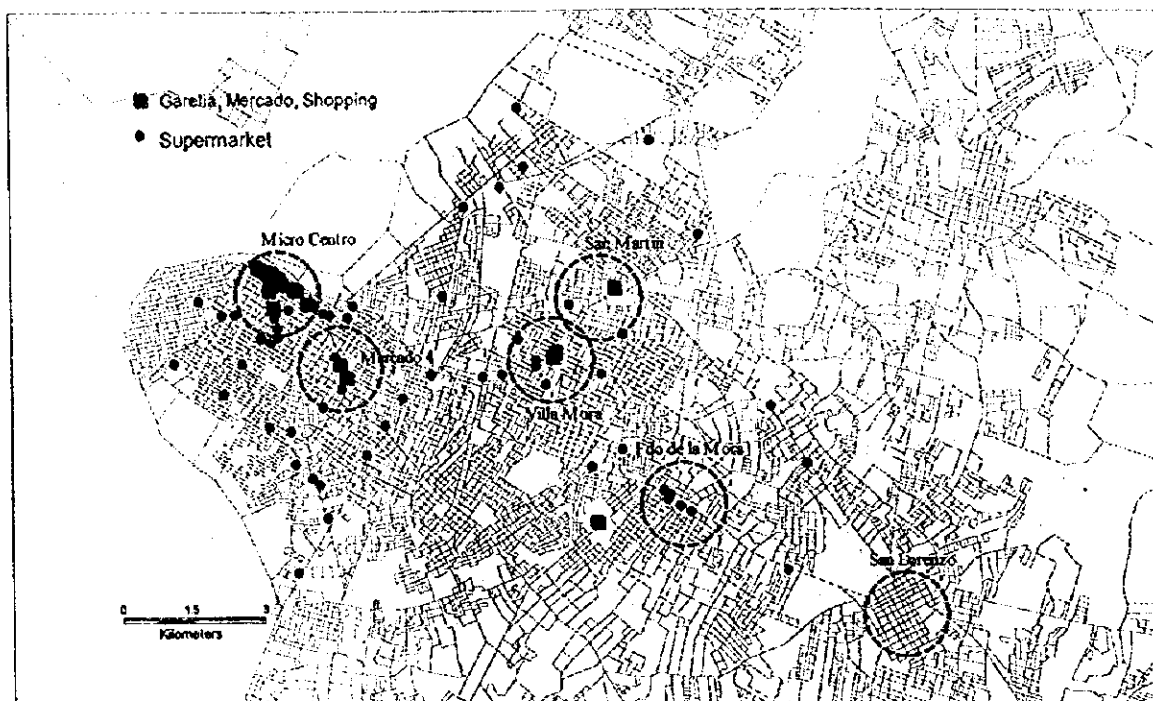


Fig. 2-2-3 Location of Large Scale Commercial Activities

2.2.3 Existing Urban Development Plans

(1) Master Plan for Urban Development and Environment (PDUA)

The plan was issued in 1995, by Asunción City, Facultad Latinoamericana de Ciencias Ambientales: FLACAM), and UNDP. The population density proposed by PDUA is summarized in Table 2-2-3.

Table 2-2-3 Population Density in PDUA

Area	Sub-area	Land Use	Density (people/ha)
Typical City	Historical Center	Commercial and Service	depend on block
	Commercial and Administrative Center	Commercial and Service	800 - 1000
	Medium Density Neighborhood	Residential	300 - 400
Garden City	Monumental Axis y landscape	Commercial and Service	800 - 1000
	Low density Residential neighborhood	Residential	150
Inter municipal border	Mixed	Commercial and Service	300
		Barrios	200
		Mixed Belts	400

Source: PDUA Report, 1995

The city was divided into areas, sub-areas, and the target population density was set by land use, however, the figures for residential purpose are much higher than the present situation. Also it proposed immediate action projects, which include the following urban development projects. The project locations are shown in Fig. 2-2-4.

Table 2-2-4 Immediate Action Projects in PDUA (Land Development Projects)

Project	Description
1. New Central	Create new sub center by land reclamation at Asunción bay
2. Market Place for company promotion	Exhibition center at Asunción port
3. Pilot Project for "Tablada Nueva"	Land renovation
4. Pilot Project for "Bañado Tacumbu"	Land development along river
5. Pilot Project for "San Estanislao"	Land development at a swamp area
6. Technological Park Management	Technology park development
7. Urban Renewal of "Mundo Aparte"	Slam renovation

