TABLE 2-27 POPULATION ABSORPTIVE CAPACITY IN PANAMA URBAN AREA

Zone	Vacant Lots (R, R-C) (in ha.)	Capacity (persons)
San Felipe (01)	–	–
El Chorrillo (02)	1.9	1350
Santa Ana (03)	6.8	5100
Calidonia Sur (04)	3.6	2700
Calidonia Norte (05)	0.8	600
Curundu (06)	–	–
01–06 Total	13.1	9750
La Cresta (07)	3.9	1800
Urraca-Campo Alegre (08)	7.4	4310
Obarrio (09)	7.8	3490
El Cangrejo (10)	12.9	7560
07–10 Total	32.0	17160
Central Area	45.1	26910
Punta Paitilla (11)	8.0	5050
San Francisco (12)	8.0	1570
El Golf (13)	7.1	2670
Vista Hermosa (14)	4.7	1100
Pueblo Nuevo (15)	22.7	4860
11–15 Total	50.5	15250
Loceria (16)	16.8	1710
El Dorado (17)	69.5	22920
Betania (18)	16.4	2910
16–18 Total	102.7	27540
Parque Lefevre (19)	27.5	4090
Chanis (20)	25.9	4910
Rio Abajo (21)	14.8	2500
Villa Lorena (22)	36.6	8340
19–22 Total	104.8	19840
Panama Urban Area (01–22)	303.1	89545

Source: ESTAMPA

C. Decree No.59 of July 17, 1975, designated a part of El Maranon area which extends from Corregimiento de Calidonia to Corregimento de Santa Ana as an urban renewal area.

D. Decree No.72 of August 20, 1975, designated a part (Barriada de San Sebastian) of Corregimiento de San Francisco as an area for public facilities development through urban renewal.

E. Decree No.109 of September 23, 1976, designated Santa Cruz (Curundu), a part of San Miguel, as an urban renewal area.

F. Decree No.44 of August 10, 1981, designated a part of Corregimiento de Santa Ana as an urban renewal area.

In addition, Panama Viejo, Portobelo (in Colon Province), and San Felipe have been designated as historical memorial areas subject to regulation by the Instituto Panameno de Turismo (IPAT, or the Panama Institute of Tourism) under cooperation of and in coordination with MIVI and

other related agencies, under the provisions of Law No.91 of December 22, 1976.

(ii) Standards of Urban Development for Panama City (Zoning Regulations)

MIVI was empowered by Law No.9 of January 25, 1973 to establish the standards for zoning after coordination with related agencies of the three levels of government: national, regional, and local.

Under this Law, MIVI issued Ministerial Order No. 2-78 on August 28, 1978, establishing "Standards of Urban Development for Panama City", which is applicable to Panama District and San Miguelito District.

In consideration of such factors as rapid swell of urban area, lack of land space, inefficient utilization, and so forth, the standards for zoning designation are changed rather frequently, opening new ways for land utilization. When an application is filed for such change, decision is made by MIVI, and the applicant has the right to request reconsideration of the decision. This reconsideration is under the jurisdiction of the Director of Urban Development Bureau, while appeal against the decision of Urban Development Director is judged by the Minister of Housing.

The use categories of zoning regulations are as follows (technical description of the standards are omitted):

A. Residential Zone Class I (R_1)
Permitted Use: Detached and Semi-detached houses (including ancillary facilities)
Maximum population density: 200 persons per hectare

B. Residential Zone Class II (R_2)
Permitted Use : Detached, semi-detached, and row houses, and apartment houses (including ancillary facilities); educational, religious, cultural, and social facilities; and professional office-dwelling houses
Maximum population density: 400 persons per hectare

C. Special Residential Zone (RE)
Permitted Use: Detached, semi-detached, and row houses (including ancillary facilities)
Maximum population density: 400 persons per hectare

D. High-Density Residential Zone, Class I (RM_1)
Permitted Use: Semi-detached, row houses and apartment houses; educational, religious, administrative, cultural, philanthropic, and social facilities; and professional office-dwelling houses
Maximum population density: 750 persons per hectare

E. High-Density Residential Zone, Class II (RM_2)
Permitted Use: Those allowed for RM_1 and apartment houses with commercial facilities on the ground (first) floor
Maximum population density: 1,000 persons per hectare

F. High-Density Residential Zone, Class III (RM_3)
Permitted Use: Those allowed for RM_2 and student dormitories, offices, and libraries
Maximum population density: 1,500 persons per hectare

G. Commercial Zone (C_2)
Permitted Use: Commercial facilities, offices, high-rise residential buildings (commercial

/residential zone is sometimes designated in combination with R_2, RM_1, RM_2, and/or RM_3), and light industries
Maximum floor area ratio: 500%

H. Neighborhood Commercial Zone (C_3)
Permitted Use: Neighborhood commercial facilities, offices, and houses (neighborhood commercial/residential zone can sometimes be designated in combination with RE, R_1, and/or R_2)
Maximum floor area ratio: 100%

I. Industrial Zone (I)
Permitted Use : Industries
Maximum floor area ratio: 200%

J. Public Facility Zone (P)

Land for administrative agencies, schools, parks, hospitals, and other public facilities

(iii) Regulation on Urbanizations in the Republic of Panama

The statutory regulation on urbanizations in Panama has a long history. It started with Law No. 78 of June 23, 1941, which, as amended and supplemented by subsequent laws, placed the permission granting on urbanizations under the jurisdiction of Ministerio de Obras Publicas (MOP, or the Ministry of Public Works). This authority was subsequently transferred to Instituto de Vivienda y Urbanismo (IVU, or the Housing and Urban Development Agency), upon its establishment under Law No. 17 of January 20, 1958.

Authority over "parcelacion y urbanizacion" is presently under the jurisdiction of MIVI. The definition of these words according to the Standards of Urban Development for Panama City are:

Parcelacion: The act of dividing one parcel of land into two or more according to the requisite conditions of the established standards.

Urbanizacion: The act of developing roads and other public facilities upon accomplishment of parcelacion.

Important to the permission of any urbanization project are the facts that the intended use is in conformity with the zoning regulations and that 5% of effective area of lots is provided for public use.

Land for public facilities is provided to the Republic by the developer for free. The area so provided was 5% of the total area size under the provision of Article 6 of the 1941 law, which has been amended to read as follows:

"Article 6 In all urbanization exceeding twenty hectares, land space needed for road shall, in accordance with the existing provisions, be offered to the Republic free of charge. Furthermore, 5% of the remaining land after the deduction of said land shall be offered to the Republic free of charge as land for parks and public buildings."

When the development areal size is 20 hectares or less, the 5% can be reduced at the discretion of the Director of Urban Development Bureau of MIVI.

(iv) Standard Concerning Mangrove Area Control and Development (Corregimiento de Juan Diaz)

The below described standards for the use of mangrove area, finally formulated after study and deliberation by MIVI, MOP, MIDA (Ministerio de Desarrollo Agropecuario), and scholars from the Panama National University, was approved by the ministerial order of January 3, 1980:

(Zonal Classification)

Ecology system preservation zone
Residential zone
Commercial zone
Light industry zone
Reserve for rainwater drainage

(Land Use)

Light industry zone must be at least 50 meters away from the limits of mangrove area.

Residential areas are to be planned as follows:

a. Minimum size of each development: 50 hectares (division of land into sizes smaller than 5 hectares not permitted)
b. Building coverage: 10% (including parking space and access path)
c. Ratio of green area: One tree is to be preserved per each 50 square meters.

(v) Technical Standard for Alajuela Lake Basin

A document titled, "Technical Standard for Controlling Alajuela Lake Basin" was approved by the Ministerial Order No. 22 or May 15, 1979, which was issued under Article 110, Chapter 6 of the Constitution of the Republic of Panama, for the purpose of regulating the development of said catchment area, which not only functions as the water reservoir needed for the operation of the Canal, but also functions as the source of water supply to Panama City and vicinity.

The basin is divided into A, B, and C zones depending on topographic condition, population concentration condition and density, and distance from the lakefront, and development is regulated as follows:

A Zone

Included in this zone are all lakeshore areas which can become the source of water contamination directly affecting the quality of lakewater, or the land sandwitched between the lakefront line and a circle line drawn on the lakeshore land which, in the north and east of the lake, follows the line of divide with maximum elevation of 305 meters above sea level and, in the west and south of the lake, follows the boundary line of the catchment.

Thus, in this zone will be two characteristic areas: urbanized parts and areas epecialized in farming and forestry. The latter is subject to the following controls:

(i) Any and all construction work is prohibited.

(ii) Tree felling or burning is prohibited.

(iii) Without RENARE permission, the construction of new piers, ramps, or other recreational facilities is prohibited.

B Zone

Approximately 80% of areas with sporadic villages and basically agricultural areas in the catchment area is designated B Zone.

C Zone

Areas with maximum precipitation are designed Canal Basin Forest Reserve Area. In this Area, reserve forests subject to the following controls were designated by the Decree No. 14 of 1967:

(i) No application for the recognition of ownership with regard to nationally-owned land is to be accepted.

(ii) Construction in privately-owned land cannot exceed 100 square meters.

(iii) New farming activities or the expansion of existing farming activities are not permitted.

5) Interregional Transportation

(1) Facilities

Panama Metropolitan Area, situated on the Pacific coast of the Isthmus of Panama, is a strategic point for international traffic. Omar Torrijos Herrera Airport in Panama City is an important node of international air network. Some 5% of the world's trade volume is said to pass through the Panama Canal. Pan American Highway connects Panama with Central and North America, while it is currently being extended toward Colombia for connection with South American countries.

As for domestic transport, the skeleton of road network consists of the east-west axis of Pan American Highway, running along the Pacific coast, and the north-south axis of Transistmica Highway running between Panama City and Colon. Marcos A. Gelabert Airport in Panama City is the hub of domestic air network connecting far corners of the country. Panama Railway runs along the Panama Canal and connects Panama City and Colon, but its importance is small both in terms of passenger and cargo. Panama City also functions as the base for domestic sea transport connecting off-shore islands with ports on the Pacific coast.

Transportation facilities existing in Panama Metropolitan Area (see FIG. 2-15) are briefly described in below.

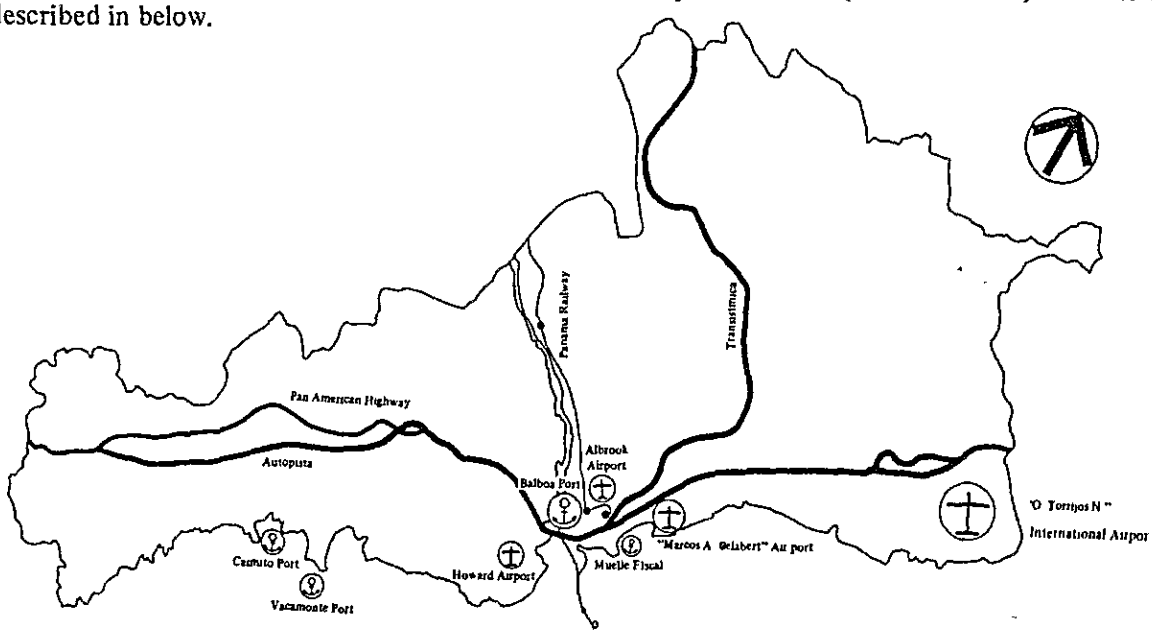


FIG. 2-13 INTERREGIONAL TRANSPORTATION FACILITIES
Source : ESTAMPA

(i) Airports

a. Omar Torrijos Herrera International Airport
(formerly known as Tocumen Airport)

This is a modern international airport with a 3,050-meter runway constructed adjacent to the previously existing airport. The number of international passenger arrivals and departures (that is, excluding transit passengers) has increased by about 8% per annum during the past decade and is presently about one million per year.

b. Marcos A. Gelabert Airport

This airport, located in Punta Paitilla, Panama City, is the pivot of domestic air network and accommodates small aircrafts with a passenger capacity of about 30 or less with its 1,298-meter runway. About 230 thousand passengers and 80 thousand tons of cargo pass through this airport each year. Both the number of passengers and the volume of cargo have increased by about 10% each year during the past several years.

c. Other Airports

In addition to these two airports, there exist several private, training, and military airports, which play little role in domestic air transport. They are: Albrook Field Airport, Howard Air Force Base, Calzada Larga Airport, La Joya No. 1 Airport, and Finca El Limon Airport.

(ii) Seaports

a. Balboa Port

Balboa Port is the second largest port in Panama with 13 piers to serve tankers, container ships, and other freighters, as well as regular shuttle service to Taboga Island. The total quantity of cargo handled at this port in 1980 was 362 thousand metric tons or about half that of Cristobal Port, but the average annual growth of cargo volume at this port during the past decade was about 6% which is much higher than that of about 2% at Cristobal Port. Containerized cargo handling at Balboa Port has particularly increased in recent years.

b. Vacamonte Port

Constructed together with fishery products processing facilities, Vacamonte Port provides a base for fisheries activities both for domestic consumption and for export.

c. Other Seaports

Other seaports existing in the Study Area are Puerto Caimito Port, Playa Leona Port, and Juan Diaz Port, which are local fishery ports, and Muelle Fiscal Port, which is the Panama City terminal of domestic lines.

(iii) Highways

Pan American Highway is the most important trunk route in Panama, with major Panamanian cities distributed and industries and population heavily concentrated along the route. It is also the east-west arterial in Study Area as it connects La Chorrera, Arraijan, and Tocument. With asphalt or

cement concrete surface, this Highway in most part has two drive lanes. A high standard 4-lane expressway was constructed in May 1981 to provide a tolled by-pass between La Chorrera and Arraijan. It is planned that this Autopista be extended from Arraijan, across the Canal, and up to Via Transistmica.

Via Transistmica is the only trunk road transversing the Isthmus of Panama, connecting the largest and the second largest cities of Panama: Panama City and Colon City. Traffic is heavy on this Highway, and it has two drive lanes in most part. Upgrading of the Highway to a 4-lane road has begun from Panama City and is progressing toward Colon City.

(iv) Other

Bus transportation, formulating a nationwide service network, is chiefly depended upon for the movement of passengers throughout the Republic. Bus terminals are scattered to a number of locations in Corregimiento del Chorrillo and Santa Ana.

(2) Land Transportation Industry

(i) Trucking Business

No reliable data is available for defining the current state of trucking business. The telephone directory lists a total of 146 firms in this business. From the 146, 71 firms were randomly selected and of the 71, questionnaire forms were filled out by 37 firms. Data obtained from these 37 firms will be used for the following discussion.

The 37 firms together had a total of 436 trucks, for an average of 12 trucks per firm. At this average, total truck fleet for the 146 firms would be 1,720. It is known that the total number of trucks registered in the Province of Panama in 1980 was 15,381. Then, in terms of the number of trucks, the transportation capacity of the 146 firms amounts to over 11% of that of Panama Province (See Table 2-28). The truckers fleets are bipolarized: 2-ton or smaller trucks represent 23% of the total while 10-ton or larger trucks represent 63%. Typical cargo movements are as follows:

Petroleum Products: The single commodity of the largest quantity moved. Transported by 14-ton or larger trailers on arterials, with 35-ton trailers most frequently used.

Construction materials: Typically transported by 16-ton or larger trailers. An overwhelming majority of steel products are moved from Colon City to Panama City, which is from the port of entry to consumption area.

Other commodities: Often carried by 14 to 20-ton trailers. Trailers are registered in Panama but are scattered throughout the Republic looking for clients.

(ii) Passenger Transport Service

Large buses with an average seat capacity of 67 passengers run from Panama City to Colon City 116 times per day, carrying a total of 5,425 passengers. However, because many of the passengers are commuters, the average turnover ratio of the buses is low at only 1.7 (average turnover ratio is calculated by dividing the frequency of bus operation on each route per day by the number of buses operated on that route on that day).

TABLE 2-28 RELATION BETWEEN FREIGHT AND TRUCK SIZE

Freight	Truck Size (No. of Trucks)					TOTAL
	2 - Ton	4 - Ton	8 - Ton	20 - Ton	35 - Ton	
Petroleum	32	4		3	18	57
Steel	4	3	4	9	5	25
Wood (construction materials)	5	1	4		14	24
Ex-Factory Products	14	4	3	11	14	32
General Goods	19	4	15	174		212
Sugar			5			5
Beverages				42		42
Animal Food	27		12			39
TOTAL	101	16	43	239	37	436

Source: ESTAMPA

TABLE 2-29 RELATION BETWEEN ORIGIN/DESTINATION AND TRUCK SIZE

(No. of Trucks)

Direction	Truck Size					TOTAL
	2 - Ton	4 - Ton	8 - Ton	20 - Ton	35 - Ton	
Intra Panama City	32	7	9	67	14	129
Colón	13	5	16	4	5	43
Veraguas	18	1				19
Chiriqui	8	1		7		16
Los Santos				4		4
Coclé	8					8
Whole Country	22	2	18	157	18	217
TOTAL	101	16	43	239	37	436

Source: ESTAMPA

TABLE 2-30 RELATION BETWEEN DIRECTION AND FREIGHT

(No. of Trucks)

Direction	Freight								
	Petroleum	Steel	Wood (Const. Mat.)	Ex-Factory	General Goods	Sugar	Beverages	Animal Food	TOTAL
Intra Panama City	2	4	17	10	37	5	42	12	129
Colón	11	13		8	11				43
Veraguas	19								19
Chiriquí	15	1							16
Los Santos	4								4
Coclé	2				6				8
Whole Country	4	7	7	14	158			27	217
TOTAL	57	25	24	32	212	5	42	39	436

Source : ESTAMPA

Buses from Panama City going eastwards mostly go to Chepo and Pacora, with insignificant number of daily passengers of 390 and 215, respectively. These buses are of the most popular type in use in Panama City and has a seating capacity of about 40. The bus turnover ratio is also low.

Bus service toward the west should be clasified into (1) long distance service, (2) medium distance service to central area, and (3) service to surrounding areas such as La Chorrera, Arraijan, and Capira. As for long distance service, a bus leaves for David City eleven times per day, carrying an average of 340 passengers per day. Relatively large buses with 54 seats are used.

Aside from a slight degree of concentration to Penonome City, the major town in the central area, bus services to this area, achieved by small buses called "Chiva," are generally evenly distributed. Despite the short time distances to central area destinations of only two or three hours, the average turnover ratio is also low.

By far the largest quantity of passengers from the surrounding towns is the 8,030 coming from La Chorrera, followed by 3,000 from Capira, and 1,300 from Arraijan and Veracruz. Buses with 50- or 40-seat capacity serve on these routes, while Chiva serve on routes from other peripheral towns. Average turnover ratio is only 1.2 even on the route from La Chorrera, on which over 8,000 passengers are carried and one-way trip takes only less than an hour.

Most of bus operating entities are syndicates organized by route. Of those listed in Table 2-31,

TABLE 2-31 INTERCITY DAILY BUS SERVICES TO PANAMA CITY (1982)

Route	No. of Buses Registered	No. of Buses Operated	Average Capacity per Bus	Daily Service Frequency (one direction)	Average Frequency per Bus	Total No. of Passengers
Panamá – Colón	127	70	68	116	1.7	5,425
Panamá – Chepo		12	43	21	1.7	390
Panamá – Pacora		17	38	15	0.9	215
Panamá – La Mesa		5	38	5	1.0	107
Panamá – Darién		10	20	4	0.4	30
Panamá – David	68	54	54	11	0.2	340
Panamá – Santiago		124	21	33	0.3	335
Panamá – Chitré	48	48	21	14	0.3	170
Panamá – Ocú – Pesé	14	7	18	3	0.4	40
Panamá – Las Tablas	45	45	22	12	0.3	150
Panamá – Penonomé	70	54	18	23	0.4	320
Panamá – Antón	26	19	20	11	0.6	125
Panamá – El Valle	10	8	35	6	0.7	115
Panamá – Chorrera	127	125	52	154	1.2	8,030
Panamá – Arraiján	25	20	43	47	2.3	1,310
Panamá – Aguadulce	50	45	19	15	0.3	200
Panamá – Natá	10	8	18	5	0.6	90
Panamá – Marcasa		9	26	4	0.4	50
Panamá – Chame		28	23	12	0.4	120
Panamá – San Carlos		20	21	10	0.5	105
Panamá – Capira		51	41	96	1.9	3,135
Panamá – Soná	8	6	23	7	1.2	85
Panamá – La Pintada		8	18	2	0.2	27
Panamá – NVO. Emperador		10	37	6	0.6	190
Panamá – Santa Clara		2	33	4	2.0	105
Panamá – Veracruz		21	43	33	1.6	1,330
Panamá – Burunga		2	18	5	2.5	150
Panamá – NVO. Chorrillo	10	8	46	16	2.0	550
Panamá – El Copé		8	20	4	0.5	60
Panamá – Tonosí		2	26	1	0.5	15

some of Panama - Colon routes, some of Panama - Santiago routes, and all of Panama - Las Tablas routes, and all of Panama - Nuevo Chorrillo routes are operated by cooperatives.

(3) Air Transport

(i) Domestic

Over 30 airports exist in the Republic of Panama, and a total of 32,961 domestic flights carried a total 293,760 passengers in 1980, for an average of 9 passengers per flight. The number of passengers has fluctuated within the proximity of 300,000 during the past four years.

Of said 32,961 flights, 13,380 originated from Panama airport, and the remaining 19,581, from other airports. The most frequent destination was Contadora Island, off Panama City, to which an average of 11 passengers were carried over 4,000 times per year. The second most frequent destination was Bocas del Toro Province, followed by San Blas Island, David City, and Colon City. Contadora Island and San Blas Island are the representative tourist spots in the Republic, David City and Colon City are major cities in the Republic only after Panama City, and Bocas del Toro is the largest city in the region to which no direct land access is available from Panama City. Major passengers on flight to Colon City are high government officials and directors of large corporations living in Panama City and commuting to Colon City.

(ii) International

A total of 19 airlines of 15 different nationalities fly in and out of Omar Torrijos H. International Airport. Airlines of Panamanian nationality (Air Panama and COPA) represent only 6 out of an average total of 40 flights departing from this airport daily.

During the past five years, the number of flights to and from this airport fluctuated only around 21,000 per year, and the number of passengers, within about 10% of 1,100,000.

(4) Panama-Colon Railroad

The Panama-Colon Railroad, constructed by an American company, was owned by France while Ferdinand de Lesseps was building the Canal, after which it was transferred to the Americans and operated by the Canal Company until 1979, when it was returned to the Republic under the Torrijos-Carter Treaty. The Port Authority has been operating the railroad since 1980.

Major descriptive indices of the railroad are:

Number of employees:	280
Length of operating line:	76 kilometers
Track:	1.52 m gauge, 45 kg/m or 50 kg/m rail
Locomotive:	6 diesel locomotives
Passenger coach:	24
Freight car:	348
Passengers:	635,000 (in 1979)
Cargo transported:	190,000 tons (in 1979)

It is estimated that the number of passengers declined to 472,000 and the quantity of cargo transported dropped to 178,000 tons in 1980. The result of a person-trip survey showed that the railroad can be disregarded in the consideration of traffic flowing in and out of Panama City.

(5) Marine Transport

(i) Domestic Waters

The total number of ships serving domestic waters slightly increased from the 681 in 1976 to 706 in 1980, as the result of increases in small ships under 30 tons, which more than offset decreases in ships larger than 30 tons. The 1980 inventory listed 282 ships under 30 tons, 225 ships over 30 but under 60 tons, and 199 ships over 60 tons, for a total of 706.

The major route serving Panama City is the route connected to Darien Province, chiefly for carrying timbers from Darien Province. In 1979, 755.5 metric tons of timber were brought from Darien Province and 559 metric tons of goods were carried from Panama City to Darien Province by a total of 714 ships.

(ii) High Seas

Balboa Port in Panama City is known as the second most important trading port of the Republic after Cristobal Port in Colon City. But the former has grown rapidly, and its total cargo handling in 1980 was 163,000 tons—only slightly less than the 172,000 tons recorded by the latter. As for export cargo quantity, the positions have been reversed, and Balboa recorded 30,000 tons against Cristobal's 22,000 tons. This trend is believed to continue in the future when Panama City's momentum of growth is considered.

6) Infrastructure and Urban Facilities

(1) Energy

(i) Electric Power

Instituto de Recursos Hidraulicos y Electrificacion (IRHE) supplies power to the entire area of the Republic with the exception of the Canal Area and the banana plantation of Chiriqui Land Company.

Power distribution is achieved with four integrated systems serving the Metropolitan Area, West Panama, Central Provinces, and Chiriqui Province, and seven isolated systems. At the end of 1980, IRHE had a total of 51 generation plants, 18 of which being integrated systems and the largest plant capacity being the 150,000 KW of BayancoHydraulic Plant. The total capacity of the 51 plants is 527,000 KW, of which 251,000 KW or 47.6% is by hydraulic and 276,000 KW by thermal. The total length of power transmission cables is 724 kilometers and the total length of distribution cables, 3,611 kilometers. The length of transmission cables is rather excessive in relation to the generation capacity.

In 1980, in addition to its sending net power of 1,754,000 MWH, IRHE bought 2,000 MWH from the Canal Commission, while it sold 8,000 MWH back to the Commission, and a total 22,000 MWH to Chiriqui Land Company, Fortuna Dam construction site, and Costa Rica Energy Corporation.

The Study Area is served by Panama of the Metropolitan Area and West Panama Integrated Systems, which include said Bayano Generation Plant (hydraulic, 150,000 KW), Avenida Sur Plant (thermal, 12,500 KW), San Francisco Plant (thermal, 18,650 KW), Pier Sticks Plant (thermal, 28,200 KW), and Capila Plant (thermal, 9,200 KW), for a total generation capacity of 231,000 KW or sending net power of 589,423 MWH, which is far from satisfying the power demand of 1,117,064 MWH in the Study Area, the shortage being supplied from three generation plants (total capacity of 149,000 KW, net power of 668,458 MWH) in Colon, where power demand (in-

cluding Canal Area Cristobal) is only 124,485 MWH or 11% of the Study Area.

Of the total power demand of the Republic, 75% is concentrated in the Study Area, where approximately one-third is used for domestic and one-third for commercial purposes, and the remaining one-third for industrial and public purposes. It is characteristic of the Study Area that industrial use of power is very small.

Based on the data of the national census, the rate of electrification is 64.8% for the entire Republic and is 87.4% for the Study Area.

TABLE 2-32 NUMBER OF IRHE-OPERATED POWER GENERATION PLANTS AND INSTALLED CAPACITY BY TYPE, BY SYSTEM AND BY REGION

Systems and Region	Total		Hydroelectric		Thermal	
	Number of Plants	Installed Capacity (K.W.)	Number of Plants	Installed Capacity (K.W)	Number of Plants	Installed Capacity (K.W)
Total	51	527,154	7	251,160	44	275,994
Integrated Systems	18	519,140	6	250,810	12	268,330
Metropolitan Area	8	371,100	1	150,000	7	221,100
Panama	5	222,100	1	150,000	4	72,100
Colon	3	149,000	–	–	3	149,000
West Panama	1	9,200	–	–	1	9,200
Central Provinces	2	21,000	1	7,000	1	14,000
Chiriqui Provinces	7	117,840	4	93,810	3	24,030
Isolated Systems	33	8,014	1	350	32	7,664
Golfo de Panama	4	1,281	–	–	4	1,281
Colon Provinces	8	965	–	–	8	965
Darien Provinces	10	1,084	–	–	10	1,084
Central Provinces	8	1,740	1	350	7	1,390
Bocas del Toro Provinces	1	1,400	–	–	1	1,400
Chiriqui Provinces	1	175	–	–	1	175
West Panama	1	1,369	–	–	1	1,369

Source: I.R.H.E., Boletin de Estadistica Electrica, Año 1980

TABLE 2-33 INSTALLED CAPACITY OF IRHE-OPERATED POWER PLANTS BY TYPE OF POWER AND SALES BY TYPE OF USER, REPUBLIC OF PANAMA, PANAMA AND WEST PANAMA AREA (1980)

	Unit	Republic of Panama	Panama and West Panama	Percentage
Installed Capacity	K.W	527,154	231,300	43.9
Hydroelectric		251,160	150,000	59.7
Thermal		275,994	81,300	29.5
Sales	M.W.h	1,472,954 (100.0)	1,117,064 (100.0)	75.6
Residential		457,024 (31.0)	349,927 (31.3)	76.6
Commercial		479,230 (32.5)	379,339 (34.0)	79.2
Industrial		184,428 (12.5)	152,863 (13.7)	82.9
Public Lighting		31,005 (2.1)	16,684 (1.5)	53.8
Government & Municipal		281,166 (19.1)	211,174 (18.9)	75.1
Staff Quarters		9,622 (0.7)	7,077 (0.6)	73.6
Canal Commission		8,243 (0.6)	–	–
Other Enterprises		22,236 (1.5)	–	–

Source: I.R.H.E., Boletin Estadistica Electrica, Año 1980

TABLE 2-34 RATE OF HOUSES WITHOUT ELECTRIC LIGHT

1970, 1980

(Percentage)

	Republic of Panama	Study Area
1970	48.1	18.0
1980	35.2	12.6

Source: Contraloria General

(ii) Gas

In the Republic of Panama, it is only in Colon City that a city gas system is currently available. It is operated by IRHE, whose city gas system in Panama City was replaced in April 1976 by liquefied petroleum gas due to the high price and dangerously obsolete facilities of city gas. Annual consumption in the Republic of gases was approximately 750 million cubic feet, 65% of which or 490 million cubic feet was consumed in Panama Province.

(2) Water Supply and Sewer System

(i) Water Supply

In the Republic of Panama, water is supplied by Instituto de Acueductos y Alcantarillados Nacionales (IDDAN), local government, private suppliers, or community water systems.

Two water supply systems exist in the Study Area. One obtains water from the Chilibre and

TABLE 2-35 CONSUMPTION OF GAS IN THE REPUBLIC BY PROVINCE

1972 – 1979

Year and Province	Consumption of Gas (Thousands ft^3)		
	Total	By Gas Cylinder	By I.R.H.E.
1972	933,631	448,030	485,601
1973	899,051	475,964	423,087
1974	898,015	511,735	386,280
1975	893,795	598,590	295,205
1976	717,082	629,356	87,726
1977	703,352	647,394	55,958
1978	738,115	689,327	48,788
1979	750,691	709,289	41,402
Colon	93,109	51,707	41,402
Panama	491,095	491,095	–
Others	166,487	166,487	–

Source: Distributors of Gas Cylinder and I.R.H.E.

Miraflores Filtration Plants and supplies three districts; Panama, San Miguelito, and Arraijan. The

other obtains water from the Caimito River Filtration Plant and supplies an area of about 1,200 hectares around La Chorrera City.

The Panama Water System has Chilibre Plant with a purification capacity of 75 million gallons per day and Miraflores Plant with a capacity of 33 million gallons per day, for a total capacity of 108 million gallons per day. There is a plan to increase this capacity to 120 million gallons per day by the year 1985, in line with the anticipated population increases.

Two alternatives are currently under comparative study for the expansion of the existing capacity of 6 million gallons per day of the Chorrera System: the creation of a dam on the Caimito River, or the establishment of another water-taking point on Lake Gatun.

Based on the national census data, the rate of water supply coverage is 79.7% of households in the Republic and is 95.4% in the Study Area.

TABLE 2-36 RATE OF HOUSES WITHOUT POTABLE WATER
1970, 1980

	Republic of Panama	Study Area
1970	35.7	8.6
1980	20.3	4.6

Source: Contraloria General

(ii) Sewer System

Currently existing in the Republic of Panama are 17 sewer systems, 15 of which are operated by IDDAN and 2 by the United Fruits Banana Company. Overall urban area coverage is 69%. Of the 15 IDAAN systems, the Panama City and Colon City Systems drain into the sea without pre-treatment. Little problem is caused in the case of Colon City, because the point of drainage is far from the shore and tide remains rather high, but the Panama City System is causing problems.

The Panama City Drainage System was constructed at the time of Canal construction for draining both rainwater and sewage together . It drains directly into the Panama Bay. where the water drops low at ebb tide on the Pacific, causing an extremely dangerous situation from public health standpoint. This is damaging to the plans of turning the coastal area into recreational and tourist facilities. Therefore, IDAAN formulated a project for the sanitization of Casco Viejo (place where the present Panama City started and a historical memorial area) and close-by shore area, and had a feasibility study completed. Implementation of the project has been postponed in preference for water supply projects..

TABLE 3-37 RATES OF HOUSES WITHOUT SANITARY LAVATORY 1970, 1980

	Republic of Panama	Study Area
1970	28.3	6.4
1980	12.0	3.2

Source: Contraloria General

(3) Educational Facilities

The Panamanian educational system stipulates six years of compulsory education in primary school. Middle schools have six years. The first three years school courses are in common, but the latter three years they are divided into ordinary (science or liberal arts) and vocational (industry, agriculture, commerce, or teaching). Higher education is available from either universities or professional schools. Prerequisite to university education is the completion of middle school education, but no age limit is imposed. Professional schools offer courses designed to produce bilingual secretaries, tourist guides, nurses, computer programmers, and so forth.

In addition to the above, vocational and miscellaneous schools offer courses in fine arts, languages, cooking, beauty, and so forth. Special education facilities are available for the physically or mentally handicapped, operated by Instituto Panameno de Habilitacion Especial, under the assistance of the Government.

For adults with an insufficient fundamental education, literacy centers are established. According to the national census of 1980, the Republic's illiteracy rate is still 14.2% for population over nine years of age.

Education at public schools are all offered free of charge.

In the Study Area, there are 260 primary schools, 124 middle schools, and two universities (prior to the separation of the Panama Institute of Technology from the Panama National University in the second semester of 1981). The density of primary schools is one per population of 2,800, each primary school having an average of 465 children and the number of children per teacher being 30. Being in an urban area, these primary schools tend to be larger than the national average.

TABLE 2-38 SCHOOLS, REGISTERED PUPILS AND TEACHERS

1980

DISTRICT	PRIMARY			SECONDARY		
	Schools	Registered Pupiles	Teachers	Schools	Registered Pupiles	Teachers
Total	260	120,994	4,018	124	91,269	4,037
Arraijan	16	6,518	200	2	991	49
La Chorrera	59	13,343	481	15	8,753	382
Panama	156	74,065	2,458	95	69,944	3,108
San Miguelito	29	27,068	879	12	11,581	498

Source: Ministerio de Educacion

Both the Panama National University (and the Panama Institute of Technology) and the private Santa Maria University are located in Panama City. In addition to the main campus in Panama City, the Panama National University has six more campuses in the provinces. Extension courses are also offered regularly at various locations, one of which being offered in La Chorrera, in the Study Area. Santa Maria University also has two local campuses.

The total number of registered university students in the Republic is 40,443 of which 77% or 31,324 are concentrated in Panama City. The Panama National University (including the Panama Institute of Technology) has 27,887 students on the main campus (about half attending day courses and the other half, night courses; about 80% of the local students attend night courses), and Santa Maria University has 3,437 students on the main campus (70% attending night courses).

TABLE 2-39 REGISTERED STUDENTS OF UNIVERSITIES FIRST SEMESTER OF YEARS 1978–1980

Location	University of Panama			Santa Maria University		
	1978	1979	1980(P)	1978	1979	1980(P)
Total	32,386	34,294	36,067	2,580	3,591	4,376
Main Campus (in Panama City)	25,844	27,087	27,887	1,916	2,737	3,437
Regional Centers	6,542	7,207	8,180	664	854	939

Source: Universidad de Panama y Santa Maria La Antigua

TABLE 2-40 SPACE CAPACITIES OF UNIVERSITY OF PANAMA 1979

Location	Academic Spaces (Number of rooms)			Total Floor Area (M^2)	Total Capacity (Number of Students)		
	Total	Lecture Rooms	Labo-ratories		By Standard	Existing Use	Balance
Total	616	462	154	50,802	22,579	28,413	Δ 5,834
Main Campus	399	273	126	35,608	15,780	19,269	Δ 3,489
Regional Centers	217	189	28	15,194	6,799	9,144	Δ 2,345

Source : Universidad de Panama

There is strong pressure for expanding the existing university campuses, which have been saturated by the rapid increases of students in recent years.

(4) Medical Facilities

In the Republic of Panama, a total of 522 medical facilities exists as of 1980, 47 of which are general hospitals. A total of 7,345 beds are installed in the general hospitals and some of the 145 dispensaries, for an average of 3.8 beds per population of 1,000. Total number of physicians is 1,821, for an average of 9.4 physicians for every 10,000 people.

In the Study Area in 1978, there were 13 general hospitals, eleven of which were in Panama City, one in Corregimiento de Las Cumbres in the suburb of Panama City, and one in La Chorrera. Beds counted 3,835, or an average 5.2 for every 1,000 people, and physicians counted 1,054, or an average 14.4 for every 10,000 people. Concentration in Panama City is high of medical facilities: 91.9% of beds and 89.7% of physicians.

TABLE 2-41 PUBLIC HEALTH FACILITIES IN THE REPUBLIC OF PANAMA 1978–1980

Year	Total Number of Health Insitutions	Of which Integrated Medical Centers and Hospitals	Number of Beds and Cots	Physicians	Dentists	Nurses
1978	356	45	6,954	1,550	250	1,337
1979	395	46	7,042	1,686	256	1,377
1980 (P)	522	47	7,345	1,821	275	1,496

Source: Public and Private Health Institutions

TABLE 2-42 PUBLIC HEALTH FACILITIES IN THE STUDY AREA AND PANAMA CITY 1978

District	Integrated Medical Centers and Hospitals	Number of Beds and Cots	Physicians	Dentists	Nurses
Total	13	3,835	1,054	129	910
Arraijan	–	–	5	2	3
La Chorrera	1	293	55	8	40
Panama	12	3,542	954	110	850
San Miguelito	–	–	40	9	17
Ciudad de Panama	11	3,526	945	107	839

Source: Contraloria General, Situacion Social, Asistencia Social, Año 1978

Of the 13 general hospitals, large ones are the National Mental Hospital (891 beds) in Corregimiento de Juan Diaz, the Santo Tomas Hospital (882 beds) and the Children Hospital (565 beds) both in Corregimiento de Calidonia, the Social Insurance Hospital (804 beds) in Corregimiento de Bella Vista, and Nicolas Solano Hospital (393 beds) in La Chorrera City, and the remainder are medium or small-sized hospitals with about 100 beds or less.

The number of out-patients in 102,527 per year at the Santo Tomas Hospital and 139,502 per year at the Children Hospital, the daily average being from 300 to 400.

(5) Dwelling Houses

The total inventory of dwelling units in the Study Area is 162,058, of which 62% or 100,600 are detached houses, 23% or 37,900 are apartment houses, and 15% or 23,500 are neighborhood houses. It is in Panama City that apartment houses and neighborhood houses are abundant, the former being 33% of total and the latter, 19%.

Some of the neighborhood houses were built recently, but a great majority of them are worn out two-story wooden buildings erected for laborers at the time of Canal construction. Each family occupies one room and shares lavatories and bathrooms. This type of houses are concentrated in Centro of Panama City, and more than 60% of the houses in Corregimiento de San Felipe and El Chorrillo are of this type. The ratio of occupants-owned houses is high at 63%, the ratio of rented houses being 31%, and condemned houses, 7%.

In the Study Area, 40% of all houses were constructed within the last ten years. Particularly in San Miguelito District, where urbanization has been vigorously progressing, 65% of all houses were built within the last 10 years and 40% or more, since 1975. Also, in Arraijan District, 55% were built since 1970. Dwelling house construction work has been active recently in both San Miguelito and Arraijan Districts, which are starting to become a suburb of Panama City. The ratio of newer houses is also high in Corregimientos de Juan Diaz, Pedregal, Las Cumbres, and Tocumen. Dwelling houses constructed in these four corregimientos by private contractors in 1979 totalled 610 (619 units). Total floor space was 54,631 square meters (an average of 88.3 square meters per unit), and average construction cost was 124.0 dollars per square meter.

TABLE 2-43 TYPE AND OWNERSHIP OF OCCUPIED HOUSES IN THE REPUBLIC OF PANAMA AND STUDY AREA 1980

	Republic of Panama	Study Area
Total of Occupied Houses	364,325	162,058
Type of Houses		
Individual House	279,670	100,600
Apartment	46,765	37,900
Neighborhood House	37,890	23,500
Ownership of Houses		
Self-owned	254,905	101,300
Rented	76,590	49,900
Others	32,830	10,800

Source: Contraloria General

TABLE 2-44 TYPE AND OWNERSHIP OF OCCUPIED HOUSES IN THE STUDY AREA BY DISTRICT 1980

	Study Area Total	Arraijan	La Chorrera	Panama	San Miguelito
Total of Occupied Houses	162,058	7,790	13,737	109,835	30,696
Type of Houses					
Individual House	100,600	7,300	11,900	52,600	38,800
Apartment	37,900	100	500	35,900	1,400
Neighborhood House	23,500	400	1,300	21,300	500
Ownership of Houses					
Self-owned	101,300	6,500	10,200	56,400	28,200
Rented	49,900	900	2,700	44,500	1,800
Others	10,800	400	800	8,900	700

Source: Contraloria General

TABLE 2-45 PERCENTAGE DISTRIBUTION OF HOUSES BY YEAR OF CONSTRUCTION IN STUDY AREA AND IN SOME OF ITS DISTRICTS

Year of Construction	Study Area	Arraijan	La Chorrera	Panama	San Miguelito
1969 and before	44.0	32.0	43.4	49.1	28.5
1970	3.6	4.7	3.9	2.9	5.5
1971	2.5	2.0	2.6	2.2	3.6
1972	3.5	4.8	5.0	2.8	4.9
1973	2.9	3.1	3.8	2.6	3.4
1974	3.7	4.2	3.9	3.4	4.3
1975	4.8	5.3	4.7	4.6	5.7
1976	4.4	6.6	4.4	3.2	8.1
1977	4.7	6.8	4.4	3.5	9.0
1978	4.0	7.2	3.9	2.8	7.7
1979	4.5	7.2	5.1	3.0	9.1
1980	1.3	2.9	1.7	0.8	2.4
Unreported	16.2	13.1	13.1	19.1	7.7

Source: Contraloria General

TABLE 2-46 PERCENTAGE DISTRIBUTION OF HOUSES BY YEAR OF CONSTRUCTION IN SOME CORREGIMIENTOS IN PANAMA DISTRICT

Year of Construction	Juan Diaz	Pedregal	Las Cumbres	Tocumen
1969 and before	36.1	30.2	28.2	20.1
1970 – 1974	18.9	13.4	18.8	20.4
1975 – 1980	35.2	38.1	43.0	46.5
Unreported	9.7	18.3	10.1	12.9

Source. Contraloria General

CHAPTER 3.

EXISTING ROAD FACILITIES

3. EXISTING ROAD FACILITIES

1) Road Network

The total extension of roads existing in the Republic of Panama is 8,378 kilometers, of which 559 kilometers are portland cement concrete roads, 402 kilometers are asphalt concrete paved, 1,886 kilometers are of asphalt treated surface, and the remaining 5,531 kilometers are gravel or dirt roads.[1)] The pavement standards prescribed by the Ministry of Public Works (MOP) are shown in Table 3-1.

The road network covering the Planning Area and vicinity is shown in Figure 3-1. Pan American Highway (Route No.1) connects Chepo District, Corregimiento de Pacora, and Corregimiento de Tocumen with the Panama City. Feeder roads such as Routes 77 and 79 are practically all used for agricultura/livestock activities and are connected with Old Pan American Highway, which also connects those Corregimientos with the Panama City. The section of Pan American Highway between Omar Torrijos Herrera International Airport and Via Transistmica is called Via Domingo Diaz and has recently been upgraded from a 2-lane to a 4-lane road. The section from Corregimiento de Tocumen to Chepo District, an extension of 37.1 kilometers, is a 2-lane road and was completely paved with Portland cement concrete in 1977. Via Jose Agustin Arango, now being upgraded to a 4-lane road, connects Juan Diaz-Pedregal with Panama Urban Area.

Pan American Highway connects La Chorrera and Arraijan with Panama City. A 4-lane toll road with a wide center median, called Autopista, was completed in 1981 under financing by the Inter-American Development Bank as a by-pass between La Chorrera and Arraijan for an extension of 20.8 kilometers. Its extension via north of Panama City and up to Via Transistmica is planned under financing by the Venezuelan Government. In the southwest part of Panama City, Pan American Highway is connected with a coastal reaas via Routes 716, 72 and via Puerto Vacamonte, and with inland areas via Routes 73, 82, 75, 719, and 24.

Via Transistmica (Route #3) connects Colon City with Panama City and is th road which connects Corregimiento de Chilibre, Alcalde Diaz and San Miguelito District with Panama City. The upgrading of Transistmica Highway to I 4-lane road has been completed for about 3.3 kilometers northwards from its intersection with Via Domingo Diaz and is now progressing starting from Colon City toward Panama City. Major feeder roads connecting to Via Transistmica are Routes 725, and 727 and Madden Road. Routes 725 and 727 are being used not only for agricultural/livestock activities but also for the Portland cement industry, which utilizes limestone found in this region. Madden Road leads from Madden Lake (which was constructed for the purpose of supplying water to the Canal) and goes through the forest reserve in the Canal Area up to Gaillard Highway, and its route nearly coincides with the former Trans-Isthmus Road, (Which is mostly disused).

The total extension of roads existing in the Planning Area is approximately 1,290 kilometers,

TABLE 3-1 PAVEMENT STANDARD BY TRAFFIC VOLUME

Pavement	Traffic Volume per Day
Asphalt / Cement Concrete	more than 1000
Asphalt Treatment	100 – 1000
Gravel	50 – 350
Earth	less than 50

Source : MOP

of which about 530 kilometers are paved roads (cement concrete or asphalt concrete), about 350 kilometers are asphalt treated, and 410 kilometers are gravel or dirt roads. The breakdown of these roads by zone is presented in Table 3-2.

