

THE URBAN TRANSPORT STUDY

IN

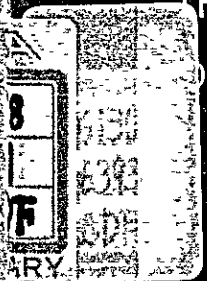
PANAMA METROPOLITAN AREA

SUMMARY REPORT

DECEMBER, 1982

THE REPUBLIC
OF PANAMA

JAPAN INTERNATIONAL
COOPERATION AGENCY



国際協力事業団	
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PREFACE

In response to the request of the Republic of Panama the Government of Japan decided to conduct a survey on the Project to improve transport in the Metropolitan Area of Panama and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Panama a survey team headed by Mr. Hajime Tanaka from 28 January 1981 to 27 October 1982

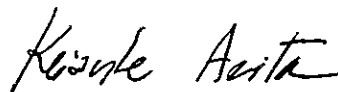
The team exchanged views with the officials concerned of the Government of the Republic of Panama on the Project and conducted a field survey in the Metropolitan Area.

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.

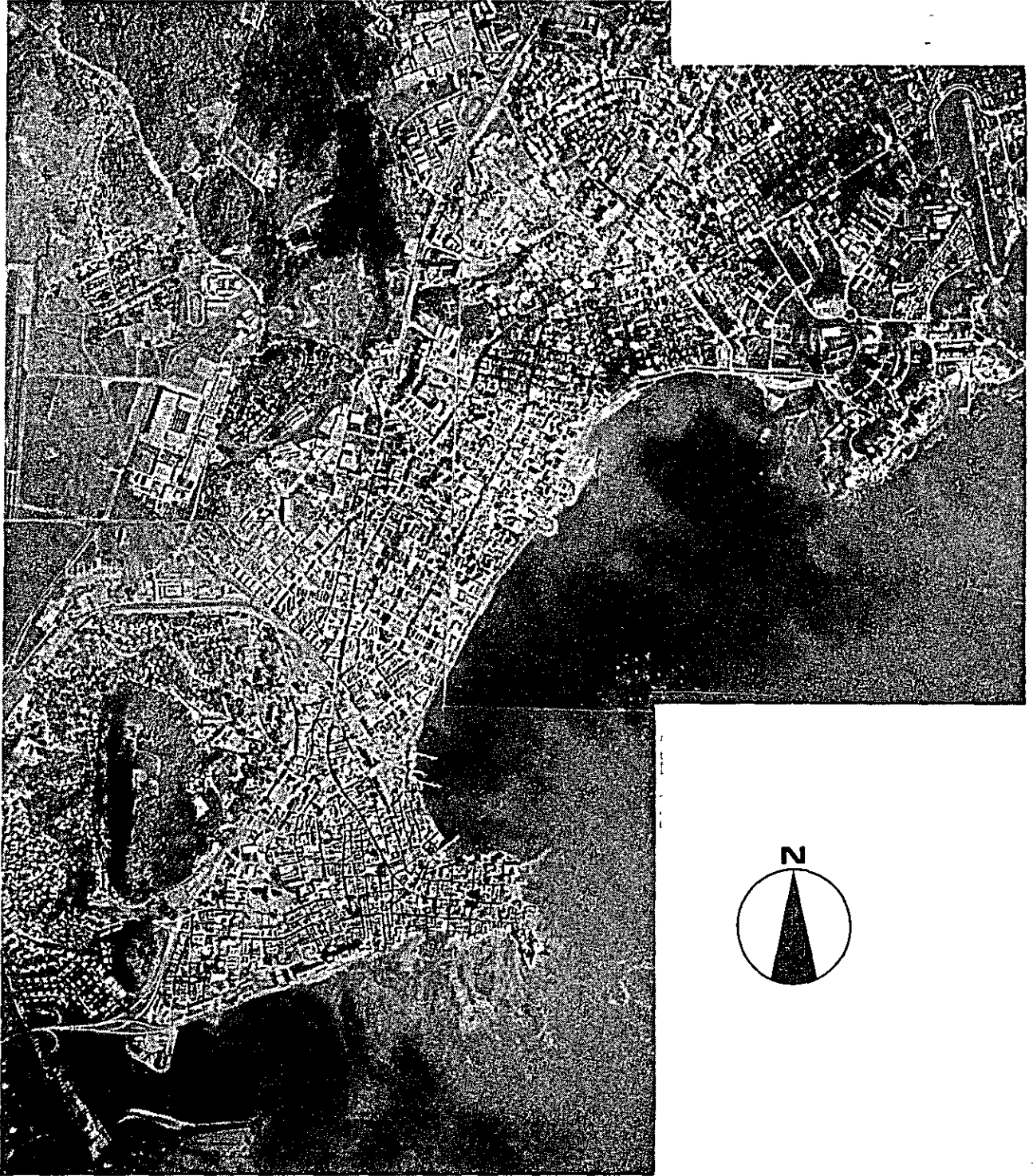
December, 1982



Keisuke Arita

President

Japan International Cooperation Agency



CENTRAL PART OF PANAMA CITY.

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1 . INTRODUCTION

Study Development

In response to the request of the Government of the Republic of Panama for technical cooperation, the Government of Japan dispatched, through its Japan International Cooperation Agency, a study team (consisting of 16 experts) to Panama from January 1981 through October 1982 for the purpose of formulating an Urban Transport Study in Panama Metropolitan Area. This Study Team, with the cooperation of a counterpart team organized by the Panamanian Government, formulated such an Urban Transport Plan (with target year of 2000) based on predicted changes in land use by the year 2000, as well as an urgent short term plan for the solution of the existing traffic congestion, the deterioration of bus transport service, and other transport problems by which the Area was already plagued. The accomplishment of the entire process of this Study in Panama facilitated and ensured the transfer of survey, study and planning technology.

Study Background

The Study Area has evolved as the administrative, economic, and financial center of the Republic. The municipal population grew by an average annual rate of 4.6% in the 1960s and by 3.5% in the 1970s, and it is expected to continue to grow by 3.3% in the 1980s and 2.7% in the 1990s. As a result, the residents of the Planning Area (which is defined hereunder) will reach 987,000 by 1990 and 1,299,000 by the year 2000. Economic concentration was also remarkable, and the Regional Gross Domestic Products of Panama Province, the major portion of whose economic activities is represented by the Planning Area, reached 1,448,000,000 balboas (1975 prices) in 1979.

Reflecting such economic development and population concentration, traffic congestion is being aggravated in the downtown Panama almost by the day. The travel-time survey conducted in 1981 revealed that on almost all of the arterial roads in Panama Urban Area average vehicle travel speed was less than 10 Kilometers per hour.

The indicated slow vehicle operation speed and the outward expansion of residential areas into the suburbs have been the major causes for the impairment of productivity of bus businesses, which in turn has caused chain reactions of delay in the renewal of annuated buses, the accelerated superannuation of bus fleets, and, on the part of the bus businesses, attempt to maintain revenue—expenditure balance by dropping the level of bus service.

Study Area and Planning (Survey) Area

Socio-economic studies covered the entire territory of the Study Area, which consisted of four Districts: Panama, San Miguelito, Arraijan, and La Chorrera.

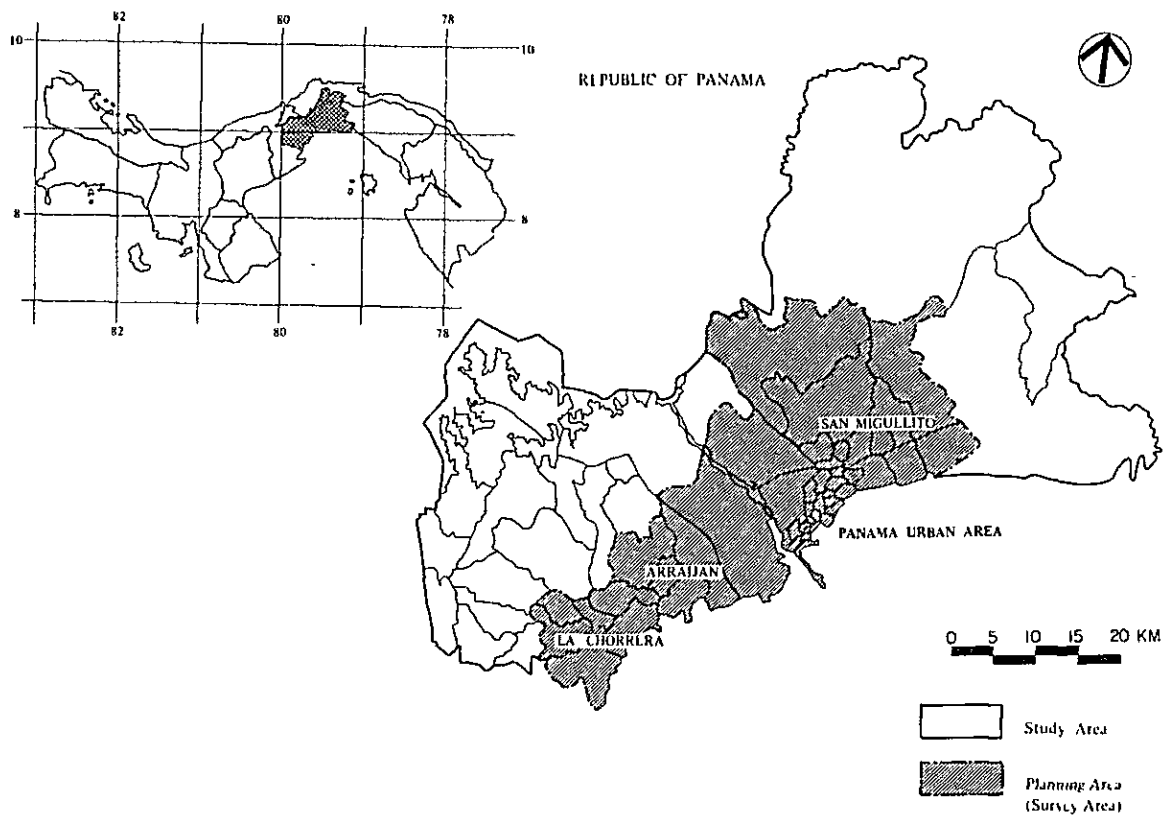
A person-trip survey, which was the most important field survey in this Study, was conducted covering a Survey Area which was established inside the Study Area and which encompassed most of Panama District, all of San Miguelito District, and the southern portions of La Chorrera and Arraijan Districts. The Survey Area, which was referred to as the Planning Area in the planning stage covered a land space of 107,620 hectares and had a population of 708,000.

Organization

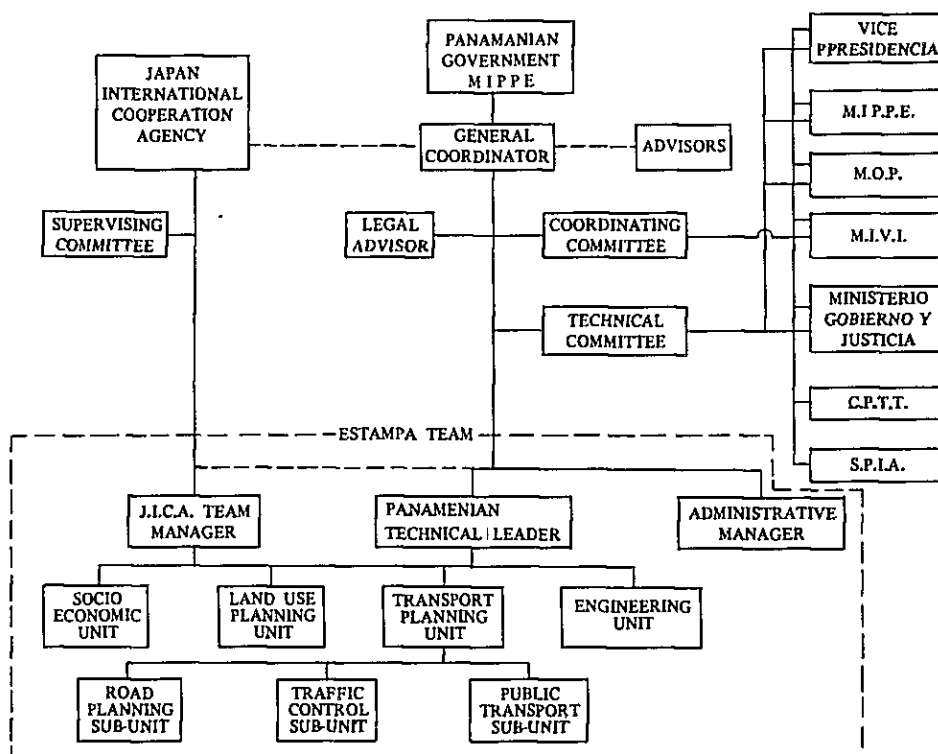
The Ministry of Economic Planning and Policy (MIPPE) acted on behalf of the Panamanian Government as the contact with JICA Team and organized the Panamanian Team composed of experienced engineers selected from MIPPE, the Ministry of Public Works (MOP), the Ministry of Government and Justice, the Ministry of Housing (MIVI), and the Panamanian Transport Operators Union (CPTT). MIPPE also organized a Steering Committee and a Technical Committee composed of the directors of various relevant ministries and organizations. The Panamanian Team and the two Committees are presided by chairmen appointed by the President.

JICA organized an Supervising Committee for the management of the JICA Team.

The Panamanian Team and the JICA Team were unified as an integrated entity referred to as the ESTAMPA Team, which was divided into the following four professional groups for the achievement of this Study: Socio Economics, Land Use Planning, Engineering and Transport Planning.



STUDY AREA AND PLANNING (SURVEY) AREA



ORGANIZATION OF ESTAMPA

2 . PROBLEMS

Topographical Restraints

Regarding the Pacific shore line of Panama as x axis, the Canal as y axis, and Centro as the origin of this Cartesian coordinates, Panama City land area can be typically conceived of as an approximately 45° sector representing the lower half of the first quadrant of the circle. The Canal Area and U.S. Forces base in the upper half have blocked the northward expansions of Panama Urban Area. The second quadrant, separated from the first by the Canal, has not been available for urbanization due, also, to the presence of the Canal Area and military bases: a daily traffic of only about 13,000 person-trips moves to and from isolated western cities across the Canal Area. The third and fourth quadrants are the sea.

In this situation, the usual 360° urban expansion has been impossible. As population and socio-economic activities increased in Panama City, the City core (Centro) and the City's peripheral areas grew, but grew only in the general direction of east-northeast. The fact that the City nucleus remained in Centro in the corner of the sector angle and the mono-directional extension of the peripheral have resulted in accelerated increase in traffic between the core and the peripheral as the peripheral moved farther and farther away from the core.

Problem Areas on Arterials

Arterials were reviewed and rated against the following evaluation items: the capacity and traffic flow at intersections, pedestrian crossing control, congestion at bus stops, traffic moving in and out of narrow streets, number of vehicles making left-turns, number of traffic accidents, parking conditions, and road structures. The sections of arterials where more than one item were rated low were designated "problem areas."

The problem areas thus identified were: 8 sections on Via Espana, the 3 sections on Ave. Central, 1 section on Ave. Peru, 1 section on Ave. Justo Arosemena, 2 sections on Ave. A, and 2 sections on Ave. B. Phenomena commonly seen in these sections were that vehicle operation speed often drops to less than 10 kilometers per hour, that traffic accidents occur frequently, that traffic congestion is caused by buses near bus stops, parking ratio is high on the subject arterial (when parking is permitted) and on adjoining streets. It was characteristic of Via Espana that a large number of signaled intersections the volume of traffic exceeded the design capacity.

Public Transport

Despite the supply of transport capacity over demand in terms of the daily average indicated for all bus routes, the peak hour supply did not meet the peak hour demand on 39 out of the total 54 routes. Only 932 buses were calculated necessary to meet the peak hour demand even at the seating capacity of the buses as against 1,088 buses which were in operation on the day of the survey. Therefore, lack of adequate planning for the allocation of bus routes is suspected.

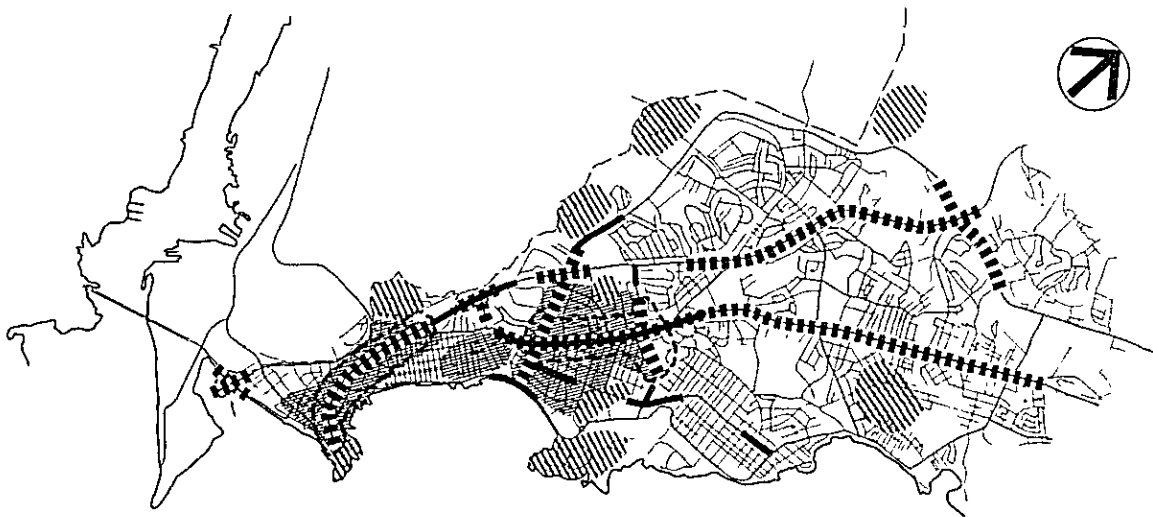
A review of the balance between demand and supply by area indicates that a tight situation exists at the cross-section between San Miguelito (VI) and Area Residencial (III). The existing route network will become incapable of responding to urban expansion, diversification, and deterioration sooner or later.



HEAVY BUS TRAFFIC ON AVE. CENTRAL



CONGESTION ON VIA ESPANA



LEGEND

- Traffic Congestion
- - - - Frequent Traffic Accidents
- /// Want of Parking Space
- Congested Bus Stops
- ||||| Poor Access to Bus Service

CURRENT TRAFFIC PROBLEM MAP

3 . SOCIO-ECONOMIC FRAMEWORK

Industrial Structure

Panama City is not only the capital of the Republic of Panama, but is also prominent as the center of international finance in Central and South America. A large number of foreign enterprises are engaged in international business activities in Panama City, attracted by the political stability and general preferential treatment available for not only financial but also other international economic activities.

The industrial distribution of the total 220,000 employees in the Study Area is 4% to agriculture, forestry, and fishery, 22% to secondary industries, and 74% to tertiary industries. Of the tertiary industries, conspicuous are distributions to service (36%), wholesale and retailing (19%), finance (7%), and, as a unique category, service in the Canal Area (6%). Tourism should not be overlooked as it earned 165 million dollars of foreign exchange against the 310 million dollars of net deficit in the current balance of payments of Panama in 1979 (preliminary). Most tourist spendings occur in the Study Area.

Population, Labor Force and Employment

The Study Area population increased from the 330,000 in 1960 to 730,000 in 1980 at an average annual rate of 4.3%, and is forecast to increase by an average 3.3% per year until 1990 and by 2.7% from 1990 to the year 2000. If this does occur, the Study Area population will be 1,020,000 in 1990 and 1,330,000 in 2000, while the Planning Area population will be 990,000 in 1990 and 1,300,000 in 2000.

The predicted demographic tree of the Study Area will shift from that of a pyramid shape to that of a barrel shape due to social increase and declines in birth and mortality rates. Working age (15-64) population will exceed two-thirds of total population at 68.5%.

The number of workers will increase by 2.24 times the present and reach nearly 500,000 in the 20-year period, while population will increase by 1 82 times. The ratio of workers to population will ascend from the present 30.2% to 37.1%.

In the Study Area, the number of employees is forecast to grow from the 220,000 in 1980 to 340,000 by 1990, when its industrial distribution will be 20% to secondary (of which, 12% to manufacturing) and 79% to tertiary industries, and to further grow to 490,000 by 2000, when such distribution will be 18% to secondary (of which, 11% to manufacturing) and 81% to tertiary industries.

The Canal Area

Panama City is strongly characterized by the presence of the Isthmus Canal, which brought a total revenue of 334 million dollars in 1979 (135 million dollars from employment, 85 million dollars from the sale of petroleum and other commodities, and 51 million dollars from the expenditures of Canal residents).

Under the Torrijos-Carter Treaty, some of the Canal facilities and a part of the Canal land were returned to the Republic, and the system of annuity payment by the Canal Commission (formerly the Panama Canal Company) was changed effective November 1979.

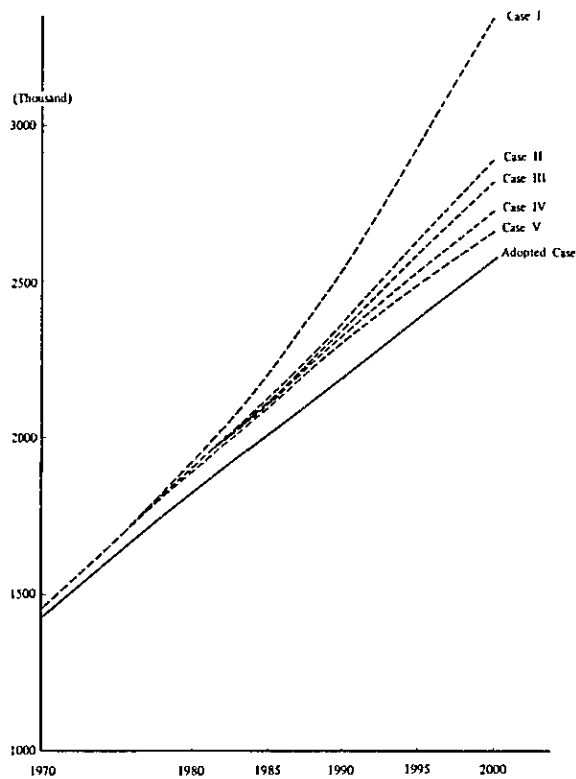
Canal employment was estimated at 19,000 in 1980, of which 13,300 are concentrated in the Corregimiento de Ancón, which is a part of the Study Area. Two-thirds of the Canal workers are employed by the United States and one-third by the Republic of Panama.

Planned Population

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

Employment in the Study Area

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



**FIVE CASES OF POPULATION PROJECTION BY CONTRALORIA
GENERAL AND THE ADOPTED FUTURE POPULATION OF THE
REPUBLIC**

4 . DEVELOPMENT PATTERN

Urban Development Pattern

Three alternative urban development patterns are possible.