Source: PDUA Report, 1995

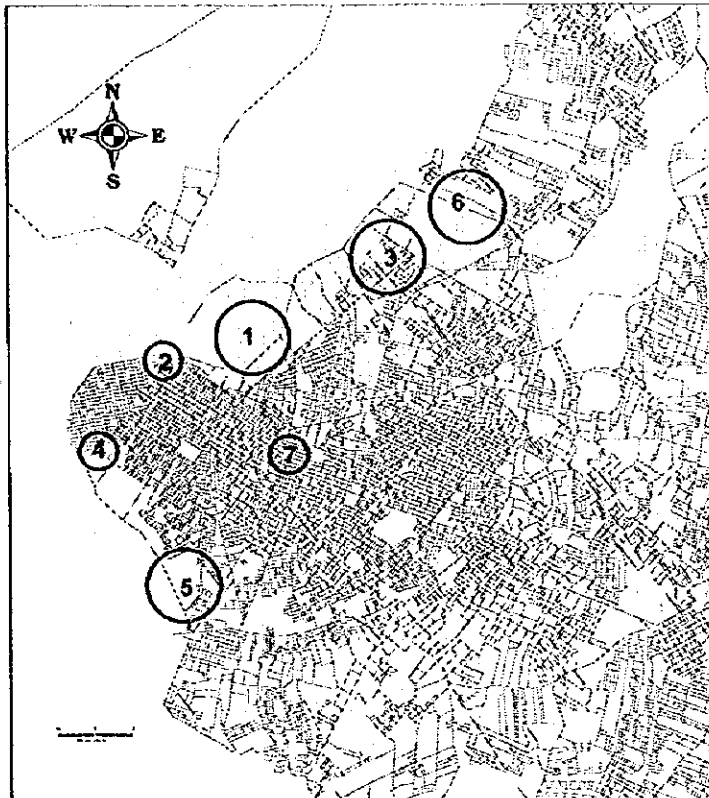


Fig. 2-2-4 Location of Land Development Projects

(2) Waterfront (North) Project

Based on the report of PDUA, the Inter American Development Bank (IDB) has taken a close interest in the prospect of redevelopment of the Waterfront and has financed a comprehensive study which was undertaken by a consulting consortium headed by Abt Associates Inc. of the United States. The final report was presented in January 1997. Whilst the Abt report recognizes scope for commercial development as a component of the Waterfront program, the definition of the project is founded on public financing, principally through borrowing from IDB. After the presentation of the report, the municipality of Asunción has recognized that growing demands for infrastructure development and public service provision can be met only through increasing reliance on private sector initiatives, and asked to carry out another study on the potential of the Waterfront project for private sector participation.

The report was presented in October 1977. The area by land use category was planned as shown in Table 2-2-5. The total development area is 481 ha., of which 244 ha. or 50.7% is subject to

sale. The area for social housings are planned to be allocated mainly for the squatters who live along the water-front of Asunción Bay at present.

Table 2-2-5 Land Use of Waterfront

Land Use Category	Category	Site Area (ha)	Floor Area (ha)
Marketable	Private Housing	109	78
	Commerce	80	80
	Sport/Leisure	55	55
Subtotal		244	213
Non-marketable	Social Housing	68	50
	Public Area	82	82
	Local infrastructure		50
Subtotal		151	182
Total development		395	395
Major infrastructure		86	86
Grand Total		481	481

Source: Waterfront Project, Oct. 1997

The total residents in the development area was planned at 1,550 house holds in private housing and 5,520 house holds in social housing. Employment in commercial activities was planned at 38,400 workers.

The project is assumed to commence in 1999 in 6 phases and to be completed in 2011. The project cost was estimated at 232.3 million US dollars in current prices, of which 31.4% or 73.0 million US dollars was assumed to be financed by the Municipality borrowed from international funding sources and the rest from the private sector.

2.3 Population

2.3.1 Trend of Population

The population of the Asunción Metropolitan Area grew at an annual average rate of 3.4% in the 10 years between the census years of 1982 and 1992, which is a slighter higher rate than the national average of 3.2% over the same period. Accordingly, the population concentration in the metropolitan area has increased by 3.7% between 1962 and 1992 from 23.5% to 27.2%. Incidentally, in Thailand and Philippines, which are known for having excessive population concentration in their respective metropolitan areas, the share of the population in Bangkok to the national population is 11.9% (1989) and that in Manila is 21.4% (1996), which means that the level of population concentration in the metropolitan area in Paraguay outstrips even these countries.

Looking at population in the metropolitan area by city since the census year of 1962, population growth has been more pronounced in the surrounding cities of Luque, Fernando de la Mora, San Lorenzo and Lambaré rather than in Asunción City. The population in these four cities has increased by approximately 170,000, which is 3.7 times more than the increase of 46,000 that has been witnessed in Asunción City.

Table 2-3-1 Trend of Population in Asunción Metropolitan Area

Municipalities	Inhabitants According to CENSUS				Annual Average Growth Rate (%)			Surface (ha)	Density (persons/ha)			
	1962	1972	1982	1992	1962/72	1972/82	1982/92		1962	1972	1982	1992
Asunción	288,882	388,958	454,881	500,938	3.0	1.6	1.0	11,700	24.7	33.2	38.9	42.8
Fdo. de la Mora	14,519	36,892	66,597	95,072	9.8	6.1	3.6	2,054	7.1	18.0	32.4	46.3
Lambaré	20,778	31,732	67,168	99,572	4.3	7.8	4.0	2,198	9.5	14.4	30.6	45.3
Limpio	10,126	12,767	16,036	35,297	2.3	2.3	8.2	11,150	0.9	1.1	1.4	3.2
Luque	30,834	40,677	64,288	116,600	2.8	4.7	6.1	15,246	2.0	2.7	4.2	7.6
M.R. Alonso	5,696	7,388	14,636	39,289	2.7	7.1	10.4	3,629	1.6	2.0	4.0	10.8
Nemby	5,984	6,899	11,991	38,516	1.4	5.7	12.4	2,677	2.2	2.6	4.5	14.4
San Antonio	5,965	7,321	8,293	14,919	2.1	1.3	6.0	2,105	2.8	3.5	3.9	7.1
San Lorenzo	18,573	36,811	74,552	133,395	7.1	7.3	6.0	5,650	3.3	6.5	13.2	23.6
Villa Elisa	3,214	4,774	12,038	29,796	4.0	9.7	9.5	1,721	1.9	2.8	7.0	17.3
Villa Hayes	23,457	31,656	19,875	27,370	3.0	-4.5	3.3	13,800	1.7	2.3	1.4	2.0
Total Metropolitan Area	428,018	605,875	810,358	1,130,764	3.5	3.0	3.4	71,930	6.0	8.4	11.3	15.7
Paraguay	1,819,103	2,357,955	3,029,830	4,152,588	2.6	2.5	3.2					
Share of Metropolitan Area (%)	23.5	25.7	26.7	27.2								

Source: National Census for household and population

In terms of gross population density in the metropolitan area in 1992, that in the three cities of Asunción, Fdo. de la Mora and Lambaré stood in excess of 40 people/ha. Whereas population density in Fdo. de la Mora and Lambaré was less than half that in Asunción in 1962, the rapid population growth that took place in these two cities from 1972 meant that they had outstripped Asunción in terms of population density by 1992. In contrast to Asunción City, where population is thought to have reached saturation point due to the concentrated location of public, commercial and business facilities, it is considered that population in the surrounding cities is still on an upward trend. San Lorenzo has the next highest population density with 23.6 people/ha, but this amounts to only just over half the corresponding figure in the three cities mentioned above.