The total extension of roads existing in Panama Urban Area is 342 kilometers, of which about

TABLE 3-2 ROAD BY TYPE OF SURFACE AND BY CORREGIMIENTO

(Kilometer)

Zone	Corregimiento	Total Length	Cement Concrete	Asphalt Treatment	Asphalt Concrete	Brick	Selected Material	Gravel	Earth
01	San Felipe	11.13	1 83	2.76	2 69	3 85			
02	Chorrillo	8 73	4.03	2 01	2 69				
03	Santa Ana	11.34	4.21	1 99	4 68	0.46			
04	Calidonia Sur	8.42	5 80	0 20	2 42				
05	Calidonia Norte	19.26	11 17	0.76	7.22		0 11		
06	Curundu	3.53	1 68	0 37	1.42			0 06	
07	La Cresta	11.25	6 41		4 84				
08	Urraca-Campo Alegre	19.02	8.11	0 80	10.11				
09	Obarrio	15.15	8 22		6 93				
10	El Cangrejo	21.48	13 08	0 26	8 14				
11	Punta Pantilla	10 63	8 01	0 14	0 58		1 90		
12	San Francisco	21 00	6 42	6 03	6.71		1 84		
13	El Golf	9.13	3.17	3.59	1.26		1 11		
14	Vista Hermosa	9 99	5 82	0.71	2 23		1 23		
15	Pueblo Nuevo	14 70	5 66	6.19			1.75	0 45	0 65
16	Loceria	13 45	11.48	1.52	0 45				
17	El Dorado	37.70	37 35	0 31	0 04				
18	Betania	24 96	16 25	4.34	3 55		0 34	0.48	
19	Parque Lefevre	29.92	7 26	10 06	4 86		3.78	1 67	2 29
20	Chanis	11 34	5 08	4.96			0 22	1.08	
21	Rio Abajo	17 08	5.71	5.14	4 63		0 52	1 08	
22	Villa Lorena	12 87	3 88	4.56	1 21		0 82	2.40	
23	Hopódromo	9 40	4 27	0.78	3.10		0 90		0 35
24	Juan Diaz	42.59	6 85	13 65	3.29		9.25	9 25	0.30
25	Pedregal	54.27	6 42	17.00	2.30		8 05	16.70	3 80
26	Nuevo Aeropuerto	1 40						1.40	
27	Tocumen	35.55	8 60	5 50	8 40			9.70	3.35
28	Area de Paraiso	18.72	6 02	6 84	2.45		1 65	1.25	0 51
29	Amelia D. de Icaza	18 02	2 48	6 95	4.70		0 67	3.22	
30	Samaria	4 43	0.48	1.10			1.20	1 65	
31	San Isidro	7.80		4 65			2 80	0.35	
32	Los Andes N°2	0.50		0 50					
33	La Pulida	10.36	6.21	0 20	3.95				
34	Cerro Viento	16 27	16.27						
35	Las Cumbres	61.20	9.70		49 83				1.67
36	Chilibre	19.73	18 07						1.66
37	Fuerte Amador	3.57	3 5 4						
38	La Boca	1 02	1.02						
39	Balboa	9.20	9 20						
40	Albrook Field								
41	Fuerte Clayton	22 60	22.60						
42	Pedro Miguel	5.70	5 70						
43	Cocoli	37.33	1.6		35.73				
	Cab. Arraijan y sus								
44	Poblados	82.69	0.95	42 09	4.60		35.05		
45	Veracruz	26.30		26.30					
46	Nuevo Arraijan	65.73	8 40	38 22	6.70		12 41		
47	Puerto Caimito	74.23		66.76	5 47		2 00		
48	Balboa	65.11		59.01	2.40		2 50		1.20
49	Area de Guadalupe	38 21		4.45	5.30		27.34		1.12
51	Area Nvo. Emperador	17.21					17.21		
52	Area de Mendoza	136.22		28 20			63 95		44 07
53	Santa Rita	121.27		19.75	5 50		34.74		61 28
55	Capira	459.11	25.95	121.85	35 40		57 01		218.90
61	Provincia de Cocle	7.70		7.70					
Total		1,815.52	344 99	528 20	255.78	4.31	290.35	50.74	341.15

Source : ESTAMPA

Note: 1) According to information from Direccion de Mantenimiento, MOP, Mayo de 1981.

85 kilometers represent the roads considered as arterials (Fig. 3-2, Table 3-4). Of said total, 55.4 kilometers are 4-lane or wider roads (Fig. 3-3), and about 28 kilometers are 4-lane roads with center median. The extension of 4-lane or wider roads in the Planning Area is 93.8 kilometers (Fig. 3-4).

The extension of 4-lane or wider roads in the Planning Area is 93.8 kilometers. The names and the lengths of 4-lane or wider roads existing outside Panama Urban Area are listed in Table 3-3.

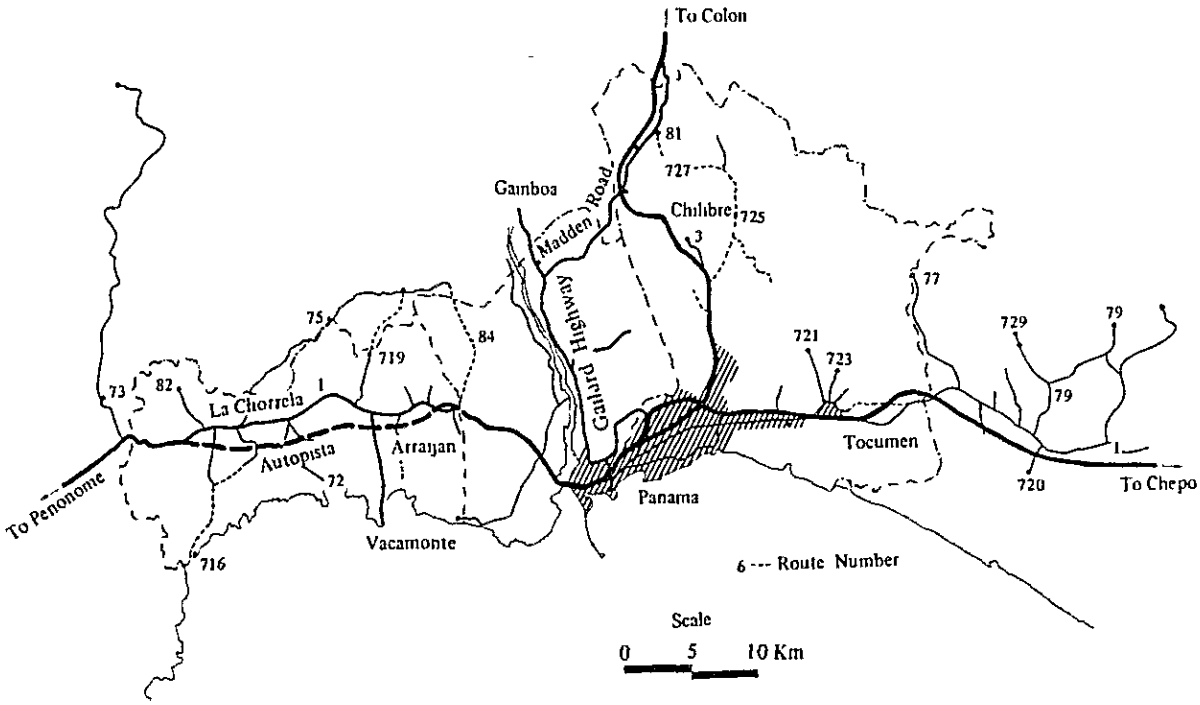


FIG. 3-1 ROAD NETWORK IN PLANNING AREA

Source : ESTAMPA

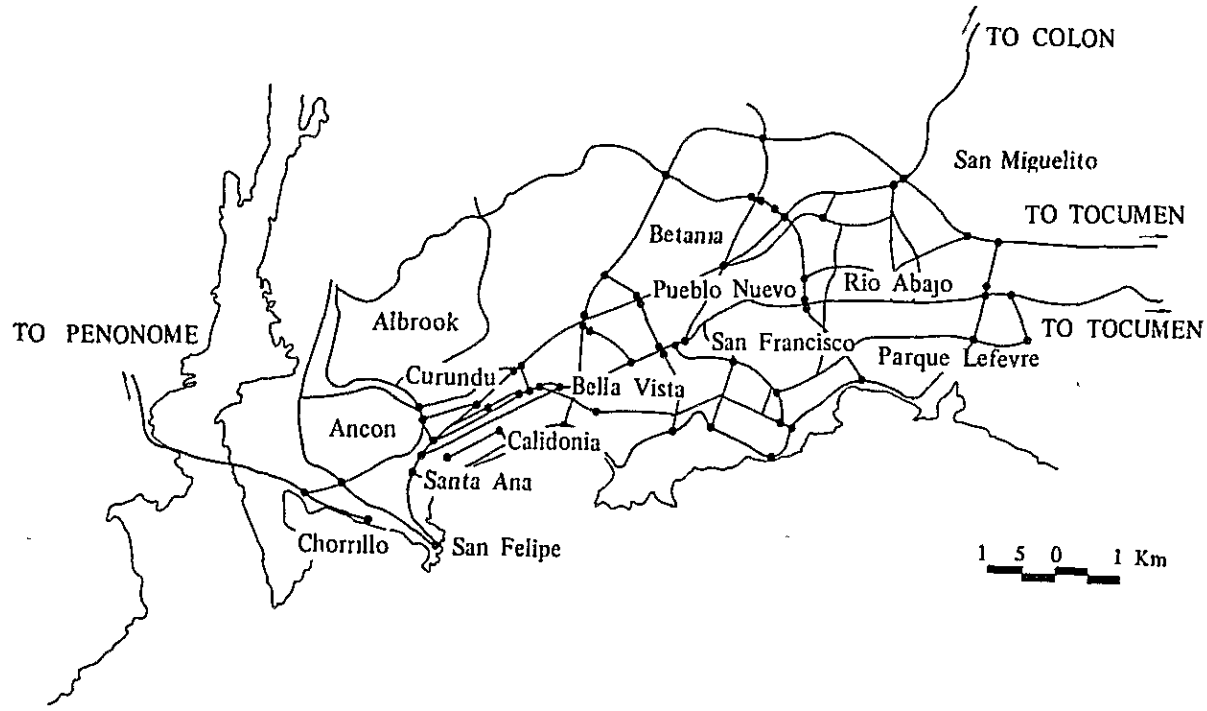


FIG. 3-2 MAIN ROADS IN PANAMA URBAN AREA

Source : ESTAMPA

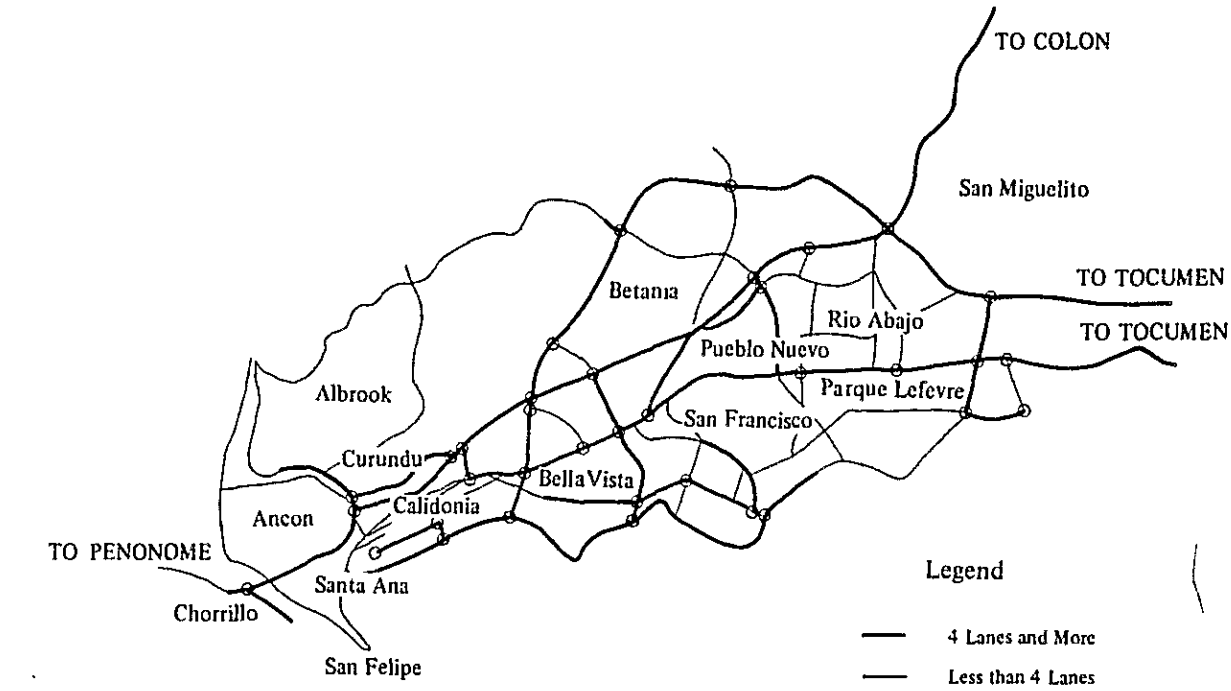
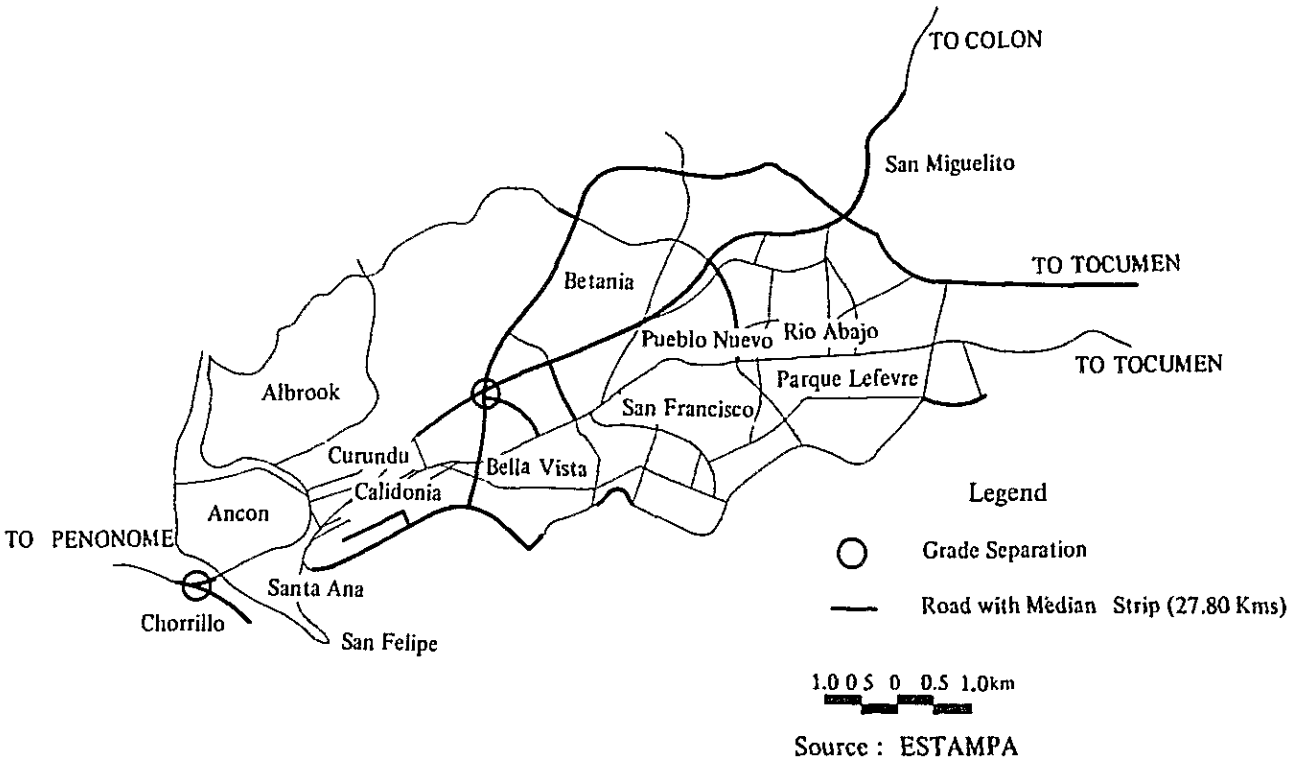


FIG. 3-3 ROADS WITH 4 LANES AND MORE IN PANAMA URBAN AREA



Source : ESTAMPA

FIG. 3-4 FOUR LANE ROADS WITH MEDIAN STRIP IN PANAMA URBAN AREA

2) Road Facilities

(1) Road Facility Standard

No universal road facility installation standard nor geometric design standard exists in the

TABLE 3-3 MULTI-LANE ROADS IN THE SUBURBAN AREA

	Road	No. of Lane	Extention	Route	Remarks
1.	Autopista	4	10.5 Km	La Chorrera-Arraijan	Toll Road
2.	Route 3	4	3.3	Intersection of Route 3 at San Miguelito-San Isidro	
3.	Domingo Diaz (Route 1)	4	12.5	Via Boyd Roosevelt-International Airport	
4.	Via España	4	2.1	Urb. Los Pinos-Hipodromo	no intermedian
Total			28.4 Km		

Source : ESTAMPA

Republic of Panama, where such standards are decided by project based on either ASSHO, the Mexican standards, or the Costa Rican standards depending on the characteristic of the road. Presented in Table 3-5 are standards used for some example projects; they are minimum standards with no relationship with traffic volume. The standard agreed upon by the Ministry of Housing and the Ministry of Public Works provides only for road with composition, without providing for road alignment or traffic control at intersections.

According to the law of 1944, which provided for the width of road right-of-way, road width, and the construction line within which private or public buildings were restricted and which has subsequently been amended, the construction line is stipulated as 15 meters from road center (or, in Centro, where the 15-meter construction line may not be secured, 10 meters from road center), and road to be newly constructed must have a width of at least 25 meters and a construction line of 15 meters or more from road center. Further details are provided for Panama Urban Area (see Fig. 3-5 for major road width, road right-of-way width, and Fig. 3-6 for relationship between road width and construction line in Panama Urban Area).

TABLE 3-4 MAIN ROADS IN THE PANAMA URBAN AREA

No.	Name	m	No. of Lane	No of Way	Remarks
1	Avenida "A"	1,750	3	2	
2	Ave. de los Poetas	750	4	2	W.M.S.
3	Ave. Central	1,880	2–4 *	1	
4	Ave. 78 Central	360	4 *	1	Perejil
5	Ave. Peru	1,560	4 *	1	
6	Ave. J. Arosemena	2,100	4	2	
7	Ave. Balboa	4,710	4	2	W.M.S.
8	Via Israel	810	4	2	W.M.S.
9	Via Israel	1,140	4	2	
10	Ave. Mexico	750	4	2	W.M.S.
11	Ave. Faco. Boyd	630	4	2	W.M.S
12	Ave. M.E. Batista	930	4	2	W.M S.
13	Calle M. Sosa	380	4	2	
14	Ave. Nacional	750	3 *	1	
15	Ave. L F. Clement	1,450	3 *	1	
16	Ave. Jose D. Espinar	750	3 *	1	
17	Ave. Simon Bolivar	11,040	4	2	W.M S
18	Ave. R.J. Alfaro	7,020	4	2	W.M.S
19	Via España	7,900	4	2	
20	Calle 50	600	2 *	1	
21	Calle 50	3,240	4	2	
22	Via Argentina	1,050	4	2	W.M S.
23	Via Ramon Arias	900	4	2	W.M S.
24	Via El Paical	600	2	2	
25	Via Brasil	1,070	4	2	
26	Via Porras	1,330	4	2	
27	Via Porras	1,070	2	2	
28	Via F de Cordoba	3,030	4	2	
29	Via F. de Cordoba	1,770	2	2	
30	Ave. La Pulida	2,620	2	2	
31	Ave. La Paz	2,090	2	2	
32	Calle 74 Oeste	1,620	2	2	
33	Calle Domingo Diaz	520	2	2	
34	Ave. 11 de Octubre	1,430	4	2	W.M.S.
35	Ave. Ernesto T. Lef.	1,580	4	2	
36	Ave. Santa Elena	3,270	2	2	
37	Ave Los Martines	1,280	4	2	
38	Paseo Cincuentenario	2,270	4	2	
39	Paseo Cincuentenario	2,080	2	2	
40	Paseo Cincuentenario	670	4	2	
41	Ave. Santa Elena	910	4	2	
42	Calle 11 Este	700	2 *	1	Chanis
43	Ave. Cincuentenario	950	4	2	
44	Gaillard Highway	1,140	4	2	to 15 road
Total		84,450			

Note : W.M.S = with Center Median
* = one way

Source ESTAMPA

TABLE 3-5 GEOMETRIC DESIGN STANDARDS

	MOP Highway Design Standards			Roads Program MOP-BID		MOP Road Improvement Standards
	Primary	Secondary	Local	Flat Area	Mountain Area	
Design Speed (km/h)	80	50	40	50	30	40
Pavement Width (m)	6.1	6.0	5.0	6.6	6.6	5.0
Shoulder Width (m)	1.5	0.6	–	0.7	0.7	0.5
Minimum Radius (m)	130	30	30	75	30	40
Maximum Gradient (%) and Dist. Limit	5	8	12	12% 200m 10 500m 8 1000m	15% 150 12 200 10 500 8 1000	10
Minimum Sight Distance (m)	85	40	40	50	50	
Minimum Vertical Curve Radius (m)	–	–	–	40	40	–
Median Strip (m)	–	–	–	–	–	–
Right of Way (m)	–	–	–	50.0	50.0	–
Bridge Loading	AASHO Hs 15–44			AASHO H-15 or Hs-15 H-20 Hs-20		

Source . MOP. (Ministerio de Obras Publicas)

All roads existing in the Planning Area have at least two lanes, each lane having a width of at least 2.5 meters. However, they are not free from factors hindering the flow of traffic, such as the fact that their horizontal alignment gives no wider width at curves and the lack of shoulder pavement, sidewalks, and effective draining facilities.

The locations of roads in the Planning Area and their widths are shown in Fig. 3-7 and Table 3-6. Also, the locations of roads in Panama Urban Area and their widths are shown in Fig. 3-8 and Table 3-7.

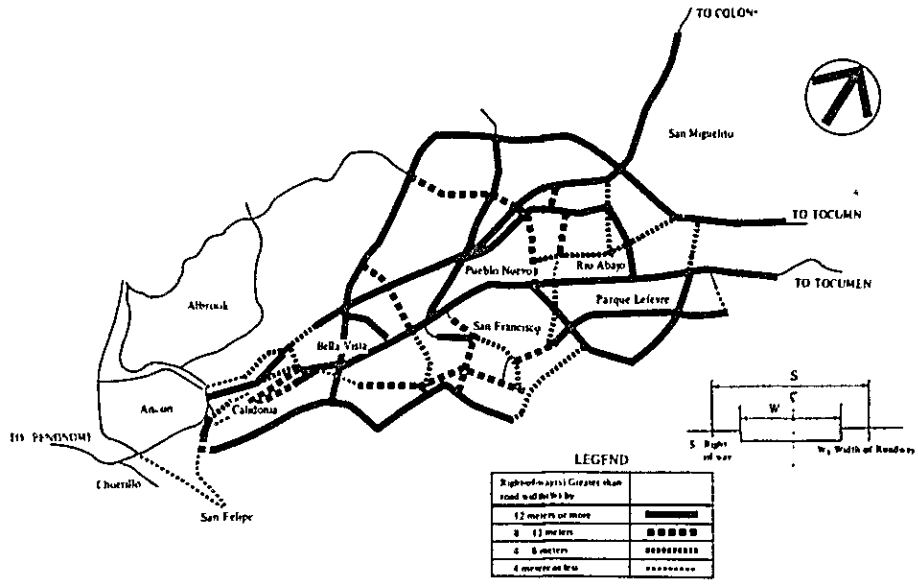


FIG. 3-5 RIGHT-OF-WAY OF EXISTING ROADS

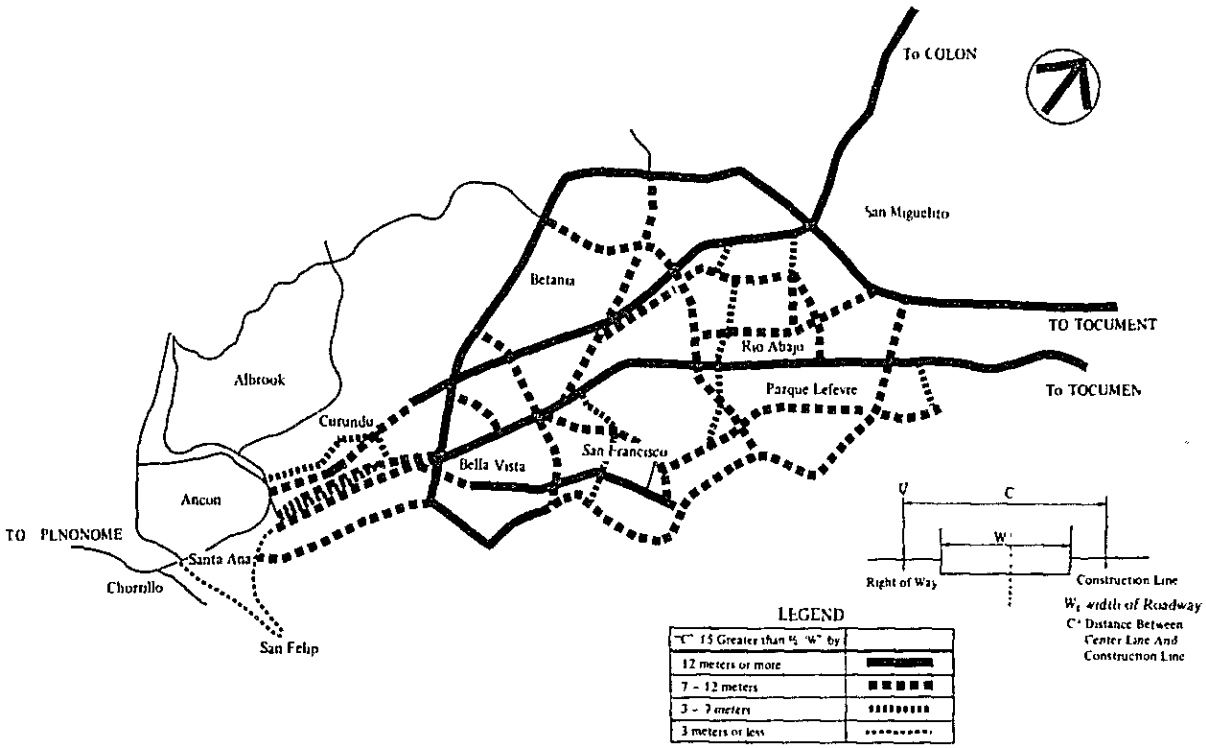
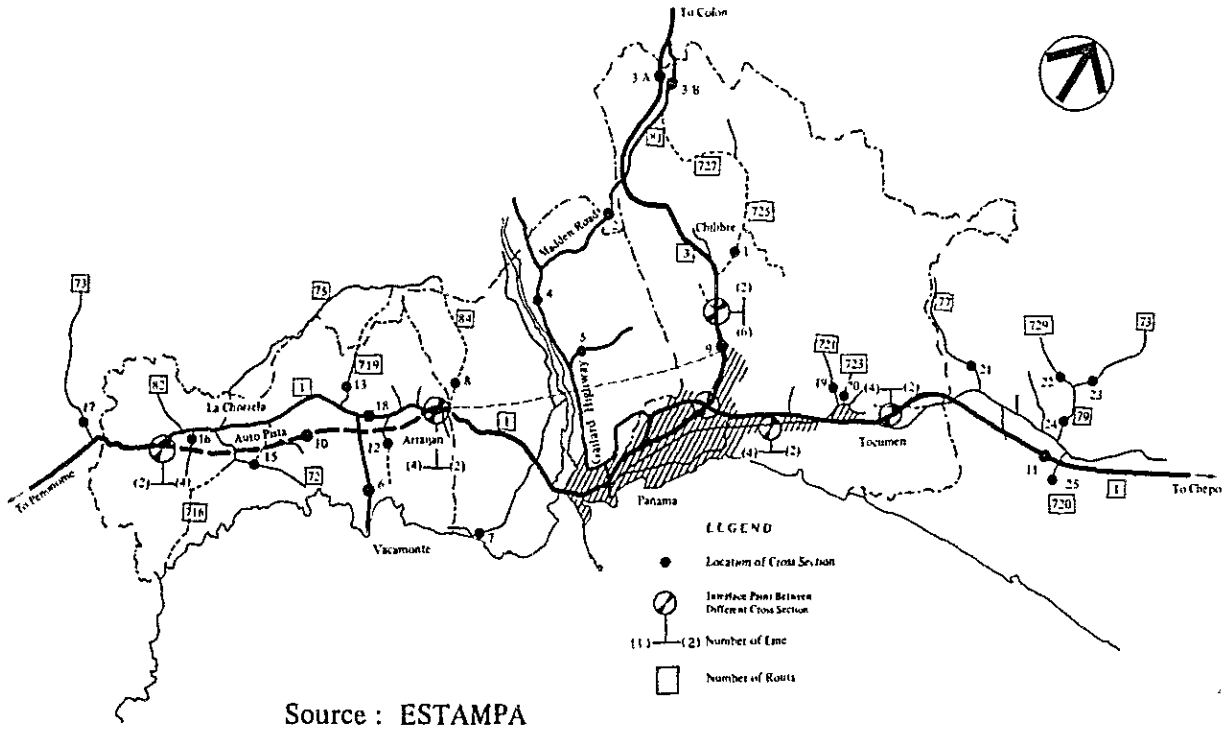


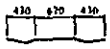
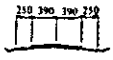
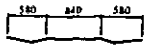
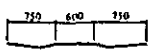
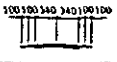
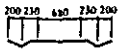
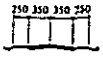
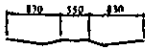
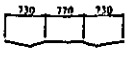
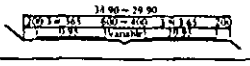
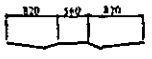
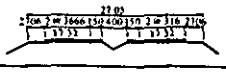
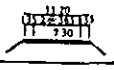
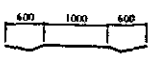
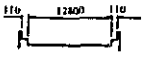
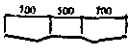
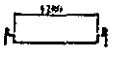
FIG. 3-6 ROADSIDE CLEARANCES BY CONSTRUCTION LINES



Source : ESTAMPA

FIG. 3-7 LOCATIONS OF ROAD CROSS SECTION IN THE PLANNING AREA

TABLE 3-6 CROSS SECTION OF MAIN ROADS IN THE PLANNING AREA

No	NAME OF THE ROAD	TIPICAL CROSS SECTION	No	NAME OF THE ROAD	TIPICAL CROSS SECTION
1	ROUTE 725 (CHILIBRE)		14	ROUTE 75 (RIO CONGO)	
2	MADDEN		15	ROUTE 72 (PUERTO CAIMITO)	
3-A	VIA TRANSISTMICA (CHILIBRE)		16	ROUTE 716 (PLAYA LEONA)	
3-B	ROUTE 81 (CHILIBRE)		17	ROUTE 73 (LA ARENOSA)	
4	GAILARD HIGHWAY		18	ROUTE 1 (NUEVO ARRAIJAN)	
5	CHIVO CHIVO		19	ROUTE 721 (VILLA ROBOS)	
6	VACAMONTE		20	ROUTE 723 (ALTOS DE TAPIA)	
7	ROUTE 724 (VERACRUZ)		21	ROUTE 77 (CERRO AZUL)	
8	ROUTE 84 (ARRAIJAN-NUEVO EMPERADOR)		22	ROUTE 729 (UTIVE)	
9	VIA TRANSISTMICA (SAN MIGUELITO)		23	ROUTE 79 (SAN MIGUEL)	
10	AUTOPISTA		24	ROUTE 79 (ENTRADA UTIVE YA SAN MIGUEL)	
11	ROUTE 1 (TOCUMEN-CHEPO)		25	ROUTE 720 (PACORA)	
12	ROUTE 760 (BIQUE)		26	BALBOA BRIDGE	
13	ROUTE 719 (CHAPALA)		27	AUTOPISTA BRIDGE	

Source : ESTAMPA

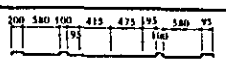
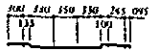
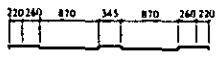
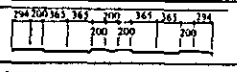
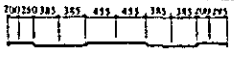
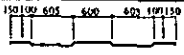
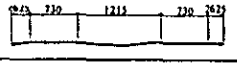
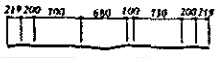
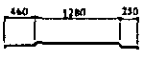
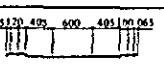
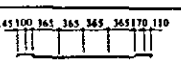
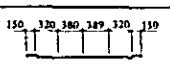
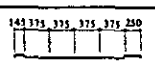
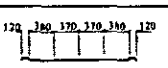
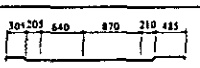
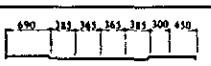
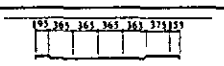
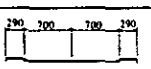
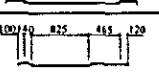
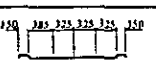
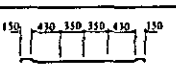
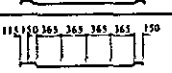
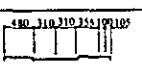
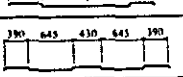
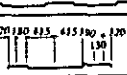
(2) Intersection

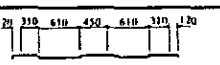
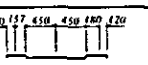
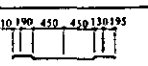
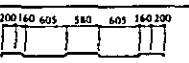
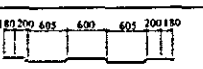
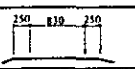
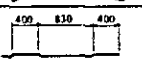
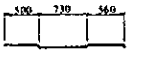
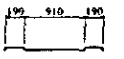
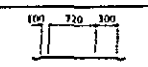
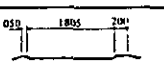
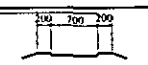
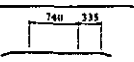
A total of about 80 intersections exist in Panama Urban Area, of which No. 33 and No. 72 are of grade separation and No. 72 is round-about type. These three intersections were constructed from the latter half of the 1960s to the first half of the 1970s, since then no grade-separated intersections have been constructed. At many intersections, the rounding off of the corners is insufficient and, therefore, vehicles making left or right-turns cannot complete the turn without bulging out into other lanes. About 20 intersections have lanes for left or right turn, but they are generally short in length and few of them are installed on superior roads. At intersections No. 9 and No. 45, the road turns sharply, making the driver's sight distance very short. The locations of major intersections are shown in Fig. 3-9, and intersection intervals, in Fig. 3-10.

(3) Bridge

In Panama Urban Area, bridges are required at several locations, generally for a short distance, except for American Bridge over the Panama Canal, which is 1,653.5 meters long and has a maxi-

TABLE 3-7 CROSS SECTION OF ROADS IN PANAMA URBAN AREA

No.	NAME OF THE ROAD	TIPICAL CROSS SECTION
1	AVE. J. Fco DE LA OSSA	
2	AVE LUIS FELIPE CLEMENT	
3	VIA TRANSISTMICA	
4	*VIA TRANSISTMICA*	
5	AVE BALBOA	
6	MANUEL ESPINOSA BATISTA	
7	VIA RICARDO J ALFARO	
8	VIA DOMINGO DIAZ	
9	VIA ESPANA	
10	*VIA JOSE A ARANGO*	
11	VIA ISRAEL	
12	VIA CINCUENTENARIO	
13	VIA CINCUENTENARIO	
14	VIA CINCUENTENARIO	
15	VIA CINCUENTENARIO	
16	*AVE PERU*	
17	AVE. JUSTO AROSEMENA	
18	CALLE 50	
19	CALLE 50	
20	VIA SANTA ELENA	
21	VIA MARTIN SOSA	
22	VIA PORRAS	
23	VIA FERNANDEZ DE CORDOBA	
24	VIA FERNANDEZ DE CORDOBA	
25	VIA BRASIL	
26	VIA RAMON ARIAS	
27	AVE. ERNESTO T. LEFEVRE	

No	NAME OF THE ROAD	TIPICAL CROSS SECTION
28	AVE. 11 DE OCTUBRE	
29	AVE JUAN RIVERA REYES 74 OESTE	
30	*AVE. JUAN RIVERA REYES 74 OESTE*	
31	VIA FEDERICO BOYD	
32	VIA ARGENTINA	
33	DIABLO ROAD	
34	AVE. ROOSEVELT	
35	AVE. ROOSEVELT	
36	BALBOA ROAD	
37	*CLAYTON ROAD*	
38	CLAYTON ROAD	
39	VIA CURUNDU	
40	GAILLARD HIGHWAY	
41	GAILLARD HIGHWAY	
42	DIABLO ROAD	
43	AMADOR	
44	AVE DE LOS POETAS	
45	CALLE 17 OESTE	
46	AVE. JUSTO AROSEMENA	
47	CALLE 50	
48	VIA PORRAS	
49	*CALLE J*	
50	CALLE MONTE OSCURO	
51	CALLE MONTE OSCURO	
52	VIA LA PULIDA	
53	VIA LA PULIDA	

Source : ESTAMPA

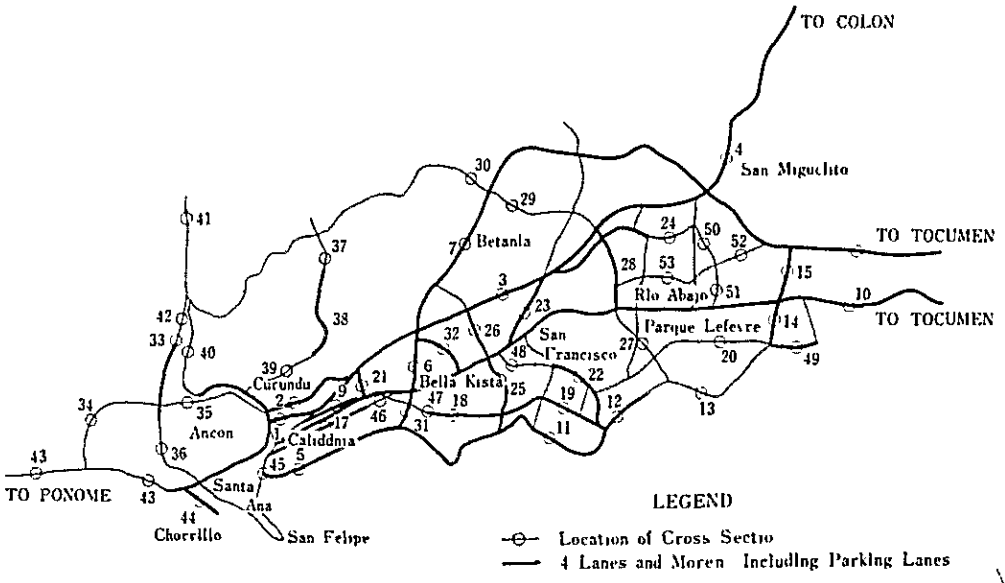


FIG. 3-8 LOCATIONS OF ROAD CROSS SECTION IN PANAMA URBAN AREA

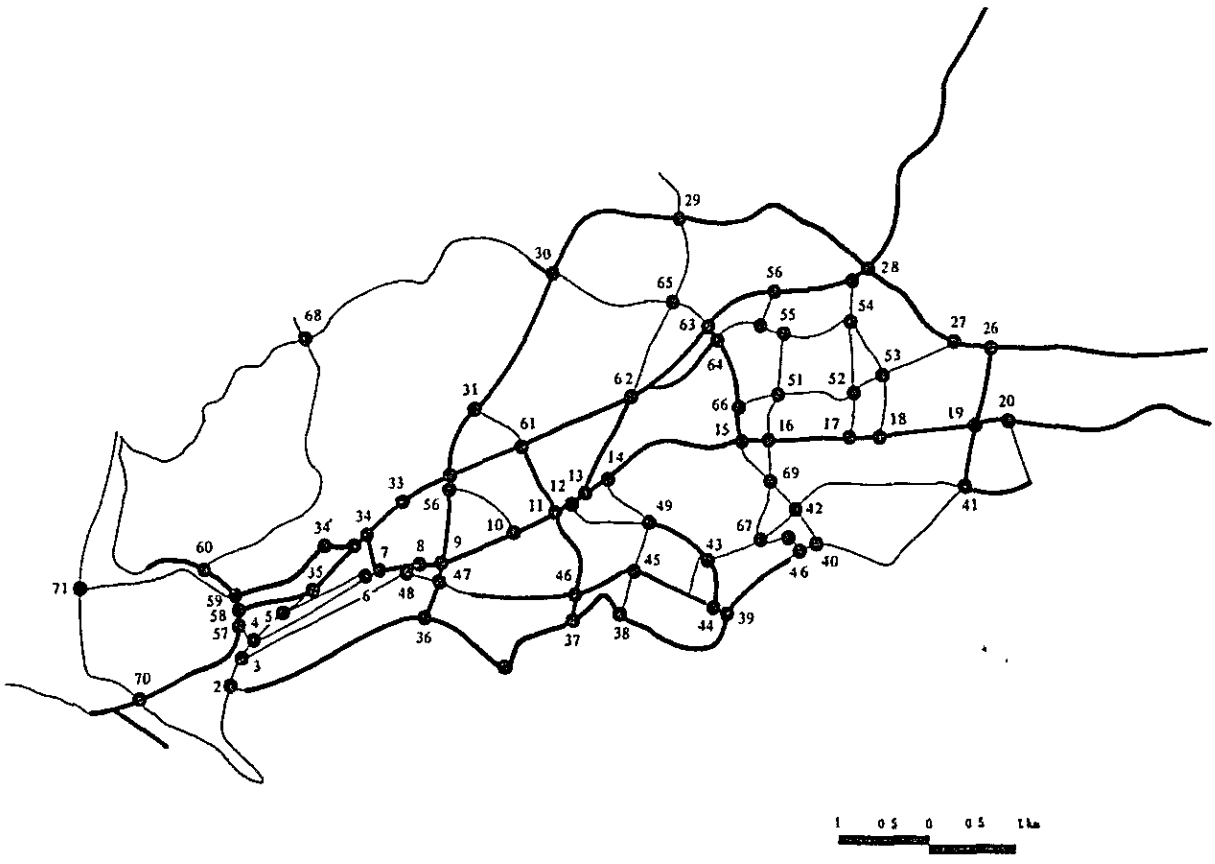


FIG. 3-9 LOCATION OF INTERSECTIONS IN PANAMA URBAN AREA

mum span of 343.8 meters. The central span is a 4-lane (3-lane in other parts) road, but due to the passage of over-loaded trucks the bridge floor panels have cracks at intervals of 30 to 50 meters, with some cracks throughout the thickness of the panel.

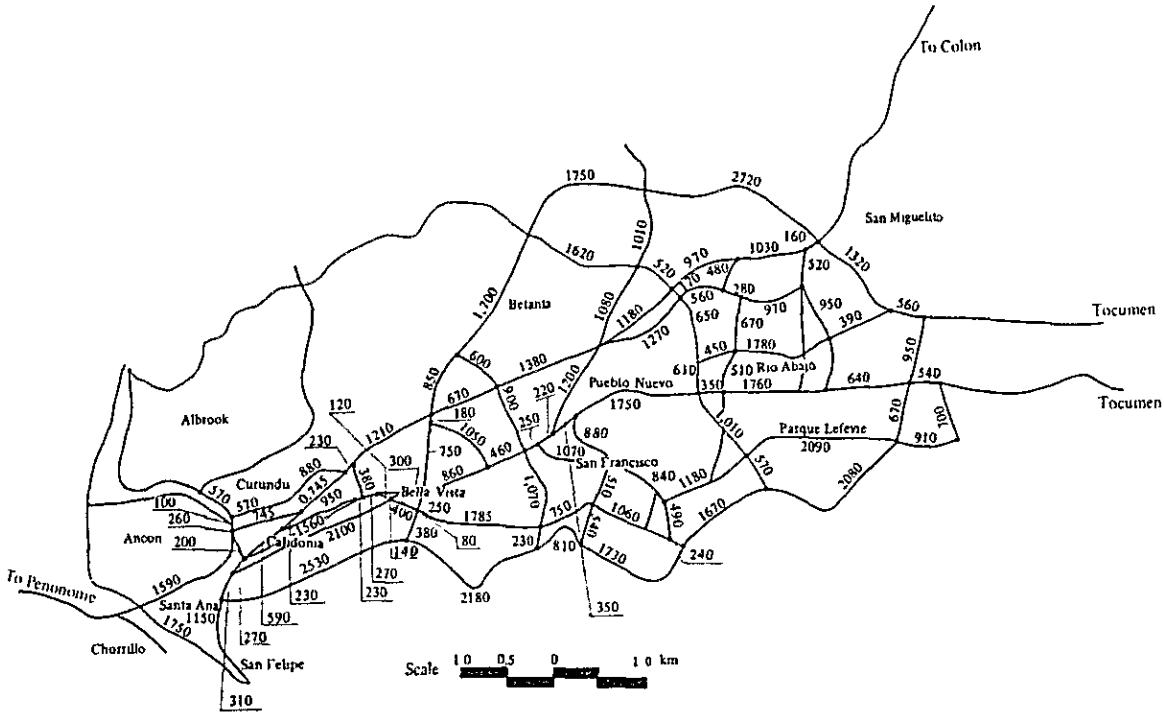


FIG. 3-10 ROAD LENGTH BETWEEN INTERSECTIONS

Source : ESTAMPA

(4) Ancillary Facilities

(i) Sidewalk

Sidewalks are not fully developed in Centro and Corregimiento de Parque Lefevre, where the land strip for sidewalk is less than two meters in width. In other zones, sidewalks have sufficient width but are paved only for the minimum width (1.5 meters) needed for pedestrians to be able to pass each other. In some sections of the roads recently widened, a part of sidewalk land strip has been utilized for lane and the width of sidewalks has been reduced to less than two meters. Sidewalks and road extensions in Centro are shown in Table 3-8.

TABLE 3-8 ROADS WITH SIDEWALK, CENTRO

Corregimiento	Road Length km	Sidewalk Length km
San Felipe	11.3	2.6
El Chorrillo	8.7	6.0
Santa Ana	11.3	9.0

Source : ESTAMPA

(ii) Pedestrian Overpass

In the Planning Area are a total of 11 pedestrians overpasses, of which five are outside Panama Urban Area (3 over Autopista, 1 over Via Domingo Diaz, and 1 over Via Espana). Of the six over-

passes in the Panama Urban Area, two are over Via Espana, one is over Via Ricardo J. Alfaro, one over Ave. Balboa, and 2 over Via Transistmica (see Fig. 3-11). Another overpass on Via Espana in front of the Panama National Bank is under plan. The existing overpasses usually conform to the standard bridge width of 1.8 meters, and the standard for their installation is that the location is on an arterial, has a school or other public building, near by and many people will make use of the bridge.

