THE FEASIBILITY STUDY ON THE URBAN TRANSPORT PROJECT IN THE PANAMA METROPOLITAN AREA

ESTAMPA II

MAIN REPORT

DECEMBER, 1984

MINISTRY OF PUBLIC WORKS
THE REPUBLIC OF PANAMA

JAPAN INTERNATIONAL
COOPERATION AGENCY

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PREFACE

In response to the request of the Republic of Panama the Government of Japan decided to conduct a feasibility study on the Urban Transport Project in the Panama Metroporitan Area and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Panama a study team headed by Mr. Takeshi Yoshida from 31 May 1983 to 24 September 1984.

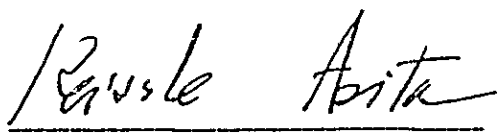
The team exchanged views with the officials concerned of the Government of the Republic of Panama on the Project and conducted a field survey in the Metropolitan Area.

After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

December, 1984



Keisuke Arita
President
Japan International Cooperation Agency

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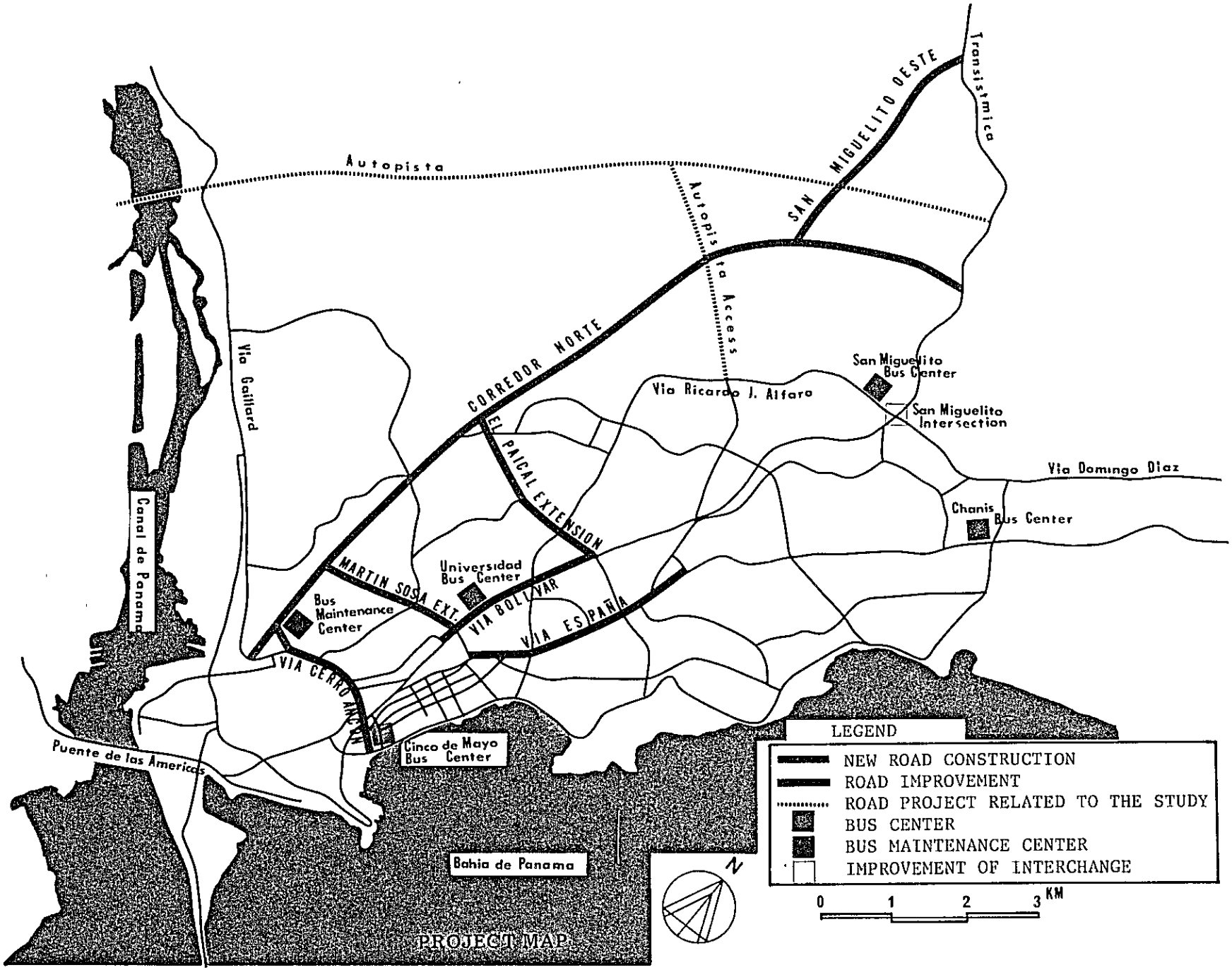
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ROAD IMPROVEMENT
ROAD PROJECT RELATED TO THE STUDY
BUS CENTER
BUS MAINTENANCE CENTER
IMPROVEMENT OF INTERCHANGE
0 1 2 3 KM
N

PROJECT MAP

INTRODUCTION

INTRODUCTION

1. Study Development

Population concentration, outward expansion of urban area, and motor traffic increase in Panama Metropolitan Area, which has grown as a modern international area around Panama City at the Pacific entrance of the Panama Canal, have contributed to the surfacing of traffic problems as a social issue. In this situation, Panamanian President upon his visit to Japan in February 1980 requested the Government of Japan to provide technical cooperation on urban transport planning studies. In response, the Government of Japan had the Japan International Cooperation Agency (JICA) implement such study.

As the first step of the study, JICA Team stayed in Panama from January 1981 to October 1982 for the formulation of an urban transport masterplan for the Metropolitan Area. The outcome of this study, called ESTAMPA Phase I, was compiled into the "ESTAMPA Masterplan" report, submitted in December 1982. This report consisted of future economic framework forecast, land use plans as supported by the findings of comprehensive transport and traffic field surveys, the evaluation of alternative plans, and the recommendation of an urban transport masterplan for the target year of 2000, as well as investment programs for the masterplan project implementation.

Of a large number of projects proposed for the realization of ESTAMPA Masterplan, geographically interrelated projects for planned completion by 1990 have been selected for a feasibility study with the aims of accelerating the Reverted Area development, of meeting swelling motor traffic demand, and of improving the public transportation system. The scope of work of this feasibility study was determined in February 1983. JICA again dispatched a study team to Panama from May 1983 to April 1984 for the accomplishment of the feasibility study, called ESTAMPA Phase II.

2. Study Purpose

The purpose of this Feasibility Study is to assess the technical and socioeconomic feasibility of the subject projects and to, thereby, identify the projects whose implementation will contribute to the solution of said traffic problems in the Metropolitan Area. An additional important purpose of the Study is to transfer, through the process of actual study accomplishment, study and planning technology to the Panamanian counterpart personnel.

3. Scope of Study

1) Projects Subject to Study

The below enumerated road and public transport facility projects are subject to the present Feasibility Study:

(1) Road Projects

New Road Construction Projects	Corredor Norte
	Via El Paical Extension
	Via Martin Sosa Extension
	Via Cerro Ancon Extension
	Via San Miguelito Oeste

Existing Road Improvement Projects	Via Espana Via Bolivar Via El Paical Via Cerro Ancon San Miguelito Intersection

(2) Public Transport Facility Projects

Bus Centers	Plaza Cico De Mayo Universidad San Miguelito Chanis
Bus Maintenance Center	

2) Geographic Scope

The geographic area subject to the Feasibility Study shall be the Panama Metropolitan Area, as defined by ESTAMPA Masterplan, which shall be called the "Study Area". (See Fig. 1).

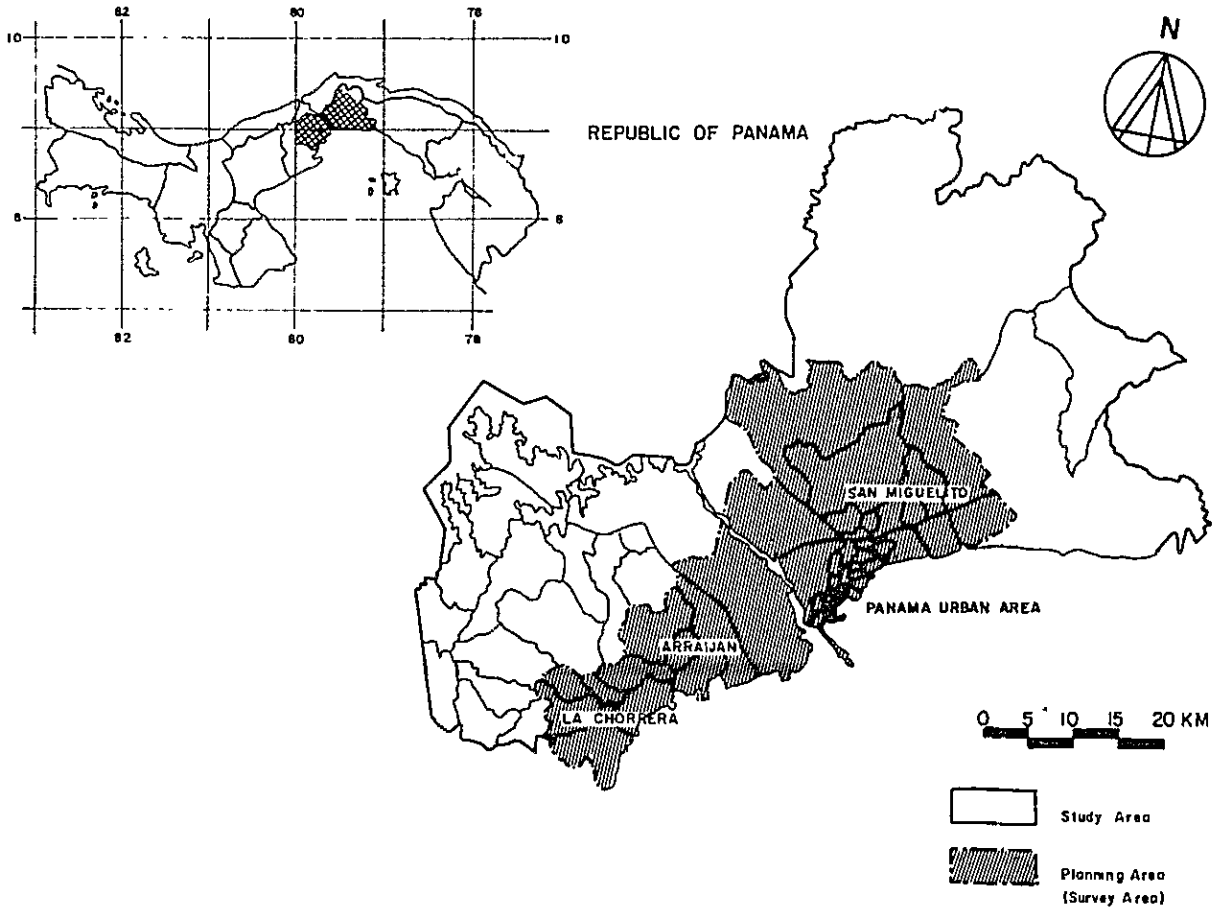


Fig. 1. STUDY AREA

3) Planning Year

Feasibility shall be assessed in view of the situations for the period up to the Planning Year of 2000. However, target year for project completion shall be 1990.

4. Organization

For ESTAMPA II, JICA organized a team (JICA Study Team) consisting of 12 experts for accomplishing the feasibility study under the supervision of a Supervisory Committee. The Republic Government of Panama instituted a system for cooperation, assigning the responsibility to the Ministry of Public Works (MOP), under which a Coordinator was appointed, organized under whom, in turn, was a Counterpart Team. Also, MOP organized a Steering Committee consisting of relevant authorities for the facilitation of smooth achievement of the study(See Fig. 2). The Panamanian Counterpart Team and JICA Study Team were unified as the ESTAMPA Team for the achievement of the Study.

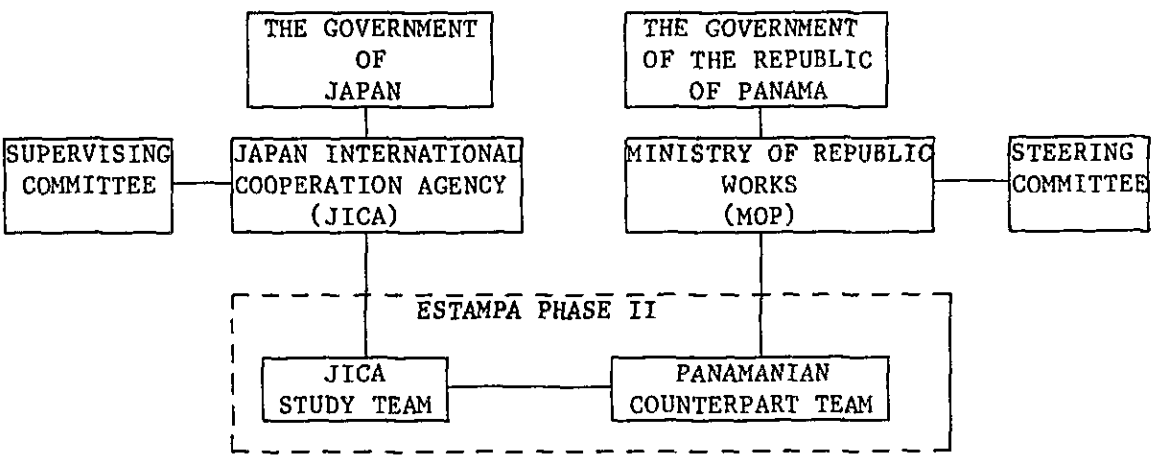


Fig. 2. ORGANIZATION OF THE STUDY

5. Study Report

The study report consists of three parts: (1) Executive Summary Report, (2) Main Report and (3) Drawing Volume.

The Executive Summary Report gives a digest not only of the conclusions and recommendations arrived at through the present Study, but also of the Study background and the descriptions of individual projects and their evaluations. The text generally appears on the left-hand side and figures on the right for easy reading and understanding.

The Main Report is comprised of the following chapters in addition to the Introduction:

I. Background of the Study
II. Planning Basis, and
III. Road Projects, and
IV. Public Transportation Facility Projects.

Drawing Volume is a collection of drawings which are not included in the Main Report and which give a more detailed idea of the projects — in other words, land use plan of project areas and preliminary design of Road Projects and Public Transportation Facility Projects.

TABLE 1 STUDY ORGANIZATION MEMBERS

JICA SUPERVISING COMMITTEE

Chairman	Dr. Makoto Ishikawa	The Technological University of Nagaoka
	Ing. Kazuo Yoda	Ministry of Construction
	Ing. Ichiro Ozawa	Ministry of Construction
	*Lic. Taketo Masui	Ministry of Transport
	*Ing. Asao Yamakawa	Ministry of Construction
	Ing. Masahiko Naito	Ministry of Transport
	Dr. Koichi Yamagata	Ibaraki University
	Ing. Kunio Matsukawa	Ministry of Transport

PANAMANIAN STEERING COMMITTEE

Coordinator:	Lic. Raul Cisneros	Ministerio de Obras Publicas
	Ing. Damaso Dominguez	Ministerio de Obras Publicas
	Lic. Amael Candanedo	Ministerio de Planificacion y Politica Economica
	Arq. Juvenal Hernandez	Ministerio de Vivienda
	Ing. Arturo Gonzalez	Direccion Nal. de Transito y Transporte Terrestre
	Ing. Angelino Harris	Ministerio de Gobierno y Justicia
	Lic. Vicente Allen	Municipio de Panama (FALLECIDO)

JICA STUDY TEAM

Ing. Takeshi Yoshida	Project Manager
Ing. Tetsuo Wakui	Deputy Manager, Transport Planner/ Economist
Ing. Hajime Goto	Supervisor for Land Survey
Arq. Iwane Mizuno	Land Use Planner
Arq. Ryuzo Hasegawa	Land Use Planner
Ing. Eizaburo Iwama	System Engineer for Demand Forecast
Ing. Toshihiro Hotta	Highway Engineer
Ing. Katsunori Fuse	Structure Engineer
Ing. Tetsuo Kawamura	Road/Traffic Engineer
Arq. Iwao Nakajima	Public Transport Facility Planner
Ing. Masato Harigae	Bus Maintenance Engineer
Ing. Yoshio Yoshida	System Engineer for Computer Training

PANAMANIAN COUNTER PART TEAM

Ing. Jesualda L. de Sanchez	Gerente de Proyecto Planificadora de Transporte
Arq. Feliciano Campbell S.	Planificador de Transporte Publico
Ing. Omar Moreno	Ingeniero de Transito y Vialidad
Arq. Roberto Ramos	Planificador de Transporte Publico
Ing. Jaime Maestre	Ingeniero Estructural
Ing. Francisco Ching Chong	Ingeniero Vial
Arq. Melva I. Abrego	Planificadora de Facilidades de Transporte Publico
Arq. Teresa Lopez	Planificadora de Transporte Publico
Ing. Rigoberto Quintana	Ingeniero de Sistemas
Sr. Hector Moreno	Planificador de Trafico
*Arq. Elba Urena	Planificadora Urbana

Note: *Predecessor

I. BACKGROUND OF THE STUDY

1. GENERAL BACKGROUND

2. OUTLINE OF ESTAMPA MASTERPLAN

I. BACKGROUND OF THE STUDY

1. General Background

1.1. Geography

1) Location and Size

An isthmian country connecting the North and South American continents, the Republic of Panama (hereinafter "Panama") borders with Colombia on east and with Costa Rica on west. With a national territory of 77,082 square kilometers, Panama extends from about 77 to 83 degrees of east longitude between latitudes seven and nine north.

Panama Metropolitan Area is located approximately in the middle of the nation. Centering around Panama City, it is an area of 3,570 square kilometers spreading for about 80 kilometers east-west and 50 kilometers north-south, and is located on the Pacific entrance of the Panama Canal. As defined and called the "Study Area" by the ESTAMPA Masterplan Study, the Metropolitan Area consists of Panama, San Miguelito, Arraijan, and Chorrera Districts and belongs to Panama Province.

2) Topography

A spine of ridges traverses the center of the Isthmus of Panama, and on the Pacific side are plains. The Study Area faces the Gulf of Panama on south, has continuous hills in the northern part, and is divided in the center by the Panama Canal running north-south. The sites of the projects subject to this Feasibility Study occur in the flat Panama urban area and the adjacent hilly areas.

3) Climate

Climate in Panama is generally understood as that of marine tropical type, with high temperature and humidity (see detailed meteorology information in Table I-1-1). From January to April is usually called the dry season, and from May to December, the rainy season. Of the annual precipitation of about 2,000 millimeters, some 93% fall during the rainy season.

TABLE I-1-1 METEOROLOGY IN PANAMA

	MONTH	PRECIPITATION(mm)		TEMPERATURE(CENTIGRADE)			RELATIVE HUMIDITY(%)		
		TOTAL	DAILY AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
1.	January	21.4	0.7	31.9	21.0	26.5	95.1	55.0	75.1
2.	February	9.9	0.4	32.8	21.5	27.2	93.4	51.4	72.4
3.	March	35.7	1.2	33.0	21.9	27.5	92.4	50.6	71.5
4.	April	124.0	4.1	32.2	22.5	27.4	95.1	58.8	77.0
5.	May	285.9	9.2	30.8	23.1	27.0	97.4	70.1	83.8
6.	June	264.1	8.8	30.6	22.6	26.6	98.2	72.0	85.1
7.	July	161.8	5.2	31.0	22.7	26.9	98.3	69.2	83.8
8.	August	251.8	8.1	30.8	22.4	26.6	98.7	71.4	85.1
9.	September	230.0	7.7	30.4	22.6	26.5	98.4	72.0	85.2
10.	October	371.1	12.0	29.9	22.3	26.1	98.8	73.5	86.2
11.	November	185.9	6.2	30.7	22.2	26.5	98.3	69.5	83.9
12.	December	113.3	3.7	31.1	21.7	26.4	97.0	64.2	80.6
	Total	2,054.9	5.6	31.3	22.2	26.8	96.8	64.8	80.8

SOURCE: PANAMA EN CIFRAS NOV.1983
RECORD FOR THE PERIOD 1978-1982

1.2. Socioeconomic Conditions

1) Geographical Features

The geographic location of Panama is greatly reponsible for the shaping of its history and its present prosperity. Since the successful 1503 Balboa expedition across the Isthmus, Panama, being the nodal point between the two grand continents and the two oceans, has grown as a trade center. Particularly the Panama Canal, since its opening in 1914, has immeasurably contributed to the socioeconomic development of the nation. Colon, situated near the Atlantic entrance to the Canal, has thrived as the site of a free-trade zone. Panama has now evolved as the financial center of Central and South American countries.

2) Population

The national population of Panama was 1,830,000 in 1980. Average annual population increase rate was 2.5% from 1970 to 1980, but the increase has been slowing down. The Study Area had a population of 730,000 in 1980, with an average increase rate of 3.8% during the same decade. This population was 2.3 times greater than that in 1960, as a result of population concentration to the Metropolitan Area(see Table I-1-2).

TABLE I-1-2 POPULATION OF THE REPUBLIC AND STUDY AREA
IN 1960, 1970 and 1980

AREA YEAR	1960	1970	1980	
Republic of Panama	1,075,541	1,428,082	1,830,175	
Study Area	331,804	519,643	759,153	(732,840)*
Percentage	30.8	36.4	41.5	

* Excluding the population which belongs to the non-reverted area of Ancon Corregimiento

SOURCE: CONTRALORIA GENERAL, CENSOS NACIONALES (1960, 1970, 1980)

Of the Study Area, heavily populated integrated zones (defined by the ESTAMPA Masterplan Study) are Panama Urban Area with 300,000, San Miguelito with 160,000, and Juan Diaz and Pedregal with 80,000. During said decade, population of Panama Urban Area decreased and San Miguelito experienced declining population increase rates, while such rates have risen in suburbs of Tocumen, Las Cumbres, Chilibre, and Arraijan. This phenomenon suggests that the urban area is expanding physically outward.

3) GDP and Economic Growth

The gross domestic product (GDP) of Panama in 1982 was estimated at 3,945 million balboas. With fluctuating economic performances, the growths of Panama's GDP during the past decade averaged 5.1% per annum. The rapid growth period from the end of 1960s to early 1970s was followed by the post-oil crisis stagnation, which has subsequently been recovered. Exception were 1982 and 1983, when the Panamanian economy fared not so well in the worldwide recessive economic environment(see Table I-1-3 for the trend of GDP).

TABLE I-1-3 GROSS DOMESTIC PRODUCT. YEAR 1972-1982

Y E A R	Gross Domestic Product (in 1970 market price)		
	Total (millions B/.)	Per-capita (B/.) 1/	Increasing Rate(%)
1972	1,170.7	744	4.6
1973	1,233.5	763	5.4
1974	1,263.7	761	2.4
1975	1,285.7	755	1.7
1976	1,307.1	748	1.7
1977	1,321.4	738	1.1
1978	1,450.8	791	9.8
1979	1,516.3	807	4.5
1980	1,745.8	892	15.1
1981	1,818.8	910	4.2
1982 p/	1,919.0	939	5.5

1/ Based on estimation of total population
p/ Preliminary figures
SOURCE: PANAMA EN CIFRAS, NOV. 1983

The large industrial origin of GDP is agriculture, whose growth, however, is deccelerating with consequentially shrinking sectoral composition rate to total GDP. While manufacturing sector represents only one-tenth of GDP, activities in the tertiary sector from electric power to government services represent already large, and still increasing, portions of GDP(see Table I-1-4).