A. Triangular Development Pattern

The present reverse "T" pattern is to be shifted to as close to a triangular pattern as possible through the outward expansion of Panama Urban Area and the development of the reverted Canal Area. Neighborhood centers are to be developed in distributed locations.

B. East-West Development Pattern

Urbanization is to be induced in east-west directions leaving the reverted Canal Area for a comprehensive development upon the complete reversion of the entire Canal Area. Particularly, La Chorrera District, Arraijan District and the Corregimiento de Tocumen are to be developed as employment bases.

C. Northern New Town Development Pattern

The northern part of the reverted Canal Area is to be developed into a new town as the second urban center with much tertiary industrial activities, while inhibiting development in east-west directions.

Of the three, Alternative B will achieve the shortest average commutation time due to the widest geographical distribution of employment and will leave the greatest future development potential in the reverted Canal Area which will be desirable from nature preservation and disaster prevention purposes. However, the accomplishment of such employment distribution will be difficult, and it will be difficult to keep the large reverted land in undeveloped condition.

Alternative C, on the other hand, will remedy the current pattern and create a favorable urban environment under strong national leadership through the development of a well planned urban residential area and urban nucleus in the reverted land. However, the amount of public investment required for disaster prevention measures and new infrastructure to support the large-scale development of the hilly land will be prodigious.

Therefore, Alternative A, which aims at the extension of the existing trend and is a compromise between the other two alternatives, is to be adopted for its practicality.

Zonal Divisions, Population, and Employment Distribution

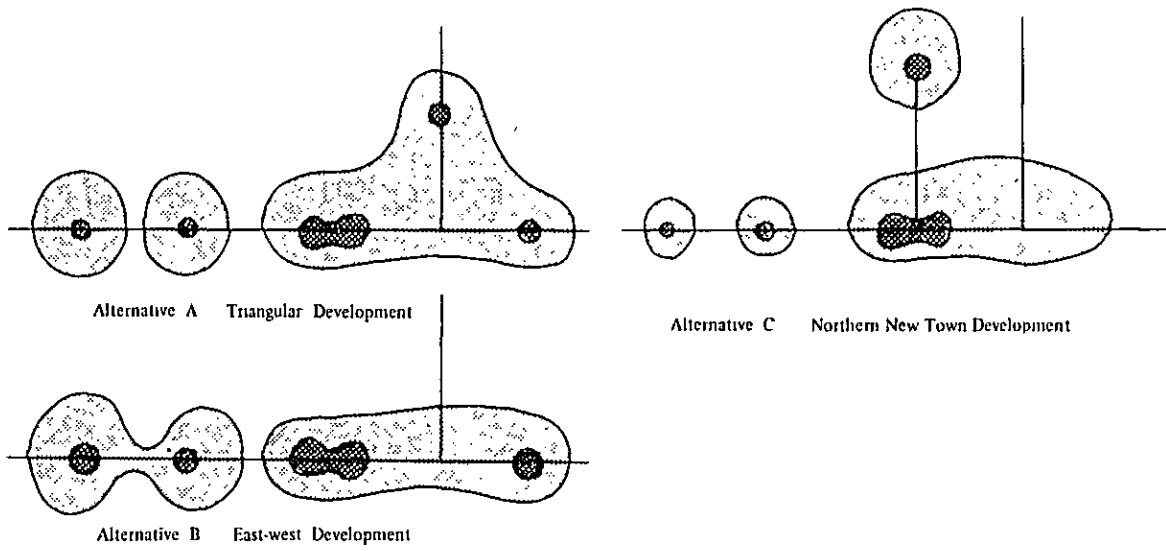
After reviewing the present population distribution, land use, developable land distribution, existing large-scale projects, and administrative jurisdictions, the Planning Area is divided into 11 parts called Integrated Zones.

The remaining part of the Study Area is likewise divided into the eastern part called Pacora (XII) and the western part called Nuevo Emperador (XIII).

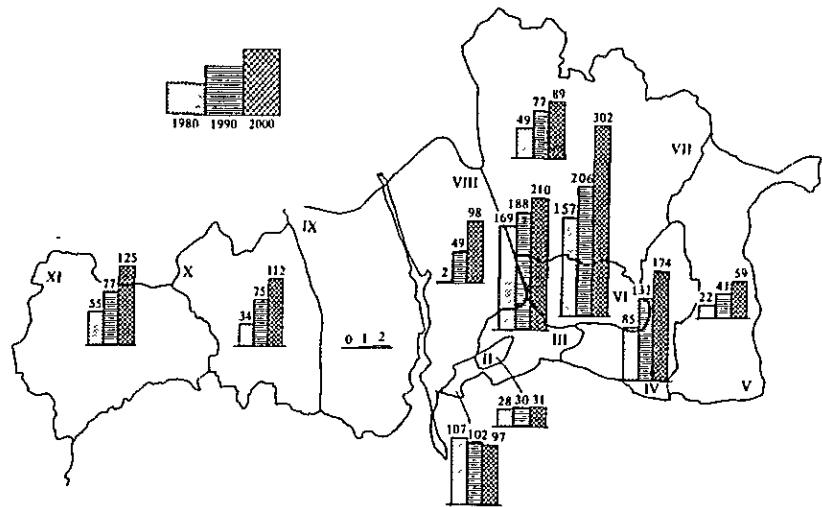
Future population and employment in each Zone have been forecast as follows, based on the availability of developable land, the trend of population increase, the development concepts of the government, and rise in the level of self-sufficiency.

PLANNED POPULATION AND EMPLOYMENT (YEAR 2000)

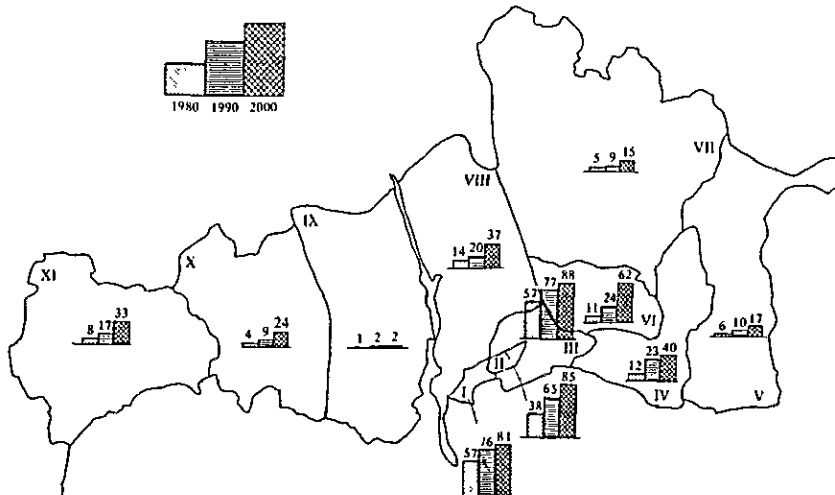
	Population	Employment		Population	Employment
I Centro	96,600	81,030	VIII Ancon Este	98,400	37,015
II Bella Vista	31,300	85,185	IX Ancon Oeste	1,500	2,395
III Area Residencial	210,300	87,735	X Arraijan	111,500	24,030
IV Juan Diaz-Pedregal	174,000	39,540	XI Chorrera	125,100	32,960
V Tocumen	59,300	17,000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



DEVELOPMENT PATTERNS



POPULATION OF INTEGRATED ZONES (1980, 1990, 2000)



EMPLOYMENT IN INTEGRATED ZONES (1980, 1990, 2000)

5 . LAND USE PLAN

Scale of Urbanized Area

The scale of urbanized area will expand by 1.56 times from the 12,800 hectares in 1980 to 20,000 hectares by the year 2000. The urban population in the year 2000 will be 1,236,000 of which 827,000 will live in the existing urbanized area and 409,000 in the area to be newly urbanized. Urban population density will rise from the present 50 persons per hectare to 62 persons per hectare.

Of about 7,200 hectares to be newly urbanized, about half, or 3,600 hectares, will be developed in the eastern suburb of Panama (Juan Díaz Pedregal, Tocumen, and the eastern part of San Miguelito), 500 hectares in the reverted Canal area, and 2,300 hectares in Arraijan and La Chorrera.

Commercial Nuclei

- (1) Central commercial and business nucleus to serve the Metropolitan Area: Centro and Bella Vista
- (2) Suburban commercial nuclei: eastern part of San Miguelito and La Chorrera
- (3) Neighborhood commercial nuclei: Corregimiento de Betania, Corregimiento de Rio Abajo, central part of San Miguelito District, and the Corregimiento de Arraijan.

Public Facilities

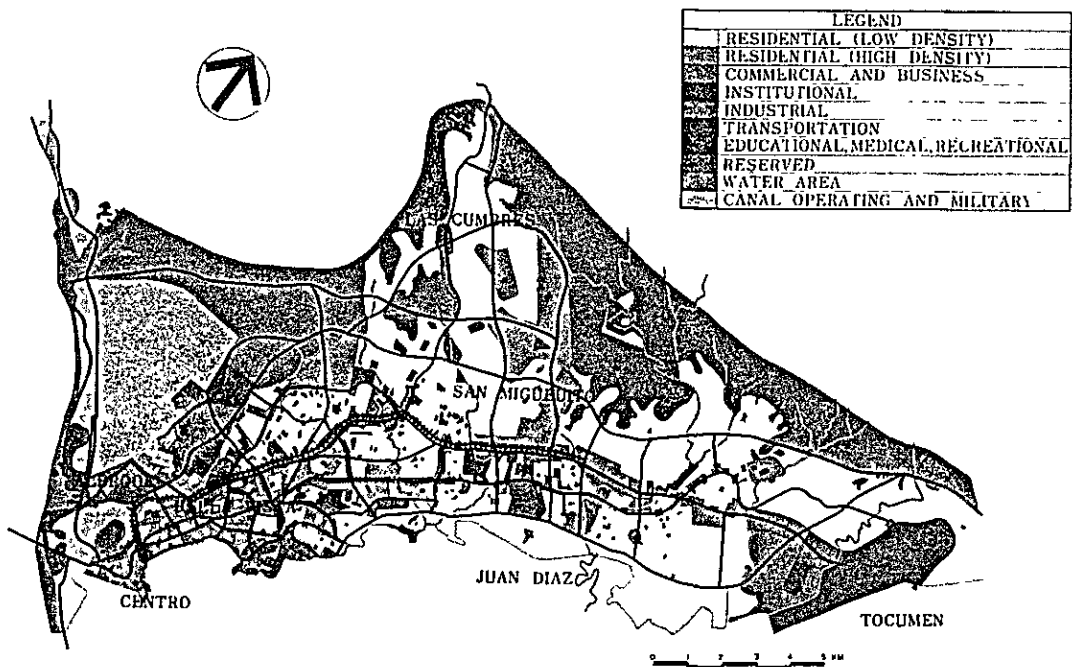
- (1) El Marañon Government Center: MIPPE as well as other ministerial offices, will be gathered into a part of the El Marañon Urban Renewal Area in Centro to make it the government center.
- (2) Albrook Public Facilities Nucleus: Transportation-related ministries and other necessary public facilities will be gathered in and around the former Albrook Airport in the reverted area to give it a characteristic of transportation administration center.
- (3) Nuevo Corredor Norte Public Facilities: Public corporations, public enterprises, and educational facilities will be located in concentration along Nuevo Corredor Norte in the reverted area to form a public facilities nucleus.
- (4) Eastern Suburb Public Facilities Nucleus: Administrative agencies, public corporations, detachment offices of public enterprises, campuses of universities, colleges, and a general hospital for the zone will be located along the commercial nucleus in the eastern part of San Miguelito.
- (5) Western Suburb Public Facilities Nucleus: Campuses of universities and a general hospital for the zone will be established and the existing facilities expanded in La Chorrera for its greater sufficiency.

Industrial Estate Development

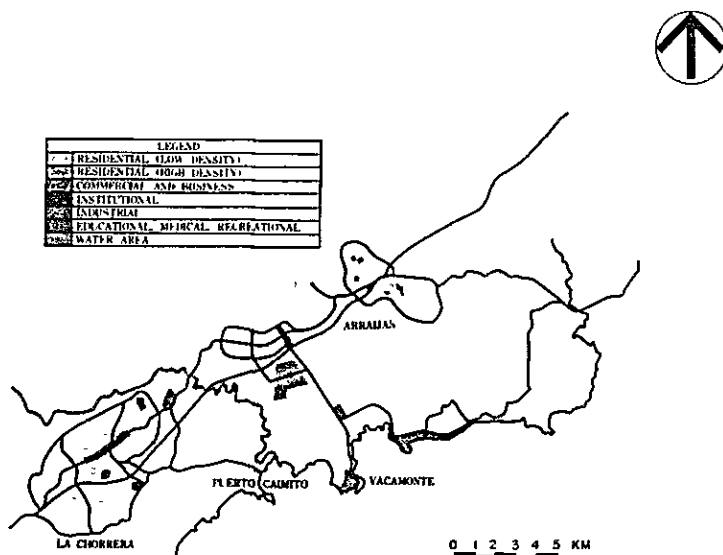
The following industrial estates will be developed to receive the factories relocated from Panama Urban Area and to create employment opportunities: such as Tocumen Industrial Estate, Albrook Industrial Estate, Vacamonte Port Industrial Estate and La Chorrera Industrial Estate.

Major Housing Development

- (1) Ancon Este: New development projects in four areas including Albrook Norte covering a total land size of 283 hectares (with planned population of 53,500) and the increase of density in two areas including Paraiso covering a total land size of 63 hectares (with a planned population of 15,000).
- (2) San Miguelito District: New development of a middle-class and high-class residential area for sale in lots in the Corregimiento Jose D. Espinar (estimated population, 100,000).
- (3) Arraijan District: New development of three areas including Burunga covering a total land size of 487 hectares (with a planned population of 49,000).
- (4) La Chorrera District: New development in three areas including Mastrant covering a total land size of 165 hectares (with a planned population of 14,300).



LAND USE PLAN (PANAMA-SAN MIGUELITO) 2000



LAND USE PLAN (ARRAJAN-CHORRERA) 2000

6 . CENTRO AND BELLA VISTA

Centro

Housing development, as well as related commercial and public facilities development, will be achieved in El Chorrillo, Curundu, Calidonia (Santa Cruz) and Santa Ana; and urban renewal with the formation of a complex of government agencies, commercial buildings and high rise residential buildings will be achieved in El Maranon. Also, a public transport center will be introduced around Maranon.

In the C. de Curundu, a road leading to the reverted area will be developed, motor vehicle related service industries will be concentrated, and residential and public facilities will be developed.

In the C. de San Felipe, the restoration project of the Tourist Agency (IPAT) will be continued, hotels and necessary parking spaces will be developed, and feeder bus service will be introduced.

Bella Vista

The development of building spaces will be necessary in order to accommodate for the estimated 47,000 job increases in the tertiary and other industries, as this Zone will be developed as an international financial center for the Central and South America. The development of parking lots and pedestrian paths will be also needed in response to a greater accumulation of financial and commercial activities.

Almost all of lots presently designated for commercial/residential uses and those designated for commercial use which still remain vacant will be occupied by commercial buildings. In addition, one-half of apartment houses to be newly constructed in the high density residential area will have stores on the first floor. Furthermore, transition of land use from residential to commercial, which is currently taking place, will accelerate.

For parking space development, a total land size of about 13 hectares are needed (if all are ground surface parking, as opposed multi-layer parking).

A center to serve Bella Vista will be established in the reverted area near the University of Panama.

Reverted Canal Area

The reverted area in Ancon Este is a large space for which the Panamanian Government may make plans with complete freedom and constitutes an important factors for the correction of the presently disturbed pattern of Panama Urban Area. The basic land use concept for this area envisages the followings:

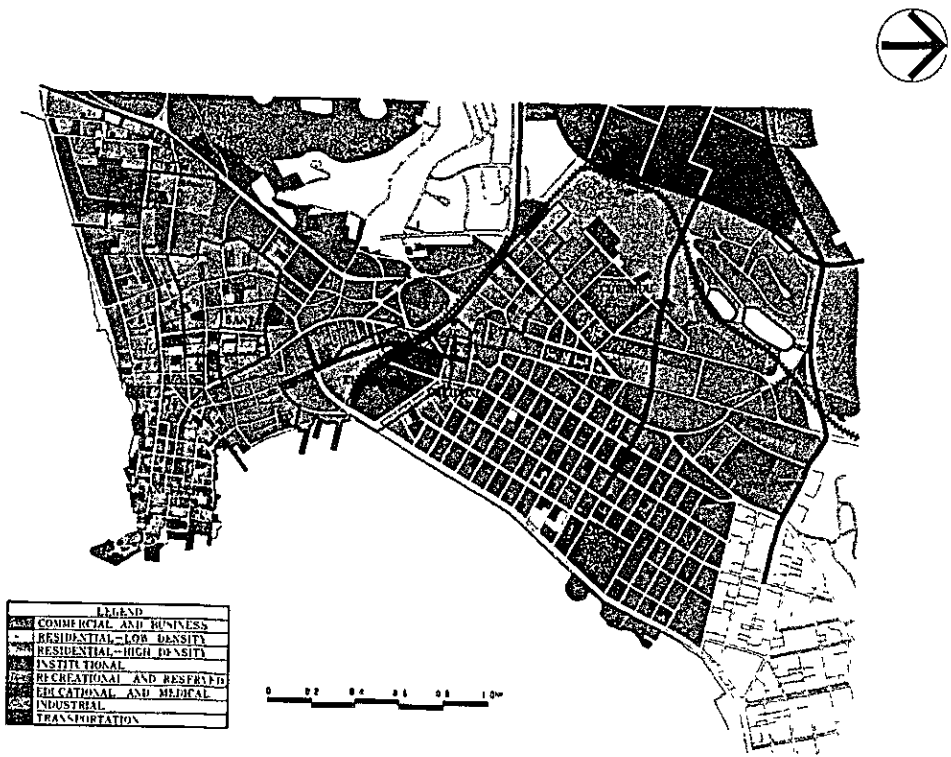
(1) A new road (Corredor Norte) will be installed on the right bank of Curundu River, and various functions needed in the future and residential areas will be developed along this road.

(2) As new urban functions, located in the northern part will be public corporations, public enterprises, and educational facilities, located in Albrook in the southern part will be public agencies concerning transportation and an industrial estate, and located at the foot of Cerro Ancon will be cultural facilities.

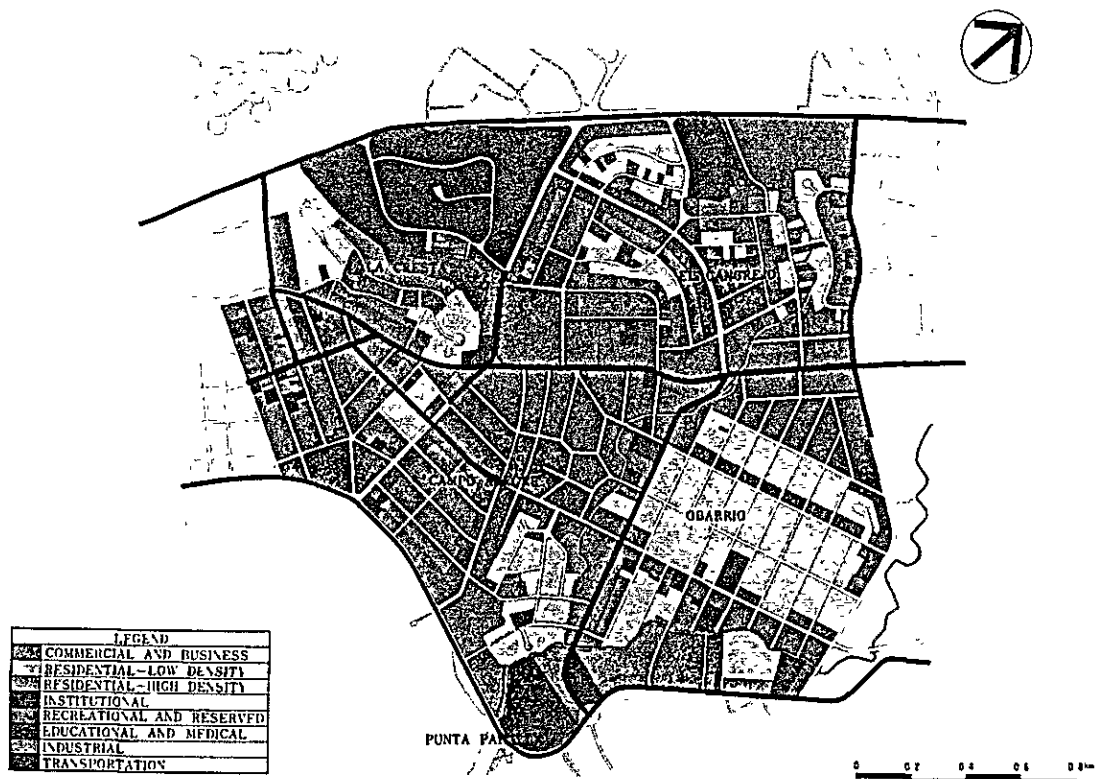
(3) High density residential areas will be developed in the shape of a bulb while the density existing residential areas of Paraiso and Pedro Miguel will be made heavier.

(4) Neighborhood commercial centers will be formed in the Ricardo J. Alfaro Area in the northern part and in the vicinity of Albrook Norte.

(5) The hills in the north of Campo de Antena will be preserved as neighborhood greens.



LAND USE PLAN FOR CENTRO (2000)



LAND USE PLAN FOR BELLA VISTA (2000)

7 . PERSON TRIP IN PANAMA

Trips by Purpose and Mode

The Person-Trip Survey revealed that the Study Area is self-sufficient with regard to transport demand and supply: of the total of about 1,474,000 trips per day, 98% were by the Area residents and 96% were internal trips, and only 941 trips were through trips.

Of the internal trips, the most prominent of the trips purposes was "to go home" (43.6%), followed by "to work" (17.9%) and "to school" (15.7%) – these three purposes accounted for as much as 77.2% of the total. By mode of travel, buses in public use accounted for the largest portion of the total, or 34.2%, followed by cars (26.9%). It is estimated that as many as 11,000 persons use the Chiva everyday, but a majority of them transfer to or from the bus and, therefore, are included in bus trips. As a result, the Chiva shows a small share in total trips.

Car Ownership and Trip Production

Trip generation rate varies little by trip purpose but varies substantially between car-owning family members and non-car owning family members, the former being 3.39 and the latter, only 1.94. This gap is explained not by behavioral pattern, but by the higher trip maker ratio among the former families than the latter.

In the Study Area to ratio of car-owning families was already as high as 28.7% (36.7%, including commercial vehicles) in 1980, and, because this ratio is expected to continue to rise in the future, the people's propensity to achieve high mobility by owning a car cannot be overlooked in forecasting future transport demands

Inter-Zonal Trips

A review of Integrated Zones for their trip generations reveals that the number of trips generated in Centro (I) and Area Residencial (II) is much higher than other Zones.