(iii) Pedestrian Crossing and Signs

Reflector mirrors or simple signs are installed at pedestrian crossings. The locations of crossing in Panama Urban Area are shown in Fig. 3-11.

(iv) Safety Facilities

Almost no guard rails and guard fences are installed; those that are installed are seen in Albrook area and Autopista. Center lines and side lines are marked in some road sections, but the marking is fading under inadequate maintenance. In other road sections, lane separation is done with cat's eyes but for short lengths. The distribution of locations where road illumination and cat's eyes are installed in Panama Urban Area is shown in Fig. 3-12.

3) Road Construction, Maintenance, and Administration

(1) Road Administration

The construction and maintenance of roads in the Republic of Panama are under the jurisdiction of the Ministry of Public Works (MOP). MOP is also responsible for the construction, maintenance, and administration of rivers, draining facilities, national buildings, urban streets, and related facilities, as well as for map making. Roads for industrial or housing development are constructed either by the Ministry of Housing or by private developers, and the constructed roads are transferred to MOP for administration and maintenance. All roads constructed by other than MOP are subject to MOP inspection at the time of designing and the time of construction, but the inspection is limited to technical guidance on road structure in the absence of MOP's road network masterplan. After reorganization in 1978, another reorganization is planned for MOP in 1982. The current and proposed organizational comparison reveals the following three major differences.

The First is that MOP's Provincial branch offices will be merged with the Western Construction Bureau, Central Construction Bureau, or Metropolitan Construction Bureau. The second is that special road construction (such as Pan American Highway) projects will be broken into designing, construction, and administration sectors for the fulfillment of responsibilities in individual sectors. The third is that the river and drainage sectors will be upgraded to a bureau. It is noted that the planned reorganization will generally enhance direct connection between the Minister and his bureaus.

(2) Road Construction

Approximately 80 MOP-related road construction projects are being implemented each year, mostly by private contractors under competitive bids. For any foreign contractor to be able to participate in bidding, he will have to either station a technical representative in the Republic or enter into a joint-venture with Panamanian enterprise (according to Ley No. 15 de 1959, Ingenieria de Panama).

Directly implemented by MOP are relatively small-scale but urgent projects. MOP supplies construction materials (drainage pires, aggregates, asphalt concrete, etc.) for small-scale road construction work in rural areas.

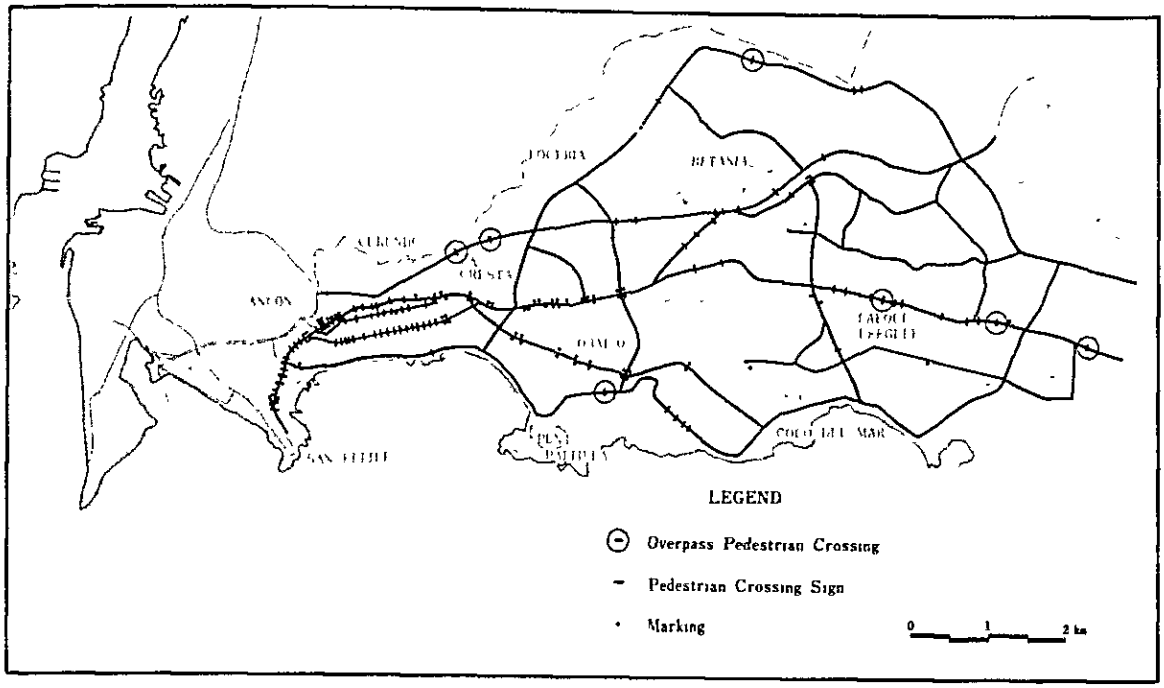


FIG. 3-11 LOCATIONS OF OVERPASS PEDESTRIAN CROSSINGS AND SIGNS: PANAMA URBAN AREA

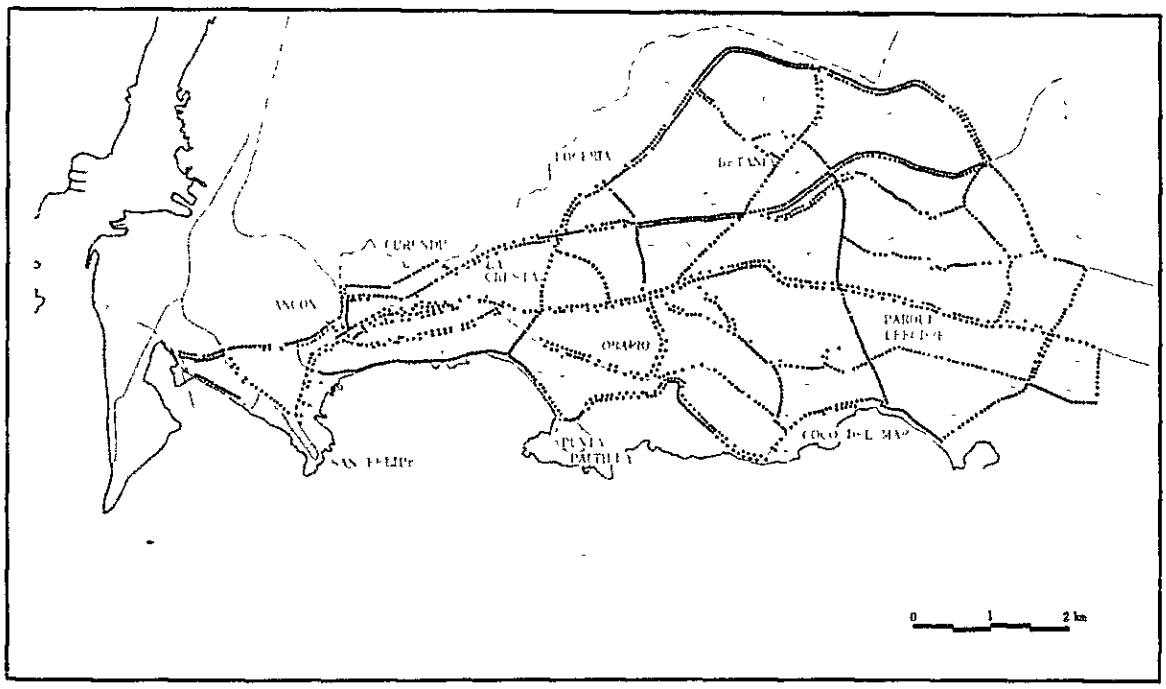


FIG. 3-12 DISTRIBUTION OF STREET LIGHTS

Recent work has chiefly been the repair or construction of local roads as parts of the national road network. MOP-BID projects (implemented under loan from the Inter-American Development Bank) are limited to road construction/repair for regional development purposes. The third loan has been disbursed and the fourth loan has started. Under the third loan local roads for a total extension of 253 kilometers were newly constructed or upgraded starting 1975 and, of the total cost of 43 million balboas, 30 million were loaned from the Inter-American Development Bank. The fourth loan is divided into two phases. In Phase A, 337 kilometers of local roads are to be newly constructed or upgraded in four years from 1980 for a total cost of 70 million balboas, of which 41.5 million will be loaned from the Bank, and Phase B will be for three years from 1982 for a total cost of 71.5 million balboas, of which 45.5 million will be financed by the Bank.

MOP-AID project is for the construction of new roads and upgrading of existing roads for a total extension of 830 kilometers for the purpose of agricultural development, starting in 1979 for completion in 1983, with a total cost of 16 million balboas, of which 10 million are financed by the United States Agency for International Development.

Roads existing in Panama Metropolitan Area are being upgraded or paved starting in 1982 for completion within three years for a total cost of 31.7 million balboas, of which 12.7 million are loaned from the International Bank for Reconstruction and Development (and the remaining 12.7 million being the Republic Government expenditure).

(3) Maintenance and Administration

Roads are maintained and administered by provincial branch offices of MOP, but responsibilities are divided into numerous bureau in the absence of clear distinction with regard to the scope of maintenance and administration. Under a road maintenance project, materials needed for maintenance and parts of existing equipment were purchased for the maintenance of chiefly local feeder roads with the government expenditure of 36 million balboas and a loan of 12 million balboas from IBRD from 1979 through 1982. Projects implemented in Panama City and its suburbs in 1980 included the widening of Via Porras, the paving of roads in Parque Lefevre, the maintenance and repair of roads and bridges by the Street/River Bureau, and the application of overlay to Via Espana and Via Simon Bolivar by the Inspection Bureau. These were all small projects, and the cost of road maintenance and administration for Panama City and its suburbs remain three to five million balboas per year, including 0.5 million balboas for the maintenance of American Bridge.

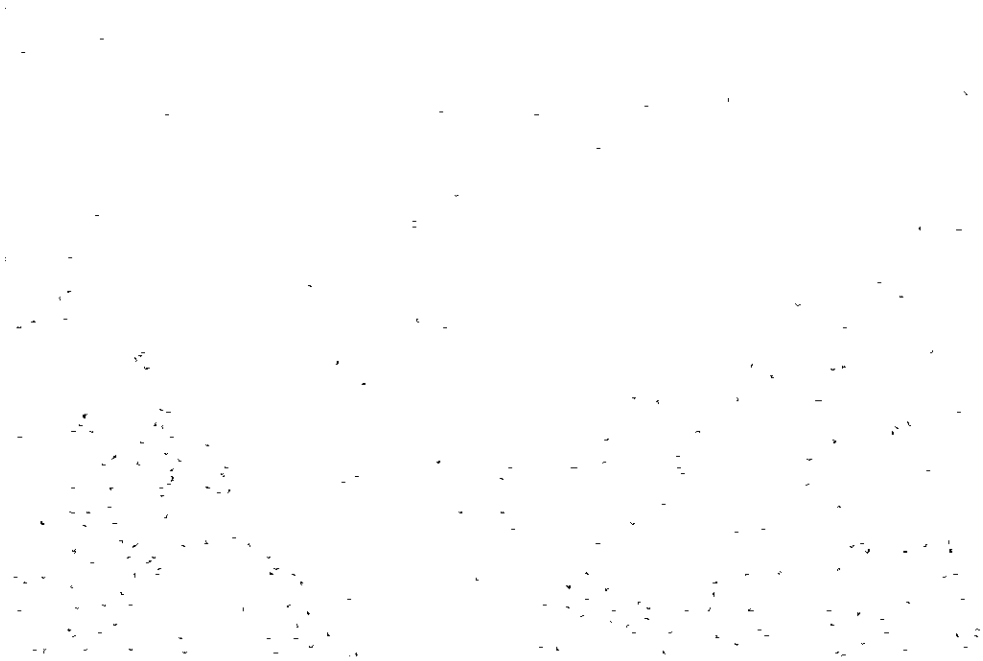
As for the construction of arterials, the extension of Pan American Highway from Corregimiento de Tocumen to the Columbian border for an extension of 316.8 kilometers is being accomplished by the International Road League, and earth work has been completed for 236.9 kilometers but pavement has been completed for only 33.7 kilometers. The construction of Autopista for a total budget of 100 million balboas has progressed under the finance of BID and the economic cooperation of Venezuela.

On-going road construction projects in the Study Area are small in scope, with the exception of Autopista project, and their project costs come to a yearly total of about 8 million balboas. These projects include, in addition to said MOP-IBRD projects, the development of intra-zonal streets in San Miguelito, the widening of Via Porras and Via Jose A. Arango.

About 170 domestic contractors are in business, of which 10 to 15 are engaged in road work as their chief business and have grown as such through engaging in the Pan American Highway and MOP-BID projects. According to the list of contractors qualified for government bid, several of these are considered capable of accomplished work for 50 to 100 million balboas.

CHAPTER 4.

CURRENT STATUS OF ROAD TRAFFIC



4. CURRENT STATUS OF ROAD TRAFFIC

A review of traffic flow in the Panama Metropolitan Area indicates that 30,000 vehicles flow into Panama Urban Area (P.T. Zones 1 through 22) per day from the east via two roads (Via Domingo Diaz and Via Jose Arango), 20,000 from the north via one road (Via Transistmica), and 10,000 from the west via one road (Pan American Highway), this forming a simple traffic network of an upside-down "T" (see Fig. 4-1).

The area in which traffic problems are rising is Panama Urban Area, where traffic flows from said three directions merge and disperse into the outskirt of the urban area or into its road network. Therefore, roadside traffic count, travel time survey, and other surveys were accomplished only for Panama Urban Area and the identification of problems will be limited to that Area.

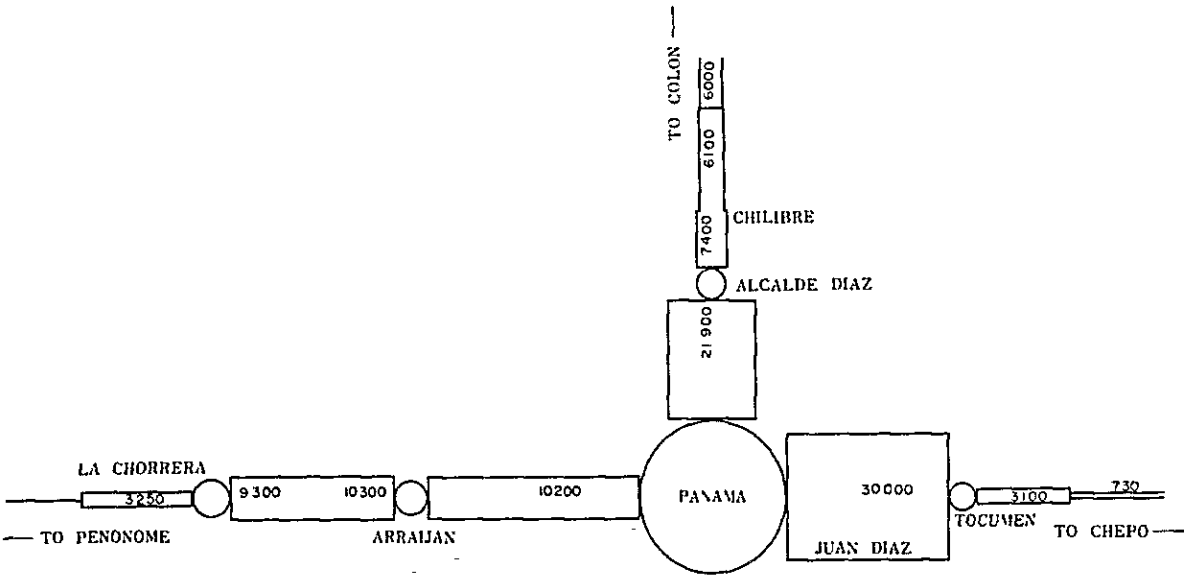


FIG. 4-1 TRAFFIC FLOW IN THE SUBURBAN AND RURAL AREAS

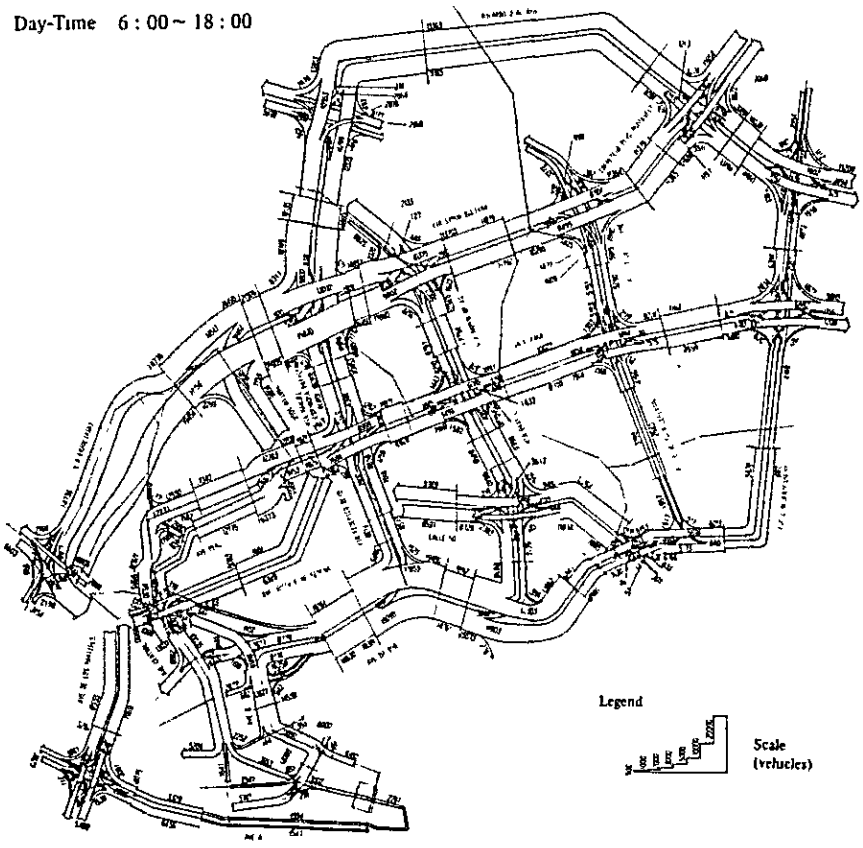
1) Traffic Volume

In Panama Urban Area, major traffic flows occur in an east-west direction on four major arterials--Via Ricardo J. Alfaro, Via Simon Bolivar, Via Espana, and Ave. Balboa--and in a north-south direction on four streets which connect these four arterials.

Day traffic flow of 12 hours, and morning and evening peak hour traffic flow are illustrated in Figures 4-2 (1) through (3). Generally speaking, traffic becomes heavier as it moves from east to west, is particularly heavy in Centro (I) and Bella Vista (II). Heavy traffic road sections are where Via Ricardo J. Alfaro and Via Simon Bolivar intersect with each other in the vicinity of the Panama National University and where Via Espana connects with Ave. Central.

A review of hourly variations of traffic volume indicates that, while such variation is limited in the central part of Panama Urban Area, distinct peaks and troughs are observed on such busy roads as Via Ricardo J. Alfaro, Via Simon Bolivar, and Ave. Balboa, where variation patterns have

(1) Day-Time 6 : 00 ~ 18 : 00



(2) Morning Peak Hour 7 : 00 ~ 8 : 00

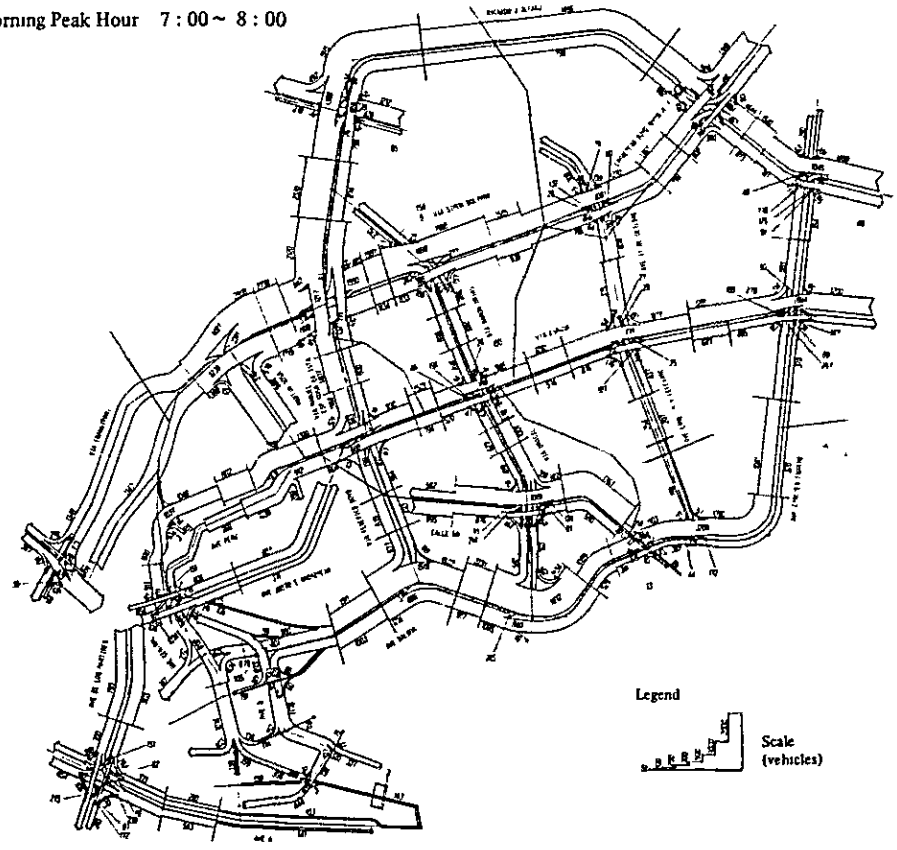


FIG. 4-2 TRAFFIC FLOW IN PANAMA URBAN AREA

(3) Evening Peak Hour 16 : 00 ~ 17 : 00

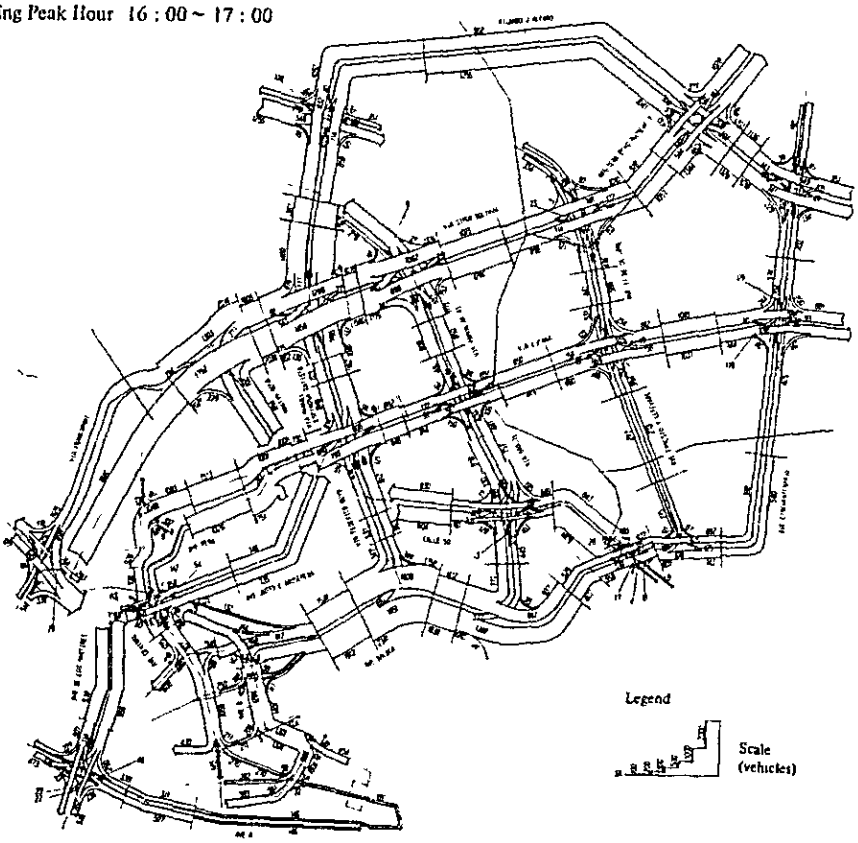


Fig. 4-2 (Cont'd)

three peaks: generally one from 07:00 to 08:00 and one in lunch hours, and one from 16:00 to 18:00. Traffic on Via Espana shows little hourly variation. Hourly traffic variations on major roads at the Corregimiento de Calidonia–Corregimiento de Bella Vista cross-section and in Rio Abajo are presented in Fig. 4-3, Fig. 4-4.

A review of composition of vehicle types indicates that the ratio of cars is high on all roads, and, while the ratio of buses on any road would naturally depend on whether or not the road is a bus route, it is characteristic that bus ratio is high on Via Espana and the adjoining Centro, where taxi ratio is also high. The ratio of trucks is generally low, but it is relatively high on Ave. De los Martires from the American Bridge to San Miguelito and on Via Simon Bolivar, indicating that these roads function as the axes of commodity flow (see Fig. 4-5).

2) Travel Time

A travel time survey was conducted on major routes in order to find out the characteristics and causes of congestion. The distribution of travel speeds by hour is shown for major roads in Fig. 4-6 (1) through (8), which indicate that, in the morning peak hour, travel speed is 20 kilometers/hour or slower in many sections of Via Ricardo J. Alfaro, Via Espana, Calle 50, and in the old Panama City area (P.T. Zones 1 through 3), and that slow speed sections are also seen on Via Brazil and other transversing streets. Generally the same pattern is seen in the evening peak hour, except that sporadic slow sections are seen on Via Simon Bolivar instead of Via Ricardo J. Alfaro and that more

slow sections are seen in Centro. Vehicle travel speed tends to be slow on Via Espana throughout the day.

On such perimeter roads as Via. Ricardo J. Alfaro, Ave. Balboa, and Via Cincuentenario, traffic congestion is caused by commuters in the morning peak hour, while on Via Simon Bolivar, localized congestions are caused by those going home in the evening peak hour. On Ave. Central, Ave. A and Ave. B. traffic congestion begins from the time bus traffic increases, and, particularly in the afternoon peak hour, considerable confusion is caused by traffic jams near bus stops. Congestions on Via España are caused by crossing pedestrians, inappropriate traffic signal phases, congestion near bus stops, and confluent and divergent traffic.

These observations can be summarized into a list of causes of traffic congestion on streets as follows:

- Obstruction by crossing pedestrians
- Traffic signal phases with a long cycle time or, in rush hours, the manual operation of signals by policemen resulting in a long line of waiting cars
- Confusion of confluent and divergent traffic with buses jammed near bus stops
- Confusion of confluent and divergent traffic at non-signaled intersections
- Left-turning vehicles hindering the movement of vehicles behind

Congested sections, travel speeds, and causes of congestions have been tabulated for Via Espana, Ave. Central, Ave. Peru, Ave. A and Ave. B, on which congestions are observed all day, and presented in Tables 4-1 and 4-2.

3) Traffic Accidents

In the Republic of Panama, the number of traffic accidents have increased along with the increase of vehicles. Average number of accidents per 100 vehicles has remained steady at 13 or 14, with the exception of certain years. (Fig. 4-7).

(1) Traffic Accidents by Vehicle Type

The number of traffic accidents in Panama City in 1978 by type of vehicle is shown in Table 4-3. Of all accidents caused by 4-wheel vehicles, about 65% involved a car, and about 17% each involved a bus and a truck. When broken down into accidents by private vehicles and those by commercial vehicles, a very high average of 88 accidents per 100 vehicles is shown by the commercial group.

(2) Accidents by Route

The number of accidents per 100-meter section of major roads in 1978 are shown in Fig. 3-8. Listed with high accident ratios are Via Espana, Ave. Central, Ave. Balboa, Via Simon Bolivar, Via Manuel Espinosa, and Via Federico Boyd. Particularly high accident ratios are conspicuous on Avenue Central in the vicinity of Plaza 5 de Mayo and Santa Ana and on Via Espana in El Cangrejo. In these sections, serious hindrance to traffic flow is being caused by very frequent pedestrian crossing, bus congestion, vigorous traffic confluence and diversion, and left-turning vehicles.

TABLE 4-1 MAJOR CONGESTED SECTIONS ON VIA ESPANA AND AVE. PERU
(With its Main Causes)

Direction	Hours	Congested Section	Average Speed (km/h)	Main Causes of Congestion
TO CHORRILLO	MORNING PEAK	Via Brasil – Via Belisario Porras	4–8 km/h	– Waiting for signal light change – Manual operation of signal
		Via Federico Boyd-Via Eusebio A. Morales	8–10 km/h	– Congestion of buses near bus stops – Pedestrian's crossing – Waiting the change of signal lights – Manual operation of signal – Influence of cars turning to the left – Merging from alley
	DAYTIME PEAK	Via Brasil – Via Belisario Porras	About 8 km/h	– Waiting the change of signal lights – Manual operation of signal
		Calle 57 – Via Brasil	About 11 km/h	– Waiting the change of signal lights – Manual operation of signal
		Via Federico Boyd-Calle 49	About 7 km/h	– Waiting the change of signal lights – Manual operation of signal
	EVENING PEAK	Via Brazil – Via Fernandez de Cordoba	7–9 km/h	– Waiting the change of signal lights – Manual operation of signal
		Calle 57 – Via Brasil	About 11 km/h	– Influece of cars turning to the left – Merging from alley
		Via Federico Boyd – Calle 49	About 7 km/h	– Congestion of buses near bus stops – Pedestrian's crossing – Waiting the change of signal lights – Manual operation of signal – Influence of cars turning to the left – Merging from alley
		Plaza 5 de Mayo – Calle 28	9–12 km/h	– Congestion of buses near bus stops – Pedestrian's crossing – Waiting the change of signal lights – Manual operation of signal – Influence of cars turning to the left – Merging from alley
TO CINCUENTENATIO	MORNING PEAK	Ave. Justo Arosemena – Calle 29E	About 9 km/h	– Congestion of buses near bus stops – Merging from alley
		Calle 3 de Noviembre – Calle 12 de octubre	About 12 km/h	– Congestion of buses near bus stops – Merging from alley
		Ave. Justo Arosemena – Via Federico Boyd	About 12 km/h	– Waiting the change of signal lights – Manual operation of signal
		Calle 49–Via Eusebio A. Morales	About 12 km/h	– Congestion of buses near bus stops – Pedestrian's crossing
		Calle 57–Via Belisario Porras	8–12 km/h	– Congestion of buses near bus stops – Waiting the change of signal lights – Manual operation of signal
	DAYTIME PEAK	Calle Eusebio A. Morales – Via Argentina	About 12 km/h	– Waiting the change of signal lights – Manual operation of signal
		San Miguel – Via Belisario	About 12 km/h	– Waiting the change of signal lights – Manual operation of signal
		Via Fernandez de Cordoba – Calle La Cantera	About 10 km/h	– Waiting the change of signal lights – Manual operation of signal
	EVENING PEAK	Calle 3 de Noviembre – Calle 12 de octubre	9–10 km/h	– Congestion of buses near bus stops
		Ave. Justo Arosemena – Via Federico Boyd	10 km/h	– Waiting the change of signal lights – Manual operation of signal
		Calle 57 – Calle 62-A Este	4–9 km/h	– Waiting the change of signal lights – Manual operation of signal – Influence of cars turning to the left – Merging from alley

Source : ESTAMPA

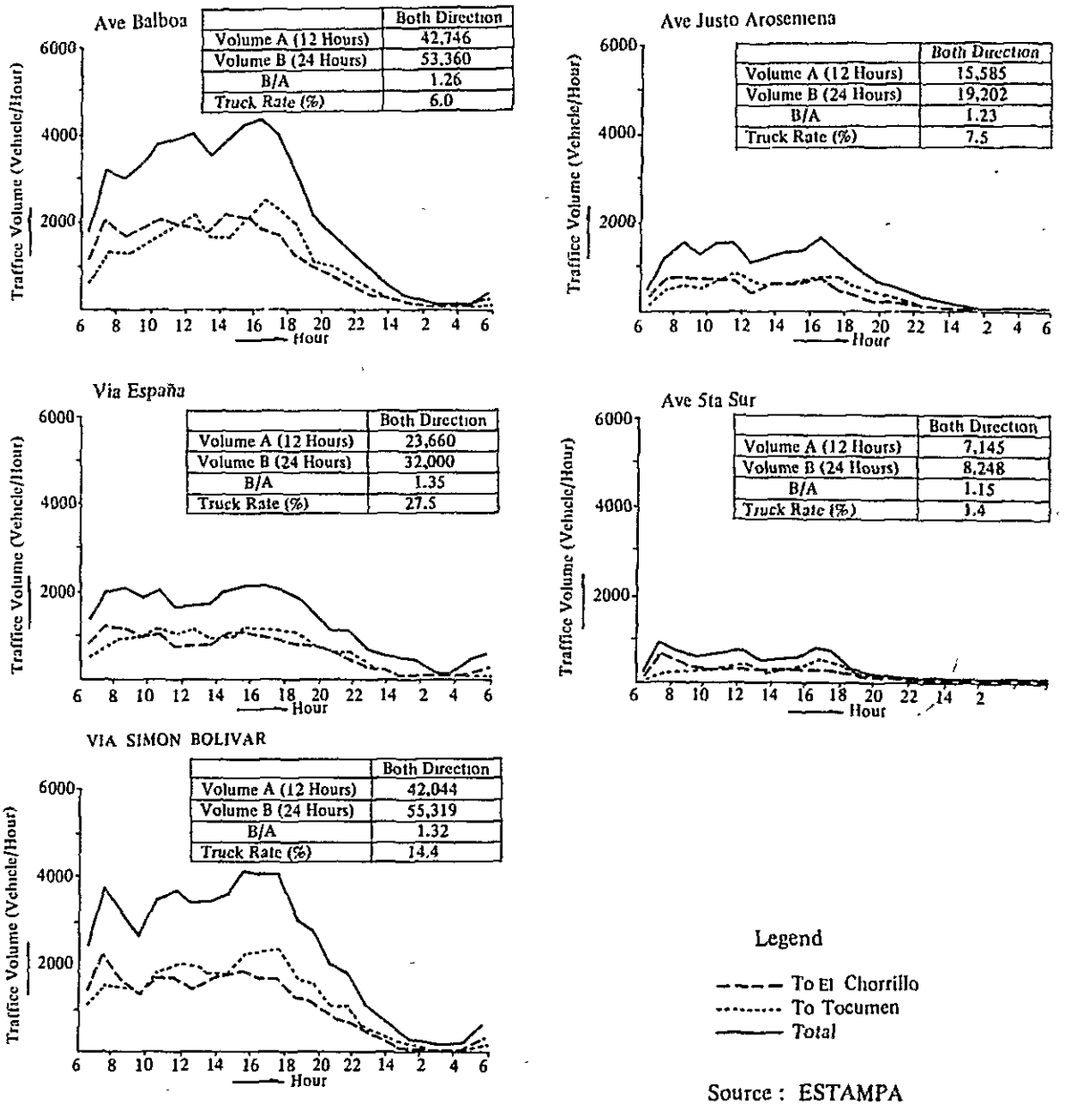


FIG. 4-3 HOURLY TRAFFIC VARIATION (RIO ABAJO)

(3) High Incidence Locations and Accident Types

By Corregimiento, the incidence of accidents was high in Corregimiento de Bella Vista, Calidonia, Betania, and Santa Ana (Table 4-4). The high incidence locations have been plotted on a map in Fig. 4-9, which shows that a large number of accidents occurred at the intersections of major arterials, the most representative being the two intersections of Via Simon Bolivar and Ave. Ricardo

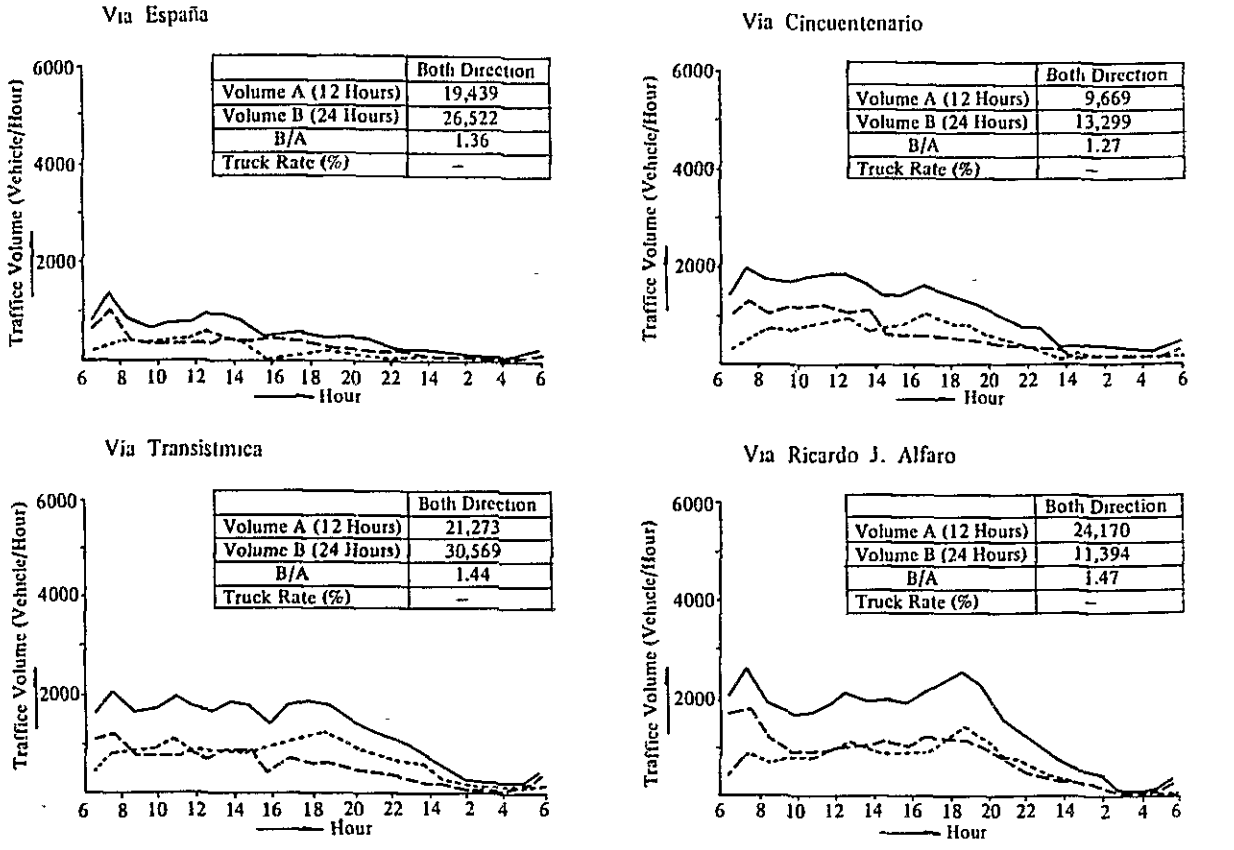


FIG. 4-4 HOURLY TRAFFIC VARIATION (CALIDONIA-BELLA VISTA)

TABLE 4-2 MAJOR CONGESTED SECTIONS ON AVE. CENTRAL, AVE. A AND AVE. B

Direction	Hours	Congested Section	Average Speed (km/h)	Main Causes of Congestion
Central → Ave. A	Morning Peak	Ave. de Los Martires – Plaza 5 de Mayo	About 11 km/h	– Pedestrian's crossing – Waiting the changes of signal lights
		Calle 13 – Calle 15	About 4 km/h	– Congestion of buses near bus stops – Pedestrian's crossing – Merging from alley
	Daytime Peak	Calle 12 Oeste–Calle 7	About 12 km/h	– Pedestrian's crossing – Merging from alley
	Evening Peak	Plaza 5 de Mayo-Calle 13 E	About 14 km/h	– Congestion of buses near bus stop – Pedestrian crossing – Merging from alley
Ave. A → Central	Morning Peak	Calle 7 – Ave. Balboa	About 12 km/h	– Congestion of buses near bus stops – Merging from alley
	Daytime Peak	Calle 7 – Calle 13E	About 7 km/h	– Congestion of buses near bus stops
	Evening Peak	Ave. de los Martires – Calle 12 Ave. Balboa –Plaza 5 de Mayo	13–14 km/h 9–12 km/h	– Congestion of buses near bus stops – Congestion of buses near bus stops

Source : ESTAMPA

J. Alfaro, one in front of the Panama University and the other in San Miguelito, followed by intersections on Via Espana, Ave. Central, Ave. Balboa, and Calle 50. In Fig. 4-10, types of accidents recorded in the two intersections of Via Simon Bolivar and Ave. Ricardo J. Alfaro are shown by symbols. The Figure indicates that rearend collisions, side swipes, and head-on collisions were more frequent. Also, accidents are classified by type of violation in Table 4-5, which makes it clear that accidents are caused most frequently by failure to allow sufficient headways, followed by side swipes caused by sudden lane changes. In order to minimize accidents, the upgrading of intersections, through traffic channelization, and improvement of traffic signals will be essential in addition to traffic regulation enforcement.

TABLE 4-3 TRAFFIC ACCIDENTS BY TYPE OF CAR IN PANAMA CITY (1978)

Type of Car \ Accidents		Number of Accidents	Accidents / 100 Registered
Private	Passenger car	3853	9.5
	Bus	12	3.8
	Truck	140	14.2
	Others	–	–
	Total	4005	9.6
Commercial	Passenger car	883	25.0
	Bus	1258	88.3
	Truck	1098	18.2
	Others	11	19.0
	Total	3244	29.5
Motorcycle		60	6.3
Bicycle		55	1.3

Source : Contraloria General

TABLE 4-4 NUMBER OF TRAFFIC ACCIDENTS (1980)

MONTH / CORREGIMIENTOS	J	F	M	A	M	J	J	A	S	O	N	D	Year Total	Year (%)
El Chorrillo	22	16	25	16	17	17	16	32	24	20	22	22	298	3.3
Santa Ana	62	79	67	62	73	63	65	81	57	91	104	99	865	9.5
San Felipe	7	3	5	4	11	14	4	5	7	7	11	10	195	2.1
Curundú	7	5	5	3	7	10	17	21	24	32	25	25	138	1.5
Calidonia	119	137	92	80	108	118	122	135	140	140	143	162	1594	17.4
Bella Vista	183	178	168	147	195	174	185	177	203	186	178	201	2046	22.5
San Francisco	59	54	53	49	43	55	80	66	72	79	62	95	812	8.9
Bethania	94	64	78	82	101	107	101	81	128	114	96	126	1115	12.2
Pueblo Nuevo	36	29	41	34	49	45	38	51	53	56	51	55	592	6.5
Rio Abajo	54	50	45	37	60	43	43	69	61	53	61	52	401	4.4
Parque Lefevre	52	17	18	21	27	42	38	43	34	50	37	43	537	5.9
Victoriano Lorenzo	22	19	28	12	32	34	29	32	36	34	28	48	354	3.9
Jose D. Espinar	14	13	12	12	10	11	12	24	18	22	18	17	183	1.9
Total	731	664	637	559	773	733	750	817	857	884	836	955	9156	100.0

Source: D.N.T.T.

