In the northwest along the Puerto Colombia are located the campuses of the Uninorte and the University of Atlantico, sports clubs, cemetaries and resorts.

Thus, the industrial axis of the Barranquilla-Soledad urban district stretches from the banks of Rio Magdalena to the airport, and its commercial/business center is strating to shift from Centro to Calle 72. However, there are no commercial centers to service the residential districts expanding rapidly towards the suburbs, especially to the south. In addiiton, a new educational/recreational zone is being formed in the northwest. Therefore, the flow of people between the suburban residential districts and the central district and the flow of commodities along the industrial axis are expected to intensify in the future, and the generation of a new flow of traffic northwestwards for educational and recreational purposes is expected.

There are also some environmental problems. In addition to the drainage problem mentioned above, there is scarcity of parks and green spots in the existing built-up area and the problem of the heavy chemical industry zone being adjacent to a residential district.

3–2 Central District

3–2–1 General Features of Central District

1) Study Area

The area of the Central District Study of Barranquilla covers 499.5 ha. This area was set up taking into account the study area by PIDAMB (Plan Integral de Desarrollo del Area Metropolitana de Barranquilla) as well as the recent development tendency of the central district.

Although the area studied in PIDAMB includes the Loma No. 1 area, our study excludes it simply because of its present land use: mostly vacant land with exceptional use by the recent establishment of a veterinary unit of ICA (Instituto Colombiano de Agropecuaria).

On the other hand, the development of the central district has extended of late to the west, and this seems to justify a wider delimitation of the study boundary in the west part. This study area is divided into 5 zones, and each zone is further divided into some sub-divisions as illustrated in Figure 3–2–1. The division is in accordance with main streets which characteristically divide the study area.

The actual study area is composed of blocks (Manzanas), and each block of lots (Predios).

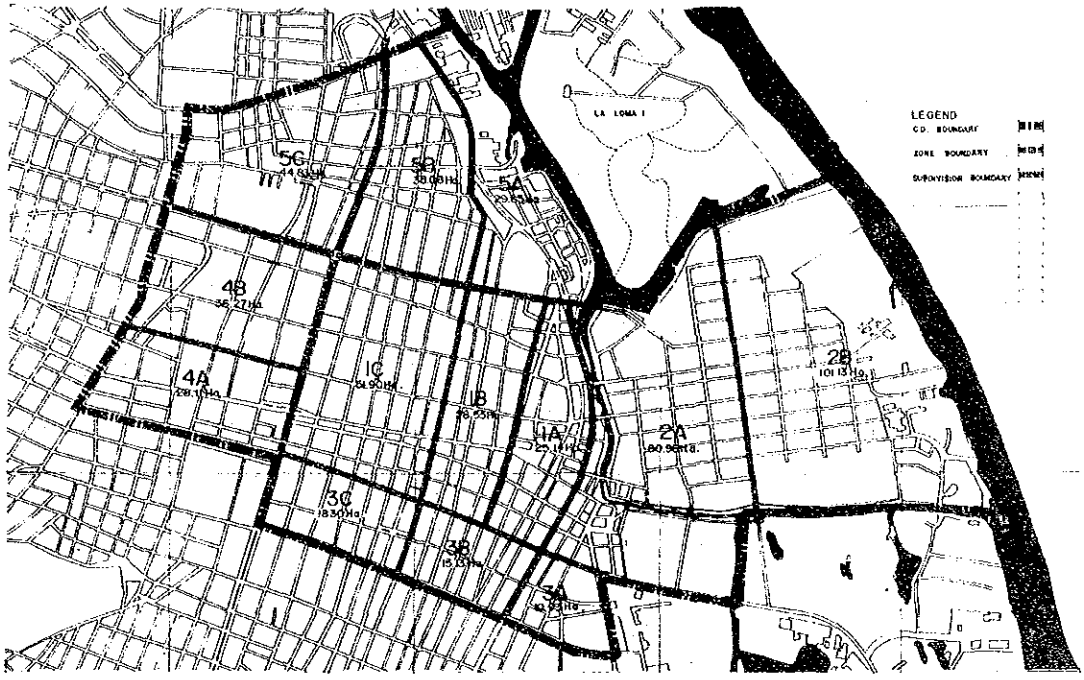


Fig. 3–2–1 Study Area

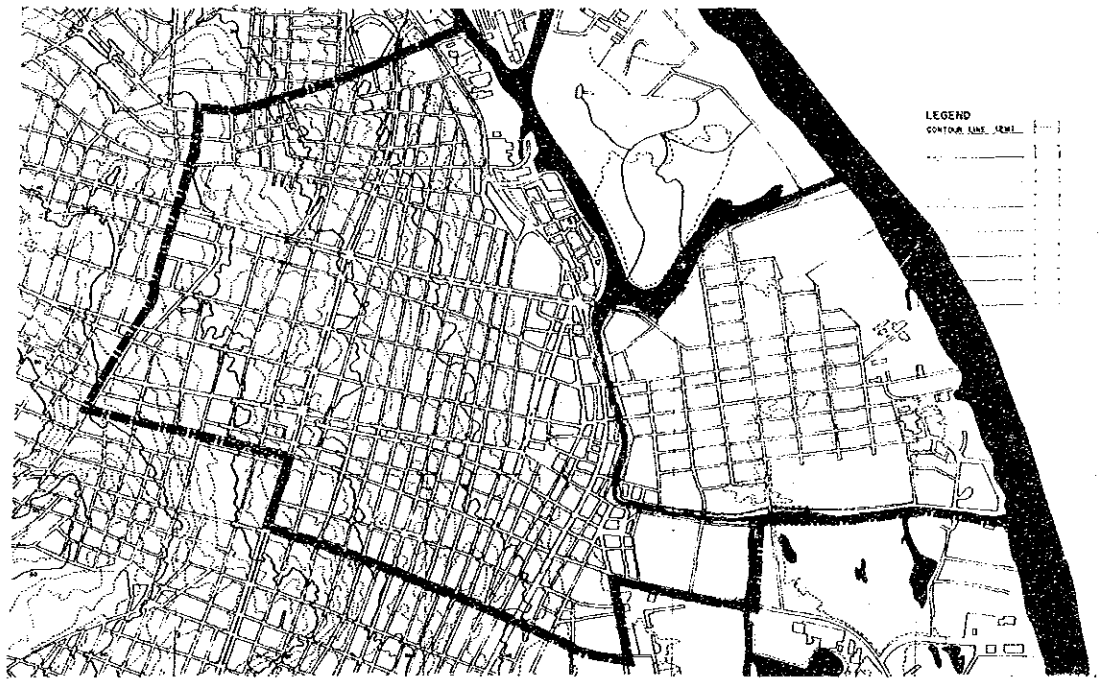


Fig. 3–2–2 Topography

Table 3–2–1 shows the number of blocks and the number of lots for each zone and sub-division. In Zone 2 and 4 the average area for block is larger and is smaller in Zone 1, which may reflect the historical development of the area.

2) Topography

The topographic features of the central district can be summarized as follows and are shown in Figure 3–2–2:

a. The east half of the district is almost flat with the height of below 5 m above sea level. This part faces the Rio Magdalena and its branch or canal goes through the area. This area almost conforms to the Zones 1A, 2A, 2B, 3A and 5A: notably most of the Barranquillita area is less than 2 m above the sea level.

b. The west half of the district is characterized by upward gentle slopes to the west. The average grade is about 2 to 3% and this hardly gives an impression that Barranquilla has a hilly topographic formation.

3) Historical Brief

Barranquilla is believed to have been settled between 1620 and 1629 in the present central district. The configuration of this settlement was similar to the pattern introduced by Spaniards at that time: a central plaza with a church surrounded by buildings and houses. This primary settlement has developed as the center of commodity flow and trade between foreign and domestic territories. The extension pattern of the settlement had been rather irregular in terms of the shape of blocks and the width of streets.

In the early 19th centruy the governor of Cartagena is said to have stimulated the land development in Barranquilla with some exemption from taxation. In 1820 the Sabanilla seaport was opened fro local trade, and in the middle of the centry Spanish, German and Jewish marchants had been active in foreign trade. Baranquilla became a city in 1857.

A milestone in the economic, political and social evolution of Barrnaquilla was reached with the construction of railroad between the Sabanilla seaport and the existing customhouse in 1871. In the same year the first steam tramway system started. Thus, at the end of the last centry, Barranquilla had seen remarkable demographic and economic development, and various commercial, financial, industrial and administrative activities had concentrated in the central district. Notworthy among them are, the Aduana (customhouse) Plaza as the terminal of the

railroad (Montova Section), St. Nicolás Plaza as a landmark of the city, the center of the catholic community with surrounding commercial activities and seasonal religious events, and the market Plaza as the center of commodities interchange with the river transport terminal on it.

In the 1920's the seaport was moved to Barranquilla and the role of the Aduana Plaza diminished, while the more sophisticated urbanization could be identified through the introduction of bus service, and the establishment of the chamber of Commerce, the Municipal Public Works Enterprise, the Municipal Telephone Enterprise, and so on. The modern water supply and severage systems were introduced for the first time in 1925. The population at that time is estimated to have been around 30 thousands.

When the seaport was constructed at the existing site, there had been an effort, though with little success, to develop Barranquillita in relation to the seaport activities.
The Barranquillita district had to wait for its development until the 1950's because of its chronical flooding in the winter (rainy) season. Since then, factories, warehouses, and bus terminals have been constructed and the importance of the district has increased in terms of the land use in the city.

As for the relation between the building use and the height of buildings in the very central area, the following are the summary of the historical development:

(1) In and around the year of 1930, the core of the central district was located along Cll 32. For the most part, the height of buildings was no more than four stories. In general, commercial activities and banks were located on the first floor and housing and hotels occupied the upper floors.

(2) About 1950, the core had moved to Cll. 34 (Paseo de Bolivar). Building heights started to increase. Commercial activities and banks continued to occupy the first floor, but the rest was used, in general, by offices. There has been a growing tendency for housing to diminish and for remaining hotels to loose their functional importance.

(3) At present, the core is moving up toward Calle 45 (Murillo) mainly with banks and offices. However, it seems that the building height will be limited because of the low rental income derived by developers.

Apparently the recent development and expansion of the city has had its effect the central district the relative decline in commercial activties, acute traffic congestion, decrease in

the number of households (population), and some environmental deterioration along the canal are the major elements which have been affected. These are some of the key issues which are sparking the urban renewal a centry after the city development had actually started.

3–2–2 Land Use

1) General

The data upon which land use studies in the central area are based have been collected from two sources. The first one is the field survey conducted by the survey team, where each building in the study area was checked as to its use, height, construction materials and age. The second is the land and building cadaster by IGAC (Instituto Geografico "Agustin Codazzi", Ministerio de Hacienda y Credito Publico).

Extensive Correlation work between those two sources has been carried out to determine the actual land use, and relating building use information into land use for each parcel of land. Through data collection and measurements for buildings and land it was possible to calculate the building area ratio and the floor area ratio for each lot in the study area. At the same time the vacancy ratio of each building and the vacancy ratio of land for each block was also calculated on the basis of these data.

The existing urban oridinance code for the central area has been compiled. The original code was established in 1957, and was modified in 1968 by the City Planning Board of Barranquilla (see Table 3–2–10 and Figure 3–2–16).

2) Major Land Use

The land use features in the Central District is summerized in Tables 3–2–2 and 3–2–3. The tables show that the three major land uses, in the district, as a whole, are commercial, industrial and residential. Almost two-third of the district involves these uses.

Commercial land use amounts to a little more than one-fourth of the total area. In sub-zones 1A and 1B, the commercial use is more than three-fourths, and in 1C and 3B almost half. These facts depict the major location of commercial activities in the district. In other sub-zones except 28 where vacant land occupies more than half of the area, commercial use is between 13 and 25% (see Figure 3–2–3).