The ratio of intra-zonal trips to total trips scatter in the range of 30% to 50% but is a particularly high 85% in La Chorrera (XI), indicating that this Zone is comparatively independent from Panama City as far as transportation is concerned.

A desire line diagram, translated from the O-D table of Integrated Zones, reveals heavy flows of people between and among Centro, Bella Vista, Area Residencial, San Miguelito, and Juan Diaz-Pedregal, and little traffic between other Zones. This shows that the traffic sphere of Panama Metropolitan Area covers only up to San Miguelito and Juan Diaz Pedregal. These two zones are each connected with Panama Urban Area, but not with each other.

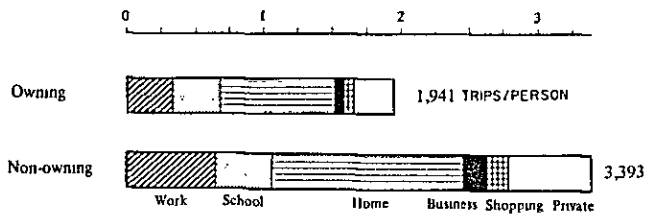
Trips within and between the above-mentioned five zones total 1,108,390, or 75% of the Study Area total. Relatively little traffic currently exists between Panama Urban Area and the west of the Canal.

GENERATED TRIPS BY PURPOSE

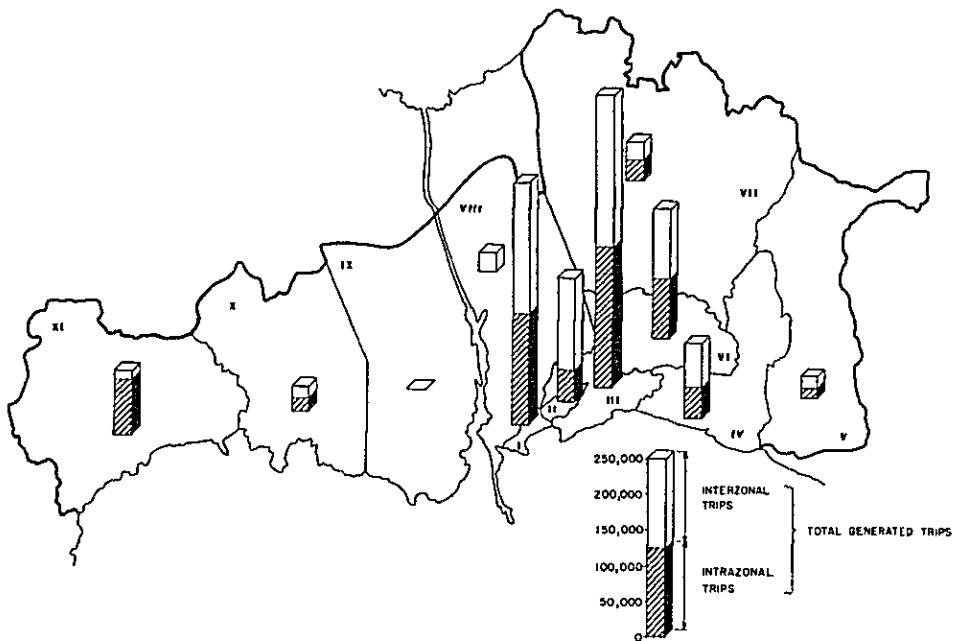
Purpose	Survey Area		External Area		Total	
	Trips	%	Trips	%	Trips	%
1 Work	259,864	17.9	3,043	12.2	262,907	17.8
2 School	227,727	15.7	111	0.4	227,838	15.5
3 Home	632,279	43.6	7,435	29.9	639,714	43.4
4 Business	58,574	4.0	7,153	28.7	65,727	4.5
5 Shopping	64,655	4.6	1,589	6.4	66,244	4.5
6 Private	205,705	14.2	5,555	22.4	211,260	14.3
7 Total	1,448,804	100.0	24,886	100.0	1,473,690	100.0

GENERATED TRIPS BY MODE

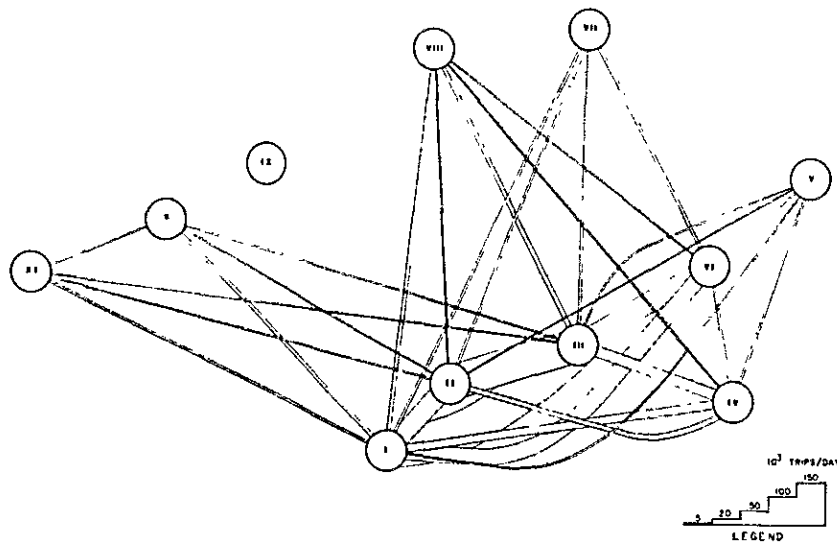
	Trips	Modal Share
1 Walk	326,133	22.1
2 Two Wheeler	2,319	0.2
3 Car	395,895	26.9
4 Truck	102,197	6.9
5 Taxi	71,120	4.8
6 Chiva	5,162	0.4
7 Bus (Public)	503,851	34.2
8 Bus (Private)	65,359	4.4
9 Rail	-	-
10 Others	1,554	0.1
11 Total	1,473,690	100.0



TRIP PRODUCTION RATE BY CAR-OWNERSHIP



TRIP GENERATION BY ZONE



DESIRE LINES FOR INTERNAL, TRIPS, 1981

8 . TRANSPORTATION DEMAND

Increase of Trips

Transport demands in the target years of 1990 and 2000, which constitute the base for transportation planning, have been predicted based on the current person-trip data and using various models, future population, and economic indicators.

The Planning Area population is predicted to increase by 1.8 times from the present 710,000 to 1,300,000 by the year 2000, while the total number of generated and attracted person-trips will more than double from 1,430,000 to 3,140,000 as people show higher mobility with a greater average number of cars per unit of population. In 1990, the number of person-trips will be 2,230,000 or 1.5 times the present.

Those for work and school purposes (the major contributors to peak hour traffic) as a percent of total trip generation will remain at the present share of 33%. Those for business and shopping will also remain practically unchanged. As the people's mobility rises, those for social and amusement purposes will increase from the present 14% to 15%.

Panama Urban Area (Centro, Bella Vista, and Area Residencial), though a relatively small area, will continue to represent a large portion of the total trip generation/attraction, but will show a moderate rate of growth. In contrast, such growth will be remarkable in suburban areas, particularly in San Miguelito, Juan Diaz-Pedregal, and Ancon Este, where urbanization will be rapid.

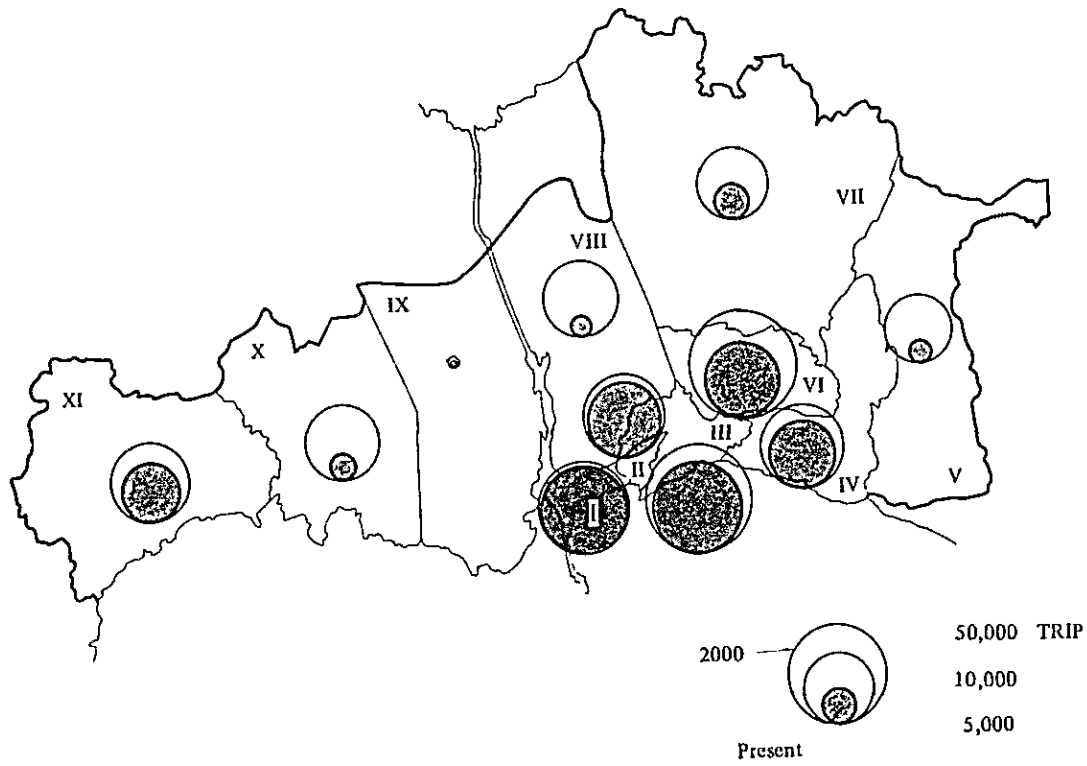
Increase of Motor Traffic

With no restraints on car ownership and utilization, car traffic is predicted to increase by 2.3 times from the present 490,000 trips to 1,110,000 trips in 2000, while the car-owning family ratio in the Study Area will rise from the current 29% to 48% (37% to 60%, including commercial vehicles) and the modal share of passenger cars in total person-trips will advance from the current 27% to 32%. A huge amount of road investment will be mandatory, if such an aggrandizement of cars is to be tolerated. It is essential, therefore, that certain measures be taken to discourage the holding and using of cars, while improving the capacity and quality of public transport service. Also indispensable will be plans to develop public transport network as an integral part of the urban structure.

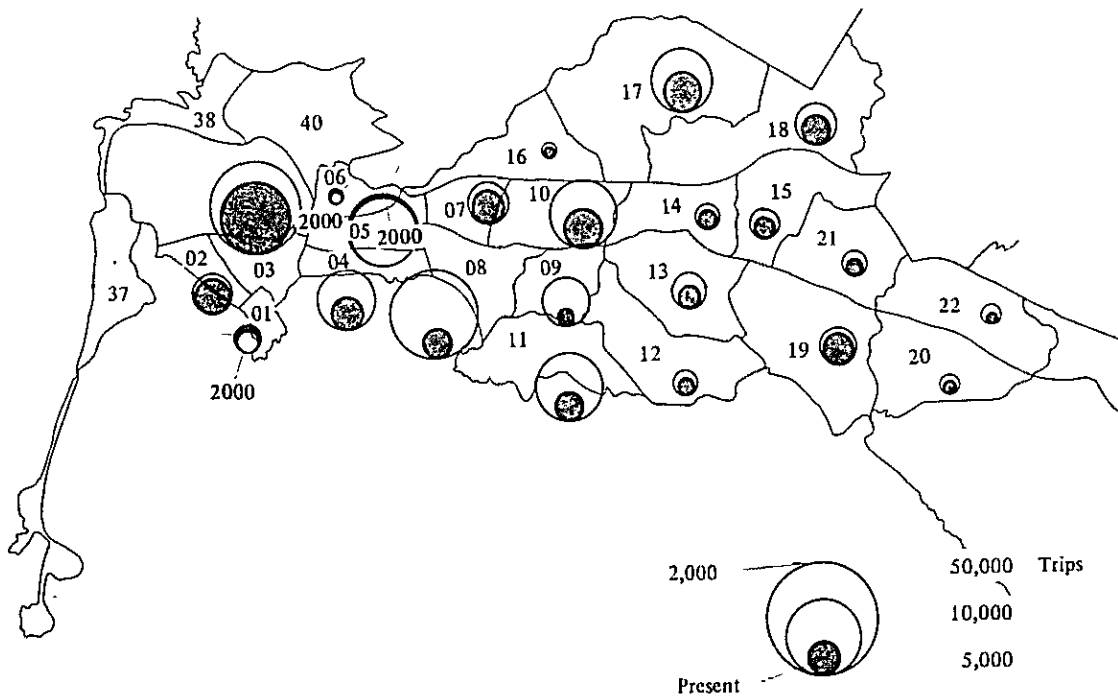
Cross Section Traffic Volume

Cross section traffic volumes have been estimated for the year 2000 and compared with those in 1981. It is estimated that traffic flow into the central part from (and to) suburban areas will increase by five times at the Canal cross section, flow from (and to) Juan Diaz-Pedregal and Tocumen will also increase by five times at Cinquentenario cross section, and that flowing from (and to) San Miguelito will increase by four times.

Flows within Panama Urban Area will rise to about 2.5 times at both Via Brasil cross section and all 11 de Octubre cross section. This means that traffic at these cross sections, which is already substantial, will approach 500,000 vehicles per day by the year 2000.



TRIP INCREASE BY INTEGRATED ZONE



TRIP INCREASE BY P.T. ZONE

9 . FUTURE TRAFFIC FLOW

Zonal Distribution

The proportions of person-trips originated and terminated within Panama Urban Area (Integrated Zones I through III), those completed within the remainder (suburban parts) of the Planning Area, and those moving between the two are presently 5 : 2 : 3. This will estimatedly shift to 3 : 4 : 3, as those completed in the Urban Area shrink to half while those in the suburban parts double. Then, future transport planning must be addressed to the provision of transport facilities to accommodate the suburban traffic.

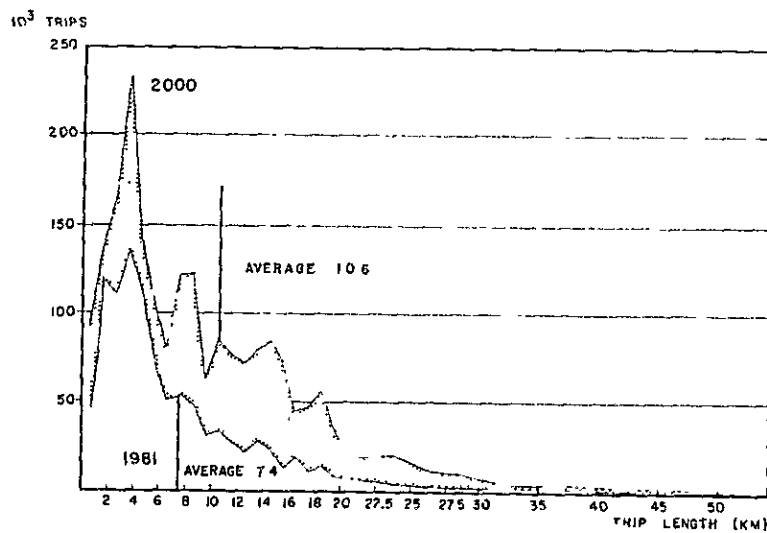
Change in Trip Length

Reflecting outward urban expansion, overall average trip length is expected to increase from the present 7 kilometers to 11 kilometers by 2000. Particularly, the average length of trips to work will increase from the present 9 kilometers to the longest 12 kilometers. The effects of such trip lengthening will compound upon the impacts of multiplied trips on transport facilities, necessitating an enormous amount of investment. Traffic burden in peak hours is particularly important in that it determines the quantity of transport facilities required.

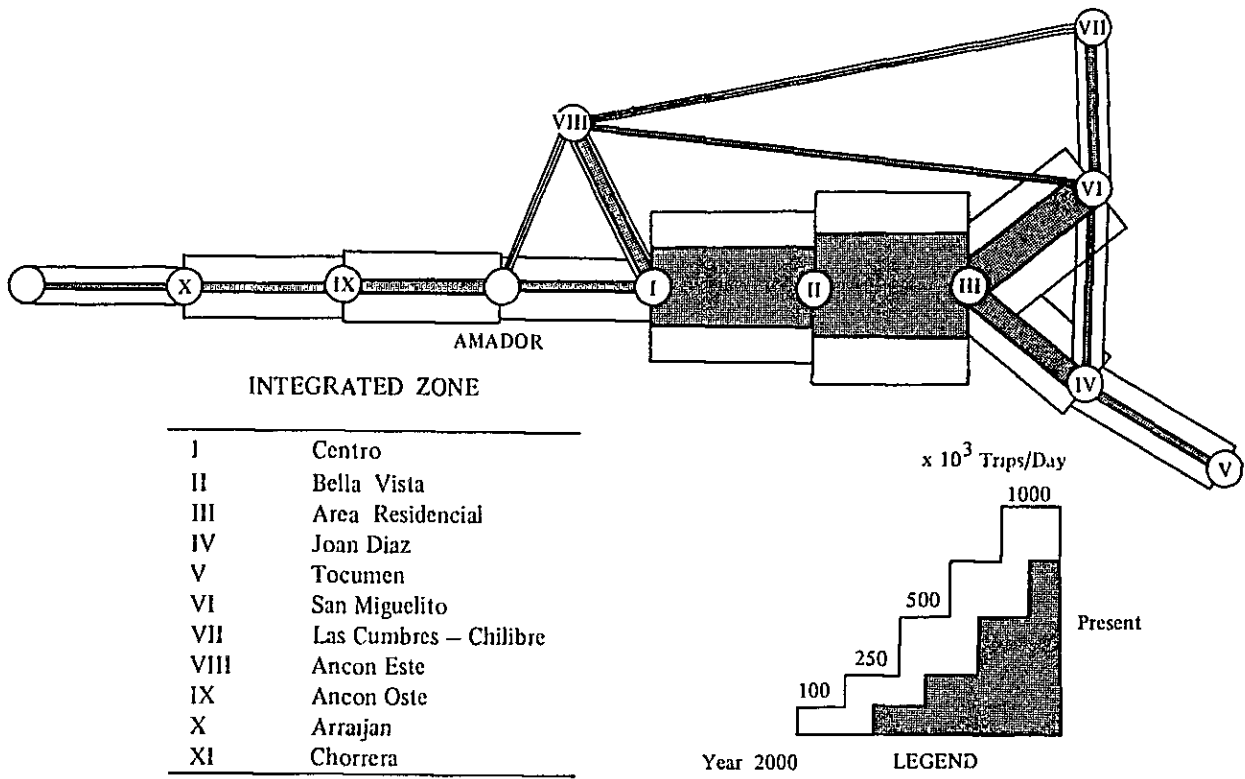
Traffic Flow Pattern

The present person-trip distribution on a spider network is compared against that for 2000, in the Figure given in the next page. It is noted that each traffic flow will be about doubled, but two flows into Panama Urban Area, one from Juan Diaz-Pedregal and other east areas and one from San Miguelito, Las Cumbres and other northern areas, will swell substantially. Cross-section traffic will be the greatest at their point of confluence in Panama Urban Area.

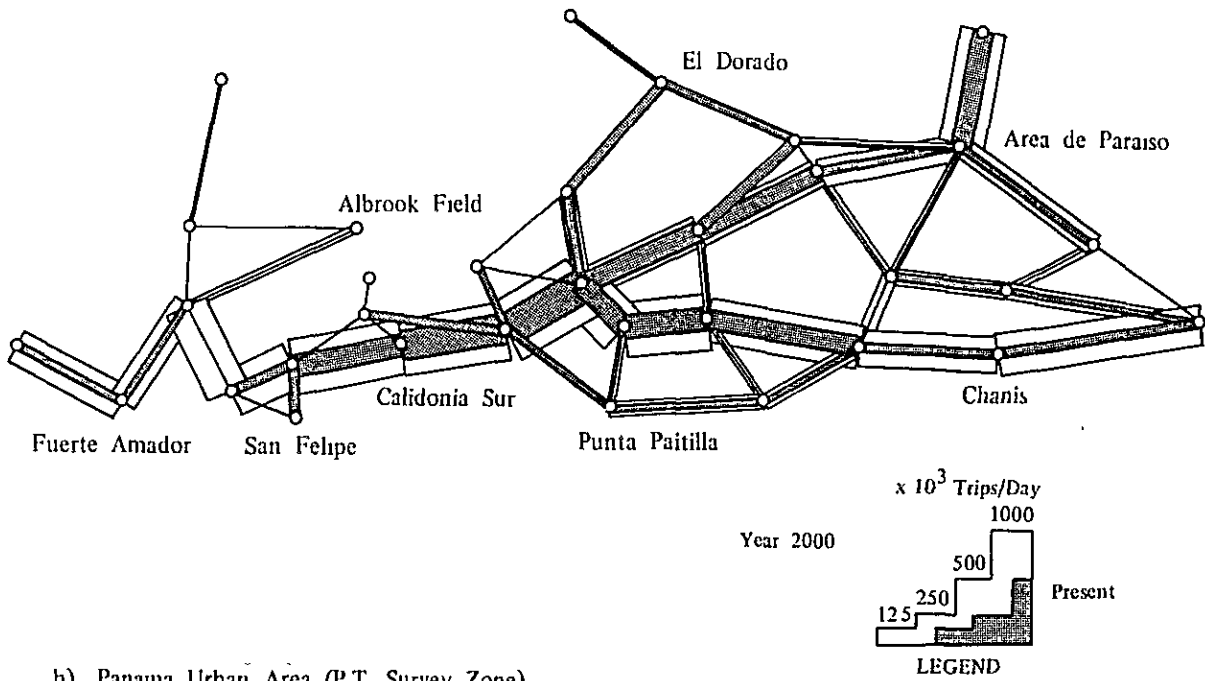
In view of the above, it will be of vital importance that, in the formulation of future transportation network, the direction, position, and scale of arterial network in rapidly urbanizing areas be carefully determined and that an adequate method be devised for handling the confluence of east-west traffic and north-south traffic. Particularly important will be the effective handling of motor traffic passing through Panama Urban Area and the improvement of public transport service directly to the core of the Urban Area.



CHANGE IN TRIP LENGTH DISTRIBUTION



a) Planning Area (Integrated Zone)



b) Panama Urban Area (P.T. Survey Zone)

PERSON TRIPS ASSIGNED ONTO SPIDER NETWORK, 1981 AND 2000

10. TRANSPORTATION NETWORK ALTERNATIVES

Concept

The areas which should be particularly reviewed in formulating alternative transport plans are Panama Urban Area, Juan Diaz - Pedregal, and San Miguelito.