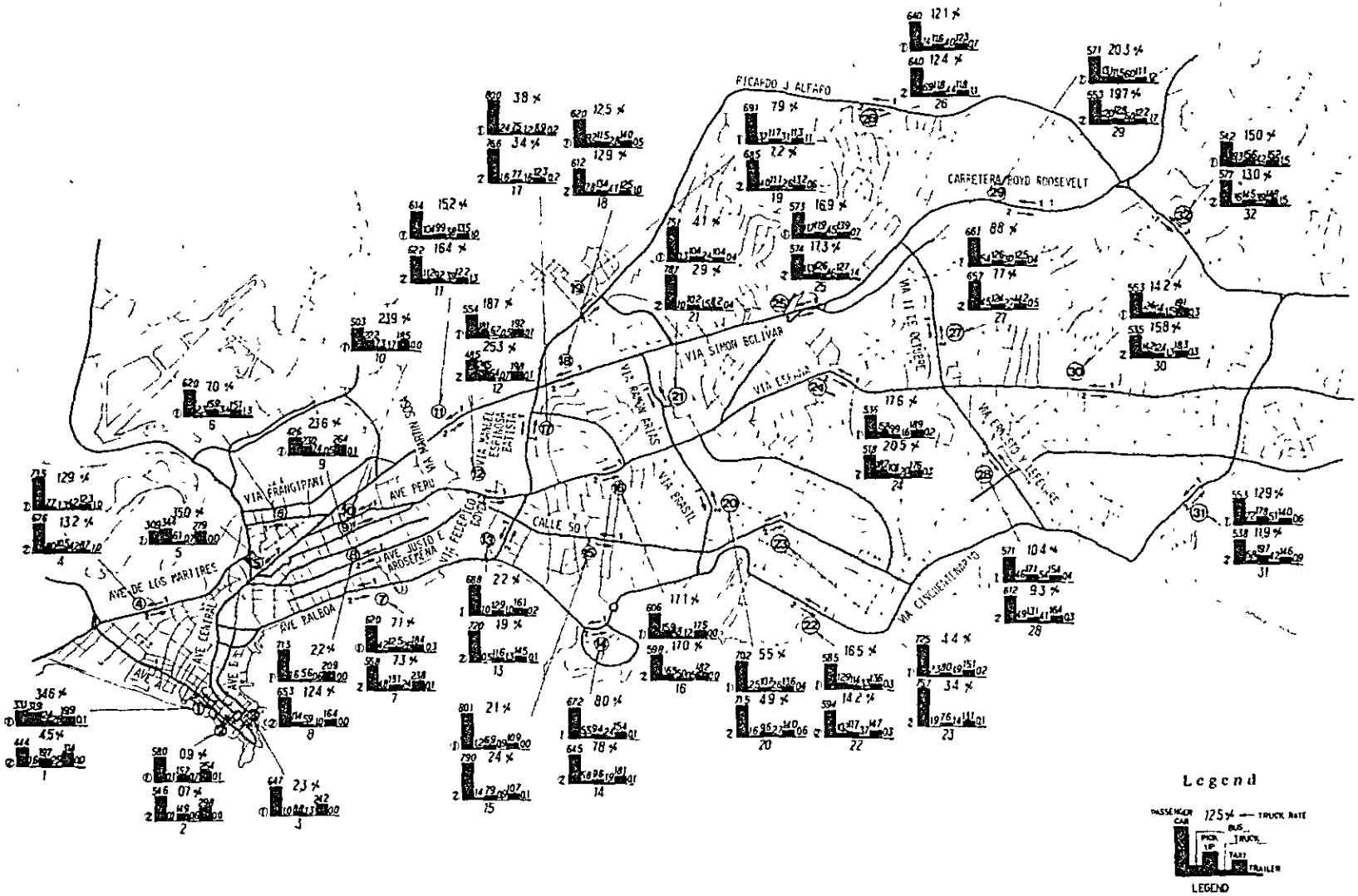


FIG. 4-5 TYPE COMPOSITION OF VEHICLES

Source : ESTAMPA

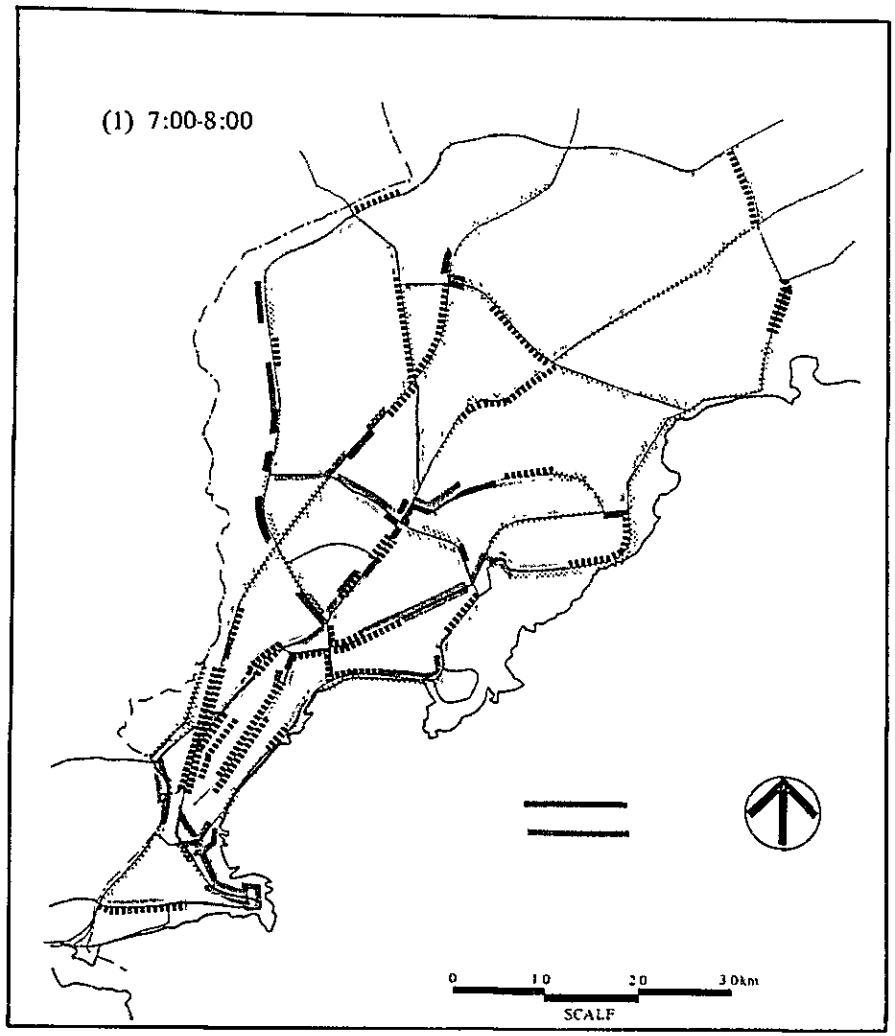


FIG. 4-6 AVERAGE VEHICLE TRAVEL SPEED

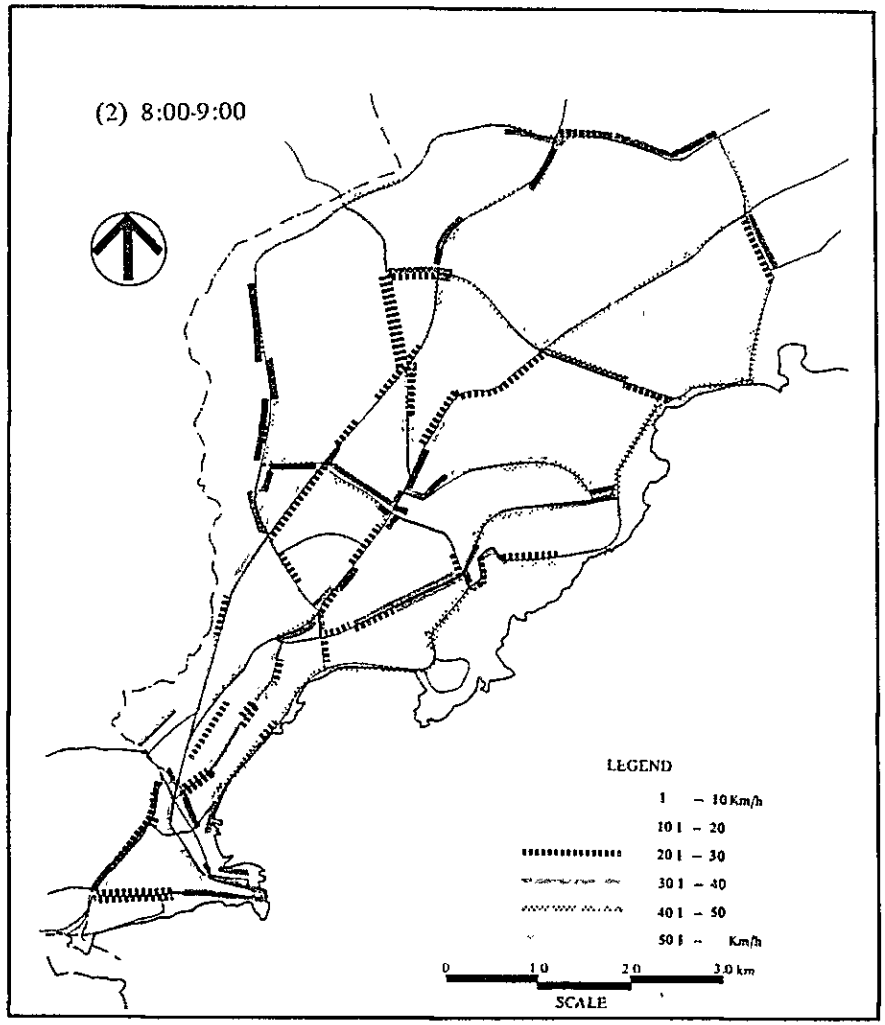


FIG. 4-6 (Cont'd)

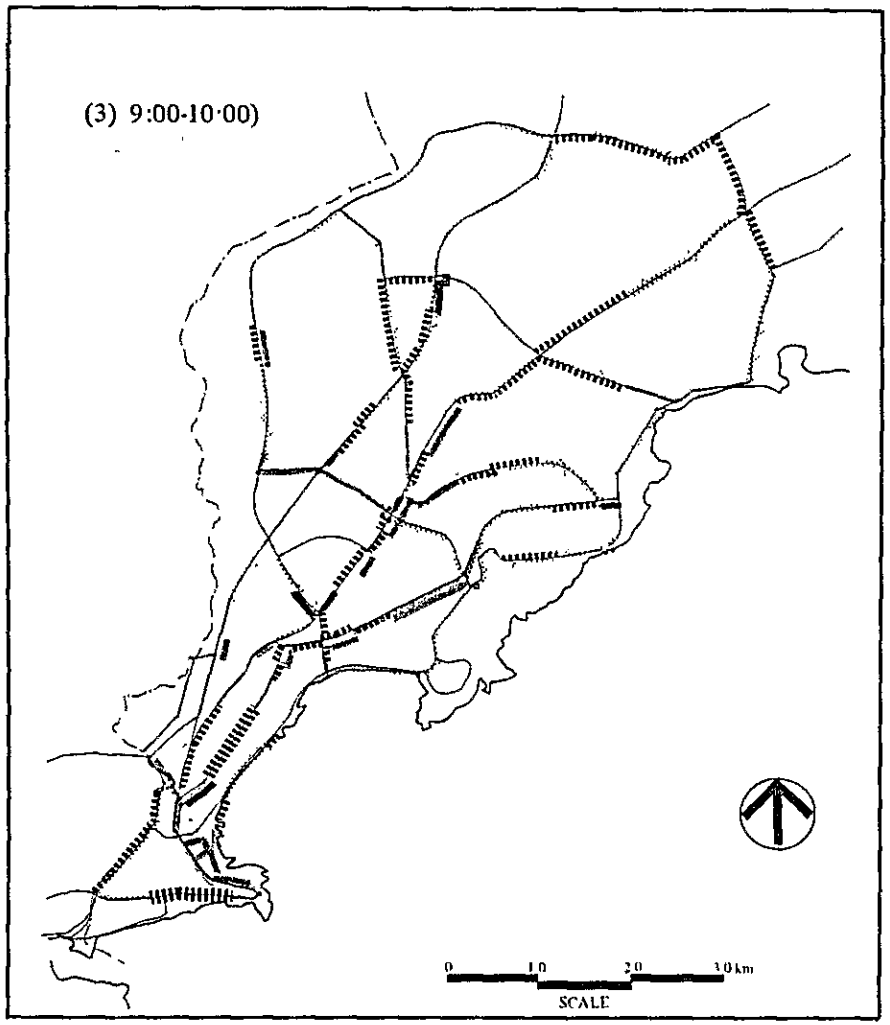


FIG. 4-6 (Cont'd)

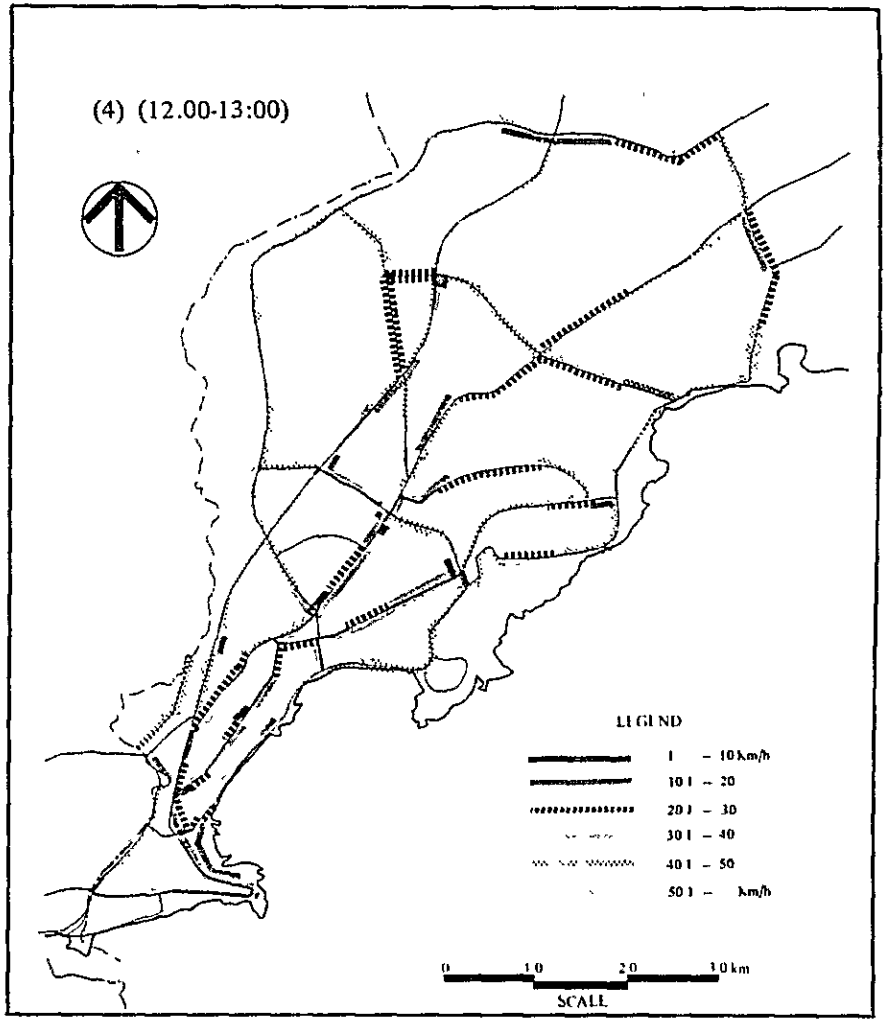


FIG. 4-6 (Cont'd)

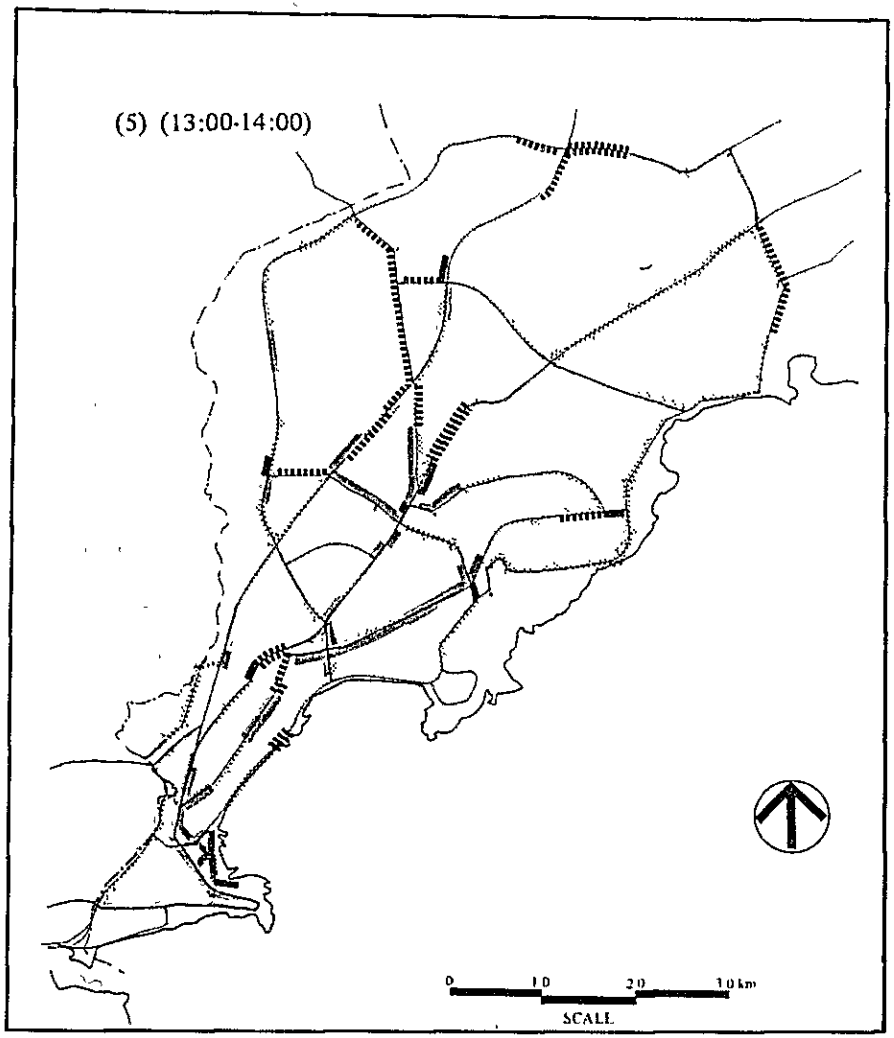


FIG. 4-6 (Cont'd)

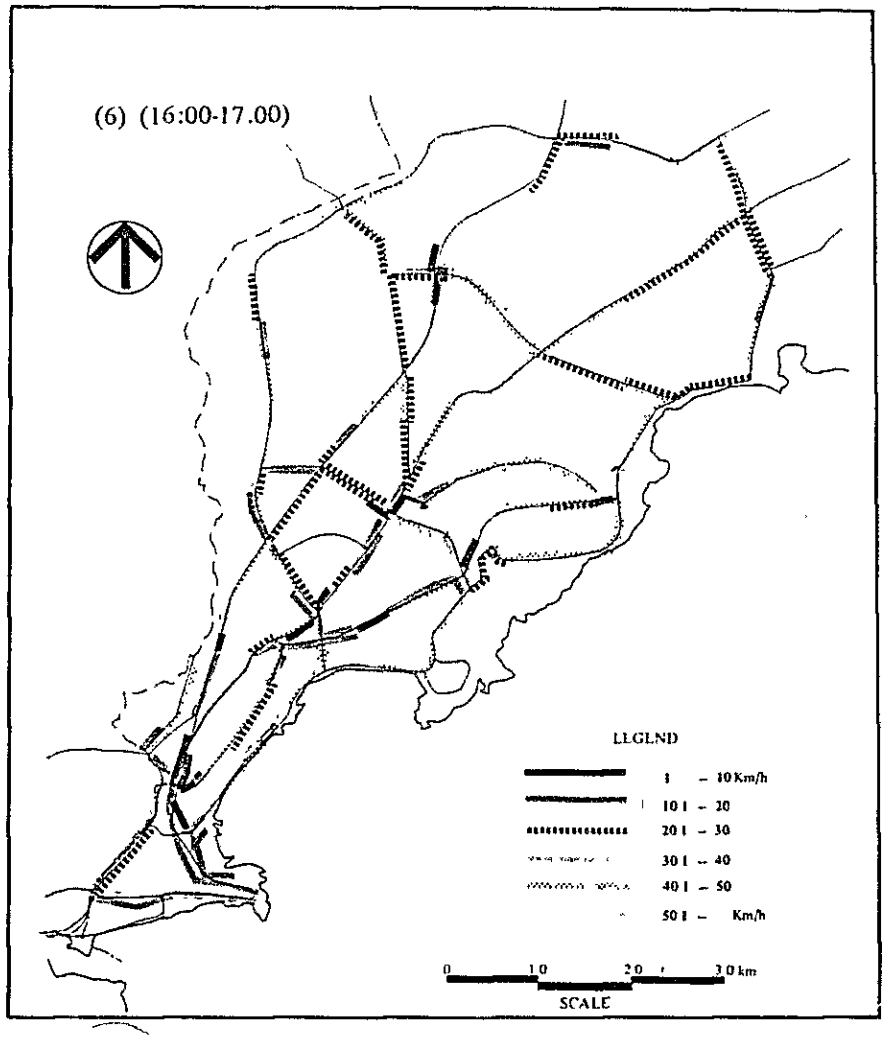


FIG. 4-6 (Cont'd)

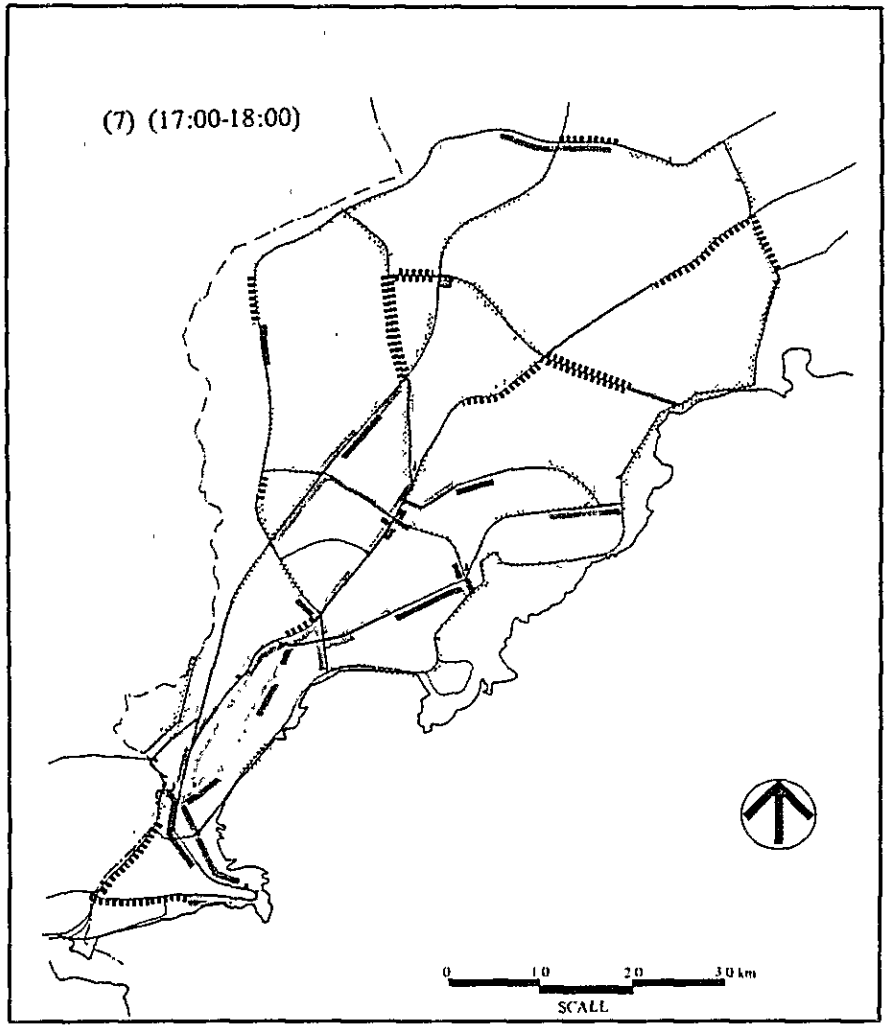


FIG. 4-6 (Cont'd)

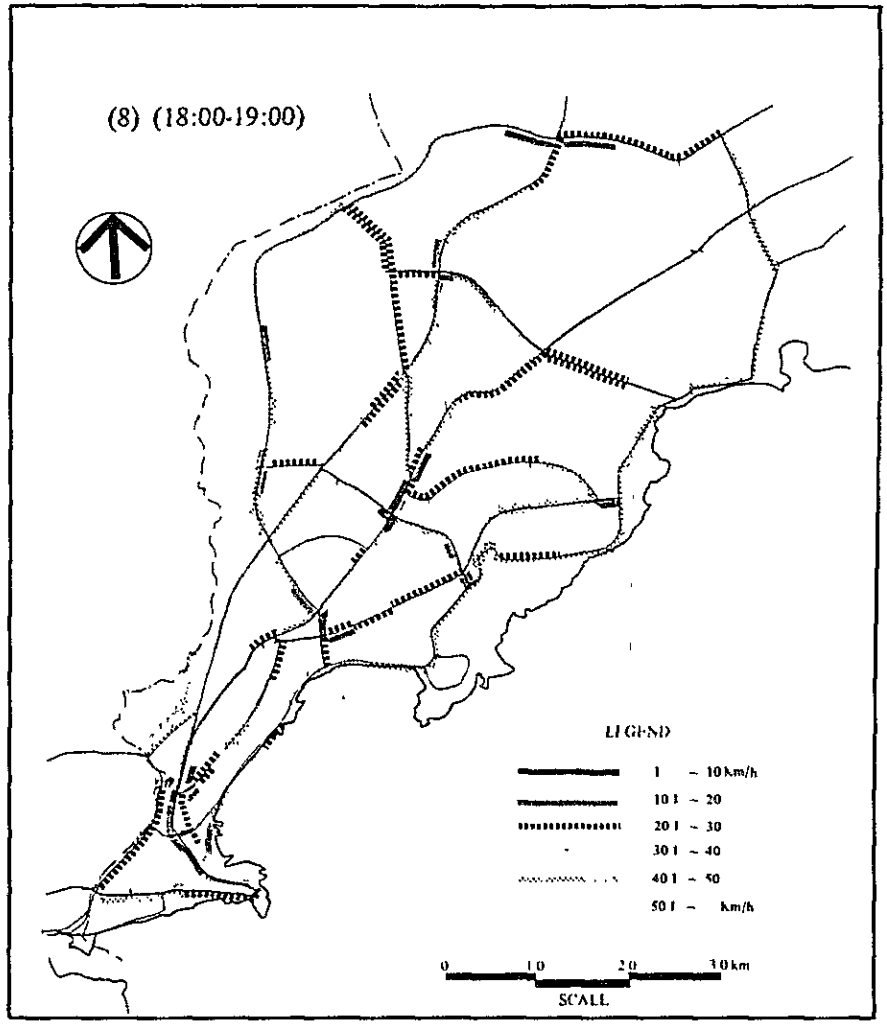


FIG. 4-6 (Cont'd)

FIG. 4-7 YEARLY TREND OF TRAFFIC ACCIDENTS (1959–1978)

Source : Contraloria General de la República

4) Parking

In an attempt to obtain facts about parking in the central part of Panama Urban Area, a parking survey was conducted in Centro and Bella Vista Zones. The survey findings are discussed hereunder.

(1) Parking Density

Parking density is the ratio of parked cars to parking capacity in terms of the number of cars that can be parked. Two sets of definitions are proposed for parking capacity. One is physical parking capacity, which is conceived of as a function of road extension (length) irrespective of regulatory parking controls. The other is regulatory capacity, which is conceived of as a function of the extension of roads where parking is authorized by regulations.

Said survey resulted in finding the following geographical and hourly distribution of parking density based on physicial capacity: (See Fig. 4-11)

- 08:00 - 09:00: Calidonia Sur (P.T. Zones 4-1 and 4-2) showed a density of 30% to 50%, while such density was below 30% in all other Zones.
- 11:00 - 12:00: Parts of Calidonia (P.T. Zones 4-1 and 5-1) showed the density of 30% to 50%, with all others showing under 30%.
- 16:00 - 17:00: The density in parts of Calidonia (P.T. Zone 4-1) rose to 50% to 100%.
- 20:00 - 21:00: Only Urraca–Campo Alegre (P.T. Zone 8) showed a density from 30% to 50%, with all others showing less than 30%.

Similar distribution of parking density based on regulatory parking capacity was:

- 08:00 - 09:00: Of all P.T. Zones in the Area, half showed a density of 50% to 100%; a

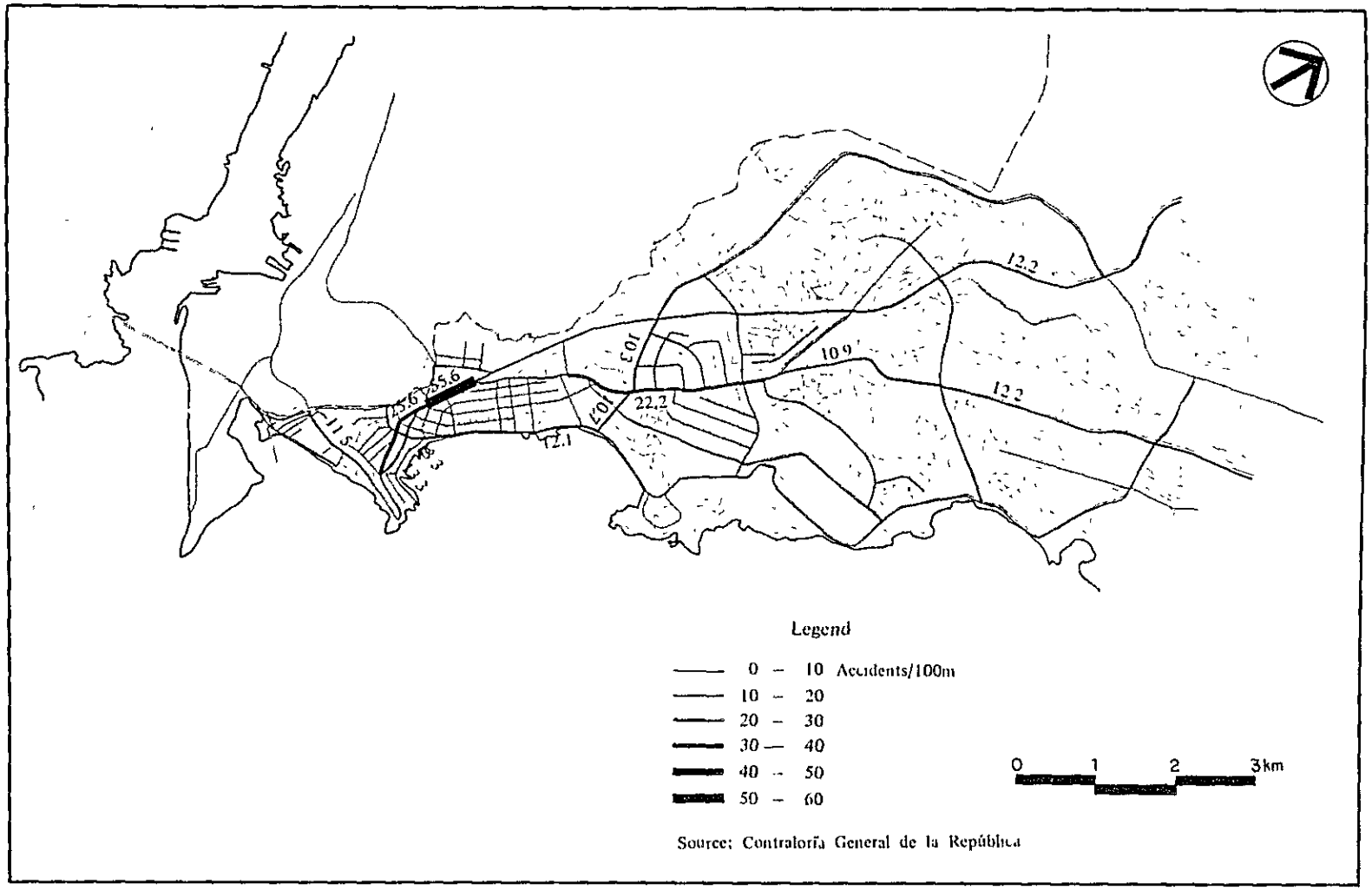


FIG. 4-8 YEARLY ACCIDENT RATES (1978)

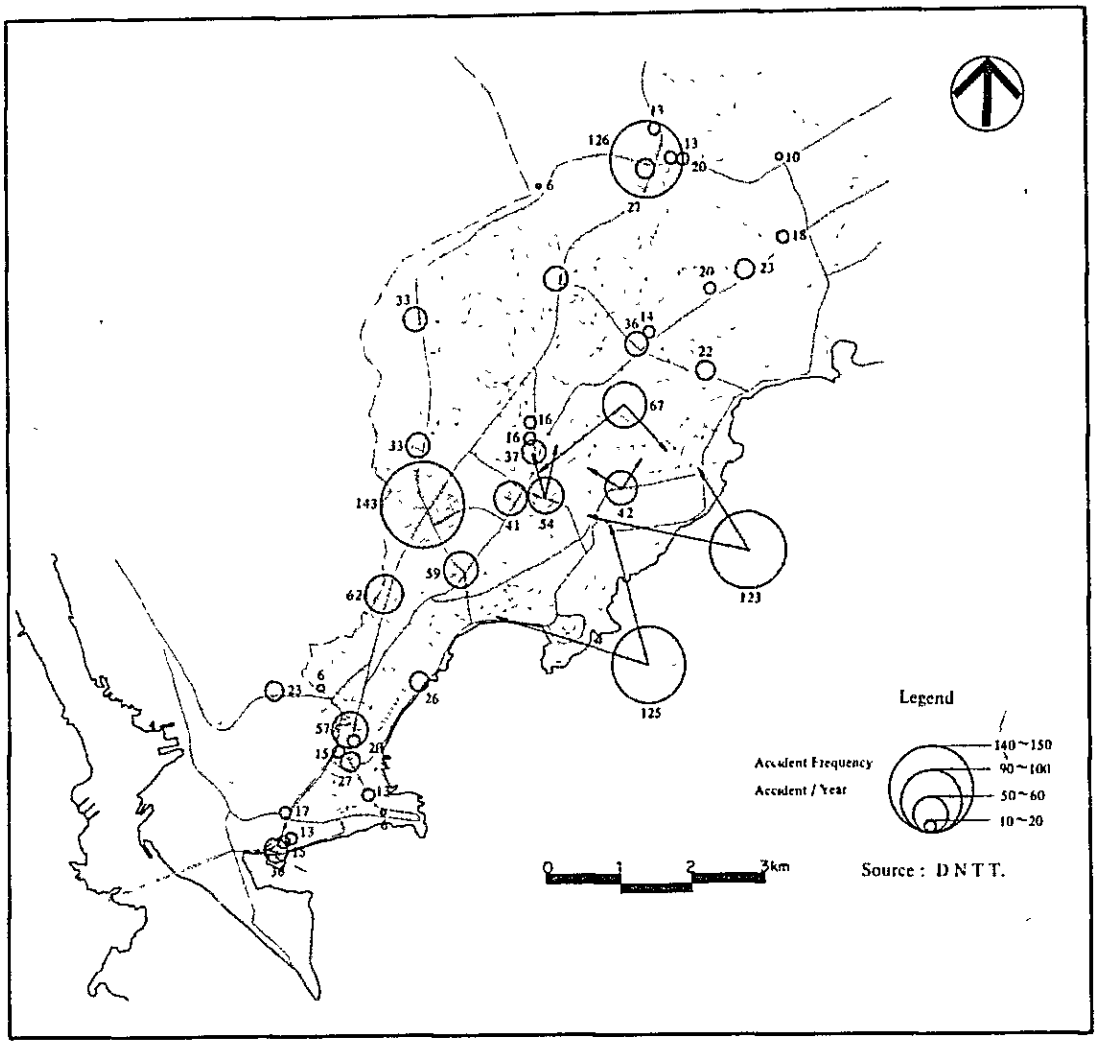


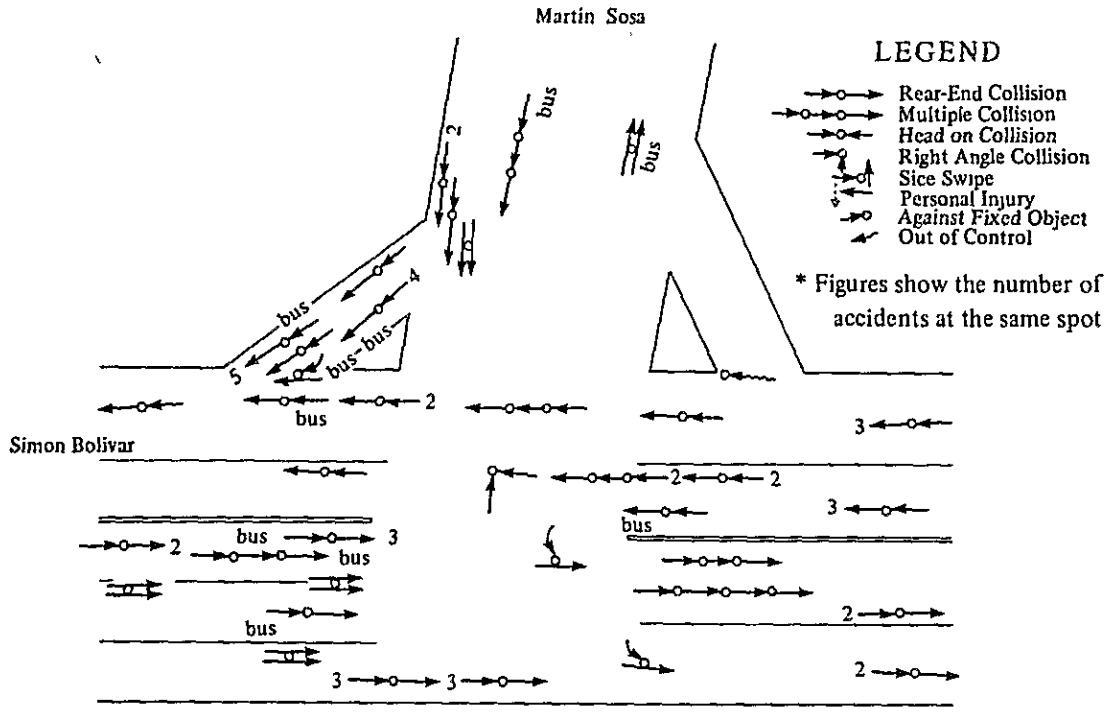
FIG. 4-9 HIGH ACCIDENT FREQUENCY POINTS (1980)

density of under 30% was shown only in El Chorrillo (P.T. Zone 2-2), Santa Ana (3-2), Calidonia (5-1), Curundu (6), and El Cangrego (10-1).

- 11:00 - 12:00· Fewer P.T. Zones showed a high density; those which showed 50% or higher were limited to San Felipe (P.T. Zone 1), a part of Corregimiento de Calidonia (4-1 and 5-1), a part of La Cresta (7-2), the remainder showing generally from 30% to 50%.

- 16:00 - 17:00: The number of zones showing a high density increased again; particularly in Calidonia Sur (P.T. Zone 4-1) the density was higher than 100%, with others ranging from 30% to 90%.
- 20:00 - 21:00: Those showing 50% to 100% were San Felipe (P.T. Zone 1), El Chorrillo (2-1 and 2-2), a part of Calidonia Sur (4-1), and a part of El Cangrejo (10-2), with all others showing generally from 30% to 50%.

(1) Via Martin Sosa
&
Via Simon Bolivar



(2) Plaza Cinco de Mayo

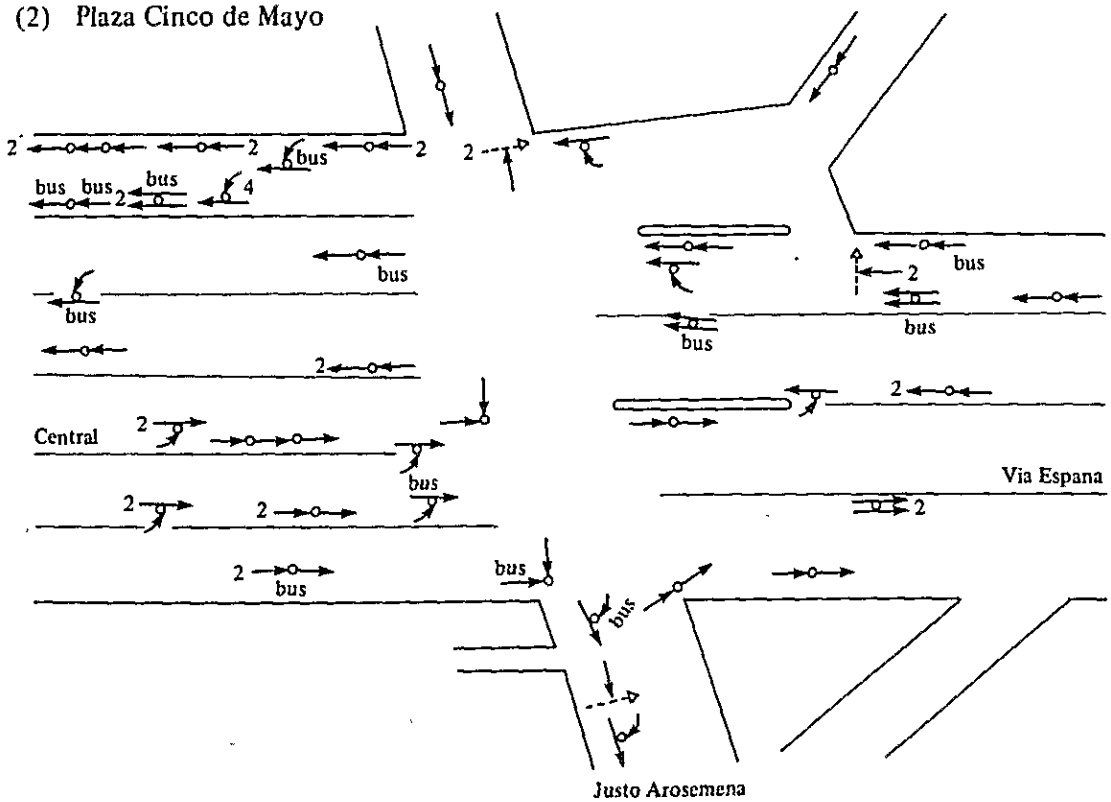
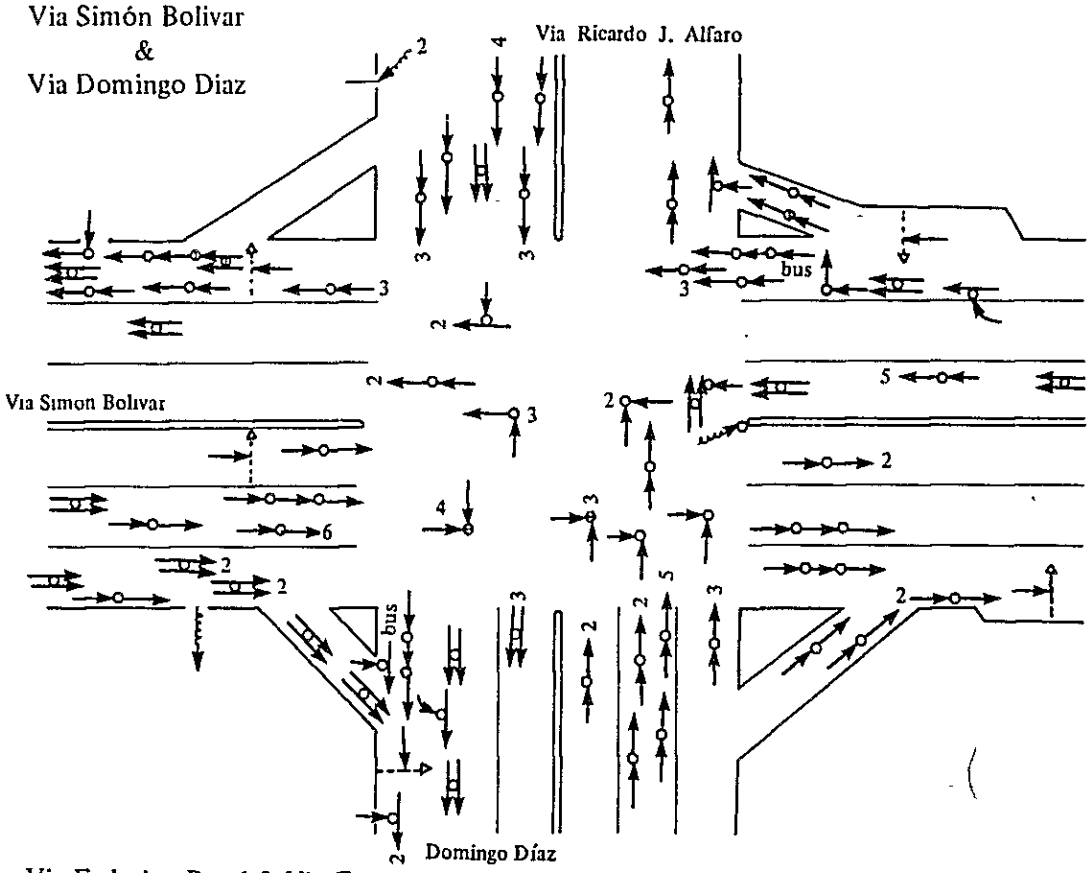


FIG. 4-10 COLLISION DIAGRAMS FOR HIGH ACCIDENT INTERSECTIONS

(3) Via Ricardo J. Alfaro,
Via Simón Bolivar
&
Via Domingo Diaz



(4) Via Federico Boyd & Via España

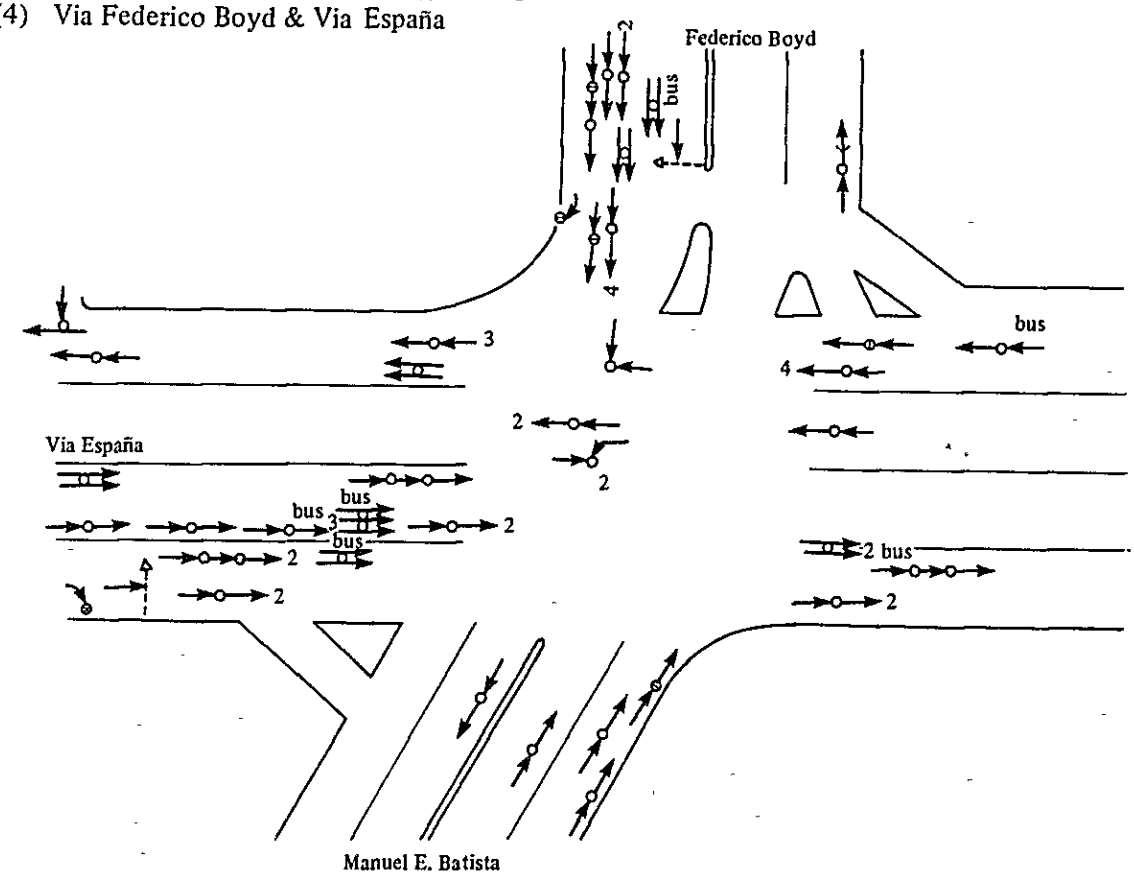
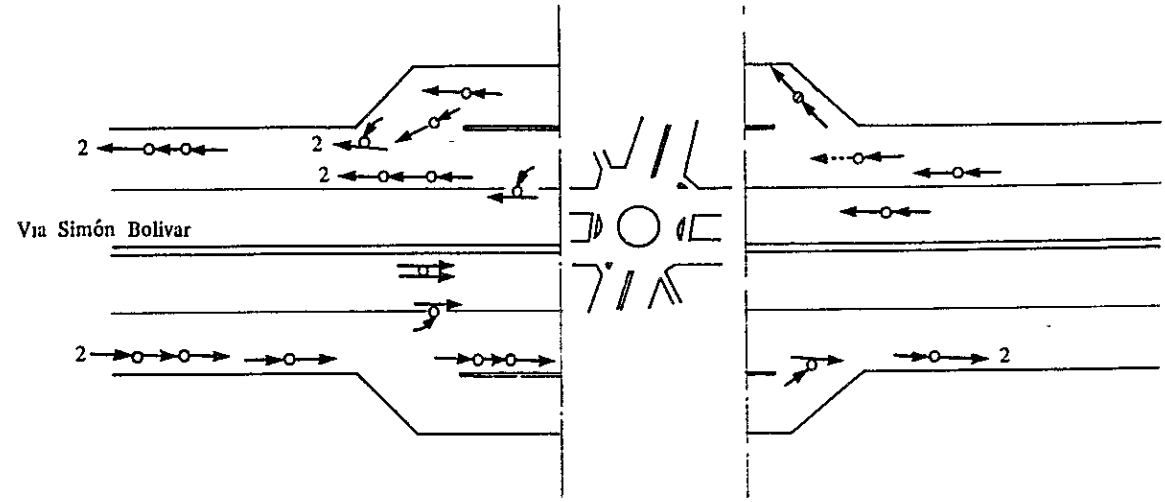