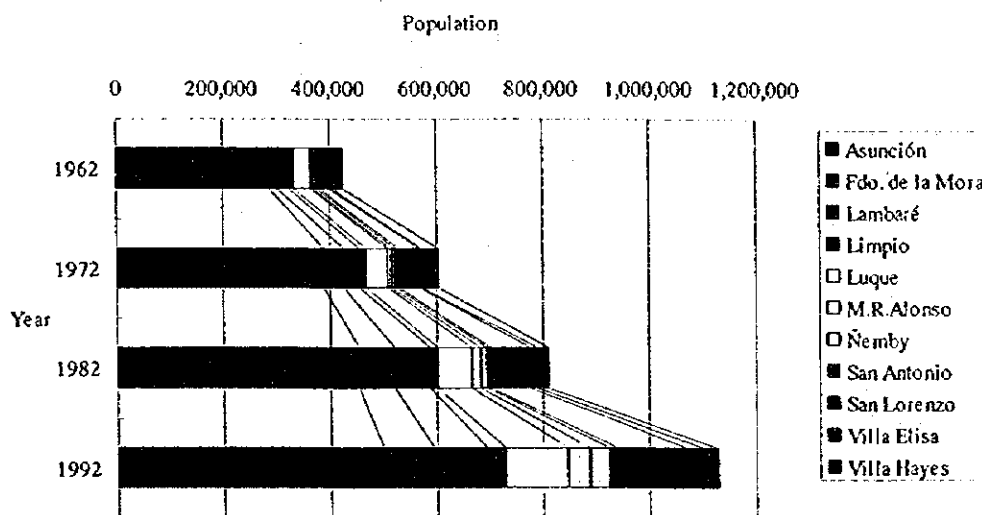


Fig. 2-3-1 Population Trend in the Asunción Metropolitan Area

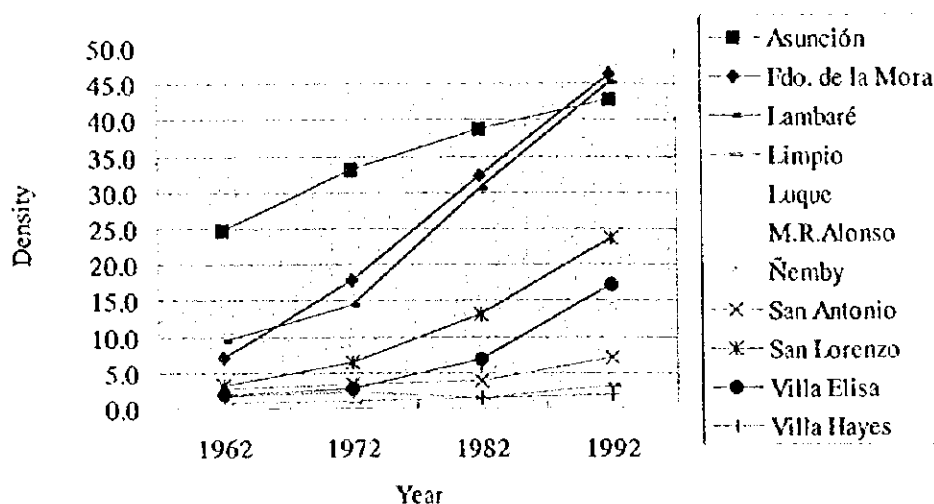


Fig. 2-3-2 Trend of Population Density in Each City in the Metropolitan Area

Looking at the trend of numbers of households in the metropolitan area, the rate of increase is higher than the rate of population growth. In the 10 years between 1982 and 1992, the number of households increased at an annual average rate of 3.8%, slightly higher than the rate of population growth, and as a result the number of household members fell slightly from 4.93 people to 4.76 people over this period.

Table 2-3-2 Trend of Number of Households in the Metropolitan Area

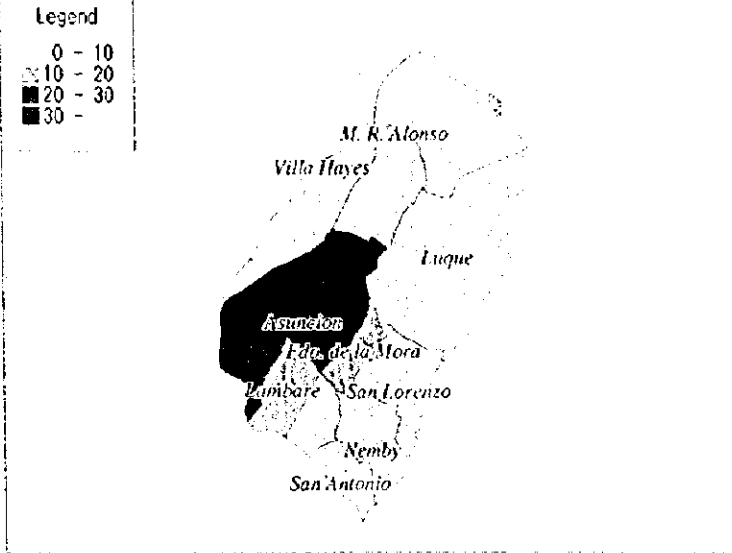
Municipalities	Occupied Private Households		Annual Average Growth Rate (%) 1982/92	Population/ Household	
	1982	1992		1982	1992
Asunción	91,526	105,746	1.5	4.97	4.74
Fdo. de la Mora	14,050	20,249	3.7	4.74	4.70
Lambaré	13,725	20,341	4.0	4.89	4.90
Limpio	3,344	7,590	8.5	4.80	4.65
Luque	12,983	23,940	6.3	4.95	4.87
M.R. Alonso	2,988	8,092	10.5	4.90	4.86
Ñemby	2,378	8,126	13.1	5.04	4.74
San Antonio	1,750	3,255	6.4	4.74	4.58
San Lorenzo	15,283	28,266	6.3	4.88	4.72
Villa Elisa	2,520	6,308	9.6	4.78	4.72
Villa Hayes	3,697	5,596	4.2	5.38	4.89
Metropolitan Area Total	164,244	237,509	3.8	4.93	4.76
Paraguay	578,714	855,547	4.0	5.24	4.85