While a ladder pattern is appropriate for the skelton network judging from natural and social conditions, two arrangements are conceivable: one is to lay major transport axes outside the urban area and have traffic dispersed onto lateral and longitudinal distributors stemming from the axes, and the other is to lead the major axis into the urban area from which traffic is distributed. The former will better meet the situation wherein a low density urbanization spreads throughout a wide expanse of land, and the latter expects the progress of a high density urbanization along the transport axis.

In an attempt to promote the use of the means of public transport, the owning and using of cars are to be discouraged by levying a motor vehicle ownership tax (200 balboas in 1985, to be increased up to 300 balboas by 2000), as well as by imposing taxes on gasoline (20% in 1985, 30% by 2000) and diesel fuel (10% in 1985, 20% by 2000).

Alternatives

Following alternative combinations of whether or not cars use are discourage and the location of transport axes are possible.

SETTING-UP ALTERNATIVE NETWORKS

	No Discouragement	Discouragement of Car Uses
Enhancement of external transport axes	Alternative 1	Alternative 3
Enhancement of central transport axis	Alternative 2	Alternative 4 Alternative 5

Alternative 1: Total road capacity is to be maximized by widening streets as much as practical, and by constructing arterials in the north of the urban area.

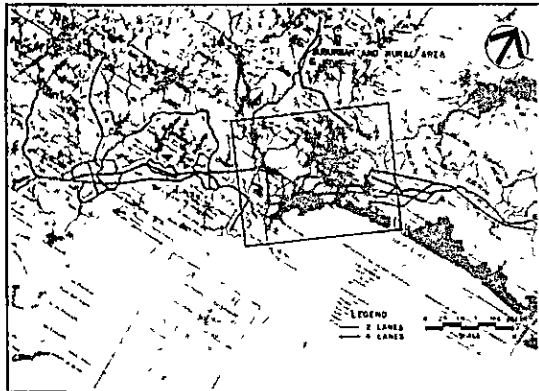
Alternative 2: Introduce an expressway onto Via Simon Bolivar.

Alternative 3: Same as Alternative 1, but smaller road capacity due to reduced quantity of street widening.

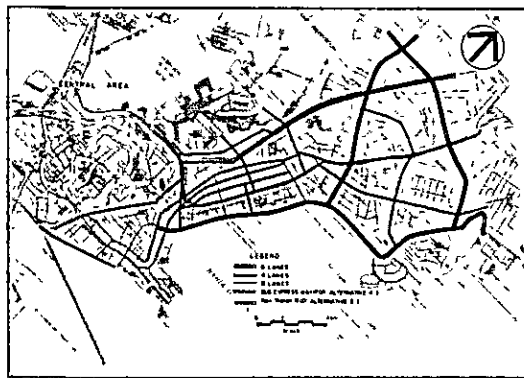
Alternative 4: Same as Alternative 2, but the urban expressway is designated for exclusive use by bus.

Alternative 5: Introduce a rail transit between Albrook Airport and Torrijos Airport via the urban center.

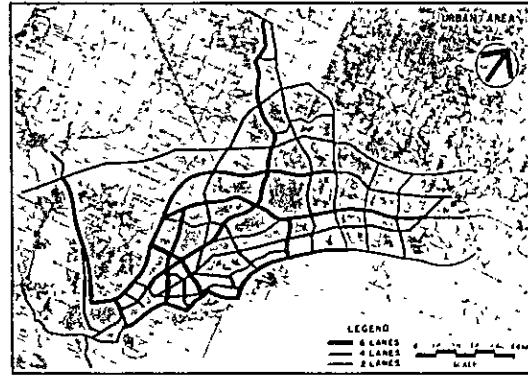
Typical Alternatives 3, 4 and 5 are illustrated on the next page. Alternative 1 shares the same network pattern with Alternative 3, while Alternatives 2 and 4 are identical except for the proposed use of the expressway. All the alternatives (1 through 5) use the same network pattern in Centro/Bella Vista and the suburban/rural area.



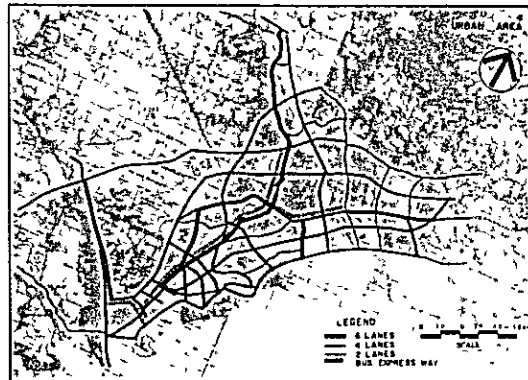
**NETWORK AND TRANSPORTATION
PROJECTS ALTERNATIVE 3, 4 & 5
IN SUBURBAN AND RURAL AREA**



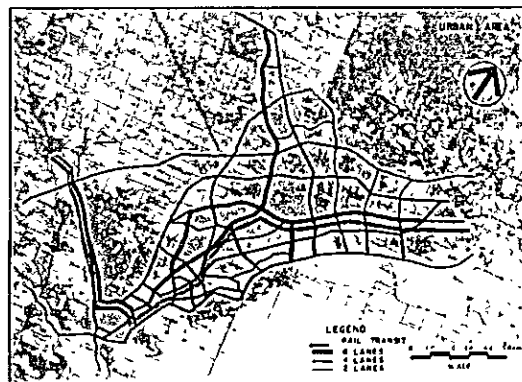
**NETWORK AND TRANSPORTATION
PROJECTS: AND 5 IN URBAN AREA**



**NETWORK AND TRANSPORTATION
PROJECT ALTERNATIVE -
3 IN URBAN AREA**



**NETWORK AND TRANSPORTATION
PROJECTS: ALTERNATIVE
4 IN URBAN AREA**



**NETWORK AND TRANSPORTATION
PROJECTS: ALTERNATIVE
5 IN URBAN AREA**

11. EVALUATION OF ALTERNATIVES

Assigned Traffic

Alternatives have been formulated, which will sustain the present level of service. As a result, the overall congestion ratios* shown by the alternatives ranged from 0.5 to 0.6 in a close proximity to the present 0.5.

Both total travel time (vehicle-hour) and total traffic load (vehicle-kilometer) are 12% to 13% lower under the car-controlled type alternatives (3, 4 and 5) than under the no car-controlled type alternatives (1 and 2), due to the reduction of car trips under control. A particularly favorable result is shown by the alternative for the introduction of a rail transit.

Average travel speed is about 19 kilometers per hour under any alternative, but it is somewhat slower under the no car-controlled and central transport axis type alternative (2).

The total length of congested sections is longer under the car-controlled type alternatives, due to the establishment of bus lanes in the sacrifice of non-exclusive lanes.

Evaluation of Alternative Transport Networks

Alternative transport networks have been evaluated through cost-benefit analysis. As the benefit, savings in motor vehicle operation cost to be realized under each of the alternatives have been quantified. The analysis has shown that all the alternative networks will be feasible inasmuch as the benefit will far exceed the cost in all cases.

The alternatives have been formulated so as that they will assure comparable levels of transport services, and, therefore, little difference is recognized between the benefits to be brought about by the alternatives. Differences in their benefit/cost ratios are chiefly attributable to the diversity of the cost (investment size). Thus, the economy of road widening plans (Alternatives 1 and 3), which would require relatively small investments, is higher than the economy of plans for an elevated expressway or a rail transit system, which would entail substantial investments. A particularly high benefit/cost ratio of 6.16 is shown by the plan for road widening under policy for discouraging passenger car uses (Alternative 3). Between the expressway plan (Alternative 2) and the rail transit plan (Alternative 5), the latter shows a higher economy due to the greater number of estimated passengers.

Selection of the Alternative

The road widening alternative is selected as the base for the formulation of road network masterplan. Prepared in addition will be the introduction of a rail transit system in an anticipation that the transport system centering around motor vehicles will reach its limit sooner or later. The masterplan is to be formulated so as to achieve a high economy through the minimization of costs without compromising on the level of services.

*: Average ratio of traffic volume to road capacity by network link weighted with link length.

RESULT OF TRAFFIC ASSIGNMENT ON ALTERNATIVE NETWORKS

	Present Situation	Do Nothing Case	Alternative Network				
			1	2	3	4	5
Total length of Network (Km)	415	415	568	589	553	553	553
Traffic Load (1000 Veh. Km)	3,651	12,021	10,308	10,335	9,224	9,162	9,112
Total Travel Time (1000 Veh H)	218	2,087	533	577	473	478	478
Average Travel Speed (Km/H)	16.8	5.8	19.3	17.9	19.5	19.2	19.0
Average Congestion Rate (Whole Area)	0.5	1.8	0.6	0.6	0.6	0.6	0.6
Average Congestion Rate (Zone 1~10)			0.7	0.7	0.7	0.8	0.7
Total Length of Congested Section (Km)							
Congestion Rate 1.0 or more	54	249	126	122	137	128	130
Congestion Rate 1.5 or more	21	197	8	9	8	13	9
Traffic Volume on Congested Sections (1000 Veh-Km)							
Congestion Rate 1.0 or more	1,287	10,930	4,405	4,421	4,408	4,164	4,206
Congestion Rate 1.5 or more	702	10,209	1,486	1,785	1,254	1,286	1,307

Source · ESTAMPA

SUMMARY OF ECONOMIC EVALUATION

ALTERNATIVE		COST (MILLION B/.)		NET PRESENT VALUE (MILLION B/.) ²⁾		BENEFIT COST RATIO ²⁾	
Code	Name	Economic Cost	Discounted Economic Cost ³⁾	Incl. SPTC ¹⁾	Excl. SPTC ¹⁾	Incl. SPTC ¹⁾	Excl. SPTC ¹⁾
1	Street Widening Plan without Policy	530.0	156.5	2495.4	517.0	16.95	4.31
2	Expressway Plan without Policy	732.5	251.9	2078.4	437.7	9.25	2.74
3	Street Widening Plan with Policy	446.0	133.4	2464.9	688.0	19.48	6.16
4	Exclusive Bus-Expressway Plan with Policy	664.1	232.7	2298.8	580.7	10.88	3.50
5	Rail Transit Plan with Policy	689.7	262.2 ⁴⁾	2345.7	621.5	12.15	3.95

Note: 1) SPTC : Saving of Passenger Time Cost

2) Calculated under 12% of discount rate.

3) Including road maintenance cost and excluding the residual value in 2000

4) Including railway operating cost

Source · ESTAMPA

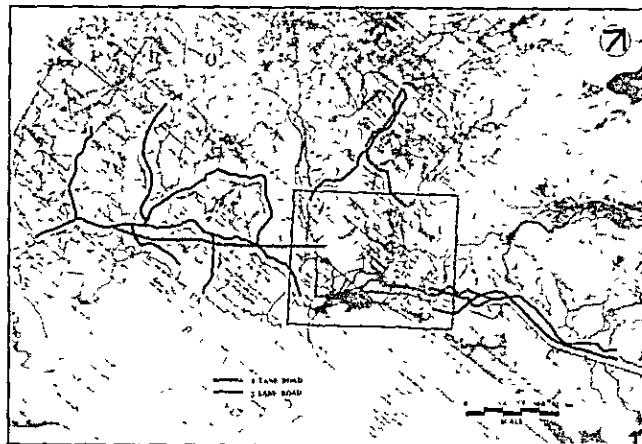
12. TRANSPORTATION NETWORK MASTERPLAN

Masterplan 2000

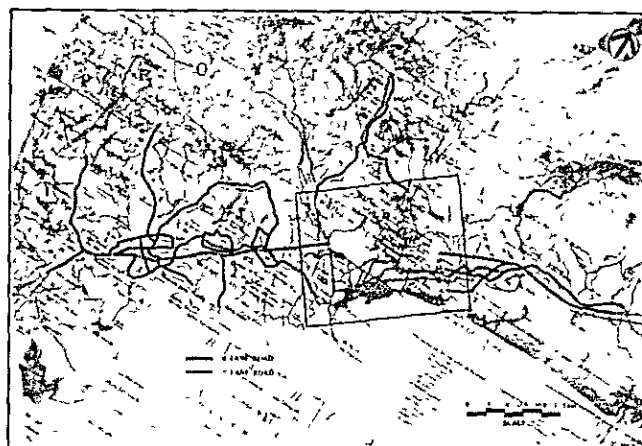
The transport network of Panama Metropolitan Area in 2000 will be, in a wide perspective, an enhanced version of the pattern consisting of Autopista and Pan American Highway as east-west axes and Via Transistmica as north-south axis. The network in Panama Urban Area will conform with the original ladder pattern and will consist of Corredor Norte in the northern part of the Area and Corredor Sur in the southern part of the Area as the major east-west car traffic axes, Via Transistmica and Via Domingo Diaz as the major public transport axes, and a number of other east-west arterials, with a number of arterials running perpendicular to them. A rail transit will be introduced by the year 2000 from Centro to Urb. Cerro Viento chiefly utilizing the right-of-way of the existing road.

Masterplan 1990

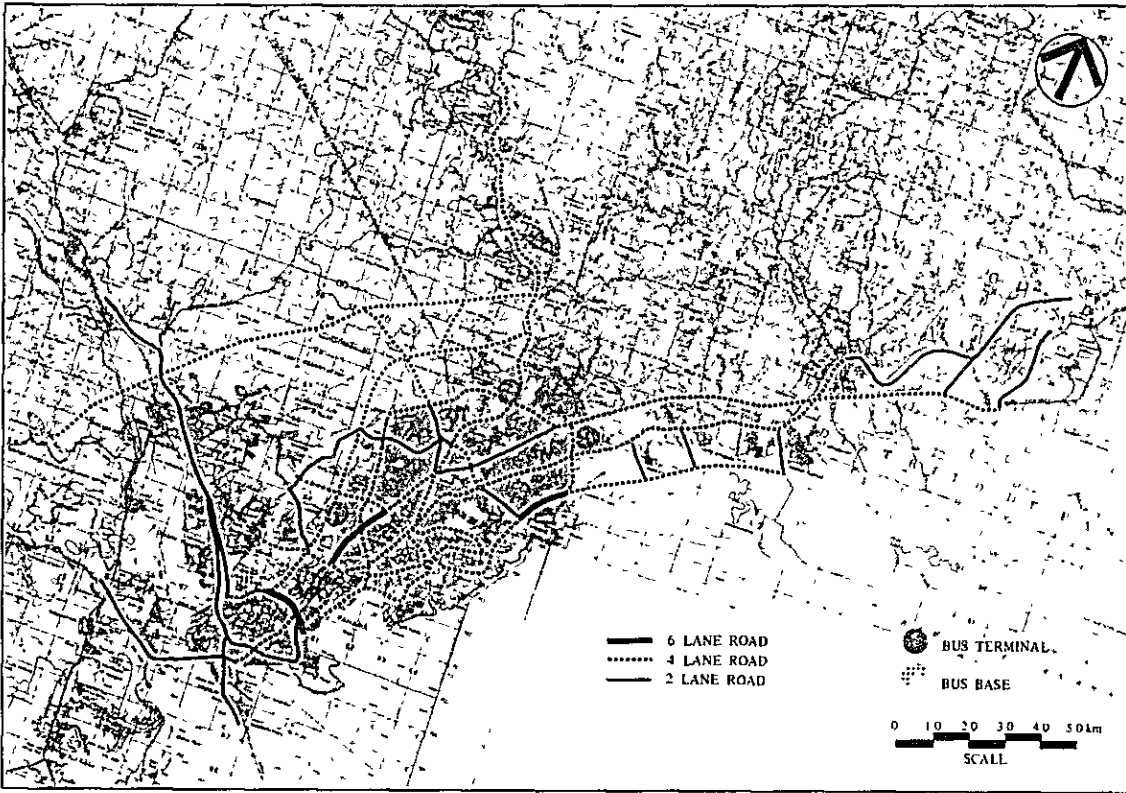
The transport network to be developed by the year 1990 is determined based on urban development requirements chiefly in the reverted area and on the project schedule under government investment frame. Major differences from the existing arterial network will be the extension of Autopista the construction of new Corredor Norte in the reverted area and accompanying road upgrading and new road construction, the installation of Corredor Sur, and the widening of a part of Via Espana and of Via Jose A. Arango. Express bus and mini bus systems will be introduced and four bus centers be established at major locations in Panama Urban Area, and the bus will continue to be the mainstay of public transport.



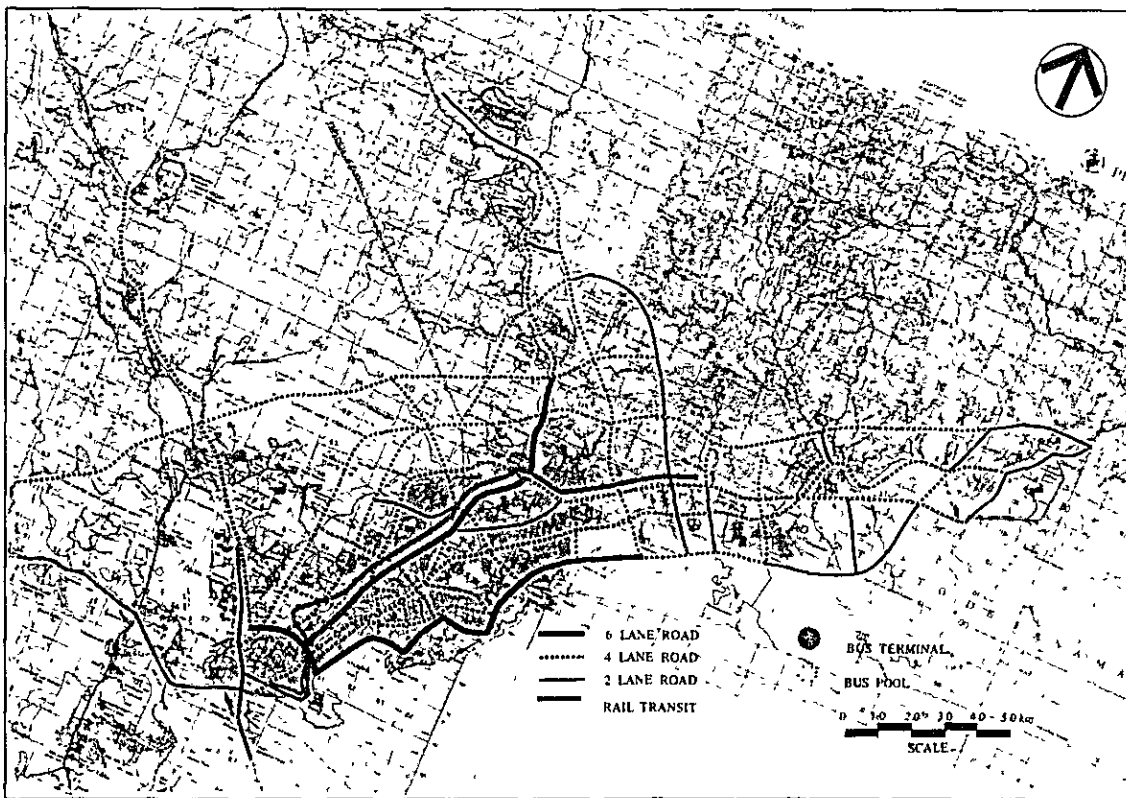
TRANSPORTATION NETWORK MASTERPLAN FOR 1990
(SUBURBAN AND RURAL AREA)



TRANSPORTATION NETWORK MASTERPLAN FOR 2000
(SUBURBAN AND RURAL AREA)



TRANSPORTATION NETWORK MASTERPLAN FOR 1990 (URBAN AREA)



TRANSPORTATION MASTERPLAN OFR 2000 (URBAN AREA)

13. ROAD TRANSPORTATION IMPROVEMENT

Road Transport Demand

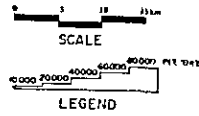
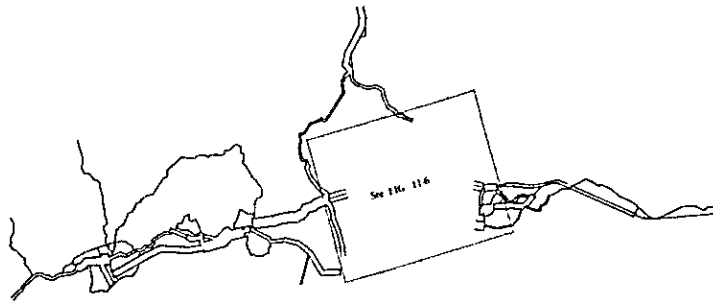
Traffic demand on each road is forecast through the assignment of total demand in the year 2000 to the masterplan 2000. Demand will be heavy on the east-west arterials constituting the skeleton of the ladder pattern: Corredor Norte, San Miguelito West Road, Via Transistmica Domingo Diaz, and Corredor Sur. Demand will also be heavy on north-south arterials which connect these east-west arterials; Via Brasil and Via 11 de Octubre. Those arterials will perform important roles, and the result of traffic assignment proves that the traffic flow pattern will be as initially intended.

Road Transportation Improvement Effect

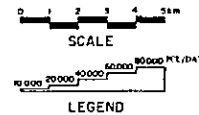
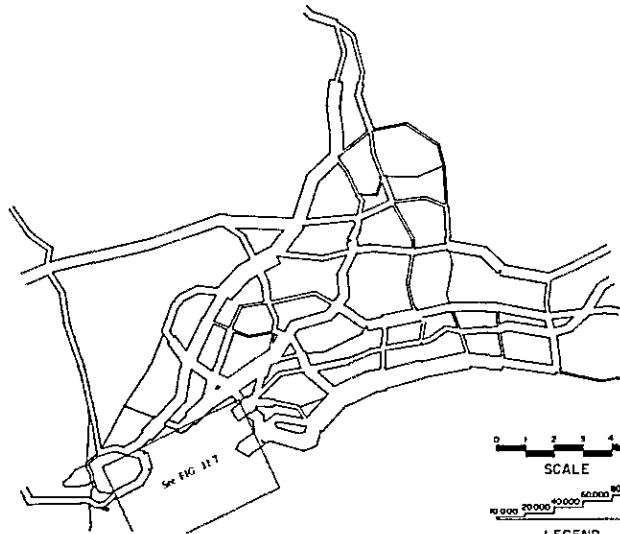
If no additional roads are constructed (do nothing case), future car traffic demand will exceed the road capacity to cause traffic congestions, and the urban functions will be seriously hindered. In contrast, the masterplan 2000 will result in substantial reductions in both total traffic load (in terms of vehicle-kilometers) and total travel time (vehicle-hours). The efficiency of the proposed road network is proven. Also, average travel speed will be 25.6 kilometers per hour – a fair improvement from the present 18.9 kilometers per hour. Average congestion ratio of the assigned traffic to the design capacity will be 0.6 as initially envisaged, and the sections in which congestion ratio will reach or exceed 1.5, critical service level, will be 7 kilometers or only less than 1.5% of the total extension of network road's. Therefore, it can be concluded that the level of service supported by the masterplan 2000 will be quite satisfactory.