FIG. 4-10 (Cont'd)

(5) Via Ricardo J. Alfaro
&
Via Simon Bolivar
(At The Overpass And Aproach)



(6) Via Ricardo J. Alfaro
&
Via Simon Bolivar

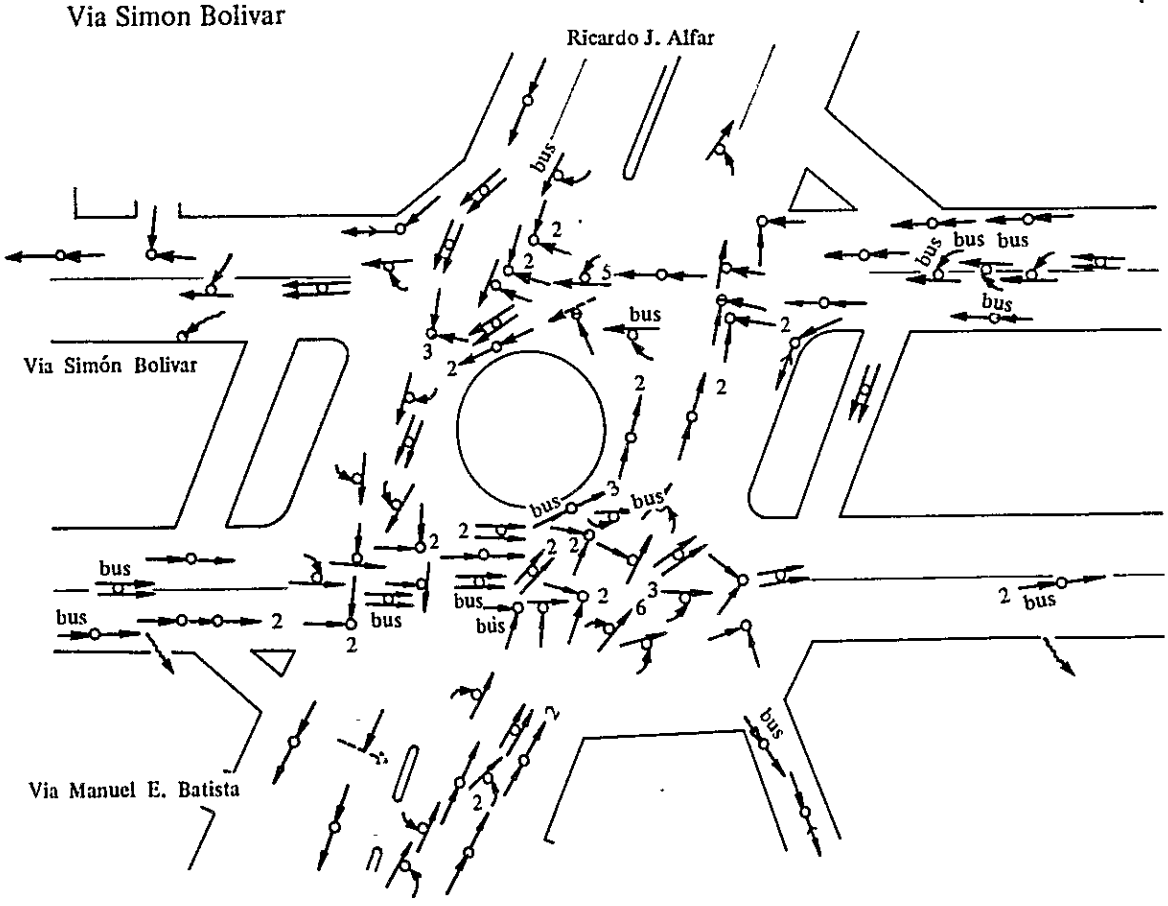
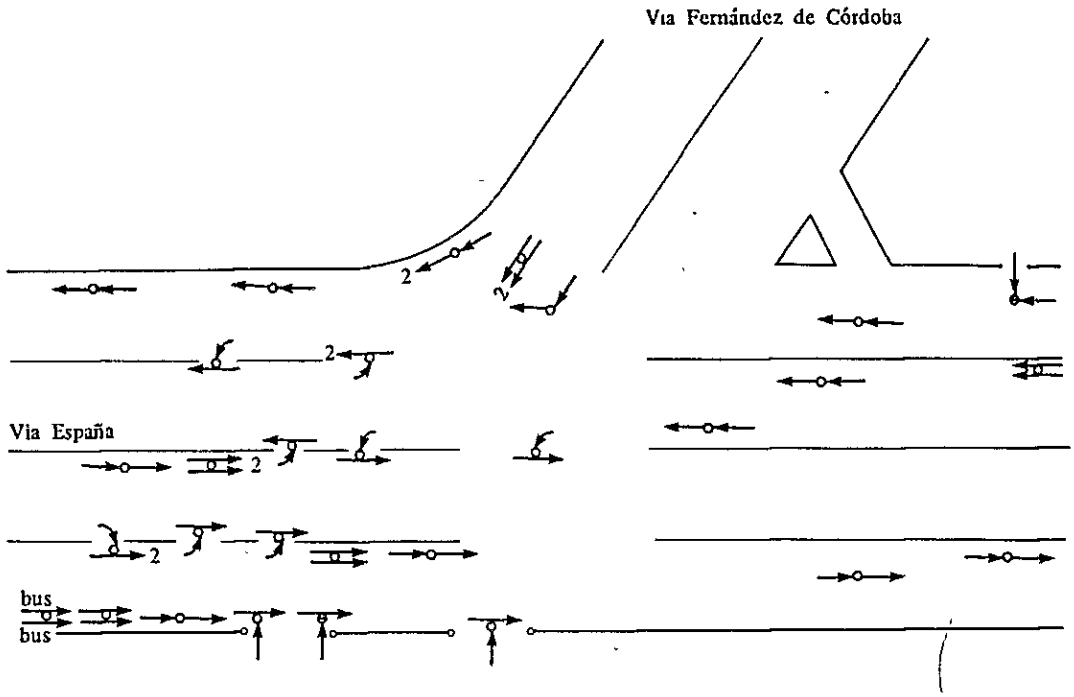


FIG. 4-10 (Cont'd)

(7) Via Espana
&
Via Fernandez de Cordoba



(8) Via Espana & Calle 57

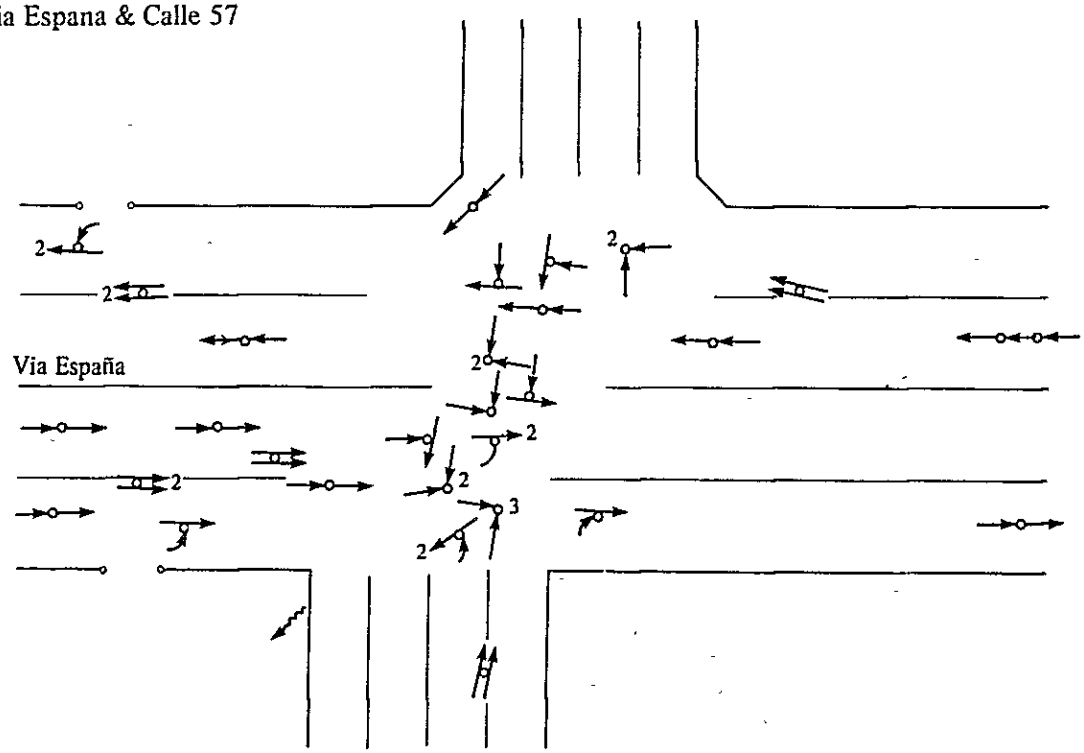


FIG. 4-10 (Cont'd)

(2) Parking Purpose and Average Walking Distance

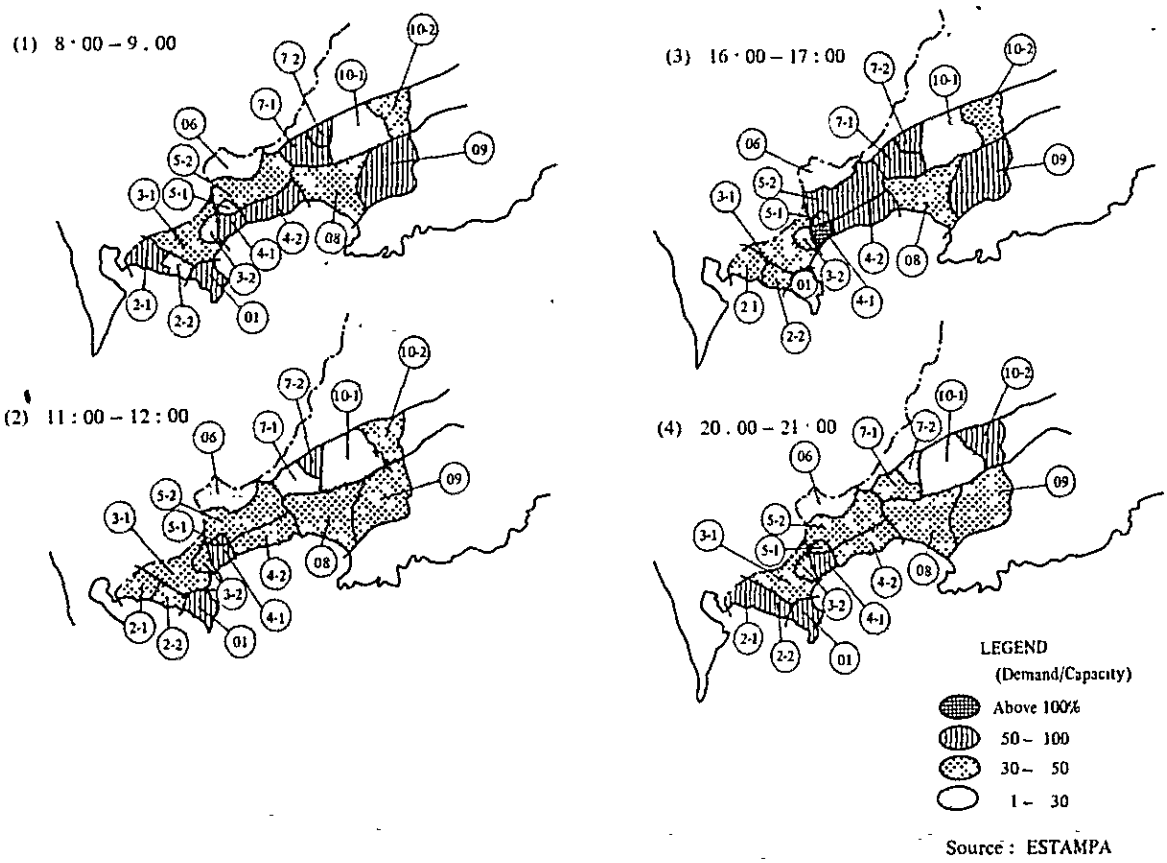
(i) Purpose

An interview survey of parking drivers resulted in the finding that approximately 28% were parking for business purposes, about 21% for going to school or work, 15% for going home, and 20% for miscellaneous purposes. 16% of miscellaneous purposes were shopping, going to restaurant, and recreation.

By zone, the frequency of parking for business purposes is high in Centro and Parque Urraca-Via Campo Alegre, which generally coincides with the heavy concentration of business activities in these zones. Frequency for going to office is about the same in all zones, with the exception of a high in Urraca-Campo Alegre. For going home, it is relatively high in San Felipe and El Cangrejo, for going to school it is overwhelmingly high in La Cresta, where the Panama National University located, and for shopping, going to restaurant, and recreation it is high in Obarrio. (See Table 4-6). 4-6).

(ii) Averagee Waling Distance

The average walking distance from the point of parking to the destination is only 20 to 40 meters. (See Fig. 4-12).



Source : ESTAMPA

Note: PT zones are subdevided here, in order to analyze local problems of parking.

FIG. 4-11 PARKING DEMAND TO CAPACITY RATIOS BY P.T. ZONE (CAPACITY BASED ON EXISTING REGULATION)

TABLE 4-5 TYPES OF ACCIDENTS AND TYPES OF VIOLATIONS

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	Via Simon Bolivar – Via Martin Sosa															Plaza 5 de Mayo														
	REAR END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL	REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY	36							6						42	22							2							24
IMPROPER CHANGE OF LANE					4									4					7										7
IMPROPER CROSSING	1				2									3			2		3										5
OPENED DOOR																													
WRECKLESS DRIVING																			6			1							7
BREAK FAILURE	2													2	1														1
DISREGARD OF TRAFFIC SIGNAL			1											1															
NO FORWARD ATTENTION																													
IMPROPER PEDESTRIAN CROSSING																				4									4
IMPROPER TURNING					1									1					3										3
IMPROPER BACKING																													
DRIVING ON WRONG LANE																													
LOOKING ASIDE IN DRIVING	6						1	1	1					9					1	1									2
IMPROPER OVERTAKING																			1										1
NO STOP AT STOP SIGN																													
DEFICIENT ROAD																													
IMPROPER IN COMING OUT OF PARKING																			2										2
CARELESS DRIVING					1									1															
CARELESS PARKING																							1						1
NO PREVENTIVE CARE																													
TOTAL	45	–	1	–	8	–	1	7	1	–	–	–	–	63	23	–	2	–	23	5	–	3	1	–	–	–	–	–	57

TABLE 4-5 (Cont'd)

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	Via Ricardo J. Alfaro – Via Transistmica															Via Ricardo J. Alfaro – Via Simon Bolivar														
	REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL	REAR END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY	35				2			4						41	18			1				7							26
IMPROPER CHANGE OF LANE					4									4	1				45										46
IMPROPER CROSSING			4		2			1						7				11	5										16
OPENED DOOR													1	1														1	1
WRECKLESS DRIVING	1				3									4	1				1		1								3
BREAK FAILURE	7		1				2	2						12	2				1										3
DISREGARD OF TRAFFIC SIGNAL			5		1									6															
NO FORRWARD ATTENTION																													
IMPROPER PEDESTRIAN CROSSING						5								5						1									1
IMPROPER TURNING																							1						1
IMPROPER BACKING											2			2											3				3
DRIVING ON WRONG LANE					1									1															
LOOKING ASIDE IN DRIVING	21		2		6		2							31	17				5		1	1	1						25
IMPROPER OVERTAKING					8									8	1				2			1							4
NO STOP AT STOP SIGN	1				2									1				11	1				1						13
DEFICIENT ROAD																													
IMPROPER IN COMING OUT OF PARKING																													
CARELESS DRIVING																													
CARELESS PARKING																													
NO PREVENTIVE CARE							1							1											1				1
TOTAL	65	–	12	–	29	5	5	7	–	–	2	–	1	–	126	40	–	23	–	60	1	2	9	3	1	3	–	1	–	143

TABLE 4-5 (Cont'd)

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	Via Federico Boyd – Via Espana															Via Espana – Calle 57												
	REAR END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL	REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY	25					1	3							29	9							1						10
IMPROPER CHANGE OF LANE	3				4									7					4									4
IMPROPER CROSSING			2		2									4			9		10									19
OPENED DOOR																												
WRECKLESS DRIVING																			1									1
BREAK FAILURE	2						2							4														
DISREGARDED TRAFFIC SIGNAL			1											1			1											1
NO FOREWARD ATTENTION																												
IMPROPER PEDESTRIAN CROSSING						2								2														
IMPROPER TURNING																				2								2
IMPROPER FOR BACKING											1			1											1			1
DRIVING ON WRONG LANE	1													1														
LOOKING ASIDE IN DRIVING	5						1							6					1									1
IMPROPER OVERTAKING					3									3														
NO STOP AT STOP SIGN																1												1
DEFICIENTLY ROAD					1									1														
IMPROPER IN COMING OUT OF PARKING																												
CARELESS DRIVING																									1			1
CARELESS PARKING																												
NO PREVENTIVE CARE																												
TOTAL	36	–	3	–	10	2	5	–	–	–	1	–	–	59	10	–	10	–	18	–	–	1	–	1	1	–	–	–	41

TABLE 4-5 (Cont'd)

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	Via Espana – Via Fernandez de Cordoba															Total												
	RLAR END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL	REAR END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MUSTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY	10				2									12	155		1		4		1	23							184
IMPROPER CHANGE OF LANE					6									6	4				74										78
IMPROPER CROSSING			4		3									7	1		32		27			1							61
OPENED DOOR																											2		2
WRECKNESS DRIVING															2				11		1	1							15
BREAK FAILURE															14		1		1		2	4							22
DISREGARDED TRAFFIC SIGNAL			1											1			9		1										10
NO FOREWARD ATTENTION					1									1					1										1
IMPROPER PEDESTRIAN CROSSING					1									1					1	12									13
IMPROPER TURNING			1		2									3			1		8					1					10
IMPROPER BACKING																										7			7
DRIVING ON WRONG LANE															1				1										2
LOOKING ASIDE IN DRIVING	1													1	50		2		13	1	5	2	2						75
IMPROPER OVERTAKING					1									1	1				15			1							17
NO STOP AT STOP SIGN			1											1	2		12		3				1						18
DLI ICH-NT ROAD																			1										1
IMPROPER IN COMING OUT OF PARKING																			2										2
CARELESS DRIVING																			1					1					2
CARELESS PARKING									1					1									2						2
NO PREVENTIVE CARE																					1			1					2
TOTAL	11	–	7	–	16	–	–	–	1	–	–	–	–	35	230	–	58	–	164	13	10	32	6	2	7	–	2	–	324

Source: ESTAMPA

(3) Toll Parking Space Survey

Few toll parking lots exist in Panama Urban Area, of which the following two representative parking lots were surveyed:

	BNP Parking Lot (Business district)	GAR Parking Lot (Commercial district)
Average length of parking	111 min.	86 min.
Turnover ratio	3.7	2.1
Peak, morning	10 – 11	9 – 10
Peak, afternoon	Insignif.	3 – 4

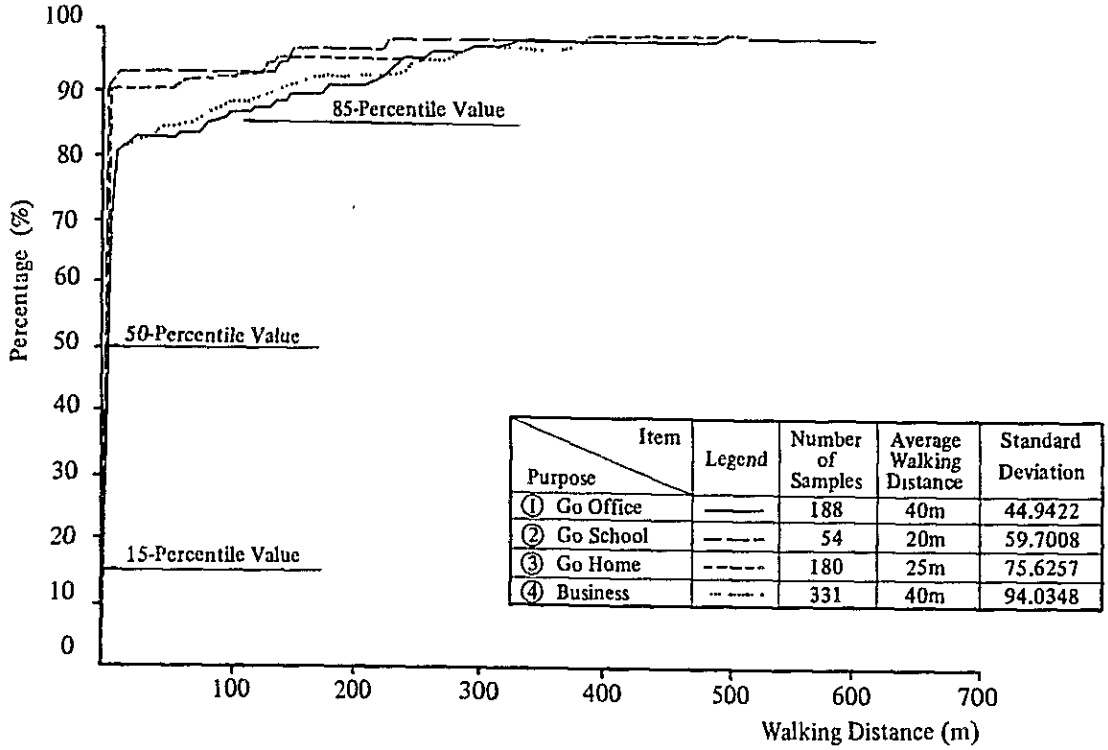
The indicated low turnover ratios for these urban center parking lots are probably attributable to the fact that curb parking, legal or illegal, is relatively easy and that parking tolls are inexpense (50 to 75 cents per hour). The afternoon peak shown by GAR Lot reflects shoppers demand. The peak ratio is from 16% to 17% for both lots. (See Fig. 4-13)

TABLE 4-6 TRIP PURPOSE DISTRIBUTION OF INTERVIEWED SAMPLES BY AREA

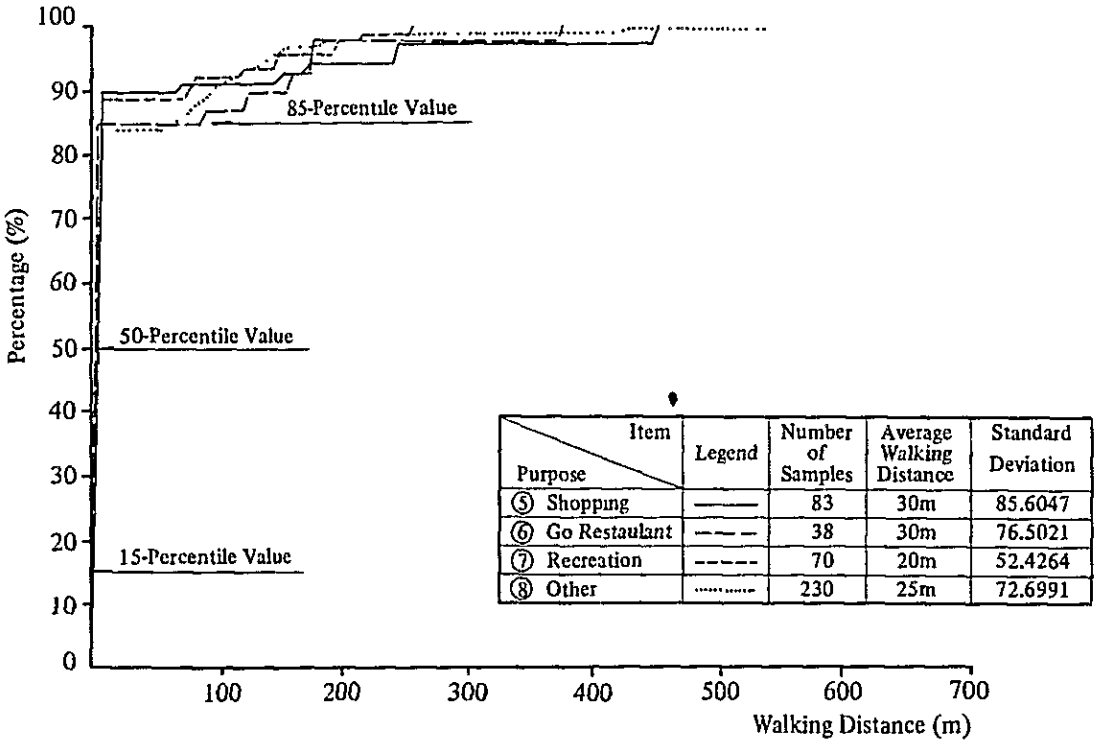
PURPOSE / AREA	1 GO OFFICE	2 GO SCHOOL	3 GO HOME	4 BUSINESS	5 SHOPPING	6 GO RES-TAURANT	7 REC-REATION	8 OTHER	TOTAL
SAN FELIPE	6	1	16	5	7	1	1	18	55
EL CHORRILLO	20	2	35	78	12	10	4	41	202
SANTA ANA	8	0	10	28	12	1	2	15	76
CALIDONIA (1)	27	2	14	45	4	2	4	33	131
CALIDONIA (2)	32	1	41	59	22	4	30	54	243
CURUNDU	8	0	6	7	2	1	8	9	41
BELLA VISTA (1)	14	40	77	11	3	2	1	10	88
BELLA VISTA (2)	43	3	23	57	3	4	6	13	152
BELLA VISTA (3)	14	2	5	15	14	10	4	19	83
BELLA VISTA (4)	16	3	23	26	4	3	10	18	103
TOTAL	118	54	180	331	83	38	70	230	1174
DISTRIBUTION(%)	16.0	4.6	15.3	28.2	77.1	3.2	6.0	19.6	100

(4) Curb Parking (Sample) Survey

A curb parking sample survey was conducted in Corregimiento de San Felipe, Calidonia, and Urb. Obarrio. In these three zones, the heaviest parking was experienced generally from 09:00 to



Purpose \ Item	Legend	Number of Samples	Average Walking Distance	Standard Deviation
① Go Office	———	188	40m	44.9422
② Go School	— — —	54	20m	59.7008
③ Go Home	- - - - -	180	25m	75.6257
④ Business	— · — ·	331	40m	94.0348



Purpose \ Item	Legend	Number of Samples	Average Walking Distance	Standard Deviation
⑤ Shopping	———	83	30m	85.6047
⑥ Go Restaulant	— — —	38	30m	76.5021
⑦ Recreation	- - - - -	70	20m	52.4264
⑧ Other	·····	230	25m	72.6991

FIG. 4-12 WALKING DISTANCE DISTRIBUTIONS

Note: Distance from road-side parking lot to the final destination

Source : ESTAMPA

TABLE 4-7 PARKING TIME & AVERAGE TURNOVER RATIO

PARKING STATION	NUMBER OF PARKING DEMAND	AVAILABLE CAPACITY	AVERAGE TURNOVER RATIO	AVERAGE PARKING TIME	15 PER-CENT *	50 PER-CENT *	85 PER-CENT *
GAR	380	178	2.1	86 Min. S=95.8334	15 Min.	55 Min.	155 Min.
BNC	1103	300	3.7	111 Min. S=153.6134	10	35	270

S = Standard Devation Source : ESTAMPA * See Fig. 4-13.

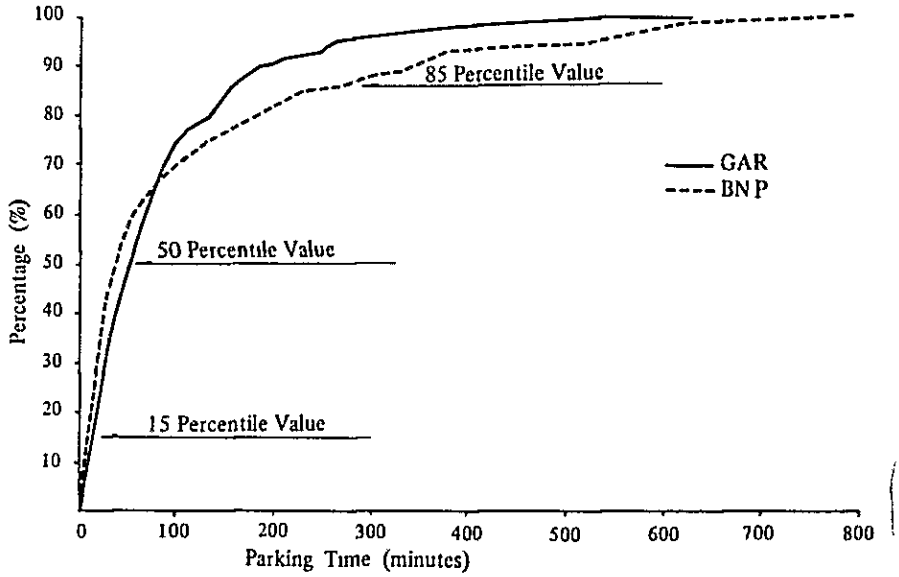


FIG. 4-13 PARKING TIME DISTRIBUTIONS

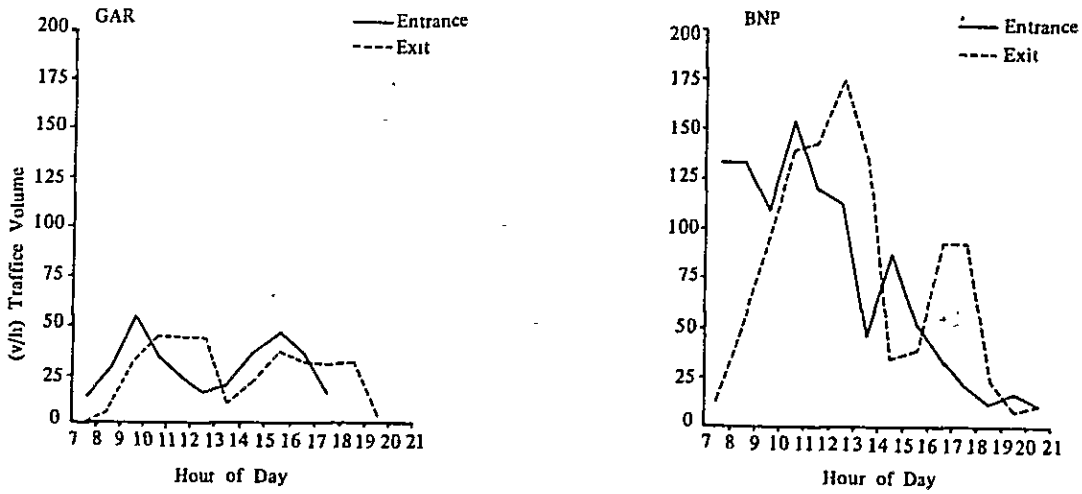


FIG. 4-14 HOURLY TRAFFIC TO AND FROM TOLL PARKING LOTS

11:00, when parking rate exceeded 100% in Corregimiento de Calidonia. The utilization of metered parking spaces is high only in Corregimiento de Calidonia, where their turnover ratio is high at 11.0, with the other two zones showing a turnover ratio of only 2.1 to 4.1. The turnover of nonmetered curb spaces is lower than those indicated. Average parking time is from 50 to 60 minutes in metered and non-metered spaces alike.

CHAPTER 5.

CURRENT TRAVEL CHARACTERISTIC

5. CURRENT TRAVEL CHARACTERISTIC

1) Person-Trip Survey

(1) Purpose

The survey and analysis of the existing passenger car, bus, truck and other traffic volumes are not enough for the purpose of forecasting transportation demand in a long-term future. In addition, long-term changes in such fundamental conditions as urban land use pattern, transportation network, the level of motor vehicle ownership, and so forth, must also be taken into consideration.

Motor traffic generation is a result of man's desire to travel from place to place for certain purpose. Thus, knowledge about people who travel, places between which they travel, the purpose of their travel, and the means of transportation facilities gives the in-depth understanding of transportation demand structure. A person-trip survey is conducted for the very purpose of obtaining such informations. The survey data are processed into relationships between the attributes of trip makers (such as age, sex, occupation and whether car owner or not) and travel characteristics (such as origin and destination, mode of transportation, trip length, and time) of which result will offer the most important fundamental infomation for the formulation of a comprehensive transportation masterplan.

(2) Method

The person-trip survey was conducted in the Survey Area against 7.5% to 10% samples of households in each zone of the Area. These samples represented in total 37.5% to 50% samples randomly selected from 20% of the total household sheets gathered in the 1980 population census.

Trips made by all of the individual members, except those under six, of the sample households were surveyed through interview. The door-to-door visits were made in about one month period from May 12 to June 7, 1981.

Included in the Survey Area were a total of 32 corregimientos having a total of 157,076 household and a total population aged more than or equal to six of 607,794, according to the 1980 census. Of these totals, the samples were 11,806 households with a total family members of 44,555.

(3) Zoning

In order to clearly define the object of Study and the object of planning, the Republic of Panama is divided into Study Area and External Area, and a part of Study Area is designated as person-Trip Survey Area, which is further divided into a total of 63 PT Zones (identified by two digit numerical figures from 1 to 63), taking into consideration such matters as corregimiento boundaries, road network, socio-economic homogenity, geographical conditions, and the survey precision required. In facilitation of analysis and overall understanding, the 63 zones are grouped into a total of 17 integrated zones (identified by Roman figures from I to XVII). (See Figure 5-1 and Tables 5-1 and 5-2).

(4) Data Processing

The prime data gathered through the Person-Trip Survey were coded, punched onto cards, and stored in discs for computer data processing. Then, after the checking of errors, sample data expansion, the addition of external trip quantity as revealed by a cordon line survey, and data correction by the result of a screen line survey, the processed data was compiled into a master file. This process is illustrated by a flow chart presented in Figure 5-2.

The final effective sampling rate was 5.8 % and the ratio of effective samples (response rate) was 79%. In general, the response rate was higher in rural area than in urban area, provided that, because the survey time was limited to two weeks, such rates in Chilibre (36) and Las Cumbres (35) were low at 3.6% and 4.5%

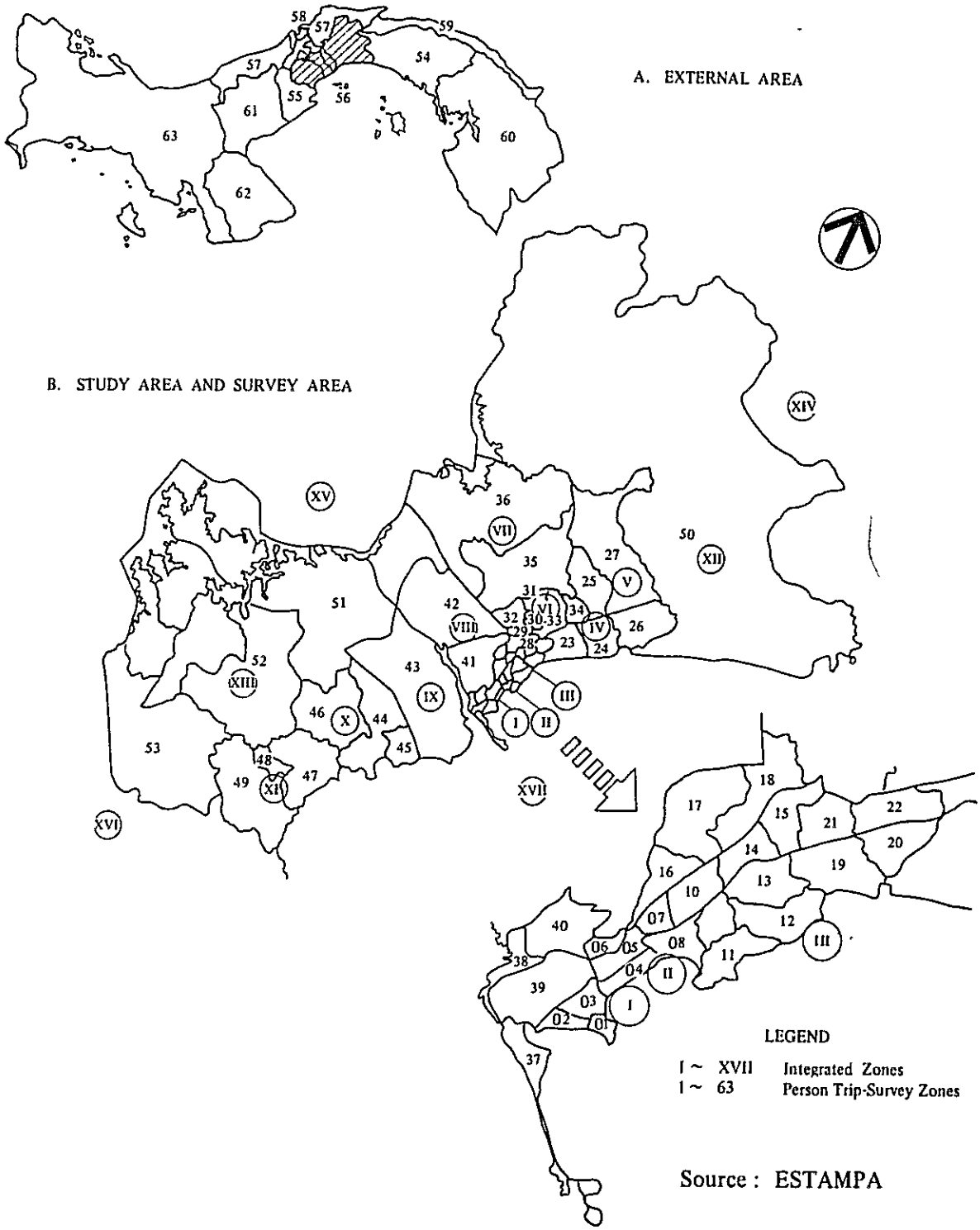


FIG. 5-1 ZONE MAP

TABLE 5-1 ZONE CODE AND ZONE NAME

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

* In the area of the external area, the division is at the level of district or province.

Source : ESTAMPA

TABLE 5-2 NUMBER OF ZONES

Description of Area			Integrated Zones	P.T. Survey Zones
Study Area	Survey Area	Panama	8	36
		San Miguelito	1	7
		Arraiján	1	3
		La Chorrera	1	3
		Sub–Total	11	49
	Pacora, Nuevo Emperador		2	2
External Area			4	10
		Total	17	63

Source : ESTAMPA

(5) Supplemental Surveys

The Person-Trip Survey interviews were limited to the residents of the PT Survey Area and, therefore, did not reveal non-resident trips in the Area. To supply this missing information, a Cordon Line Survey was conducted. Cordon Line is an imaginary line which surrounds a survey area. The Cordon Line Survey for the purpose of this Study obtained the counts of vehicles of each type which crossed the Cordon Line to enter or leave the PT Survey Area and, as for passenger cars, taxis and trucks, obtained information on the passengers's place of residence and origins and destinations. Traffic counting was conducted at stations shown in Figure 5-3, for a 12-hour period in Arraijan (Station 6) and for a 24-hour period at other stations.

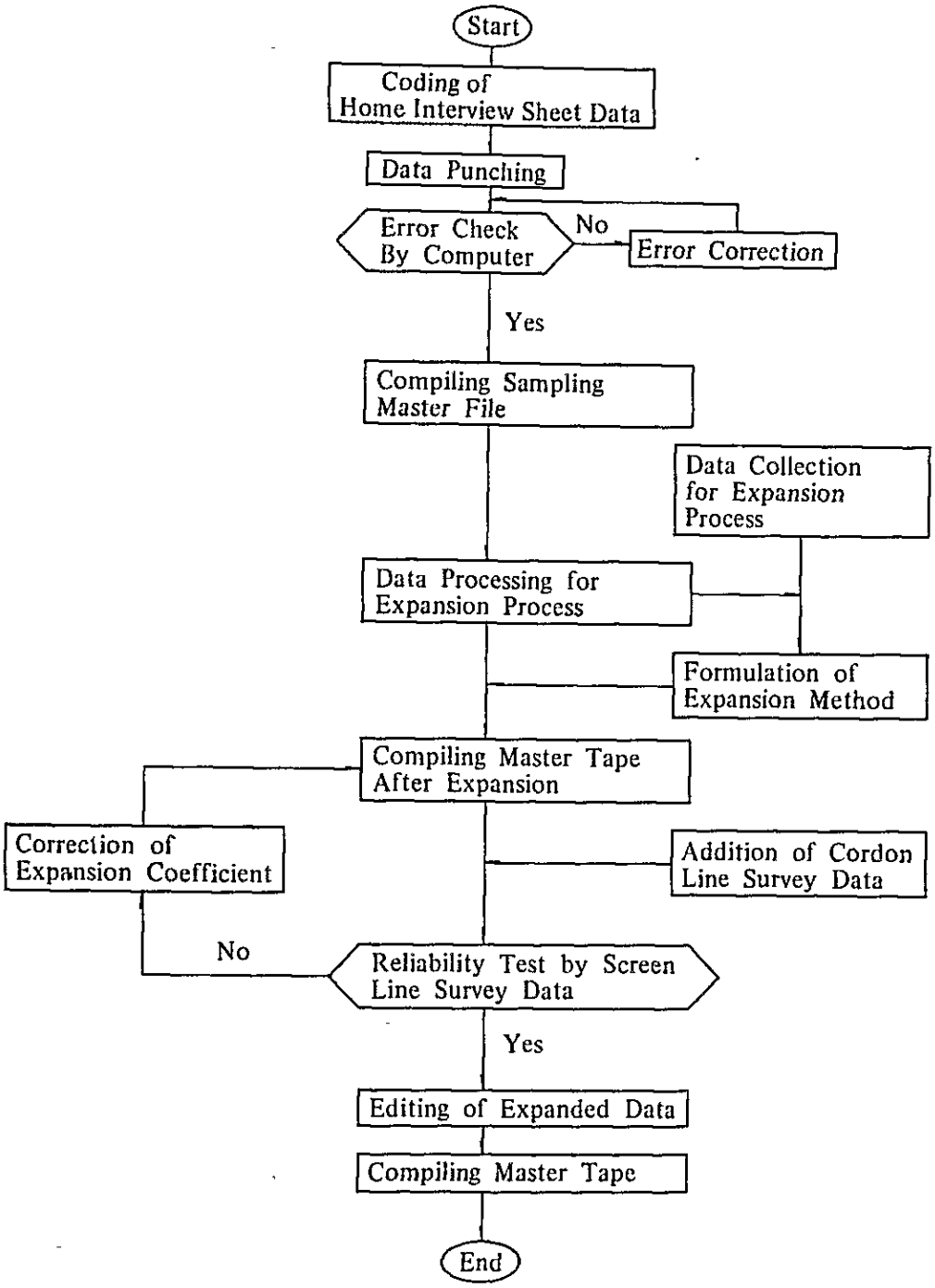
A screen line survey is a traffic counting on a line drawn to divide a PT survey area into approximately equal halves for the purpose of testing the reliability of the result of the PT survey and to effect correction thereof, if necessary. In this Study, two screen lines were used: one line starting from Ave. Balboa in front of Parque de Urraca, crossing the downtown area, and ending at Campo de Antenas de Curundu, and the other line is the Panama Canal. Traffic was counted by vehicle type during a 24-hour period at the screen line traffic counting stations also shown in Figure 5-3.

2) **Outline**

Trip is defined as "the locomotion of person from place to place" for the purpose of achieving certain purpose. Often, more than one mode of travel is utilized for completing this locomotion. Thus, two methods are available for counting the number of trips; one method counts man's locomotion for achieving each purpose as one trip (which is called linked trip) and the other method counts locomotion by each mode of travel as one trip (which is called unlinked trip). In the illustrative case presented in Figure 5-4, the same locomotion is counted as one linked trip (for the purpose of going to "work") or as four unlinked trips (utilizing four different modes of travel). The unlinked trip gives more accurate information for the purpose of analyzing demand on each mode of travel at the sacrifice of information pertaining to relationship between trip purpose and trip O-D. Furthermore, interzonal connections and the intensity of land use may not be discussed in terms of unlinked trip. Therefore, analyses hereunder will use linked trips, unless otherwise noted.

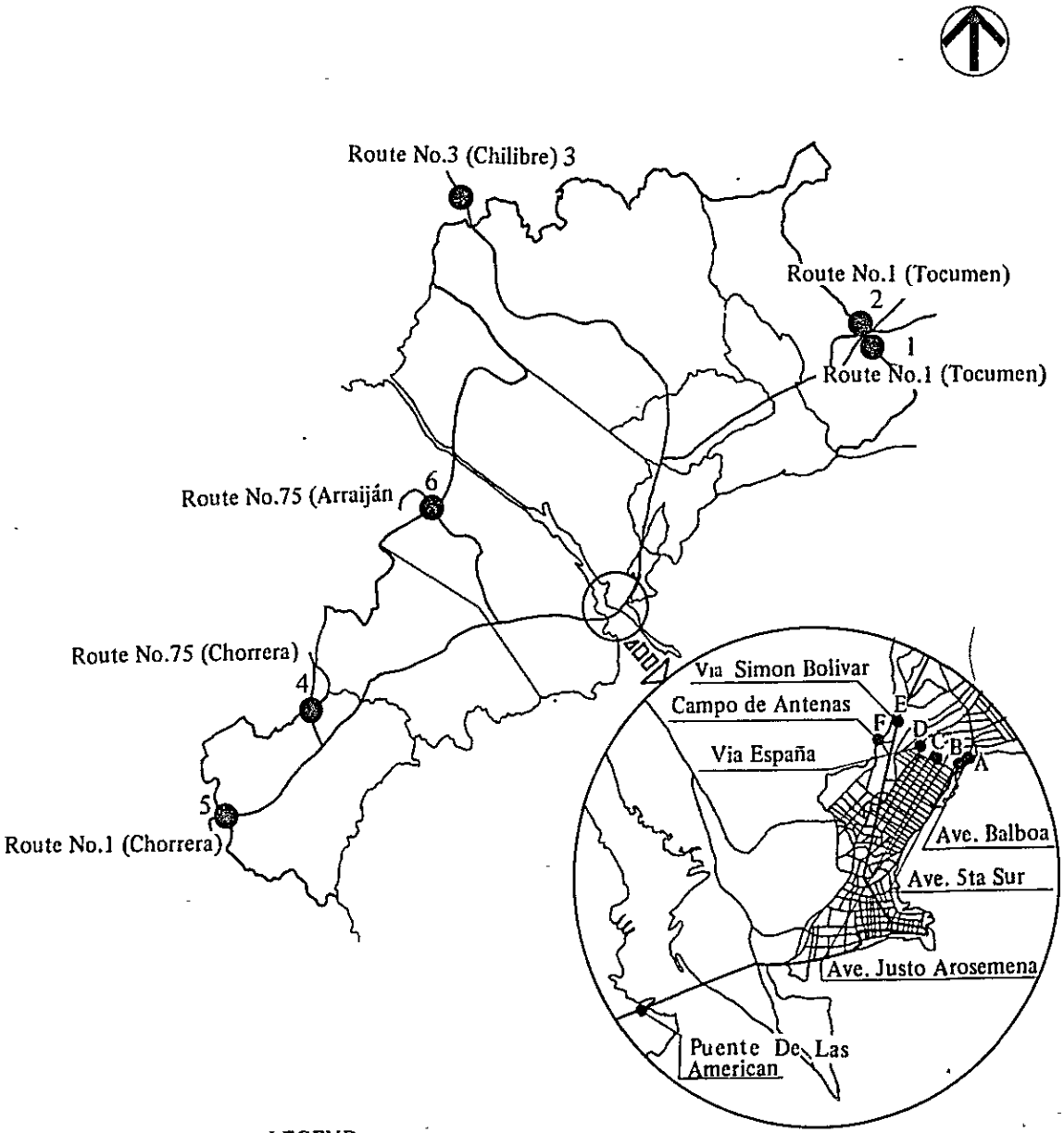
Transportation modes in the Study Area has been arranged in one order shown below in order to make one-to-one correspondence between a linked trip and a trip mode. Based on this order, a trip by more than one modes will be regarded as the trip by the highest-ranked mode. This order (ranking) of modes is set only for analytical purpose and doesn't mean the hierarchy of importance of modes.