TABLE I-1-4 COMPOSITION OF GROSS DOMESTIC PRODUCT. YEAR 1982

(unit: million B/. in 1970 price)

	SECTOR	GDP	SHARE
1.	AGRICULTURE	188.7	9.8
2.	MINING	4.1	0.2
3.	INDUSTRY	180.3	9.3
4.	CONSTRUCTION	159.1	8.3
5.	ELECTRICITY, GAS	59.2	3.1
6.	COMMUNICATION, TRANSP.	247.0	12.8
7.	COMMERCE, BANKING	434.6	22.6
8.	SERVICES	161.8	8.4
9.	GOVERNMENT SERVICES	232.1	12.1
10.	OTHERS	252.1	13.1
	TOTAL	1919.0	100.0

SOURCE: PANAMA EN CIFRAS, NOV. 1983

4) Employment by Sector

An estimated 500,000 employees are in Panama (1980), 29% in the primary industry, 18% in secondary, and a chacteristically high 53% in the tertiary. Also a high 74% of total employees of 220,000 in the Metropolitan Area is engaged in the tertiary industry, indicating a strong specialization of the economy in this sector(see Table I-1-5).

TABLE I-1-5 EMPLOYMENT BY SECTOR. YEAR-1980

	SECTOR	WHOLE COUNTRY (exclude indigenous areas)	STUDY AREA	SHARE %
1.	Agriculture	144,590	8,155	5.6
2.	Mining	965	280	29.0
3.	Industry	52,720	29,680	56.3
4.	Construction	29,825	14,410	48.3
5.	Electricity, Gas	7,965	4,650	58.4
6.	Communication, Transp.	28,840	10,495	36.4
7.	Commerce, Banking	87,210	57,580	66.0
8.	House Rental	128,815	78,715	61.1
9.	Others	22,610	15,565	68.8
10.	TOTAL	503,540	219,530	43.6

SOURCE: CONTRALORIA GENERAL

5) Foreign Trade

In 1982, Panama exported a total FOB value of 375 million balboas and imported a total FOB value of 1,407 million balboas (both excluding those of Colon Free Zone). Major export items were such agro-fishery products as bananas, shrimp, sugar, coffe beans, and beef, and refined petroleum products. Major import items were industrial products, transportation equipment, and chemical products(see Table I-1-6).

TABLE I-1-6 IMPORT AND EXPORT. YEAR 1978-1982

Unit: million B/.

	YEAR	IMPORT 1/	EXPORT 2/	BALANCE
	1978	844.8	256.4	-588.4
	1979	1,062.9	302.9	-760.0
	1980	1,288.9	360.5	-928.4
	1981	1,391.8	328.6	-1,063.2
p/	1982	1,407.4	375.4	-1,032.0

1/ Direct imports for local comsuption
2/ National goods and reexport of nationalized goods
p/ Preliminary figures
SOURCE: PANAMA EN CIFRAS, NOV. 1983

The international trade of Panama is characterized by its unusually large trade in the Free Zone, larger than the regular through-the-customs trade. A total FOB value of 1,703 million balboas was imported to Colon Free Zone and a total FOB value of 2,149 million balboas was re-exported from that zone in 1982(see Table I-1-7).

TABLE I-1-7 IMPORT AND EXPORT OF COLON FREE ZONE. YEAR 1978-1982

	COLON FREE ZONE (in millions B/.)	
YEAR	IMPORT	REEXPORT
1978	1,081.5	1,206.7
1979	1,324.9	1,529.1
1980	1,781.2	2,055.9
1981 p/	1,996.2	2,338.2
1982 p/	1,703.6	2,149.2

p/ Preliminary figures
SOURCE: PANAMA EN CIFRAS NOV. 1983

6) Government Finance

The filling of deficits with domestic and foreign loans has been the regular pattern of the recent treasury practice of the Government of Panama. The 1984 national budget of 137 million balboas represented only a 4% increase over the initial budget of 1983, reflecting a very stern condition of the national coffers. Against the budget of total current revenues of 895 million balboas (65%) and total capital revenues of 477 million balboas (35%), 539 million balboas is allocated for fiscal loan redemption. Of this, 407 million balboas is to pay back foreign loans, 242 million balboas for principal and 164 million balboas for interest(see Table I-1-8).

TABLE I-1-8 GOVERNMENT FINANCE. YEAR 1978-1982

Unit: million B/.

Year	Revenue	Expenditure	Balance
1978	624.9	647.3	-22.4
1979	896.0	933.5	-37.5
1980	1044.3	1064.9	-20.6
1981	1155.7	1216.5	60.8
1982	1557.7	1624.5	66.8

SOURCE: PANAMA EN CIFRAS, NOV. 1983

1.3. Interregional Transportation

1) Panama Canal

After vicissitudes which followed the initial attempt by Ferdinand Lesseps in 1880, the construction of the Panama Canal was re-started by Americans in 1903 and was completed in 1914. Ships navigate a distance of 69.1 kilometers from entrance to exit, rising and falling a total of about 26 meters between the sea level and the level of Gatun Lake, through three lock gates in each side. At the Pacific entrance is Balboa Port, and at the Atlantic is Cristobal Port.

During the American Fiscal Year of 1983 (ending June 30, 1983), 12,954 ships and 145.9 million long tons of cargo passed through the Canal, paying 287.8 million dollars in toll. After continuous yearly increases, the passage dropped in 1983, when the number of oil barges decreased due to the completion of a pipeline between Chiriqui and Bocas del Toro Provinces and when world trade suffered from serious recession(see Table I-1-9).

TABLE I-1-9 PANAMA CANAL TRAFFIC. YEAR 1978-1983

Year	TOTAL TRAFFIC		
	Number of Transits	Toll (Million B/.)	Long Tons of Cargo (millions)
1978	13,808	195.7	142.8
1979	14,362	209.5	154.4
1980	14,725	293.4	167.6
1981	15,050	303.1	171.5
1982	15,271	325.6	185.7
1983	12,954	287.8	145.9

SOURCE: PANAMA CANAL COMMISSION

Control over the Canal has been transferred from what used to be called the Panama Canal Company to a newly established Panama Canal Commission. The operation and maintenance of the Canal will be completely transferred to the Republic as of the year 2000 in accordance with the treaty (usually called "Torrijos-Carter Treaty) which was signed between the Republic of Panama and the United States of America in September 1977 and became effective as of October 1979. The Canal facilities are becoming old and short-capacity in order to accommodate ships which are becoming larger in size. A preparatory committee for the feasibility study of second canal alternatives was established in December 1982 and is presently meeting for discussions.

2) Airports

(1) Omar Torrijos Herrera Airport

This modern international airport with a 3,050-meter runway is located in Tocumen on the eastern edge of the Metropolitan Area. It is the hub of air transport in Latin America, accommodating about one million passengers and 50,000 tons of air cargo per year(see Table I-1-10).

TABLE I-1-10 PASSENGER AND CARGO IN OMAR TORRIJOS INTERNATIONAL AIRPORT. YEAR 1978-1982

YEAR	PASSENGERS	CARGO (metric tons.)
1978	1,130,420	42,582
1979	1,280,518	49,793
1980	1,183,251	52,141
1981	1,185,364	53,305
1982 p/	1,121,300	51,044

p/ Preliminary figures
SOURCE: PANAMA EN CIFRAS, NOV. 1983

(2) Marcos A. Gelabert Airport

Located in Punta Paitilla within Panama urban area, this airport has a 1,298-meter runway and serves domestic air connections between Panama City and parts of the nation, while it also accommodates privately owned airplanes. About 230,000 passengers and 80,000 tons of air cargo pass through this airport.

3) Sea Ports

(1) Balboa Port

Located at the Pacific entrance of the Panama Canal, Balboa Port is the second largest seaport in Panama (after Cristobal Port), handling a total of 440,000 metric tons of cargo (1982).

(2) Miscellaneous Ports

Other main ports in the Metropolitan Area are Vacamonte fishery port, which was newly constructed in 1979, and Muelle Fiscal Port near Centro.

4) Railway

The Panama-Colon Railway is older than the Panama Canal. With a 76km operational line, this railway carries about 470,000 passengers(1980) and 200,000 tons of freight annually. The number of passengers has been decreasing in recent years, and the major function of this railway is the transportation of goods, rather than urban travellers.

5) Highways

(1) Pan American Highway

Pan American Highway traverses the national territory east-west, running through, by, or near major cities in the relatively flat land on Pacific coast, and may be called the "backbone" of the country. Within the Study Area, this Highway constitutes the east-west axis of the Metropolitan Area connecting Chorrera, Arraijan, Panama City, San Miguelito, Juan Diaz, Pedregal, and Tocumen. Between Chorrera and Arraijan, Autopista offers a bypass.

(2) Transistmica Highway

Connecting Panama City and Colon across the Isthmus, Transistmica Highway constitutes the north-south axis of the Study Area. The section (Via Bolivar) where it joins with Pan American Highway in Panama City has the greatest volume of traffic.

2. Outline of ESTAMPA Masterplan

2.1. Economic Framework

1) Population

The Study Area had a population of 730,000 in 1980. Population increase rate, which has been an average 4.3% per annum during the past 20 years, will slightly slow down in the future. At an average rate of 3.3%, the population is estimated to increase to 1,020,000 by 1990 and at 2.7%, to 1,330,000 by the year 2000 (see Table I-2-1).

TABLE I-2-1 PLANNED POPULATION

AREA YEAR	1980	1990	2000
Planning Area	707,725	987,000	1,298,800
Study Area	732,840	1,018,000	1,334,800

SOURCE: ESTAMPA I

2) Employment

Employment in the Study Area are estimated to increase from the 220,000 in 1980 to 340,000 by 1990 and to 490,000 by the year 2000. Specialization of employment in the tertiary industry is predicted to advance from the 74% in 1980 to 79% in 1990 and to 81% in the year 2000 (see Table I-2-2).

TABLE I-2-2 EMPLOYMENT IN THE STUDY AREA

Industrial Sector	1980	1990	2000
Primary	8,155	7,155	6,430
Secondary	49,020	67,755	87,410
(of which manufacturing)	(29,680)	(41,110)	(53,760)
Tertiary	162,355	265,550	400,320
TOTAL	219,530	340,460	494,160

SOURCE: ESTAMPA I

3) Economic Activities

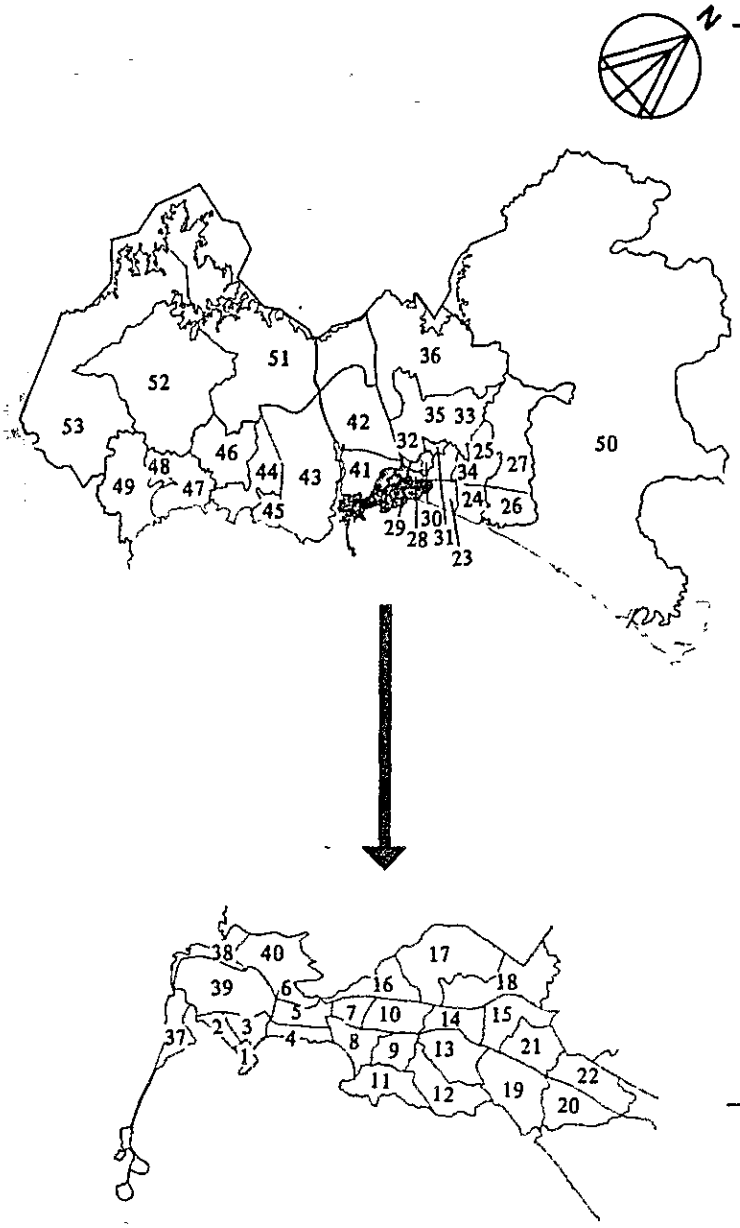
The gross regional domestic product (GRDP) of Panama Province is expected to rise from the 1,448 million balboas in 1979 to 3,577 million balboas by the year 2000, at an average rate of 4.4% per annum. Per capita GRDP, then, will grow from the 1,976 balboas in 1979 to 2,680 balboas by the year 2000, at a yearly average of 1.5% (see Table I-2-3).

TABLE I-2-3 ECONOMIC FRAMEWORK OF STUDY AREA

(Million Balboas)
(Thousand Persons)

Item	Year			
	1979	1985	1990	2000
GRDP	1,447.9	1,886.7	2,374.7	3,576.9
Regional Consumption Expenditures	1,184.6	1,443.6	1,821.3	2,755.8
Regional Gross Fixed Capital Formation	325.8	705.4	891.3	1,262.3
Population	732.8*	874.2	1,018.0	1,334.8
Economically Active Population	237.9*	299.3	368.0	533.4

*: Figures in 1980
SOURCE: ESTAMPA I



ZONE CODE AND NAME

	INTEGRATED ZONE №		ZONE NAME №	P.T. ZONE	CORREGIMIENTO*
STUDY AREA / PLANNING AREA	I	CENTRO	01	San Felipe	San Felipe
			02	El Chorrillo	El Chorrillo
			03	Santa Ana	Santa Ana
			04	Caledonia Sur	Caledonia
			05	Caledonia Norte	Caledonia
			06	Curundu	Curundú
	II	BELLA VISTA	07	La Cresta	Bella Vista
			08	Urracá-Campo Alegre	Bella Vista
			09	Obarrio	Bella Vista
			10	El Cangrejo	Bella Vista
	III	AREA RESIDENCIAL	11	Punta Paitilla	San Francisco
			12	San Francisco	San Francisco
			13	El Golf	San Francisco
			14	Vista Hermosa	Pueblo Nuevo
			15	Pueblo Nuevo	Pueblo Nuevo
			16	Lucerna	Betania
			17	El Dorado	Betania
			18	Betania	Betania
			19	Parque Lefevre	Parque Lefevre
			20	Chanis	Parque Lefevre
			21	Rio Abajo	Rio Abajo
			22	Villa Lorena	Rio Abajo
	IV	JUAN DIAZ PEDREGAL	23	Hipódromo	Juan Diaz
			24	Juan Diaz	Juan Diaz
			25	Pedregal	Pedregal
	V	TOCUMEN	26	Nuevo Aeropuerto	Tocumen
			27	Tocumen	Tocumen
	VI	SAN MIGUELITO	28	Area de Parasso	Mateo Iturralde y Victoriano Lorenzo
			29	Amelia Denis de Icaza	Amelia Denis de Icaza
			30	Samaria	Belisario Porras
			31	San Isidro	Belisario Porras
			32	Los Andes №2	Belisario Porras
			33	La Pulida	José Domingo Espinar
			34	Cerro Viento	José Domingo Espinar
	VII	LAS CUMBRES-CHILIBRE	35	Las Cumbres	Las Cumbres
			36	Chilibre	Chilibre
	VIII	ANCON ESTE	37	Fuerte Amador	Ancón
			38	La Boca	Ancón
			39	Balboa	Ancón
			40	Albrook Field	Ancón
			41	Fuerte Clayton	Ancón
			42	Pedro Miguel	Ancón
	IX	ANCON OESTE	43	Cocoli	Ancón
	X	ARRAIJAN	44	Arraijan Cabecera	Arraján Cabecera
			45	Veracruz	Veracruz
			46	Nuevo Arraján	Vista Alegre y Juan D. Arosemena
	XI	CHORRERA	47	Barrio Colón y Puerto Caimito	Barrio Colón y Puerto Caimito
			48	Barrio Balboa	Barrio Balboa
			49	Area de Cuadalupe	Playa Leona, El Coco Guadalupe
	XII	PACORA	50	Area de Pacora	Pacora y San Martin
			51	Area Nuevo Emperador	Santa Clara y Nuevo Emperador
	XIII	NUEVO EMPERADOR	52	Area de Mendoza	El Arado Herrera, La Represa y Mendoza
			53	Area de Santa Rita	Amador Arosemena Hurtado Iturralde Los Diaz, Feuillet, Obaldia Santa Rita
EXTERNAL AREA	XIV	SECTOR ESTE	54	Distritos de Chepo y Chimán	Distritos de Chepo y Chimán
			60	Provincia de Darién	Provincia de Darién
	XV	SECTOR NORTE	57	Provincia de Colón	Provincia de Colón
			58	Ciudad de Colón	Barrio Norte y Barrio Sur
			59	Comarca de San Blas	Comarca de San Blas
	XVI	SECTOR OESTE	55	Distritos Capira Chame San Carlos	Distritos Capira, Chame San Carlos
			61	Provincia de Coclé	Provincia de Coclé
			62	Prov. de Herrera y Los Santos	Prov. de Herrera y Los Santos
			63	Prov. de Veraguas Chiriqui Bocas del Toro	Prov. de Veraguas, Chiriqui Bocas del Toro
	XVII	ISLAS DEL GOLFO DE PANAMA	56	Taboga	Distrito de Balboa

*In the case of the external area, the division is at the level of Distritct or Province.

Fig. I-2-1 ZONES IN ESTAMPA MASTERPLAN

2.2 Land Use

1) Urban Development Pattern

The present pattern of land use in the Metropolitan Area is a reversed "T" formed by Pan American Highway and Transistmica perpendicularly adjoining thereto. Transfiguration of this reverse "T" into a triangle as the future development pattern is to be achieved through the Reverted Area development and the outward expansion of Panama urban area in such a way as to distribute living centers in all directions.

2) Population/Employment Distributions

The Study Area is divided into 13 integrated zones, and future population and employment have been estimated for each of them through the scrutiny of the size of developable land, population trend, government's development concept, expansion of autonomy, and other relevant factors (see Table I-2-4).

TABLE I-2-4 PLANNED POPULATION AND EMPLOYMENT(YEAR 2000)

		Population	Employment
I	Centro	96,600	81,030
II	Bella Vista	31,300	85,185
III	Area Residencial	210,300	87,735
IV	Juna Diaz-Pedregal	174,000	39,540
V	Tocumen	59,300	17,000
VI	San Miguelito	301,800	61,900
VII	Las Cumbres-Chilibre	89,000	15,250
VIII	Ancon Este	98,400	37,015
IX	Ancon Oeste	1,500	2,395
X	Arraijan	111,500	24,030
XI	Chorrera	125,100	32,960
PLANNING AREA TOTAL		1,298,800	484,040
XII	Pacora	21,600	5,990
XIII	Nuevo Emperador	14,400	4,130
STUDY AREA TOTAL		1,334,800	494,160

SOURCE: ESTAMPA I

3) Urbanized Area Expansion

In 1980, urban limits encompassed an area of 12,800 hectares. This is expected to expand by 1.6 times to 20,000 hectares by the year 2000, while urban population density will rise from 50 per hectare to 62 per hectare. Future urban population will be 1,236,000, of which 827,000 will live in the existing urban area and 409,000 in new urban areas. Of an estimated 7,200 hectares of new urban areas, about half or 3,600 hectares will be developed in east of Panama urban area: Juan Diaz, Pedregal, Tocumen, and San Miguelito Oeste. Of the other half, 500 hectares will be the Reverted Area, and 2,300 hectares will be in Arraijan and Chorrera.

4) Living Centers

The Reverted Area is a vast expanse, only developable under government plans, and is strongly expected to play a vital role in correcting the distorted configuration into which Panama urban area has sprawled thus far. To achieve this, land for various urban functions, as well as housing areas, will be developed on the axis of Corredor Norte.

Major housing area development shall be in the Reverted Area itself, San Miguelito Este, Arraijan, and Chorrera. Commercial centers for the entire Panama Metropolitan Area shall be Centro and Bella Vista. Suburban commercial centers shall be planned in San Miguelito Este and Chorrera, while semi-urban commercial centers shall be planned in Betania, Rio Abajo, San Miguelito Centro, and Arraijan.

Public facilities shall be distributed as follows: Maranon Government Center, Albrook Center, Corredor Norte Center, San Miguelito Este Suburban Center, and Chorrera Oeste Suburban Center. Industrial estates shall be developed in Tocumen, Albrook, Vacamonte, and Chorrera.

2.3 Traffic Demand

1) Trip Characteristics

The Person-Trip Survey in 1981 revealed the total trips related to Panama Metropolitan Area as 1,470,000 trips per day. Of this, 96% were internal trips, and through trips were few. By purpose, a large number of trips were for to go home (44%), to work (18%), and to school (16%). By mode, a great majority, or 34% of all trips, were made by public bus, followed by 27% by car.

A chracteristic gap in unit trip generation exists between the 3.39 trips by car owning family members and the only 1.94 by non-car owning family members in the Study Area. The rate of car owning families, who make oftener trips by non-car owning families as indicated, is already 29% and is still increasing in the Study Area.

2) Traffic Demand Increase

Traffic demands in 1990 and the year 2000 have been estimated using the result of the Person-Trip survey, which revealed the existing condition, the future population and other economic indicators as predicted, and the forecast model constructed for the purpose. As estimated, the Study Area population will increase by 1.8 times from the existing 710,000 to 1,330,000 by the year 2000, while person-trip generation will increase by 1.5 times from the present 1,430,000 trips to 2,230,000 trips for 1990 and 3,140,000 trips or 2.1 times for the year 2000. The predicted faster trip increases than population increases is explained by car ownership increase and consequential rise in the people's mobility.

By Integrated zones, Panama urban area will continue to have a high potential in trip generation and attraction, while the rate of trip increase will be low. Conversely, high trip increase rates are estimated for San Miguelito, Juan Diaz-Pedregal, and Ancon Este, where rapid urbanization will take place.