Source: National Census for household and population

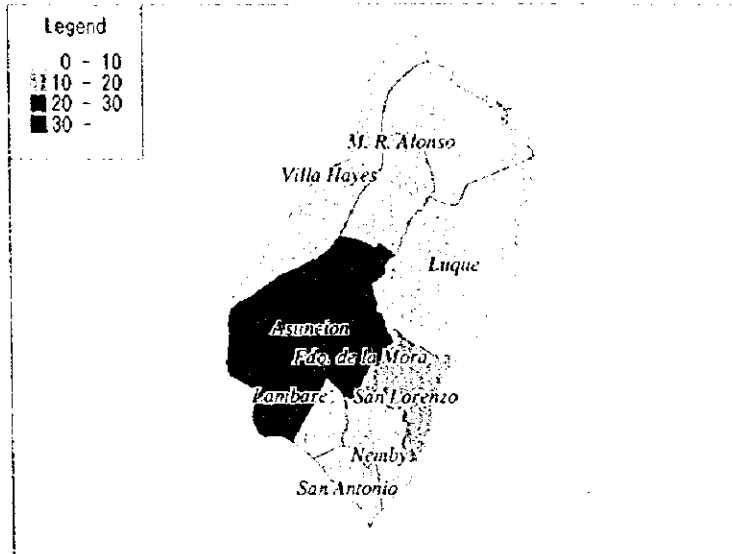
The population composition of Paraguay viewed in terms of gender and age is shown in Table 2-3-3. The ratio of males to females stood at 98.3 in 1972, but this increased to 100.3 in 1982, thus reversing the balance, and had increased further by 1992. In terms of age composition, the trend of decrease in the child population (0-14 years) and the trend of increase in the productive population (15-64 years) settled down and the population aged over this period.

Year 1972

(unit: persons/ha)



Year 1982



Year 1992

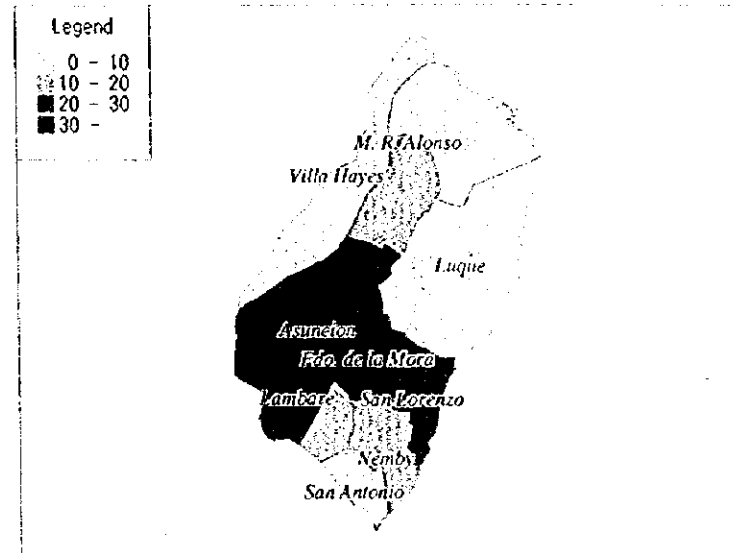


Fig. 2-3-3 Trend of Population Density in Each City in the Metropolitan Area

Table 2-3-3 Trend of Population Composition by Gender and Age Group in Paraguay

Unit: %

Age Group	1972			1982			1992		
	Both Sex	Male	Female	Both Sex	Male	Female	Both Sex	Male	Female
0 - 14	44.8	22.9	21.9	41.0	21.0	20.0	41.5	21.1	20.4
15 - 64	51.2	25.0	26.2	54.7	27.2	27.5	53.9	27.0	26.9
65 -	4.0	1.7	2.3	4.3	1.9	2.4	4.6	2.1	2.5
Total	100.0	49.6	50.4	100.0	50.1	49.9	100.0	50.2	49.8
Male/Female		98.3			100.3			100.9	

Source: National Census for household and population

Looking at the composition of population by gender and age group in the metropolitan area, the ratio of the productive population and the female population is higher than the corresponding national averages. This implies that females account for a large share of the people who move from the regions to the metropolitan area in search of work.

Table 2-3-4 Trend of Population Composition by Gender and Age Group in the Metropolitan Area

Unit: %

Age Group	1972			1982			1992		
	Both Sex	Male	Female	Both Sex	Male	Female	Both Sex	Male	Female
0 - 14	36.1	18.0	18.1	32.1	16.0	16.1	34.4	17.3	17.1
15 - 64	59.6	27.8	31.8	62.9	29.7	33.2	60.5	28.5	32.0
65 -	4.3	1.7	2.6	5.0	2.0	5.1	5.1	2.0	3.0
Total	100.0	47.5	52.5	100.0	47.7	52.3	100.0	47.8	52.2
Male/Female		90.5			91.3			91.7	

Source: National Census for household and population

Looking at the situation regarding social migration between 1987 and 1992, immigration exceeded emigration in all the cities except for Asunción, and this was particularly true in the two cities of Luque and San Lorenzo. This is considered to be the result of people leaving Asunción due to spiraling land prices and deterioration of the living environment, in search of new homes in suburban areas where a better environment can be found.