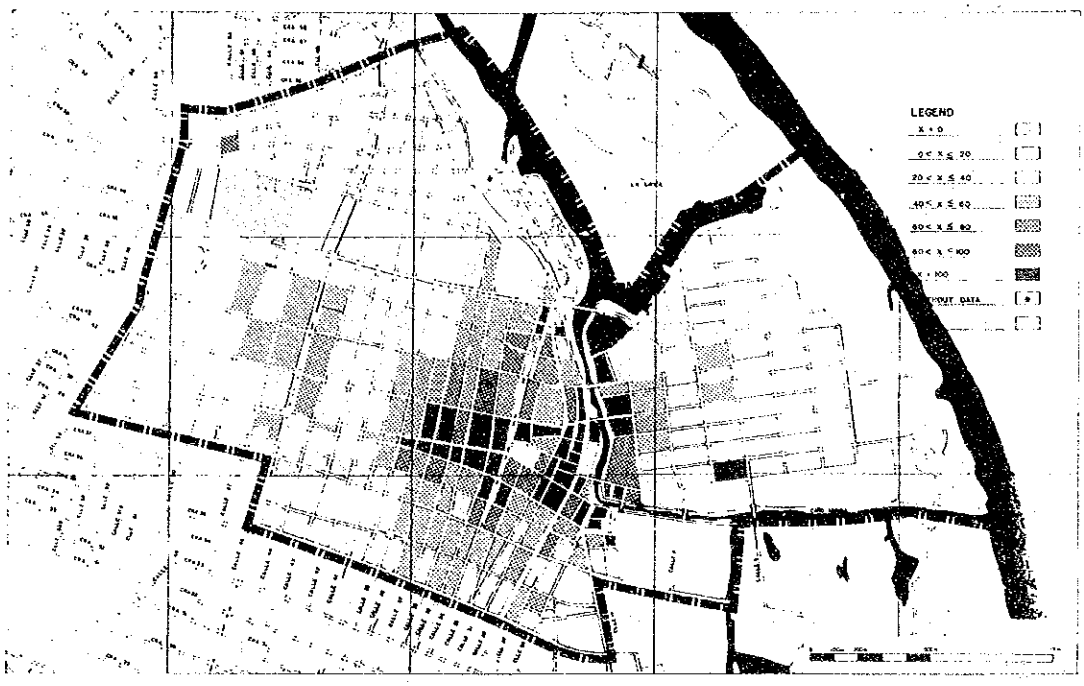


Fig. 3–2–3 Commercial Land Use

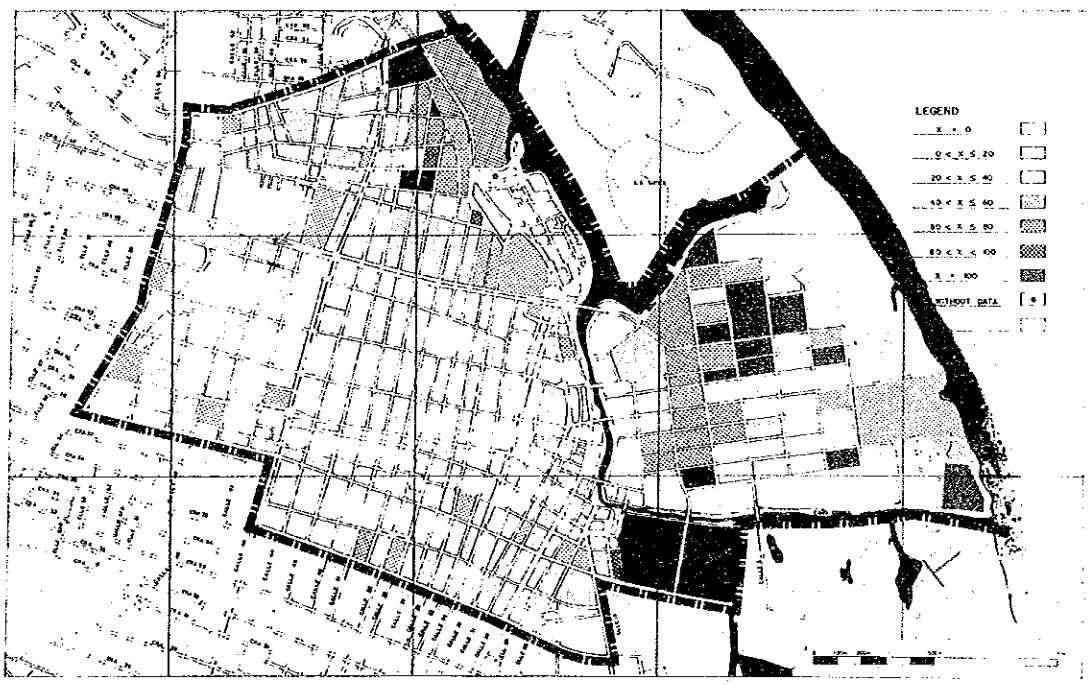


Fig. 3–2–4 Industrial Land Use

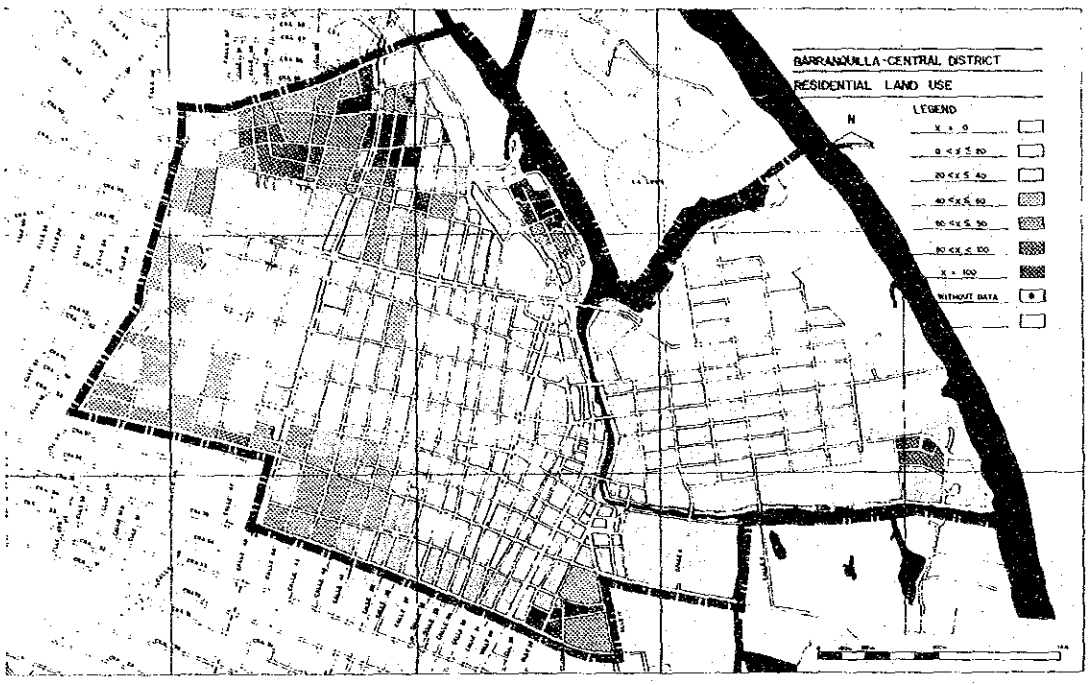


Fig. 3–2–5 Residential Land Use

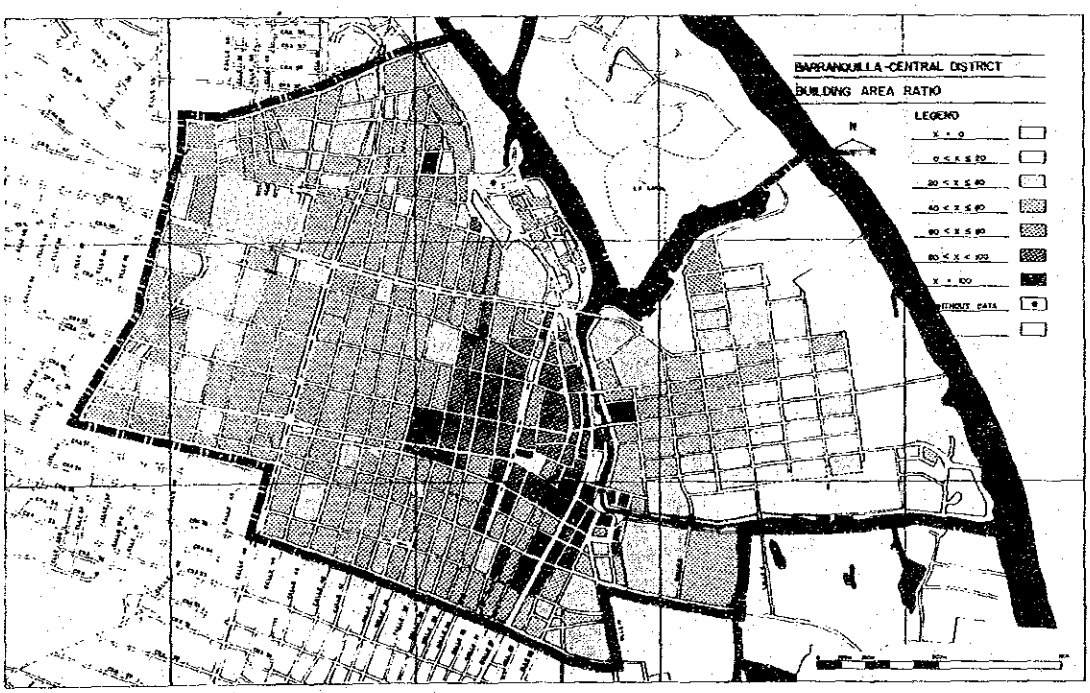


Fig. 3–2–6 Building Area Ratio

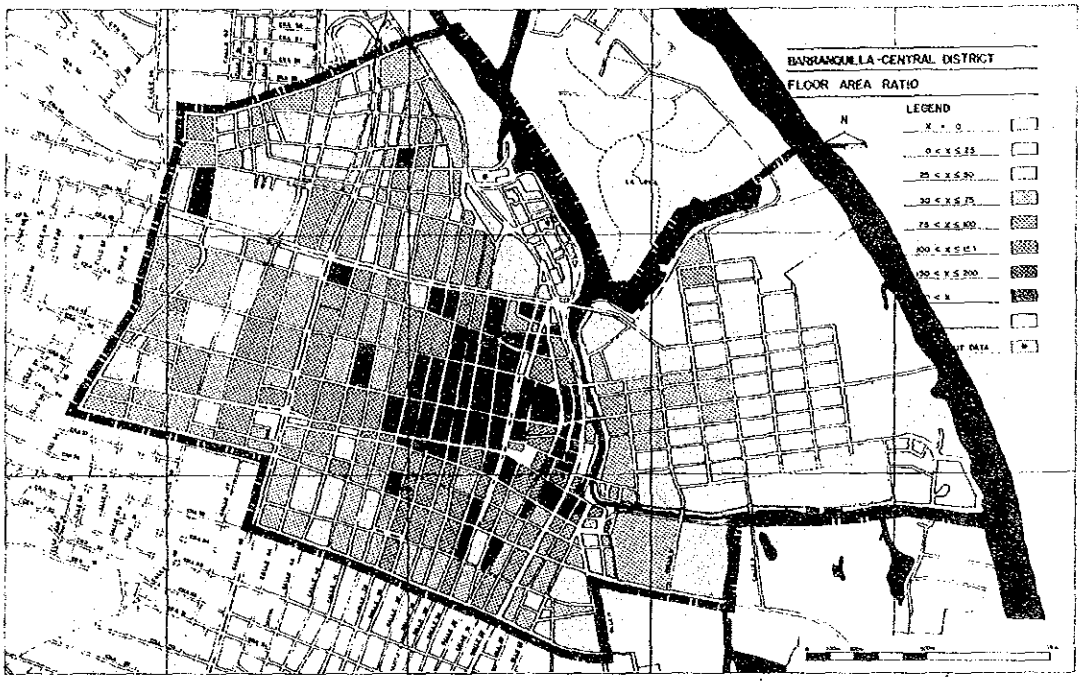


Fig. 3–2–7 Floor Area Ratio

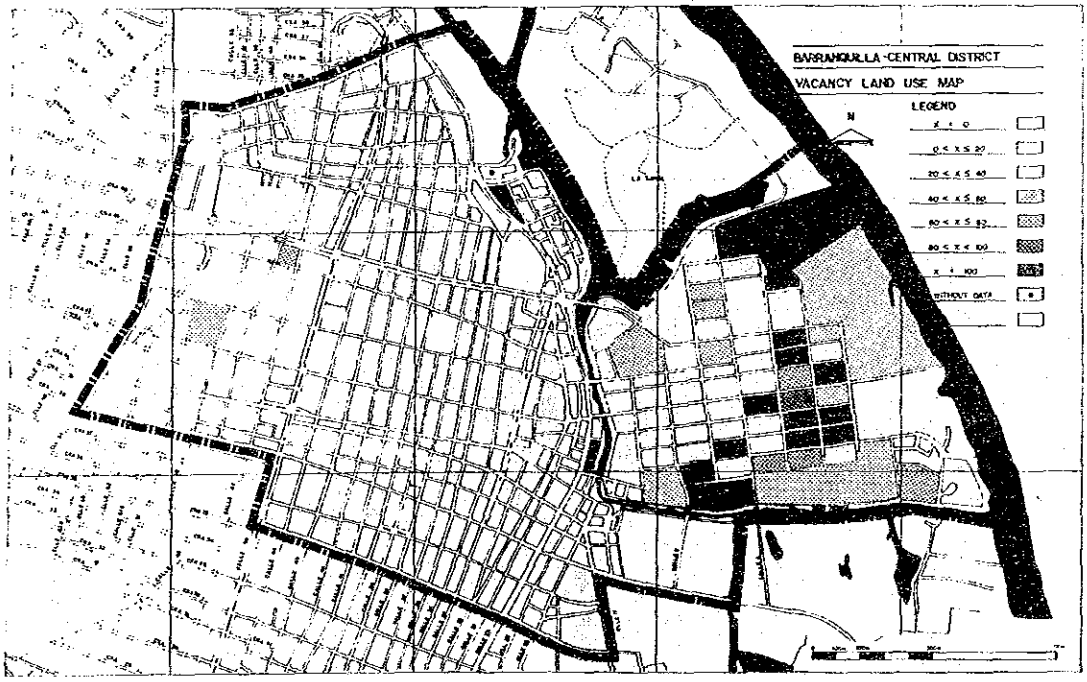


Fig. 3–2–8 Land Vacancy

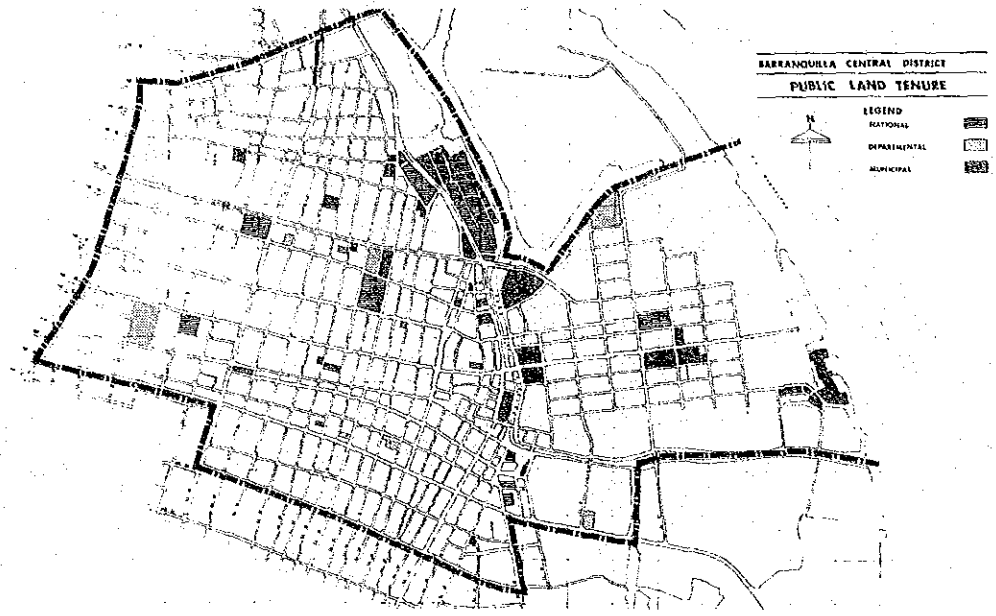


Fig. 3–2–9 Public Land Tenure

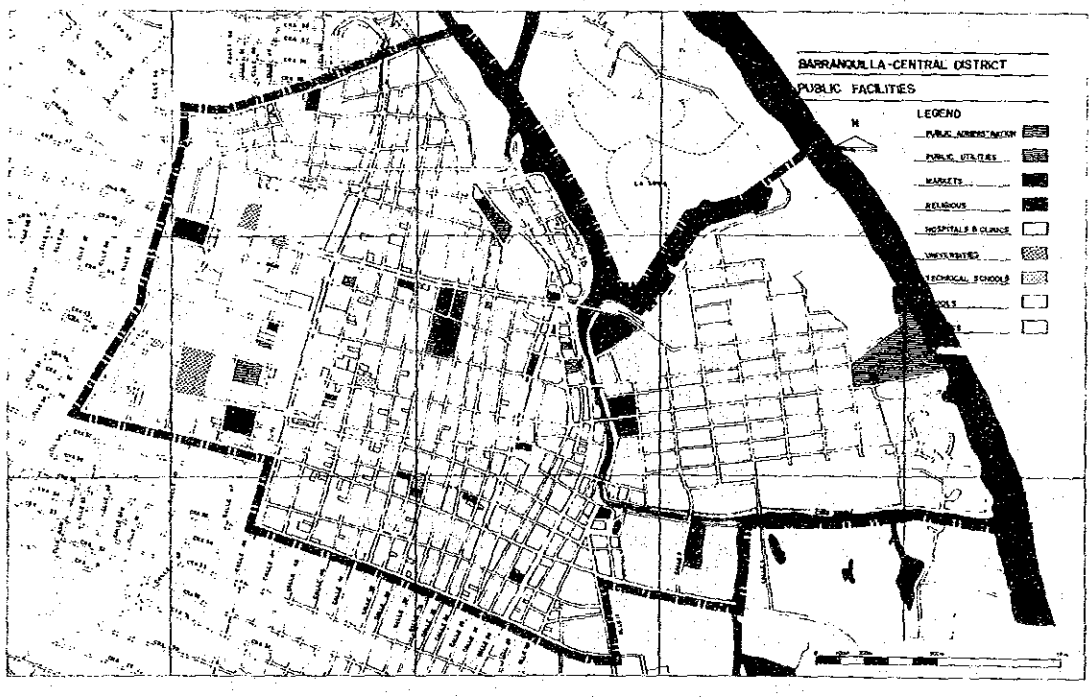


Fig. 3–2–10 Public Facilities

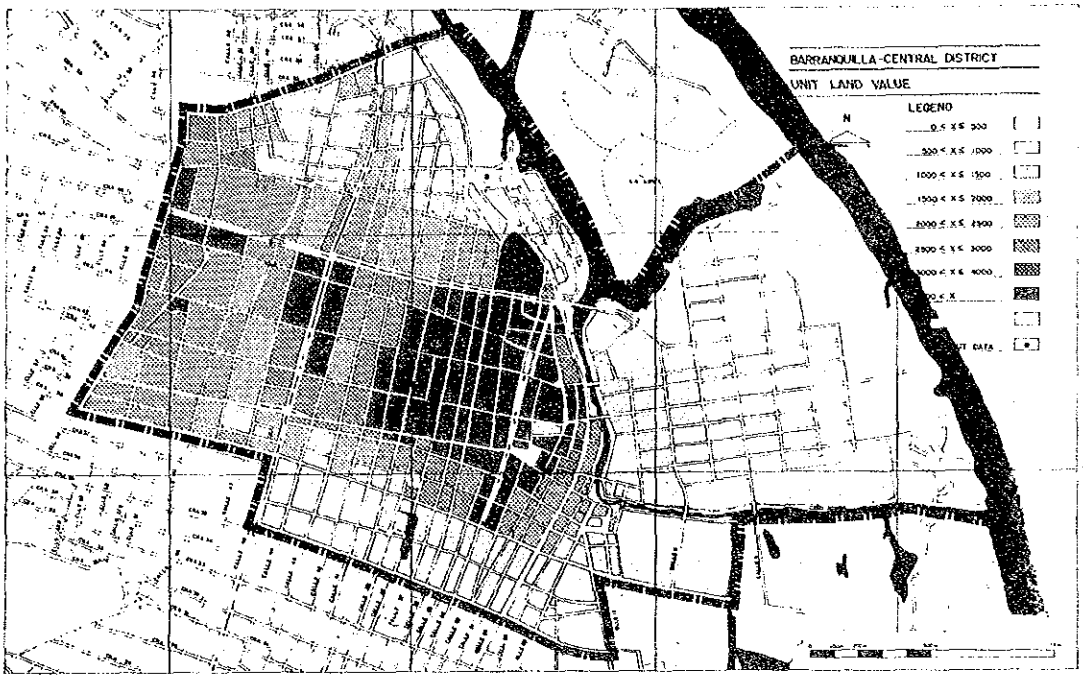


Fig. 3–2–11 Unit Land Value

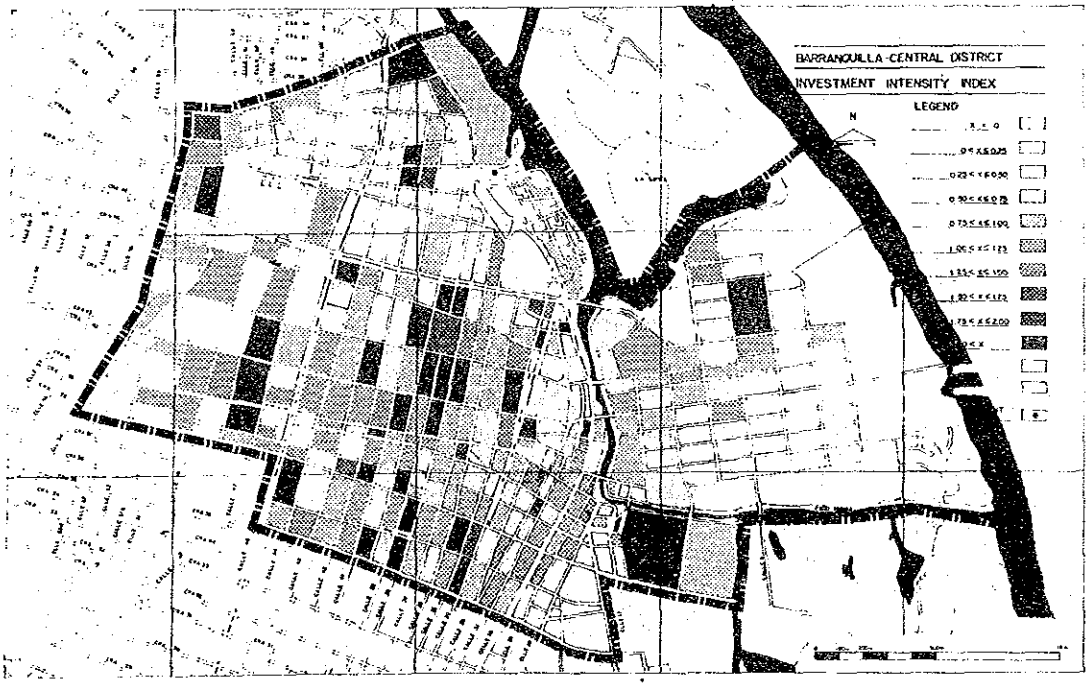


Fig. 3–2–12 Investment Intensity

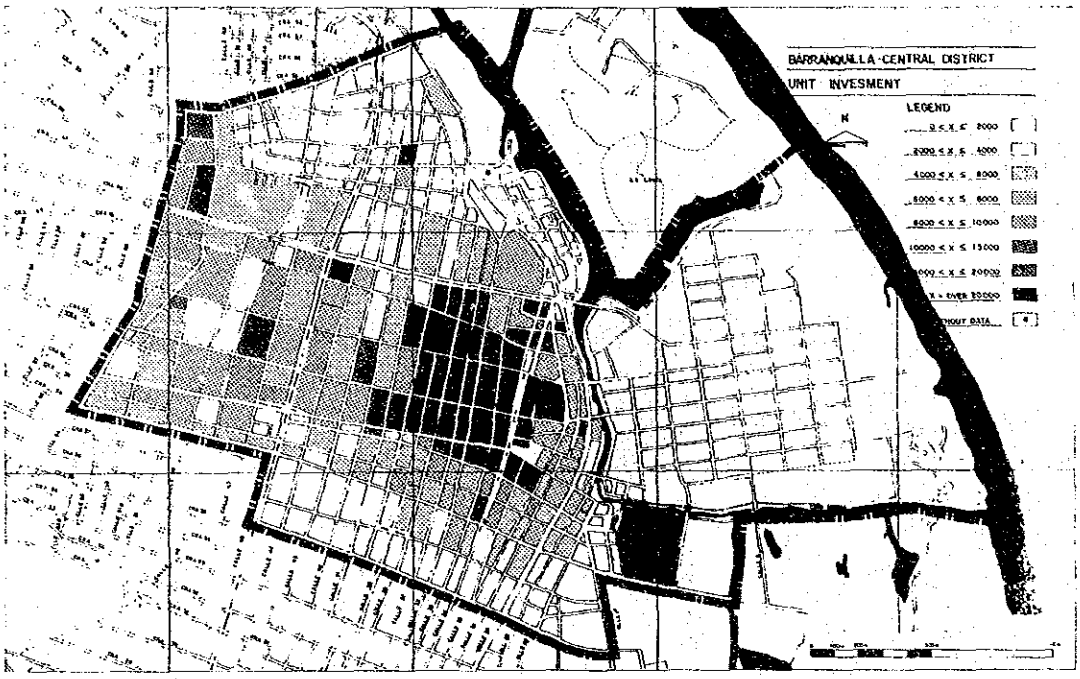


Fig. 3–2–13 Unit Investment

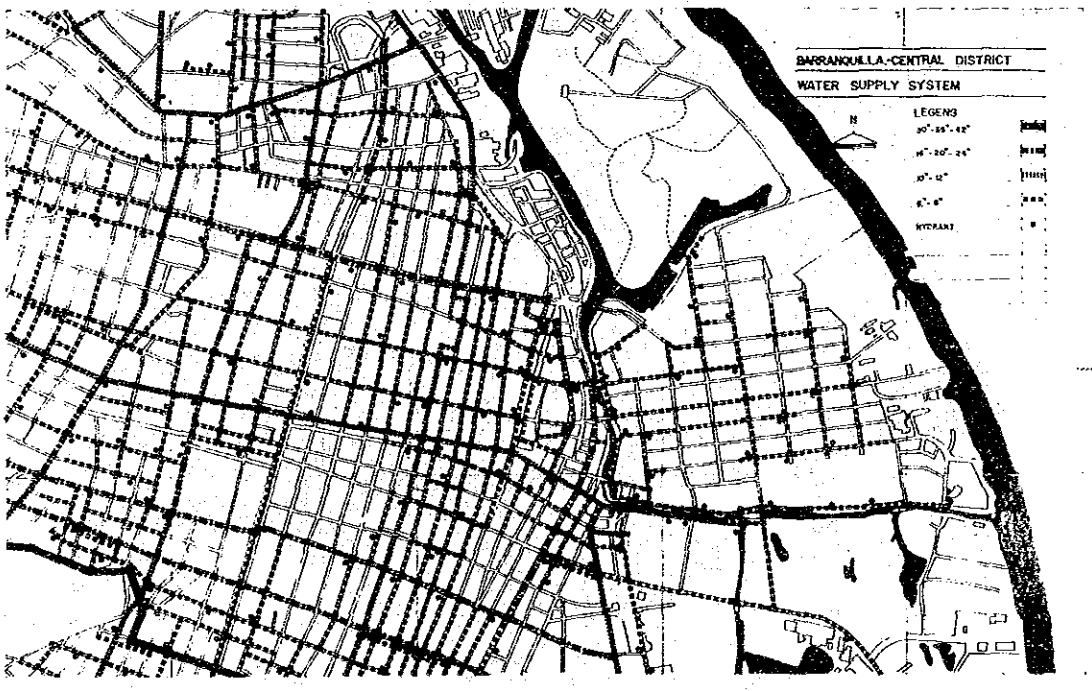


Fig. 3–2–14 Water Supply Network

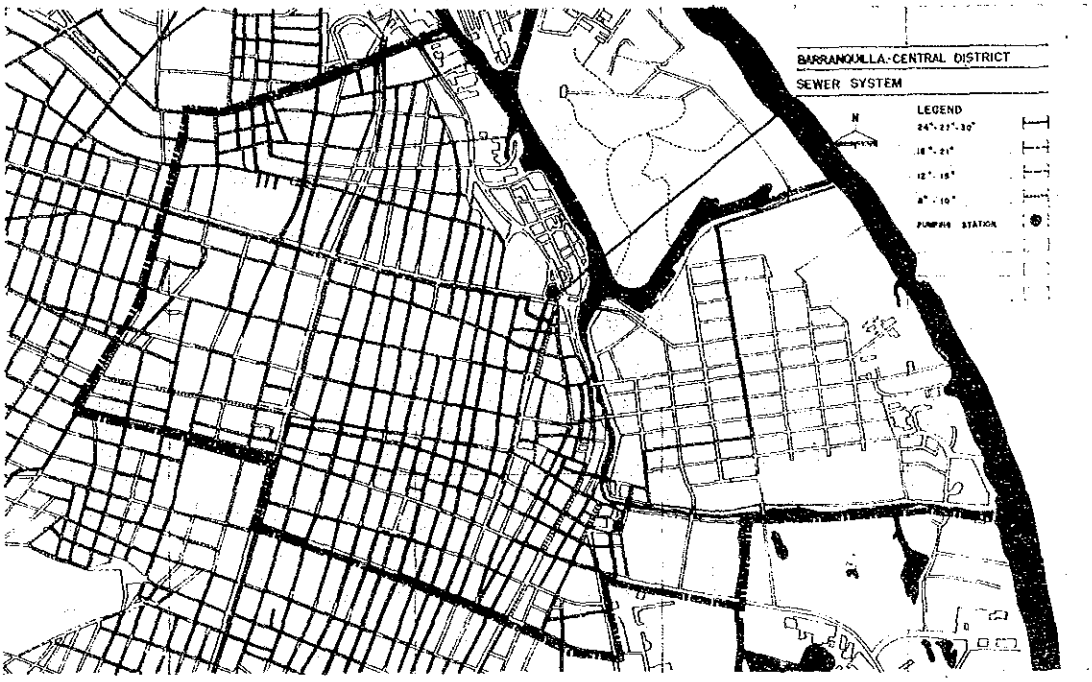


Fig. 3–2–15 Sewer Network

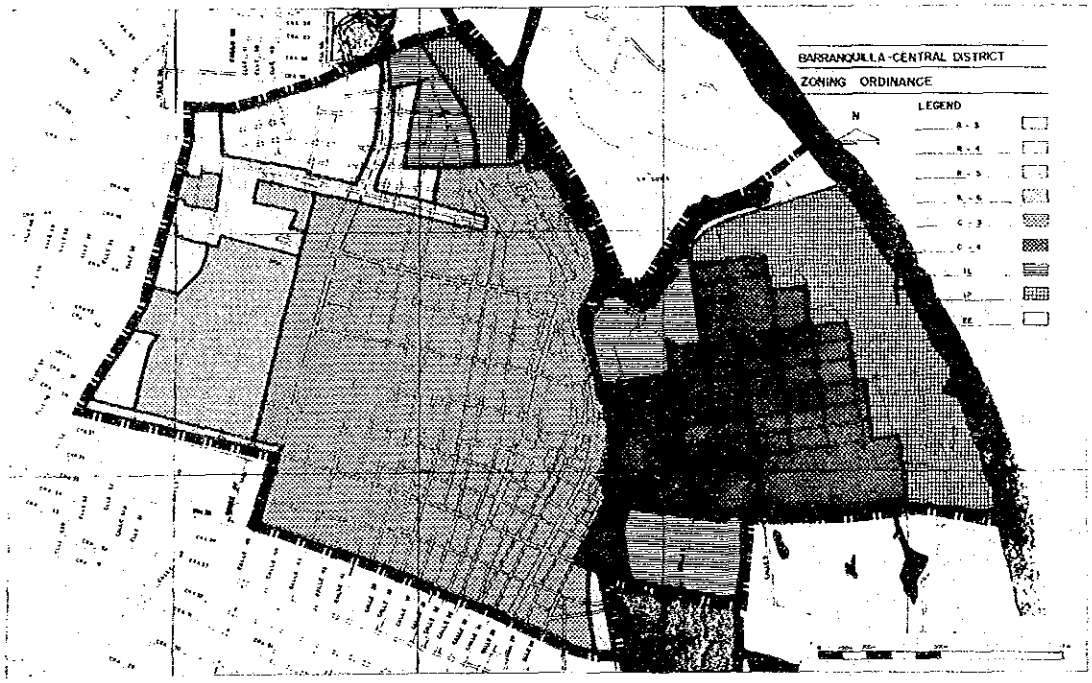


Fig. 3–2–16 Urban Zoning Ordinance

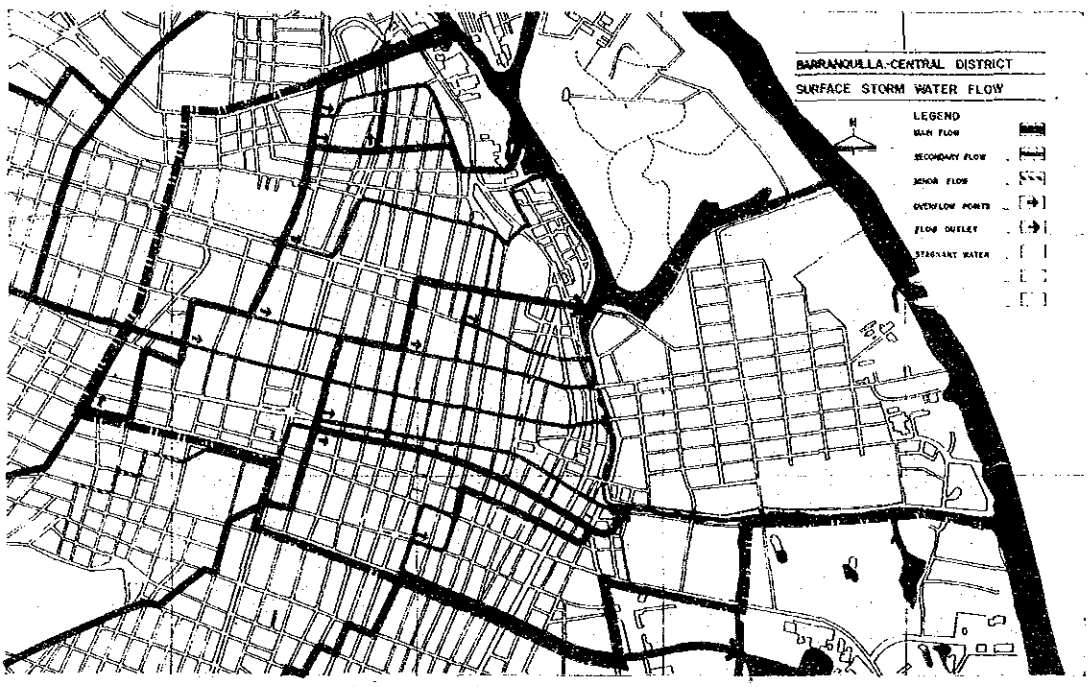


Fig. 3–2–17 Surface Storm Water Flow

Table 3–2–1 Features of Central District by Zone

	Zone	Land Area*1 (HA)	No. of Blocks*2	No. of Lots*3	No. of *4 Households	No. of*5 Households
1	A	25.14 (4.9)	40 (10.2)	258 (5.1)	122 (1.8)	68 (1.3)
	B	28.55 (5.6)	30 (7.7)	330 (6.6)	368 (5.5)	208 (3.9)
	C	51.90 (10.2)	48 (12.3)	674 (13.4)	995 (15.0)	716 (13.3)
	S.T.	105.60 (20.7)	118 (30.2)	1,262 (25.1)	1,485 (22.4)	992 (18.4)
2	A	80.98 (15.9)	58 (14.8)	272 (5.4)	222 (3.3)	122 (2.3)
	B	101.13 (19.9)	34 (8.7)	230 (4.6)	134 (2.0)	207 (3.8)
	S.T.	182.11 (35.8)	92 (23.5)	502 (10.0)	356 (5.4)	329 (6.1)
3	A	10.93 (2.2)	11 (2.8)	179 (3.6)	346 (5.2)	340 (6.3)
	B	15.13 (3.0)	16 (4.1)	290 (5.8)	319 (4.8)	215 (4.0)
	C	18.30 (3.5)	14 (3.6)	341 (6.7)	558 (8.4)	442 (8.2)
	S.T.	44.36 (8.7)	41 (10.5)	810 (16.1)	1,223 (18.4)	997 (18.5)
4	A	28.11 (5.5)	22 (5.6)	405 (8.1)	594 (8.9)	528 (9.8)
	B	36.27 (7.1)	19 (4.9)	269 (5.3)	428 (6.4)	387 (7.2)
	S.T.	64.38 (12.6)	41 (10.5)	674 (13.4)	1,022 (15.4)	915 (16.9)
5	A	29.83 (5.9)	22 (5.6)	390 (7.6)	401 (6.0)	368 (6.8)
	B	38.08 (7.5)	37 (9.5)	556 (11.1)	808 (12.2)	665 (12.3)
	C	44.83 (8.8)	40 (10.2)	835 (16.7)	1,349 (20.3)	1,136 (21.0)
	S.T.	112.74 (22.3)	99 (25.3)	1,781 (35.4)	2,558 (38.5)	2,169 (40.2)
	Total	509.19 (100.0)	391 (100.0)	5,029(100.0)	6,644(100.0)	5,402(100.0)

Source : *1 JICA Measurement on 1/2000 IGAC Map. 2* & 3* JICA. 4* DANE(1981). 5* JICA Survey(1983)

Table 3–2–2 Land Use by Zone

(in square meters)

	Zone	Residen.	Commer.	Indust.	Public	Admini.	Trans.	Recreat.	Mixed	Vacant	Others	Total
1	A	0	124,029	3,743	1,506	4,885	6,965	416	6,988	7,913	0	155,445
	B	443	151,705	12,360	432	4,095	7,851	0	6,892	9,894	0	193,672
	C	57,336	146,540	26,387	44,762	31,084	25,629	2,029	16,405	28,649	0	378,821
	S.T.	57,779	421,274	42,490	46,700	40,064	40,445	2,445	30,285	46,456	0	727,938
2	A	2,320	148,116	265,670	0	684	14,611	0	19,401	128,966	0	579,768
	B	36,852	2,666	238,699	883	900	42,829	0	0	410,541	51,661	785,031