If future car ownership increase will be checked in no way in the Metropolitan Area, the rate of car owning families will rise to 32% by the year 2000 with accompanying enlargement of the passenger car's modal split share from the present 27% to 32%, and , consequently, traffic volume in PCU will swell to 1,110,000, or 2.3 times the present 490,000. In view that motor traffic increase will inevitably entail enormous amounts of road investments, some effective control will be necessary on the ownership and the utilization of passenger cars with some effective measures for the qualitative and quantitative improvement of public transport services.

Average length of trips for all purpose is estimated to be prolonged from the present seven kilometers to 11 by the year 2000, reflecting outward expansion of the urbanized area. particularly, the average length of commuting trips, whose quantity usually much determines the quantity of necessary transport facilities, is estimated to be elongated from the current nine kilometers to 12.

Two major traffic flows into Panama urban area will be that from east (Juan Diaz-Pedregal, Tocumen, etc.) and that from north (San Miguelito, Las Cumbres, etc.), and the greatest cross section traffic flow will occur in the part of the urban area where the two flows will merge.

2.4 Transportation Network Masterplan

1) Alternative Evaluation

The following five alternative Metropolitan Area transportation network have been conceived of for the year 2000 as the combinations of (1) whether or not the ownership and utilization of passenger cars will be somehow controlled, (2) whether the transportation axis will traverse the center of the urban area or run outside, and (3) various kinds of transport facilities:

a. Street widening without car control
b. Expressway construction without car control
c. New road construction with control on cars
d. Exclusive bus expressway construction with control on cars
e. Rail transit construction with control on cars

Evaluation has screened out all but alternatives (c) and (e).

2) Transportation Network Pattern

The year 2000 transportation network shall be of a ladder pattern formed by major east-west axes and north-south diversion axes, thereby placing motor traffic axes outside the urban area and bus or rail transit axes in its center(see Fig. I-2-2).

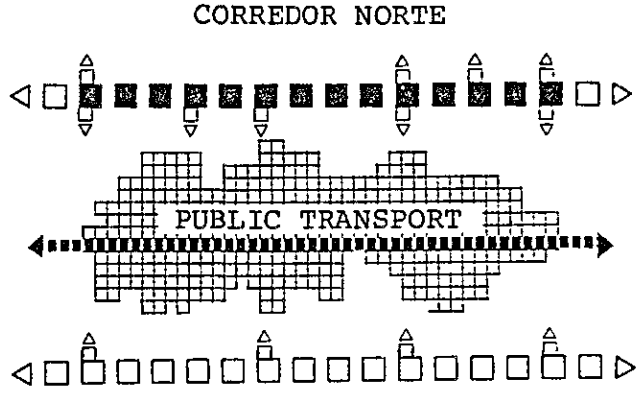


Fig. I-2-2 CONCEPT OF TRANSPORT NETWORK MASTERPLAN

3) Transportation Network Masterplan

The year 2000 transportation masterplan, in terms of long distance traffic, shall consist of Autopista, Pan American Highway and Transistmica Highway, and, in terms of urban traffic, shall be formed by;

a. The construction of Corredor Norte, a new arterial which will run east-west to the north of the urban area, for the accomodation of motor traffic while serving as development axis for the Reverted Area and future urbanized areas.

b. The establishment of Corredor Sur, a new arterial which will run also east-west but to the south of the urban area along the Bay of Panama, for accomodation of motor traffic while serving as development axis for diverse urban development projects.

c. The development of previously lacking north-south streets (Via Cerro Ancon, Via El Paical, Via Brasil, and Via Once de Octubre) in the urban area, for the diversion of traffic to and from said two corridors.

d. The development on the axis of Corredor Norte, an arterial road network, by the construction of three new roads (Via San Miguelito Oeste, Via San Miguelito Centro, and Via San Miguelito Este).

Public transport development projects shall include the followings:

a. The introduction, under a long term plan, of a rail transit system starting from Centro, traversing the center of the urban area, and reaching San Miguelito Este and Juan Diaz.

b. The quantitative and qualitative improvement of bus services through the accomplishment of a bus rerouting scheme to include the introduction of an express bus service, mini-bus service, and circular city bus service, the discontinuation of long distance routes, and the enhancement of routes with poor service.

c. The construction of four bus centers in the city as strategic points for bus service improvement

d. The construction of a bus operation base in Albrook with a maintenance center for the modernization of bus maintenance.

Fig. I-2-3 presents the idea of this Transportation Network Masterplan.

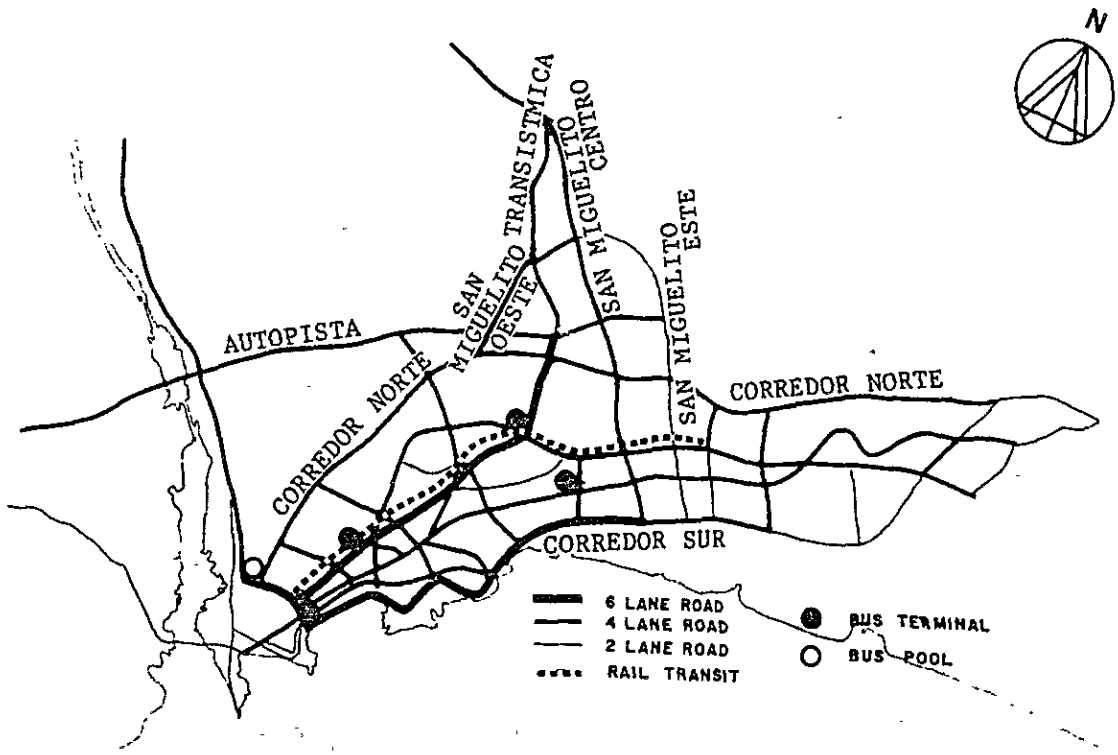


Fig. I-2-3 TRANPORTATION MASTERPLAN FOR 2000

2.5 Investment Program

The numerous projects proposed for the realization of the year 2000 Metropolitan Area Transportation Masterplan need to be arrayed on the axis of chronology into an implementation schedule. This schedule must achieve early implementation of the urgent projects, the expansions of necessary investments in pace with the national economic growths, and growth of transport network in synchronization with traffic demand swell as estimated, while maintaining a harmony between these Masterplan projects and those forerunning.

(1) Road Investment

Total road investment is estimated at 350 million balboas, 120 million by 1990 and 230 million from 1991 to 2000. Major projects to be implemented by 1990 will be the construction of the western half and the Reverted Area section of Corredor Norte, the construction and improvement of roads connecting thereto (Via Cerro Ancon, Via Martin Sosa, Via El Paical, and Via San Miguelito Oeste), the construction of the central section of Corredor Sur, and the widening and upgrading of the currently heavily congested urban streets such as Via Espana.

(2) Public Transport

The bus center project is to be implemented by 1990 with a total investment of 15 million balboas. The rail transit project, which is estimated to require 300 to 310 million balboas, is conceived of for implementation in the latter half of the 1990s.

(3) Traffic Control Projects

The improvement of traffic signal system and other traffic control projects shall subject to short term investment.

II. PLANNING BASIS

1. LAND USE

2. TRANSPORTATION

3. GEOGRAPHICAL CONDITIONS

4. CONSTRUCTION

5. PROCEDURE OF EXECUTION

II. PLANNING BASIS

1. Land Use

1.1 Present and Future Land Use

Forecasts of future land use in the Study Area shall basically follow those given by the ESTAMPA Masterplan. However, future land use, population and emkployment in the Reverted Area in 1979 will be restudied for the reason that new plans and projects have been implemented in this area since the completion of the ESTAMPA Masterplan. Here we will discuss the present and future land use in the Study Area excluding the Reverted Area.

The current conditions of the Panama Urban Area are looked at from the standpoints of commerce, housing and industry. First of all, commerical and entertainment activities are concentrated as of old in the Santa Ana and Calidonia zones. At the same time, there is a new center of business and commerce in Bella Vista, where major financial institutions of Panama are concentrated. Moreover, a commercial center based on a new type of commercial activity, the suburban shopping center, is currently being formed along the Ricardo J. Alfaro.

Concerning housing, it should be mentioned that as part of the process in which the current residential distribution of the city took shape, the old residential distribution of the city took shape, the old residential center of Oldtown expanded in an easterly direction with the passage of time. The Bella Vista zone, which is now a center of new business and commerce, was originally developed as a residential area. Because of the gradual shift in emphasis from residential to commercial/business, high and middle income families are moving out to Punta Paitilla and middle to low income families are being pushed even further out from the center of the city to San Miguelito, Juan Diaz, Pedregal and Tocumen, and even to Las Cumbres and Chilibre to the north.

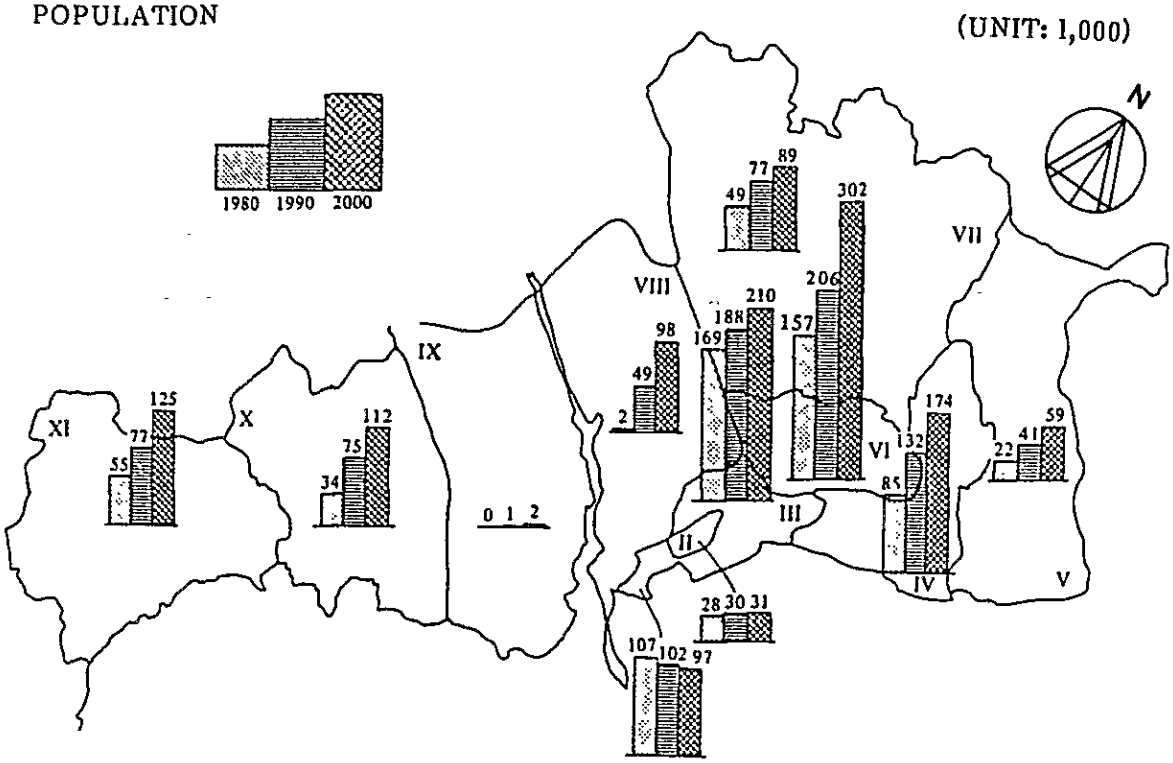
Although there is no definite sector which can be called industrial, numerous auto repair shops and consumer goods factories are seen in the Centro zone and along trunk roads, while the recent tendency is to locate them in the suburbs of Juan Diaz, San Miguelito, Domingo Diasz, etc.

According to population and employment forecasts (Fig. II-1-1) made under the ESTAMPA Masterplan, zones expected to see a sharp rise in both population and employment in year 2000 are San Miguelito followed by Juan Diaz and Pedregal, while the Centro zone is forecasted to record an increase in employment despite a decrease in population. The remaining zones will see a natural increase in both population and employment. In other words, major expansions in new housing construction and commercial/industrial activities will occur mainly in the eastern area. At the same time, commerical activities in the Centro zone are expected to continue unabated hereafter, while Bella Vista's shift from residental to business/commercial is expected to expand over a wide area. For these reasons, the Masterplan conceives of a plan for creating new towns such as La Pulida and Cerro Viento towards Tocumen in San Miguelito and areas to its east.

In addition to the above-mentioned conception of land use in the future, the Reverted Area will also be utilized as described below. The skeletal structure of the city is thus expected to develop from an "inverted T" to one of triangular shape. Current land use (1983) and future land use (the year 2000) are given in Figs. II-1-2 and II-1-3.

POPULATION

(UNIT: 1,000)



EMPLOYMENT

(UNIT: 1,000)

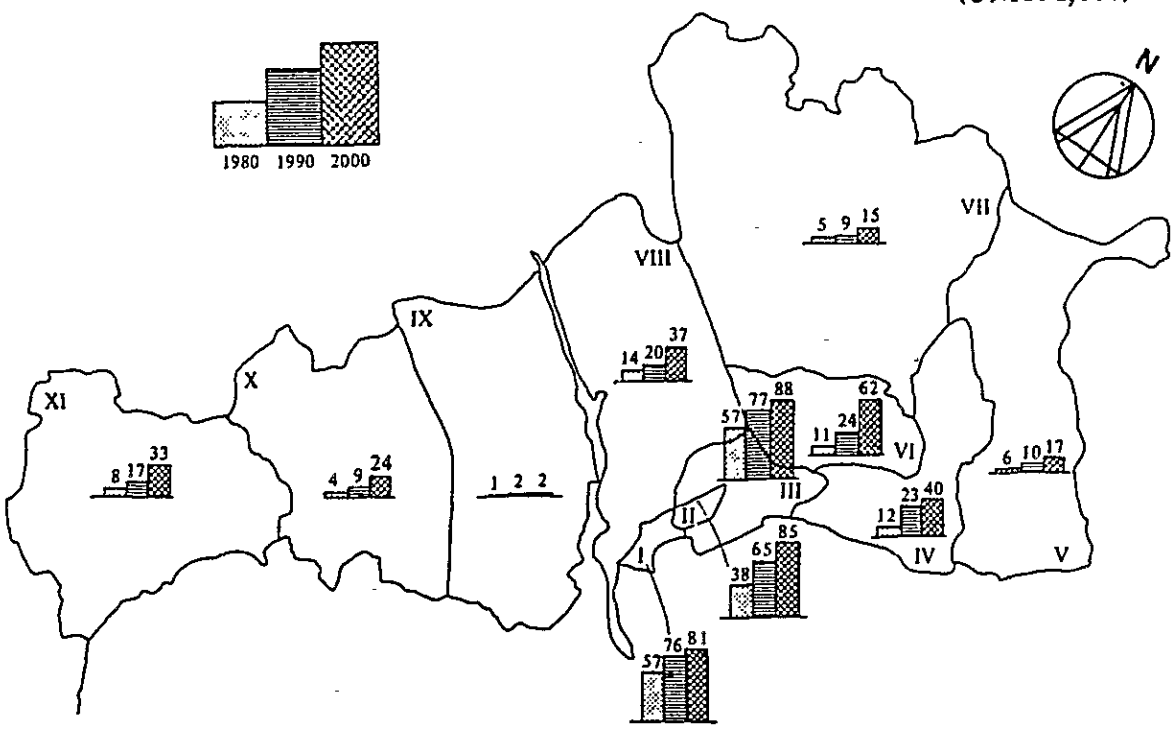


Fig. II-1-1 POPULATION AND EMPLOYMENT (1980,1990 and 2000)
* I - XI: Integrated zones shown in appendix

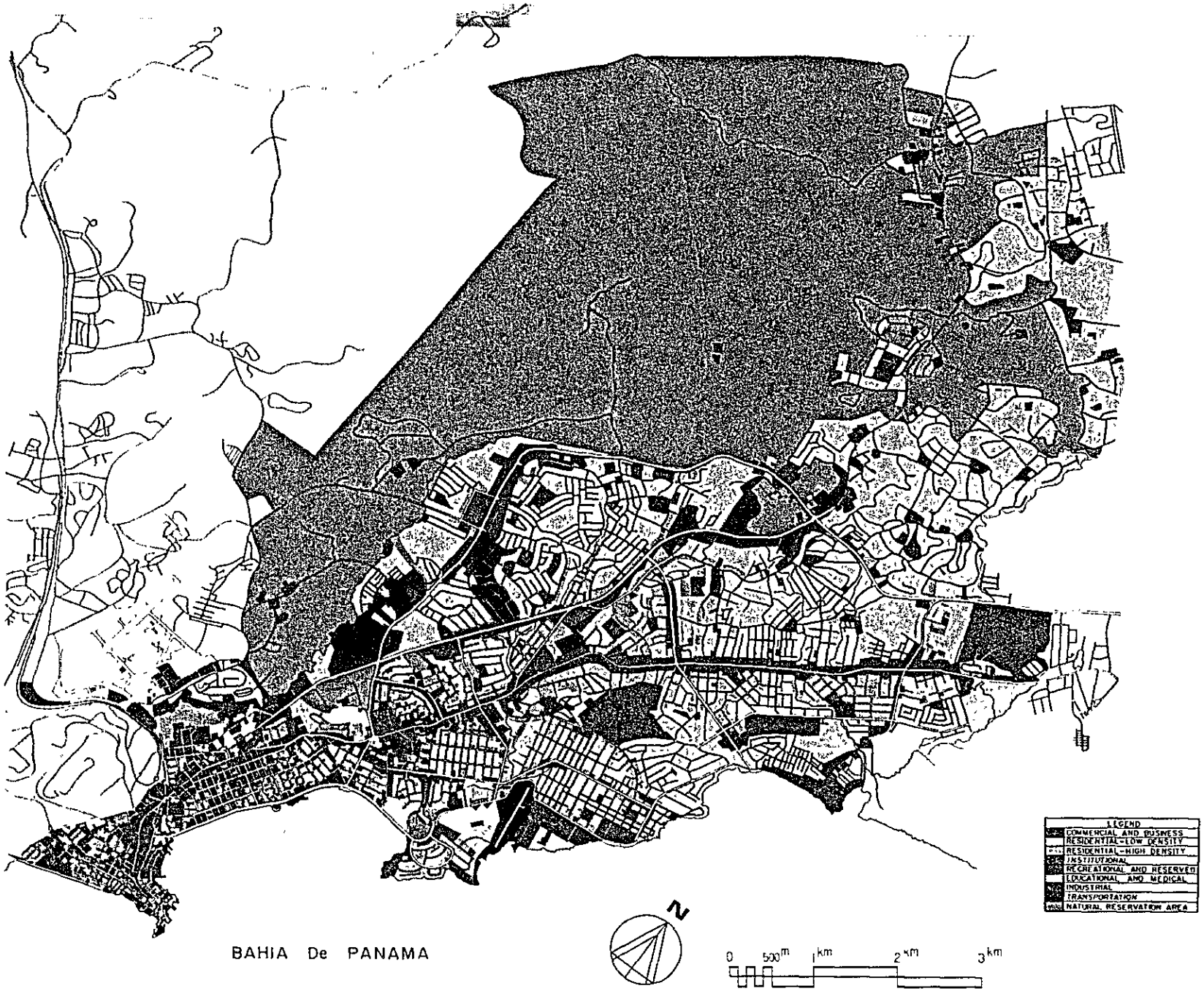


Fig. II-1-2 CURRENT LAND USE (1981)

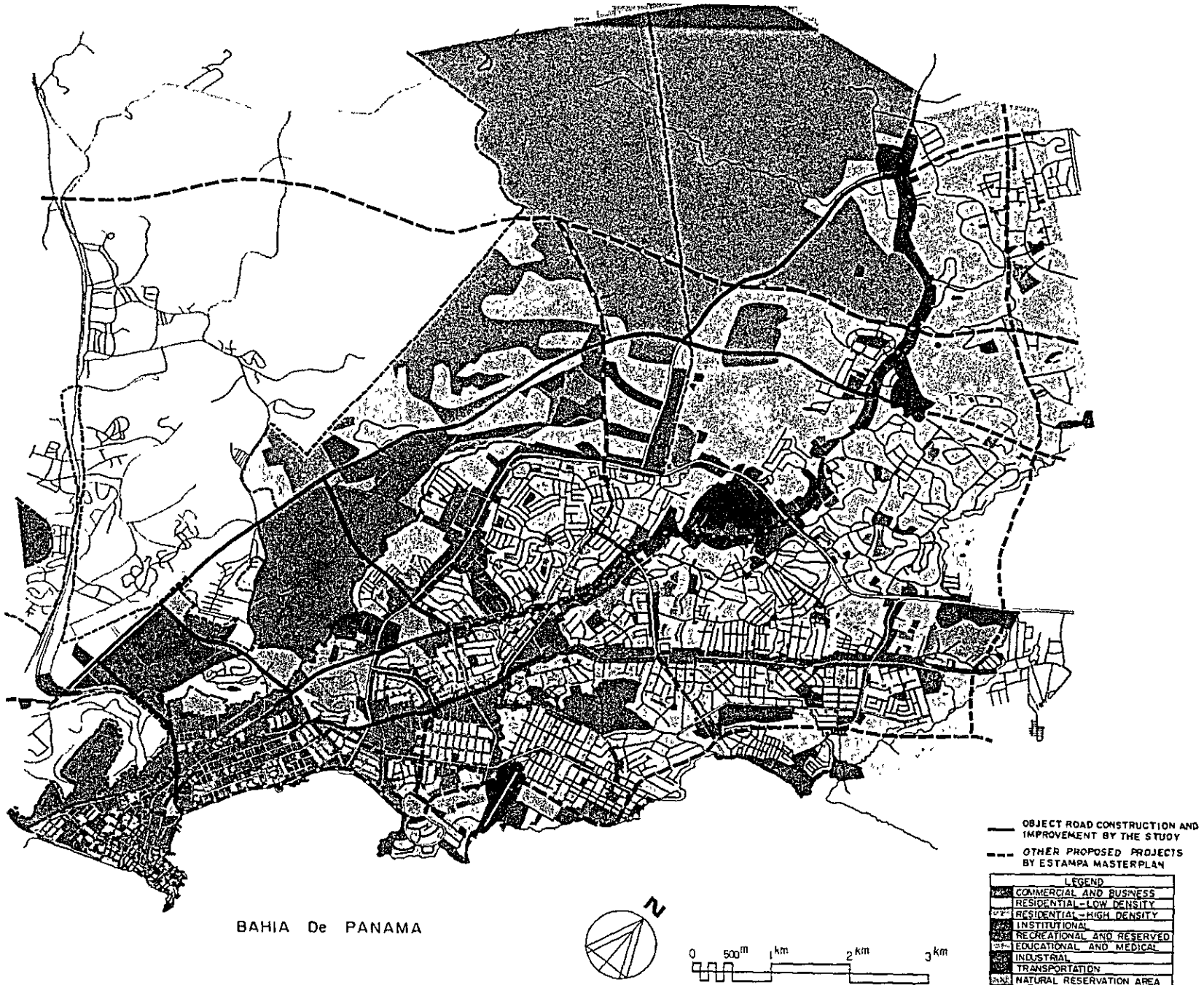


Fig. II-1-3 FUTURE LAND USE (2000)

b) The route of Corredor Norte needs to be changed, because the site of the Natural Recreation Park (265 hectares) was reserved; and

c) Land use in Albrook toward Curundu area is more strongly characterized as the site of transportation facilities by the Rail Cargo Terminal, the Inter-Urban Bus Terminal, and the Bus Maintenance Center