Table 2-3-5 Trend of Social Migration in the Metropolitan Area

Municipalities	Immigration (interstate)	Emigration (interstate)	Net Migration
Asunción	56,552	71,584	-15,032
Fdo. de la Mora	17,147	11,478	5,669
Lambaré	15,713	8,011	7,702
Limpio	7,082	1,523	5,559
Luque	16,407	5,824	10,583
M.R. Alonso	10,126	2,054	8,072
Nemby	10,834	1,839	8,995
San Antonio	2,672	706	1,966
San Lorenzo	24,924	10,756	14,168
Villa Elisa	7,760	1,594	6,166
Villa Hayes	2,396	2,624	-228
Metropolitan Area Total	171,613	117,993	53,620

Source: National Census for household and population

Moreover, from Table 2-3-6, which shows the situation regarding social migration of the

population aged five years and over between 1987 and 1992, it can be seen that migration in the metropolitan area has been particularly pronounced from Asunción to Fdo. de la Mora, Lambaré, Luque, Mariano Roque Alonso and San Lorenzo, etc. In terms of migration between the metropolitan area and other regions, there has been little exodus to the regions but a large influx of people into the metropolitan area as a whole. In particular, migration into Asunción has been more pronounced from regions outside of the metropolitan area. Social migration has been characterized by movement from the regions into the metropolitan area when viewed in national terms, and by movement from Asunción City into surrounding cities when viewed in terms of the metropolitan area alone.

Table 2-3-6 Social Migration Situation

	Asunción	Fdo de la Mora	Lambaré	Limpio	Luque	M.R. Alonso	Nemby	San Antonio	San Lorenzo	Villa Elisa	Villa Hayes	Metropolitan Area Total	Other Central Region	Rest of the country	No information	Paraguay Total
Asunción	0	5,717	6,283	3,603	5,945	5,160	4,129	821	7,626	2,761	469	42,315	8,570	20,499	0	71,584
Fdo de la Mora	2,214	0	508	186	701	254	1,090	244	2,259	675	29	8,160	2,226	1,092	0	11,478
Lambaré	2,059	536	0	185	472	150	897	188	795	1,154	11	6,488	985	538	0	8,611
Limpio	535	63	69	0	123	172	58	19	79	16	37	1,171	106	246	0	1,523
Luque	1,825	285	308	240	0	205	108	19	540	66	49	3,645	801	1,378	0	5,824
M.R. Alonso	702	92	61	308	140	0	59	19	122	46	75	1,624	99	331	0	2,054
Nemby	452	170	117	37	66	22	0	173	219	111	9	1,376	215	248	0	1,839
San Antonio	190	40	32	8	19	10	158	0	38	50	9	554	71	81	0	706
San Lorenzo	2,126	845	434	114	871	157	524	100	0	183	63	5,425	2,934	2,397	0	10,756
Villa Elisa	279	193	187	39	41	20	329	117	123	0	4	1,332	170	92	0	1,594
Villa Hayes	632	100	76	107	130	227	34	14	85	11	0	1,416	150	1,058	0	2,624
Sub-total	11,014	8,044	8,075	4,828	8,509	6,417	7,385	1,714	11,886	5,078	755	73,706	16,327	27,960	0	117,993
Otro Central	3,512	911	663	140	682	204	384	105	1,684	210	77	8,572	2,478	3,386	0	14,436
Others	42,026	8,192	6,975	2,114	7,216	3,505	3,064	853	11,354	2,472	1,564	89,335	13,109	119,807	0	222,251
Paraguay Total	56,552	17,147	15,713	7,082	16,407	10,126	10,834	2,672	24,924	7,760	2,395	171,613	31,914	151,153	0	354,680
Exterior	15,699	2,503	2,138	505	1,795	885	710	331	3,196	644	261	29,627	3,877	43,609	0	77,113
No Information	69	18	41	21	18	14	17	8	81	5	0	292	39	278	13,265	13,874

Source: National Census for household and population

2.3.2 1998 Population by Zone

The population by zone in 1998 was estimated based on the information on the population by zone in the 1992 census and the population by municipality in the 1998 statistics. The 1998 population by zone in Asunción was estimated assuming that the population change by section, which are the integrated zones of census zones, in the 1982 and 1992 census would continue from 1992 to 1998, and the calculated 1998 population by section was adjusted to the total population in 1998 statistics. For other municipalities, the population in 1998 was subdivided into the population by zone applying the population share by zone in the 1992 census. The estimated results are given in Table 2-3-7.

2.3.3 Population and Density Distribution

The population of Asunción City is 550,000 or 38.8% of the total population in the Metropolitan area, and 900,000 or 62% of the population residing outside of Asunción City. It is clear that the population increase in the cities outside of Asunción is remarkable, when compared with the 55% the share of Asunción City in 1984