(1) Railway (2) Public-use Bus (3) Chiva (4) Private-use Bus, School bus
(5) Taxi (6) Passenger car (7) Truck (8) Two wheeler (9) Walking
(10) Others



Source : ESTAMPA

FIG. 5-2 PERSON-TRIP SURVEY DATA MASTER TAPE COMPILATION PROCEDURE



Source : ESTAMPA

FIG. 5-3 LOCATIONS OF CORDON LINE AND SCREEN LINE SURVEY STATIONS

TABLE 5-3 COLLECTED SAMPLES BY CORREGIMIENTO

Cooregimiento	Population Aged Six And Over (1)	Samples (2)	Effective Samples (3)	Ratio of Effective Samples (%) (3) / (2)	Effective Sampling Rate (%) (3) / (1)
Arraijan	28534	2222	1955	88	6.9
11 Cabecera y sus lugares poblados	13408	1022	924	90	6.9
12 Juan Demostenes Arosemena	7201	507	432	85	6.0
13 Veracruz	4508	454	365	80	8.1
14 Vista Alegre	3417	239	234	98	6.9
La Chorrera	47341	3660	2999	82	6.3
21 Barrio Balboa	17798	1453	1188	82	6.7
22 Barrio Colon	13952	1037	892	86	6.4
23 El Coco	2582	192	166	86	6.4
24 Guadalupe	9072	689	523	76	5.9
25 Playa Leona	2146	152	129	85	6.0
26 Puerto Caimito	1791	137	101	74	5.6
Panama	400600	28940	22606	78	5.6
31 San Felipe	10512	776	543	70	5.2
32 El Chorrillo	21853	1589	1375	87	6.3
33 Santa Ana	24310	1712	1444	84	5.9
34 La Exposicion	25430	1786	1343	75	5.3
35 Curundu	13965	1001	832	83	6.0
36 Betania	39697	2922	2507	86	6.3
37 Bella Vista	25325	1767	1293	73	5.1
38 Pueblo Nuevo	17949	1338	1080	81	6.0
39 San Francisco	31695	2413	1698	70	5.4
40 Parque Lefevre	30257	2268	1811	80	6.0
41 Rio Abajo	27736	1953	1514	78	5.5
42 Juan Diaz	45062	3066	2667	87	5.9
43 Pedregal	27289	1945	1639	84	6.0
44 Ancon	1606	156	108	69	6.7
45 Chilibre	14581	1119	521	47	3.6
46 Las Cumbres	25841	1891	1150	61	4.5
47 Tocumen	17492	1238	1081	87	6.2
San Miguelito	131319	9733	7816	80	6.0
51 Amelia D. de Icaza	20684	1498	1356	91	6.6
52 Belisario Porras	65413	4890	3466	71	5.3
53 Jose D. Espinar	20036	1462	1291	88	6.4
54 Mateo Ituttalde	10656	812	729	90	6.8
55 Victoriano Lorenzo	14530	1071	975	91	6.7
TOTAL	607994	44555	35376	79	5.8

Source : ESTAMPA

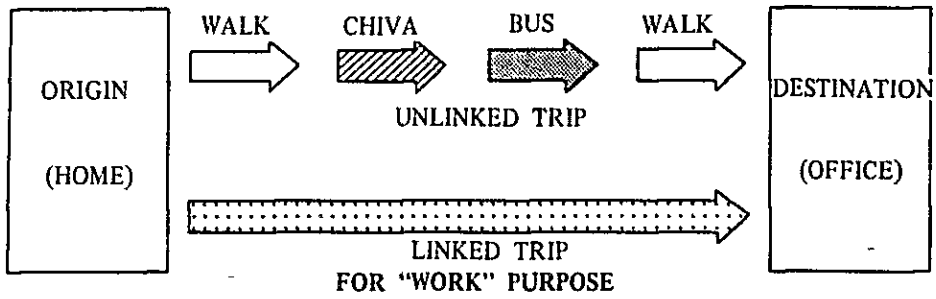


FIG. 5-4 LINKED AND UNLINKED TRIPS

Every trip has two ends: one end of origin and the other of destination. Trips are classified as in Figure 5-5, depending on the locations of these trip ends.

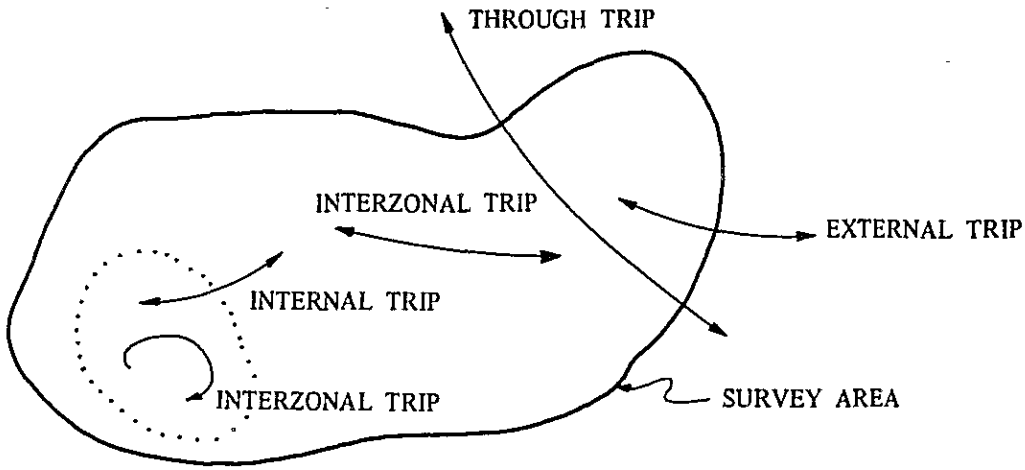


FIG. 5-5 CLASSIFICATION OF TRIPS

a. Internal Trip : The trip whose both ends occur within the Survey Area

b. External Trip : The trip whose one end occurs in the Survey Area and the other end out of the Area

c. Through Trip : The trip having both ends outside the Survey Area but going through the Area

d. Intrazonal Trip : The trip whose both ends occur within a given zone

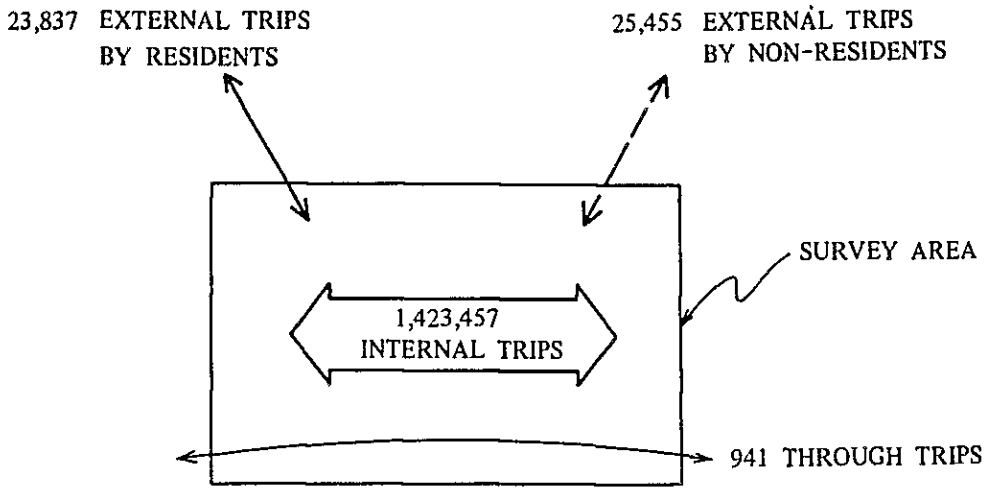
e. Interzonal Trip : The trip whose one end occurs in a given zone and the other end outside the zone

(1) Total Trips

The daily average of total number of trips either generating in and/or attracted to or passing

through the Survey Area was an estimated 1,474,000 trips in 1981. Of this, 98% of 1,447,000 trips were by the Area inhabitants (see Figure 5-6).

Of said total trips, 96% was internal trips while external trips accounted for only 4% and the number of through trips was a negligible 941. About one-half of internal trips were by residents and the other half by non-residents. Because the characteristics of non-resident trips and their activities in the Survey Area may not be revealed by the Person Trip Survey, the less the numbers of external trips and through trips, the higher the reliability of PT Survey data. In this sense, it is fortunate that the Survey Area is of a highly closed nature, in terms of transportation demand.



Source : ESTAMPA

FIG. 5-6 PERSON-TRIP OCCURRENCES IN THE SURVEY AREA

(2) Trip Purpose

The importance of internal trip purposes is, in descending order: home (43.6%), work (17.9%) and school (15.7%), which together represent as much as 77% of all purposes (see Table 5-4). Trips for these three purposes are daily routine trips and, therefore, constitute rush hour traffic flow, bearing heavily upon the formulation of a transportation plan. As the scale of a city enlarges, the number of "business" and "private" trips tends to become relatively large while trips for "work" and trips for "school" shrink to relatively small shares.

TABLE 5-4 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

Source : ESTAMPA

Following "school" trips, the share of "private" (including amusement and social activities) trips is high at 14.2%. The shares of "business" and "shopping" (including going to restaurant) trips occupy the shares of only 4% level, provided that a fair size of short trips in CBD and truck trips could have possibly not been recorded in the survey sheets and, therefore, another survey might be necessary for securing accurate information on "business" trips. Incidentally, the share of "business" trips is usually 7 to 10% in medium-size cities with a population of 50,000 to 1,000,000.

(3) Mode of Travel

A review of trip composition by mode (see Table 5-5) reveals that the share of "walk" is unusually low at 22% as against commonly over 50% in medium-size cities. This suggests that the Person-Trip Survey failed to capture all short distance walk trips. Inasmuch as walk trips are little burden on transportation facilities, however, the possible ommissions of walk trips will little impair the value of data as fundamental information for transportation planning.

When walk trips are excluded from the total, the highest share of 43.9% is shown by buses in public use, followed by 34.5% shown by passenger cars – the two modes together constituting a total share of as much as 78.4%. Motorcycles and bicycles are little used and are negligible as the means of transportation in Panama City. The low share shown by chiva (micro buses) is explained by the fact that a large portion of their passengers (estimated at about 11,000) transfer to buses and, therefore, are counted as the passengers of bus, whose importance is ranked higher than that of chiva for the purpose of counting linked trips.

TABLE 5-5 GENERATED TRIPS BY MODES

	Mode	Trips	Modal Composition (%)	
			Including Walk	Excluding Walk
1	Walk	326,133	22.1	–
2	Two Wheeler	2,319	0.2	0.2
3	Car	395,895	26.9	34.5
4	Truck	102,297	6.9	8.9
5	Taxi	71,120	4.8	6.2
6	Chiva	5,162	0.4	0.5
7	Bus (Public)	503,851	34.2	43.9
8	Bus (Private)	65,359	4.4	5.7
9	Rail *	–	–	–
10	Others	1,554	0.1	0.1
11	Total	1,473,690	100.0	100.0

* No Cordon Survey data is available for railway, but according to the Person Trip Survey, Trip by rail are estimated at a negligible number of 494.

Source : ESTAMPA

3) Trip Production Rate

Certain people travel more often than others. Efforts are made to find some correlationship between the kind of people and the frequency of trips which they make through the comparison of average number of trips made each day by each of those who commonly share a given personal attribute with such average shown by those sharing some other attribute.

Such average, referred to as "trip production rate", is one of the most basic indicators for use in estimating future transportation demand. The rate obtained by using the total number of people

belonging to the group of same attribute (regardless of whether any of them made a trip or not) as the divisor is labelled as gross trip production rate, and that obtained by using only those who made at least one trip as the divisor is called net trip production rate. Hence,

$$\text{Gross Trip Production Rate} = \frac{\text{Total Trips}}{\text{Population}} = \frac{\text{Total Trips}}{\text{No. of Trip Makers}} \times \frac{\text{No. of Trip Makers}}{\text{Population}}$$

$$= \text{Net Trip Production Rate} \times \text{Trip Maker Ratio}$$

In this Study, gross trip production rate will be used for discussion, unless otherwise noted.

Trip production rate in large cities of the world is typically 2.0 to 3.0, and such rate in the Survey Area is 2.34. As urbanization progresses and socio-economic activities become vigorous, this rates rises. In fact, Panama district show a higher trip production rate than those which suburban and rural parts of the Survey Area tend to show.

(1) Trip Production Rate by Age and Sex

In the Survey Area, the trip production rate of males of 2.75 is much higher than female rate of 1.98, indicating that males have a 1.4 times higher mobility than females. While no mobility difference by sex is noted of those under 15 (school children), males over 14 show much higher rate of "work" and "business" trips than their female counterparts (see Figure 5-7); at any age, "business" trip generation rate of female is too small to be graphically depicted. As for those over the age of 19 who are under higher education, male rate of "school" trips is higher than female. Conversely, male rate of "shopping" trips is lower than female in the age brackets of 30 to 64.

A review of trip generation rate fluctuations over age indicates that the mobility of male rises starting at the age of 20 and reaches about four trips per day in 50 to 54 bracket, after which the rate dwindles, while the mobility of female changes little through the advancement of age.

(2) Trip Production Rate by Occupation and Industry

Trip production rate varies substantially by occupation (see Figure 5-8). That is, such rate shifts from the highest rate of 5.84 trips shown by executive and managerial people, to 4.00 of 4.40 of sales workers, 4.00 to professional, technical, and office workers, and down to the lowest rates of 1.21 and 1.13 shown by the unemployed and housewives. Students and school children show low trip production rates of 2.13 and 2.37, but the number of trips made by them represents over one-third of the total trips; if and when their mobility will rise in the future, they will have a very strong impact on the total transportation demand.

Those of the top three occupational groups discussed in the above similarly make over 1.0 "work" trip and over 1.0 "home" trip, because a fairly large portion of them come home for lunch and go to work again in afternoon or go to two or more places of work.

Trip generation rates are compared by industry in Figure 5-9. The highest rate of 5.2 trips is shown by banking and insurance sector, followed by 4.1 shown by commerce, 3.6 by utilities, and 3.5 by government. The indicated sectoral difference is chiefly attributable to "work" and "home" trips; it is noteworthy that the production rate of other purpose trips show little sectoral difference. The "others" category, which include students and housewives, shows the lowest trip production rate of all industries, while the number of trips made by those who fall in this category represent about 50% of the total number of trips.

(3) Motor Vehicle-Ownership and Trip Production Rate

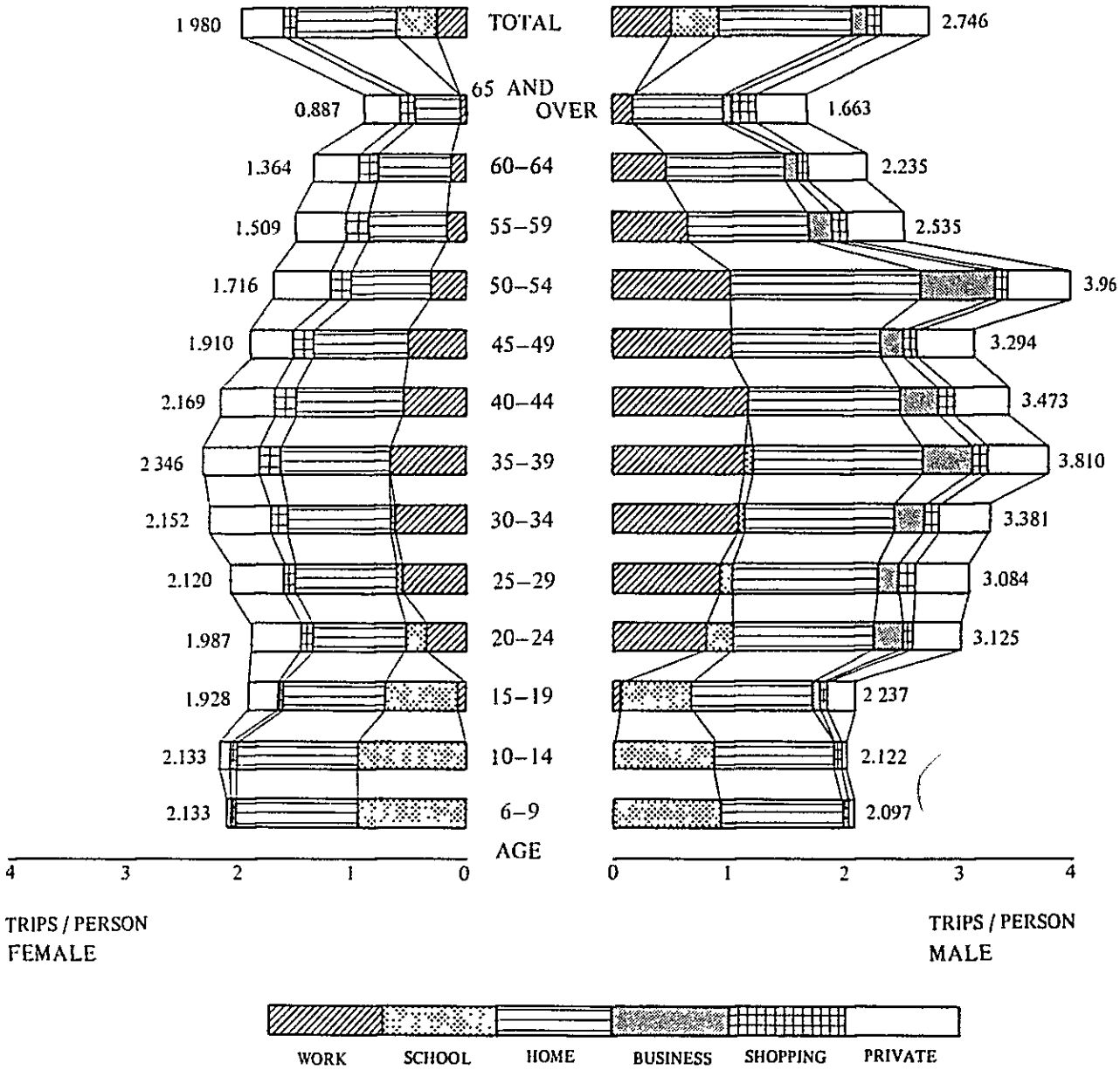
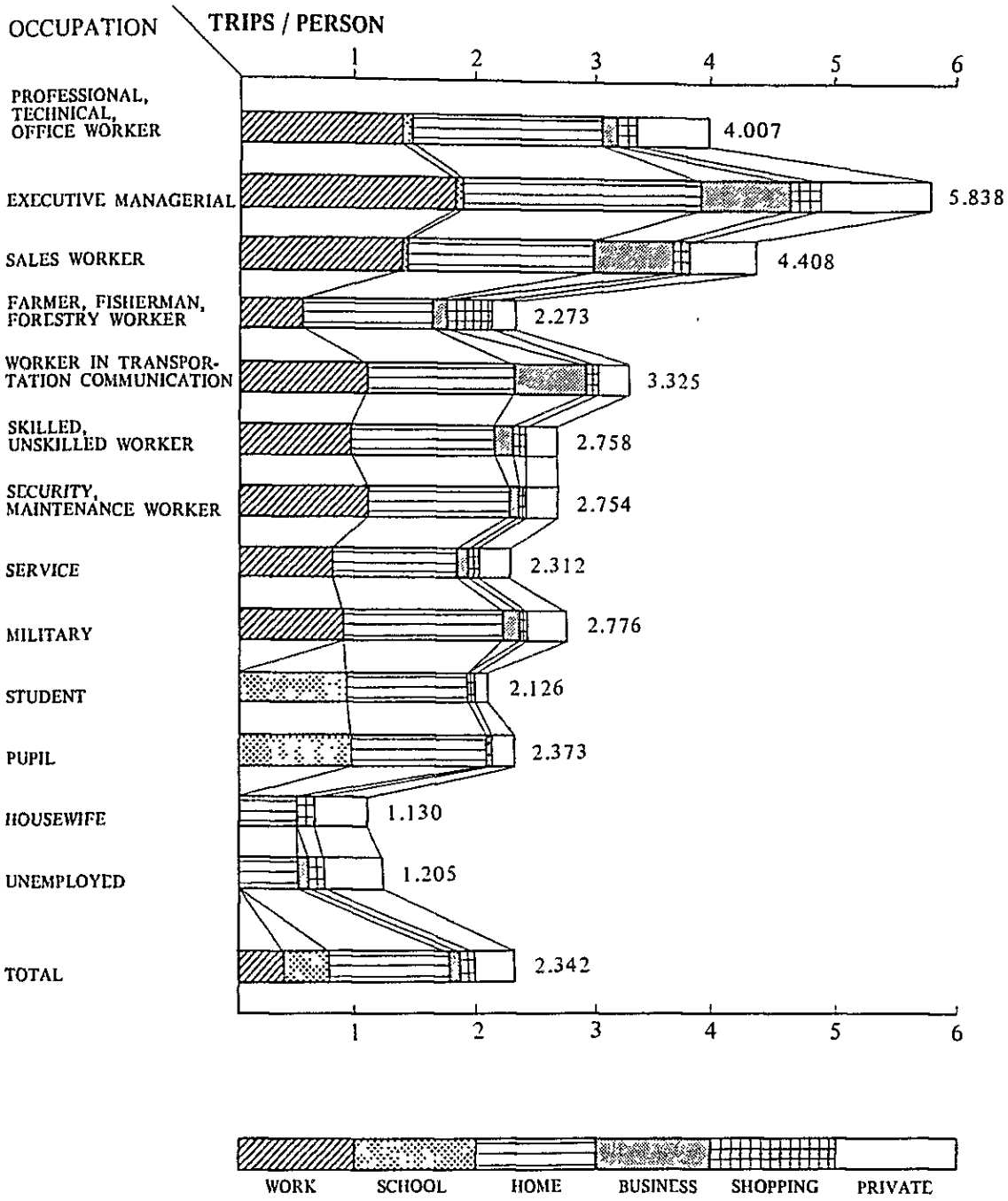


FIG. 5-7 DAILY TRIP PRODUCTION BY SEX, AGE AND PURPOSE

Source : ESTAMPA

A considerable disparity exists between the trip production rate shown by motor vehicle-owning households and that shown by non-car-owning households. The rate shown by the former is 3.39 trips, which is 1.7 times greater than 1.94 trips shown by the latter (see Figure 5-10). Inasmuch as the two groups show similar trip purpose distribution of trip production rate, this disparity is believed attributable not so much to difference in behavioral pattern but to difference in trip maker ratio. In fact, the trip maker ratio of motor vehicle-owning group is 78%, while that of the non-car-owning group is 73%.

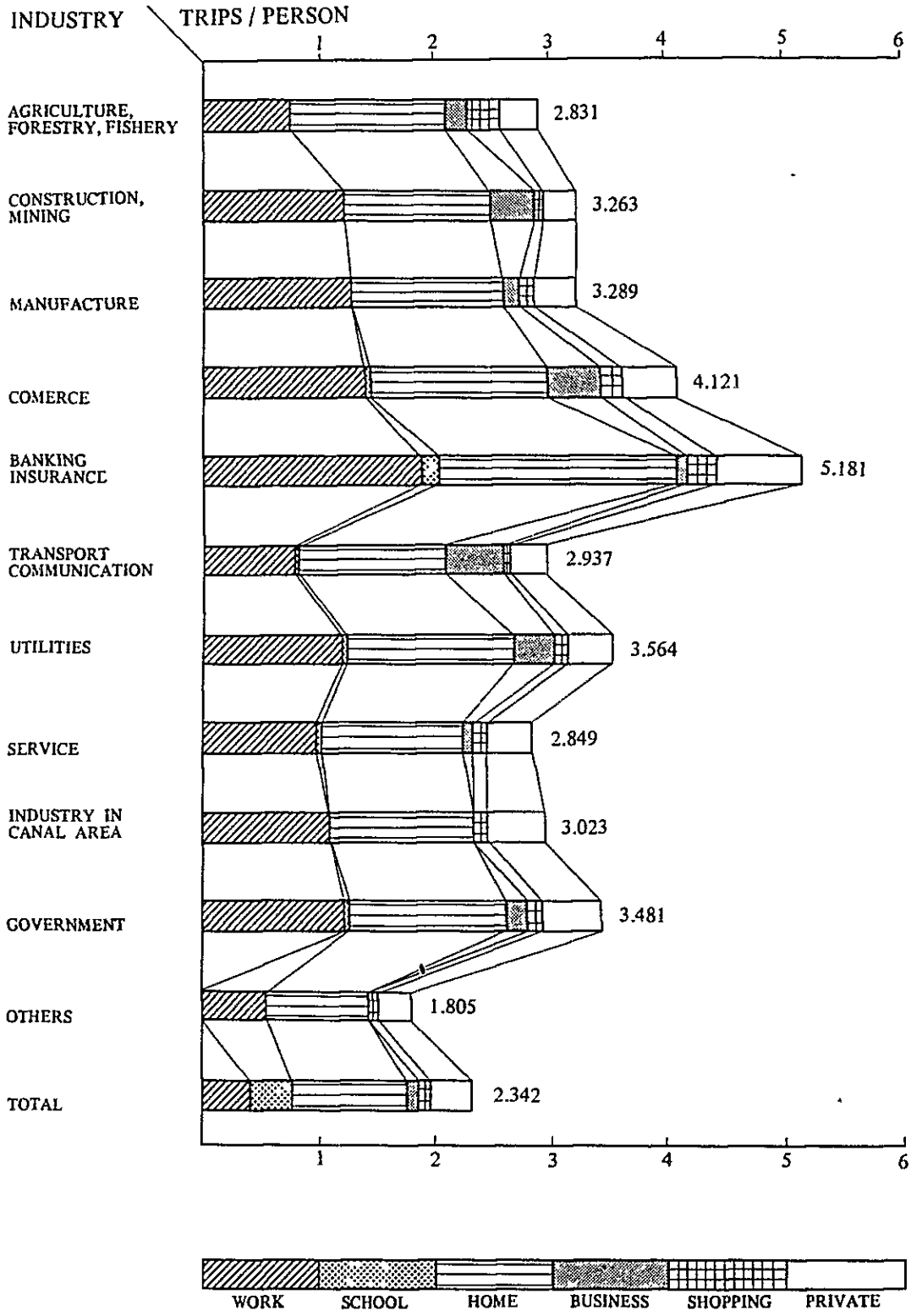
Total motor vehicle ownership in the Survey Area was 72,179 in 1980 (see Table 5-6). Over the total number of households of 157,076, this came to a motor vehicle-owning rate of 46%, which



Source : ESTAMPA

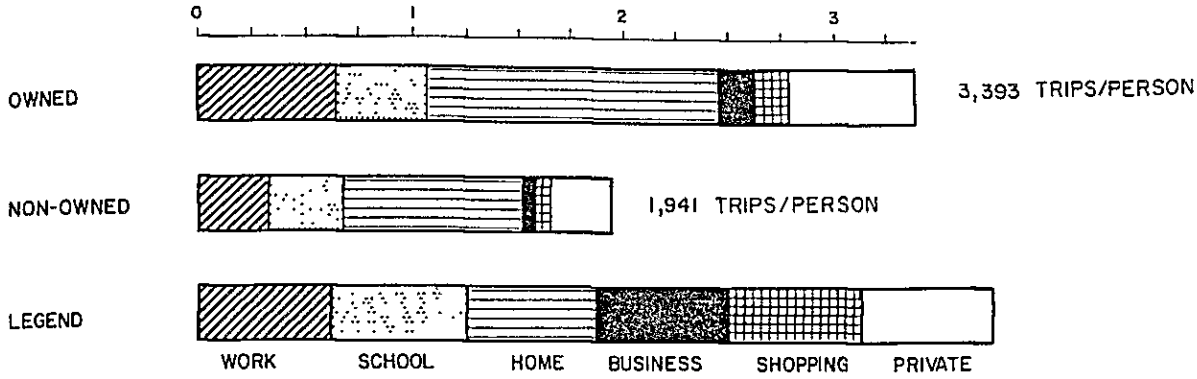
FIG. 5-8 DAILY TRIP PRODUCTION BY PURPOSE AND OCCUPATION

was a fairly high level. The rate of increase in the number of motor vehicles has exceeded population increase rate in the recent years, and, as this trend is believed to continue in the future, the motor vehicle-owning rate will achieve a sizable increase by the target year of this Study, the year 2000, unless disrupted by some unexpected socio-economic change. With this in consideration, relationship between said car-owning rate and trip production rate will have an important meaning in the forecasting of future transportation demand.



Source : ESTAMPA

FIG. 5-9 DAILY TRIP PRODUCTION BY INDUSTRY AND PURPOSE



Source : ESTAMPA

FIG. 5-10 DAILY TRIP PRODUCTION BY CAR OWNERSHIP

TABLE 5-6 VEHICLES REGISTERED IN THE SURVEY AREA

Year	District	Private	Commercial	Taxi	Bus	Total
1980	Panama	42,950	7,029	3,000	1,640	54,619
	La Chorrera	2,250	750	130	230	3,360
	Arraijan	1,000	300	–	70	1,370
	San Miguelito	10,050	2,030	750	–	12,830
	Total	56,250	10,109	3,880	1,940	72,179
1981	Panama	63,043	7,746	3,000	1,412	75,201
	La Chorrera	2,250	920	130	230	3,530
	Arraijan	1,112	300	–	70	1,482
	San Miguelito	9,219	2,330	750	200	12,499
	Total	75,624	11,296	3,880	1,912	92,712

Source : Transito, 1981

4) Travel Characteristics by Zone

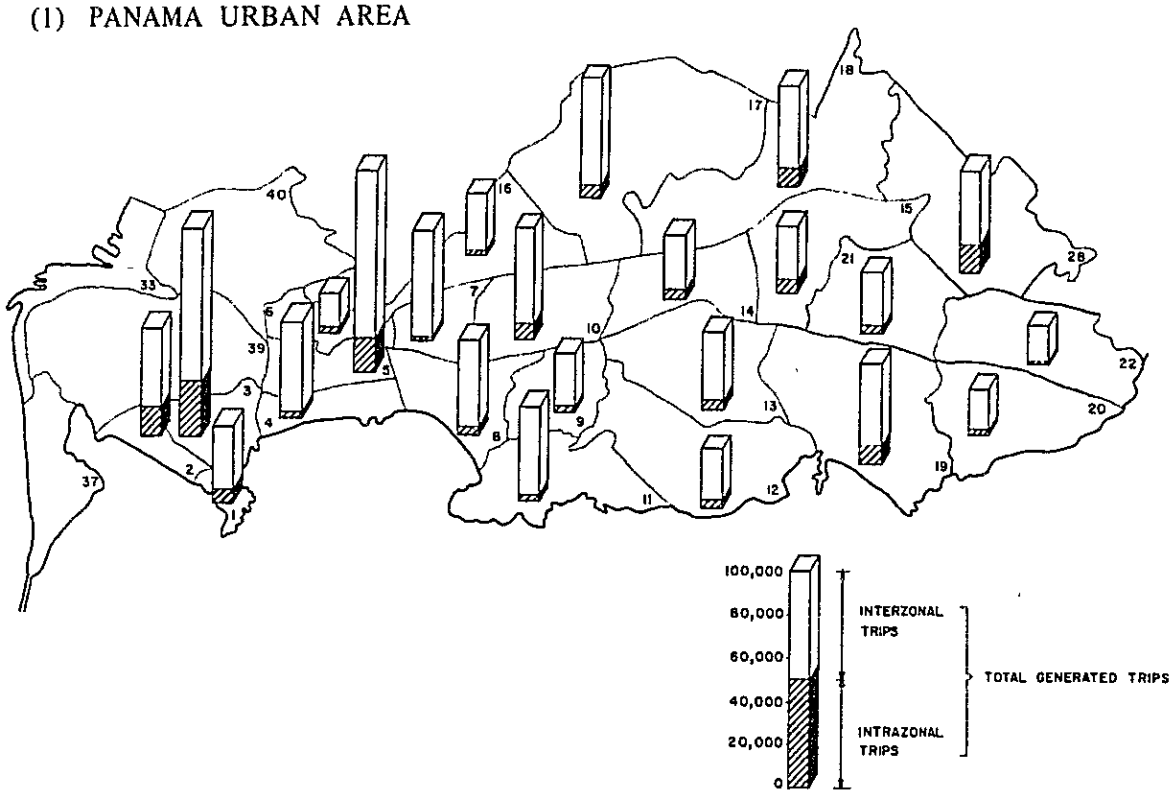
(1) Trip Generation/Attraction by Zone

The number of trips generated and the number of inhabitants are compared for each of integrated zones in Table 5-7. Trip generation is high in urbanized integrated zones such as Centro (Zone I), Bella Vista (Zone II) and Area Residencial (Zone III), which together represent 62%of total trip generation in the Survey Area, while they represent only 43%of the Area population. The proportionally high trip generation in these three integrated areas is not necessarily because the trip production rate of urban inhabitants is high, but is chiefly because the data includes trip generation by those who flow into the zones from outside. In all integrated zones other than these three, the share of total trip generation is lower than the share of the Area population.

Trips generated in each zone are separated into intrazonal trips and interzonal trips (see Figure 5-11). The rate of intrazonal trips to total generation tends to be lower in the built-up area than in suburban and rural areas. Such rate is particularly high at 85% in La Chorrera (Zone XI), indicating that this integrated zone, insofar as seen from transportation aspect, is an economic sphere independent from Panama District. Conversely, such rate is low at less than 10% in most of the PT zones in the built-up area, indicating that they are deeply tied with each other.

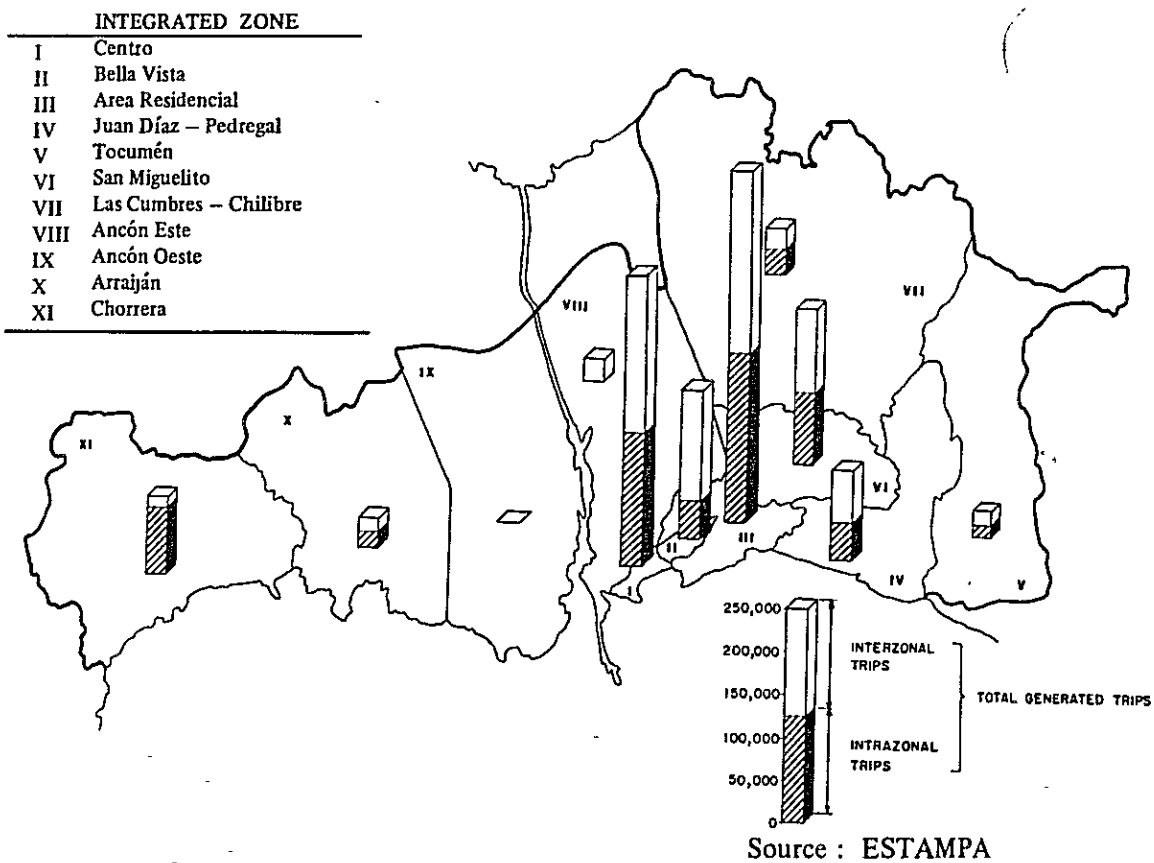
Trips which are most routine in nature are "work" and "school" trips. The generation of these

(1) PANAMA URBAN AREA



(2) SURVEY AREA

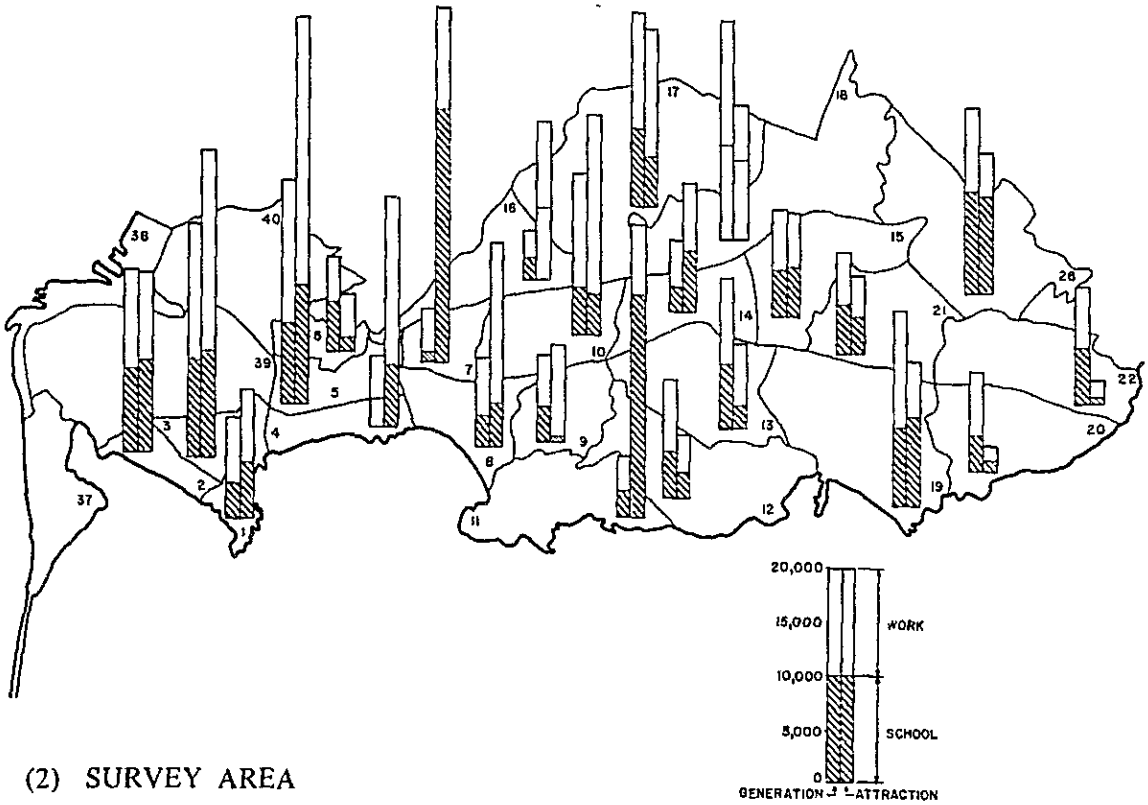
	INTEGRATED ZONE
I	Centro
II	Bella Vista
III	Area Residencial
IV	Juan Díaz – Pedregal
V	Tocumén
VI	San Miguelito
VII	Las Cumbres – Chilibre
VIII	Ancón Este
IX	Ancón Oeste
X	Arraiján
XI	Chorrera



Source : ESTAMPA

FIG. 5-11 TRIP GENERATION BY ZONE

(1) PANAMA URBAN AREA



(2) SURVEY AREA

	INTEGRATED ZONE
I	Centro
II	Bella Vista
III	Area Residencial
IV	Juan Díaz – Pedregal
V	Tocumén
VI	San Miguelito
VII	Las Cumbres – Chilibre
VIII	Ancón Este
IX	Ancón Oeste
X	Arraiján
XI	Chorrera

Note: See zone names in Table 5-2

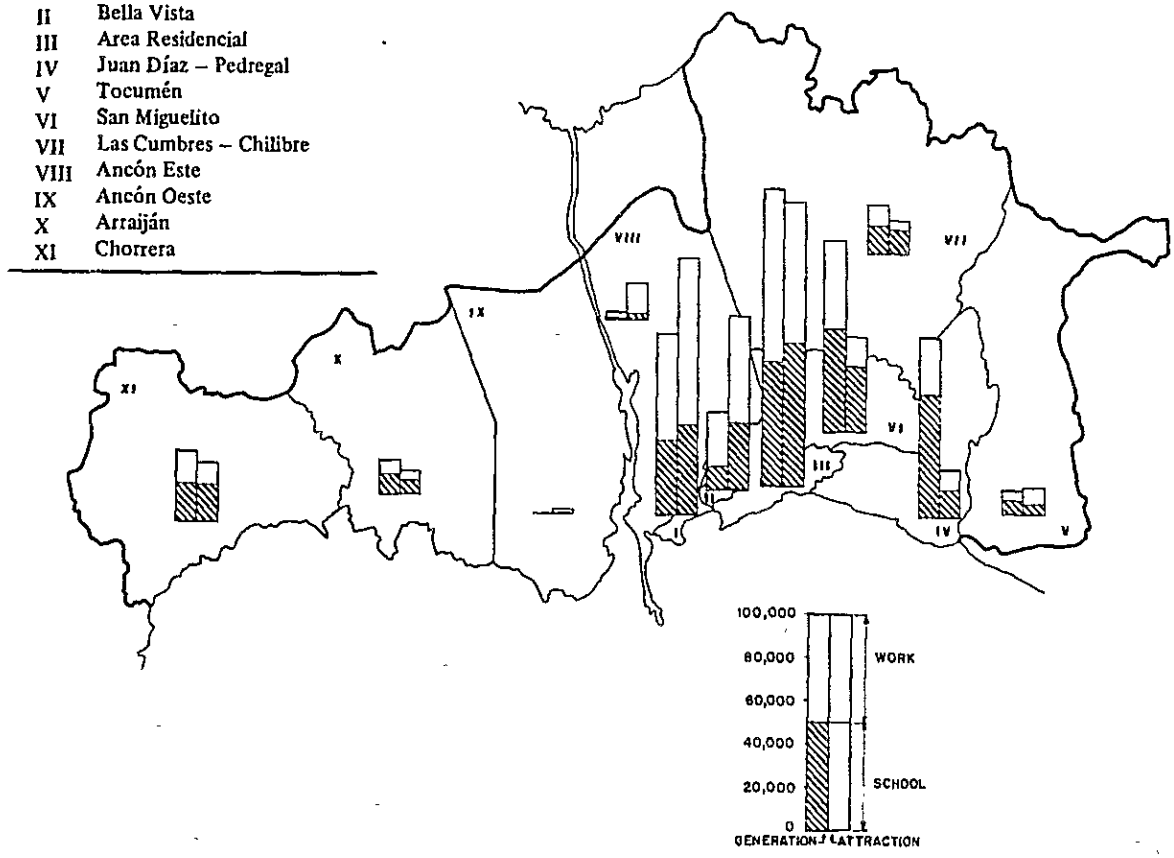


FIG. 5-12 COMPARISON OF GENERATION AND ATTRACTION OF "WORK" AND "SCHOOL" TRIPS

trips can be generally understood as the representation of demand for employment and education, and the attraction of them as the representation of supply. Zones in which the generation of these trips is greater than attraction are supply (or production) areas, and zones in which the attracttion is greater are demand (or consumption) areas. As a matter of course, the attraction is greater in built-up area, and the reverse is true in suburban areas. The generation is conspicuously higher than the attraction particularly in San Miguelito (Zone VI) and Juan Diaz-Pedregal (Zone IV). Also, the attraction is greater than the generation in such PT zones of the built-up area as La Cresta (Zone 7) and Punta Paitilla (Zone 11), where schools are concentrated, which indicates that students flow into these PT zones from other PT zones (see Figure 5-12).

TABLE 5-7 TRIPS GENERATED IN INTEGRATED ZONES

Integrated Zone		Trip Generation, 1981		1980 Population	
		Total Trips	Distribution	No. of People	Distribution
I	CENTRO	339,454	23.0%	107,295	15.1%
II	BELLA VISTA	173,971	11.8	28,091	4.0
III	AREA RESIDENCIAL	408,108	27.7	168,741	23.9
IV	JUAN DIAZ–PEDREGAL	104,420	7.1	84,511	12.0
V	TOCUMEN	29,724	2.0	21,745	3.1
VI	SAN MIGUELITO	181,751	12.3	157,063	22.2
VII	LAS CUMBRES-CHILIBRE	54,640	3.7	49,075	6.9
VIII	ANCON ESTE	27,401	1.9	1,600	0.2
IX	ANCON OESTE	2,506	0.2	200	–
X	ARRAIJAN	35,590	2.4	34,019	4.8
XI	CHORRERA	91,234	6.7	55,385	7.8
Outside Survey Area		24,886	1.7	–	–
	Total	1,473,690	100.0	707,725	100.0

Source: ESTAMPA

(2) Interzonal Trips

The O-D table of integrated zones are translated into desire line in Figure 5-13, which shows that the flow of traffic among Zones I through IV and VI is substantial, while connections between other integrated zone pairs are weak. In other words, the expanse of Metropolitan Panama's traffic sphere is up to San Miguelito and Juan Diaz-Pedregal. The total intrazone and interzone trips in those five integrated zones (I through IV and VI) is 1,108,390, or 75% of the Survey Area total. The O-D volume between Centro (Zone I) and Area Residencial (Zone III) is the largest at 144,289. Connection between Panama District and the areas west of the Canal is presently weak.