	S.T.	39,172	150,782	504,369	883	1,584	57,440	0	19,401	539,507	51,661	1,364,799
3	A	40,083	12,150	8,656	6,284	0	3,316	0	4,552	5,956	0	80,997
	B	22,998	48,523	11,433	3,899	0	6,022	315	12,717	3,422	0	109,329
	C	67,206	20,607	20,360	4,115	0	3,325	201	13,669	10,791	0	140,274
	S.T.	130,287	81,280	40,449	14,298	0	12,663	516	30,938	20,169	0	330,600
4	A	67,342	23,998	26,671	57,996	8,992	3,041	0	17,544	5,981	0	211,565
	B	47,759	62,168	37,473	51,588	2,642	19,449	5,408	13,391	46,981	0	286,859
	S.T.	115,101	86,166	64,144	109,584	11,634	22,490	5,408	30,935	52,962	0	498,424
5	A	33,583	19,278	57,568	7,940	16,420	13,734	488	30,306	9,613	0	190,930
	B	98,999	26,571	109,888	8,305	0	3,139	0	22,273	17,043	0	286,218
	C	175,601	46,263	33,049	15,330	0	5,426	6,939	18,702	51,124	0	352,434
	S.T.	310,183	92,112	200,505	31,575	16,420	22,299	7,427	71,281	77,780	0	829,582
	Total	652,522	813,614	851,957	203,040	69,702	155,337	15,796	182,840	736,874	51,661	3,751,343

Source : IGAC

Note: Exclusive of blocks and lots for which data are not available.

Table 3–2–3 Land Use Ratio by Zone

(%)

	Zone	Residen.	Commer.	Indust.	Instit.	Admin.	Trans.	Recreat.	Mixed	Vacant	Others	Total
1	A	0.0	79.1	2.4	1.0	3.1	4.5	0.3	4.5	5.1	0.0	100.0
	B	0.2	78.3	6.4	0.2	2.1	4.1	0.0	3.6	5.1	0.0	100.0
	C	15.1	38.7	7.0	11.8	8.2	6.8	0.5	4.3	7.6	0.0	100.0
	S.T.	7.9	57.9	5.8	6.4	5.5	5.6	0.3	4.2	6.4	0.0	100.0
2	A	0.4	25.5	45.8	0.0	0.1	2.5	0.0	3.3	22.2	0.0	100.0
	B	4.7	0.3	30.4	0.1	0.1	5.5	0.0	0.0	52.3	6.6	100.0
	S.T.	2.9	11.0	37.0	0.1	0.1	4.2	0.0	1.4	39.5	3.8	100.0
3	A	49.5	15.0	10.7	7.8	0.0	4.1	0.0	5.6	7.4	0.0	100.0
	B	21.0	44.4	10.5	3.6	0.0	5.5	0.3	11.6	3.1	0.0	100.0
	C	47.9	14.7	14.5	2.9	0.0	2.4	0.1	9.7	7.7	0.0	100.0
	S.T.	39.4	24.6	12.2	4.3	0.0	3.8	0.2	9.4	6.1	0.0	100.0
4	A	31.8	11.3	12.6	27.4	4.3	1.4	0.0	8.3	2.8	0.0	100.0
	B	16.6	21.7	13.1	18.0	0.9	6.8	1.9	4.7	16.4	0.0	100.0
	S.T.	23.1	17.3	12.9	22.0	2.3	4.5	1.2	6.2	10.5	0.0	100.0
5	A	18.6	10.1	30.2	4.2	8.6	7.2	0.3	15.9	5.0	0.0	100.0
	B	34.6	9.3	38.4	2.9	0.0	1.1	0.0	1.8	6.0	0.0	100.0
	C	49.8	13.1	9.4	4.3	0.0	1.5	2.0	5.3	14.4	0.0	100.0
	S.T.	37.4	11.1	24.2	3.8	2.0	2.7	0.9	8.6	9.3	0.0	100.0
	Total	17.4	22.2	22.7	5.4	1.9	4.1	0.4	4.8	19.7	1.4	100.0

Source: IGAC

Note: Exclusive of blocks and lots for which data are not available.

Industrial land use can be identified mainly in sub-zones 2A, 5A and 5B. The share of the use in these sub-zones is between 30 and 50%. Low industrial land use (less than 10%) can be observed especially in zones 1 and 3, where the major use is commercial and residential, respectively (see Figure 3–2–4).

Residential land use is prominent in sub-zones 3A, 3C, 4A, 5B and 5C, where such use is more than 30 percent. It is also observed that in the zones where commercial and/or industrial use is intense, residential use is low (see Figure 3–2–5).

In addition to these major uses, vacant land in the district is identified to be almost 15% of the total area, and 65% of the vacant land is located in Barranquillita (Zone 2).