Table 2-3-7 1998 Population and Population Density by Zone

ZONA		Area (ha)	Population	Density (Persons/ha)	ZONE		Area (ha)	Population	Density (Persons/ha)
No	Name				No	Name			
1.	Santo Domingo	100	3,069	30.7	47.	San Pablo	290	25,284	87.2
2.	Mcal. López	160	6,840	42.8	48.	Itá Pytá Punta	40	3,521	88.0
3.	Gral. José E. Díaz	80	7,490	93.6	49.	Loma Pyta	330	5,727	17.4
4.	Las Mercedes	120	5,702	47.5	50.	Virgen de la Asunción	140	11,247	80.3
5.	San Roque	130	7,916	60.9	51.	Bella Vista	100	5,085	50.9
6.	Mburicao	170	8,302	48.8	52.	Gral. Andrés Rodríguez	200	7,153	35.8
7.	Villa Morra	120	4,675	39.0	53.	Terminal	80	4,938	61.7
8.	Tembetary	70	3,782	54.0	54.	Santa Ana	300	6,506	21.7
9.	La Encarnación	90	5,195	57.7	55.	Salvador del Mundo	50	4,318	86.4
10.	Los Laureles	90	4,396	48.8	56.	Santa María	70	5,201	74.3
11.	Ciudad Nueva	110	10,670	97.0	57.	Republicano	100	12,284	122.8
12.	San Cristóbal	140	8,024	57.3	58.	Roberto L. Petit	210	28,584	136.1
13.	Recoleta	260	11,551	44.4	59.	Virgen de Fátima	140	6,451	46.1
14.	Catedral	80	4,571	57.1	60.	Itá Enramada	210	4,116	19.6
15.	Manorá	70	2,478	35.4	61.	De las Residentas	330	14,376	43.6
16.	Virgen Del Huerto	80	5,844	73.1	62.	Zeballos Cué	110	2,305	21.0
17.	Cañada de Ybyray	100	2,909	29.1	63.	Botánico	530	8,897	16.8
18.	Mcal. Estigarribia	230	9,307	40.5	64.	San Blas	110	3,520	32.0
19.	Carmelitas	150	6,400	42.7	65.	Ricardo Brugada	50	9,176	183.5
20.	Silvio Petrossi	160	13,353	83.5	66.	Tablada Nueva	140	5,018	35.8
21.	Pinozá	90	7,492	83.2	67.	Bañado Tacumbó	380	4,097	10.8
22.	Vista Alegre	180	14,046	78.0	68.	San Rafael	180	8,303	46.1
23.	Nazareth	130	8,164	62.8	69.	San Felipe	120	4,997	41.6
24.	Pirizal	90	5,095	56.6	70.	Bañado	230	1,095	4.8
25.	Panambi Reta	60	3,218	53.6	71.	Banco San Miguel	1,090	0	0.0
26.	Ycua Sati	150	8,024	53.5	ASUNCION (1-71)		11,740	553,997	47.2
27.	San Antonio	120	11,807	98.4	72.	Lambaré Norte	578	53,744	93.0
28.	Tacumbó	130	14,059	108.1	73.	Lambaré Oeste	533	18,733	35.0
29.	San Vicente	220	16,314	74.2	74.	Lambaré Este	1,085	67,819	62.5
30.	Bernardino Caballero	90	7,726	85.8	LAMBARE (72-74)		2,198	140,296	63.8
31.	Carlos Antonio López	150	15,116	100.8	75.	Fdo de la Mora Sur	1,118	53,271	47.6
32.	Madame Lynch	200	9,399	47.0	76.	Fdo de la Mora Norte	1,012	78,110	77.2
33.	Dr. Gaspar R. de Francia	170	13,241	77.9	FDO. DE LA MORA (75-76)		2,130	131,381	61.7
34.	Hipódromo	190	9,546	50.2	77.	Loque	15,246	165,079	10.8
35.	Obrero	230	22,971	99.9	78.	M.R. Alonso	3,629	55,216	15.2
36.	Santa Rosa	40	2,158	54.0	79.	Villa Hayes	13,800	33,805	2.4
37.	Santísima Trinidad	90	5,153	57.3	80.	Limpio	11,150	51,121	4.6
38.	San Jorge	160	5,233	32.7	81.	San Lorenzo Norte	775	44,260	57.1
39.	Itay	150	3,053	20.4	82.	San Lorenzo Central	2,062	83,963	40.7
40.	Luis A. De Herrera	120	6,316	52.6	83.	San Lorenzo Sur	2,813	80,191	28.5
41.	Mburucuyá	210	9,556	45.5	SAN LORENZO (81-83)		5,650	208,414	36.9
42.	Sajonia	70	2,351	33.6	84.	Nerby	2,677	54,679	20.4
43.	Panambi Verd	80	3,223	40.3	85.	San Antonio	2,105	21,519	10.2
44.	Jara	210	14,997	71.4	86.	Villa Elisa	1,721	41,729	24.2
45.	Villa Aurelia	220	11,034	50.2					
46.	Nú Guazú	150	32	0.2	METROPOLITAN AREA (1-86)		72,046	1,457,236	20.2