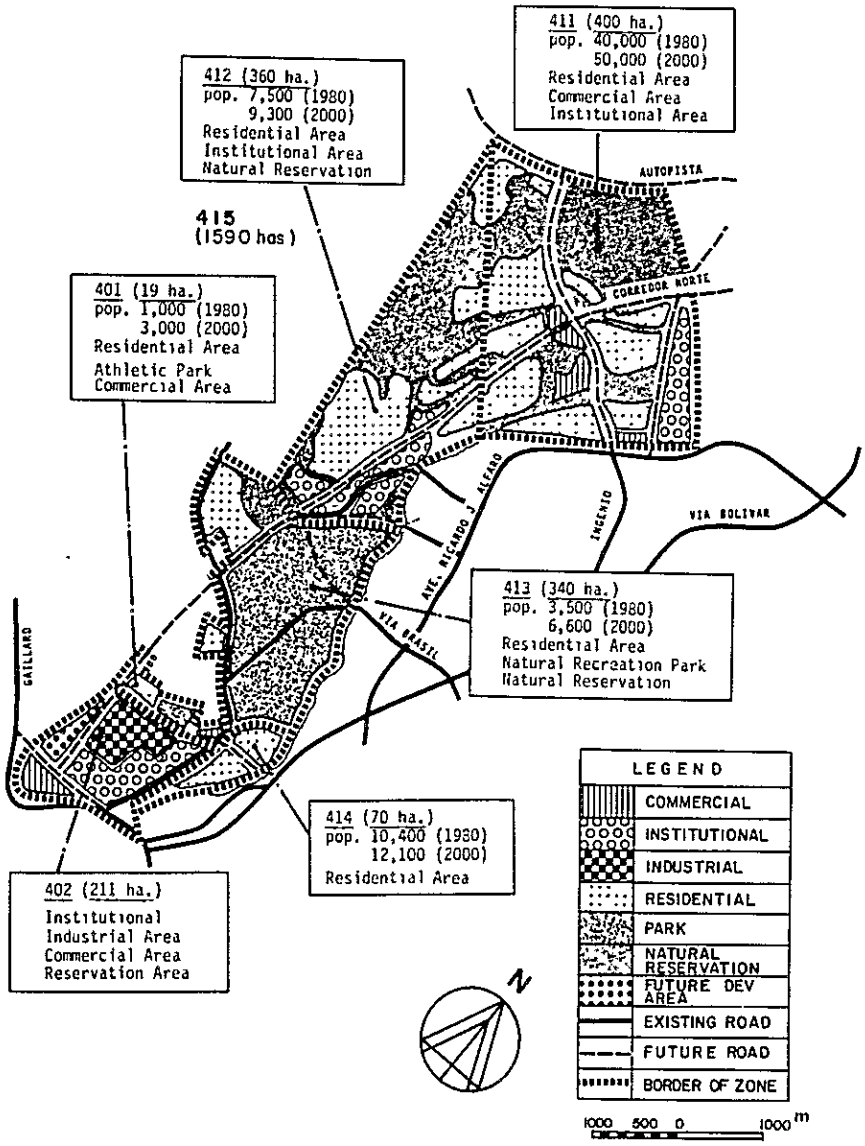


Fig. II-1-4 PRELIMINARY LAND USE PLAN FOR REVERTED AREA

1.2. Future Land Use in the Reverted Area

Since October 1st, 1979, the effective date of the new Panama Canal Treaty, the Government of Panama has continued discussions as to how the Reverted Area might be best utilized. As a result, followings have taken place with regard to the use of the Reverted Area.

(1) October 1979- December 1982:

As soon as the new Treaty became effective, several Government agencies started to move into the facilities existing in the Previous Albrook Airfield Area, while an orphanage and the facility of IPHE (the Bureau of Special Education) were constructed in nearby Camino de la Amistad.

(2) After December 1982

In pursuance to the government decision of December 30th, 1982, the following projects were formulated for implementation starting in 1983:

a)	Central Agricultural Market	Under construction
b)	Rail Cargo Terminal	Completed
c)	Building 1009 Restoration	Completed (Customs and Rail Bureau have moved in)
d)	Via Juan Pablo II	Completed
e)	Boulevard General Omar Torrijos H	Under construction
f)	Inter-Urban Bus Center	Under construction
g)	Natural Recreation Park	Land secured
h)	Municipal Cemetery	Site yet to be decided
i)	Sanitary (waste disposal) Area	Site yet to be decided
j)	Housing Project in Curundu	Under construction

(3) Since March 1983

In March 1983, the Reverted Area Development Office (Oficina de Planificacion y Desarrollo del Area Canalera: OPDAC) was established as an advisory organization to the Ministry of Economic Planning (MIPPE) for the purpose of formulating projects to be implemented after those listed above. Then, in October 1983, an inter-ministerial conference, including OPDAC, was organized for the purpose of formulating a short term development program for the Reverted Area, and OPDAC is currently undertaking the conceptualization of the land use of the Reverted Area. Preliminary land use was conceived of, as shown in Fig. II-1-4, at the end of 1983, when the following projects were included in the plan:

a) IPHE facilities construction
b) A Chinese Park construction
c) National Bank of Panama (Banco Nacional de Panama) building construction.
d) A Hindu Park construction
e) Judicial Institution facilities construction.

Based on the previous procedure of development in the Reverted Area, this concept of preliminary land use differs from ESTAMPA Masterplan in that:

a) Almost entire developable land along Corredor Norte will be urbanized, if implemented;

1.3. Future Population and Employment in the Reverted Area

1) Sub-Zones

For the purpose of estimating future population and employment in the Reverted Area, Albrook Field (Zone 40) and Fuerte Clayton (Zone 41), as used in ESTAMPA Masterplan, are further sub-divided into two zones, 401 and 402, and five zones, 411 through 415, respectively.

2) Future Zonal Population and Workers

In addition to the population estimated in ESTAMPA Masterplan, this Study considers a population increment attributable to the progress of urbanization under private efforts which are now very probable in addition to the public projects considered by Masterplan. Furthermore, it is now predicted that three-fourths of the year 2000 level of development will be achieved by 1990, as development will be accelerated in the Reverted Area, whose advantage of proximity to the built-up area will be much utilized under the recently rapidly increasing demand for houses (See Table II-1-1)

TABLE II-1-1 FUTURE POPULATION FOR SUB-DIVISION OF ALBROOK FIELD (40) AND FUERTE CLAYTON (41)

(persons)

Sub-Zone Number	YEAR 1980	1990	2000
401	-	1,000	3,000
402	-	-	-
Sub-Total(40 Zone)	-	1,000	3,000
411	-	40,000	50,000
412	-	7,500	9,300
413	-	6,200	7,800
414	-	10,400	12,000
415	200	200	200
Sub-Total(41 Zone)	200	64,300	79,300

SOURCE: ESTAMPA

The number of workers as accounted for at the place of living (night population of workers) shall be estimated by applying the worker ratio estimated for each industrial sector in ESTAMPA Masterplan to sub-zonal population (see Table II-1-2).

TABLE II-1-2 FUTURE WORKERS BY INDUSTRY FOR SUB-DIVISION OF ALBROOK FIELD (40) AND FUERTE CLAYTON (41)

(persons)

Sub-Zone Number	YEAR 1980	1990	2000
401	-	340	1,070
402	-	-	-
Sub-Total(40 Zone)	-	340	1,070
411	-	13,680	17,850
412	-	2,570	3,320
413	-	2,120	2,780
414	-	3,560	4,280
415	80	80	80
Sub-Total(41 Zone)	80	22,010	28,310

SOURCE: ESTAMPA

3) Future Zonal Employment

The quantity of future employment as the number of workers as accounted for at the place of work (day population of workers) is estimated as follows.

The sources of future employment are divided into (a) those business establishments that will be located in the industrial, business, and institutional areas to be developed under plans and (b) service business establishments to be created for catering to the needs of population as increased due to residential development and opening of new offices. Employment in the former is estimated by applying, to the size of the planned areas, the average employment per unit of land as determined in reference to similar examples in Panama. Employment in the latter is estimated by applying, to population, the number of employment per unit of population as determined (see Table II-1-3-3).

TABLE II-1-3 FUTURE EMPLOYEES FOR SUB-DIVISION OF ALBROOK FIELD (40) AND FUERTE CLAYTON (41)

(persons)

Sub-Zone Number	YEAR 1980	1990	2000
401	-	30	150
402	-	3,300	12,100
Sub-Total(40 Zone)	-	3,330	12,250
411	-	1,200	2,500
412	-	3,810	9,060
413	-	210	420
414	-	310	600
415	3,990	4,000	4,000
Sub-Total(41 Zone)	3,990	9,530	16,190

SOURCE: ESTAMPA

2. Transportation

2.1. Existing Traffic

2.1.1. Traffic Survey

A traffic counting was carried out in July and August of 1983 both at major intersections and at selected points along trunk roads. The location of survey points are shown in Table II-2-1 and Fig. II-2-1. The main purpose of the surveys are:

(a) To compare the results of this survey with those of the same kind of survey of 1981 in order to find the change in traffic volumes and their characteristics during the two years.

(b) To get basic data to formulate the road network.

(c) To get basic data for planning the bus transport facilities. For this purpose, vehicles passing through intersections are classified into 3 types of bus, large truck, and others (car and etc.).

(d) To get basic data for the demand estimate at intersections to be improved.

TABLE II-2-1 LOCATION OF TRAFFIC SURVEY

Date	Point number	Duration of observation (hours)	Intersections
26 July	101	12	Via Espana, Calle Martin Sosa
26 July	102	12	Via Espana, Ave. Justo Arosemena
26 July	103	12	Via Espana, Ave. Federico Boyd y Ave. Manuel E. Batista
26 July	104	12	Via Espana, Calle 49 B Oeste
26 July	105	12	Via Espana, Calle 52 (Eusebio A. Morales)
26 July	106	12	Via Espana with Via Argentina
26 July	107	12	Via Espana with Calle 57
26 July	108	12	Via Espana with Via Brasil
26 July	109	12	Via Espana with Via Belisario Porras
26 July	110	12	Via Espana with Via Fernandez de Cordoba
26 July	111	12	Via Espana with Ave. 1 Norte (Transversal 85)
26 July	112	12	Via Espana, Calle 66 Oeste (Jorge Zarak)
26 July	113	12	Via Espana, Ave. 11 de Oct. Ave. Ernesto T. Lefevre
26 July	114	12	Via Espana, Paseo del Cincuentenario (Chanis)
27 July	115	12	Via Bolivar, Ave. Ricardo J. Alfaro and Ave. Domingo Diaz (San Miguelito)
27 July	116	12	Ave. Ricardo J. Alfaro, Ave. La Paz
27 July	117	12	Ave. Ricardo J. Alfaro, Calle 74 Oeste (El Dorado)
27 July	118	12	Ave. Ricardo J. Alfaro, Calle 71 B Oeste (Mc Donald's)
27 July	119	12	Ave. Ricardo J. Alfaro, Via Brasil (El Paical)
27 July	120	12	Via Bolivar, Via Brasil
27 July	121	12	Via Bolivar, Ave. Ricardo J. Alfaro and Ave. Manuel E. Batista (Paso Elevado)
2 August	A	24	Ave. de los Martires (Cerro Ancon entrance)
2 August	B	24	Ave. Gaillard (In front of Motor Pool)
2 August	C	24	Ave. Balboa near Calle 3 de Noviembre
2 August	D	24	Via Espana (Casa Matriz Banco Nacional de Panama)

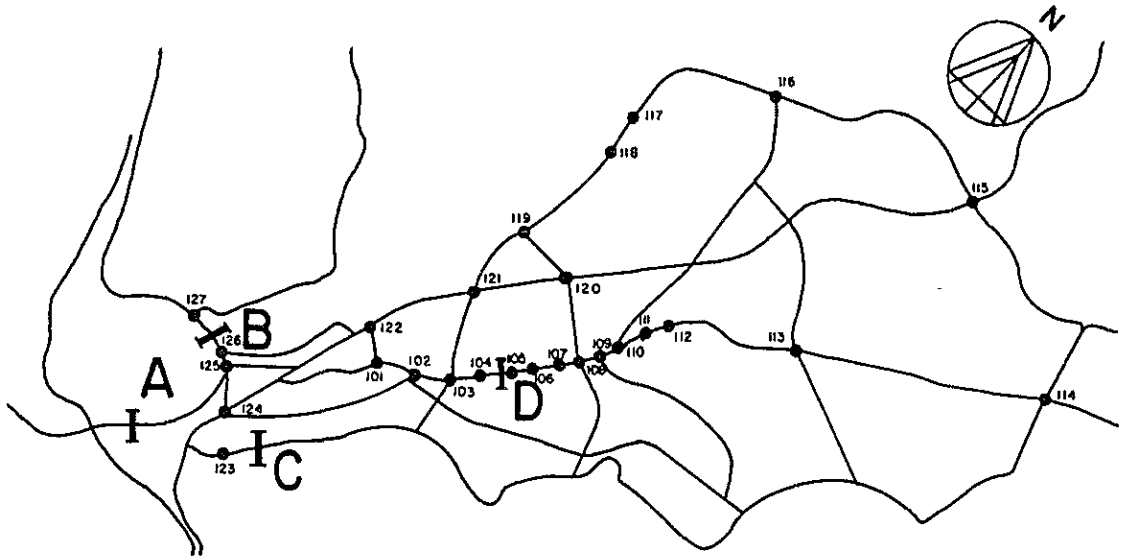


Fig. II-2-1 LOCATION OF TRAFFIC SURVEY

2.1.2. Characteristic of Traffic Flow

1) Characteristics of 12 hrs. Traffic Flow

The 12 hrs. traffic volume on main roads are illustrated in Fig. II-2-2. Via Espana has a daily traffic of about 20,000 vehicles (herinafter refered as "v.") between Via Martin Sosa and Chanis intersections. About 20,000v. flow both on Ave. Central and Ave. B, which cross each other at Cinco de Mayo intersection. Ave. Ricardo J. Alfaro and Transistmica have also a heavy traffic of more than 20,000v. and at the Paso Elevado intersection (Via Bolivar and Via Ricardo J. Alfaro-Ave. Manuel E. Batista), where the above 2 trunk roads intersect, about 30,000v. were observed.

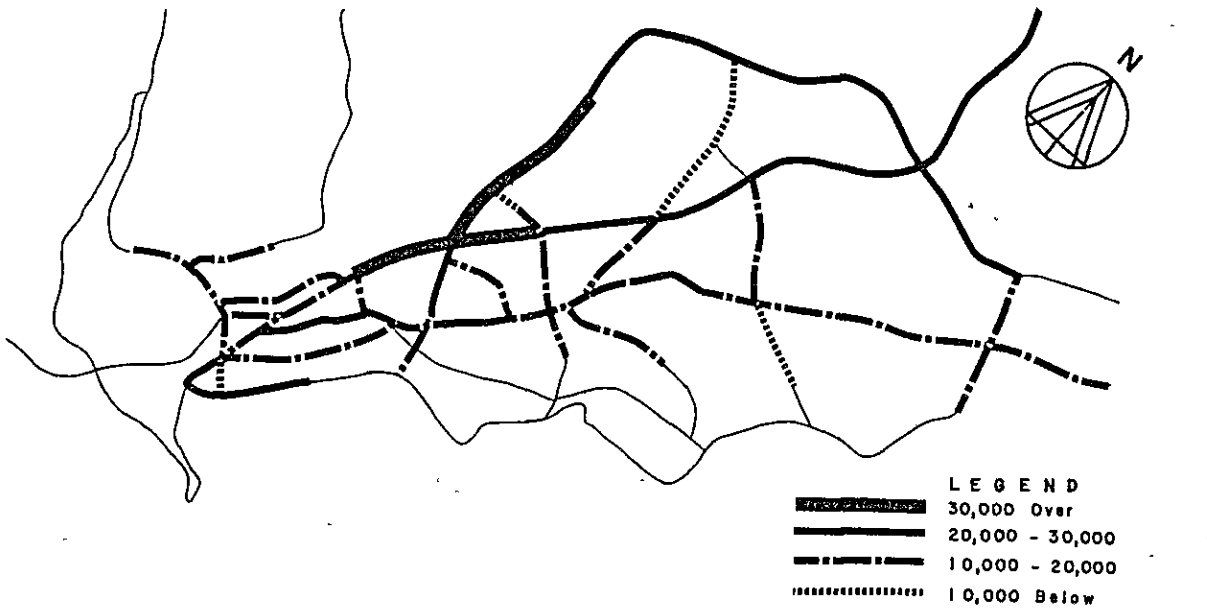


Fig. II-2-2 12 HOURS TRAFFIC VOLUME

Fig. II-2-3 shows a comparison of traffic volume in 1983 with those in 1981. All the legs of San Miguelito intersection show over 10% increase in all the directions. Such high increase rates are seen also at Chanis intersection and the intersection of Via Espana with Ave. 11 de Octubre. As a general tendency, peripheral areas such as Juan Diaz and San Miguelito show higher growth rates than the central part of the city, such as Centro and Bella Vista.

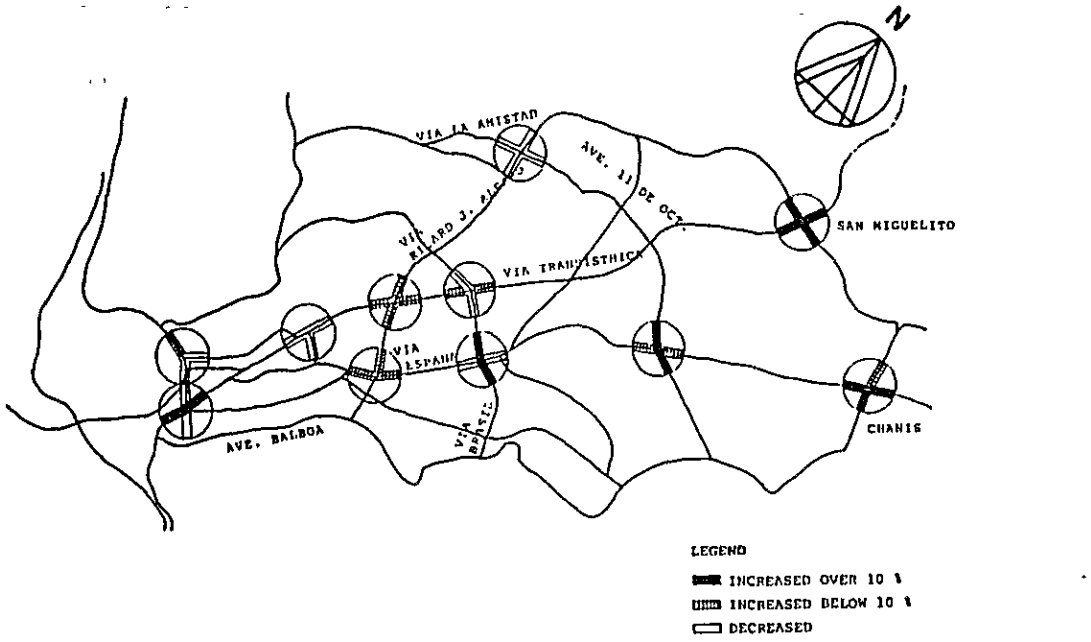


Fig. II-2-3 CHANGE IN TRAFFIC VOLUME DURING 1981 AND 1983

Sections with large truck factors are shown in Fig. II-2-4. Comparatively high ratio of over 5% can be observed only around the San Miguelito intersection. Via Espana, east of Calle 66 Oeste, shows low ratio of below 2%, while others fall in between 2% and 5%.

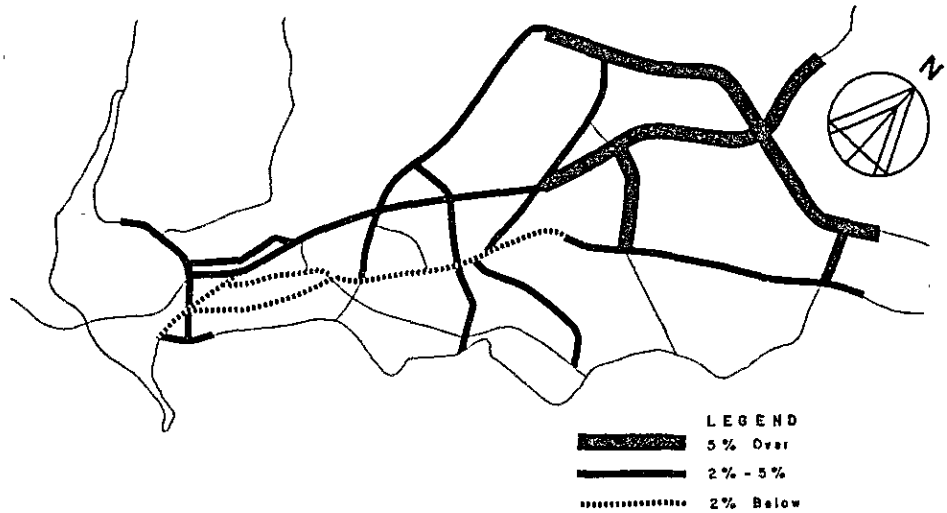


Fig. II-2-4 TRUCK FACTORS OF 12 HOURS TRAFFIC VOLUME

2) Characteristics of 24 hrs. traffic flow

Results of 24 hrs. traffic counting volume are summarized in Table II-2-2. The daytime traffic ratio of Via Espana is larger than others. This means that during the nightime, Via Espana has heavy traffic, almost half that of the daytime, while others have 23 to 35 percent. According to the traffic survey by ESTAMPA in 1981, the ratio of Via Espana was 1.35. Among four observed points, there is little difference in the prominent direction traffic ratios.