3) Building-Area Ratio and Floor-Area Ratio

The average building-area ratio and floor-area ratio by sub-zone are shown in Table 3–2–4. The average building-area ratio in the central district is 41.6%, however, it can be noted that in sub-zones 1A and 1B, the ratio is more than 80%. In these same sub-zones, the commercial land use is more than 75% of the sub-zone area, whereas in the other sub-zones the ratio falls between 35 and 65% except in sub-zone 2B where vacant land can be found abundant (see Figure 3–2–6).

The average floor-area ratio of the Central District is 63.6%. The sub-zones where this ratio is more than 100% can be found concentrated only within zone 1. The comparison of this ratio with building-area ratio reveals that the sub-zones where the average building height is more than 2 floors are only sub-zones 1B and 1C. In zones 2, 3, 4 and 5, the ratio is between 40 and 86% except the sub-zone 28 where the building-area ratio itself is remarkably low (see Figure 3–2–7).

4) Land and Building Vacancy

Vacant land can be found mainly in sub-zone 2B. Although in sub-zones 2A, 4B and 5C the vacancy ratio is relatively high, the ratio in the other sub-zones is less than 5% (see Figure 3–2–8). The vacancy ratio of buildings was studied in the very central sub-zones; 1A and 1B. The result is shown in Table 3–2–7.

As for the 1st floor vacancy little difference can be identified between 1A and 1B. The

net vacancy ratio which is defined as the ratio of vacant 1st floor area to the total 1st floor area containing vacant space is around 25%. The gross vacancy ratio signifying the ratio of vacant 1st floor area to the total 1st floor area in the sub-zone is about 7%.

On the other hand, the total floor vacancy shows a slight difference in thse two sub-zones. In sub-zone 1A the net vacancy ratio is almost 50%, whereas in sub-zone 1B it is 29%. The gross vacancy ratio is 6% in 1A, and 11% in 1B. This reveals that the building vacancy as a whole is relatively concentrated to same buildings in 1A, while in 1B vacant space is rather scattered in the sub-zone. In any way, the table shows a relatively high ratio of building vacancy.

3–2–3 Land Tenure and Land Value

1) General

The cadastral information on land and building by IGAC made it possible to work out the land tenure and assessed value of land which is the basis of taxation.
The land tenure has been also checked by the information obtained through governmental offices, and, as a result, the location of public land has been identified and plotted in the study area.

As for the land value of each lot, IGAC revalues the land annually by adding 10% to the previous year value. Thus, it seems that the relative value will not fluctuate yearly. The actual assessment of land value should be conducted through examples of real commercial transactions. Taking into account the difficulties to obtain these data, however, the comparison between the assessed value and the commercial price would be done on the basis of real estate advertisement.