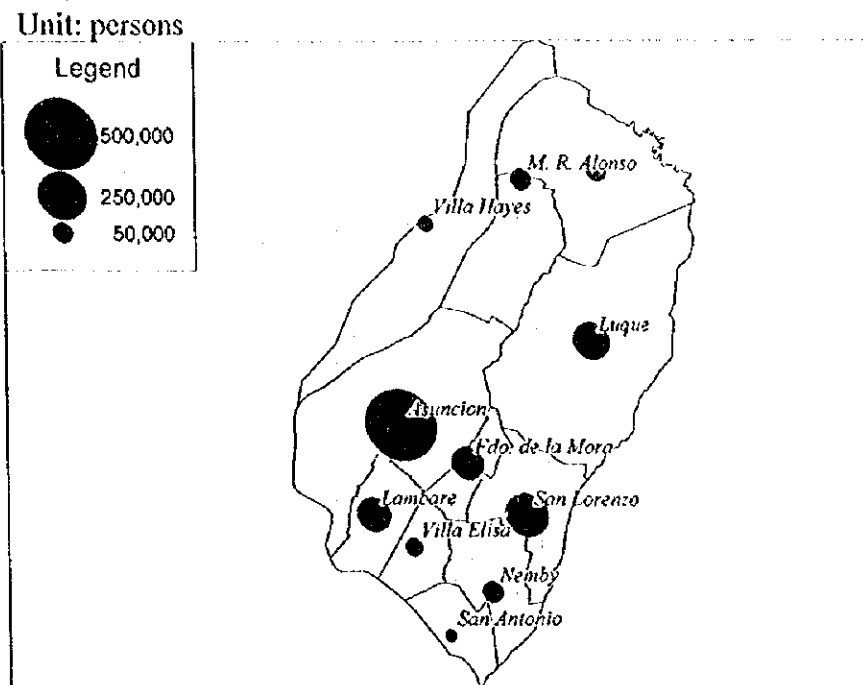


Fig. 2-3-4 Population Distribution by Municipality

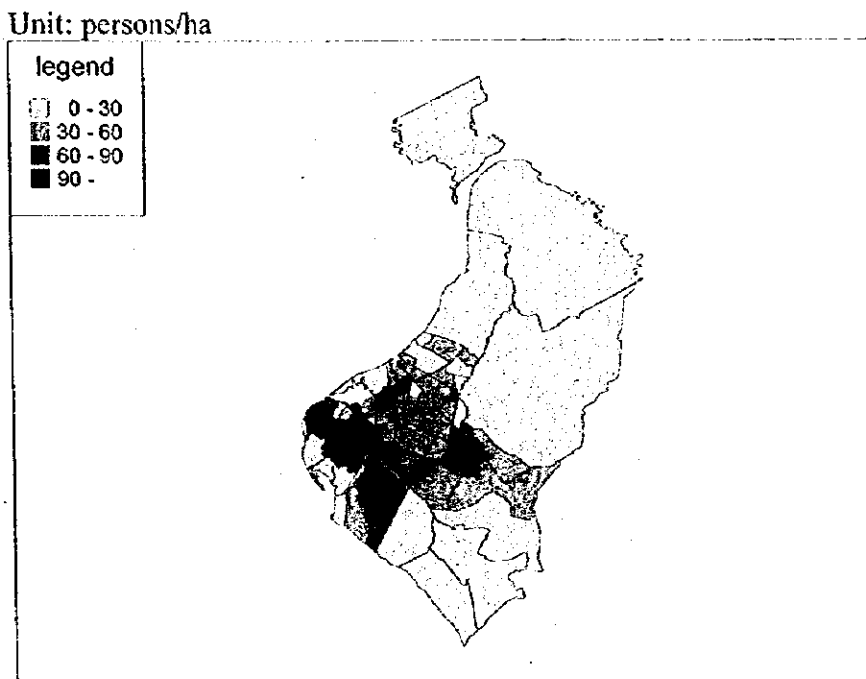


Fig. 2-3-5 Population Density by Zone

2.4 Employment

2.4.1 Resident Base Employment

(1) Trend of Age Distribution and Gender Share

The population by gender and age in 1992 in the Metropolitan Area is given in Table 2-3-4. It was characterized by the shares of economic active population (15 – 64 years old: Poblacion Economicamente Activa: PEA) and female in the metropolitan area which were higher than the national average, however, the share of the lower age group (0 – 14 years old) was expected to decrease because of the decrease in birth rate and the share of male was expected to increase afterward. The 1998 population by age group and gender in the metropolitan area is estimated as shown in Table 2-4-1.

Table 2-4-1 Estimated Population by Gender and Age Group in 1998

Age Group	Both sex	Male	Female
0 - 14	500,784	252,890	247,894
15 - 64	889,917	420,716	469,201
65 -	66,535	27,068	39,467
Total	1,457,236	700,674	756,562
Male Range (Male/Female)	0.926		

(2) PEA by Age and Gender

Fig. 2-4-1 shows the share of PEA to the total population in the metropolitan area by gender and age in the 1992 census. The share of PEA to the total population aged 10 years old or older is 52.9%. The PEA share of male is as high as 69.8%, which is almost double the 38.0% share of female, and in the age group between 20 – 54 years old, PEA shares are more than 60%.

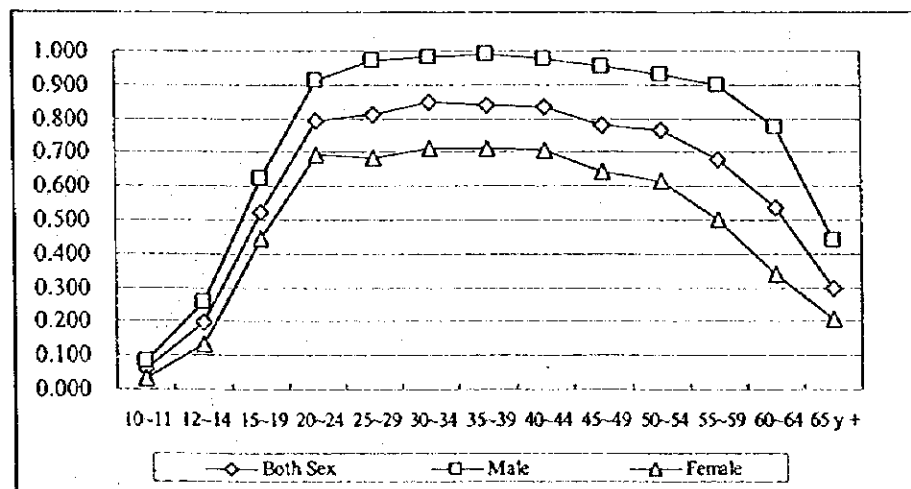


Fig. 2-4-1 PEA Share by Gender and Age

(3) Resident Base Employment

The 1998 resident base employment was estimated based on the present resident base population, resident base employment by gender and age group, and is shown in Table 2-4-2.

Table 2-4-2 1998 Resident Base Employment

	Male	Female	Total
Asunción	140,155	91,926	232,081
Lambaré	34,767	21,443	56,210
Fdo.de la Mora	33,042	20,690	53,732
Luque	40,422	23,317	63,739
M.R.Alonso	13,495	7,797	21,292
Villa Hayes	8,532	4,045	12,577
Limpio	12,570	6,891	19,461
San Lorenzo	51,448	31,102	82,550
Nemby	13,345	7,631	20,976
San Antonio	5,305	2,985	8,290
Villa Elisa	10,260	5,984	16,244
Total	363,341	223,811	587,152

2.4.2 Work Place Base Employment

(1) 1998 GDP

The trend of gross domestic product (GDP) and per capita GDP are shown in Fig. 2-4-2 and Fig. 2-4-3 respectively. The GDP in 1997 was 1,130,309 million Gs. and the per capita GDP was 222,269 Gs. in terms of 1982 fixed price. The GDP has been increasing linearly, while the per capita GDP fluctuate year by year. Therefore, the GDP in 1998 was estimated, by the linear exponential regression formula, at 1,194,700 million Gs. in terms of 1982 fixed price. The regression formula is given below.