TABLE II-2-2 24 HOURS TRAFFIC AND ITS CHARACTERISTICS

Survey Point	Survey Duration	Traffic Volume 1*	2*	Total	Daytime Traffic Ratio 24h/12h	PHF (24Hrs.) (%)
A. Ave. de los Martires	12 Hrs.	9,685	11,499	21,184	-	-
	24 Hrs.	13,329	15,238	28,567	1.35	7.5
B. Ave. Gaillard	12 Hrs.	7,053	7,418	14,471	-	-
	24 Hrs.	8,716	9,054	27,770	1.23	7.5
C. Ave. Balboa	12 Hrs.	14,759	13,058	27,817	-	-
	24 Hrs.	19,060	16,605	35,665	1.28	8.9
D. Via Espana	12 Hrs.	8,943	9,241	18,184	-	-
	24 Hrs.	13,068	14,048	27,116	1.49	6.6

Note. 1* and 2* show direction.
SOURCE: ESTAMPA

The Peak Hour Factor (PHF) on Ave. Balboa is the highest and that of Via Espana has little hourly traffic variation while on other roads traffic concentrates to some specific hours such as commuting time and lunch time.

As shown in Table II-2-3, small type vehicles including pick-up and taxi are the majority on every road. Above all, Ave. Balboa shows the highest share of small type vehicles, at 94%, while Via Espana shows the lowest, at 87%. The highest share of buses is observed along Via Espana at about 16%. The shares of taxi are remarkable on Via Espana and on Ave. Balboa about 26% each.

TABLE II-2-3 TRAFFIC BY VEHICLE TYPE

Survey Point	Small type Vehicle				Large Type Vehicle				Daily Traffic Total
	Passenger Car	Pick-Up Reparto	Taxi	Sub-Total	Bus	Truck	Trailer	Sub-Total	
A. Ave. de Los Martires	(62.5) 17,837	(12.2) 3,484	(13.8) 3,947	(88.5) 25,268	(7.9) 2,255	(2.6) 756	(1.0) 288	(11.5) 3,299	28,567
B. Ave. Gaillard	(70.2) 12,476	(12.6) 2,245	(7.9) 1,396	(90.7) 16,117	(4.7) 827	(2.9) 515	(1.7) 311	(9.3) 1,653	17,770
C. Ave. Balboa	(57.4) 20,457	(11.1) 3,954	(26.1) 9,293	(94.6) 33,704	(2.9) 1,393	(1.5) 524	(0.0) 44	(5.4) 1,961	35,665
D. Via Espana	(56.3) 15,255	(3.7) 1,000	(26.7) 7,246	(83.8) 22,721	(15.5) 4,189	(0.7) 198	(0.0) 8	(16.2) 4,395	27,116

SOURCE: ESTAMPA
Note: Figures in Parenthes : percent

3) Bus Traffic

Fig. II-2-5 shows 12 hrs. bus traffic count at the approach of each intersection and Fig. II-2-6 indicates bus traffic ratio. The heaviest bus traffic is at 5 de Mayo, that is, along Ave. Central, 3419 buses, running towards 5 de Mayo, out of which 357 buses are in the peak hour. The bus traffic ratio at the same point is also the highest and exceeds 20%.

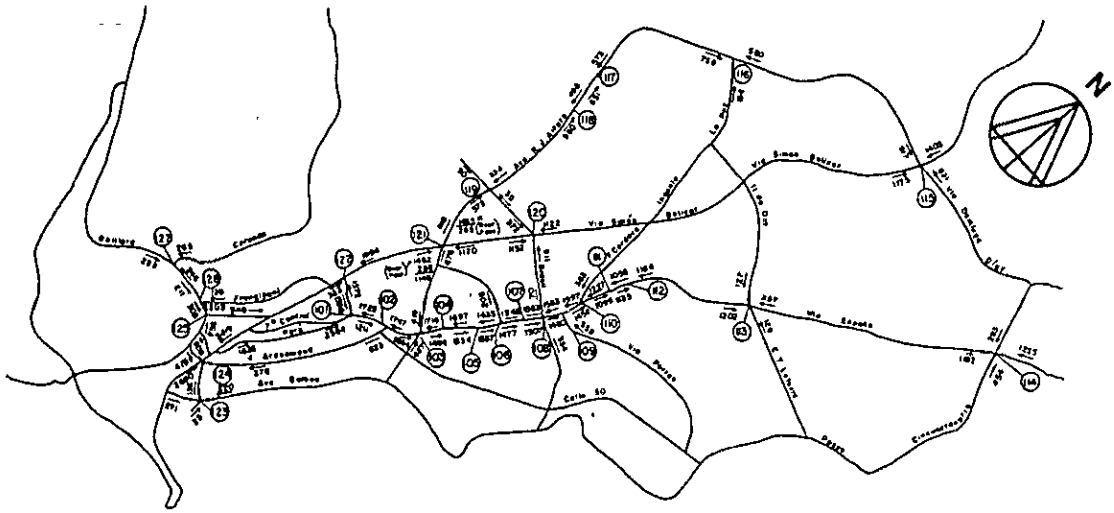


Fig. II-2-5 BUS TRAFFIC (12 HOURS)

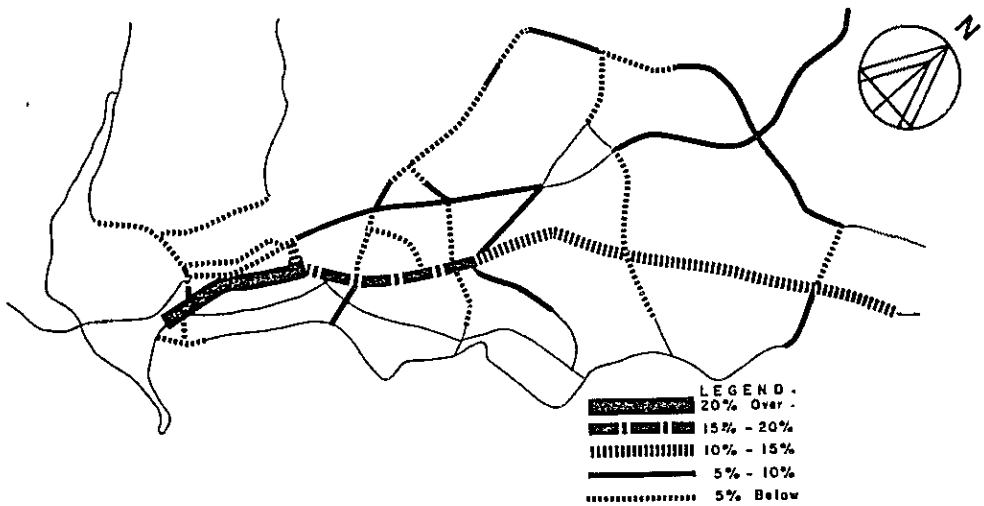


Fig. II-2-6 RATIO OF BUS TRAFFIC (12 HOURS)

At the intersection of Via Espana with Via Martin Sosa, the heavy bus traffic, which is the second largest among the intersections, is undoubtedly one of the main causes of the congestion around this point. Almost all sections of Via Espana have heavy bus traffic of over 1,000v., and the bus traffic ratio is also high, at 10-20%. In case of Transistmica, bus traffic is more than 1,000v., but the bus traffic ratio is rather moderate, at 5-10%.

2.1.3 Traffic Congestion and Travel Speed

Traffic congestion, expressed by vehicles in queues every 15 or 30 minutes at specific points, are shown in Fig. II-2-7 for Via Espana and Fig. II-2-8 for Transistmica. Along Via Espana, traffic congestion is serious in almost all sections within the project area. In case of Ricardo J. Alfaro and Transistmica along which the intervals of signalized intersections are rather long, traffic congestion is not serious except at the main intersections of San Miguelito, Via El Paical, Paso Elevado intersection and Via Martin Sosa. Travel speed is shown in Table II-2-4 (Via Espana) and Table II-2-5 (Transistmica).

Travel speed on Via Espana is the lowest in all time periods. In the sections from Via Martin Sosa to Ave. Jorge Zarak, the travel speed is specially low, mainly because (1) the geometric condition of Via Espana is comparatively poorer than that of Via Ricardo J. Alfaro and Transistmica in spite of the fact that Via Espana has almost the same volume of traffic as the others, and (2) along Via Espana, traffic signals are installed more than along the others.

On Via Ricardo J. Alfaro and Transistmica, travel traffic speed decreases toward CBD in the morning peak hours and conversely toward suburbs in the evening peak hours.

TABLE II-2-4 AVERAGE SPEED ON VIA ESPANA (KM/H)

Direction	Section	Morning	Afternoon	Evening
Panama to	101 to 112	15.1	15.1	11.0
Tocumen	112 to 114	42.1	45.2	40.7
	101 to 114	23.6	23.1	18.6
Tocumen to	112 to 101	16.6	22.7	13.0
Panama	114 to 112	32.6	40.2	40.1
	114 to 101	22.4	30.1	20.9

SOURCE: ESTAMPA
For Survey Point Numbers, see Table II-2-4

TABLE II-2-5 AVERAGE SPEED ON TRANSISTMICA (KM/H)

Direction	Section	Morning	Afternoon	Evening
Panama to Tocumen	115 to 122	45.6	35.0	27.9
Tocumen to Panama	122 to 115	23.4	35.7	34.7

SOURCE : ESTAMPA
For survey point nos., see Table II-2-4

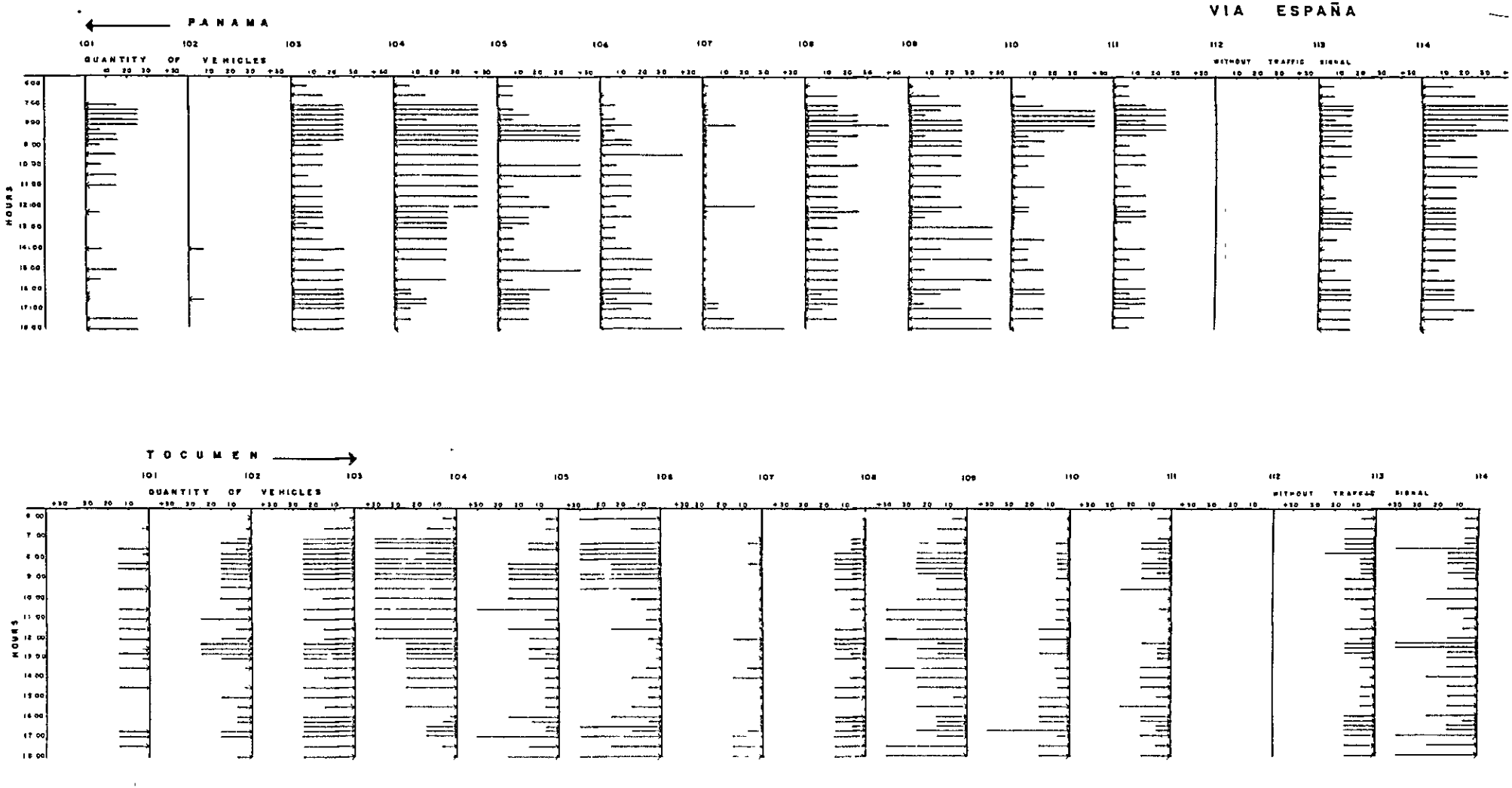


Fig. II-2-7 TRAFFIC CONGESTION ALONG VIA ESPANA

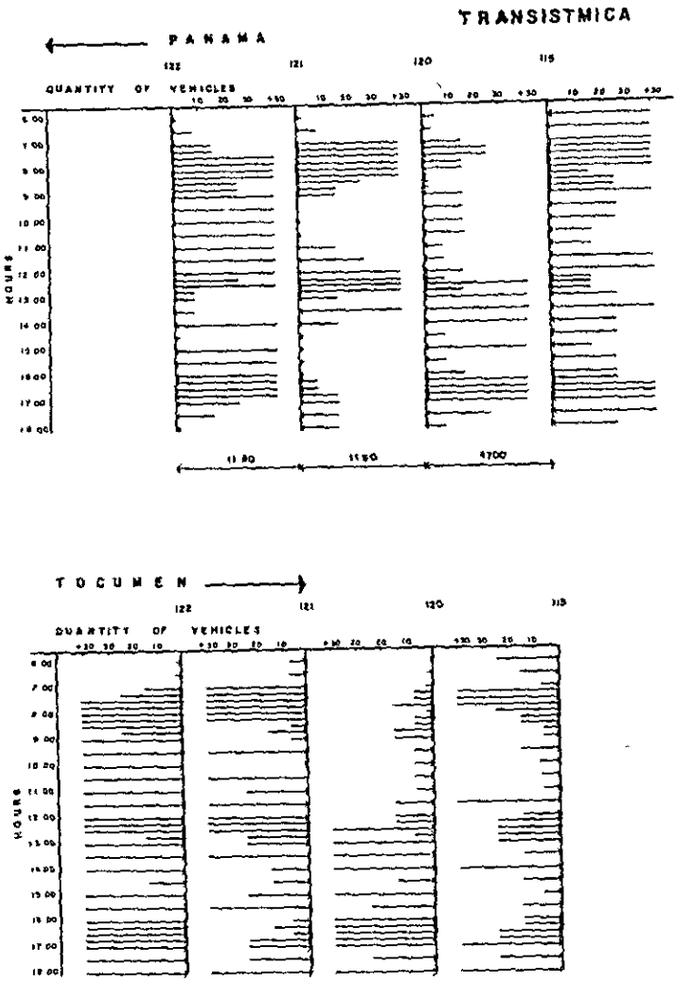


Fig. II-2-8 TRAFFIC CONGESTION ALONG TRANSISTMICA

2.2 Traffic Demand Forecast

2.2.1 General

1) Objective

One of the basic conditions of a transportation facility project is to forecast the amount of traffic demand there will be for the facility. Since the present study is a feasibility study on projects selected from those included in the ESTAMPA Masterplan, the traffic demand forecast given here is based on that conducted under the ESTAMPA Masterplan. However, a feasibility study on individual transportation facility projects differs from the masterplan in forecast accuracy and application of forecast results. The objective of coducting a traffic demand forecast under the present study can be summarized into the following points:

a) To determine the functions of subject roads and to study the road specifications.
b) To study the route alternatives of new roads.
c) To use as reference data when designing intersections.
d) To establish the size of public transportation facilities.
e) To use as reference data when making cost-benefit calculations for project evaluation.

Since traffic demand forecast for public transportation facilities in relation to d) above is discussed in Chapter IV, the volume forecast mainly on road traffic will be discussed below.

2) Procedure

The future OD Table prepared when establishing the ESTAMPA Masterplan is used as the basis of the present forecast, except that the zones in Reverted Area along Corredor Norte are subdivided as given below. The method of preparing the future OD Table is given in detail in the ESTAMPA Masterplan but is summarized here as follows:

The current OD Table, which is tha basis of the future OD Table, is based on the results obtained from the one-month person-trip survey conducted in May 1981. The person-trip survey consisted of visiting selected house-holds included in the 1980 population census and interviewing all members of 6 years or older as to their individual movements.

The Study Area is divided into 53 zones and the External Area into 10 zones, making a total of 63 zones, called PT zones, nationwide. The Study Area zones in which person-trip surveys were conducted are clled the Survey Area, except in the planning stage, when they are called the Planning Area, and these consists of 49 PT zones. The PT zones are combined into integrated zones, of which there are 11 in the Survey Area, 13 in the Study area and 17 nationwide, for the purpose of making analyses and forecasts.

The current OD Table was prepared from the person-trip survey results by expanding the sample data and by making use of the results of the cordon line and screen line surveys conducted at the same time.

The traffic demand forecast was made by the four-step method using i) trip generation/attraction model, ii) traffic distribution model, iii) modal split model and iv) traffic assignment model.

a) Generation/Attraction Model
Taking a house-hold's owenership or non-ownership of a car as a personal attribute, gross trip generation rates for households with and without cars are given as 3.39 trips/day and 1.94 trips/day, respectively. The Generation/ Attraction model is a linear regression model prepared by trip purpose with overall population, number of workers by industry and number of jobs by industry as explanatory variables. Trip purposes are classified, as in the facts-finding survey, into commuting to work, commuting to school, returning home, on business, shopping and personal business.

b) Distribution Model
A Voohees's gravity model is used for the distribution model, but different model is used for trips within zones.

c) Modal Split
The modal split model is based on the binary choice method, wherein first all trips are divided into pedestrian trips and vehicle trips, then vehicle trips are divided into those by public means of transportation and those by private means of transportation, and so forth until the modal split ratios for pedestrian, passenger cars, trucks, taxis, public buses and private buses are arrived at.

d) Assignment Model
Calculations of traffic assignments are made according to the network simulation method, wherein the certain traffic capacities are established for road links and inter-zone trips are assumed to follow the quickest possible link. Using the passenger car conversion rate for each type of vehicle, all vehicle types, except for pedestrian traffic, are converted into number of passengers cars, and this unit is called the passenger car unit (PCU). The traffic is assigned in five steps, and the quickest route within a road network is determined by the QV curve, which gives the relationship between increasing traffic volume, road capacity and running speed. The basic concept for establishing the QV curve follows that given in the Highway Capacity Mannual.

2.2.2 Subdivision of OD Table

1) Objective

Accompanied with the reversion of Canal Area (Albrook Field; Zone No. 40, Fuerte Clayton; Zone No. 41), trips related to this area had to be reviewed in order to make analysis on traffic demand in more detail. With this purpose, sub-zones included in the original 2 zones above were considered and were forecasted by following procedure preserving original numbers of trips.

2) Procedure

First, Generation/Attraction of trips (G/A trips) by purpose of sub-zones were calculated by sub-zonal future economic indicators, using G/A Model developed in ESTAMPA Masterplan. Next, G/A trips of some sub-zones were adjusted by the reason of applicability, and then the ratio by purpose of G/A trips of each sub-zone for original zone were calculated. After that, O.D. Table by purpose made in Phase I was divided and aggregated G/A trips into one total purpose, and then, the ratio of division for O.D. Table by mode was re-calculated.

Finally, O.D. Table by mode in ESTAMPA Masterplan was divided by that ratio. The flow chart of this procedure is shown in Fig. II-2-9. For each mode of transport, the same ratio of division for original zone was applied, because the trips divided into sub-zones from the original zone can behave in same manner as trips related in the same original zone.

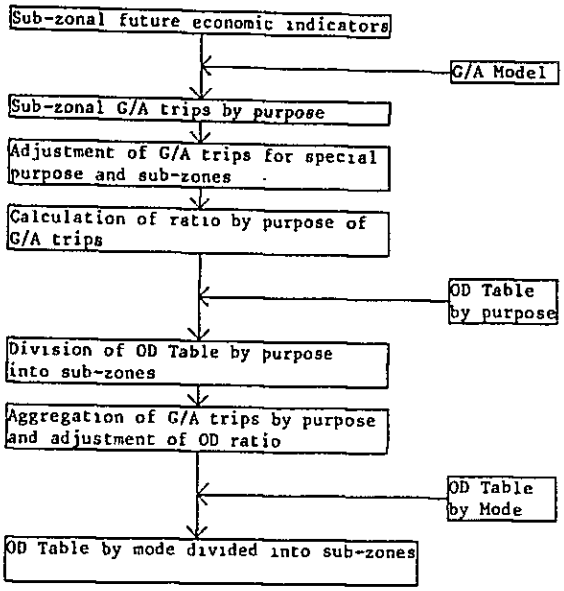
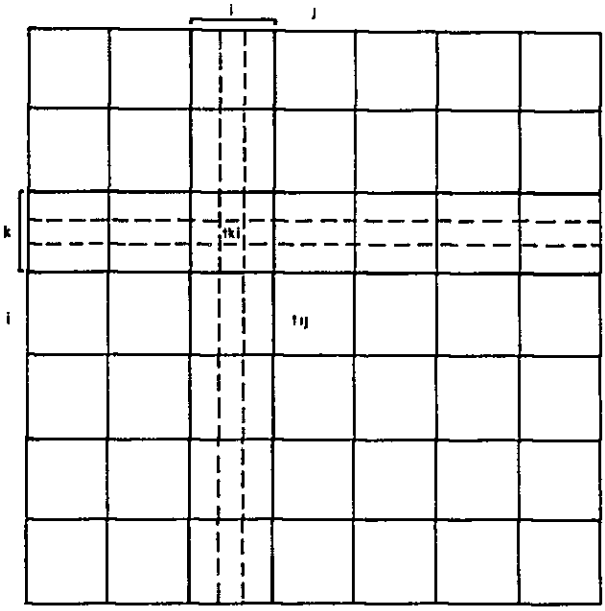


Fig. II-2-9 FLOW CHART OF REVISION OF OD TABLE



For specific i and j; $t_{k.l} = T_{i.j} \times R_k \times R_l$

where, $T_{i.j}$: Original OD volume of inter-zone pair i and j
R_k : Division ration for the generation of trips from zone i
R_l : Division ration for the attraction of trips of zone j

Note; Difference between $t_{k.l}$ and $T_{k.j}$ for specific zone pair i and j was adjusted by gathering the highest number of $t_{k.l}$.

Fig. II-2-10 DIVISION OF OD VOLUME

3) Subdivided OD Table

As the result of calculation mentioned above, OD Table in ESTAMPA Materplan was subdivided. Zone Codes and Subdivided Motor Vehicle OD Table in year 2000 are attached in APPENDIX.