RESULT OF TRAFFIC VOLUME ASSIGNMENT ON MASTERPLAN NETWORK

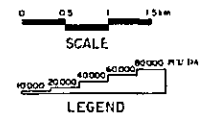
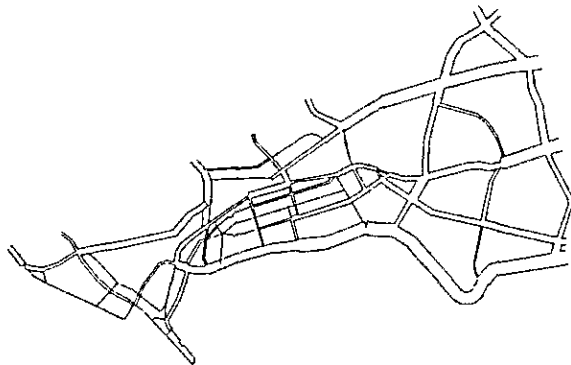
	Do Nothing Case(2000)	Network 2000
Total Length of Network (Km)	324	448
Traffic Load (1000 veh. Km.)	9893	8178
Total Travel Time (1000 veh. h.)	1608	319
Average Travel Speed (Km. h.)	6.2	25.6
Average Congestion Rate (Whole Planning Area)	1.81	0.60
Average Congestion Rate (Zone 01 – 10)	1.40	0.58
Total Length of Congestion Section (Km)		
Congested Rate 1.0 and More	224	79
Congested Rate 1.5 and More	172	7
Traffic Volume on Congested Section (1000 veh. Km.)		
Congested Rate 1.0 and More	8706	2348
Congested Rate 1.5 and More	7801	552



**ASSIGNED TRAFFIC VOLUME, 2000
(SUBURBAN AND RURAL AREA)**



ASSIGNED TRAFFIC VOLUME, 2000 (URBAN AREA)



ASSIGNED TRAFFIC VOLUME, 2000 (CENTRAL AREA)

14. MAJOR ARTERIALS

Pan American Highway

A precondition to the network planning is the completion of this Highway between Arraijan and San Miguelito, as well as its branch line up to Via Ricardo J. Alfaro, by 1985. The section of old Pan American Highway is La Chorrera and Arraijan where urbanization will take place will be widened.

Via Transistmica

The suburban section from Corregimiento de Las Cumbres to the border of the Planning Area will be upgraded to a 4-lane long-distance arterial, and the section which traverses Panama Urban Area will be upgraded to a 6-lane public transport axis.

Corredor Norte

A 4-lane high speed heavy traffic road, Corredor Norte, will be the east-west traffic axis north of Panama Urban Area and a mainstay of the ladder pattern traffic network. Its section in the reverted area will facilitate various development projects and, as such, will become the main axis of development in that area. In San Miguelito District, where no arterial has existed, this Corredor will become the arterial and the foundation for the development of a street network in that Zone. In the eastern part of San Miguelito District and in Juan Diaz - Pedregal, this New Corredor will be the arterial street in the northern part of the urbanizing area and a part of the skeleton in these Zones.

Corredor Sur

Ave. Balboa and Corredor Sur, as the extension of the former, will together form the southern "shaft" of the ladder pattern network along the Bay of Panama and will detour a large volume of traffic around Panama Urban Area center. The section between Centro Zone and Urb. Neuvo Panama will be a 6-lane road, and the eastern section in the central part of Juan Diaz, where population will increase, will be a 4-lane road. Of the section from Urb. Punta Paitilla to Panama Viejo, the widening of the inland route is preferred, for its lower cost and less damage to the scenery.

Via Cerro Ancon

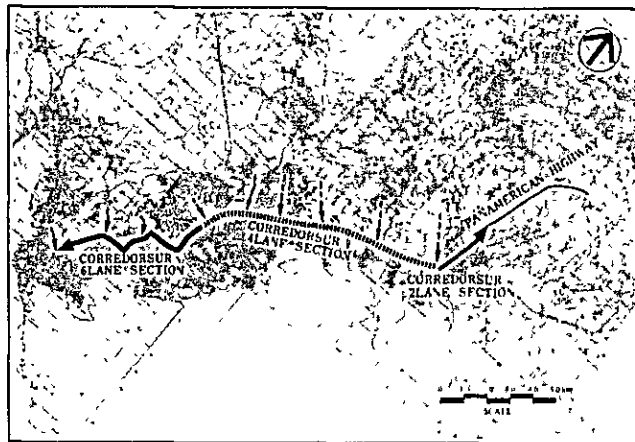
This will be a 6-lane road and will meet the three east-west axis roads (Corredor Norte, Via Transistmica, and Ave Balboa) in the western part of Panama Urban Area, in order to distribute traffic from the three roads onto other arterials. It will be the main street in El Maranon Redevelopment Area and will perform a central role in supporting public transport service.

Ave. A and Ave. B

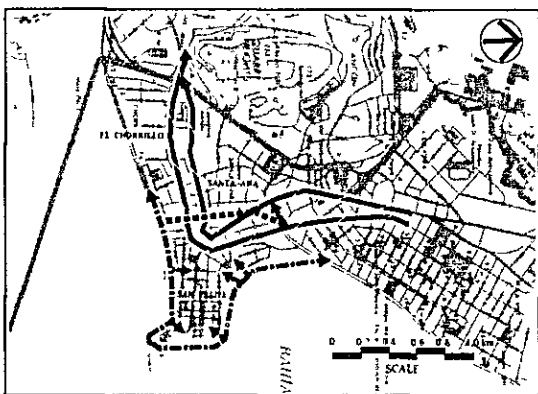
For the introduction of an arterial into Corregimiento de Santa Ana, Corregimiento de El Chorillo, and Corregimiento de San Felipe- the so-called old urban area, to widen Calle 17 and upgrade Ave. Central, Ave. B, Ave. A and Calle B was selected in view of future traffic distribution, the difficulty of constructing a road through the shopping area, and the historical nature of Corregimiento de San Felipe.



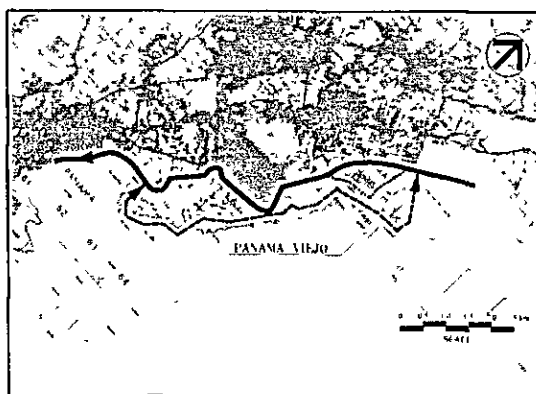
CORREDOR NORTE



LOCATION MAP OF CORREDOR SUR



ALTERNATIVE IDEAS FOR INTRODUCTION OF AN ARTERIAL INTO CORREGIMIENTOS SANTA ANA, EL CHORRILLO AND SAN FELIPE



ALTERNATIVE ROUTES OF CORREDOR SUR

15. ROAD CONSTRUCTION COST

Quantity of Arterials Construction Work

The total extension of new arterials to be constructed or the existing arterials to be upgraded by the year 2000 is estimated at 241 kilometers, and the cost of work, at 354 million balboas. Of this, 323 million balboas or about 90% pertain to Panama Urban Area and its suburbs east of the Canal, and the quantity of work in La Chorrera District and Arraijan District west of the Canal is relatively small.

Major arterial projects will be the construction of a new Corredor Norte with an extension of 21.1 kilometers and costing 53.2 million balboas, the widening of Ave. Balboa and the construction of a new Corredor Sur with a total length of 23.3 kilometers for 53 million balboas, the upgrading of 14.5 kilometers of Via Espana and its extension for 33.4 million balboas, and the widening of 19.5 kilometers of the urban section of Via Transistmica (Via Simon Bolivar) to 6 lanes for 24.6 million balboas.

Standard Road Structure and Corss-Section

Lane width of arterials is to range between 2.75 meters and 3.65 meters, depending on the road function, traffic volume, and width of available right-of-way. The right-of-way of newly established arterials is to be at least 50 meters to provide sufficient room for environmental protection and installation of traffic safety and other facilities. The arterials are to be given a concrete pavement which will bear the running load of heavy vehicles.

While the installation standards of sidewalks, roadside trees and shrubs, traffic management, draining, and other facilities for arterials in rural areas are to conform with the present condition, Much improved standards are to be used for other arterials, particularly for those in Panama Urban Area and areas expected to be urbanized.

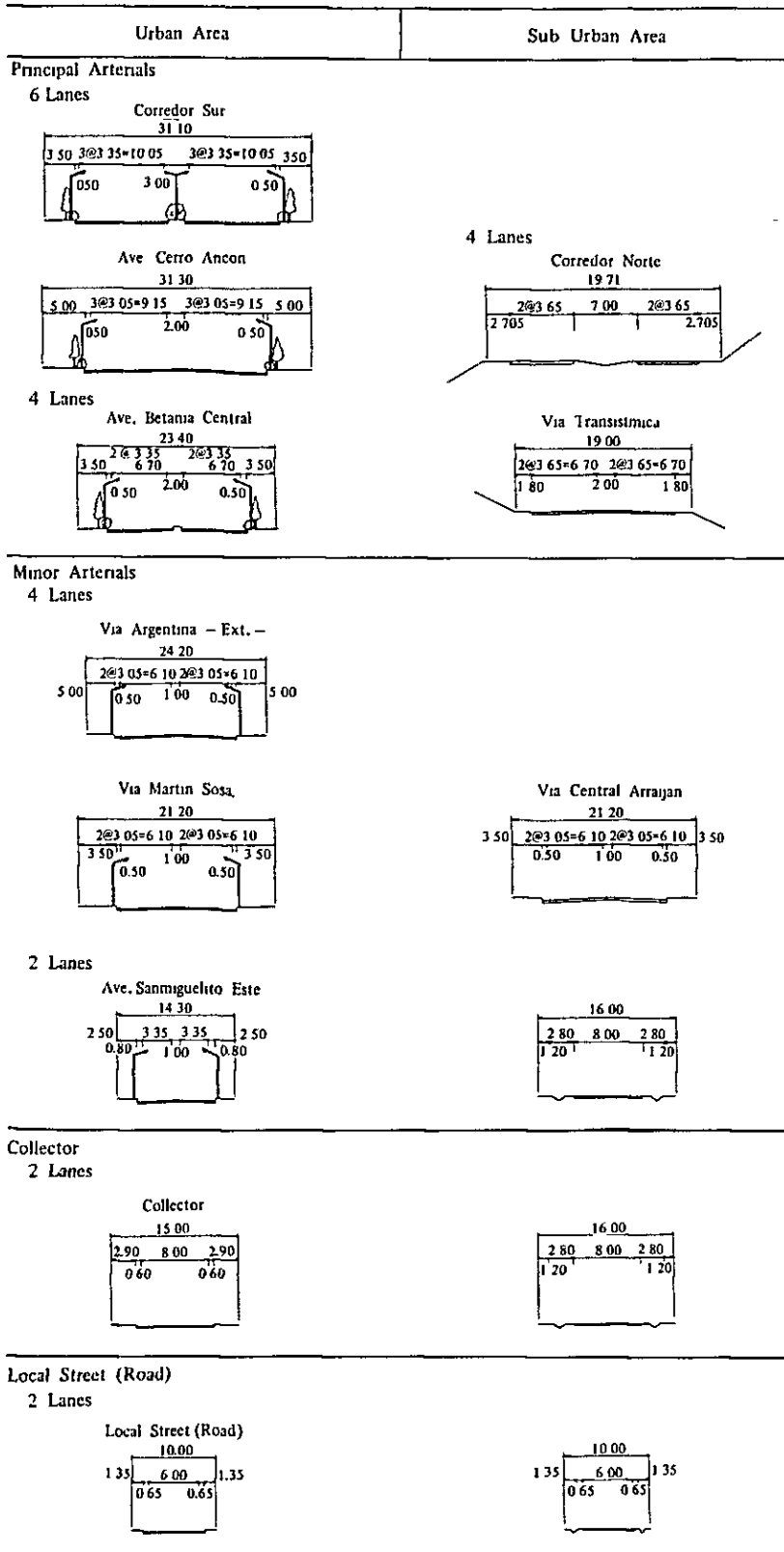
Road Construction Cost Calculation

For quantity survey purposes, unit construction costs are expressed in 1981 prices.

Road construction costs are calculated for diverse types of road cross-sections as determined based on the area and the nature of route and for various combinations of different types of sidewalks, shoulders, lanes, and center medians, with the addition of separately calculated costs of overlay, bridges, viaducts, and culverts. The cost of land, compensations for demolished buildings, and expenses for the relocation of electric poles and other public facilities are also calculated.

TOTAL LENGTH AND CONSTRUCTION COST OF RAODS

	Length (Km)	Construction Cost (Million B/.)
New Construction (Total)	133.2	171.2
6-lane	1.6	7.5
4-lane	62.2	123.7
2-lane	69.4	40.0
Widening and Up-gradings (Total)	108.0	124.3
2-lane to 6-lane	0.6	3.8
2-lane to 4-lane	81.2	80.9
4-lane to 6-lane	22.4	34.7
Up-graing	3.8	4.9
Grade Separation of Intersection	21 points	58.7
Grand Total	241.2	354.2



STANDARD ROAD CROSS SECTIONS

16. TRAFFIC MANAGEMENT PLAN

Basic Planning Policy

Excepting those which involve large facilities, traffic management improvement plans can be carried out with relatively small investments. Also, trials and experimentations are possible of traffic management, providing opportunities for alterations based on monitored changes in traffic flow. Traffic management system should be updated yearly in response to the most recent changes. Therefore, the main theme of traffic management plans is to solve short period problems.

The area subject to this planning will be Panama Urban Area, where a multitude of traffic problems are currently present and will occur in the future. Particularly, a comprehensive mixture of various measures will be taken for areas along Via Espana and in Centro.

Improvement of Signal Control

Signal control is the key to smooth traffic flow and determines the volume of traffic on urban streets. Existing signals will be improved and new signals installed at problem intersections identified through the present status analysis, that is, signaled intersections which are traffic bottlenecks, intersections without signal where diverging and emerging traffic is large, and intersections without signal where the frequency of traffic accidents is high:

Most of signals to be installed will be traffic-actuated type which selects the best combination of control patterns in response to traffic flow. Pre-timed signals will also be installed where deemed acceptable. Coordinated control with traffic-actuated signals will be introduced on roads with a high density of intersections: namely, 3.1 kilometers of Via Espana and other three arterials.

Intersection Improvement

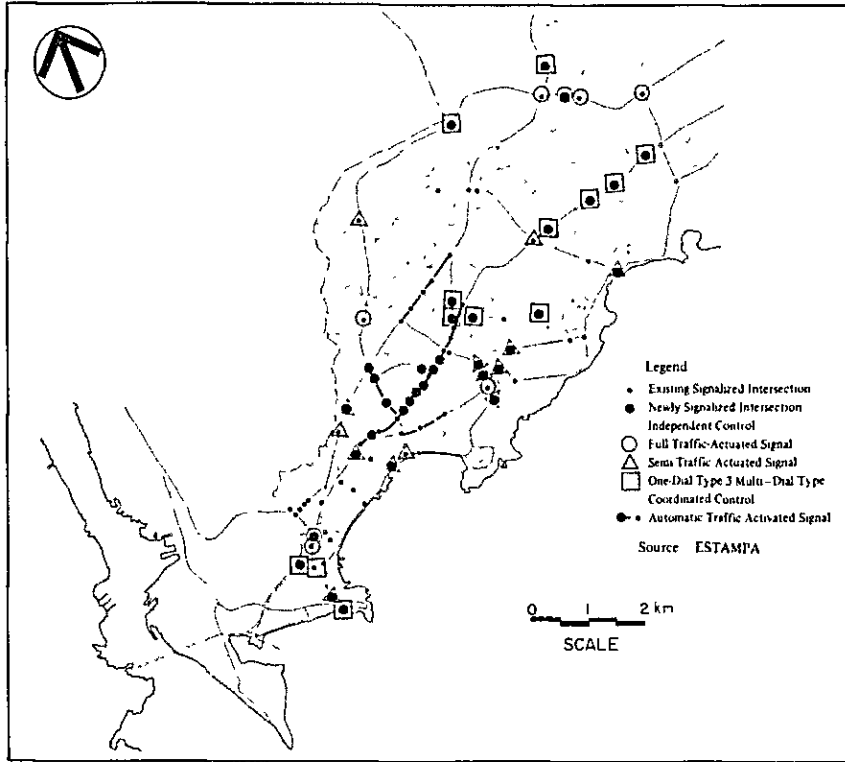
For the improvement of bottleneck intersections, traffic volume will be measured, signal phases improved in accordance with congestion ratio, additional lanes created, and grade separation accomplished. In order to remedy intersections where traffic accidents are frequent, training islands will be installed, corners corrected, road makings accomplished, and traffic channellization effected.

Traffic Safety Facilities Augmentation

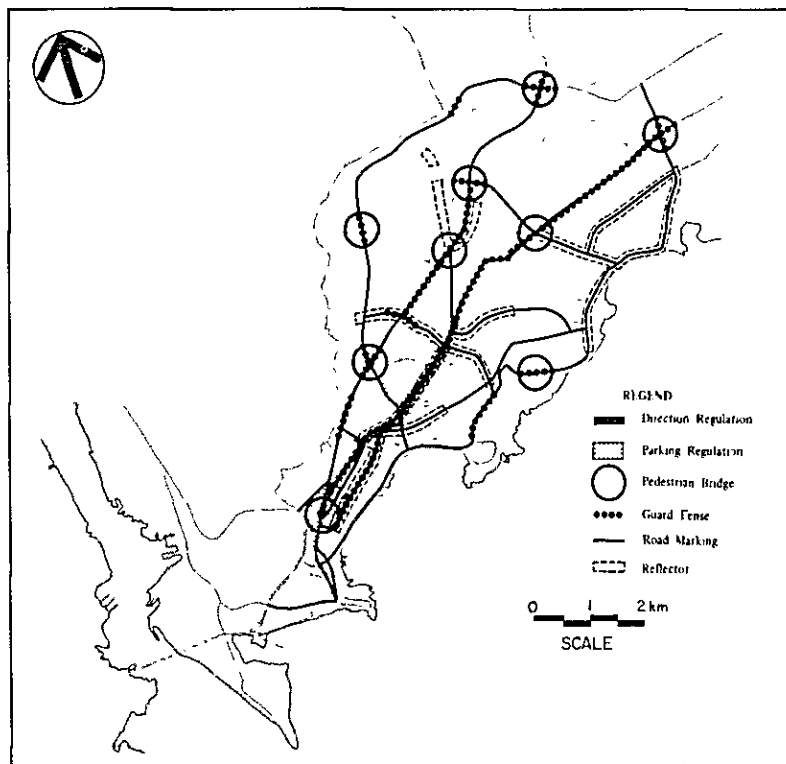
Essential to traffic safety are facilities for the protection of pedestrians and vehicle drivers, which, at the same time, help traffic flow smoothly. In the vicinity of public buildings and bus stops, where people and vehicles come and go in confusion, pedestrian bridges will be constructed and guard fences installed. As for facilities for appropriately guiding traffic, road markings will be effected and reflectors installed.

Strengthening of Traffic Regulations

Parking will be prohibited in Centro and Urb. Obarrio, where traffic congestion is heavy and curb-parking is presently indulged in. For Via Espana, where traffic blocking by left-turning vehicles is frequent, controls will be exercised on left-turns. In Corregimiento de Calidonia and Urb. Obarrio, where streets present a grid pattern and where traffic is heavy, one-way streets will be designated in order to expand the street network capacity, with accompanying measures to provide detours and to prohibit curb-parking on roads connecting to it.



TRAFFIC CONTROL SIGNAL PLAN



TRAFFIC SAFETY FACILITY PLAN

17. PUBLIC TRANSPORT SYSTEM: PROBLEMS AND SOLUTIONS

Current Problems

Problems to users are the short supply of transport capacity in peak hours, unreliability of service in low demand hours, and the existence of low service areas. Bus operators' problem is the superannuation of buses due to low profitability and to their low desire for bus renewal. A number of factors are behind these problems. The lack of adequate supply/service in peak and low-demand hours is caused by the excessive length of routes, the concentration of routes along arterials, and the lack of ability to perform appropriate route assignment/allocation of buses. The local shortage of transport capacity is attributable to, in addition to the uneven concentration of routes along arterials, the fact that routes are established only to offer shuttle service between Centro and suburban residential areas. The low profitability stems from long routes, uneven distribution of buses to routes, and high bus maintenance costs.

More fundamentally, however, problems are the predominance of rental buses in this industry, the lack of a bus operation management system under government-private cooperation and the lack of a system for the pricing and indexing of bus fares.