$$GDP = 689,000 \times 1.035^{(X - 1982)}$$

$$R=0.995, t\text{-value}=0.989$$

where, GDP: million Gs.
x: year

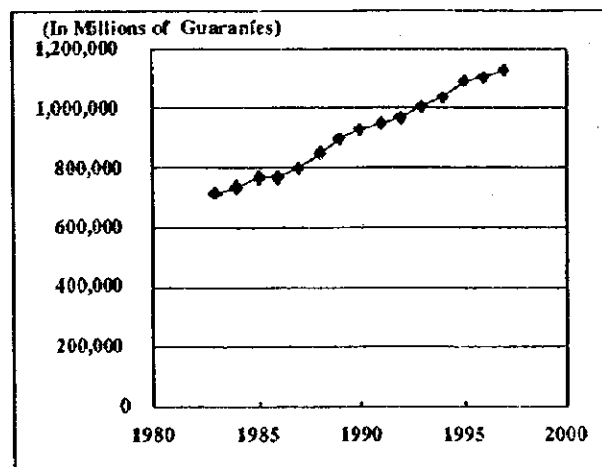


Fig. 2-4-2 Trend of GDP

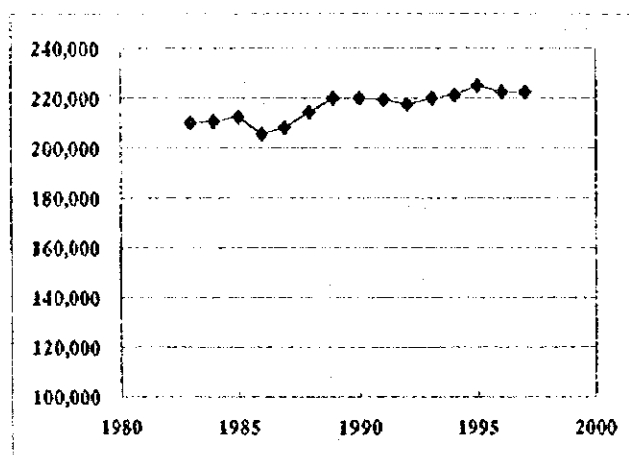


Fig. 2-4-3 Trend of Per Capita GDP

(2) 1998 GRDP in Asunción Metropolitan Area

The gross regional domestic product (GRDP) in Asunción Metropolitan Area in 1984 was 319,284 million Gs. or 43.3% of GDP of 736,900 million Gs. The population share of the metropolitan area was 26.7% in 1984, therefore the concentration of GRDP was higher than the population concentration, which implies the productivity was higher than the national average. The 1998 GRDP of the metropolitan area in 1998 was estimated at 536,420 million Gs. assuming that the share of GRDP will change in proportion with the population share. The share of GRDP in Asunción Metropolitan area in 1998 was estimated at 44.9%.

GRDP share in 1998 = GRDP share in 1984 x 1998 population share / 1984 population share =
 $43.3\% \times 27.8\% / 26.8\% = 44.9\%$

(3) Work Place Base Employment

From the GDP and employment in Paraguay, the per-worker GDP in 1996 can be calculated as Gs 698,627 (Table 2-4-3). The 1998 per-worker GDP is estimated to be about Gs 705,600 by extrapolating it from the trend shown in Table 2-4-3.

On the other hand, the per-worker GRDP in the metropolitan area is relatively higher than the national figure. Since the distribution rate of population in the metropolitan area is 27.9% and that of the GRDP 44.9% in 1998, the economic disparity between the capital area and the rest of the country is calculated as $44.9/27.9=1.6$. In addition, taking into account the difference in economically-active population between Asunción and that outside the metropolitan area,¹ which is obtained from the 1996 household survey, the 1998 per-worker GRDP can be obtained from the formula, $705,600 \times 1.6 \times 61.8/66.0$, or Gs 1,057,100 per worker. Thus, the number of employed in the capital area is the quotient of the GRDP by the per-worker GRDP, or 536,420 (Gs million) divided by 1,057,100 (Gs/worker), about 507,500.

¹ According to the 1996 household survey, the share of working population in Asunción is $302,307/458,039=0.660$, whereas that in the area outside the metropolitan area is $431,488/697,789=0.618$.

Table 2-4-3 1996 GRDP and Productivity

Unit:1982 Constant Price

Sector	GRDP (In millions of Guaraníes)	Economically Active Employed	Productivity (In Guaraníes)	Total=1.000
Agricultural	176,564			
Livestock	83,293			
Forest	30,409			
Fishing	1,479			
Primary Sector	291,745	559,042	521,866	0.747
Mining	5,134	2,568	1,999,221	2.862
Industrial	157,778	181,983	866,993	1.241
Construction	59,764	142,678	418,873	0.600
Secondary Sector	222,676	327,229	680,490	0.974
Electricity	54,406			
Water and Sanitary Service	6,291	13,150	4,615,741	6.607
Transport and Communication	52,180	55,972	932,252	1.334
Commerce and Finance	279,758	224,210	1,247,750	1.786
General Government	60,671			
Households	30,039	396,573	489,451	0.701
Other services	103,393			
Tertiary Sector	586,738	689,905	850,462	1.217
Total	1,101,159	1,576,176	698,627	1.000

As shown in Table 2-4-2, the number of residence-base employed in the metropolitan area in 1998 is 587,200, whereas that of workplace-base is 507,500. The number of unemployed can be, therefore, be the difference between them, or 79,700 (13.6%). Since there are people who commute to the metropolitan area for work, the unemployment rate should be actually higher. However, according to the results of the cordon line survey on the border of the metropolitan area, the number of workers who commute outside the metropolitan area and that of vice versa are about the same, and thus this unemployment rate is considered reasonable. Although the unemployment rate in urban areas is estimated at about 10% by the Central Bank of Paraguay, the rate in the metropolitan area seems to be higher. (The 1984 Master Plan estimated it at 13%.)

Table 2-4-4 1998 PEA and Unemployment Rate

Items	Amount
Total Population	1,457,240
Population more than 10 years old	1,113,290
PEA	587,200
PEA Employed	516,700
PEA Unemployed	70,500
Unemployment Rate	12.0