2.2.2. Traffic Assignment

1) Subject

After subdivision of OD Table and composition of road network alternatives, examination of assigned traffic volume was necessary for the evaluation of road planning. Subjects of traffic assignment are as follows:

(a) To clarify the characteristics of roads in the road network by the assigned traffic volume.

(b) To examine the alternatives of road projects by means of changes of speed, road capacity and alignment.

(c) To examine the route alternatives of Corredor Norte.

(d) To get the necessary information of traffic volume for the purpose of road planning and intersection planning.

(e) To examine the importance of projects by means of comparison between with-project cases and without-project cases.

2) Premise

The premises of the work of traffic assignment are as follows:

(a) The object years for the traffic assignment are year 1990 and year 2000.

(b) Alternative road networks have three patterns: one is the existing road network (do nothing case); the second is the existing roads plus road projects of the study; the third is the existing roads plus road projects of the ESTAMPA Masterplan Network in the year 2000.

(c) The road projects of the Feasibility Study should be completed by 1990.

(d) Autopista project should be completed between year 1990 - 2000.

(e) Ave. B project in Area Centro should be completed at the same time of the completion of Ave. Cerro Ancon.

(f) Methodology and factors for the traffic assignment are the same as specified in the ESTAMPA Masterplan.

3) Result of Traffic Assignment

Various cases of traffic assignment were examined for the purpose of the road planning. Among their cases the examination of traffic assignment onto Corredor Norte is especially described.

Route alternatives of Corredor Norte, mentioned in Chap. III-1-2, Route Location, were examined. Western half section of Corredor Norte has six route alternatives: N-0 through N-5. The future traffic assignment onto N-1, N-3, N-4 and N-5 is shown in Fig. II-2-11. Assigned traffic volume on alternative routes such as N-4 and N-5, which are located comparatively far from built-up area, are different from those of alternative routes N-1 and N-2, but the difference of traffic volume is not very big. The traffic volume on related roads to Corredor Norte such as Via Martin Sosa Extension and Via El Paical Extension will be affected by route location alternatives of Corredor Norte, but traffic volume on main roads in built-up area such as Via Espana and Via Bolivar will not be affected much by the difference of route locations of Corredor Norte.

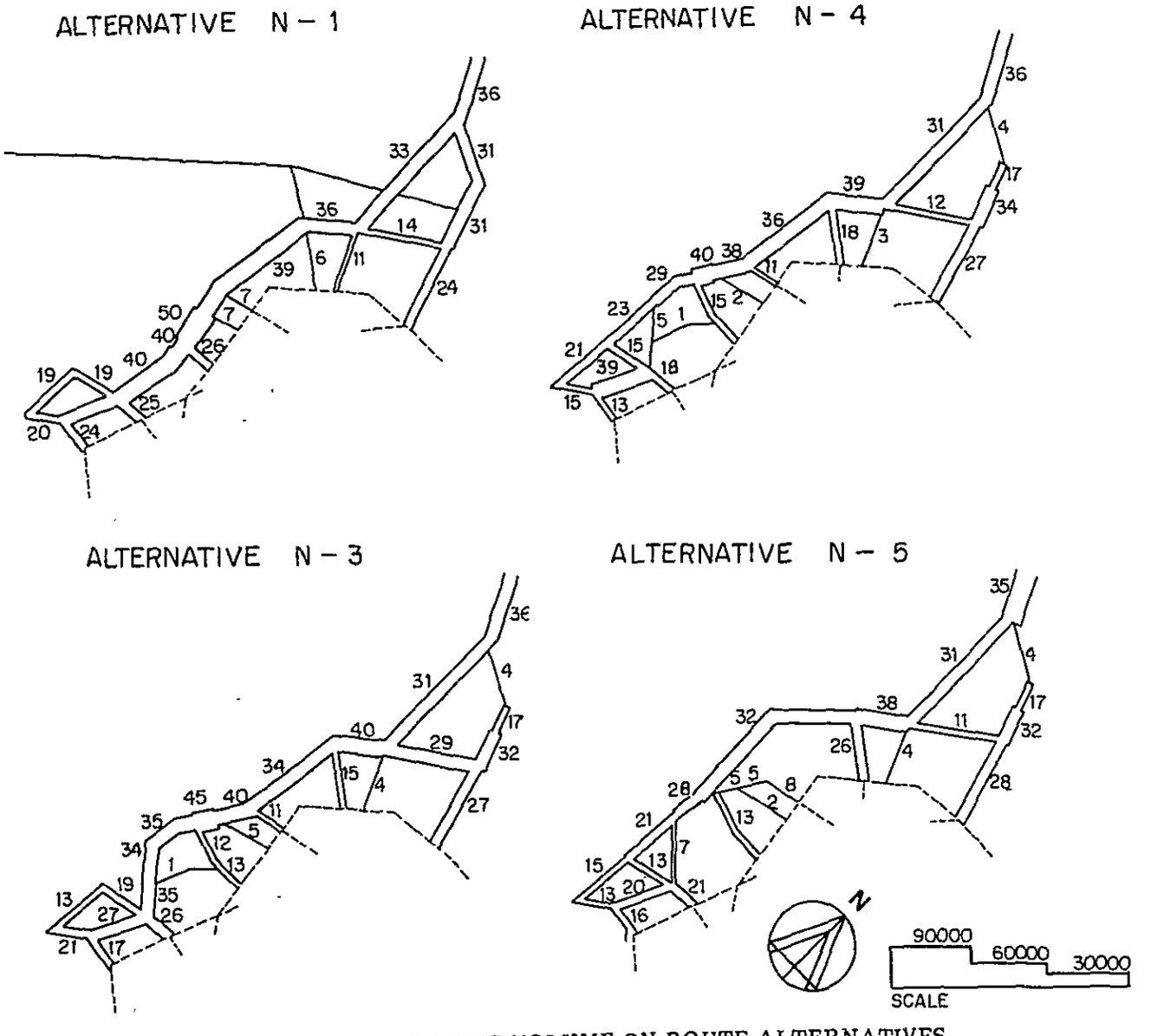


Fig. II-2-11 ASSIGNED TRAFFIC VOLUME ON ROUTE ALTERNATIVES OF CORREDOR NORTE IN YEAR 1990

For the definition of road standard of Corredor Norte, two kinds of design speed, 80 km/h and 60 km/h, are examined by traffic assignment. In the case of higher design speed, the assigned traffic volume is more than the one in the case of lower speed, and the difference of traffic volume in two cases are fairly big. Considering the principal characteristics of Corredor Norte in the future road network, the higher design speed is to be recommended. Traffic assignment of two different design speeds on Corredor Norte is shown in Fig. II-2-12.

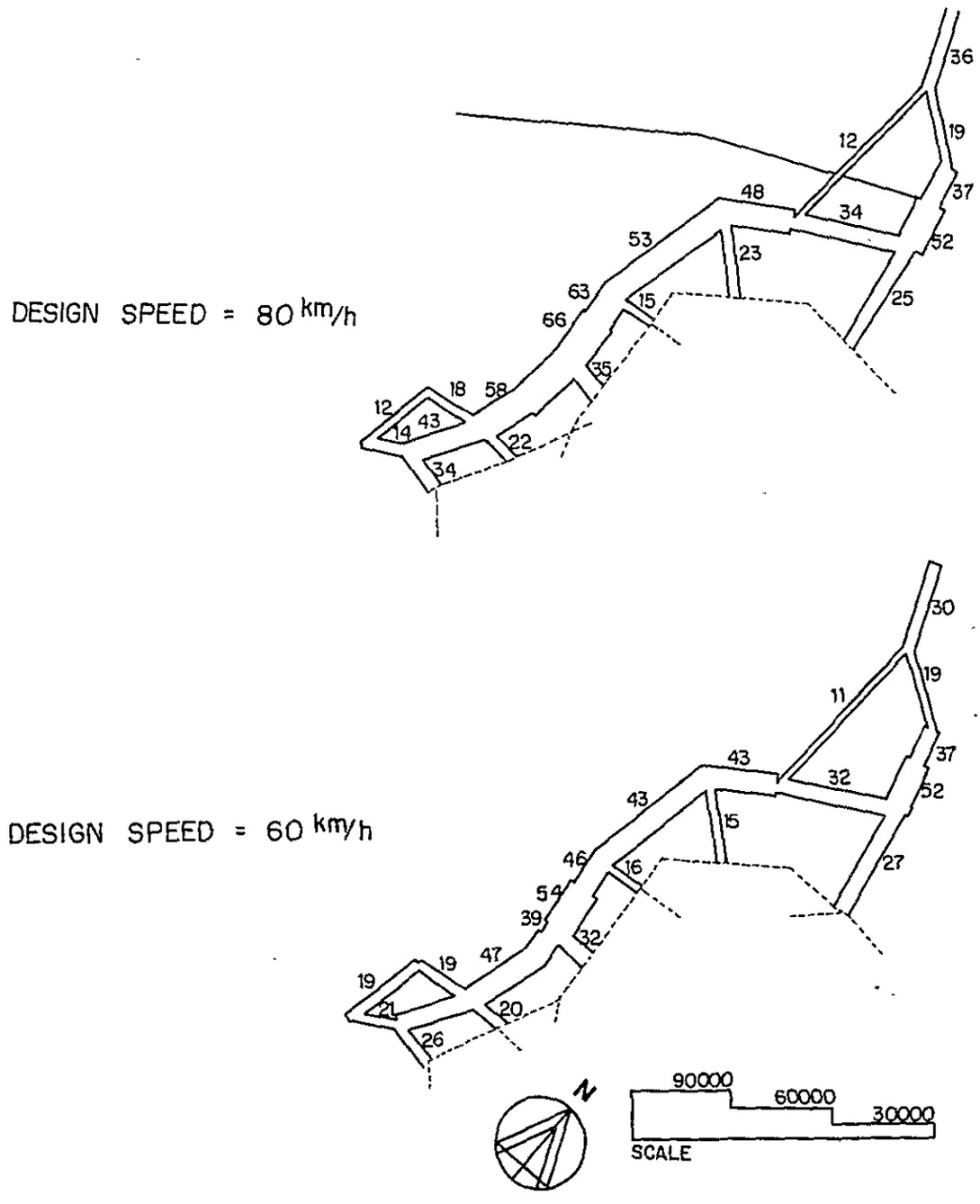


Fig. II-2-12 ASSIGNED TRAFFIC VOLUME ON DESIGN SPEED ALTERNATIVES OF CORREDOR NORTE (1990)

After the examination of various cases of traffic assignmnet, the composition of road network was formulated. For the preliminary design of new road projects and road improvement projects, the following two types of assigned traffic volume are prepared as the planned traffic volume. The assigned future traffic volume onto future road networks is shown in Fig. II-2-13

a) The planned traffic volume in the year 1990 is the assigned future traffic volume onto the road network which is composed of existing roads and road projects of the Study.

b) The planned traffic volume in the year 2000 is the assigned future traffic volume onto the road network which is the variation of ESTAMPA Masterplan network in the year 2000.

(1) YEAR 1990

(2) YEAR 2000

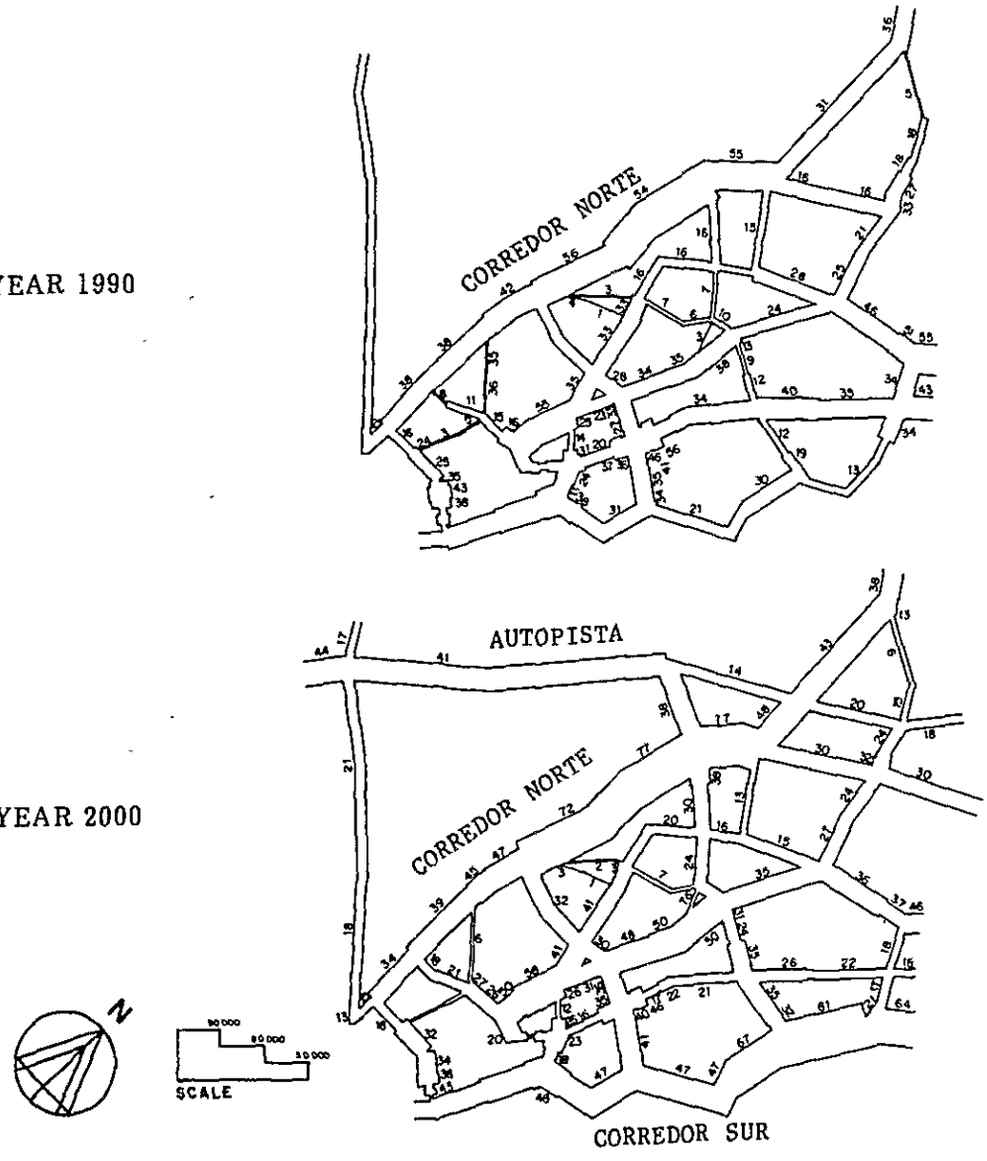


Fig. II-2-13 ASSIGNED TRAFFIC VOLUME ON THE FUTURE ROAD NETWORK

3. Geographical Conditions

3.1. Topography

3.1.1. General Topography

Panama Metropolitan Area constitutes a long piece of land extending in east-west direction, faces the Bay of Panama in south, and is backed in north by a slope gradually rising up to the watershed on the coast of the Atlantic Ocean. The Panama Canal runs in north-south direction in the middle of the Area. The northern hills function as water reservoir for Gatun Lake and Alajuela Lake, which supply water to the Canal. A water system formed by small rivers and streams is found among hills rising 100m to 200m above sea level and protruding close to the shore. Among the more important rivers are Matasnillo, Rio Abajo and Rio Curundu.

(a) Rio Matasnillo

Runs in the middle of the urban area of Panama City from north to south, with a total length of 4.4kms. Rio Matasnillo before discharging cross five major roads (Via Espana, Via Porras, Calle 50, Via Brasil and Ave. Balboa). The river bed and hydraulic section has been improved between Via Porras up to 400m before discharging to Panama Bay in Ave. Balboa.

(b) Rio Abajo

This river is located at the northeast part of Panama City and runs from northwest to southeast, to a small bay on Panama Viejo. This river has a length of 4.8kms., and it crosses all the major arterial roads of the city (Via Ricardo J. Alfaro, Via Transistmica, Via Espana, and Via Santa Elena). The river bed has not been improved, nor its hydraulic section; only some alignment of the river has been improved.

(c) Rio Curundu

Is at the north part of Via Ricardo J. Alfaro, runs from north to west, and discharges at the Pacific entrance of the Panama Canal after going through a box culvert under the previous Albrook Airfield. The approximate length is 11.0kms. The hydraulic section has been improved in some areas, especially near the University, but its main problem is the lack of capacity the box culvert due to the accelerated construction in its watershed area.

3.1.2 Land Survey

The existing 1:5,000 map of Panama City cannot meet the required accuracy for the preliminary design; therefore, 1:2,500 and 1:1,000 topographic maps were prepared using the aerial photogrammetric method. The outlines, kinds and quantities of the work are as follows:

1) Aerial Photography

(1) 1:10,000 Aerial Photography for 1:2,500 mapping. The number of flight lines was three lines and the total length of flight lines was 32 km.

(2) 1:6,000 Aerial Photography for 1:1,000 mapping. The number of flight lines was nine, and the total length of flight lines was 43 km. However, four flight lines out of these nine flight lines are to be used to prepare the 1:1,000 maps.

(3) Photo processing of the aerial photographs. Preparation of contact prints, diapositives and enlarged prints for pricking and field classification were included in the work.

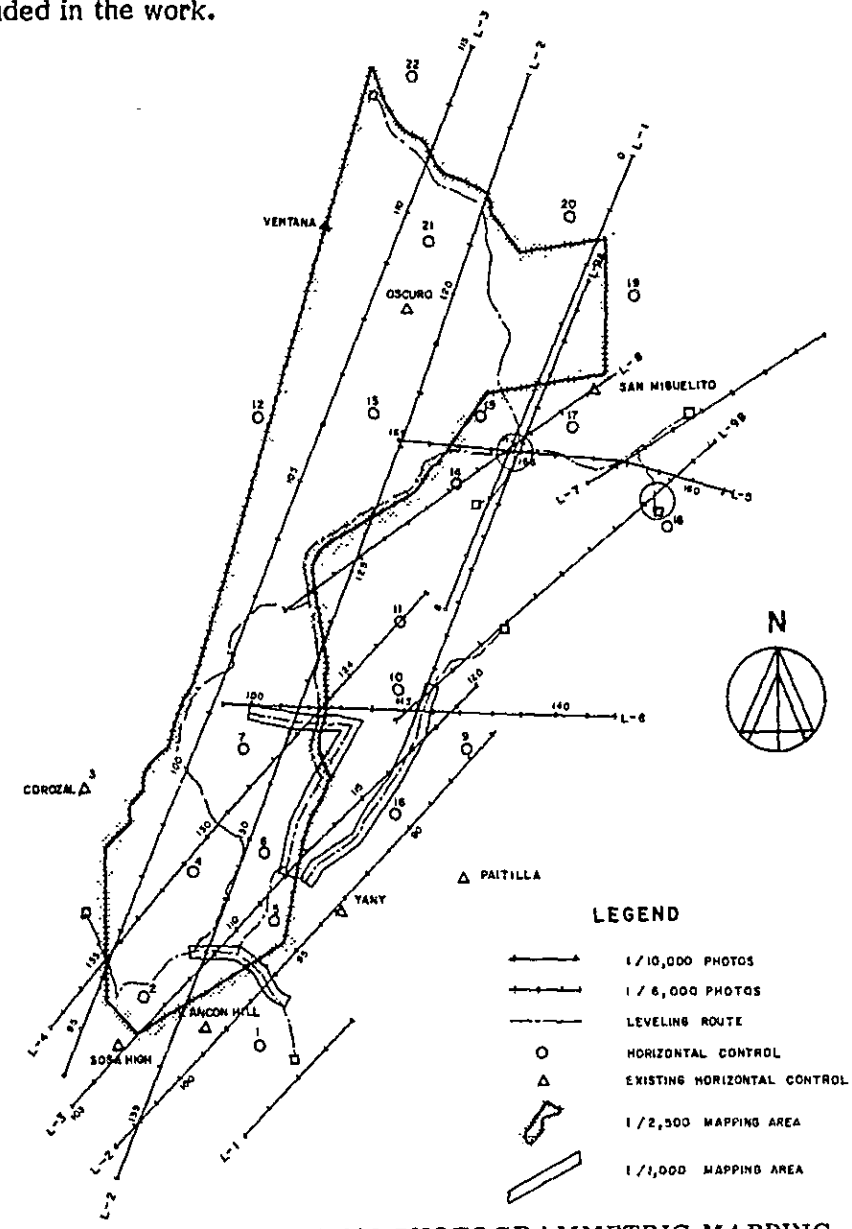


Fig. II-3-1 1:1,000 AND 1:2,500 PHOTOGRAMMETRIC MAPPING

2) Field Survey

(1) Horizontal Ground Control Survey.

Ground controls to be established were 22 points. Traverse surveying was applied. These ground controls together with existing controls were to be used for photogrammetric control of the aerial photographs. Therefore, these 22 points and 7 existing controls were signalized.

(2) Vertical Ground Control Survey.

To control and strengthen the vertical accuracy of the photogrammetry, direct leveling was executed along the roads in the project area. The total length of the leveling routes was approximately 45 km, and, at each 100 to 200m intervals, leveled points were pricked and shown their positions and heights on the aerial photographs.

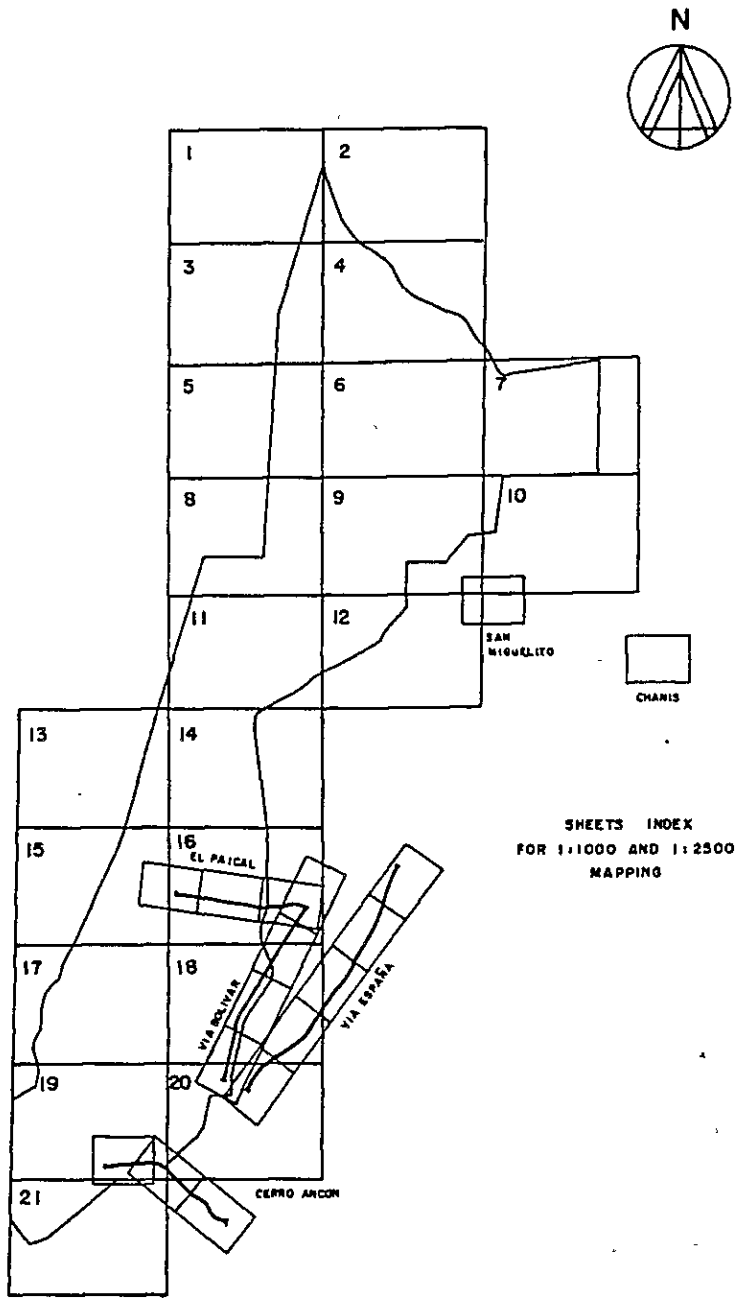


Fig. II-3-2 MAPPING KEY PLAN

(3) Field Classification and Compilation for 1:2,500 and 1:1,000 mapping.