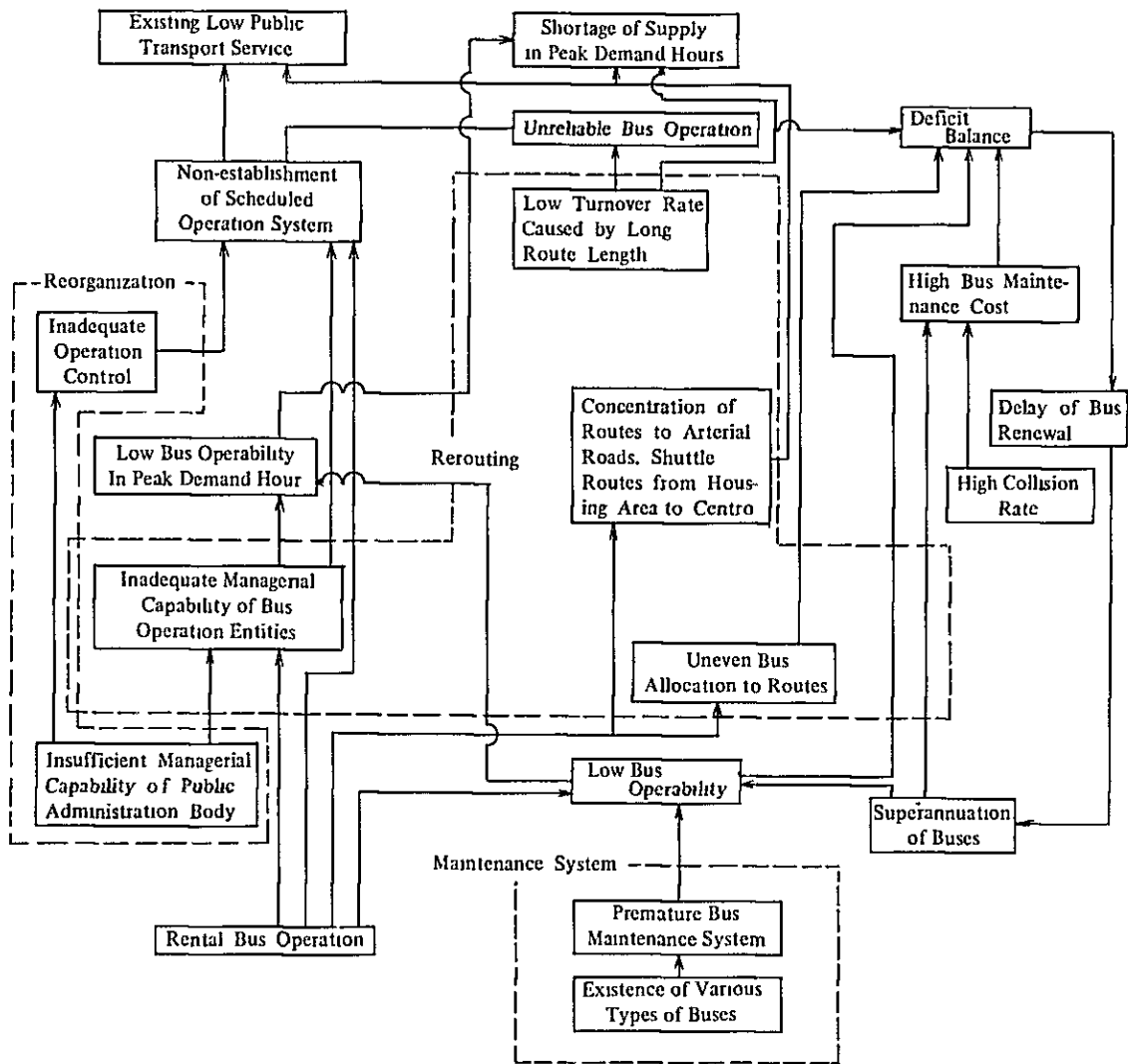
Approach to Solution

To solve the above problems two different approaches are possible: (1) Reorganization of both the supervisory authorities and public bus industry into modern entities of modern systems, so that they will effectively achieve bus operation management, bus rerouting, and development of bus maintenance system, or (2) the formulation of a bus rerouting scheme with accompanying improvements to the extent necessary of the bus maintenance system, the establishment of new, or the improvement of the existing, bus operation entities, and the enhancement of the bus operation management system.

The latter approach is adopted, not only for its urgency and practicality, but also under the realization that the overall bus route network must be reorganized as soon as possible to match the scale of Panama Metropolitan Area, which is now too large to be satisfactorily served only by the shuttle services between Centro and suburban residential areas.

Scope of Measures

Measures to solve the above problems will cover a period of up to 1990 and will cover the area east of the Canal with the exclusion of the area serviced by SACA, or, namely, Centro (I), Bella Vista (II), Area Residencial (III), Juan Diaz-Pedregal (VI), Tocumen (V), San Miguelito (VI), and Las Cumbres-Chilibre (VII).



CAUSE-EFFECT DIAGRAM OF THE CURRENT PROBLEMS

18. FUTURE TREND OF PUBLIC TRANSPORT SYSTEM

Public Transport Network – Development Stages

The first stage in the development of a public transport system is when there is only one urban center and all traffic converges to the center. In the second stage, more than one urban center exist and all traffic moves directly to and from each of the centers, presently a complex pattern of pathways. Fortunately in Panama City, the old urban center was located on the western edge of the City and the new urban center was developed on the arterial lying between the old center and the major residential area, thereby making the pattern simpler than usual.

The complex pattern of public transport routes in the second stage, wherein all routes are of same characteristics, are usually simplified chiefly for the convenience of public transport service suppliers: the route serving each residential area is now connected to the closest of the urban centers and routes are separately established to serve between the centers, with a clear distinction between the former routes and the latter.

Urban growth results in greater demands on each route (in Panama City, 1.6 times greater by 1990 and 2.1 times greater by 2000), particularly on inter-urban center routes. When limits are foreseen to the expansion of bus transport capacities due, for instance, to road or bus stop facilities, the introduction of a new inter-urban center transport system with a greater capacity would usually be considered. By this time, extend urban limits may have resulted in excessively long bus routes, making it no longer practical for buses to serve a residential area to the closest urban center transportation. This situation is recognized as the fourth stage.

The current situation in Panama City is close to the end of the second stage, and it will eventually evolve into the third stage if left alone. However, in view of the fact that major bus operating entities in Panama City are groups of individuals with inadequate planning and execution capabilities, it is believed essential that appropriate government actions be taken to facilitate smooth and accelerated transition to the third stage. Otherwise, confusion, overall diseconomy, and user inconveniences can result from delayed transition.

Increase of Bus Trip

The number of trips by bus is predicted to reach about 600,000 trips a day in 1990, or about 1.6 times the present level.

Bus trips are presently concentrated, and will continue to be concentrated in the future, most heavily in Centro (I), followed by Area Residencial (III) and Bella Vista (II). Because the areal size of Area Residencial is large, the concentration density is and will be high in Centro and Bella Vista. The absorption of bus trips by Centro is currently 2.4 times that of Bella Vista, but it will subside to 1.7 times by 1990.

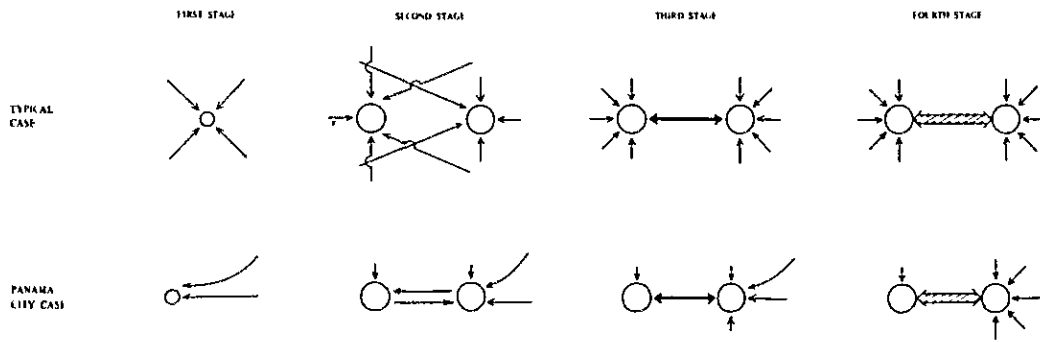
A daily bus traffic of at least 15,000 person-trips (excluding intrazonal trips) was observed in 1981 between the following six O-D (Integrated Zone) pairs : Centro to and from Area Residencial, Centro to and from San Miguelito, and San Miguelito to and from Area Residencial. In 1990, such level of bus trip flow is predicted to occur between all pairs to be formed by Centro, Bella Vista, Area Residencial, Juan Diaz-Pedregal, and San Miguelito, with the exception of Juan Diaz-Pedregal to and from San Miguelito and from Bella Vista to Juan Diaz-Pedregal, in view of the fact that the total number of bus trips is predicted to swell by 1.6 times by 1990, however the corresponding level of bus trip flow of 24,000 per day (1.6 times 15,000 per day) will be limited to Centro to and from Area Residencial, Centro to and from San Miguelito, and Area Residencial to and from San Miguelito.

Public Transport Planning Year

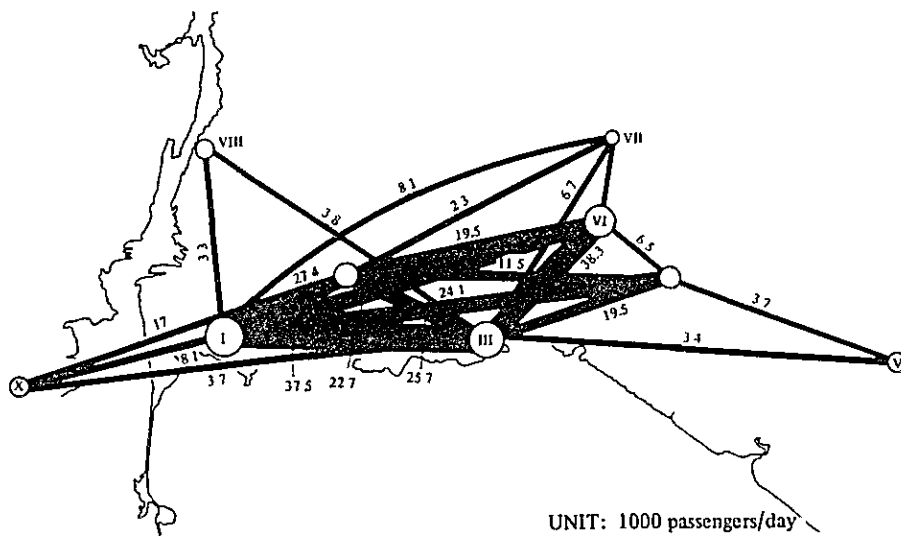
Bus industry—the representative means of public transport in Panama—is noted of its low profitability and its superannuated means of production (buses), as previously pointed out, while the bus industry presents predominantly pre-modern characteristic. These facts only point to a danger of demand-supply imbalance in a near future as demand will expand and supply capacity will remain stagnant, unless the modernization of the bus transport system is commenced immediately.

A review of bus transportation demand forecast shows that from 1990 to the year 2000, the demand will change quantitatively but will remain unchanged qualitatively, that is, in terms of trip O-D pattern. In view of this, the plan for 1990 is to be understood as a mid point on the way to the plan for 2000.

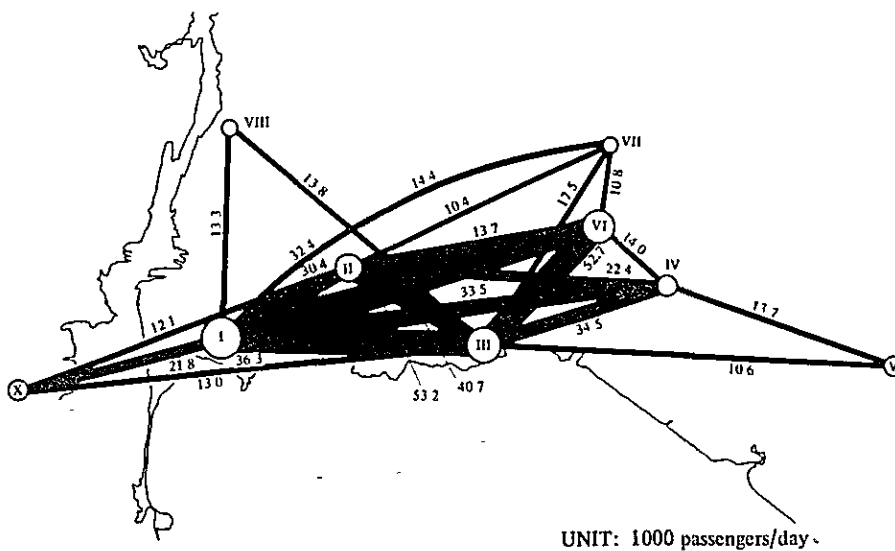
In consideration of the plan's urgency and the assurance of its continuity into the future, 1990 is set as the plan's target year, while it is confirmed that the plan will play appropriate roles in the long range perspective up to the year 2000.



DEVELOPMENT STAGES OF PUBLIC TRANSPORT NETWORK



DESIRE LINE OF BUS PASSENGERS, 1981



DESIRE LINE OF BUS PASSENGERS, 1990

19. PROPOSED BUS NETWORK

Existing Network

Existing bus routes can be conceived of as providing shuttle services between suburban residential areas and Casco Viejo joining through 5 de Mayo. Bus routes originating in residential areas converge at the edge of Panama Urban Area, while, in Bella Vista, most of the routes are concentrated on either Via Transistmica or Via Espana. These routes all terminate in Casco Viejo. In Casco Viejo, some turn around on Calle 12, and some turn around in El Chorrillo – the number of routes reaches the maximum in the vicinity of Plaza 5 de Mayo, or the entrance to Casco Viejo.

The number of bus passengers is generally smaller in suburban areas and larger in urban areas, but reaches the maximum between Area Residencial and Bella Vista, after which it reduces slightly toward Centro. In Centro, bus trip-ends are concentrated in Corregimiento de Calidonia and Corregimiento de Santa Ana, while the number of bus passengers is small in Corregimiento de El Chorrillo and Corregimiento de San Felipe.

Current Problems

Demand and supply are not well balanced with each other on the existing routes, inasmuch as transport demand reaches the maximum in the middle of the routes, while closer to the urban center the bus service is greater.

For this reason, the average bus congestion ratio is supposed to decrease from Bella Vista to Plaza 5 de Mayo and be even lower in Casco Viejo. On the other hand, road traffic congestion in the vicinity of Plaza 5 de Mayo is so serious as to constitute one of the traffic problems facing Panama City. The problem is partly attributable to the operation of buses in excess of demand.

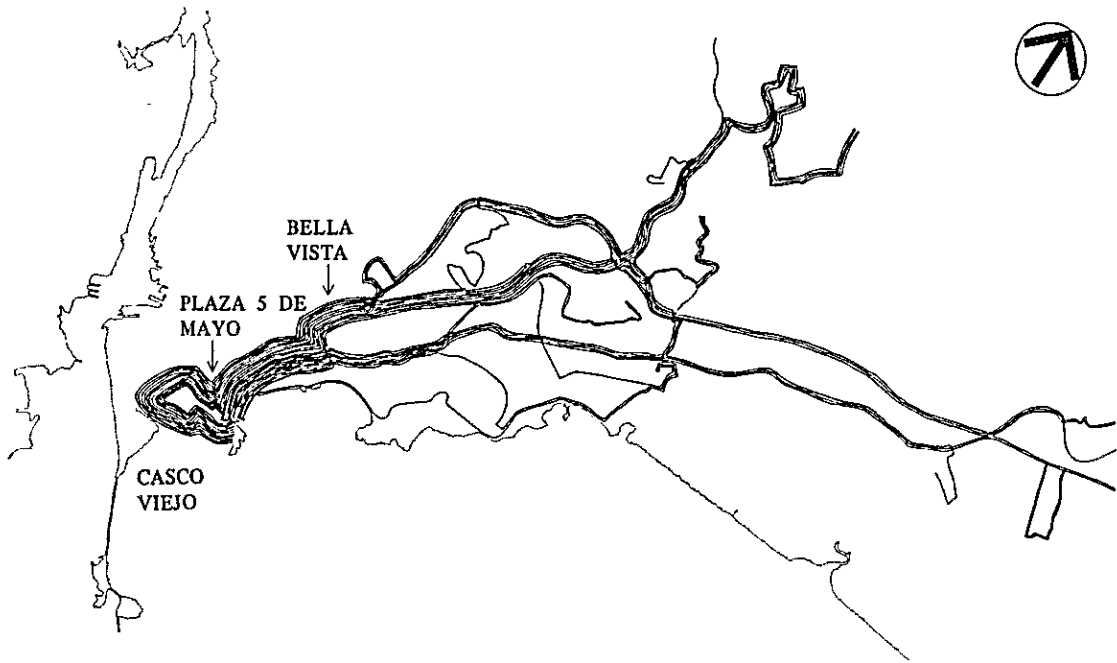
The location of residential areas in remote sites have caused the lengthening of bus routes, operation cost increases, deterioration of bus turnover ratio, and the impairment of bus operation flexibilities in peak hours.

The poorer transport service in the north-south direction than in the east-west direction is being left alone without efforts for improvement.

Recommended Network

A bus route network which will (1) provide express service connecting Juan Diaz-Pedregal, San Miguelito, and San Isidro (San Miguelito) with the old and new urban centers, (2) offer long-distance bus service from Tocumen and from Alcalde Diaz only up to Urb. Chanis and San Miguelito Intersection, discontinuing service beyond these, (3) introduce mini bus service route, starting from El Maranon, into Casco Viejo, (4) offer city bus service on circular routes in Corregimiento Calidonia, Bella Vista, and Area Residencial, (5) provide suburban connection between San Isidro and Urb. Chanis, and (6) offer medium/short distance city bus service on a total of 11 routes including those to be established in areas currently wanting bus service, so that bus service in the north-south direction will be enhanced.

Long-distance routes will be cut shorter, and routes will be connected with each other at terminals, and, as a natural consequence, an estimated 55% of the total 620,000 passengers per day will make at least one transfer. To minimize or compensate for passenger inconvenience in making transfers, an improved zone fare system and improved or newly installed transfer facilities should be established.



EXISTING BUS NET WORK



RECOMMENDED FUTURE BUS NETWORK, 1990

20. BUS TERMINAL

NECESSITY OF Bus Centers

Bus rerouting will result in increased passenger transfers, as previously pointed out. In order to minimize the disadvantages of increased transfers—such as double fare paying, the trouble of transferring, longer waiting time per trip, and difficulty of determining routes and transfer points to an unfamiliar destination—bus centers with adequate facilities for passenger convenience must be established as common transfer points to which bus routes in the vicinity will converge. Such bus centers will provide passengers with the convenience of easy route selection and the safe embarkation/debarkation, and provide bus operators with the opportunity to offer new services such as express buses by gathering passengers at central points.

The Need of a Bus Pool

A sample survey of SICOTRAC bus owners revealed that the average annual cost of bus maintenance was 5,352 balboas. This amounts to 16.8 centavos per each kilometers of bus operation, which is very high as judged from common sense. On the other hand, a sample survey of SICOTRAC drivers revealed that “the mechanical troubles of the bus” was by far the greatest reason (66%) why the drivers did not work, followed by “due to the contract” which accounted for only 18%. The fact that the bus industry is suffering from a high break-down rate even though a very high maintenance cost is being spent, as thus revealed, only proves the need for the introduction of a modern bus repair and maintenance system.

In addition, a bus parking space is needed in the central part of the City in order to facilitate flexible adjustment of bus service frequency in accordance with demand varying from peak hours to off-peak hours.

Thus, the bus pool is conceived of as that which will meet these two requirements. The former Albrook Airfield in the reverted land is planned for the site of this bus pool.

Bus Center Locations

The recommended bus route network will require the following four Centers: El Maranon, Curudu Norte, San Miguelito Intersection, and Chanis. They are expected to accommodate in 1990 for the daily numbers of buses of 11,000, 4,700, 4,500 and 5,300, respectively. As reflected by the number of buses that will utilize it, El Maranon Center will play the central function in the recommended route network.

Cost and Profitability

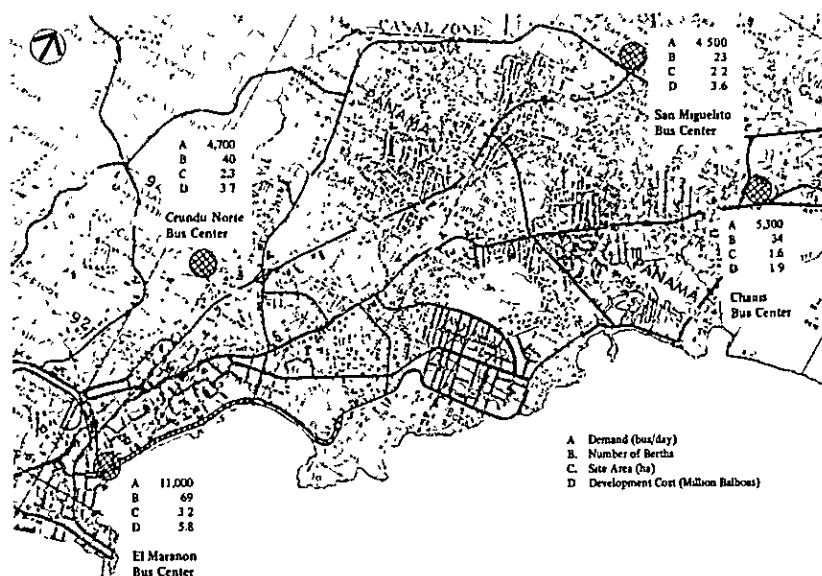
The construction cost of El Maranon Bus Center is estimated at 5.8 million balboas, that of Curundu Norte, 3.7 million balboas, that of San Miguelito Intersection Center, 3.6 million balboas (including 0.6 million balboas of land cost), and that of Urb. Chanis Center, 1.9 million balboas (including 0.2 million balboas of land cost), for a total of 15.0 million balboas.

Estimating Bus Center construction cost at the equity capital ratio of 10% and the interest rate of 12% (or for short term loans, 15%) per annum and assuming a terminal charge of 50 centavos per use (with a 50% to 75% discount for mini buses and circulating buses which will utilize the center frequently), the four centers, as a whole, will be financially feasible with a cumulative net profit in the 19th years from inception. Particularly profitable will be Chanis Center, while El Maranon and San Miguelito Bus Centers will about break even and Curundu Norte Bus Centers will incur a net loss.

Recommendations

The opening of the bus terminals will give a strong impetus to bus rerouting and the improvement of bus service. In view that the four terminals will function organically, it will be desirable that the four will be constructed about the same time in the latter half of the 1980s. The four must be operated by one organization because of their profitability disparity. Although financially feasible, the overall profitability is not so good, and it will be appropriate to have a government or semi-government natured organization operate the terminals.

It is possible that a new urban core be formed around a bus terminal to which a large number of bus trips converge. Therefore, it will be necessary that not only transport plans be formulated for the terminal but also an urban development plans be formulated for the area around the terminal.



RECOMMENDED LOCATION OF BUS CENTERS

COST ESTIMATES OF BUS CENTERS

	El Marañon		Crundu Norte		San Miguelito		Chanis	
	Quantity (m ²)	Cost (1000 B./.)	Quantity (m ²)	Cost (1000 B./.)	Quantity (m ²)	Cost (1000 B./.)	Quantity (m ²)	Cost (1000 B./.)
1. Berths, Corridor for Bus	22,600	1,136	14,600 ²⁾	990	12,600	490	10,800	590
2. Concourse, Platform	10,100	402	5,500	90	2,600	50	5,600	90
3. Pedestrian Deck, Stair	11,400	2,900	—	—	1,740	440	—	—
4. Office, Other Facilities	—	270	—	200	—	1,020 ³⁾	—	240
5. Access Road ¹⁾	—	—	1,600m	1,700	—	—	700m	440
6. Taxi Pool ¹⁾	—	—	—	—	1,100	50	—	—
7. Bus Bay ¹⁾	—	—	—	—	1,500	120	—	—
8. Contingency	—	470	—	300	—	220	—	140
9. Engineering Cost	—	620	—	420	—	290	—	180
10. Land Acquisition Cost	—	—	—	—	17,800	920	7,300	220
Total	—	5,800	—	3,700	—	3,600	—	1,900

Note: 1) Auxiliary facilities outside the Bus Centers.

2) Including drainage facilities

3) Including commercial buildings and facilities.