From the viewpoint of urban renewal, it is essential to see whether a piece of land is effectively used by buildings by checking their values. On the assumption that the total construction value in a lot is proportional to the land value of the lot, the following investment intensity index (I.I.I.) was worked out newly based on IGAC data:

$$\text{I.I.I.} = \frac{\text{UNIT INVESTMENT VALUE for each lot}}{\text{UNIT LAND VALUE for each lot}}$$

$$+ \frac{\text{average UNIT INVESTMENT VALUE for the study area}}{\text{average UNIT LAND VALUE for the study area}}$$

Table 3–2–4 Land & Building Features by Zone

	Zone	Land Area (sq.m.)	Build. Area (sq.m.)	Floor Area (sq.m.)	Build. Area Ratio (%)	Floor Area Ratio (%)	Unit Land Value (P/sq.m.)	Unit Const. Value (P/sq.m.)	Unit Real Est. Value (P/sq.m.)	Invest. Intens. Index
1	A	155,445	127,213	227,831	84.0	150.5	3,630	3,510	9,040	0.85
	B	193,672	155,684	359,442	80.7	186.4	5,570	5,830	16,440	1.16
	C	378,821	212,339	425,773	57.0	114.2	2,830	5,950	9,710	1.41
	S.T.	727,938	495,236	1,013,046	68.0	139.2	3,730	5,360	11,360	–
2	A	579,768	238,084	274,655	41.1	47.5	920	4,470	3,030	1.38
	B	785,031	61,214	67,353	7.8	8.6	410	2,960	660	0.37
	S.T.	1,364,799	299,298	342,008	21.9	25.1	630	4,170	2,280	–
3	A	80,997	29,536	32,889	40.2	44.8	380	680	720	0.43
	B	109,329	69,406	94,939	64.6	88.3	910	2,130	2,810	1.22
	C	140,274	71,493	87,850	51.7	63.5	640	2,200	2,050	1.29
	S.T.	330,600	170,434	215,678	51.6	65.2	670	1,940	1,980	–
4	A	211,565	92,968	138,099	43.9	65.3	2,120	5,550	5,740	1.02
	B	286,859	100,707	157,059	35.4	55.2	2,870	7,000	6,750	0.80
	S.T.	498,424	193,675	295,158	38.9	59.2	2,550	6,320	6,320	–
5	A	190,930	71,380	81,148	37.5	42.6	1,110	2,390	2,150	0.55
	B	286,218	151,484	179,748	54.2	64.3	1,540	2,810	3,390	0.69
	C	352,434	180,514	182,190	37.7	52.6	1,930	4,500	4,360	0.72
	S.T.	829,582	353,378	443,086	40.7	51.3	1,610	3,430	3,520	–
	Total	3,252,919	1,512,021	2,308,976	46.5	71.0	1,970	4,620	5,570	1.00

Source: IGAC

Note : Exclusive of blocks and lots for which data are not available.

Table 3–2–5 Building Use by Zone

(in square meters)

	Zone	Residen.	Commer.	Indust.	Public	Admini.	Trans.	Recreat.	Mixed	Vacant	Others	Total
1	A	0	107,146	2,661	1,506	3,706	836	0	6,021	5,337	0	127,213
	B	278	129,286	6,879	366	3,586	1,818	0	5,531	7,941	0	155,684
	C	29,715	100,424	14,097	26,668	13,949	7,518	0	9,551	10,417	0	212,339
	S.T.	29,993	336,856	23,637	28,540	21,240	10,172	0	21,103	23,695	0	495,236
2	A	330	99,299	116,220	0	521	232	0	10,560	8,827	0	238,084
	B	6,447	537	49,412	207	431	2,969	0	0	136	1,075	61,214
	S.T.	6,777	99,836	165,632	207	952	5,296	0	10,560	8,963	1,075	299,298
3	A	14,663	5,319	3,044	3,843	0	456	0	1,755	455	0	29,535
	B	14,112	35,430	6,433	3,071	0	1,160	175	7,477	1,548	0	69,406
	C	31,178	12,837	13,109	2,098	0	868	104	8,319	2,980	0	71,493
	S.T.	59,953	53,586	22,586	9,012	0	2,484	279	17,551	4,983	0	170,434
4	A	33,491	14,523	8,383	22,472	4,429	261	0	6,694	2,715	0	92,968
	B	16,340	29,602	15,288	18,867	736	3,847	0	5,847	10,180	0	100,707
	S.T.	49,831	44,125	23,671	41,339	5,165	4,108	0	12,541	12,895	0	193,675
5	A	14,800	14,135	26,076	2,305	4,228	1,602	0	8,111	123	0	71,380
	B	46,096	14,349	68,051	3,972	0	521	0	11,453	7,042	0	151,484
	C	71,607	19,209	17,242	5,944	0	1,561	684	9,525	4,742	0	130,514
	S.T.	132,503	47,693	111,369	12,221	4,228	3,684	684	29,089	11,907	27,026	353,378
	Total	279,057	582,096	346,895	91,319	31,585	25,744	963	90,844	62,443	1,075	1,512,021

Source: IGAC

Note: Exclusive of blocks and lots for which data are not available.

Table 3–2–6 Building Use Ratio by Zone

(%)

	Zone	Residen.	Commer.	Indust.	Public	Admini.	Trans.	Recreat.	Mixed	Vacant	Others	Total
1	A	0	84.2	2.1	1.2	2.9	0.7	0	4.7	4.2	0	100.0
	B	0.2	83.0	4.4	0.2	2.3	1.2	0	3.6	5.1	0	100.0
	C	14.0	47.3	6.6	12.6	6.6	3.5	0	4.5	4.9	0	100.0
	S.T.	6.0	68.0	4.8	5.8	4.3	2.0	0	4.3	4.8	0	100.0
2	A	0.1	41.7	48.8	0	0.2	1.0	0	4.4	3.7	0	100.0
	B	10.5	0.9	80.7	0.3	0.7	4.9	0	0	0.2	1.8	100.0
	S.T.	2.3	33.3	55.3	0.1	0.3	1.8	0	3.5	3.0	0.4	100.0
3	A	49.6	18.0	10.3	13.0	0	1.5	0	5.9	1.5	0	100.0
	B	20.3	51.0	9.3	4.4	0	1.7	0.3	10.8	2.2	0	100.0
	C	43.6	18.0	18.3	2.9	0	1.2	0.1	11.6	4.2	0	100.0
	S.T.	35.2	31.4	13.2	5.3	0	1.4	0.2	10.3	3.0	0	100.0
4	A	36.0	15.6	9.0	24.2	4.8	0.3	0	7.2	2.9	0	100.0
	B	16.2	29.4	15.2	18.7	0.7	3.8	0	5.8	10.1	0	100.0
	S.T.	25.7	22.8	12.2	21.3	2.7	2.1	0	6.5	6.7	0	100.0
5	A	20.7	19.8	36.5	3.2	5.9	2.2	0	11.4	0.2	0	100.0
	B	30.4	9.5	44.9	2.6	0	0.3	0	7.6	4.6	0	100.0
	C	54.9	14.7	13.2	4.6	0	1.2	0.5	7.3	3.6	0	100.0
	S.T.	37.5	13.5	31.5	3.5	1.2	1.0	0.2	8.2	3.4	0	100.0
	Total	18.5	38.5	22.9	6.0	2.1	1.7	0.1	6.0	4.1	0.1	100.0

Source : IGAC

Note: Exclusive of blocks and lots for which data are not available.

Table 3–2–7 Building Vacancy

Zone	Vacant 1F Area (1)	1F Area with Vacancy (2)	Total 1F (3)	Total Vacant Floor Area (4)	Total Floor Area with Vacancy (5)	Total Floor Area (6)
1 A	8,987	34,195	127,723	14,343	29,245	228,542
B	10,716	43,156	156,017	39,646	138,821	360,121
Total	19,703	77,351	283,740	53,989	168,066	588,663
	(1)/(2)	(1)/(3)		(4)/(5)	(4)/(6)	
1 A	26.3	7.0		49.0	6.3	
B	24.8	6.9		28.6	11.0	
Total	25.5	6.9		38.9	9.2	

Table 3–2–8 Public Land Tenure

(in sq. meters)

Zone		Municipal	Departmental	National	Total
1	A	7,007 (4)	0	1,756 (2)	8,763 (6)
	B	669 (1)	2,993 (1)	0	3,662 (2)
	C	26,949 (8)	3,463 (3)	0	30,412 (11)
2	A	21,819 (5)	22,875 (2)	15,408 (3)	60,102 (10)
	B	35,742 (7)	900 (1)	0	36,642 (8)
3	A	1,089 (1)	0	0	1,089 (1)
	B	0	0	0	0 (0)
	C	0	0	0	0 (0)
4	A	0	24,833 (1)	7,824 (1)	32,707 (2)
	B	0		10,454 (1)	10,454 (1)
5	A	3,009 (1)	0	56,250 (1)	59,259 (2)
	B	6,446 (4)	0	13,800 (1)	20,246 (5)
	C	1,658 (2)	0	0	1,658 (2)
Total		104,388 (23)	55,114 (8)	105,492 (9)	264,994 (40)

Source: IGAC

Note: – Subject to change according to further check and confirmation.
– Figures in parenthesis show the number of lots.

where UNIT INVESTMENT VALUE is (total floor area) X (unit construction value)/ (land area).

Thus, if I.I.I. is greater than 1.00, it signifies that the investment in the construction of the building is relatively larger for the land value than the average for the study area (see Figure 3–2–10).

2) Land Tenure

Public land tenure in the Central District was identified through IGAC cadastral information and compiled in Table 3–2–8 and Figure 3–2–9. Though the location and quantity of public land is still subject to alteration with further confirmation through governmental offices the present information shows that about 40% of public land is municipal, another about 40% national, and the rest departmental. From the standpoint of urban renewal, public land in the very heart of the District and in Barranquillita area might be akey factor in the involvement of the public sector into renewal. Careful attention will be paid to it in the process of the study to ensure its future use (see Figure 3–2–9).

3) Land Value

Land value by sub-zone is tabulated in Table 3–2–9 and its distribution in the District is illustrated in Figure 3–2–11. The average value of the District is 1,770 pesos/sq.m. with the highest value of 5,450 pesos/sq.m. in 1B and the lowest 340 pesos/sq.m. in 3A (see Figure 3–2–10).

The characteristics of the distribution of land value can be summarized as follows:

(1) The difference between the highest and the lowest value by average of sub-zone is, just as quoted above, a little more than 16 times.

(2) From the highest sub-zone 1B, the value shows a gradual decrease to the west, but a rather abrupt or discontinuous decrease is observed in the other directions; notably toward the south.

4) Construction Value & Investment

Unit construction value per sq.m. by sub-zone is tabulated in Table 3–2–4. The average value in the District is 4,590 pesos/sq.m., and compared with this figure, construction value is much lower than the average in sub-zones 1A, 2B, 3A, 3B, 3C, 5A and 5B. Since this value might have some relation with the quality of buildings in terms of their materials and age, it

signifies by itself the necessity of some renewal.

Unit real estate value in the same table is the sum of unit land value and the total construction value per sq.m. In sub-zone 2B, low unit land value and scarce construction volume (floor area) in comparison with its vast land area resulted in low unit real estate value. On the other hand, in sub-zone 3A, low unit construction value together with low unit land value might be the main reason of low unit real estate value (see Figure 3–2–12, Figure 3–2–13).

The investment intensity index in those sub-zones 2A and 3A is remarkably low. However, the I.I.I. is also quite low in sub-zone 5A. This might be caused bythe relative scaresity of floor area for its unit land value.

3–2–4 Economic Activities

Economic activities in the central area can be characterized by the concentration of commercial and financial establishments. The average ratio of concentration of all kinds of establishments in the central district can be estimated around 40%. However, the concentration ratio of stores, hotels, restaurants, and financial establishments approaches 50%, and most of these are located in Zone 1 (see Table 3–2–9).

In spite of this high concentration, the recent tendency for location of commercial and financial establishments is to the west of the central district or up the hill to Calle 72 area. This tendency can be identified by the fact that the Barranquilla branch of the national bank (El Banco de la Republica) has already decided to move from the very center of the central district (Paseo Bolivar) to Calle 45.

Another outstanding feature of commercial activities in the central district is the existence of an enormous number of street vendors. This is not only a space problem in the central district but a profound problem rooted deeply in the issue of employment of the informal sector of the city. In connection with the proposed removal of warehouses from the Barranquillita area to Gran Abastos in the south part of the city, a careful study should be conducted about the present situation of street vendors.

3–2–5 Infrastructures

The potable water supply system in the central district is complete in terms of the piping

Table 3–2–9 Number of Establishments by Zone and Industry

	Zone	Agricul.	Mining	Manufac.	Elect. Gas	Construc.	Commerce	Transport	Finance Insurance	Services	Total	Composi. Ratio
1	A	1	–	50	–	3	729	24	49	59	915	14.6 %
	B	–	–	69	1	10	935	48	312	225	1,600	25.6
	C	–	–	97	7	8	603	16	335	661	1,727	27.6
	S.T.	1	–	216	8	21	2,267	88	695	945	4,242	62.8
2	A	–	–	90	3	1	412	51	1	14	526	8.4
	B	–	–	14	1	1	13	11	1	3	44	0.7
	S.T.	–	–	104	4	2	425	62	2	17	570	9.1
3	A	–	1	7	–	–	22	–	–	4	34	0.5
	B	–	–	30	–	3	147	21	–	25	226	3.6
	C	–	–	22	–	1	85	15	4	36	163	2.6
	S.T.	–	1	59	–	4	254	36	4	65	423	6.7
4	A	–	–	22	–	–	86	4	4	61	177	2.8
	B	–	–	22	–	3	132	10	9	57	233	3.7
	S.T.	–	–	44	–	3	218	14	13	118	410	6.5
5	A	–	–	27	1	2	132	6	6	12	186	3.0
	B	–	–	71	3	2	121	7	12	39	255	4.1
	C	–	–	23	1	1	85	5	16	39	170	2.7
	S.T.	–	–	121	5	5	338	18	34	90	611	9.8
	Total	1	1	544	17	36	3,502	172	749	1,236	6,256	39.0
City Total		80	18	3,104	37	236	6,733	372	1,543	3,918	16,041	100.0

Source: Telephone Directory (Yellow Pages)

Note: Commerce includes Hotel and Restaurant.

Table 3–2–10 Urban Zoning Ordinance

Zone	Minimum Lot Area M2		Minimum Frontage Measurement LM		Minimum Setback L.M.			Ratio %		Permitted Land use	Height	
	Detached Dwelling	High Size Building	Detached Dwelling	High Size Building	Front Yard	Side Yard	Rear Yard	Occupation	Floor Area		Maximum	Minimum
R-2	450.00	600.00	15.00	20.00	According to Road Characteristics	1.50	3.00 Is Not Permitted to Attach	70	200	Residential	Four Story	
R-2B	470.00	600.00	18.00	25.00	Idem	3.00	3.00 Is Not Permitted to Attach	70	200	Residential	Four Story	
R-3	250.00	350.00	8.00	15.00	Idem	1.00 or to Attach	3.00 or to Attach	70	200	Residential	Four Story	
R-4	200.00	250.00	8.00	12.00	Idem	1.00 or to Attach	3.00 or to Attach	80	250	Residential	Four Story	
R-5	150.00	800.00	7.00	14.00	Idem	3.00 or to Attach	3.00 Is Not Permitted to Attach	P.P. 100 D.P. 80	200	Commerce Residential	Unlimited	
R-6		250.00		10.00	Idem	3.00 or to Attach	3.00 Is Not Permitted to Attach	P.P. 100 D.P. 80		Commerce Residential	Unlimited	
C-3		250.00	7.00		Idem	3.00 or to Attach	3.00 or to Attach	P.P. 100 D.P. 80		Central Commerce	Unlimited	
C-4		250.00	7.00		Idem	3.00 or to Attach	3.00 or to Attach	P.P. 100		Commerce	Unlimited	
I-L						4.00 Is Not Permitted to Attach	4.00 Is Not Permitted to Attach	65	150	Light Industry		
I-P						5.00	5.00 Is Not Permitted to Attach	60	200	Heavy Industry		
E-E												

P.P = First Floor D.P = Other Floor

networks, and the area enjoys water supply. On a 24 hour basis, however, the quality of water is innected improvement together with the aging piping system which frequently suffers a high ratio of water leakage (see Figure 3–2–14).