The area of field classification and compilation for 1:1,000 mapping was approximately 2 square km. The area for 1:2,500 was approximately 30 spuare km. The field classification was carried out with enlarged aerial photographs before the beginning of photogrammetric plotting so that photo interpretation for the plotting will be effectively aided. The field compilation was carried out with draft maps before the beginning of final drawing.

3) Aerial Triangulation

The aerial triangulation was executed to establish photo controls, the so-called pass points for each stereo model which would be used for photogrammetric plotting. The method to be applied was independent model stereo-triangulation. Total number of the models for 1:1000 plotting is 55 in 5 flight lines. That of 1:2500 plotting is 43 in 4 flight lines.

4) Photogrammetric Plotting

(1) 1:2,500 Stereo Plotting. Total number of stereo models to be plotted is 35 and the area is approximately 30 square kilometers.

(2) 1:2,500 Editing. Area to be edited is to be approximately 30 square kilometers. Total number of sheets (size of 80cm. x 60cm.) to cover the area is 21.

(3) 1:1,000 Stereo Plotting. Total number of stereo models to be plotted is 33 and the area is approximately 2 square kilometers.

(4) 1:1,000 Editing. Area to be edited is approximately 2 square kilometers. Number of sheets (size of 80cm. x 60cm.) is 17.

3.2 Soil Condition

3.2.1. General Feature

Panama City lies over an area of volcanic formation of undefined sedimentary rock origin. The area can be classified into the following three major categories.

(1) Balboa, Albrook and El Maranon Area

La Boca Formation (TI), early Miocene, mudstone, siltstone, sandstone tuff and limestone.

(2) Corredor Norte Area

The predominant geological formation of Panama Formation (Tp) but scatter spots of intrusive and extrusive basalt, middle and late Miocene parallel to the Curundu River (Tb).

(3) Along Rio Abajo River and San Miguelito Intersection

Panama Formation, marine facies, early to late Oligocene, tuffaceous sandstone, tuffaceous siltstone, algal and foraniniferal limestone, sandy siltstone in basalt part of formation in Quebrada Ancha syncline (Tpm).

3.2.2. Soil Survey

Engineering soil survey is performed for the recognition of soil characteristics, both in plan and profile of the soils, which may be encountered for their possible use as construction material for earthwork, pavement and foundation facilities before the final selection of each project site(see Fig. II-3-3 for the boring locations). Based on the results of the soil survey and the following laboratory test, the soil along the project road was classified. According to the soil investigation, the mechanical and physical characteristics of soil is summarized in Table II-3-1 by roads and sections and the soil profile along Corredor Norte is given in Fig. II-3-4.

The soil classifications and their characteritics are:

(1) A-2-4 This type of soil includes such materials as gravel and coarse sand with silt content of small plasticity index and fine sand with non plastic silt content in excess of the limitation. This type of soil is found in San Miguelito Oeste, Via Bolivar, and Via El Paical from Via Bolivar to Curundu river.

(2) A-2-7 This type of soil includes material similar to those described under A-2-4 except that the fine portion contains plastic clay of A-7. This type of soil is found on Corredor Norte and Via El Paical extension from Curundu river to Corredor Norte.

(3) A-7-5 Includes those materials which have moderate plasticity index in relation to liquid limit and which may be highly elastic as well as subject to considerable volume change. This type of soil can be found on Via Martin Sosa Extension.

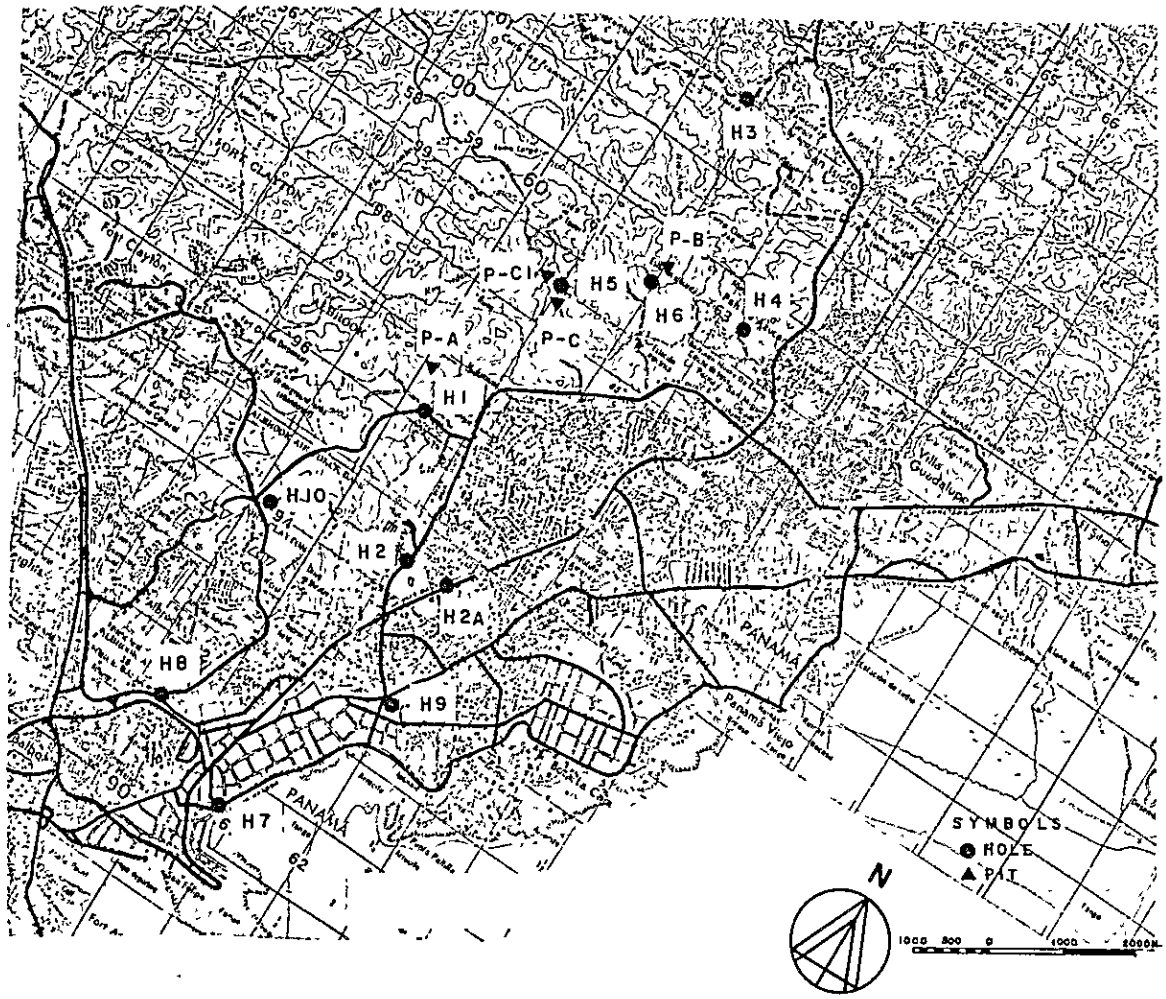


Fig. II-3-3 DETAIL LOCATION OF BORING LOGS

TABLE II-3-1 SOIL CLASSIFICATIONS

Project Description	Soil Classification (AASHTO)	K Value	CBR (%)
1. Corredor Norte			
A. Albrook-Ascanio Villalaz	A-7-6	50-225	2-14
B. Ascanio Villalaz San Miguelito Oeste	A-2-7	175-325	75-30.5
C. San Miguelito Oeste Transistmica	A-2-7		
2. Via San Miguelito Oeste	A-2-4	300-700	27-80
3. Via El Paical Extension-Curundu River-Corredor Norte	A-2-7	175-325	75-30.5
4. Via Martin Sosa Extension	A-7-5	50-225	2-14
5. Via Espana	A-4	100-300	3-27
6. Via Bolivar	A-2-4	300-700	27-80
7. Via Cerro Ancon			
A. Ave. Balboa-5 de Mayo	A-7-6		
B. 5 de Mayo-Curundu Road	A-7-6	50-225	2-14
C. Curundu Road-Corredor Norte	A-7-6		
8. El Paical			
A. Via Bolivar-Curundu River	A-2-4	300-700	27-80

SOURCE: ESTAMPA

(4) A-7-6 Includes those materials which have high plasticity index in relation to liquid limit and which are subject to extremely high volume change. This type of soil can be found on Via Cerro Ancon and and Corredor Norte (Albrook area Ascanio Villalaz).

The structures in the projects can be placed on the steady and sound foundation which was found at a depth of 3.0m to 6.0m except in Curundu and Albrook Area, where weak soil conditions are found. At these places, special consideration should be taken to secure good foundations. The soil conditions by road and by section are described below.

1) New Road Construction Area

(1) Albrook-Curundu River Area

La Boca Formation and Panama Formation border on each other in this general area. Along Curundu River, these foundation layers are covered by a 3m to 7m soft layer with a natural moisture content of nearly 100%. Therefore, care must be used in determining embankment plan, embankment cross section, and post-embankment compaction.

(2) Albrook- Clayton Road Area

The foundation layer in this area is Panama Formation, and it is covered by 1m to 4m layer of residual soil from efflorescence, which has a CBR of two to five and is unsuitable as a base course material but may be used as a roadbed material.

(3) Camino de La Amistad Area

In this general area, the foundation layer contains a green tuff and volcanic basalt of Panama Formation. The green tuff is covered by a 4m to 6m layer of sandy clay, which is residual from effloresecence and is expected to have a CBR of four to five. The volcanic basalt is covered by a thin layer of its efflorescent residual has an expected CBR of 30 to 40, and may be used as a base course material.

(4) Camino de La Amistad - Autopista Access

The geology of this area is similar to that of Camino de La Amistad area. The hilly part is generally covered by a thin sandy clay surface layer of one to two meters, whose CBR is four to six. The foundation layer is either the green tuff or the andesitic agglomerate of Panama Formation. The 1m to 6m efflorescent residual layer is sandy silt with a CBR of 30 to 40 and is usable as a base course material.

(5) Autopista Access - San Miguelito Oeste

This section is almost the same as (4) above, but along Rio Abajo the foundation layer is either tuffaceous sandstone or taufaceous siltstone of Panama Formation. Nevertheless, no soft layer from the alluvial epoch is found in the gorge part, where stiff (S.T.P. test value of 20 to 30) silty clay, which is a diluvial deposit, covers the ground.

(6) San Miguelito Oeste and Corredor Norte-Los Andes Area

Limestone, silt and volcanic basalt of Panama Formation are seen in parts of Los Andes area. Los Andes is generally of conglomerate rocks or fine grained andesitic tuff of Panama Formation, covered by a hard silt layer of less than one meter. From 3m to 10m from the ground surface down to the foundation layer is seen a layer of efflorescent residual with a mixture of sandy silt which have a CBR of 30 to 50 and which is usable as a base course material.

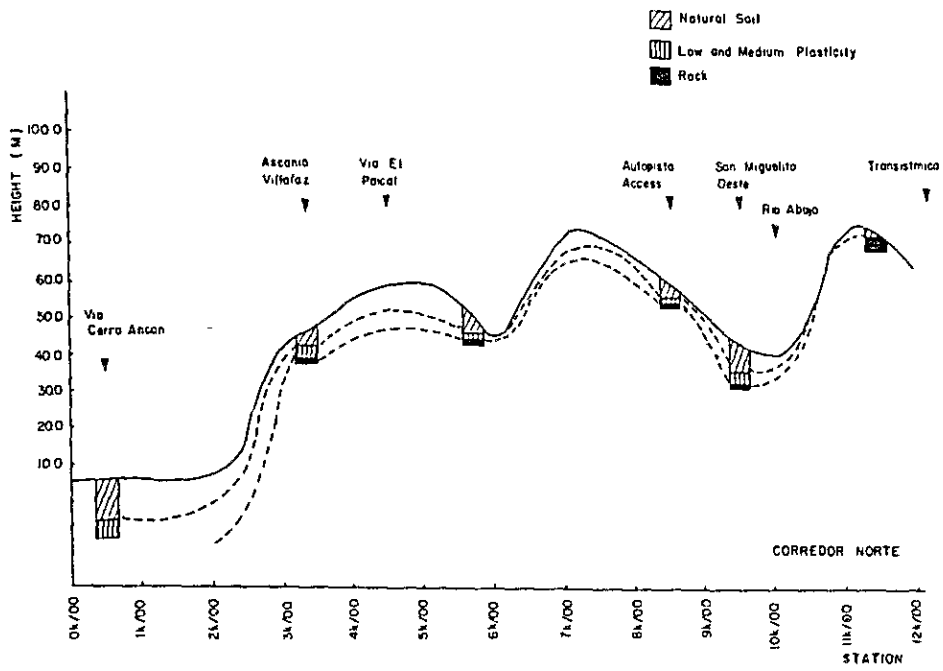


Fig. II-3-4 SOIL PROFILE ALONG CORREDOR NORTE

2) Road Improvement Area

In the road improvement areas, the Foundation layer is Panama formation, consisting of fine grained tuff or conglomerate rocks. Landscaping fills and alluvial constitute the 1m to 4m surface soil, which is expected to have an N value of three to five. Efflorescent residual layer with an N value of 15 to 30 is found in the depth of 3m to 15m.

(1) Via Espana-Federico Boyd Intersection

A 10m to 13m layer of either diluvial deposits or efflorescent residual exists, and the level of the foundation layer is about one meter above sea level. Under the efflorescent residual is a layer of hard sandy silt with an N value of 20 to 40, and above it is sandy silt with little clay, whose N value is 20 to 40. These layers can be exploited for retaining wall foundations but not for separate foundations such as of bridge piers.

(2) Via Espana - Via Brasil Intersection

The foundation layer occurs at the depth of 11m to 13m from the surface. A 7m to 8m layer of efflorescent residual occurs at the depth of 4m to 6m from the surface, and it has an N value of 25 to 100. Care should be used in determining the type of foundation for structures.

(3) San Miguelito Intersection

A layer of efflorescent residual with an N value of nearly 100 occurs close to the ground surface but declines from Transistmica towards San Miguelito, where it is covered by an alluvial or diluvial layer, whose thickness increases toward and reaches 4m at San Miguelito. The alluvial is of sandy clay with an N value of 20.

(4) Via El Paical - Via Bolivar Intersection

The surface layer is landscaping fill of soil from nearby locations in a depth of less than 2m, under which is an about 5m layer of efflorescent residual concreted sandy silt with an N value of over 100.

(5) Via El Paical-Via Ricardo J. Alfaro Intersection

The surface is landscaping fills of less than 1m thickness, under which is a 4m to 5m layer of highly concreted effloresecent residual with an N value of 30 to 90.

3.3 Hydrology

In Panama Metropolitan Area, rainy season is from May to December and dry season is from January to April, just as for the entire nation. Even during the rainy season, however, rainfull continues for only about one hour each day, and climate is more agreeable in the coastal to Las Cumbres area, where average annual precipitation is 1,730 to 2,250 mm., than in Atlantic coastal area, where rain is heavier.

As for rainfall intensity in Panama City, the probable rainfall intensity calculated by Talbot System based on 57-year precipitation record is presented in Table II-3-2 based on Informe de Drenaje Pluvial Ciudad de Panama, compiled by the Ministry of Public Works (MOP) in 1972.

TABLE II-3-2 PROBABLE RAINFALL INTENSITY

Return Period (years)	Probable Rainfall intensity (inch/hr)
2	237/(29+t)
5	294/(36+t)
10	323/(36+t)
20	357/(37+t)
25	370/(37+t)
30	370/(36+t)
50	370/(33+t)

SOURCE: MOP. Informe de Drenaje Pluvial Ciudad de Panama

Note, t : Duration in min.

For the draining of road, return period must be determined in consideration of economy and the extent of impact on surrounding areas of rainfall in excess of the planning discharge volume. However, most of the new road projects sites are presently forest and the roadside areas are under housing development plans, and the applicable probability years are shown by the kind of building in Table II-3-3. Flux coefficient "C" is determined in consideration of future land use plans (see Table II-3-4).

TABLE II-3-3 PROPOSED RETURN PERIOD

System	Return Period (years)
Storm Drainage System	2
Culvert, Retaining Wall, Permanent Structure	5
River Section	20

SOURCE: ESTAMPA

TABLE II-3-4 PROPOSED RUN-OFF COEFFICIENT

Area Classification	C. Values
Park and Green Area	0.25
Hilly Area	0.30
Residential Area	0.50
Pavement	0.80

SOURCE: ESTAMPA

4. Construction

4.1. Construction Field

The investment in the construction field, compiled in Contraloria General is shown in Table II-4-1 by public and private sectors. The construction investment has been increasing recently. Especially in the private Sector investment, the housing and building construction has been increasing since 1979.

TABLE II-4-1 INVESTMENT IN CONSTRUCTION SECTOR AND TYPE OF WORK

(million B/.)

Sector and Type of Work	1973	1974	1975	1976	1977	1978	1979	1980	1981 p/
Public Sector	71.3	121.5	190.9	269.8	169.9	263.4	180.3	251.8	249.4
Houses	5.1	2.8	21.7	19.3	43.1	37.7	24.0	15.2	17.7
Non Residential Buildings	8.4	24.6	36.4	24.5	35.6	63.6	47.3	20.5	21.0
Other Construction Works	57.8	94.1	132.8	226.0	91.2	162.1	109.0	216.1	210.7
Private Sector	204.1	158.6	137.4	90.2	95.1	114.1	239.3	311.0	470.8
Houses	114.4	68.3	48.0	38.2	41.7	48.5	72.4	78.1	92.3
Non Residential Buildings	61.5	70.4	73.4	41.1	41.8	51.5	139.8	199.2	202.3
Other Construction Works	28.2	19.9	16.0	10.9	11.6	14.1	27.1	33.7	176.2
Total	275.4	280.1	328.3	360.0	265.0	377.5	419.6	562.8	720.2

p/ Preliminary figures

SOURCE: Contraloria General, Situacion Economica, Cuentas Nacionales 1970-1981

Since 1969, the public investment in the Panama City in terms of road infra-structure incresed including re-surfacing, improvement and new-construction, for roads such as Ave. 11 de Octubre in 1969, Ave. Ernesto t. Lefevre in 1970, Ave. Nicanor de Obarrio(Calle 50) extension in 1971, Via Brasil enlargement in 1971, Via Bolivar extension in 1972, Via Fernandez de Cordoba enlargement in 1973 and 1976, Via Ricardo J. Alfaro construction in 1973, Via Cincuentenario and Via Israel enlargement and renewal in 1973 and 1978, Ave. Domingo diaz (Via Tocumen) extension in 1979, and Via Belisario Porras widening in 1983, that constitute the principal arterial roads to facilitate the urban traffic.

Independently, important local programs of improvement and road construction were programmed and executed by the Government.

As for the studies, planning and engineering, some were constructed by MOP and some were contracted with the local enterprises that gave consulting or engineering services and in some occasions, they formed a group with foreign enterprises.

Equally in the construction phase, the projects were constructed by the force accounting system with equipment, materials and labour in MOP, and the same time, some works were realized by local construction companies based on the contracts according to public bidding.

A 20.7 kms. highway was constructed between Arraijan and Chorrera the total of B/.38.7 millions in June 1981 to finance the construction of the project, foreign aid was required from BID and the other portion was provided by the Government.

4.2. Construction Materials

The yearly domestic production quantities of the major construction materials are shown in Table II-4-2. Cement production generally meets the demand. Pit sand represents 90% of sand used, the remaining 10% being sea sand, which must be desalinated before use for construction purposes. Almost all coarse aggregate used is crushed stone available from nearby quarries. Both round and deformed reinforcement bars are produced in Panama. Lumber and plywood for form works had been all domestic products, but imported products have also appeared in recent years.

TABLE II-4-2 ANNUAL PRODUCT OF MATERIALS

Description	Unit	Amount
Cement	Ton	500,000
Deformed Bar	Ton	50,000
Concrete	Cuy	255,000
Wood	Sqf	19,854,000
Plywood	Sqf	993,000
Cement Block	Each	17,700,000
Cement Tile	Sqm	364,000

SOURCE: CONTRALORIA GENERAL, 1983

Of various concrete products used for the construction of roads, those which are domestically manufactured are: drainage concrete pipes with diameter of 600 to 1,500 mm., reinforced concrete piles with diameter of 200 to 600 mm. and PC concrete piles with diameter of 200 to 600 mm. Concrete curbstones, L-gutter, and PC concrete pipes are not made in Panama.

The products which are not produced locally can be imported easily . They are: high resistance cable for the prestressed, neoprene bearing plate, steel pile, aditives to increase resistance or to accelerate concrete setting, epoxy resin for the sanitation of concrete structures, electrodes for soldering of electric arc. The import tax rates of some materials are given in Table II-4-3. The yard-pound system is applied to almost all the materials rather than the metric system.

TABLE II-4-3 IMPORT TAX RATE BY MATERIAL

Description	Tax Rate
Gasoline	70% or 0.70$/Gallon
Diesel Oil	70%
Kerosine	70% or 0.70$/Gallon
Heavy Oil	70% or 0.40$/Gallon
Asphalt	5%
Cement	0.01$/Kg
Explosive	20%
Wood	0.75$/Kg
Brick	1.00$/Kg
Deformed Bar	0.35$/Kg
Round Bar	0.08$/Kg
Steel Beam	0.01$/kg
Sheet Metal	0.015$/Kg

SOURCE: ARANCELES DE IMPORTACION, 1982.

4.3. Contractors

In the Republic of Panama, there are 932 construction companies registered with Ministry of Commerce in 1980. The number of contractors by regions is shown in Table II-4-4. More than 90% of the contractors are registered in the Metropolitan area.

TABLE II-4-4 CONTRACTORS BY REGION

Name of Region	No. Of Company
Bocas del Toro	-
Colon	5
Cocle	16
Chiriqui	26
Darien	-
Herrera	15
Los Santos	3
Panama	861
Veraguas	6
Total	932

SOURCE: SITUACION ECONOMICA, 1980

The number of contractors by the amount of declared capital is given in Table II-4-5. Almost 50% of the contractors registered are small scale contractors, in terms of their capital, with less than 5,000 Balboas.