Source: ESTAMPA

FINANCIAL EVALUATION OF BUS CENTER PROJECTS

Bus Center	B/C	NPV (Million/B)	IRR (%)
El Marañon Center	1.26	1.28	14.7
Crundu Norte Bus Center	0.54	-1.39	6.1
San Miguelito Center	0.89	-0.34	10.7
Chanis Center	3.49	3.77	31.8
Bus Centers as a whole	1.27	3.27	14.7

Note. B/C and NPV are calculated under 12% of discount rate.

21. IMPLEMENTATION SCHEDULE

1985

At the time the temporary El Maranon Bus Center is opened, express bus service between Juan Diaz-Pedregal and El Maranon will be started, together with city bus service on circular routes along Ave. Central Via Simon Bolivar, Via Transistmica, Via Espana, and Justo Arosemena. An Express Bus Service Body and a Circular Bus Service Body will be organized for the operation of these services, because they will not compete with the existing services. The parking space of Albrook Bus Pool will be opened for us.

1986

Upon the completion of the upgrading of Via Simon Bolivar and grade separation of San Miguelito Intersection, the San Miguelito Bus Center and the Curundu Norte Bus Center will be opened for service with concurrent start of bus operation on Curundu Norte Bus Center – San Miguelito route, Curundu Norte Bus Center – Juan Diaz-Pedregal route, and Alcalde Diaz – San Miguelito route. As in the case of new routes opened in 1985, buses will be operated with operation diagram by newly organized Body (as well as all subsequently opened routes).

1987

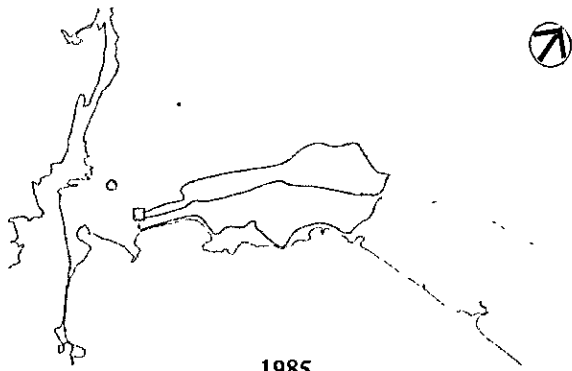
The relocation (to the temporary El Maranon Bus Center) of SACA's terminal will be necessary for sidening Via Cerro Ancon. The Urb. Chanis Bus Center is scheduled to be opened at the same time the widening of Via Jose A. Arrango is completed. The following routes will be opened at that time. San Miguelito Bus Center – El Maranon Bus Center, Tocumen – Urb. Chanis Bus Center, Urb. Chanis Bus Center – Curundu Norte Bus Center – Albrook Bus Base – El Maranon Bus Center.

1988

Corredor Norte will be opened for service, and the San Isidro – El Maranon Bus Center express route and the San Isidro – Curundu Norte Bus Center express route will be opened along the Corredor Norte. Upon the completion of the upgrading of Maranon Bus Center into a permanent facility, an overall route reorganization will be accomplished, including mini bus service in Casco Viejo. Meantime, SICOTRAC will be made the umbrella organization of individual route associations. Also at an appropriate time, fare zones will be made smaller and a new fare system will be introduced to minimize double- or over-charging that can otherwise result from transfers.



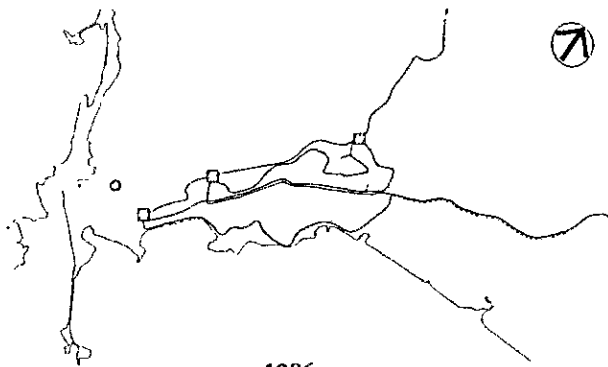
CURRENT BUS SERVICE ALONG AVE. CENTRAL



1985

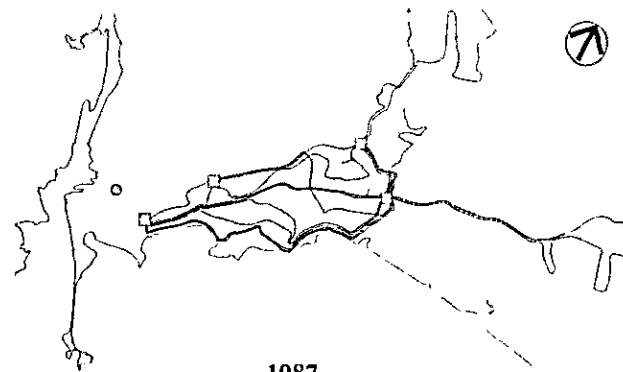
Major Events

- o Preliminary use of El Marañon Bus Center will start
- o The use of a part of Albrook Bus Pool will start
- o Juan Diaz – El Marañon express bus service will be opened for service
- o A circulating bus service will be started on Ave. Central –Via Simon Bolivar – Via Espana – Ave Justo Arosemena route



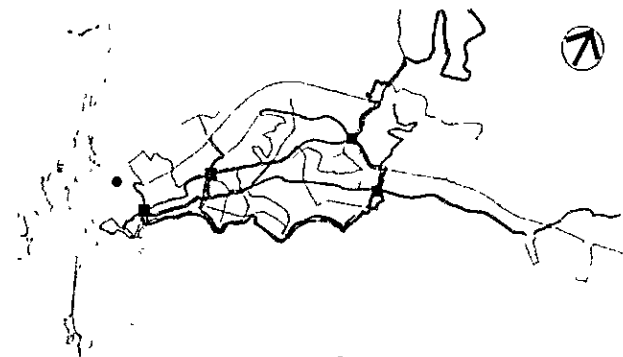
1986

- o Curundu Norte Bus Center will be opened for service
- o San Miguelito Bus Center will be opened for service
- o SACA Terminal will be relocated to El Marañon Bus Center
- o Juan Diaz – Curundu Norte Bus Center route will be opened for service
- o San Miguelito Bus Center – Curundu Norte Bus Center route will be opened for service
- o Alcalde Diaz – San Miguelito Bus Center route will be opened for service



1987

- o Albrook Bus Pool will be fully opened
- o Urb. Chanis Bus Center will be opened for service
- o San Miguelito Bus Center – El Marañon Bus Center route will be opened for service
- o San Miguelito – El Marañon Bus Center route will be opened for service
- o Tocumen – Chanis Bus Center route will be opened for service
- o Chanis Bus Center – Curundu Norte Bus Center route and Albrook Bus Pool – Marañon Bus Center route will be opened for service



After 1988

- o El Marañon Bus Center will be opened for service
- o All the recommended routes will be in service

22. RAIL SYSTEM

Theme of Analysis

As it will be nearly impossible to dramatically enlarge street network capacity in Panama Urban Area, a future transport planning task will necessarily be to improve the street utilization efficiency. However, the conversion of a large quantity of car trips to bus trips cannot be expected, and bus transport capacity will not be without limits. Then, Panama City urban transport will sooner or later reach a stage where the introduction of a rail transit as the means of rapid mass conveyance is imperative.

The present fare-bearing ability of Panama citizens is still inadequate to bear the huge financial investment which will be inevitable for the construction of a rail transit. Therefore, the only meaningful analysis at this time is that which will determine the time when, and the conditions under which, the introduction of a rail transit system becomes feasible and will be identify actions that should be taken now in preparation therefore

Rail Systems and Routes

Criterion for the transport capacity of the rail transit to be introduced is set at about one-half of the bus passengers flowing east-west, or 250,000 to 350,000. This criterion exceeds the capacities of street cars trolley buses. Subways are desirable from the standpoint of functional capabilities, but are prohibitively expensive. Then, only candidates are elevated conventional railroad and monorail.

The introduction of a rail transit will have to presuppose the utilization of road right-of-way, because the acquisition of exclusive railroad right-of-way will be almost impossible in urban areas. If a route from Centro to the entrance of Urb. Cerro Viento, San Miguelito Intersection is considered, promising routes will be the right-of-way of Via Espana and Via Transistmica. Judging from the road width and alignment conditions, the former is believed suitable to monorail and the latter, to elevated railroad. Their extensions are 11.6 kilometers and 10.1 kilometers, respectively, and the total construction cost is estimated at 300 to 310 million balboas in 1981 prices.

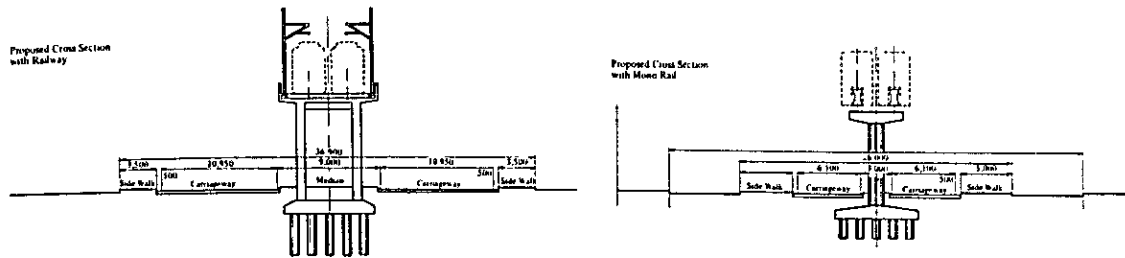
Transport Demand

Transport demand on the rail transit in 1990 is estimated from the result of traffic assignment at 288,000 persons per day in the case of monorail and 249,000 persons per day in the case of elevated railroad. A slightly larger number of passengers can be estimated for Via Espana route than for Via Transistmica route, the gap will close as urbanization will progress towards north into the reverted area.

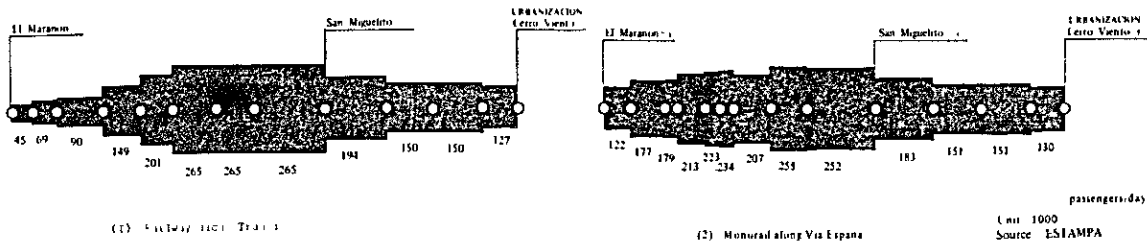
Financial Evaluation and Recommendations

If the construction cost of rail transit is funded at an interest rate of 12% per annum, analysis indicated that revenue from fares will be insufficient to recover the cost. In order for the rail transit to be feasible at a fare rate competitive with buses, the interest rate must be below 6% annum at maximum. If the minimum fare can be set at 30centabos near the end of this century, the construction of the rail transit system at the capital cost of 12% per annum may become feasible then.

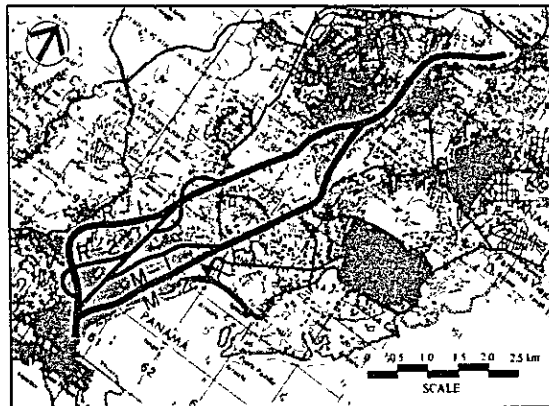
What can be done meaningfully at this time are a basic research on conversion of car trips to rail transit and on bus passengers' ability to bear the fares, as well as technical investigations for the selection of best rail transit route.



STANDARD CROSS-SECTION OF RAIL TRANSIT



DEMAND OR RAIL TRANSIT, 2000



ALTERNATIVES IN BUILT-UP AREA

FINANCIAL EVALUATION OF RAIL TRANSIT PROJECT

Case/ Condition	Mode	First Year of Operation	Profit after 25 year		Indicators for Evaluation		
			Annual (million B)	Acumulated (million B)	B/C	NVP (million B)	IRR (%)
Case 1 IL = 12% IS = 15% C = 25¢ r = 20%	Monorail	1990	-1,660	-14,449	0.468	-114	6.47
		1995	-1,587	-13,906	0.499	-110	6.87
		2000	-1,436	-12,745	0.544	-102	7.42
Case 1 IL = 12% IS = 15% C = 25¢ r = 20%	Railway	1990	-1,952	-16,746	0.391	-130	5.41
		1995	-1,913	-16,456	0.406	-128	5.61
		2000	-1,592	-13,950	0.499	-110	6.89
Case 2 IL = 10% IS = 15% C = 25¢ r = 20%	Monorail	1990	-1,016	-9,155	Same as Case 1		
		1995	-925	-8,474	Same as Case 1		
		2000	-767	-7,240	Same as Case 1		
Case 2 IL = 10% IS = 15% C = 25¢ r = 20%	Railway	1990	-1,301	-11,398	Same as Case 1		
		1995	-1,259	-11,077	Same as Case 1		
		2000	-933	-8,529	Same as Case 1		
Case 3 IL = 10% IS = 15% C = 35¢ r = 20%	Monorail	1990	71	-650	0.793	-44	10.2
		1995	462	-844	0.844	-34	10.7
		2000	219	965	0.912	-19	11.2
Case 3 IL = 10% IS = 15% C = 35¢ r = 20%	Railway	1990	-332	-3,806	0.672	-70	8.9
		1995	-241	-3,107	0.699	-65	9.2
		2000	186	252	0.833	-36	11.1

Note: IL = Interest rate of long term loan
C = Normal tariff for one ride
Source ESTAMPA

IS = Interest rate of short term loan
r = Increase rate of tariff in every three years

23. PROJECTS AND PROJECT PACKAGES

Projects Constituting the Masterplan

Gap between the facilities defined by the masterplan and the existing facilities represents the quantity of construction needs. Its divisions into units of functions are projects. For programming convenience, the projects are classified into road projects (including grade separation at intersections), public transport projects, and traffic management projects.

Road Projects

Road projects will achieve the construction of 25 new road sections, the upgrading of 29 sections of the existing roads, and improvement at 21 intersections.

Important new roads to be constructed are Corredor Norte, which will lie in the north of, and in parallel to, Via Ricardo J. Alfaro and leading up to Via Transistmica and Corredor Sur, which will run along the northern edge of the marshland in the coastal part of Corregimiento de Juan Diaz.

The road upgrading projects will include the widening of Ave. Balboa/Via Israel, the widening of the section of Carretera Boyd Roosevelt, Via Transistmica, west of San Miguelito, the upgrading of Via Cerro Ancon to a 6-lane road, the widening of Gaillard Highway, the improvement of Via Jose A. Arango/Via Ramon Arias, and the widening of Pan American Highway in the urban parts of Arraijan and La Chorrera.

Large-scale improvement will be achieved at 10 existing intersections, of which important in view of the existing traffic condition are that at the entrance of San Miguelito, Via Bolivar/Calle El Paical intersection, and Via Martin Sosa/Via Simon Bolivar intersection.

Public Transport Projects

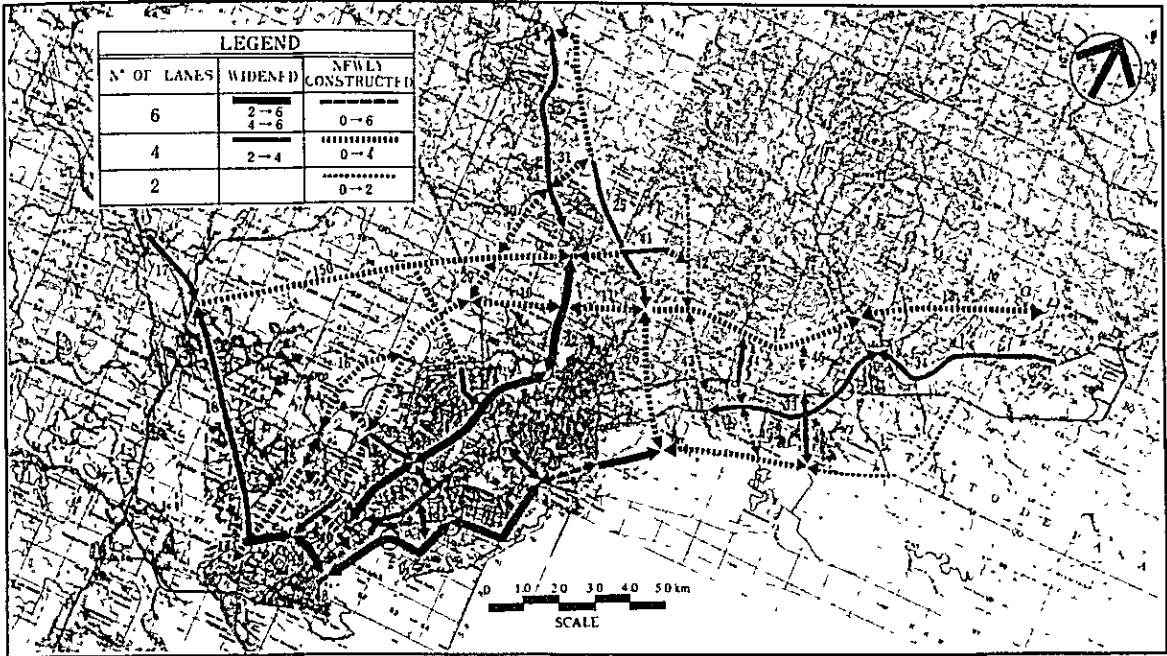
Public Transport projects aim at the improvement of bus service through bus rerouting and the construction of four bus centers (El Maranon, Crundu Norte, San Miguelito intersection, and Urb. Chanis) and Albrook Bus Pool, as well as the conditional introduction of a rail transit for commencement of service at the end of this century.

Traffic Management Projects

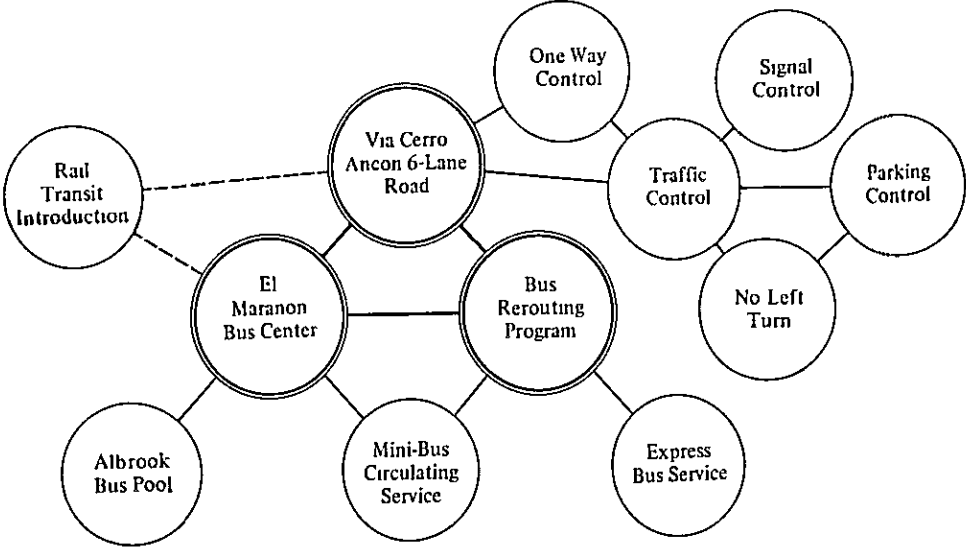
Only the traffic management projects that should be implemented within two or three years are proposed here, because it is important that traffic management system be modified from time to time and related facilities be flexibly utilized in response to change in the situation surrounding traffic management. The recommended projects include traffic signal control system improvement, intersection improvement, safety facilities installation, and traffic regulation improvement.

Project Packages

Groups of projects functionally interrelated with each other are combined into project packages for the convenience of project scheduling and evaluation. Particularly important in project packaging is the achievement of proper combinations of hardware projects, such as road construction, and software projects, such as bus rerouting or traffic regulation. An example of project package is presented on the opposite page.



ROAD PROJECT MAP



CENTRO TRAFFIC IMPROVEMENT PROJECT PACKAGE

24. INVESTMENT SCHEDULE

Scheduling Intention

In order to decide an investment schedule by aligning numerous projects on the axis of time, a multitude of scheduling conditions must be considered simultaneously. It is intended that an investment schedule be decided which will be in pace with economic growth, will achieve early implementation of those projects designed to solve already surfaced problems, will maintain a balance and harmony with existing projects, and will be coherent with the result of traffic volume forecast.

Investment Expansion

Public investment must be increased by 5% each year, in order that the Panamanian Government's objective of sustaining a long term economic growth of 3% to 5% per annum will be achieved. If the estimated cumulative total road investment in the Metropolitan Area of 350 million balboas is considered to be the result of 5% per annum increase in such investment, the amount which will be investment by 1990 will be 120 million balboas (34% of the cumulative total), the amount which will be invested from 1991 to 1995 will be 100 million balboas, and the amount which will be invested from 1996 to 2000 will be 130 million balboas. These investment increments can be used as a guideline for determining the proportion at which investment funds are allocated to each period. Also, the indicated amounts of investment increments can be financed with revenue from the road development special tax to be recommended later in this Report.

Road Investment Schedule Public

The following investment schedule is recommended (in terms of million balboas): 1983-1985, 31.2; 1986-1990, 72.3; 1991-1995, 117.7; and 1996-1999, 130.3. The amount of investment in five years from 1983 to 1987 will be 63.9 million balboas, or an average of 12.8 million balboas per year, which will be slightly higher than the previous record.

Major projects scheduled for implementation in the 1980s are: the construction of new Corredor Norte, which will go through the reverted area; the realignment of Via Cincuentenario in Panama Viejo; the construction of Via Cerro Ancon as a 6-lane road; the widening of sections of Via Transistruca, Via Martin Sosa. Projects for improvement of intersections will be implemented in accompaniment to the relevant road construction or upgrading project.

Public Public Transport Investment Schedule

The construction of four bus centers and Albrook Bus Pool is scheduled for the latter half decade of the 1980s. Projects for bus rerouting, express bus service introduction, circulating city bus service introduction, and min mini bus service introduction will be implemented at the time each relevant bus terminal is opened for service. The renewal and strengthening of bus fleets will be continued as private sector projects.

Traffic Management Projects

In the area of traffic management, only short term projects to be implemented in 1983 to 1985 are recommended. Signal control projects (4.4 million balboas) are scheduled for implementation in 1983 to 1984, intersection improvement projects (8.6 million balboas), chiefly in 1984 and 1985, and safety facilities installation projects (2.9 million balboas), in 1984.