The sanitary sewer system is complete in the central district. Recently the discharge of sewage was changed from the canal directly to the Magdalena River. The sewage, however, never goes through any treatment and the system apparently is old and deteriorating (see Figure 3–2–15).

The problem of storm water in the central district is recognized. The flow of storm water down to the lower central district, and the streets where the storm water flows to, have transport problems as well as sanitation problems such as garbage dumpting in the stream. The low ground level of the east half of the central district, causes a chronical flooding in some areas (see Figure 3–2–17).

The Canal Auyama which was once an important route for river transport to the market, is now environmentally deteriorated. With the construction of bridges, the river transport has become almost impossible. The dredging of the canal is now under study by the Municipality, and careful attention should be paid to the effective inclusion of the canal into the renewal program of the central district.

3–3 Existing Problems

3–3–1 Problems Concerning Urban Structure

As mentioned in the preceeding sections, the Study Area and Barranquilla-Soledad area have various structural problems. These problems have gradually developed along with the historical growth of this metropolis as it grew to become a one-million city. And it can easily be foreseen that then problem will become more serious as the rapid urbanization will double its size at the end of this century.

The following are the key problems with corresponding elements for consideration, especially related to the urban transport planning.

1) Employment is concentrated in the central part of Barranquilla. Many workers commute every day mainly from the south and southwest parts of the city and, recently, from as far away as the sattelite municipalities into "Centro" by bus. This is the basic cause of traffic con-

gestion which affects long distance commuters as they are forced to waste time and energy.

2) Historical residential urbanization by private developers and, recently, by squatters have formed a labyrinthian road network, except for some radial trunk roads. Present trend of urban growth will extend the built up areas to the outside of the Circunvalar. In order to cope with the new traffic demand of crossing the city from south to north and vice versa, generated by the growth of North Commercial Center along Calle 72, it is necessary to improve the roads in this direction. It is, however, difficult to implement this work because of the irregular shapes of the narrow roads. In the figure the same problems will occur outside of the Circunvalar. To cope with this situation, advance preparations of master plan and regulations of urban development in conformity with the plan should be undertaken. And as for built-up areas, some compulsory measures associated with a land adjustment system may need to be undertaken.

3) The basin of Magdalena River and the heavy storm water flows along arroyos and streets generate flooded areas in down town of Barranquilla City during the rainy season. It is feared that in future the same phenomenon will occur in the basin of Arroyo Grande. Only from the standpoint of transport planning, some measures would have to be taken to secure smooth traffic flow and safety.

4) The characteristics of urban land use in Barranquilla City are such that the production and sitribution activities of the manufacturing industries and wholesale markets are located near the central part along the Magdalena River. This causes not only daily person trips of work but also cargo flows by truck through the down town area and, of course, generates a variety of environmental problems. It should note that the relationships among some of these activities should be studied during the preparation of the plan of urban development and road network.

3–3–2 Identification of Existing Problems in the Central District

Problems in the central district seem to be rather intricate. In most cases, they are mutually related with each other and are somehow connected with the problems of the city structure. Thus the identification and analysis of problems should clarify these aspects in order to facilitate the generation of the basic idea of the urban renewal in the central district.

1) Concentration and Mixture of Activities

One of the features of the central district is the high concentration of activities. In spite

of the rapid expansion of the city, this has not changed much and is the main cause of the centripetal pattern of trips and the concentration of traffic.

The central district is also characterized by the fact that a variety of activities take place in the area. The most noteworthy feature is the adjacent configuration of the market and bus terminals to the business district in the very central district. This might be the principal reason of the congestion and confusion of traffic flow in the area.

Thus the concentration and mixture of activities bring about an acute problem of traffic congestion. It should be noted, however, that this aspect of congestion is one of the key factors which activate the central district. For example, the problem of street vendors has been pointed out many times as an obstacle to the traffic and to stopping. But since their activities makeshift spatial resolution for this issue.

Another example of the problems of mixed activities might be the squatters in Zone 5A. They are on public land and there is a tendency towards permanent settlement. Since any kind of public land is precious for the future renewal, this problem should be given some consideration in the frame of public housing policy.

2) Extension and Dispersion of Activities

Contrary to the concentration of activities, extension or more exactly dispersion of activities in the central district can be observed. It is to be noted that the establishment of commercial area up on the hill to the west has been under way and will continue in the future. The direction of the extension of apparently to the west, and the financial activties, which area the principal activities of the central district, show a trend to move some one km to the west.

Residential activities have already seen a considerable downtown in the central district. This tendency will be intensified in accordance with the dispersion of commercial activities to the west.

The disperson tendency of activities is the cause of rather high vacancy of buildings in the central district, and is one of the key factors which may exert an influence on the future urban structure.

3) Environmental Problems

The canal Auyama which runs through the central part of the district has been almost fully polluted. The dredging proposal by the Municipality might be an indispensable step for the betterment of the area surrounding the canal. Since the degradation seems to have been caused by the adjoining land use together with the sanitary sewage system, the dredging program should be coordinated closely with these factors.

The storm water is another environmental problem in the area. In the planning process of the renewal, careful consideration should be given to minimize the influx of storm water in the project area and to take some measures in order to avoid the chronical flooding of some areas.

Chapter 4.

EXISTING CONDITION OF ROADS AND STREETS

Chapter 4 EXISTING CONDITION OF ROADS AND STREETS

4–1 Existing Road Network

4–1–1 Network Outline

The major streets and roads in Barranquilla are concentrated in the center of the city i.e., "Centro". Outside the urban area, a relatively high standard road, named Circunvalar, encircles the city. Between them, the collector and local streets join together in a complex fashion along the major routes. It is difficult to judge the character of the streets in Barranquilla from the geometrical elements and results of the inventory study alone. However, in the determination of street classification, a macro-consideration has been given to the existing traffic movement in the city. The above-mentioned roads and streets can be divided into the following four categories (see Figure 4–1–1 and 4–1–2).

1) Road and Street Classification

For the purpose of planning the roads and streets in the transport study, classifying roads and streets in accordance with their function is essential as a first step of planning. Although roads and streets may also be classified by design type, classification by function is considered more effective for planning purposes.

a. Arterial Road

In the urban area of Barranquilla there exists a system of roads and streets which can be identified as particularly significant to the area in which it lies in terms of the nature and composition of travel served. The important of these facilities is also derived from its service to traffic originating in rural areas, but equally, or even more importantly, from its service to major movements within this urbanized area. In general, the arterial system should serve major centers of activity in the metropolitan area, corridors with the highest traffic volumes, and trips of long distances. This system should also serve a high proportion of the total urban area in order to minimize the running distance. Thus, it should be integrated both internally and with major rural connections. The arterial system should carry the major portion of trips entering and leaving the urban area, as well as the majority of through movement by-passing the central city. In addition, the arterial system carries significant intra-area travel, such as between central business districts and outlying residential areas and between major inner city communities. Table 4–1–1 shows those routes which are classified as arterial in this study for Metropolitan Barranquilla.

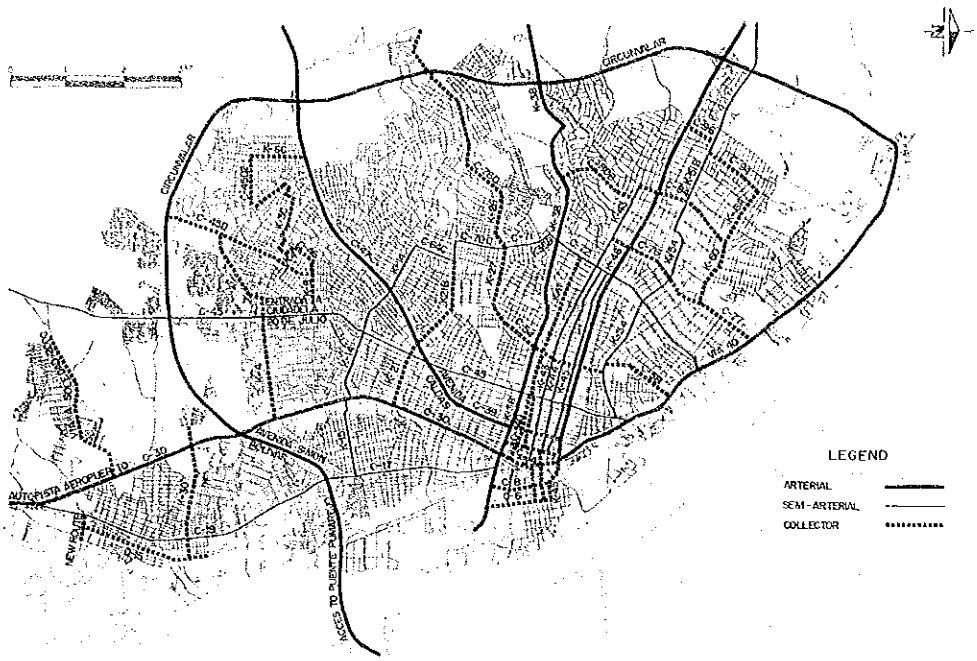


Fig. 4–1–1 The Existing Road Network in Barranquilla

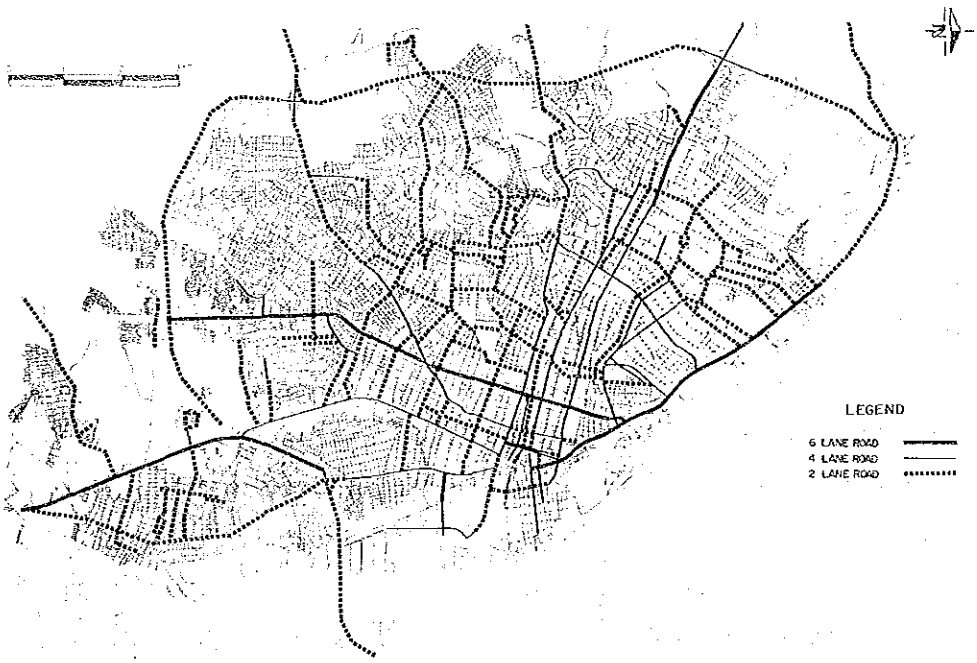


Fig. 4–1–2 The Existing Lanes of the Major Roads

Table 4–1–1 The Road and Street Classification in Barranquilla Metropolitan Region

Arterial

Road Name	From	To	Distance (km)
Calle 30	Circunvalar	Cra. 46	6.05 km
Calle 47	Circunvalar	Cra. 27	6.00
Carrera 38	Circunvalar	Calle 17	7.40
Carrera 46	Circunvalar	Via 40	7.72
Carrera 19	Calle 30	Puente Pumarejo	1.90
Circunvalar	Calle 30	Via 40	18.85
Via 40	Carrera 45	Las Flores	8.70
Total			55.62 km

Semi Arterial Street

Road Name	From	To	Distance (km)
Calle 17	Cra. 38	Ingral (Soledad)	4.65 km
Calle 18	Ingral	Via Aeropuerto	3.75
Calle 45	Via 40	Circunvalar	8.45
Carrera 43	Calle 30	Circunvalar	5.20
Carrera 54, 51B	Via 40	Circunvalar	7.20
Calle 72	Via 40	Calle 17	10.10
Total			39.35 km

b. Semi-Arterial Street

The semi-arterial street system should interconnect with, and complement, the urban principal arterial system and provide service to trips of moderate length with a somewhat lower level of travel mobility than that on the principal arterials. This system also distributes travel to geographic areas smaller than those identified with the high system. The semi-arterial street system includes all arterials not classified as principals and contains facilities with more emphasis on land access than the higher system. The semi-arterial street system also offers a low level of traffic mobility. Such facilities may be used as local bus routes and provide intracommunity continuity, but, ideally, should not penetrate local neighborhoods. The semi-arterial streets should include urban connections with rural collector roads, where such connections have not been classified, due to internal reasons, as urban principal arterials. Table 4–1–1 shows these routes in Metropolitan Barranquilla which are classified as semi-arterial in this study.

c. Collector Street

The collector street differs from the arterial road in that facilities on the collector street may penetrate local neighborhoods, distributing trips from the arterials through the area to the ultimate destination which may be on a local or collector street. Conversely, the collector street also collects traffic from the local street in the neighborhood and channels it into the arterial road system. But in some cases, due to the actual network of the overall street system, a minor amount of through-traffic may be carried on some collector streets, such as Carrera 41 and Carrea 44.

d. Local Street

This type of street comprises all facilities which are not found on the above-mentioned higher street systems. It serves primarily to provide direct access to abutting land and access to the higher order systems. It offers the lowest level of mobility and usually contains no bus routes. Service to through-traffic movement is deliveratcly discouraged.

4–2 Physical Street Conditions

Almost all the streets inside Barranguilla are narrow and the condition of maintenance is generally poor. Traffic lanes of major streets oftentimes have widths of only three meters. They have no consistent cross-sections, such as the widths of medians and sidewalks. Many streets require improvements in horizontal and vertical alighments and superelevation.

4–2–1 Pavement Condition

The results of road and street surveys show that approximately three-quarters of the roads and streets are paved with cement concrete and only a few such as the circumvelar are paved with asphlat concrete. The condition of maintenance is generally poor. In the southwestern middle-and low-class residential zone, the local streets are not even paved with asphalt. Some of these streets were constructed many years ago, and their pavement has completely deteriorated due to erosion by arroyo water flow.