O-D trip volume is loaded onto the spider network of the Survey Area, in Figure 5-14. A spider network is an imaginary traffic network formed by connecting the centers of adjacent zones. Figure 5-14 shows that the flow of people within the Survey Area presents a very simple shape; traffic volume is overwhelmingly large in the three built-up integrated zones (I through III), and, with the traffic volume going from and coming into these three zones as 100, the volume of traffic flowing into these three zones from north amounts to 50, that flowing from east is 29, that flowing from Ancon is 9, and that flowing from west is 12. In fact, there is only one major road leading to the three zones from each of these directions.

Figure 5-15 shows the source zones from which "work" trips concentrate into each of the three integrated zones with the highest trip attraction. About 52,000 "work" trips concentrate to Zone I each day, the largest source being Zone III, from which 22,000 "work" trips generate, and

	INTEGRATED ZONE
I	Centro
II	Bella Vista
III	Area Residencial
IV	Juan Díaz – Pedregal
V	Tocumén
VI	San Miguelito
VII	Las Cumbres – Chilibre
VIII	Ancón Este
IX	Ancón Oeste
X	Arraiján
XI	Chorrera

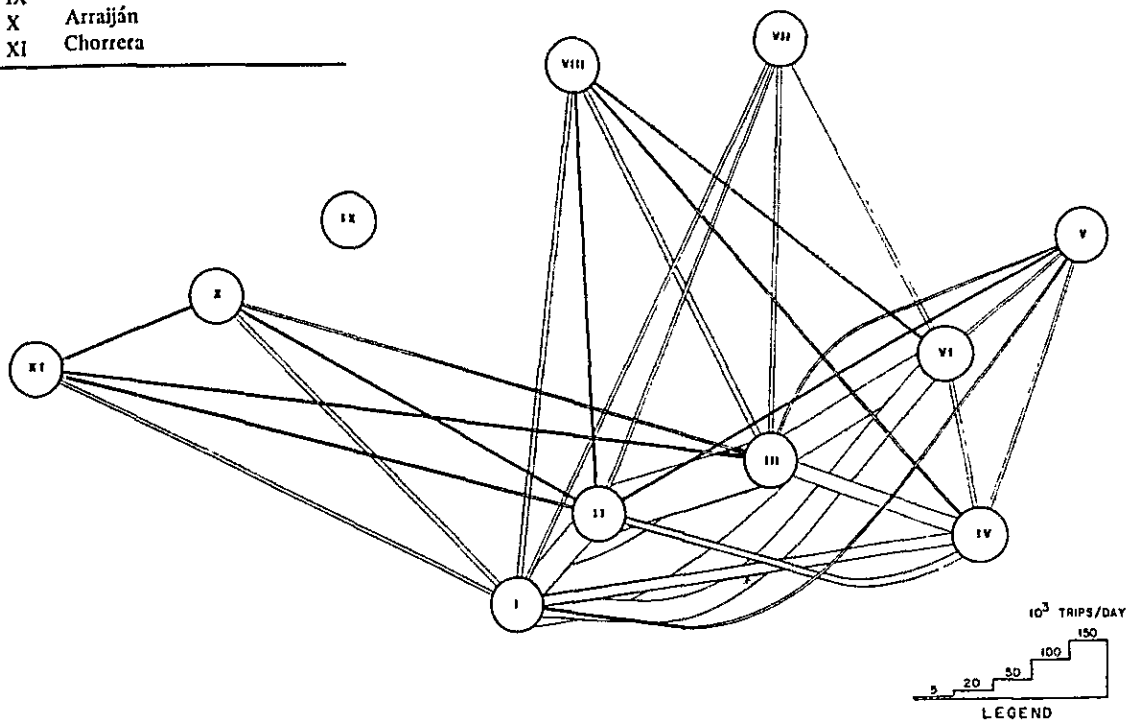


FIG. 5-13 DESIRE LINES FOR INTERNAL, TRIPS, 1981

85% of total trips attracted to Zone I are generated in Zones II, III, IV and VI. About 41,000 "work" trips concentrate to Zone II each day, and 91% of this is generated in Zones I, III, IV and VI. About 38,000 such trips concentrate to Zone III, 85% of which come from Zone I, II, IV and VI. Thus, seen from the aspect of traffic, these five integrated zones (I through IV and VI) form a nearly closed sphere.

Total trips in the Survey Area (excluding intra-PT zonal trips) are classified by trip length, and the distribution of trips by trip length is shown for each trip purpose (see Figure 5-16). Regardless of trip purpose, peak distribution is observed in the range of two to four kilometers of trip length, after which the distribution (frequency) declines following a moderate curve toward longer trip lengths. This behavior eloquently speaks for the single concentration center type urban structure of the Area. Also, the fact that little difference in trip length distribution pattern is seen between trip purposes indicates that the areal division of urban functions has so far little progressed. The minor peak indicated by the trip length of eight to nine kilometers is attributable to the traffic from San Miguelito, where population concentration is heavy, to Centro. The average length of "work" trips is 8.5 kilometers, that of "school" trips is 6.4 kilometers, that of "home" trips is 7.6 kilometers, that of "business" trips is 6.3 kilometers that of "shopping" trips is 5.5 kilometers, that of "private" trips is 6.5 kilometers, and the average trip length for all purpose is 7.4 kilometers. These trip lengths will become longer along with urban expansion in the future.

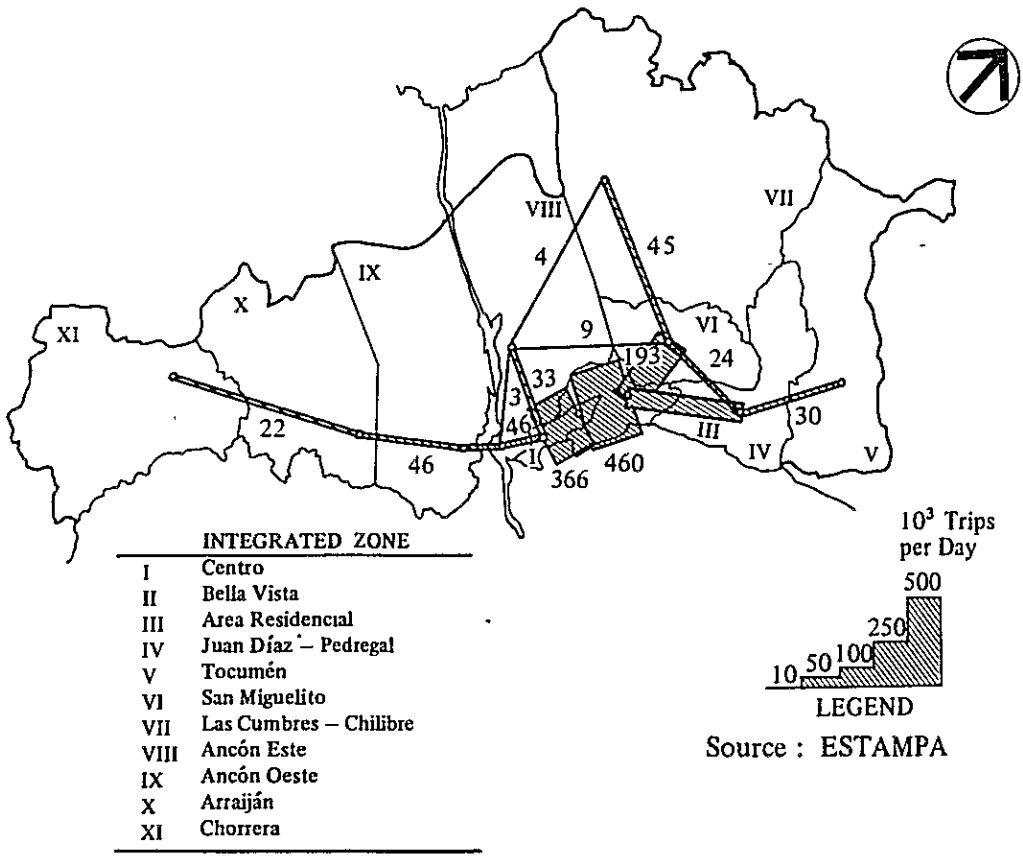


FIG. 5-14 PERSON TRIPS LOADED ONTO SPIDER NETWORK, 1981

5) Modal Choice

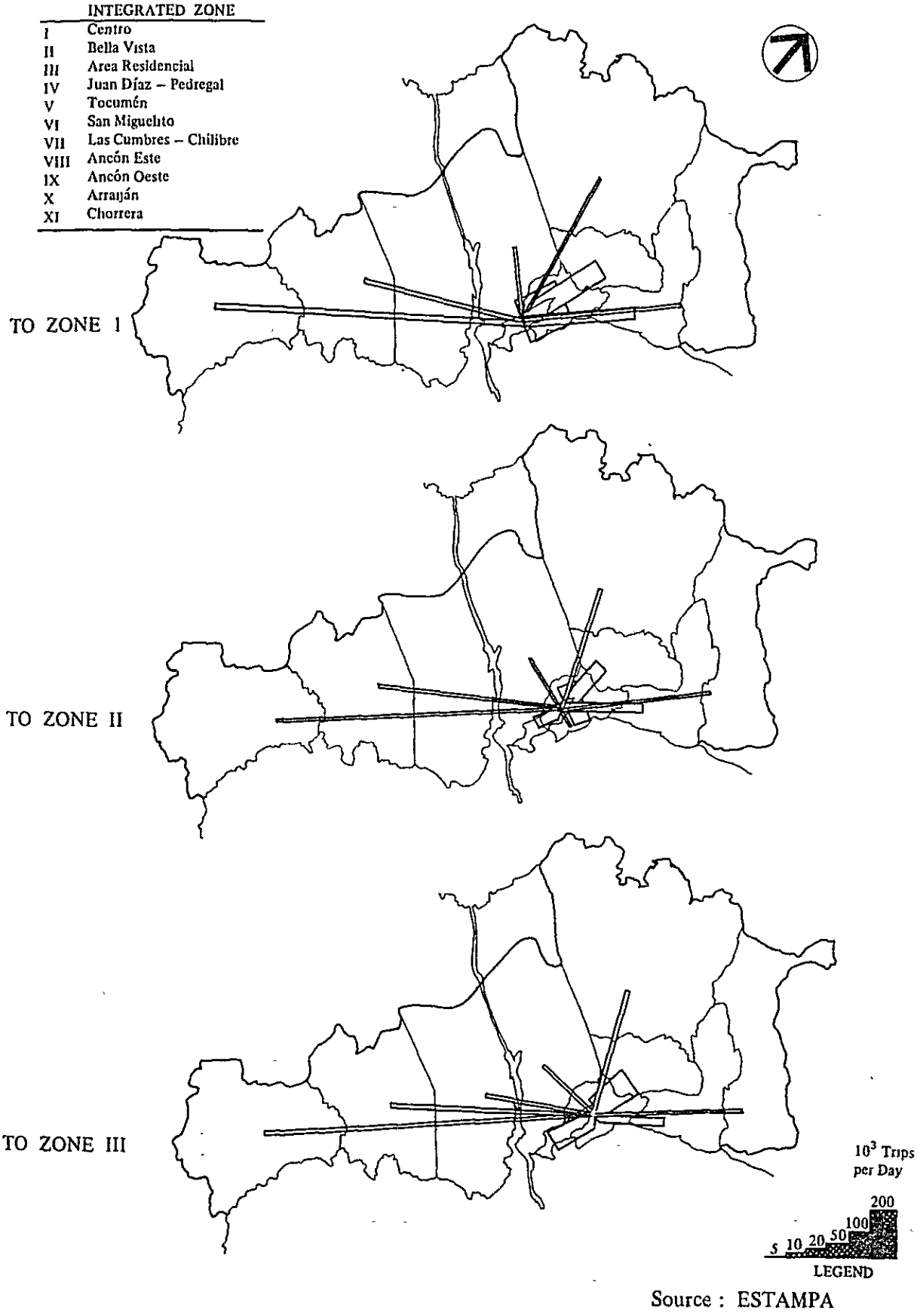
(1) Purpose and Mode of Travel

The composition of modes of travel is shown for each trip purpose in Figure 5-17. Conversely, the composition of trip purposes is shown for each mode of travel in Figure 5-18. Together, they show that the mode of travel varies much depending on the purpose of travel. "Walk" mode represents a relatively large portion of "school" and "shopping" trips, while many "business" trips utilize trucks. Passenger cars and buses in public use are highly utilized for all trip purposes except, in the case passenger cars, "school" trips and, in the case of buses, "business" trips. The modal distribution of "home" trips presents a pattern similar to that of "all purposes" distribution.

Daily routine trips (work, school, home) represent up to about 70% of trips by car and trips by taxi and about 80% of trips by bus and trips by chiva. Chiva is more used for "school" trips than bus. It is noteworthy that about 60% of trips by truck is "work" and "home" trips.

(2) Modal Choice by Zone

The modal distribution of trips generated in each of integrated zones is presented in Figure 5-19, where the areal size of each circle represent the size of total trip generation quantity of each zone. While difference in such distribution (modal choice pattern) is rather small between the zones, car and taxi show larger shares and bus shows a compensatorily smaller share in Bella Vista (Zone II) and Area Residencial (Zone III) than in other integrated zones. This reflects relatively high car ownership rates and the high utilization of cars and taxis for "business" trips in said two integrated areas.



Source : ESTAMPA

FIG. 5-15 CONCENTRATION OF "WORK" TRIPS TO THE PANAMA URBAN AREA

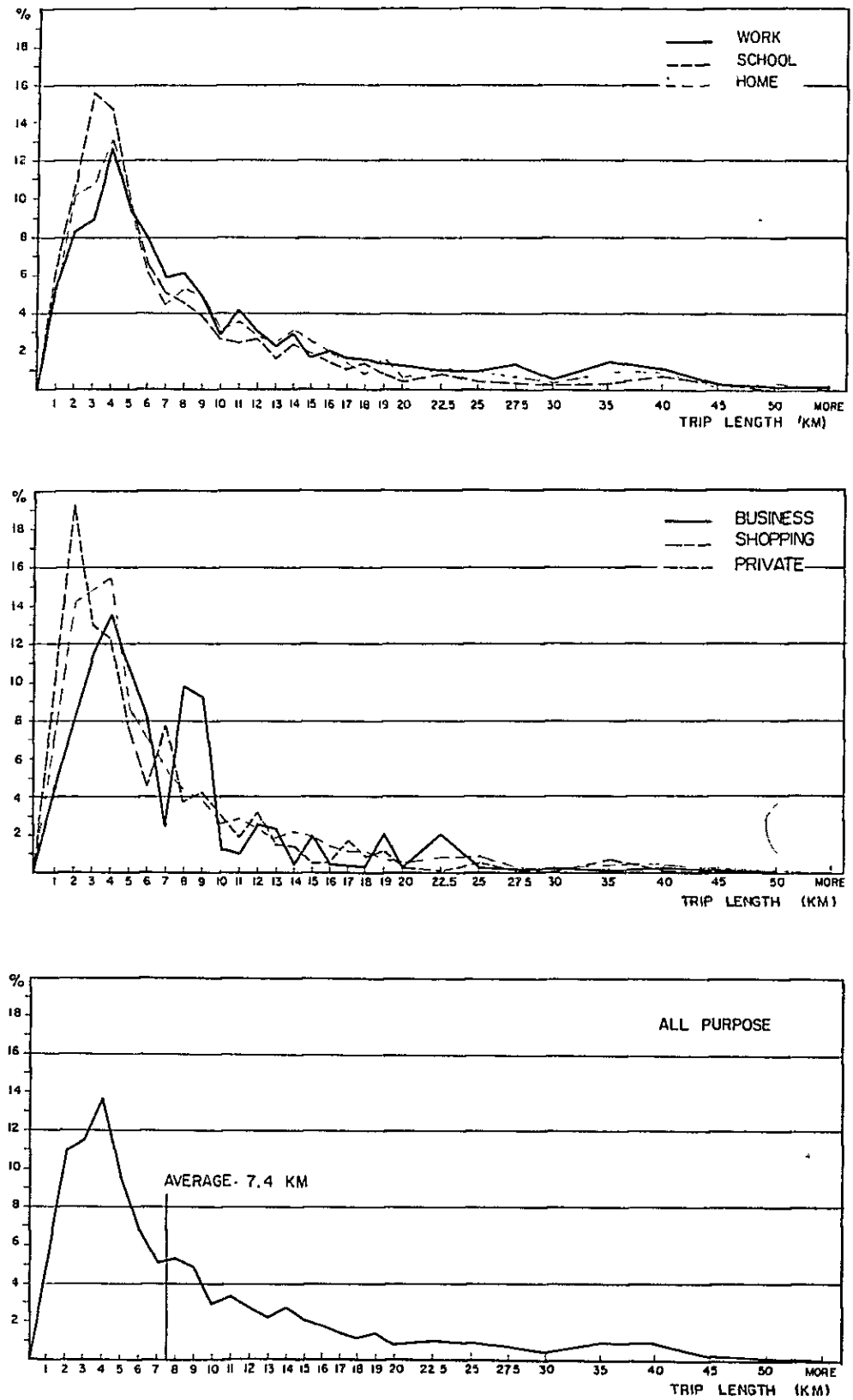


FIG. 5-16 TRIP LENGTH DISTRIBUTION BY PURPOSE

Source: ESTAMPA

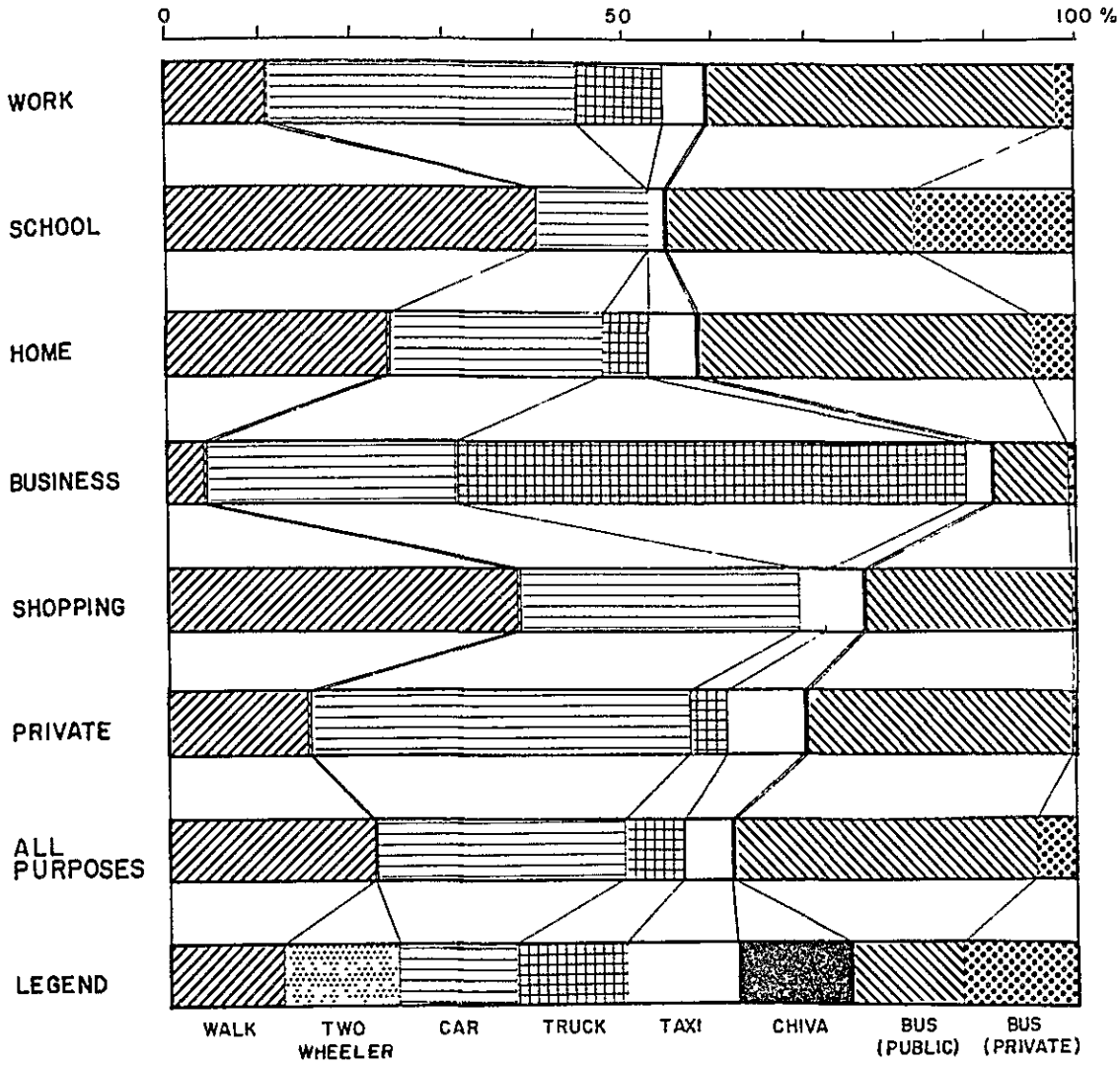
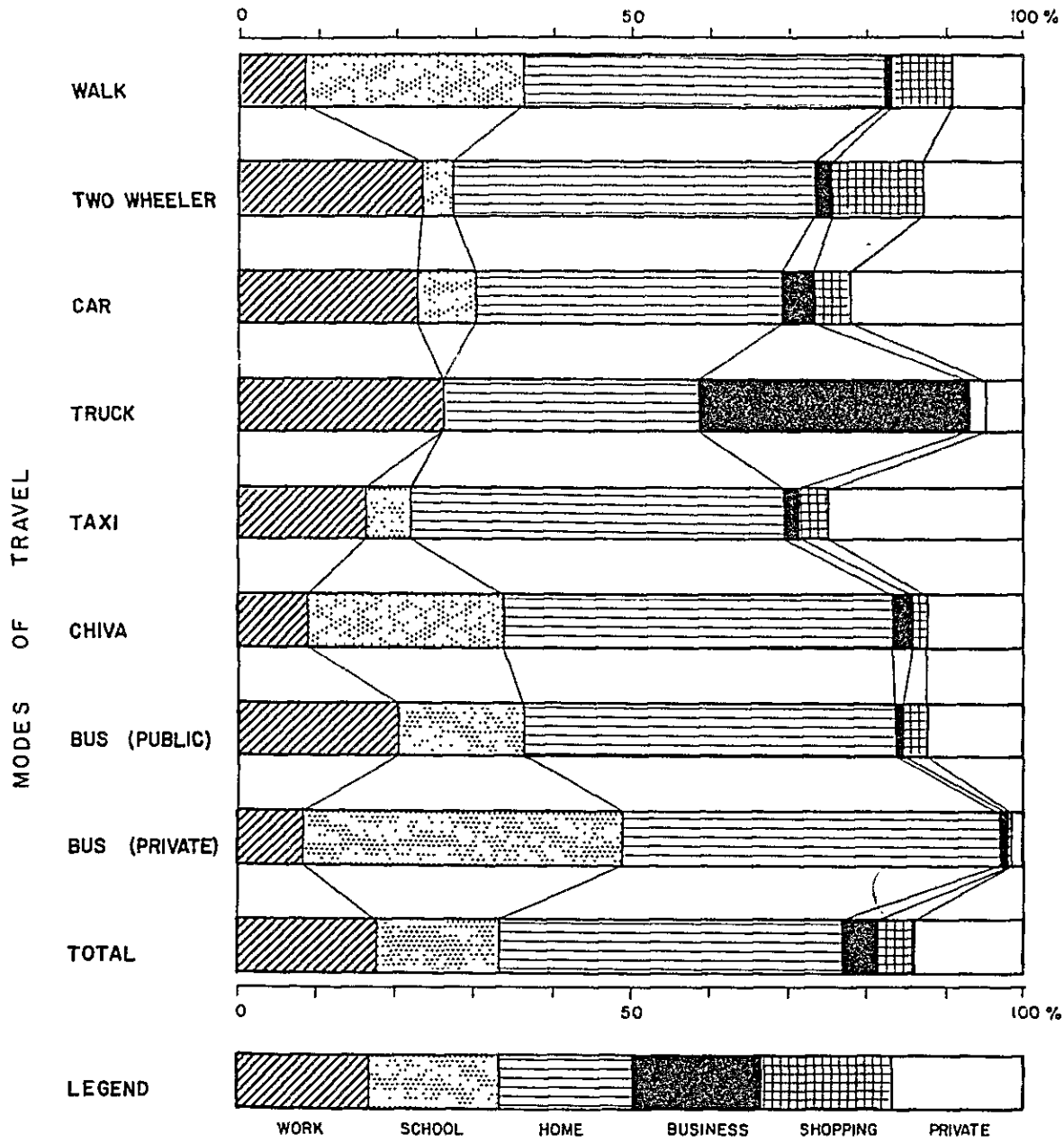


FIG. 5-17 MODAL COMPOSITION OF TRIPS BY PURPOSE

Source : ESTAMPA

(3) Trip Length and Mode of Travel

Change in modal distribution of trips along with change in trip length is shown separately for car-owning households and non-car-owning households in Figure 5-20. Revealed from a scrutiny of this Figure is an important information on factor behind modal choice that private means of transportation, if available, is nearly always preferred over public means of transportation and that variance in time and cost of travel by trip length or by mode travel is not much the motivation of modal choice. In other words, car owners would use car to go to any place, as it is shown by the fact that the modal choice of car owner is distinctly different from the modal choice of non-car owners and that the high car utilization by car owners remains practically constant (at 60 to 70% of all trips) regardless of trip length, while the high public transportation utilization by non-car owners also remains practically constant (at about 85%) regardless of trip length.



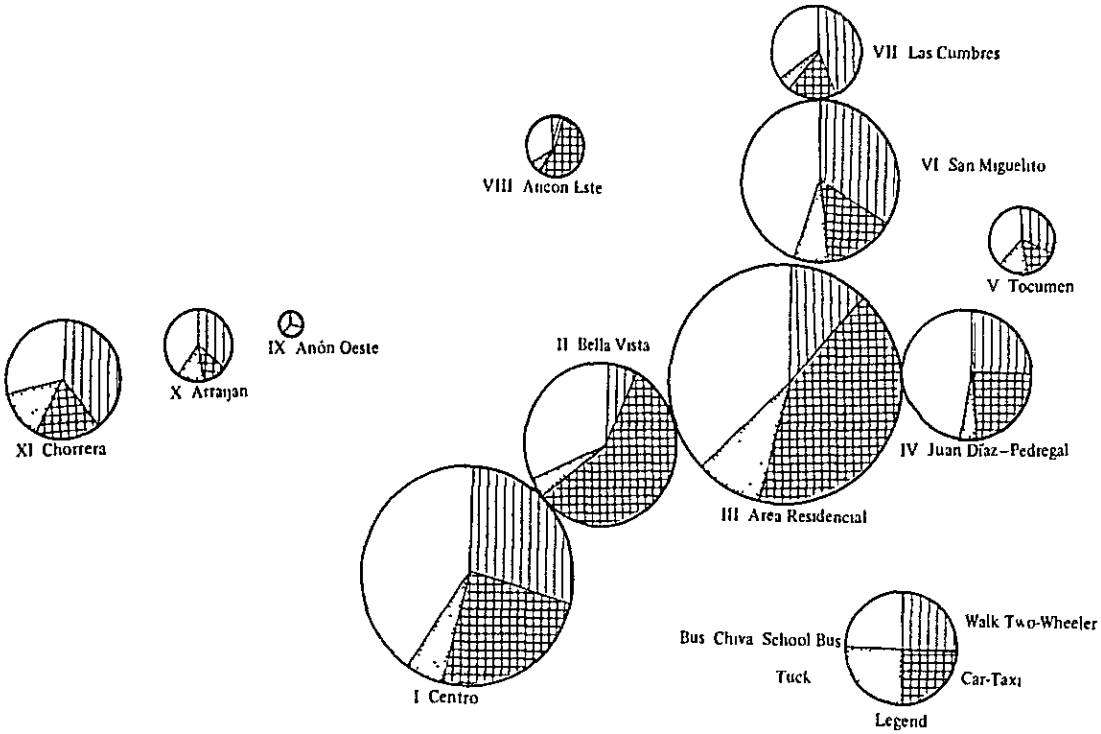
Source : ESTAMPA

FIG. 5-18 PURPOSE COMPOSITION OF TRIPS BY MODE

Presently in the case of non-car owners, "walk" shows a high 20% share even at a fairly long distance of three or four kilometers. This is because there are more than negligible number of areas where no other means of transportation is available but to walk.

6) Miscellaneous Trip Characteristics

(1) Hourly Variation of Trip



Source : ESTAMPA

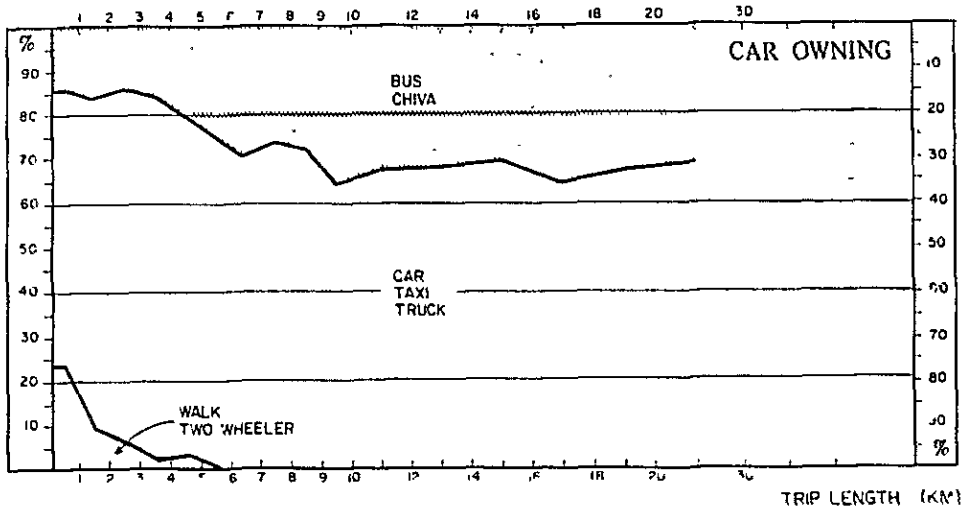
FIG. 5-19 TRIP GENERATION BY MODE

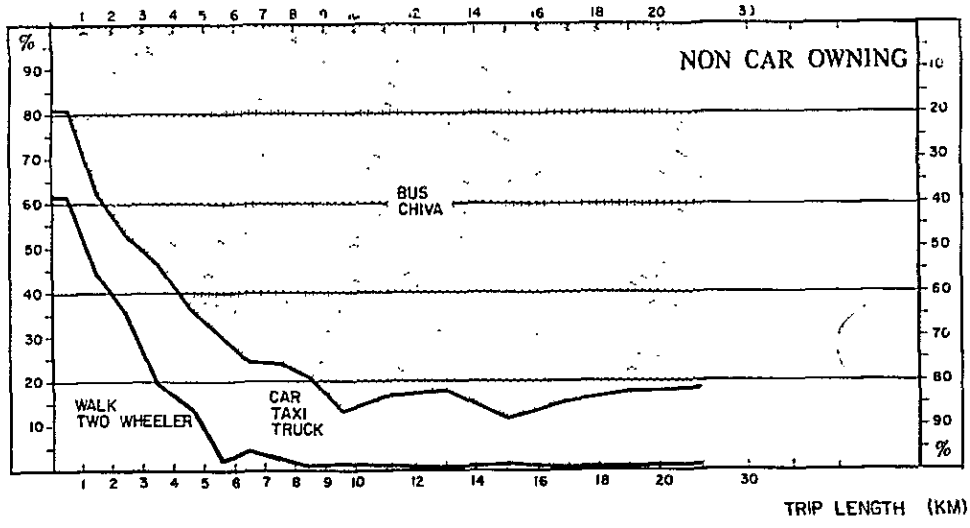
Traffic flux from hour to hour may be comprehended by hourly changes in the number of trips accounted for either at the time of their start or at the time of their ending. Hourly variation on trip termination basis is a more direct indication of traffic load in urban areas than variation on trip generation basis, and, therefore, the former is used in this Study and is shown for each trip purpose in Figure 5-21.

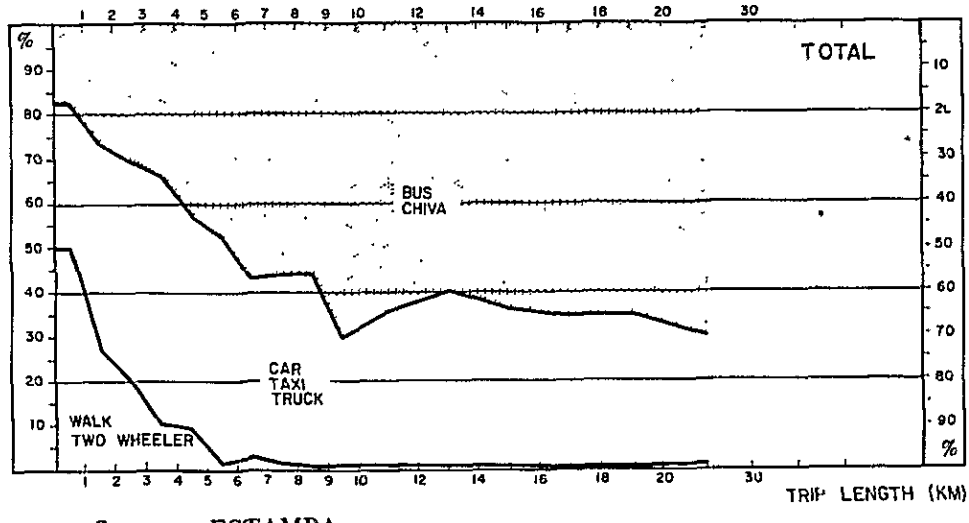
At a glance, Figure 5-21 shows three conspicuous peaks: morning (6:00 to 7:00 A.M.), noon (11:00 to 12:00 A.M.) and evening (4:00 to 6:00 P.M.) peaks. While the indicated lower and longer evening peak than morning and noon peaks is a phenomenon commonly seen in other cities, the higher noon peak than morning peak, although only slightly higher, is a peculiar feature in the Survey Area. The peak hour ratio (the ratio of trips in a peak hour to the total number of daily trip) of morning peak is 12%, that of noon peak is also 12%, and that of evening peak hour (one hour), 7%.

About 50% of the morning peak is attributable to "work" and "school" trips. The morning peak occurs rather early, as early as 6:00 to 7:00 A.M., and the traffic slackens to about half of the peak traffic in the next hour, 7:00 to 8:00 A.M. The high noon peak is explained much by "home" and "school" trips, reflecting the people's habit of going home for lunch and the 2-shift system education (consisting of morning classes and afternoon classes). Evening and night traffic consists, in a major portion, of "home" trips.

As opposed to hourly changes in the absolute number of trips shown in Figure 5-21, hourly percentage distribution of daily traffic for each trip purpose is presented in Figure 5-22. It is observed that "work", "school" and "home" trips are concentrated to certain specific hours of the day, while trips for all other purposes are rather evenly spread out with the exception of high "shopping" trip concentration in 12:00 A.M. to 1:00 P.M. (because "restaurant" trips are included in "shopping").

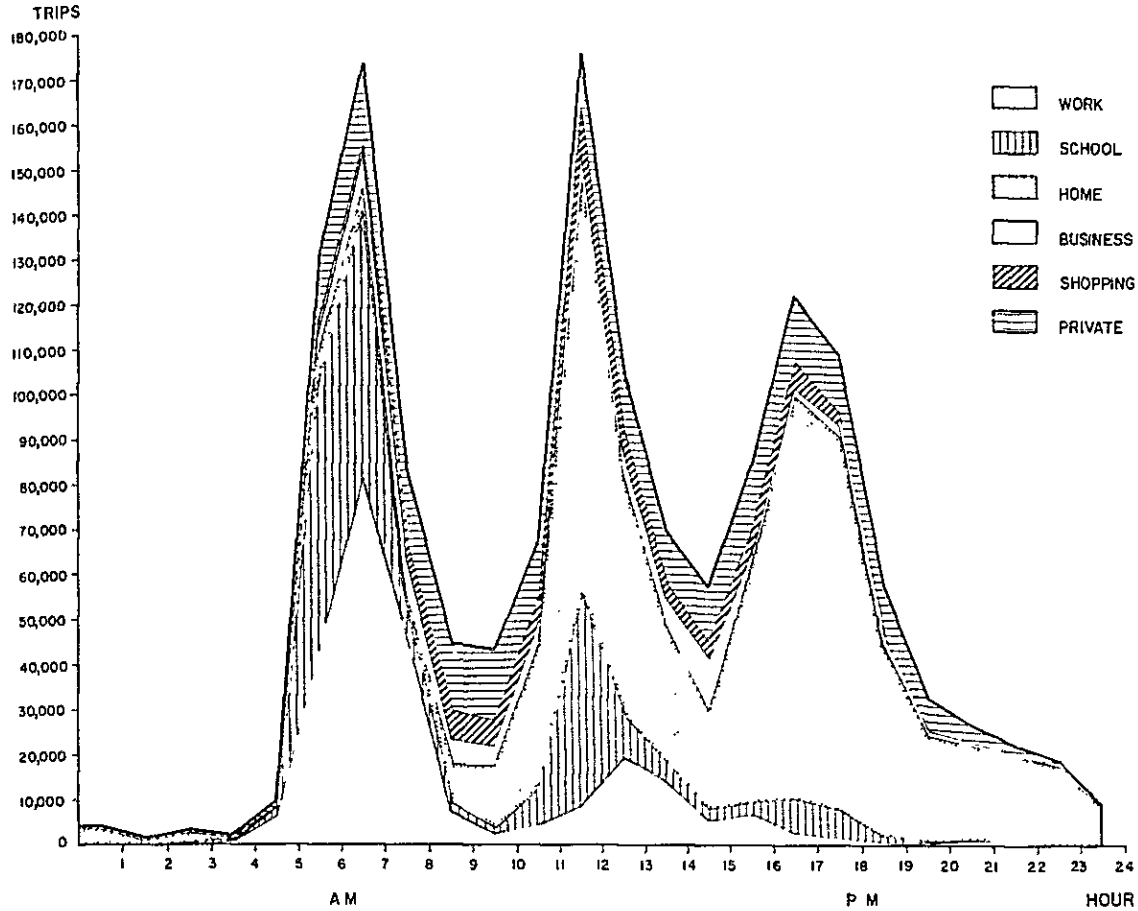






Source : ESTAMPA

FIG. 5-20 MODAL SHARE OF TRIPS BY TRIP LENGTH



Source: ESTAMPA

FIG. 5-21 HOURLY VARIATION OF TRIP GENERATION BY PURPOSE

(2) Intermodal Transfers

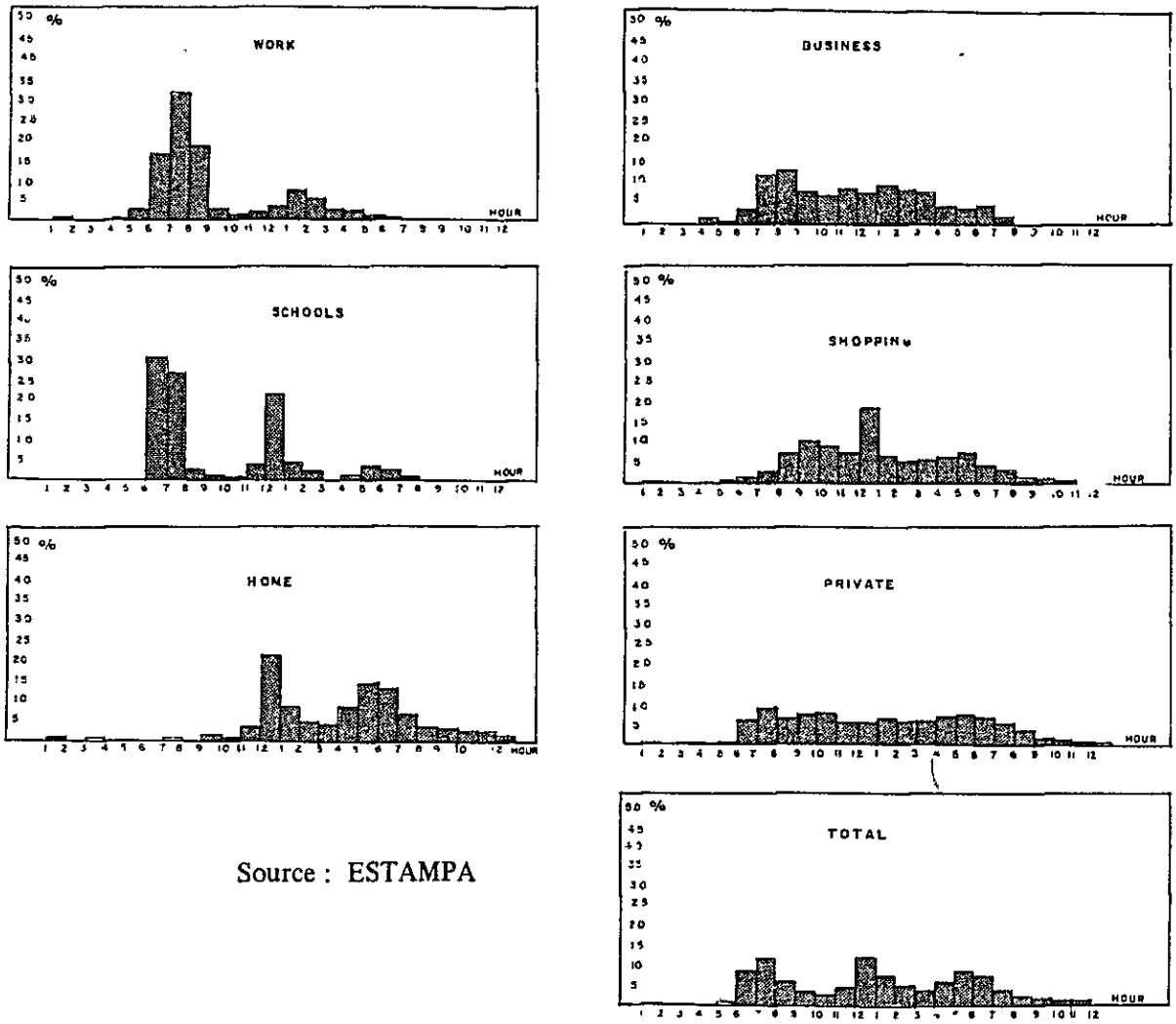
Discussions in the above have dealt with linked trips (as opposed to unlinked trips). Each of both single mode trips (walk, car, bus or whatever) and multi-mode trips (walk and bus. bus and bus, walk-bus-rail, etc.) is counted as one linked trip. When linked trips are "unfolded" into each mode of travel, revealed is the number of unlinked trips.

In the Survey Area is a total of 1,473,690 linked trips, or 2,652,670 unlinked trips. At this rate, an average of 1.8 unlinked trips are used to complete each travel. How various means of transportation are being utilized in trips involving intermodal transfers will be analyzed on basis of unlinked trips.

Trips which envolve walking on either or both ends of travel for access to and/or from a transportation facility (bus stop, station) represent a majority of difference between said total linked trips and total unlinked trips. Excluding this kind of trips (which involve walking), the total of trips utilizing non-walking mode or modes is 1,107,226 linked (or 1,201,870 unlinked) trips. Of this, single mode trips counted 1,016,192 and multi-mode trips, 91,034 (or 8% of total 1,107,226). Furthermore, of said 91,034 multi-mode linked trips, multi-transfer trips (hence, utilizing three or more non-walking modes) counted only 5,273 linked trips (or less than 0.4%).

The 91,034 multi-mode trips are reviewed with regard to the means of transportation involved

and the result is presented in Table 5-8. The largest number of transfer were made from a public use bus to another public use bus (no exaggeration to say that intermodal transfer problem is the problem of public use bus), followed by transfers between public bus and chiva, that between school/company bus and public bus, and that between car and public bus-each being less than 4,000 trips in number. The locations of major bus transferring points are shown in Figure 5-23.



Source : ESTAMPA

FIG. 5-22 HOURLY VARIATION OF TRIP ATTRACTION, 1981

TABLE 5-8 TRIPS WITH INTERMODAL TRANSFER

To / From	Two Wheeler	Car	Truck	Taxi	Chiva	Bus (Public Use)	Bus (Private Use)	Others	Total
Two Wheeler		60				46			106
Car				97		1,599	149	20	1,865
Truck						92			92
Taxi	47				19	561			627
Chiva					95	3,012	169		3,276
Bus (Public Use)	14	917	126	1,481	3,591	74,281	3,114	16	83,540
Bus (Private Use)		49			85	1,980			2,114
Others		20		16	15	16	20		87
Total	61	1,046	126	1,594	3,805	81,587	3,452	36	91,707

Source : ESTAMAPA

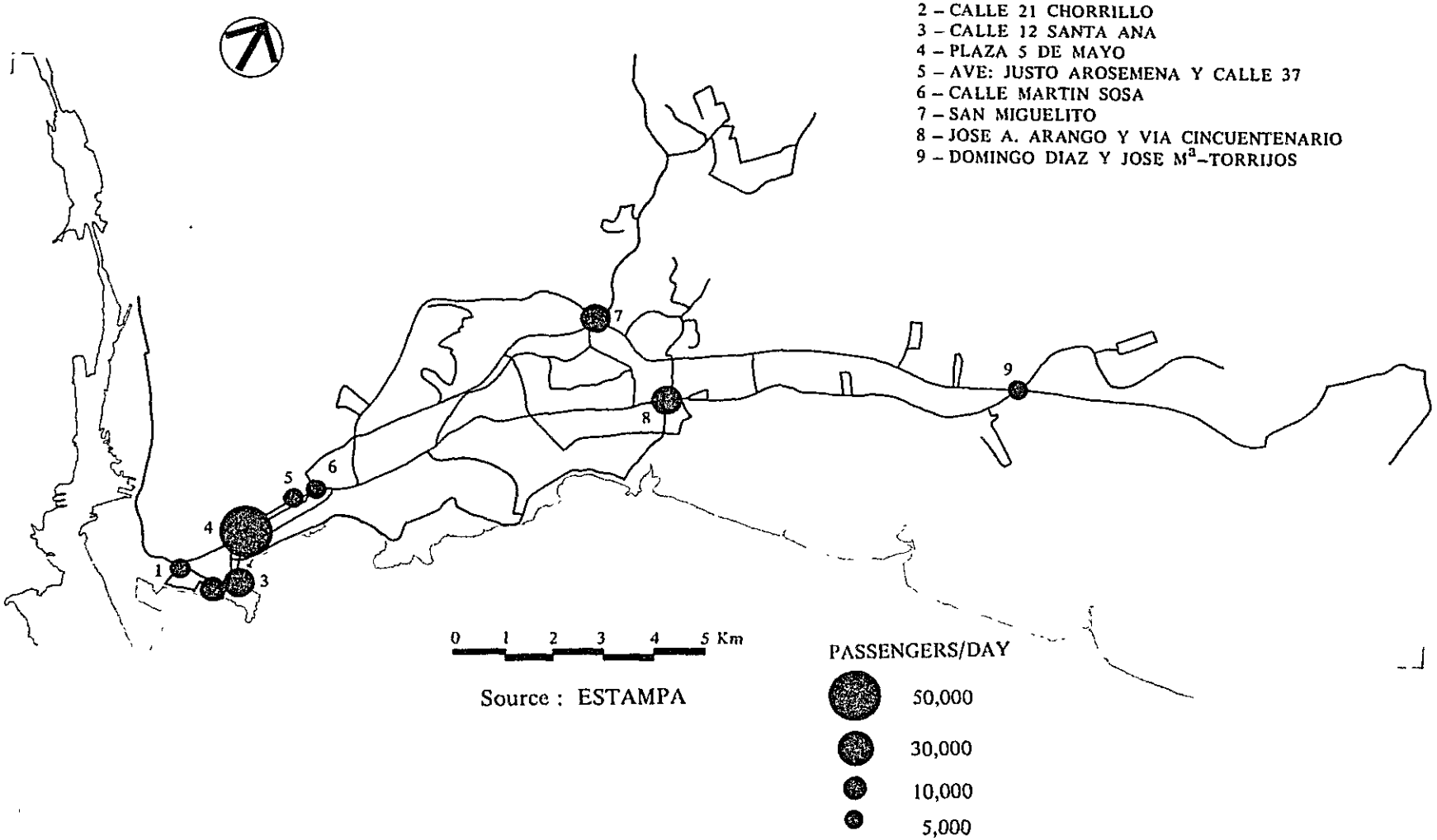


FIG. 5-23 MAJOR BUS PASSENGER TRANSFER POINTS

CHAPTER 6.