ROAD INVESTMENT SCHEDULE (Cont'd)

No	Project	Investment Amount	Economic Cost	Year			
				85	90	95	2000
1	Calle 17 (Ave. B-Central)	5.40	5.32				
2	Balboa (Ave. B-Brasil)	5.62	5.11				
3	Balboa (Via Brasil-11 de Oct.)	8.75	8.13				
4	Ave. Panama Viejo	6.37	5.87				
5	Ave. Nuevo Panma	6.94	6.30				
6	Corredor Sur A	6.40	5.85				
7	Corredor Sur B	4.84	4.51				
8	Corredor Norte (Via Curundu)	7.83	7.06				
9	Corredor Norte-A	8.29	7.47				
10	Corredor Norte B	6.78	6.38				
11	Corredor Norte (Via Samaria)	7.96	7.46				
12	Corredor Norte-C	12.97	11.91				
13	Villa Lobos-CPA	9.33	8.54				
14	Gaillard Roosevelt	0.74	0.68				
15	Via Albrook-A	1.80	1.62				
16	Via Albrook B	5.37	4.87				
17	Gaillard Miraflores	3.04	2.74				
18	Gaillard Clayton	6.69	6.04				
19	Via Cerro Ancon	7.50	7.29				
20	Via Bolivar (M. Sosa-V. Brasil)	3.71	3.40				
21	Via Bolivar (V. Brasil-S. Mgto.)	8.14	7.40				
22	Via Bolivar (S. Mgto-S. Isidro)	7.67	6.93				
23	Via Bolivar (S. Isidro-A. Diaz)	5.78	5.21				
24	Via Bolivar (A. Diaz-Chadibre)	14.53	13.10				
25	S. Miguelito Central	8.52	7.68				
26	S. Miguelito-Chanus	8.64	7.95				
27	Ave. E. T. Lefevere	1.99	1.83				
28	Betania Central	7.79	7.58				
29	S. Mgto Oeste-A	5.24	4.76				
30	S. Mgto Oeste B	6.21	5.71				
31	S. Mgto Oeste-C	5.13	4.73				
32	Via España (M. Sosa-F. Cordoba)	2.91	2.63				
33	Via José A. Arango	6.57	5.93				
34	Ave. José M. Torrijos	7.00	6.31				
35	Via El Paical	6.41	6.05				
36	Via Ramon Arias	1.88	1.79				
37	Extension Martin Sosa	3.27	2.95				
38	Via Bella Vista	2.18	2.01				
39	Extension Via Argentina	4.48	4.12				
40	Extension Calle 34 Este	6.07	5.82				
41	Extension Autopista	6.42	5.98				
42	S. Miguelito Este	2.54	2.36				
43	S. Mgto-Hipodromo	4.86	4.44				
44	Via Club de Golf	3.18	2.97				
45	Via Juan Diaz Sur	1.01	0.94				
46	Via San Antonio	1.30	1.18				
47	Via Ciudad Radial	3.02	2.73				
48	Vias Santa Ana	4.22	4.20				
50	Via Central Arrajan	4.63	4.17				
51	Via Central Nov. Arrajan	5.09	4.59				
52	Via Central Chorrera	11.43	1.31				
53	Anillo Arrajan	6.39	5.79				
54	Anillo Nov. Arrajan	3.57	3.24				
55	Anillo Chorrera	11.86	10.72				

INVESTMENT SCHEDULE OF PUBLIC TRANSPORTATION PROJECTS, 1983-1990

Project	Cost (million Bf.)		Year							
	Financial	Economic	83	84	85	86	87	88	89	90
1	Bus Center									
	El Marañon	5.8	5.2							
	Curundu Norte	1.7	1.3							
	San Miguelito	1.6	1.2							
	Chanus	1.9	1.7							
2	Albrook Bus Pool	1.6	1.2							
3	Bus Rescheduling Program	-	-							
Total		18.6	16.6							

Source: ESTAMPA

INVESTMENT SCHEDULE OF TRAFFIC MANAGEMENT PROJECTS, 1983-1985

Project	Cost (Million Bf.)		Year		
	Financial	Economic	1983	1984	1985
1	Traffic Signal Installation	4.4	4.0		
2	Intersection Improvement	8.6	7.7		
3	Safety Fence Installation	2.9	2.6		
4	Traffic Restriction Program	-	-		
Total		15.9	14.3	1983	1985

Source: ESTAMPA

25. EVALUATION

Method of Economic Evaluation

The economic benefit of the project is measured in terms of savings in the amount of vehicle operating cost. The economic benefit of the entire Masterplan is expressed by the difference between the aggregate vehicle operating cost when the Masterplan is fully carried out and the aggregate vehicle operating cost when the existing traffic facilities are left as they are without any additional investment (do nothing case). The economic benefit of each major project is expressed by the increment of vehicle operating cost resulting from the exclusion of the project from the Masterplan.

Vehicle Operating Cost

Costs of motor vehicle operation are classified into those which depend on the distance driven and those which depend on running time. The average distance-dependent cost per kilometer is estimated at 7.07 centavos for passenger cars, 10.37 centavos for small trucks, 20.40 centavos for large trucks, and 32.17 centavos for buses. The average time-dependent cost per hour is estimated at 61.3 centavos for passenger cars, 167.4 centavos for small trucks, 378.6 centavos for large trucks, and 243.2 centavos for buses. Vehicle operating costs by vehicle types are obtained by multiplying these unit costs by the total running distance and the total running time, respectively, of each type of vehicle from the result of traffic assignment.

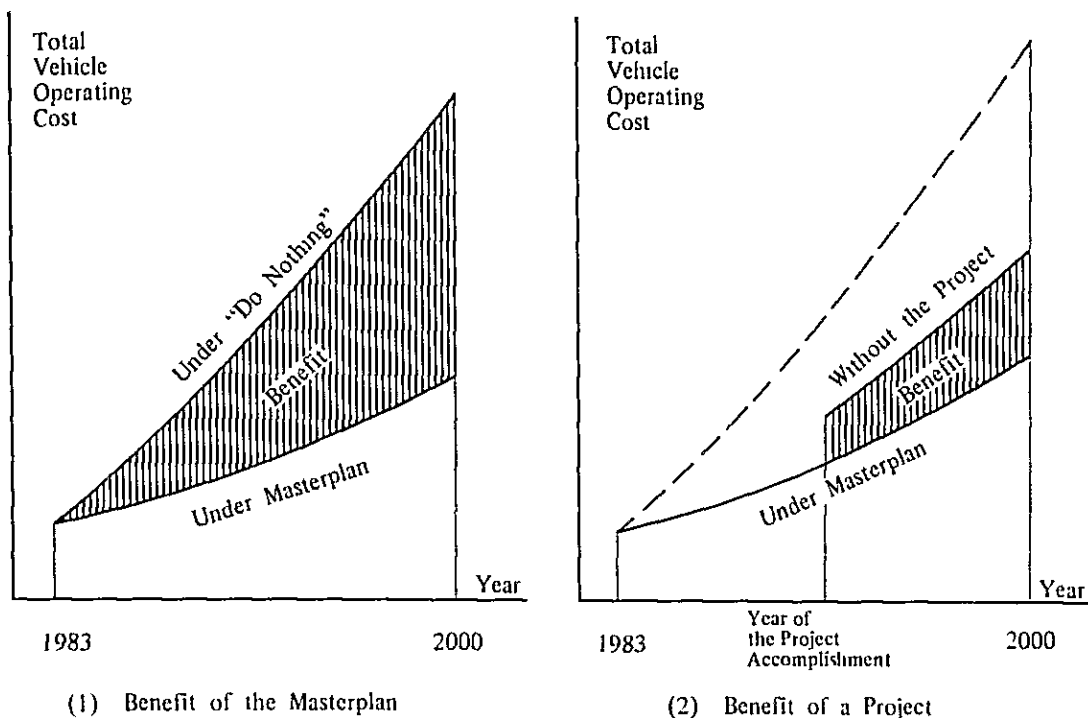
Masterplan Feasibility

The Masterplan, as a whole, is economically feasible. The current value of net benefit accruing from 1983 through 2000 is 427 million balboas and benefit/cost ratio is very favorable 6.34. Internal rate of return is calculated to be over 100%, but this is an inappropriate indicator for evaluating a plan, such as Masterplan, under which expenses are continuously incurred throughout the period for evaluation.

Projects to be implemented east of the Canal show even higher benefit/cost ratios than Masterplan. Conversely, those to be implemented west of the Canal show a relatively unfavorable evaluation results. Separated into the periods of investment, the economy of projects for investment prior to 1990 is very favorable, while those implemented in the 1990s show a relatively low investment efficiency. These facts only prove the acceptability of Masterplan.

Project Package Feasibility

Projects with a geographical proximity and projects functionally related strongly with each other are grouped into project packages. All but a few project packages are feasible. The economy of Corredor Norte, Corredor Sur, and the north-south arterial in the east of Panama Urban Area, which form a skeleton of the future road network, is proven particularly favorable. Good results are shown by streets in the reverted area, extension of Autopista, and San Miguelito – Hipodromo Road, which are planned for implementation toward the end of this century. The earlier implementation of these projects is worth considering, if funds are available. Projects with low economy should also be implemented as scheduled, because they will support the urbanization of presently suburban areas or function as access roads to Autopista.



ECONOMIC BENEFIT OF THE MASTERPLAN AND A PROJECT

EVALUATION OF ROAD PROJECT

No	Project Package	Construction Period	Construction Cost		Indicators for Evaluation		
			Financial (million B)	Economic (Billion B.)	B/C	NPV (million B)	IRR (%)
0	Master Plan as a Whole	1983-1999	354.0	325.7	6.34	427	*
1	All Projects east to Canal	1983-1999	311.1	286.9	6.52	416	*
2	All Projects west to Canal	1990-1999	43.0	38.8	1.63	3	20.4
3	Projects in 1983-1987	1983-1986	34.5	32.2	7.31	131	51.4
4	Projects in 1986-1990	1983-1989	88.7	81.9	6.90	250	75.2
5	Projects in 1991-1995	1989-1995	105.7	97.3	2.46	33	26.8
6	Projects in 1996-2000	1993-1999	153.3	140.6	3.31	25	51.0
7	Projects in 1983-1990	1983-1989	95.1	87.8	8.39	345	*
8	Projects in 1991-2000	1989-1999	259.0	237.9	4.83	127	60.4
9	Northern Corridor (I)	1983-1989	55.4	51.3	3.87	75	59.4
10	Northern Corridor (II)	1989-1997	30.3	27.9	4.58	18	47.4
11	Coastal Corridor (I)	1983-1994	17.6	16.2	4.48	26	30.0
12	Coastal Corridor (II)	1993-1999	23.9	22.0	3.68	5	55.4
13	Transistmica	1983-1993	21.2	19.4	1.05	1	15.3
14	San Miguelito-Chamis	1988-1993	17.2	15.6	1.56	2	17.1
15	Gallard-Calyton	1991-1993	6.7	6.0	1.16	0	13.7
16	LI Paical-Ranon Arias	1986-1991	11.5	10.8	0.19	-3	1.5
17	E.T. Lefevre-Betama	1990-1995	13.6	12.9	1.14	0	13.7
18	Streets in reverted area	1996-1999	7.2	6.5	4.03	1	61.5
19	San Miguelito-Ilipodromo	1994-1999	7.4	6.8	2.57	1	34.7
20	San Miguelito West	1990-1993	11.3	10.4	0.77	-1	9.3
21	N-S Corridor, eastern area	1991-1994	8.5	7.8	6.31	8	60.0
22	Via Cerro Ancon	1984-1986	7.5	7.3	1.03	0	12.3
23	Northern Corridor B	1985-1987	6.8	6.4	1.65	2	17.1
24	Auto Pista extension	1998-1999	6.4	6.0	3.55	1	70.0
25	Gallard-Ancon	1984-1993	14.2	13.3	1.81	5	18.6
26	San Miguelito east	1988-1993	12.4	11.5	0.76	-1	8.9

Note: * indicates that IRR is more than 100%

Source: ESTAMPA

26. FUND AND ORGANIZATION

Special Resources System

The realization of this Masterplan will require total funds of 350 million balboas (in 1981 prices) by the year 2000. The generation of this magnitude of funds is predicted to experience difficulties.

In order to secure the resources needed for the materialization of the Masterplan, gasoline – diesel fuel surtax and motor vehicle tax are suggested to be levied on motor vehicle users, who are the beneficiaries of, and the causers of damage to, roads.

At least 50% of revenue from these object taxes will be collected in the Panama Metropolitan Area, but, in view of the urgency of improving roads in other areas, 40% of the revenue will be retained for the Metropolitan Area, which will be adequate to finance practically all road investments under the Masterplan.

It is expected that the imposition of these taxes will have a secondary effect of discouraging passenger car uses, which will work to lessen burden on the Masterplan.

Land Transportation Planning Agency

Road construction and maintenance are programmed and executed by the Ministry of Public Works under the Road Development 5-Year Plan. Impediment to road development is the fact that this 5-year Plan is short-lived and, therefore, does not function as a guideline for road development programs from year to year.

Streets are developed, in almost all cases, by private developers under the approval of the Ministry of Housing. Problem, here, is the fact that streets are being approved and constructed with no coherence with the overall road network.

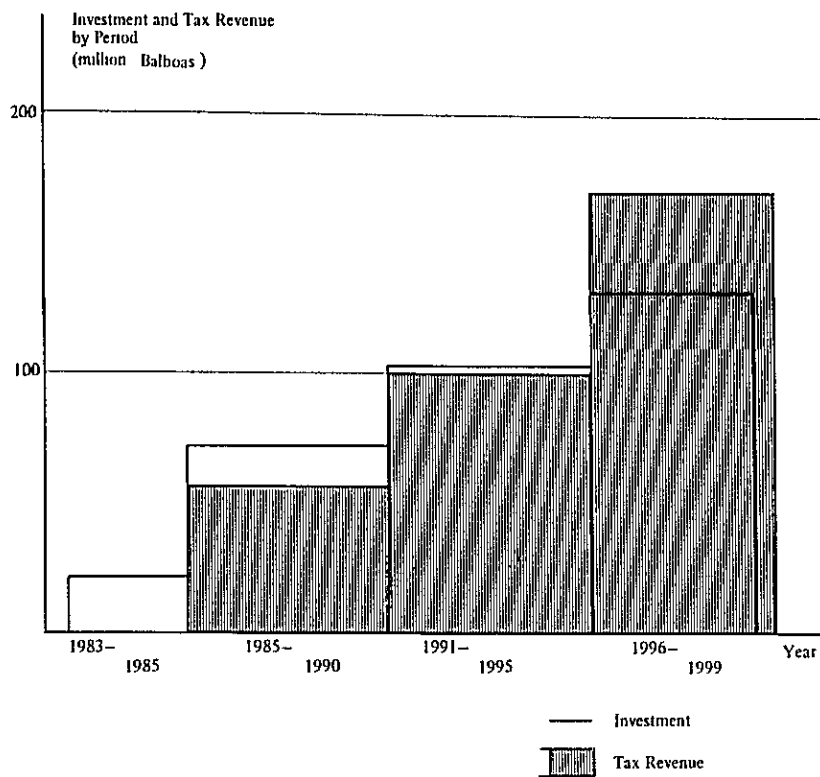
Public transport is under the jurisdiction of the Ministry of Government and Justice, but this Ministry has no channels for gathering information on the public transport operation. Fares are decided by the Price Adjustment Agency under the advice of the Ministry of Government and Justice, but neither of them has data on cost elements of the fare and revenues and expenses by routes.

Thus, every aspect of land transportation administration has functioned in a disintegrated manner in the absence of an organization to establish a common data base, to maintain coordination between individual plans and programs, and to formulate an overall plan. In order that the special resources, discussed in the above, will be distributed efficiently, an organization is needed which will formulate a comprehensive land transport plan and effectively will manage land transport.

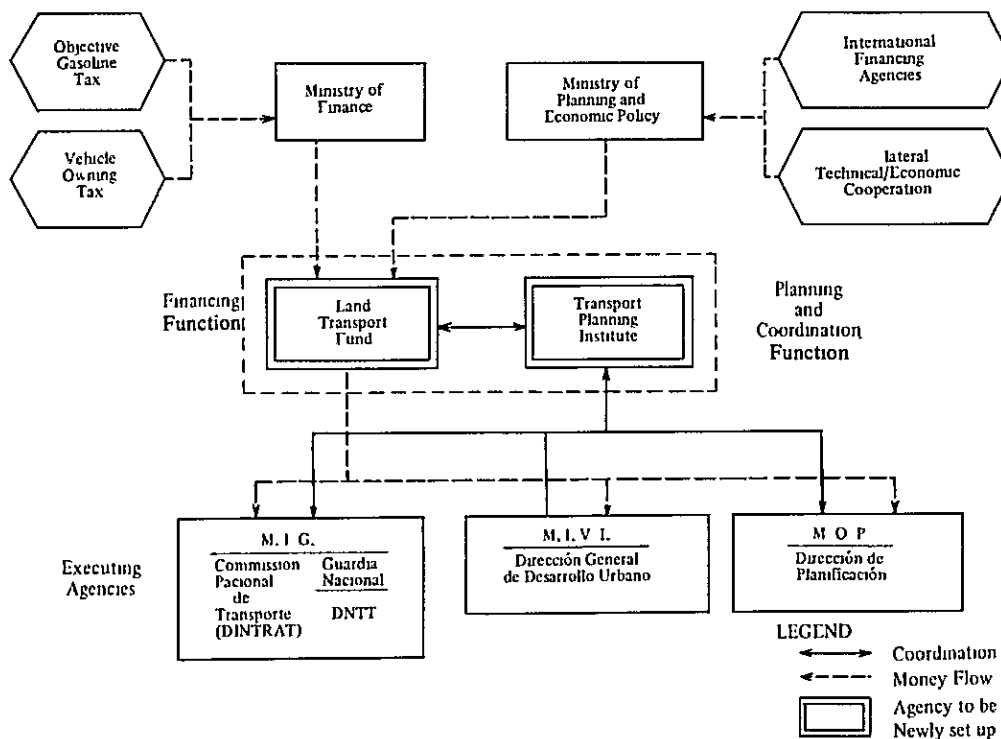
Land Transport Fund

A fund will be established for the management of the special fund resources. The Fund will receive the special resources fund from the Ministry of Finance and distribute, under the direction of Land Transportation Planning Agency, to project implementing agencies. When disbursement is expected to exceed fund receipts, the Fund may borrow on future receipts.

The special resources funds are available for all projects for the construction, improvement, and maintenance of roads and public means of transport. In other words, the Fund provides for the accounting of road development projects, public transport development projects, investments in public corporations and enterprises concerned, and subsidies to enterprises concerned.



COMPARISON OF INVESTMENT AND OBJECTIVE TAX REVENUE BY PERIOD



INTEGRATION OF FINANCING AND PLANNING FUNCTION IN TRANSPORTS FOR ADMINISTRATION

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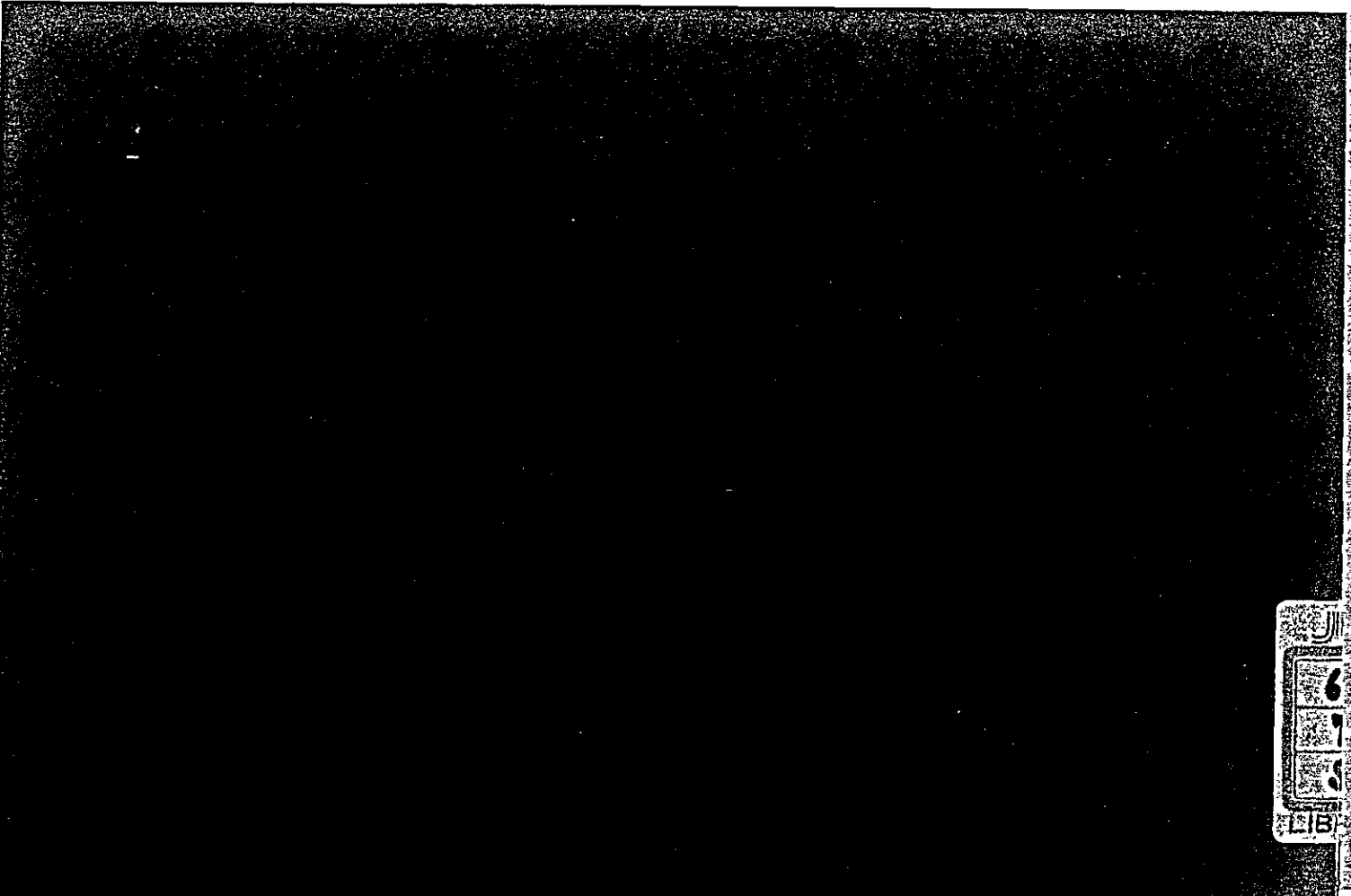
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Control de Transito
Ingeniero de Control de Transito
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* : Predecessor



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