The pavement condition influences vehicle running efficiency and also determines vehicle speed and road capacity. From an engineering standpoint, most of the streets in Barranquilla are not in a satisfactory condition. The old concrete pavement has a thickness of only 13 cm in Centro. Except for the street of Boyacia (Calle 30), most of the streets in the city have poor drainage systems and no protection from underground water. The relationship between road and drainage is well known. Many cracks and collapses in the pavement are to be found, and these sometimes even reach the basement because of heavy traffic load and impact. Many points of the pavement on the via 40 has been damaged at many locations by heavy truck transport to and from factories such as Cementos del Caribe and Monomeros Colombo Venezolano, and the garbage pit (see Figure 4–2–1 and 4–2–2).

4–2–2 Institutional Conditions

For the purpose of understanding the existing road administration and city engineering of Barranquilla, the following information concerning public works is compiled regarding regulatory, organizational, financial and engineering institutions.

(1) Agencies

At present, a traffic planning and/or construction division and public works division do not exist in the municipality. Traffic matters related to roads are managed by the Instituto Departmental de Transportes y Tránsito, one of the agencies in charge of traffic planning, management, control and education in the department of Atlántico. The Institute has only a small budget for planning and construction of traffic improvement facilities. Public works in the city are managed by Empresas Públicas Municipales de Barranquilla (EPM), which is an independent municipal organization.

(2) Road Design Standards

Road design standards are useful in planning and improving road systems. The Colombian national design standards, Criterio Geométrico para Diseñõ de Carreteras, are applicable to rural roads but not to urban roads. Thus, design standards for urban street planning

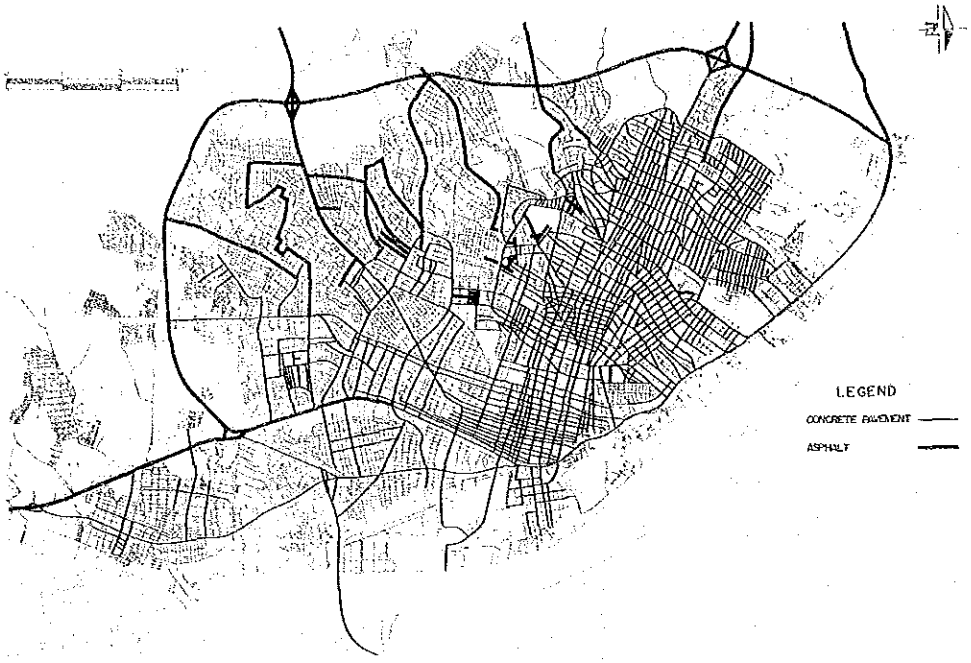


Fig. 4–2–1 Existing Pavement Condition in B/Q

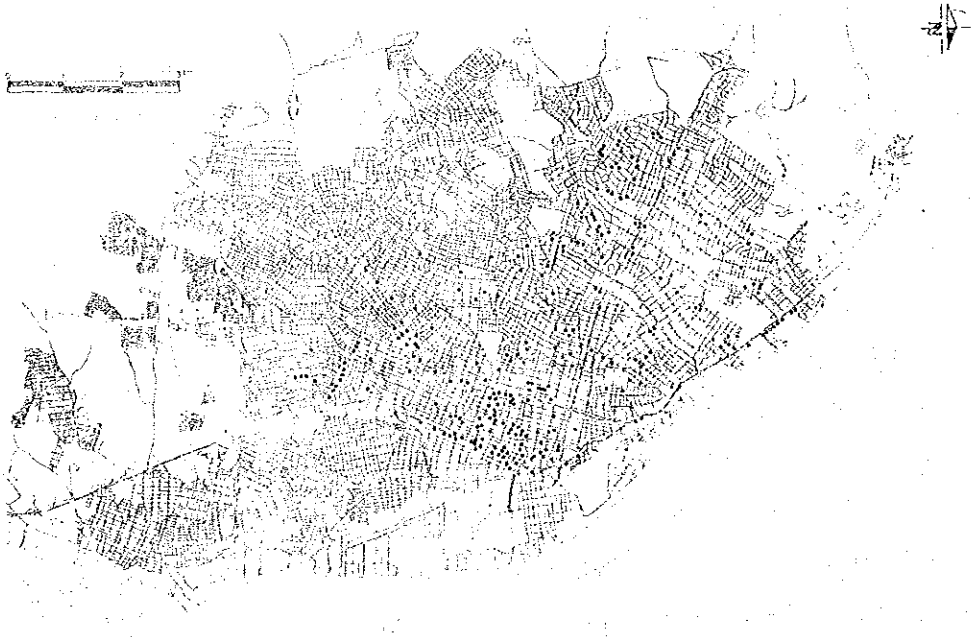


Fig. 4–2–2 Collapsed Pavement in the Streets in B/Q

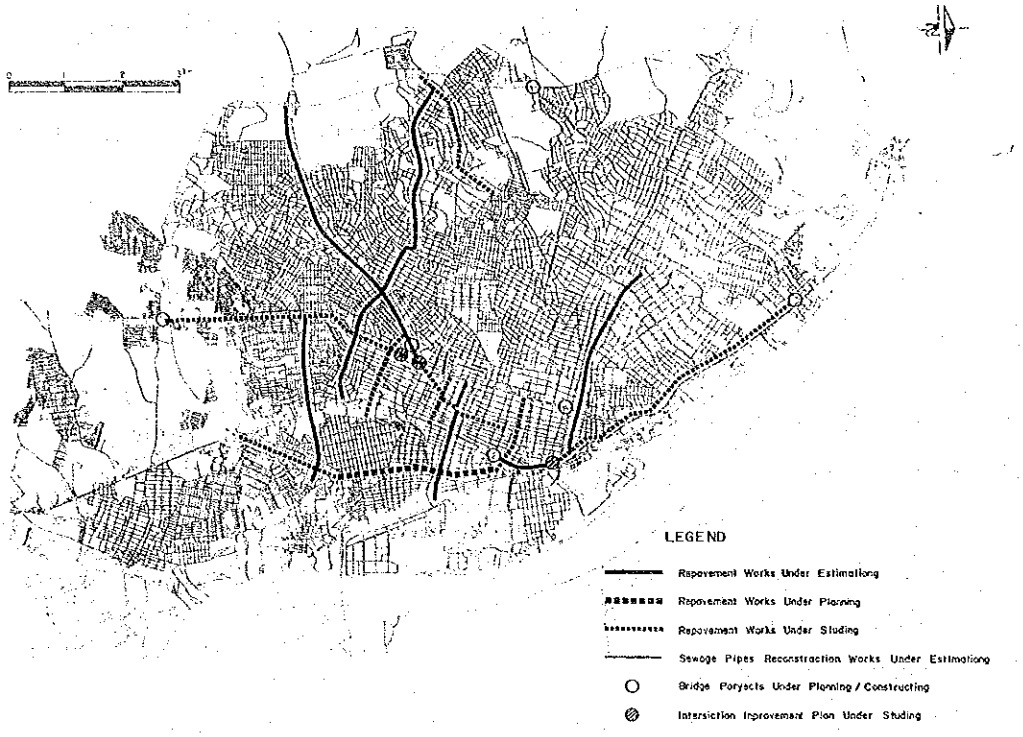


Fig. 4–2–3 Location of the Public Works in B/Q

made under this study shall correspond to AASHTO and Japanese Standards.

(3) Existing Public Works

Public works presently being planned or implemented by the municipality have been compiled. The locations of the project sites are shown in Fig. 4–2–3.

4–3 Existing Problems

4–3–1 Street Maintenance

The maintenance conditions of the streets in Barranquilla is poor, as explained in section 4–2. The following are the main findings of maintenance problems in the survey.

(1) Existing Pavement Maintenance

It is necessary to establish a high-quality street maintenance and repair system for pavement repair, and house good construction methods, material quality control and construction supervision.

(2) Communication System

Close cooperation should be established among the engineers concerned in EPM, EMT, Electrificadora del Atlántico, etc., to coordinate such efforts as installation of water lines, gas lines, etc.

There is much pavement destruction in the city streets as a result of non-coordinated construction efforts to install city utilities such as water supply and electric facilities. Once a pavement is damaged, without repair work, the damage will develop further and may result in the destruction of utility facilities below.

(3) At-grade Intersections

Most of the existing at-grade intersections in the city are in a poor condition in terms of geometric elements and traffic safety. Thus, an improvement plan for intersections should include additional lanes for turning vehicles. Installation of traffic signals at major points should be considered together with clear pavement markings such as the center line, the width of carriage way, the side strip, the stopping position for vehicles, and pedestrian crosswalks.

A plan of at-grade intersections should give careful attention to the efficiency of vehicle and pedestrian movement by using islands or painted marks of channelization.

(4) Sidewalks

Sidewalks are provided along most of the streets in the city but their condition is not satisfactory for pedestrian activity. The following points are considered in the sidewalk improvement plan drawn up under this study.

(i) Curbs at the Edge of Sidewalks

There are many high-mount curbs at intersections where the streets themselves are the routes of Arroyo. These high curbs are placed there for protection from Arroyo water, and the height far exceeds the standard curb height. Since they interrupt pedestrian movement, street improvement plans should include the addition of steps or some other facilities.

(ii) Sidewalks in Right-of-Ways

Sidewalks inside right-of-ways are for pedestrian movement, but many such sidewalks in the city are occupied by parked vehicles. This system of parking on sidewalks not only damages the curbs, but also is not authorized by the street management division of the Municipality. Vehicles parked on sidewalks interrupt pedestrian flow and are one of the reasons for traffic accidents.

Open spaces in right-of-ways and sidewalks located in front of public utilities and vacant land are mostly occupied by rubbish, broken bricks, sand, and soil. This is one example of negligent street maintenance. The inside of right-of-ways should be kept for public use, and a precise policy distinguishing clearly between public and private use should be adopted.

4–3–2 Street Drainage Facilities

Generally, the study shows that the drainage system of Barranquilla is poor and grossly inadequate. Most of the city's roads and streets have not been constructed with a drainage system; at a result, rain run-off collects and flows through certain streets and is discharged into the Magdalena River. This type of drainage is generally called an "Arroyo" in Colombia.

As it rains, water collects and flows into certain streets and roads, turning them into rivers. This water severely obstructs traffic by temporarily halting all pedestrian and vehicle movement. The study has researched this problem of obstruction only along the arterial and semi-arterial streets of the city. The obstruction can be divided into two categories: one is the situation that Arroyos intercross with major streets, and the other is the case that in some places, the major street becomes the route of the Arroyo flow.

The Arroyo problem is an important issue for the city. However, in this study, the Arroyo problem was only considered at those critical sections or points along the arterial and semi-arterial streets interrupted by Arroyo water flow, since all the Arroyo problems cannot be solved within the framework of street drainage planning. This was agreed upon between the study team and the Government of Colombia at the early stage. The study was made according to the

following procedure.

(1) Inventory Survey

As explained above, Arroyo surveys were carried out only on arterial and semi-arterial streets. Cross-sections of the main points of Arroyo were surveyed, along with other factors such as vertical alignment and water flow. The basic data was collected using 1/2000 scale maps.

(2) Rainfall Catchment Area

The areas were identified by using a 1/10,000 scale map.

(3) Estimation of Arroyo Capacity

The capacity at each main point of the Arroyo was calculated based on the data obtained through items a. and b.

(4) Rainwater Estimation

Data concerning precipitation in the city is not available. Rainfall intensity was estimated mainly on the basis of the following student report:

"Estudio y Diagnóstico de Algunos Arroyos en Barranquilla" – Reporte presentado por los estudiantes George Jaar Rubio y Javier Bassi Cer. Assesorado por los ingenieros Francisco Sánchez y Rafael Caparroso y por la Compañia Glasson y Glasson.

Corporación Uncosta, Facultad de Ingeniería Civil, Barranquilla, 1982.

Figure 4–3–1 shows the routes of the Arroyo and the locations of critical places.

(5) Arroyo Counterplans

Based on the identification of critical points and sections along the roads and streets concerned with the Arroyo water problem, the following counterplans are being studied from the viewpoint of road and street improvement and the renewal plan of Centro.

- Bypass or detour plan.
- Bridge construction plan.
- Pipe culvert construction plan.
- Box culvert construction plan.
- New channel construction plan.

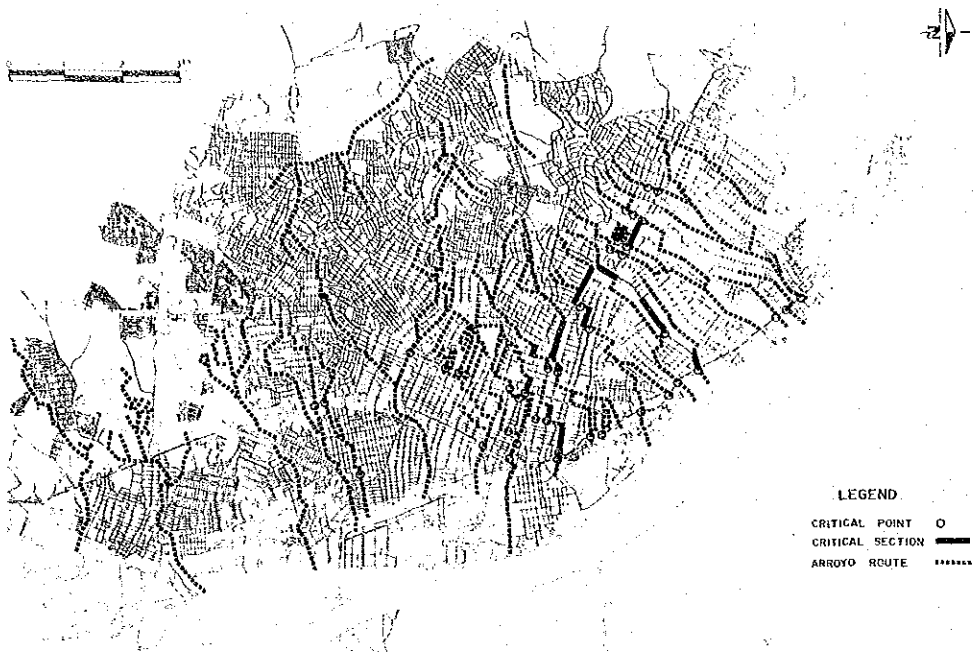


Fig. 4–3–1 Existing Routes of Arroyo in B/Q

Chapter 5.