TABLE II-4-5 CONTRACTORS BY CAPITAL DECLARED

Declared Capital (Balboas)	Number of Construction Company
501- 5,000	428
5,001- 10,000	263
10,001- 50,000	177
50,001- 100,000	37
100,001- 250,000	11
250,001- 500,000	11
500,001-1,000,000	4
More than 1,000,000	-
Not Specified	1
Total	932

SOURCE: SITUACION ECONOMICA, 1980

Only 12% of the contractors are members of CAPAC (Camara Panamena de la Construccion), and their number of permanent employees is shown in Table II-4-6. The average number of permanent employees is approx. 50, and the biggest has approx. 130 permanent employees. The majority of the contractors are believed to be small-scale contractors for certain projects.

TABLE II-4-6 CONTRACTORS BY PERMANENT EMPLOYEE

Number of Employee	Number of Construction Company
1 - 4	7
5 - 10	11
11 - 19	16
20 - 49	43
50 - 99	25
100 - 150	14
Total	116

SOURCE: CAPAC

A brief resume of CAPAC'S duty is summarize as follows:

a. To promote and protect activities related to the construction industry which benefit its members and the chamber.
b. To promote activities between professional companies and international associations.
c. To promote activities which benefit the construction labour.
d. To promote social, cultural and educational activities.

On the other hand, Junta Tecnica de Ingieneria y Arquitectura is an entity created by Law 15 of 1959, to regulate the engineer and architectural professional activities and related fields of the construction work in the Republic of Panama.

To be qualified as a construction company in the Republic of Panama, they should fullfill the requirement of Law 15 of 1959, Article 24.

Article 24 by Law 15 of 1959 states that the following engineering and architectural work or activities can only be executed by enterprises that are registered in La Junta Tecnica and that can fullfill the following requirements:

a. Has its address in the Republic of Panama or is under the protection of an international agreement.
b. The engineering and architectural work will be under competent, responsible personnel in each of the respective fields.
c. Fulfills the rest of the disposition of this law and its regulations.

5. Procedure of Execution

5.1 MOP Organization

5.1.1. General Organization

The Ministry of Public Works (MOP) is the entity created by means of the decree No. 148 of December 28, 1972 to be in charge of the transportation in general.

The Ministry of Public Works can be divided into three main levels, which are:

a. Minister's Office
b. National Direction
c. Province Direction

The Minister's Office is headed by the Minister of Public Works supported by a corp of assesors and by five departments with the responsibility of planning, public relation, legal aspects, auditing and valuation in the ministry. This office provides the political alignment to be followed, the projects to be presented for the national budget and a direct contact to the central government.

The National Direction is the direction in charge of providing the technical, administrative, and industrial supports to the third level, and also of inspecting projects under construction through contract or administration.

The Province Directions are the representatives of the minister office at the local level which enforce the road maintenance and develop small construction in the province following the alignment of the Minister's Office, with the technical, industrial and administrative support from the National Direction (see Fig. II-5-1).

5.1.2 National Direction of Construction

The National Direction of Construction is one of the National Directions of the Ministry, and is in charge of the coordination of construction, design and inspection of project to be administrated by the Ministry of Public Works. Within this function is the Special Project Office, which is in charge of the administration and implementation of such projects as MOP-BID (projects supported by International Bank for Development) and MOP-AID (projects supported by U.S. Agency of International Development).

The MOP-BID and MOP-AID are programs and projects implemented with the cooperation of 67% and 70% of foreign fund respectively and for the government portion, 33% and 30%. The organization chart of MOP-BID and MOP-AID is shown in Fig. II-5-2. The O.P.C. (Organization for Participation of Community) is an office to stimulate the participation of the community for the conservation and cooperation in the road maintenance and construction, and will support the work.

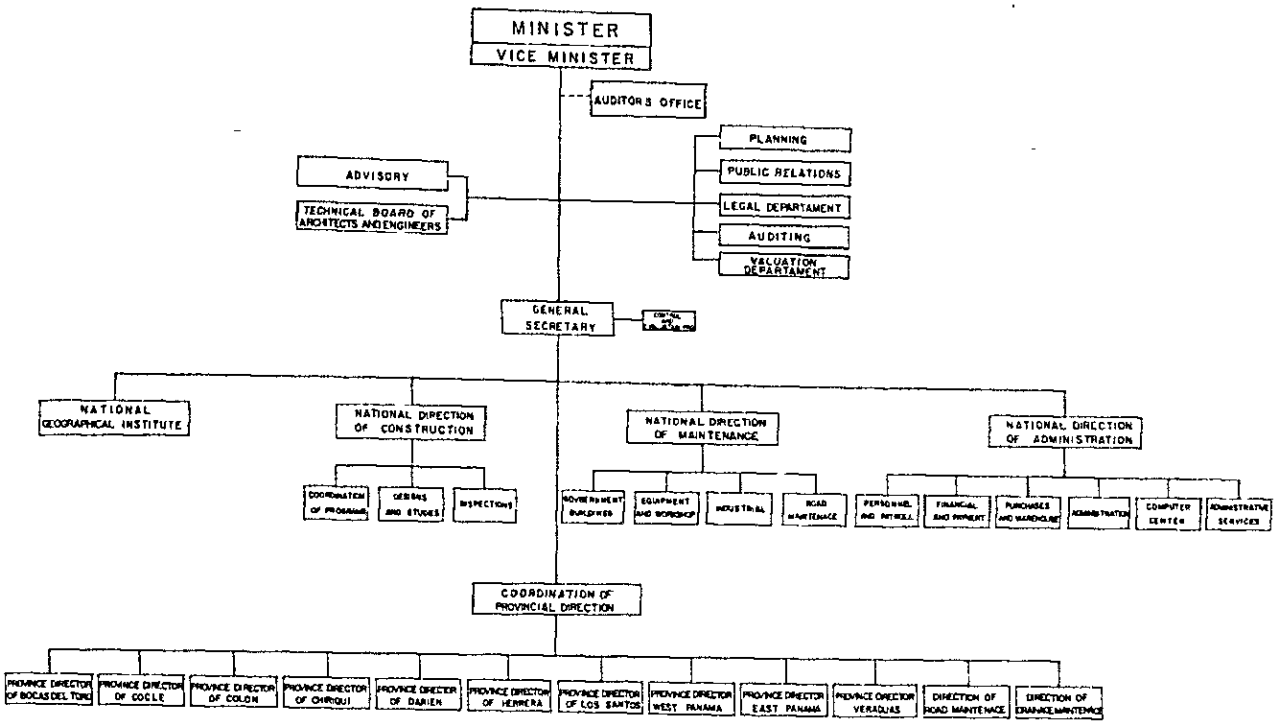


Fig. II-5-1 MOP ORGANIZATION

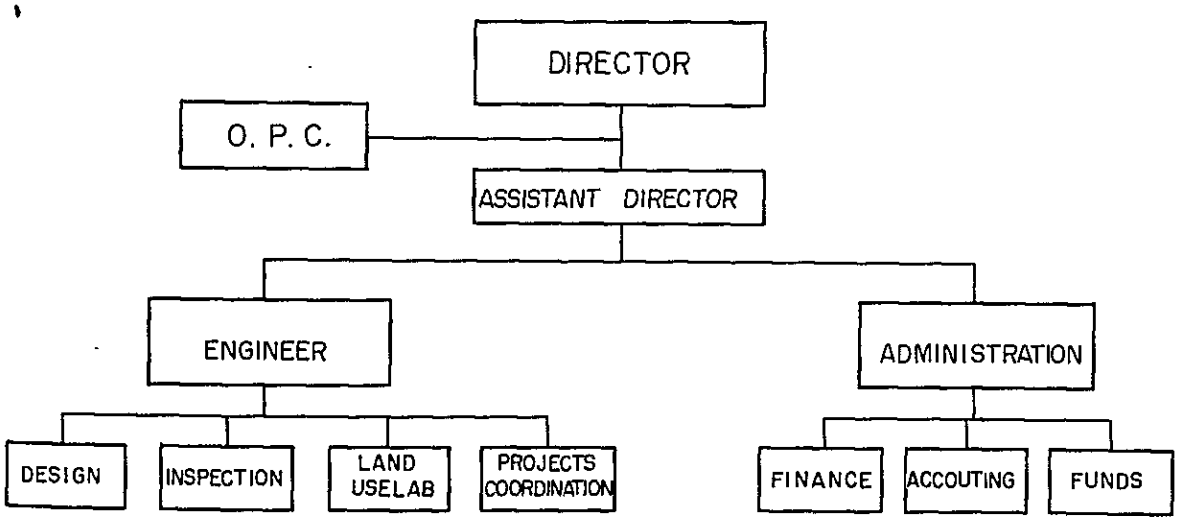


Fig. II-5-2 NATIONAL DIRECTION ORGANIZATION

5.2 Budgeting

In Panama, fiscal year begins on January 1 and ends on December 31. In the case of MOP, for instance, budget proposal for the next fiscal year is formulated by MOP Controller and submitted to MIPPE by the end of July. After receiving such budget proposals from all the ministries, MIPPE coordinates and adjusts among the ministries and compiles a draft budget by the end of November for scrutiny by the Cabinet in December. When approved by the Cabinet legislative chamber with the approval of the president, the budget is executed starting from January.

5.3 Valorizacion

1) A System Outline

Valorizacion is the system under which those who will benefit from road, plaza, urban development, and other public work projects are required to bear the cost of the project in proportion to the benefit to be enjoyed. The statutory base of this system is La Contribucion de Mejoras por Valorizacion, Law Number 94 (October 4, 1973), and the system is administrated under the jurisdiction of the Valorizacion Commission, which formerly belonged to MIVI, then subsequently to Hacienda, and presently to MOP. The Commission includes ministers of MIVI, Hacienda, and MOP.

Under this system, the benefit is defined as that which will be enjoyed during the period of 10 years from the completion of the project. The amount of benefit is calculated as the average of land price increments estimated based on the market price released by Hacienda and such increments estimated based on the land price registered at Contraloria General. In actual practice, however, the amount of benefit is adjusted to coincide with compensation for the beneficiary's house, if any is involved, so that he will neither pay, nor receive. The land owner may, within 40 days from the project completion, file an objection to the amount of benefit as assessed, and the amount must be finally decided within 60 days from the petition.

The scope of application of valorizacion system depends on project. In the case of Via Domingo Diaz Project, those who were situated within 200 meters from the right-of way were required to make contributions as beneficiaries. Contributions are collected over a maximum period of 20 years.

No limitation by the type and kind of project is stipulated, to the application of this system. When desired, the party responsible for the project implementation prepares a plan for the application of valorizacion system and submits it to MIPPE for final approval by Presidencia.

2) Precedents

Valorizacion system application precedents, chiefly-arterial road projects in Panama Metropolitan Area wherein 60% to 80% of the construction cost was collected from the benefeciaries, are enumerated in Table II-5-1. In addition, the system was used for the construction, at the request of land owners and private developers, of streets in suburban housing development areas, wherein 100% of the street construction cost was collected from the land owners.

TABLE II-5-1 APPLICATION EXAMPLES OF VALORIZACION

Road	Year of Completion	Amount of Valorizacion(B./)	Percent (%)
Via Espana	1954	153,386.31	
Ave. Federico Boyd	1958	232,320.00	
Ave. Balboa	1958	412,863.14	
Ave. Balboa	1964	928,454.12	
Via Simon Bolivar	1972	3,146,003.20	70
Ave. R. J. Alfaro	1973	4,156,347.87	80
Via Cincuentenario	1973	141,239.22	
Via Tocumen	1978	8,875,810.17	40
Via Martin Sosa	1980	198,009.21	

NOTE: PERCENT OF VALORIZACION TO TOTAL CONSTRUCTION COST
SOURCE: VALORIZACION OFFICE

In the case of the widening of Via Martin Sosa, the land owners are required to pay an average of 1.5 balboas per square meter of land per year. Assuming a property assessment value of 100 balboas per square meter, their fixed property tax is estimated at an average of 4.6 balboas per square meter per year. It turns out that they are required to contribute about one-third of the property tax equivalence.

Ⅲ. ROAD PROJECTS

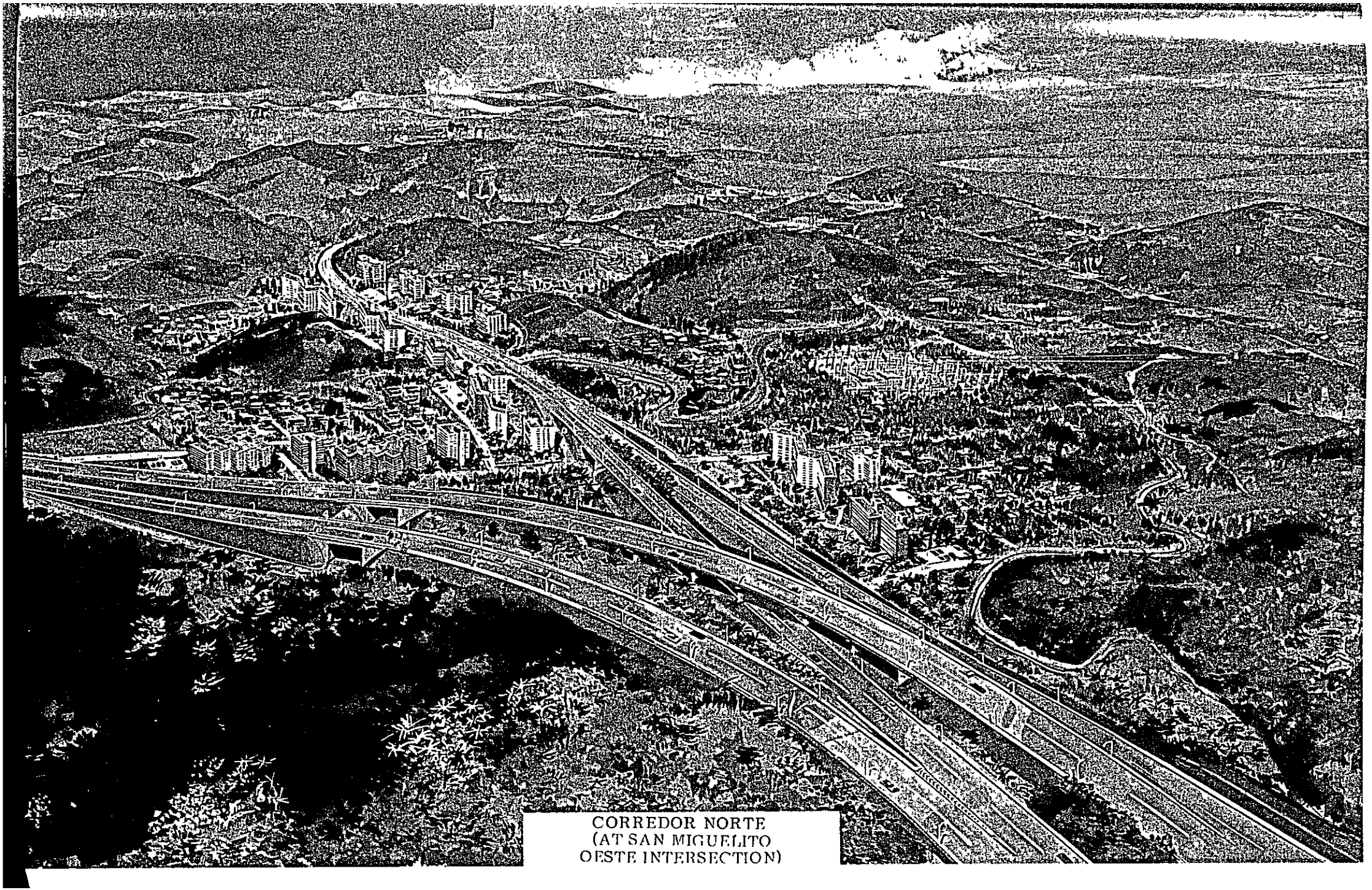
1. DESIGN CONDITION

2. NEW ROAD CONSTRUCTION PROJECTS

3. ROAD IMPROVEMENT PROJECTS

4. COST ESTIMATION AND IMPLEMENTATION SCHEDULE

5. ROAD PROJECT EVALUATION



CORREDOR NORTE
(AT SAN MIGUELITO
OESTE INTERSECTION)

III. ROAD PROJECTS

1. Design Condition

1.1. Demand Characteristics and Road Function

1) Road Function Classification

ESTAMPA Masterplan classified roads in urban areas as follows:

a. Principal Arterial Streets
b. Minor Arterial Streets
c. Collector Streets
d. Local Streets

The project roads which are subject to this Study are all principal arterial streets, but they can be further classified by whether they are new roads to be constructed or existing roads to be improved, what area they will go through, the quantity of traffic, and other criteria. The road network of ESTAMPA Masterplan is basically of a ladder pattern, formed with two east-west traffic axes, one in the northern part of the urban area and the other in the southern part, which have "grids" of north-south arterials between them. Each project road is to perform certain function depending on the role it is to play as an integral part of the ESTAMPA Masterplan network. Project roads are classified by the function in Table III-1-1.

TABLE III-1-1 CLASSIFICATION OF ROAD FUNCTION

	Type of Project		Site Location		Traffic Volume			Position in Network	
	Construction	Improvement	Built up Area	Sub-Urban Area	High	Med.	Low	East-West	North-South
1. Via Espana		o	o			o		o	
2. Via Bolivar		o	o		o			o	
3. Via Cerro Ancon		o	o				o		o
4. Corredor Norte	o			o	o			o	
5. Via El Paical Existing		o	o		o				o
Via El Paical Extention	o			o	o				o
6. Via Martin sosa Extention	o			o		o			o
7. Via San Miguelito Oeste	o			o	o				o

2) Function of Each Road

(1) Corredor Norte

In the road network, Corredor Norte is given the position of a east-west traffic axis in the north of Panama built-up area. As such, its function is to meet the large volume of traffic flowing from San Miguelito and other sources in the north and to direct the traffic so as to detour the urban area and flow onto Via El Paical and other north-south dispersion roads for direct entrance into the central area of the city. In the distant future, Corredor Norte will be extended towards east and will have a function of causing a large volume of traffic from Pedregal/Tocumen way to bypass the urban area.

Corredor Norte is the transport axis indispensable for the development of its roadside areas, which are under plans for development, particularly of the Reverted Area which it traverses, where development has already started and will progress rapidly in the future.

(2) Via El Paical

Via El Paical, which presently is but a two-lane dispersion street in a residential area, connecting arterials, will become one unified road with Via El Paical Extension and Via Brasil extending from Corredor Norte to Corredor Sur, and will function as an important distribution road traversing about the middle of downtown Panama from north to south.

(3) Via Martin Sosa Extension

Via Martin Sosa Extension is for extending Via Martin Sosa, which presently is a short road section between Via Espana and Via Bolivar, up to Corredor Norte so as to function as another north-south distribution road.

(4) Via San Miguelito Oeste

Via San Miguelito Oeste runs on the western edge of San Miguelito, where housing development is now going on, and functions as a bypass for Transistmica. In the long run, it will accommodate traffic from the north and form the skeleton of San Miguelito, together with Via San Miguelito Central and Via San Miguelito Este.

(5) Via Espana

A large number of facilities which generate and attract traffic are located in the areas along Via Espana, where various kinds of trips can start and terminate and the volume of through traffic is a relatively small portion of total traffic. Through traffic is predicted to further decrease on Via Espana when an arterial road which will detour the built-up area, such as Corredor Norte, will be opened. Therefore, it is desirable that Via Espana function as an arterial street traversing the central business district of the Capital city east-west, offering easy connection with intersecting streets and with various facilities, and as one of public transport axes which adequately accommodate bus traffic, rather than as a road to provide for a large volume of fast moving traffic. Attention should also be paid to the safety of the many pedestrians who use this road.

(6) Via Bolivar

Via Bolivar occurs where Pan American Highway overlaps with Transistmica and is the road presently with the heaviest traffic in Panama. This road will continue to be an important arterial with a heavy traffic in the future, but its nature as a urban street will be enhanced, as urbanization will further progress.

(7) Via Cerro Ancon

Via Cerro Ancon is a north-south traffic axis connected to the western ends of east-west traffic axes (Corredor Norte, Transistmica, Corredor Sur, etc.), disperses traffic from such axes and, as such, must accommodate the smooth flow of traffic at intersections. Also, because this road is connected with Autopista and Gaillard Road, the improvement of Gaillard road will become necessary in the distant future.

The section between Ave. Balboa and Ave. Central will go through Maranon Urban Renewal Area and will become the central street of this Area. This road presently runs close to Ave. Central, where the accumulation of commercial functions is the heaviest, and, when the renewal program is carried out, the roadside area will generally become a base for large scale urban activities. Particularly because it is planned that Cinco de Mayo Bus Center will be located along this road, it is necessary that this street accommodate the flow of buses and bus passengers and pedestrians.

1.2. Route Location

Unlike road improvement projects in the built-up area, preliminary design of roads to be newly constructed in suburban areas must be preceded by a comparative study of alternative routes of the road. The preliminary study of alternative routes in ESTAMPA Masterplan is brought under the new light of recent changes in circumstances. As a result, alternative routes of fairly different characteristics are evaluated particularly for the starting section, the Albrook section, and the Los Andes section near the terminal point of Corredor Norte, as well as for Via El Paical Extension.

1) Corredor Norte

(1) Albrook Section

New development since the formulation of ESTAMPA Masterplan has included government decision on the implementation of a number of projects in the Reverted Area and the organization of OPDAC for formulation of plans for utilization of the entire area of the Reverted Area.

Particularly, probability has increased of the utilization under a priority emphasis of Albrook Airfield and the vicinity, in view of its proximity to downtown area and of the presence of readily usable lots. Also, the construction of the Natural Park has been decided on with a boundary to cover an area greater than first conceived of. Against this background, expectancy has increased that Corredor Norte will act as the development axis of the area, and it has become mandatory that new alternatives including access to Via Cerro Ancon (Gaillard Road) be studied, while reviewing the route as conceived of by ESTAMPA Masterplan, which was to traverse the Park for a substantial length.

Six alternative routes are selected for consideration as shown in Fig. III-1-1. These alternative routes are characterized below, but can be grouped into the following three: (a) those which traverse the Park and follow Curundu Road (N-0, N-1, and N-2), (b) those which will use the runway of previous Albrook Airfield and traverse the military area (N-4 and N-5), and (c) those which will avoid them and use the existing roads (N-3).

a) Alternative Route N-0

This route will follow Curundu Road and run along Curundu River; it will run inside but near the edge of the Park, with the aim of keeping its impacts upon the Park at a minimum. However, it will inevitably go through the area of soft ground along the river and its alignment will inevitably be poor. The route will include sections running close to a transmission line and protective institutions.

b) Alternative Route N-1

The closest of the six to the original route in ESTAMPA Masterplan. This route will go through the southern part of the Park with a good alignment. Otherwise, it is the same as N-0.

c) Alternative Route N-2

This route will use the road newly built in the Park, Via Juan Pablo II. Poor alignment and the superimposition of two roads with different functions are the problems.