PUBLIC TRANSPORTATION SYSTEM

6. PUBLIC TRANSPORTATION SYSTEM

1) Introduction

Means of public transportation available in the Metropolitan Area are classified into railroad, bus, chiva (small bus), and taxi, which together represent 50.6% of total 580,627 trips (per day, sans pedestrians; hereinafter the same in this Chapter). Of public transports, railroad represents 0.1%; buses, 86.8%; chivas, 0.9%; and taxi cabs, 12.2%. It is apparent from these facts that the mainstay of public transport is buses. In fact, an opinion poll taken of one-fourth of the person-trip survey samples showed that 79.4% think that the most frequently used means of their transport is the bus.

Bus traffic between areas west of the Canal and Panama City is 27,682 trips, which amounts to 6.4% of bus trips originating and terminating within the area east of the Canal.

A total of 73,754 trips have either or both terminal points in the west of the Canal, which amounts to 14.6% of total bus trips of 503,851. In other words, most bus trips have both terminal points in the east of the Canal. Also, the problems of bus service are concentrated in the east of the Canal, as it will be discussed later.

In view of these facts, this Chapter will focus on the bus, particularly on bus service in the east of the Canal, in discussing the problems of public transportation.

2) Bus Demand and Supply

(1) Bus Trip Generation

The person-trip survey revealed that 440 thousand bus trips are generated in the service territory of city buses, which amounts to 43.5% of total 1,010,000 trips, sans walking.

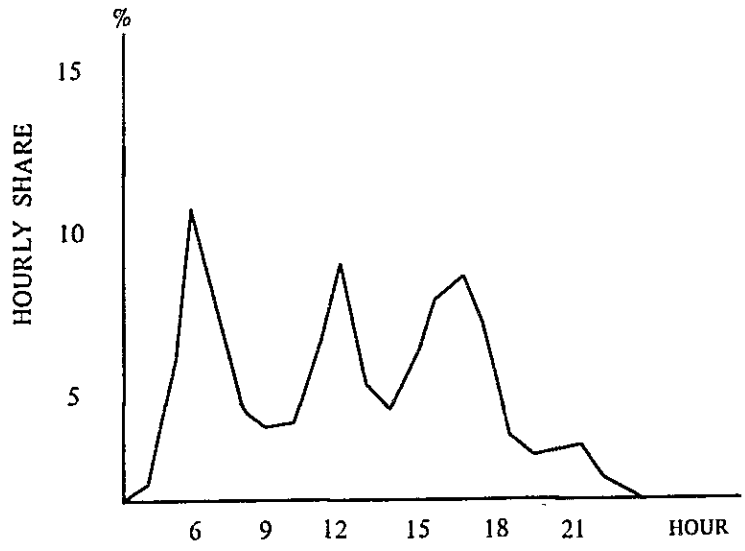


FIG. 6-1 HOURLY FLUCTUATION OF BUS TRIPS

Source : ESTAMPA

Bus trip generation uniquely shows three peaks: 06:00 to 08:00, 11:00 to 13:00, and 16:00 to 18:00, as shown in Fig. 6-1.

Bus passengers, making the trips seen in the above, typically have an income of 500 balboas per month or lower. Those with a monthly income of 300 to 500 balboas utilize buses seven out of ten times, and those with a monthly income of less than 300 balboas use buses eight out of ten times.

TABLE 6-1 USE OF TRANSPORT MODE BY MONTHLY USER INCOME

Income	MODE					
	Bus	Car	Taxi	Foot	Others	Total
0	1000	71	35	72	12	1190
1 – 100	219	2	9	17	6	253
101 – 200	317	27	13	11	5	373
201 – 300	231	42	4	8	5	290
301 – 500	105	36	6	4	0	151
500 –	57	120	4	4	4	189
unknown	699	97	19	36	13	864
TOTAL	2628	395	90	152	45	3310
	(79.4%)	(11.9%)	(2.7%)	(4.6%)	(1.4%)	(100.0%)

Source . ESTAMPA

(2) Bus Trip Pattern

Of the integrated zone origin-destination survey findings, those pertaining to bus trips are shown in Table 6-2, from which the followings are clear:

o Centro (Integrated Zone I) not only has a strong bus trip attraction from the outside, but also has a large number of intra-zonal trips, although the areal size of this Zone is small.

o Area Residential (III) generates the second largest number of bus trips after Centro (I), and 56% of the generated bus trips are intra-zonal trips or trips to and from Centro.

o Between Centro and Area Residencial, reliance on bus is low in Bella Vista (II), whose residents are mostly rich enough to rely on private cars.

o The total bus trips generated in Centro (I) and Area Residencial (III) amount to 57% of total trip genration in the Integrated Zones I through VI plus VIII, which is discussed in this Chapter. When Bella Vista (II) is added, trip generation in these three zones comes to 69% of said total. Thus, it is clear that problems of bus transportation in these three Integrated Zones are most important.

o Bus trips flowing from the eastern part of Panama City to the city center are mostly from Juan Diaz–Pedregal, with an insignificant number of trips from Tocumen.

o A representative quantity of bus trips flowing into the city center from the north of the city comes from San Miguelito (VI) from which 50,000 persons flow into Panama Urban Area, as against 27,000 from Juan Diaz–Pedregal (IV). The northern part has the strongest traffic connection with Centro and Area Residencial and, in a substantially less degree, with Bella Vista.

TABLE 6-2 BUS PASSENGERS OD, 1980 (Unit in thousand)

	ORIGIN	DESTINATION								
		I	II	III	IV	V	VI	VII	E	Total
I	CENTRO	28	13	34	12	2	22	2	17	130
II	BELLA VISTA	14	2	13	6	1	10	–	4	50
III	AREA RESIDENCIAL	34	13	34	10	2	3	1	24	121
IV	JUAN DIAZ/PEDREEGAL	12	6	9	10	2	3	1	1	44
V	TOCUMEN	2	1	2	2	2	1	–	–	10
VI	SAN MIGUELITO	21	10	19	3	1	17	1	4	76
VII	ANCON ESTE	2	–	2	1	–	1	–	1	7
E	EXTERNAL AREA	15	5	7	2	–	19	3	15	66
	TOTAL	128	50	120	46	10	76	8	66	504

Source: ESTAMPA

o The quantities of intra-zonal trips are large in both Juan Diaz-Pedregal (IV) and San Miguelito (VI).

(3) Bus Service Supply

The bus passenger origin-destination survey of April 1981 revealed the following data:

Registered number of buses:	1,455 buses
Buses operated:	1,088 buses
Average seat-capacity:	47 seats per bus
Total travel distance:	131,632 kilometers per day
Average travel distance per bus:	121 kilometers per bus
Total number of passengers:	484,570 persons per day
Average passenger trip distance:	7.37 kilometers

Thus, the maximum possible transportation capacity of the bus fleet (assuming 100% occupancy and all-out bus operation) is calculated as follows:

47 persons/bus x 1,088 buses x 121 km/day
= 6,186,700 person-kilometers per day

(4) Bus Service Demand

From the above bus service data, total bus transportation demand is calculated:

484,570 persons/day x 7.37 km
= 3,571,281 person-kilometers per day

(which is 57.7% of said maximum possible transportation capacity of bus fleet)

The above observation gave an impression that the bus transport supply is adequate to meet the demand, as far as the bus transport as a whole is concerned. Bus transport demand is route-

TABLE 6-3 NUMBER OF BUSES REQUIRED IN PEAK HOUR

Route		Through Max. Passengers	Average Capacity of Bus	Buses Required per hour	Travel Time for one per Round Trip (Hour)	Total Buses Required	Buses Actually Operated per hour
1	Panamá Viejo – Vía Porras – Calle 12	583	47	6.2	2.5	16	8.5
2	Panamá Viejo – Ave. Balboa – Calle 12	1,339	51	13.1	2.0	27	7.5
3	Panamá Viejo – Vía 11 de Octubre – Calle 12	387	54	3.6	2.0	8	1.5
4	El Cruce – Ave. Balboa – Corozal	374	46	4.1	1.0	5	8.0
5	Panamá Viejo – Santa Clara – Calle 12	276	52	2.7	3.0	8	2.0
6	Panamá Viejo – San Miguelito – Calle 12	346	54	3.2	2.5	8	3.0
7	Parque Legislativo – Ave. Balboa	580	16	18.1	1.0	19	15.5
8	El Cruce – Curundú	46	53	0.4	1.0	1	1.0
9	Boca La Caja – Calle J. – El Chorrillo	950	27	17.6	1.5	27	20.0
10	El Cruce – Cláyton	215	47	2.3	1.5	4	2.7
11	Betania – Vía Transístmica – El Chorrillo	891	47	9.5	2.0	19	9.5
12	Villa Rica – Puente – El Chorrillo	625	39	8.0	2.0	16	5.0
13	Villa Rica – Calle 9a. – El Chorrillo	995	43	11.6	2.0	24	8.5
14	Villa Rica – Puente – Mercado	124	34	1.8	2.0	4	2.0
15	Veranillo – Vía España – El Chorrillo	1,848	51	18.1	2.5	46	7.0
16	El Cruce – Albrook – Diablo	52	57	0.5	1.0	1	1.0
17	Veranillo – Vía Transístmica – El Chorrillo	1,909	61	15.6	2.5	39	16.0
18	Automotor – Vía R.J. Alfaro – Calle 12	636	46	6.9	2.0	14	6.5
19	Samaria – Vía R.J. Alfaro – Calle 12	329	51	3.2	2.0	7	7.0
20	El Cruce – Paraíso	206	48	2.1	1.5	4	2.5
21	Veranillo – Vía R.J. Alfaro – Calle 12	247	70	1.8	2.0	4	0.5
22	El Cruce – Rodman – Cocolé	52	46	0.6	1.0	1	0.5
23	Villa Lorena – Vía España – Calle 12	73	45	0.8	2.0	2	0.5
24	El Cruce – Amador	118	48	1.2	1.0	2	3.0
25	Villa Lorena – Vía España – El Chorrillo	104	42	1.2	2.5	3	1.5
26	Villa Lorena – Calle J. – El Chorrillo	516	32	8.1	2.0	17	6.0
27	San Pedro – Vía España – Calle 12	1,022	44	11.6	2.5	29	12.5
28	San Pedro – Vía España – El Chorrillo	1,319	40	16.5	2.5	42	6.5
29	San Pedro – Calle J. – El Chorrillo	713	40	8.9	2.0	18	9.0
30	Juan Díaz – Vía España – El Chorrillo	1,060	48	11.0	2.5	28	7.0
31	Pedregal – Vía Transístmica – El Chorrillo	2,848	59	24.1	2.5	61	18.0
32	Pedregal – Vía España – El Chorrillo	1,874	46	20.4	3.0	62	20.5
33	Pedregal – Vía R.J. Alfaro – Calle 12	359	58	3.1	2.5	8	2.5
34	Las Mañanitas – Vía R.J. Alfaro – Calle 12	711	52	6.8	3.0	21	6.0
35	El Cruce – Gamboa	65	43	0.8	2.0	2	1.3
37	Tocumen – Vía España – El Chorrillo	1,903	47	20.2	3.5	71	9.5
39	Santa Librada – Vía R.J. Alfaro – Calle 12	417	52	4.0	3.0	12	3.0
40	Cerro Batea – Vía R.J. Alfaro – Calle 12	711	51	7.0	2.5	18	5.0
41	El Valle – Vía España – Calle 12	556	48	5.8	2.0	12	5.0
42	El Valle – Vía Transístmica – Calle 12	898	51	8.8	1.5	14	4.5
43	Los Andes – Vía R.J. Alfaro – Calle 12	590	46	6.4	2.0	13	4.5
44	Alcalde Díaz – Vía Transístmica – Calle 12	1,500	55	13.6	2.5	34	13.0
45	Santa Librada – Vía España – Calle 12	915	50	9.2	2.5	23	3.0
46	Santa Librada – Vía Transístmica – Calle 12	973	52	9.4	2.0	19	8.5
47	Cerro Batea – Vía Transístmica – Calle 12	1,024	52	9.8	2.5	25	9.0
48	Cerro Batea – Vía España – Calle 12	421	49	4.3	2.5	11	4.5
49	Bello Horizonte – Vía Transístmica – El Chorrillo	898	58	7.7	2.5	20	8.5
50	Bello Horizonte – Vía España – El Chorrillo	739	49	7.5	3.0	23	6.0
51	El Cruce – Howard – Kobee	256	50	2.6	1.0	3	2.5
52	Santa Marta – Monte Oscuro – Calle 12	352	57	3.1	3.0	10	2.5
53	Chilibre – Area del Canal – Panamá	476	41	5.8	1.5	9	6.0
54	Panamá – Area del Canal – Chilibre	482	41	5.9	1.5	9	6.5
55	Chilibre – Vía Transístmica – Panamá	174	38	2.3	2.0	5	3.0
56	Panamá – Vía Transístmica – Chilibre	190	41	2.3	1.5	4	2.0
TOTAL		37,267		401.2		932	

Source : ESTAMPA

specific, however, and the number of buses needed to satisfy the peak demand on each route must be looked at. The numbers calculated for all routes using 100% congestion ratio and the peak hour operation speed, assuming no bus borrowing from other routes, and identifying the peak hour and peak section of the route, came to a total of 932, as shown in Table 6-3.

(5) Bus Service Demand-Supply

Bus trip demands and supplies have been estimated over five cross-sections drawn between Integrated Zones (Cross-Sections A, B, C, D, and E: see Fig. 6-2), and the estimation results are presented in Table 6-4. From this, it is observed that the supply barely meets the demand on Cross-Section B and the demand is greater than the supply on Cross-Section C. Both cross-sections connect Panama Urban Area with the suburban zones.

TABLE 6-4 DEMAND – SUPPLY ON THE SCREEN LINES

Screen Line	Demand (Trip/day)	Supply (Seat/day)	Demand/Supply
A	221,000	310,000	71%
B	111,000	112,400	99%
C	28,000	20,650	136%
D	80,000	110,700	72%
E	114,000	150,660	76%

Source: ESTAMPA

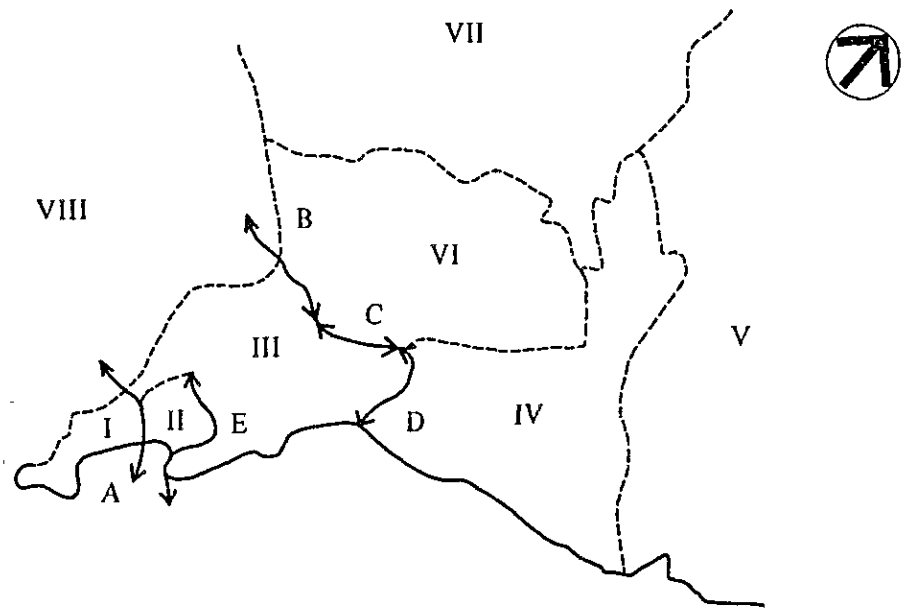


FIG. 6-2 LOCATION OF CROSS SECTIONS

Source : ESTAMPA

Next, the bus trip demand and supply are compared for each route. As far as seen in terms of daily averages, the supply is adequate to meet the demand on all routes, but a small margin (30% or less) of supply is observed on the following routes:

TABLE 6-5 CONGESTION RATE IN PEAK HOURS

Route	Congestion Rate (%)		
	Morning	Midday	Evening
1 Panamá Viejo – Vía Porras – Calle 12	95 08	78 16	70.24
2 Panamá Viejo – Ave. Balboa – Calle 12	85.57	87.15	167.16
3 Panamá Viejo – Vía 11 de Octubre – Calle 12	248.38	66.66	43 79
4 El Cruce – Ave. Balboa – Corozal	49.60	58 75	38.88
5 Panamá Viejo – Santa Clara – Calle 12	105.76	98 07	132.69
6 Panamá Viejo – San Miguelito – Calle 12	82.85	76.29	110.72
7 Parque Legislativo – Ave Balboa	116.66	101.94	11.75
8 El Cruce – Curundú	35.00	46.75	11.66
9 Boca La Caja – Calle J. – El Chorrillo	94.33	91.31	175.46
10 El Cruce – Clayton	18 00	100 00	65.76
11 Betania – Vía Transistmica – El Chorrillo	93.85	79.27	92.30
12 Villa Rica – Puente – El Chorrillo	78.75	105.67	146 06
13 Villa Rica – Calle 9a. – El Chorrillo	147.12	93.60	169 48
14 Villa Rica – Puente – Mercado		79.80	106.25
15 Veranillo – Vía España – El Chorrillo	89.13	62.74	98.89
16 El Cruce – Albrook – Diablo	21.00	17 46	63.41
17 Veranillo – Vía Transistmica – El Chorrillo	188.60	89.93	72.84
18 Automotor – Vía R.J. Alfaro – Calle 12	203.13		
19 Samaria – Vía R.J. Alfaro – Calle 12	51.76	45.92	–
20 El Cruce – Paraiso		51.91	81 08
21 Veranillo – Vía R.J. Alfaro – Calle 12	265.71	185.71	–
22 El Cruce – Rodman – Cocolé	86.66	41.66	–
23 Villa Lorena – Vía España – Calle 12	48.75	140.00	
24 El Cruce – Amador	45.20	26.00	12.00
25 Villa Lorena – Vía España – El Chorrillo	103.94	93.02	78 82
26 Villa Lorena – Calle J. – El Chorrillo	118.58	70.54	82.00
27 San Pedro – Vía España – Calle 12	87 65	83.48	95.29
28 San Pedro – Vía España – El Chorrillo	254 49		110.77
29 San Pedro – Calle J. – El Chorrillo	101.13	66 66	102.99
30 Juan Díaz – Vía España – El Chorrillo	100 19	109.30	194.79
31 Pedregal – Vía Transistmica – El Chorrillo	79.47	52.81	90 01
32 Pedregal – Vía España – El Chorrillo	156.65	96.52	90.77
33 Pedregal – Vía R.J. Alfaro – Calle 12	124 77	126.55	209.09
34 Las Mañanitas – Vía R.J. Alfaro – Calle 12	78.84	85.09	114.56
35 El Cruce – Gamboa	95.00		72.22
37 Tocumen – Vía España – El Chorrillo	87.27	55.71	188 33
39 Santa Librada – Vía R.J. Alfaro – Calle 12		88.88	123 84
40 Cerro Batea – Vía R.J. Alfaro – Calle 12	105.41	133.25	93.75
41 El Valle – Vía España – Calle 12	98.90	119.61	164.93
42 El Valle – Vía Transistmica – Calle 12	85.35	61.69	154 30
43 Los Andes – Vía R.J. Alfaro – Calle 12	116.96	136.22	98.26
44 Alcalde Díaz – Vía Transistmica – Calle 12	113.97	115 66	105.21
45 Santa Librada – Vía España–Calle 12	40 20	170.14	225.40
46 Santa Librada – Vía Transistmica – Calle 12	109.31	70.83	132.82
47 Cerro Batea – Vía Transistmica – Calle 12	132.13	109.71	207.86
48 Cerro Batea – Vía España – Calle 12	252 41	98.78	130 40
49 Bello Horizonte – Vía Transistmica – El Chorrillo	113.05	88 62	86.17
50 Bello Horizonte – Vía España – El Chorrillo	158.77	86 48	125.27
51 El Cruce – Howard – Kobee	109.87	31.00	53.22
52 Santa Marta – Monte Oscuro – Calle 12	122.37	73.56	117.75
53 Chilibre – Area del Canal – Panamá	98.92	70 25	91.44
54 Panamá – Area del Canal – Chilibre	72.93	125 74	94.90
55 Chilibre – Via Transistmica – Panamá		78.12	62.12
56 Panamá – Via Transistmica – Chilibre		109.30	123.53

Note . Congestion Rate = (Passengers/Capacity) x 100 Source : ESTAMPA

Source: ESTAMPA

28 San Pedro–Via España–El Chorrillo
33 Pedregal–Via Ricardo J. Alfaro–Calle 12
47 Cerro Batea–Via Transistmica–Calle 12
45 Santa Librada–Via España–Calle 12
39 Santa Librada–Via Ricardo J. Alfaro–Calle 12
21 Veranillo–Via Ricardo J. Alfaro–Calle 12
53 Chilibre–Area del Canal–Panama

On the other hand, the demand amounts to 30% or less of the supply on the five routes belonging to SACA and the route of Auto Motor–Via Ricardo J. Alfaro–Calle 12. (See the appendex "Urgent Improvement Plan", Part I, A'12 and A'13 for detail.)

Now, a scrutiny of the peak hours indicates that of the total 54 routes listed in Table 6-5, 39 routes show a greater peak hour demand than supply. Particularly crowded routes are:

3 Panama Viejo–Via 11 de Octubre–Calle 12 in the morning peak hour.
21 Veranillo–Via Ricardo J. Alfaro–Calle 12 in the morning peak hour.
28 San Pedro–Via España–El Chorrillo in the morning peak hour.
48 Cerro Batea–Via España–Calle 12 in the morning peak hour.
45 Santa Librada–Via Espana–Calle 12 in the evening peak hour.
33 Pedregal–Via Ricardo J. Alfaro–Calle 12 in the evening peak hour.

When the facts that 932 buses operating at seat capacity was calculated as adequate to meet the peak hour demand and that the number of buses operated was 1,088 are taken into consideration in connection with the above calculated peak hour shortage of supply, it must be concluded that the lack of appropriate allocation of, and systematic marshalling and scheduling of, buses to each route is contributing to the shortage of buses on a majority of routes.

3) **Bus Service Quality**

(1) Operation Speed and Route Distance

The average operation speed of buses is 20 kilometers per hour. It is less than 15 kilometers per hour in some sections of Via Espana and Avenida Central, as well as in parts of Via Ricardo J. Alfaro in certain hours (see Table 6-6).

Average route distance is 34.4 kilometers. Many suburban routes are long, and 13 routes are 40 kilometers (by round distance, or one way distance of 20 kilometers) or longer (see Table 6-7). The long distance of each route is currently compensated for by a high operation speed. Yet, a round trip operation required three or three and a half hours on seven routes.

(2) Operation Hours and Density

According to the SICOTRAC drivers' operation suspension rate, the level of bus operation drops on Saturdays to 54.2% of the weekday level and on Sundays, to 34.6%. Weekday operation will be discussed hereunder.

Bus operation starts at about 05:00 and continues until about 23:00 on major routes.
Operation stops after 21:00 on the Avenida Balboa route, a branch route of SACA, and the Las

TABLE 6-6 BUS TRAVEL SPEED (KILOMETERS/HOUR)

ROUTE	DIRECTION	HOURS OF DAY 7–8	8–9	9–10	12–13	13–14	16–17	17–18	18–19
Via SIMON BOLIVAR	Via CINCUENTENARIO to EL CHORRILLO	24	22	24	24	24	23	28	25
	EL CHORRILLO to Via CINCUENTENARIO	23	26	23	26	25	20	11*	24
Ave. BALBOA	Westward	21	21	27	25	25	24	30	28
	Eastward	25	26	29	27	28	24	26	28
Via RICARDO J. ALFARO	Westward	12	15	24	26	27	25	24	26
	Eastward	26	26	26	26	27	27	22	23
AVE. JUSTO AROSEMENA	Westward	14	18	14	16	17	17	23	17
	Eastward	19	19	12	12	19	13	13	15
AVE. CENTRAL	CENTRAL – AVE. A	20	19	15	15	19	15	14	15
(INCLUDE AVE. A' B'.	AVE B' – CENTRAL	17	13	17	19	15	13	15	17
VIA ESPAÑA	CENTRAL AREA	19	12	15	15	16	11	13	17
	RESIDENTIAL AREA	25	22	19	22	21	25	23	19
	CENTRAL AREA	17	15	16	16	20	11	15	15
	RESIDENTIAL AREA	25	22	25	25	21	20	18	18

Source: ESTAMPA

TABLE 6-7 DISTRIBUTION OF ROUTE LENGTH

Route Length	N° of Routes	%
10 Km	1	2.0%
10 – 20 Km	5	10.0%
20 – 30 Km	12	24.0%
30 – 40 Km	19	38.0%
40 – 50 Km	6	12.0%
50 – 60 Km	4	8.0%
Longer than 60 Km	3	6.0%
TOTAL	50	100.0%

Source : ESTAMPA

Cumbres route (see Fig. 6-3).

Daily bus operation frequencies are classified into 5 groups and illustrated in Fig. 6-4, which shows that the frequency is 30 or less on routes which pass through Gaillard Highway Via Santa Elena, and Via 11 de Octubre, service frequency is more than 300 on major routes running on roads which traverse Panama Urban Area such as Via Espana, Via Transistmica, and Via Ricardo J. Alfaro.

(3) Destination Accessibility

Bus routes are shown by origin in Figure 6-5, which shows that Via Espana and Via Transistmica are easily accessible from major origins, but Ave Balboa is isolated. Almost no bus route running in a north-south direction connecting lateral arterials exists. Few routes exist connecting San Miguelito district directly with Corregimiento De San Francisco or Corregimiento De Rio Abajo, although demands are strong. Major passengers' transfering points are shown in Fig. 5-23.

(4) Bus Stops and Terminals

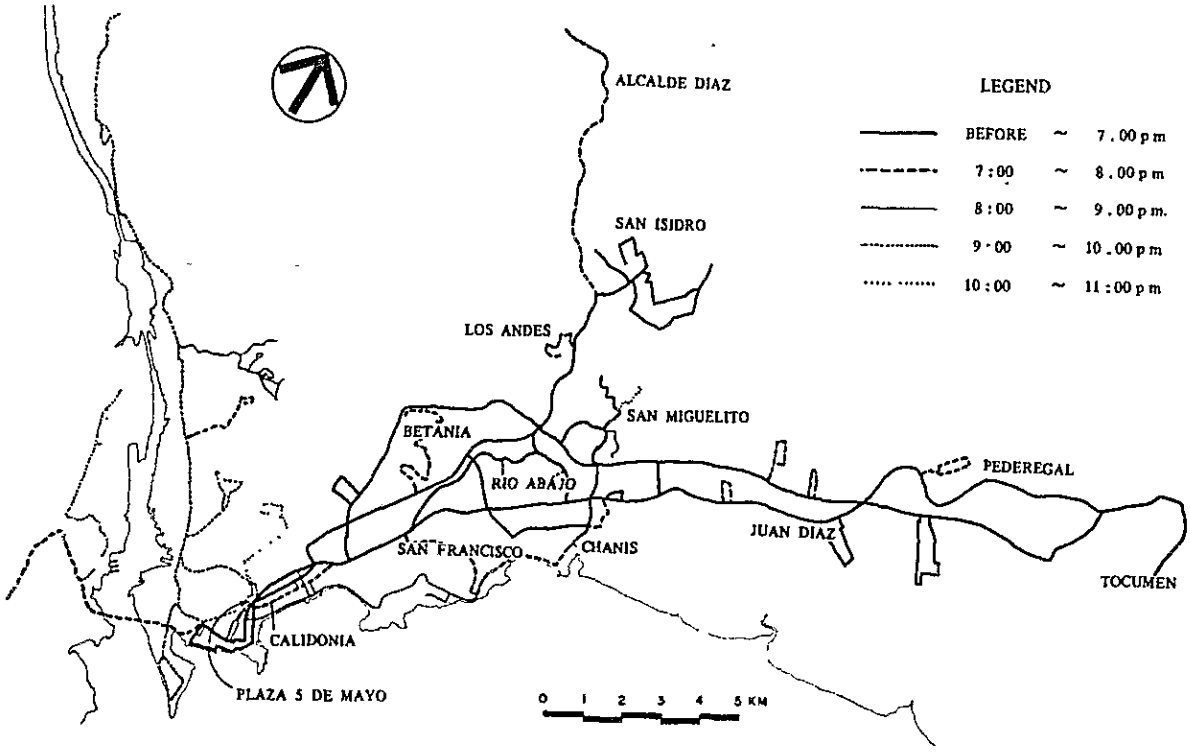


FIG. 6-3 LAST BUS SERVICE TIME PERIOD

Source : ESTAMPA

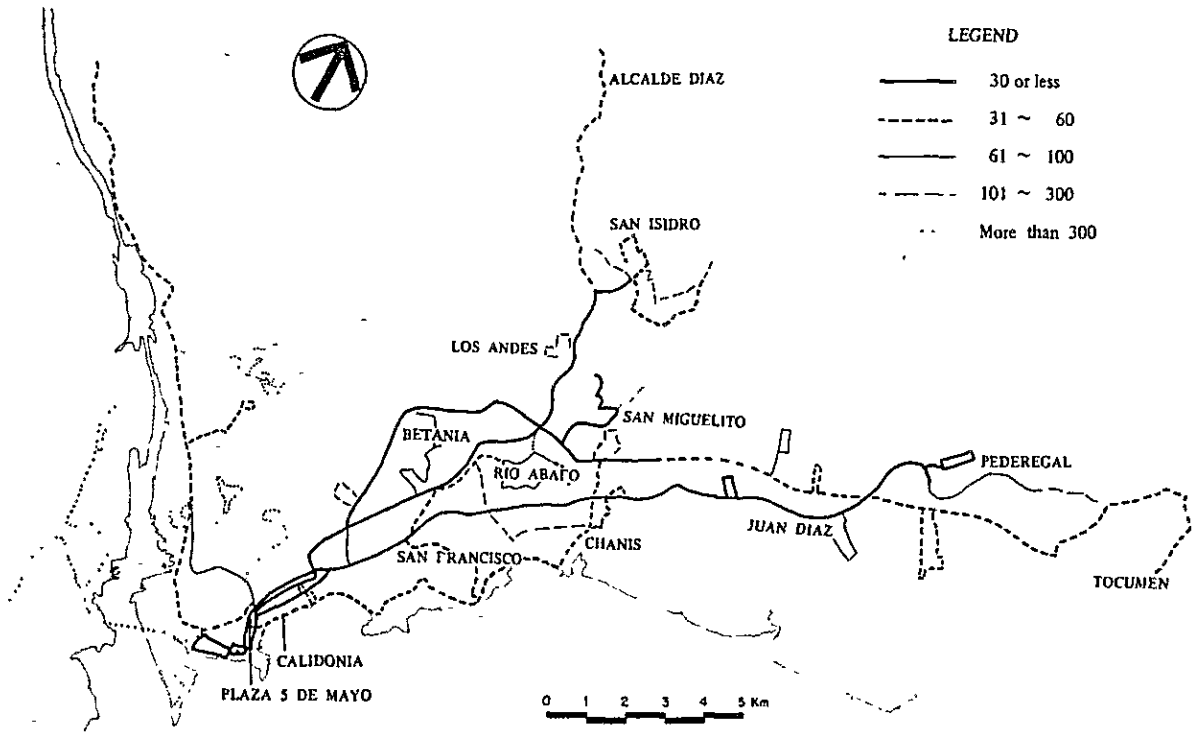


FIG. 6-4 BUS SERVICE FREQUENCY (SERVICES/DAY)

Source : ESTAMPA

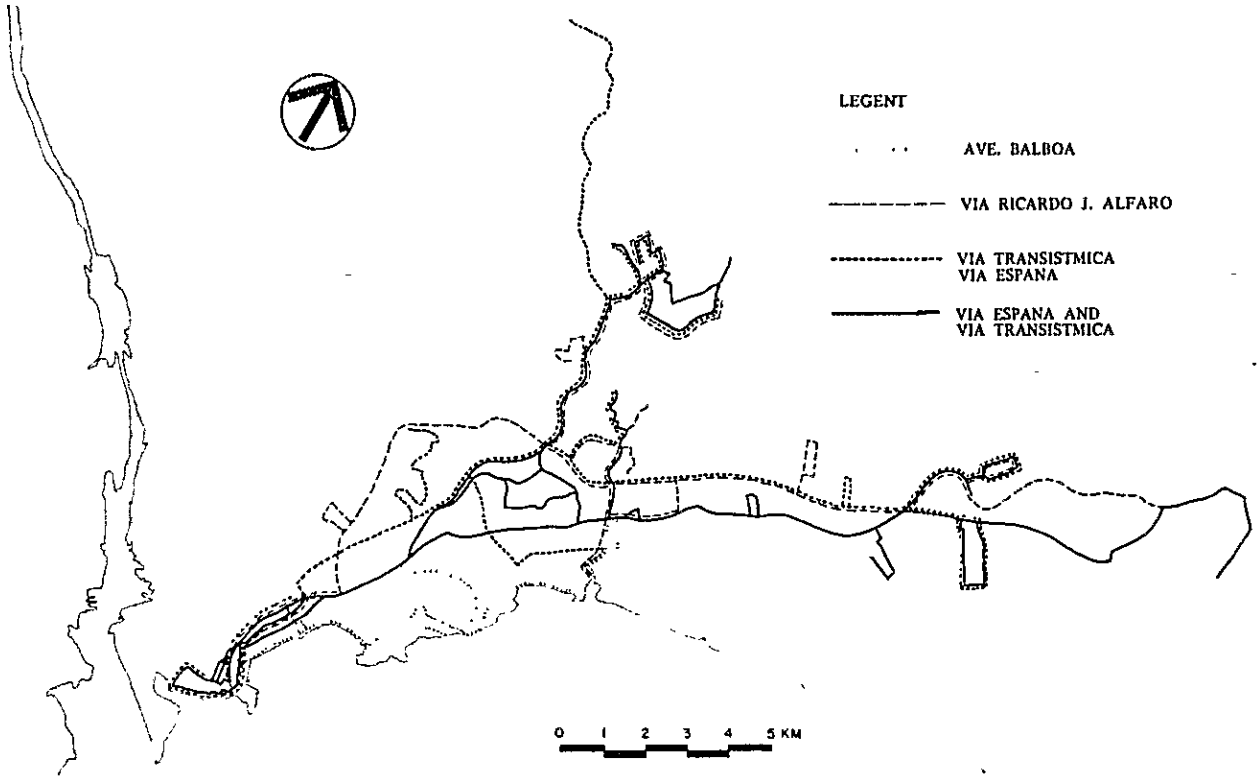


FIG. 6-5 BUS ROUTES BY MAJOR STREETS (EXCLUDING ROUTES IN CANAL AREA)
Source : ESTAMPA

Average bus stop intervals are 200 meters on Avenida Central, 300 meters on Via Espana, 450 meters on Avenida Balboa, 500 meters on Via Ricardo J. Alfaro, and is a long 720 meters on Via Simon Bolivar. Sheltered stops account for 80% of all stops on Via Simon Bolivar and Via Espana, but they account for only 50% or less on other roads. Bus bays account for 60% to 70% on Via Domingo Diaz, Via Simon Bolivar, and Via Espana, and only 40% or less on all others.

In Panama City, a number of bus terminals exist in Centro, but with obsolete facilities.

(5) Accidents

Table 4-3 shows 1978 accident records. Accidents involving a bus counted 1,258, which was approximately 17% of all traffic accidents, or 88.3 accidents per every 100 registered buses. This is at the rate of one accident per each 36,200 kilometers of operation.

(6) Fare

Two bus tariff systems are in force in Panama City; one is the zone system applied to the major parts of the Panama Urban Area, and the other is the route system chiefly applied to the Canal Area. The two systems are summarized in Figure 6-6.

Under the zone system, a fare of 15 cents is charged for the first zone, which starts from the urban center, covers the entire territory of Panama Urban Area (Centro, Bella Vista, and Area Residencial Integrated Zones) and parts of San Miguelito and Juan Diaz-Pedregal, and an additional 5 cents are charged for each additional zone. Fare to Tocumen is 30 centavos (4 zones) and fare to Alcalde Diaz is 25 centavos (3 zones). Children under the age of 5 are free of charve, while students

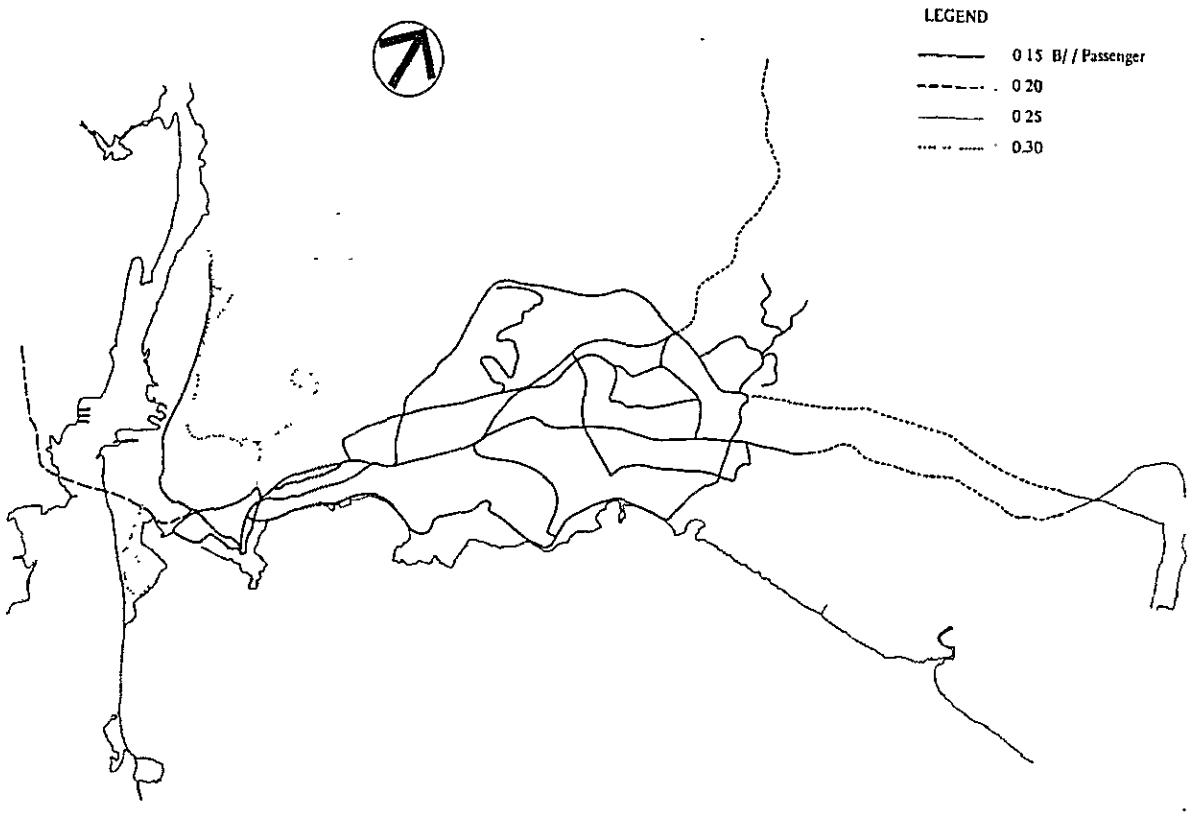


FIG. 6-6 ZONE SYSTEM OF BUS TARIFF TO/FROM CENTRO

Source : ESTAMPA

(up to high school) in uniform are given 5 cents discount. No commuter's pass is available.

Bus fares under the SACA's route system are, by route:

For the Corozal: flat rate of 20 centavos

For Curundu, Diablo, or Amador: flat rate of 30 centavos

For Clayton or Paraiso: flat rate of 35 centavos

For Cocoli or Kobee: flat rate of 40 centavos

For Gamboa: flat rate of 65 centavos

4) **Bus Service Operators**

(1) Operation entities

In Panama City there are 6 entities engaged in bus service business. The largest is SICOTRAC, which is a syndicate of bus owners and bus drivers having an 86% share in the total quantity of passengers transported. Syndicate members are allowed to own only one bus each and to operate on designated route only. Under the most typical arrangement, the bus owner rents his bus to a driver for a daily charge, usually under verbal agreement, and the driver engages in the service at his own operation expense.

The second largest is COOMETRAP, a cooperative which has 8% share in the industry. Particulars of these and other bus operation entities are summarized in Table 6-8.

TABLE 6-8 BUS OPERATORS IN PANAMA CITY (1981)

Operator	Bus Fleet		Route			Facilities Owned				Managing Organization
	Registered	Operated	N°	Length	N° of Passengers	Head Quarters	Garage	Repair Shop	Own Terminal	
SICOTRAC	1250	935 (85.9%)	34	1048.8 (61.1%)	415,139 (95.7%)	1	0	0	0	Sindicate
COOMETRAP	180 [1)]	77 (7.1%)	5	156.2 (9.1%)	37,486 (7.7%)	1	3.5 ha	1	0	Cooperative
SACA	34	27 (2.5%)	9	238.1 (13.9%)	19,036 (1.9%)	1	1.0 ha	1	1	Cooperative
COTUM	30	17 (1.6%)	1	65.4 (3.8%)	11,458 (2.4%)	1	2.0 ha	1	0	Cooperative
MOV 20 NOV	9	8 (0.7%)	1	38.6 (2.3%)	5,147 (1.1%)	0	0	0	0	Sindicate
Co. E. Indep.	42	24 (2.2%)	4	168.1 (9.8%)	6,304 (1.2%)	1	0	1	0	Sindicate/ Cooperative
TOTAL		1,088 (100.0%)	54	1715.2 (100.0%)	404,570 (100.0%)	5	6.5 ha	4	1	

Note : 1) : Estimated by ESTAMPA
Source: Bus Operators

(2) Revenue

Bus fares are the only revenue for the bus operators. Business indicators of the operators are presented in Table 6-9. The improportionally high fares shown for SACA is explained by the fact that SACA serves the Canal Area.

TABLE 6-9 FINANCIAL CHARACTERISTIC OF BUS OPERATORS

	Total Operation Kilometrage (km)	Total Sales/day (Balboa)	Passenger per Route Length (pax/km)	Passengers per Operating Km (pax/km)	Sales per Operating km (¢/km)	Sales per Passenge Kilometers (¢/pax.km)
SICOTRAC	107,064	B/66,634	348	3.9	62.2	2.20
COOMETRAP	8,438	5,328	240	4.4	63.1	2.55
SACA	5,196	2,819	38	1.7	54.3	4.30
COTUM	4,382	1,960	175	2.6	44.7	2.18
MOV.20 NOV.	1,274	866	133	4.0	68.0	2.20
Co. E. INDEP.	5,278	2,091	38	1.2	39.6	1.53
AVERAGE	131,632	79,698	261	3.7	60.5	2.22

Source : ESTAMPA

(3) Operation Cost

Operation costs are estimated for 44-passenger diesel buses, 56-passenger diesel buses, and 44-passenger gasoline buses under the assumptions that daily operation distance is 121 kilometers, the number of operation days is 246 per year, and total operation distance is 31,944 kilometers per year, and the result is presented in Table 6-10.

TABLE 6-10 BUS OPERATION COST

Engine, Size	COOMETRAP TYPE			SICOTRAC TYPE		
	D–1	D–2	G	D–1	D–2	G
a Fuel	8.00	8.00	17.79	8.00	8.00	17.79
b Oil	1.80	1.80	1.80	1.80	1.80	1.80
c Tyre	1.20	1.20	1.20	1.20	1.20	1.20
d Depreciation	11.27	16.2	7.88	11.27	16.2	7.88
e Maintenance	15.89	15.89	15.89	16.76	16.76	16.76
f Interest	10.43	15.74	7.35	10.43	15.74	7.35
g Wage	31.44	31.44	31.44	14.17	14.17	14.17
h Insurance Tax	5.68	5.68	5.68	5.68	5.68	5.68
i Overhead	8.66	10.53	9.02	–	–	–
Total (O.C. 12%)	94.37	106.48	88.26	69.31	79.55	69.83

Note :

Type	Engine	Price	Capacity
D–1	Diesel	$40,000	44 PAX
D–2	Diesel	$60,000	56 PAX
G	Gasoline	$30,000	44 PAX

Left time is 15 years

Source : ESTAMPA

In the case of SICOTRAC, the operation cost of 44-passenger diesel bus comes to 73 centavos per kilometer, which is in excess of their current revenue of 62 centavos per kilometer. However, when depreciation expense and opportunity cost are deducted, the net operation cost comes to 48 centavos per kilometer, which results in a revenue of 1.5 times the apparent cost. Therefore, if the bus owner drives the bus himself and allows an average rate of his wages for the cost calculation, he will have an apparent income of 14 centavos km x 121 kilometers = 17 Balboas per day. Of the cost elements, maintenance expense is conspicuously high.

Between comparable capacity buses, the fuel cost of gasoline buses is over twice that of diesel buses, but because of the low initial cost of the former, the overall costs of the two are, after all, about the same.

(4) Vehicle

The particulars of bus fleet are listed for each entity on Table 6-11. Safely assuming that all the 1,455 registered buses are operable, the total 1,088 buses operated comes to an operating ratio of 75%, which must be improved.

The low operating ratio of the buses, and the high maintenance cost seen in the above, are attributable to the excessive varieties of engine-chassis combinations (see Table 6-12 for 112 samples of SICOTRAC) and the mechanical deterioration over the years of the buses that as shown on Table 6-13 are in service (half of them are more than 10 years old), as well as to the absence of a

effect maintenance system (mechanics skill development and certification, periodical inspection, preventive maintenance).