CURRENT TRAFFIC CONDITIONS

Chapter 5 CURRENT TRAFFIC CONDITIONS

5–1 Traffic Volume

Major traffic flows in Barranquilla's urban area occur six radial arterial streets (Calles 30, 45 and 47 and Cras 38, 43 and 46) and on three circular streets which connect these six arterials. The volume of traffic flow for 13 hours, shown in Figure 5–1–1, was in the range of 1,200 to 20,900 vehicles. Locations with large traffic volumes are shown in Table 5–1–1, and locations with small traffic volumes are shown in Table 5–1–2.

A review of the hourly fluctuation of traffic volume indicates that morning peak hours are from about 7:00 to 8:00, midday peak hours, around 12:00 and evening peak hours, from 17:00 to 19:00. Traffic variation in the urban area of Barranquilla thus shows a typical urban pattern of three peak hours a day.

The composition of vehicle types is shown in Figure 5–1–2. Except for certain parts in the city center, the ratio of cars is high on all streets. While the ratio of buses on any street would naturally depend on whether or not the street is a bus route, it is characteristic that the bus ratio is especially high on Calles 17, 30, 34, 37 and 38, and Cras 38 and 46 in the central district.

5–2 Travel Speed

A travel time survey was conducted on major routes in order to find out the situation and causes of traffic congestion. The distribution of travel speeds by hour is shown for major streets in Figure 5–2–1. In addition, a list of congested sections by time of day and traffic direction, as well as travel speeds and causes of congestion are given in Appendix C.

Traffic in the city tends to concentrate in the central district, where commercial and business activities are high. Traffic congestion is limited to several points where arterials leading to the central district merge with the central district, with some lesser congestion in residential areas near Calles 72 and 76.

On major streets, traffic congestion is further aggravated by inappropriate signal phasing and slow-moving buses near bus stops during rush hours. The main reasons for traffic congestion are as follows:

(1) Inappropriate signal phasing
(2) Indiscriminate crossing of pedestrians
(3) Slow-moving buses near bus stops
(4) Traffic converging from side streets

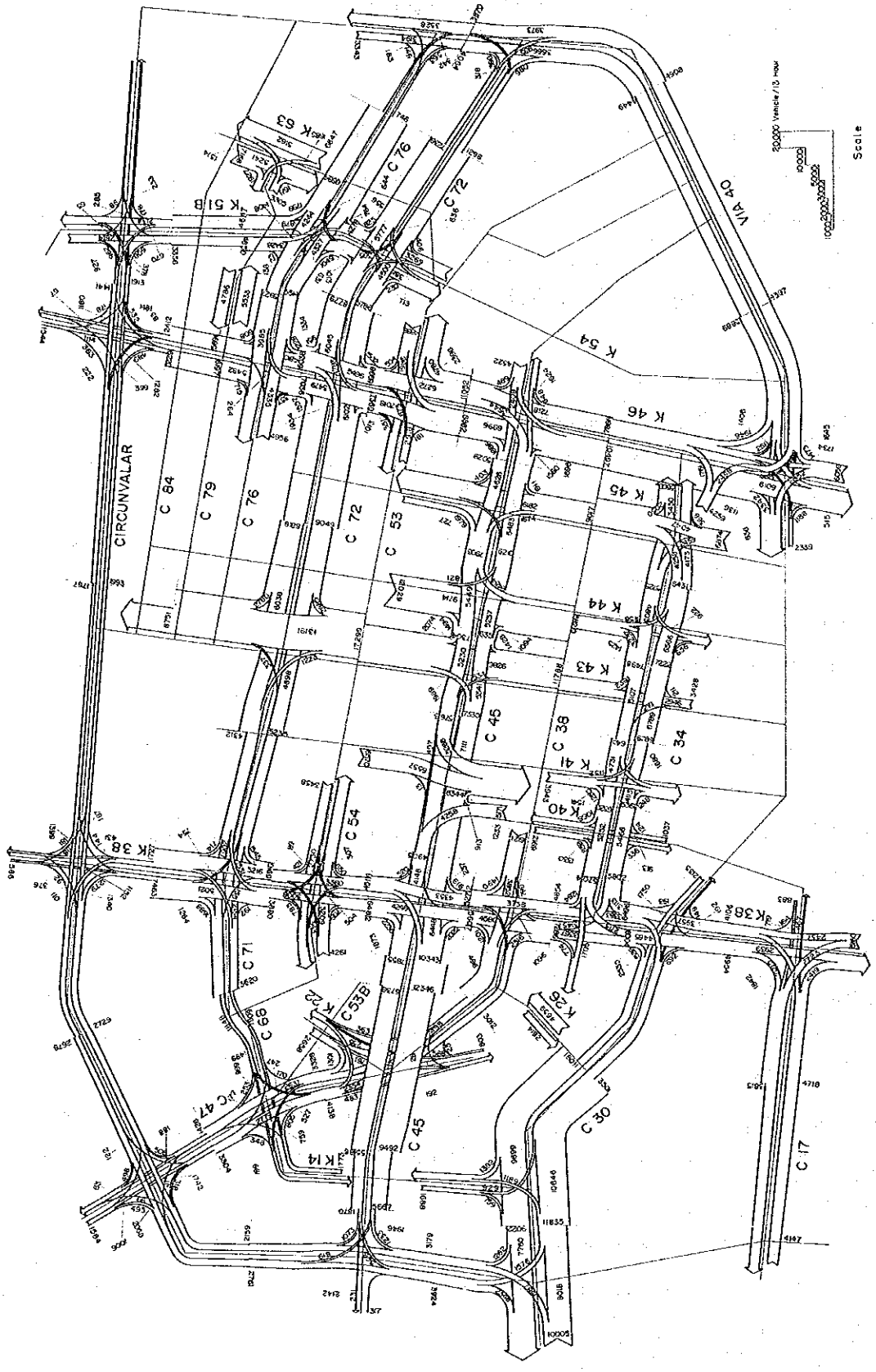


Fig. 5–1–1 Traffic Volume

Table 5–1–1 Location with Large Traffic Volume

Street	Range of the Volume
Cra 43	3,500 – 17,300 veh./13hs.
Cra 44	3,000 – 12,000
Cra 45	9,000 – 10,400
Cra 46	4,100 – 19,900
Calle 30	6,800 – 20,900
Calle 45	3,700 – 19,100
Calle 72	2,400 – 16,700

Table 5–1–2 Location with Small Traffic Volume

Street	Range of the Volume
Cra 14	2,600 – 3,600 ven./13hs.
Cra 40	2,700 – 5,200
Cra 47	2,900 – 8,000
Circunvalar	1,200 – 7,200

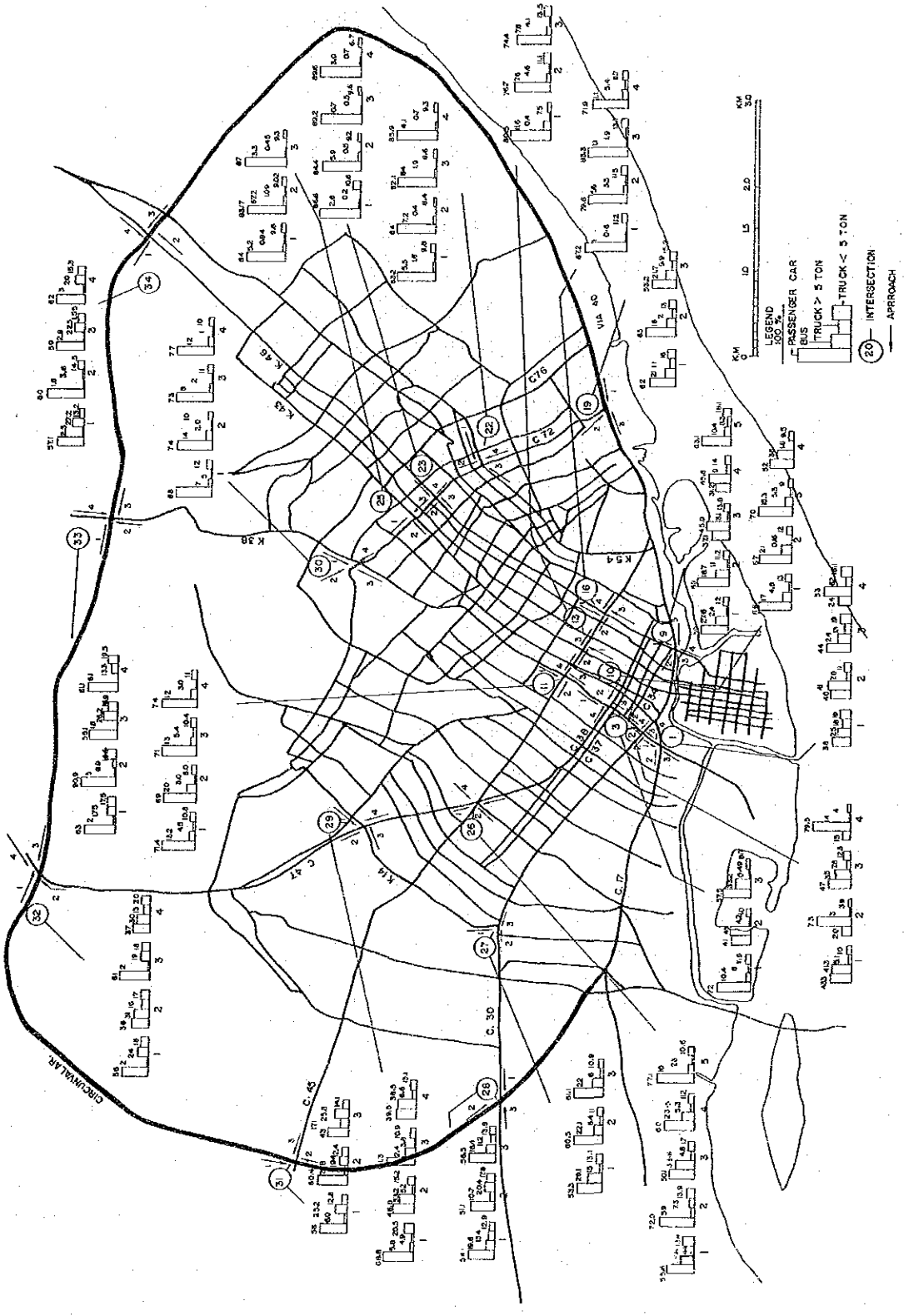


Fig. 5–1–2 Composition of Vehicle Types

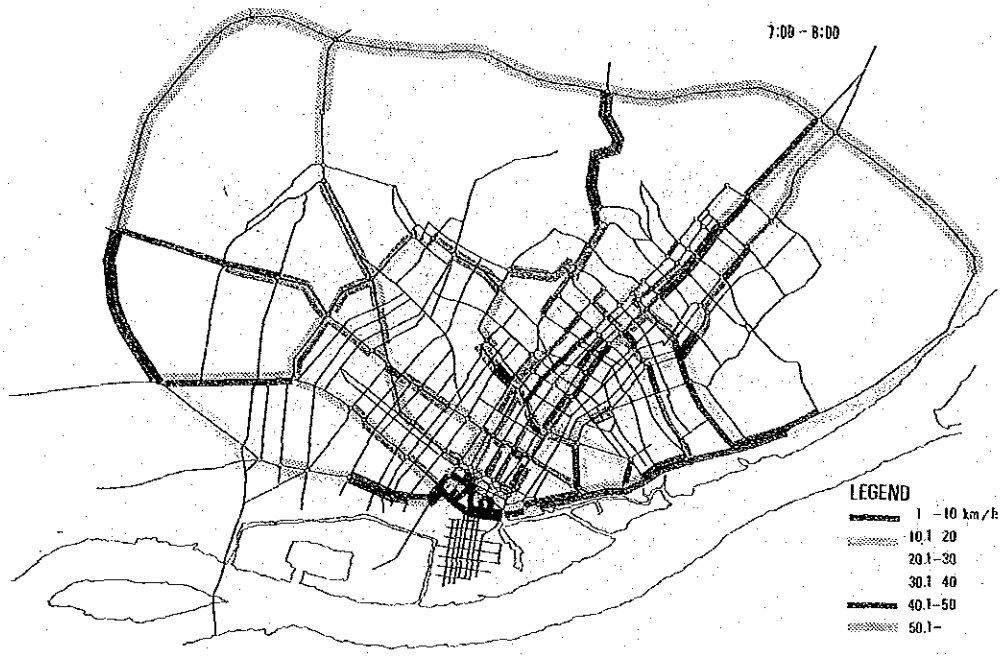


Fig. 5–2–1 (1) Average Vehicle Travel Speed

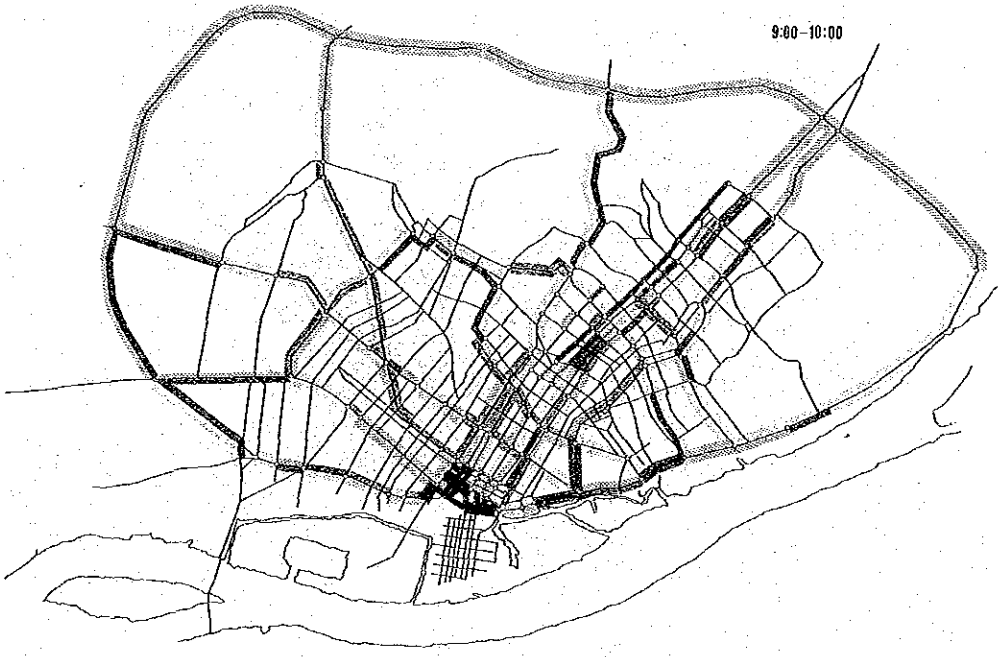


Fig. 5–2–1 (2) Average Vehicle Travel Speed

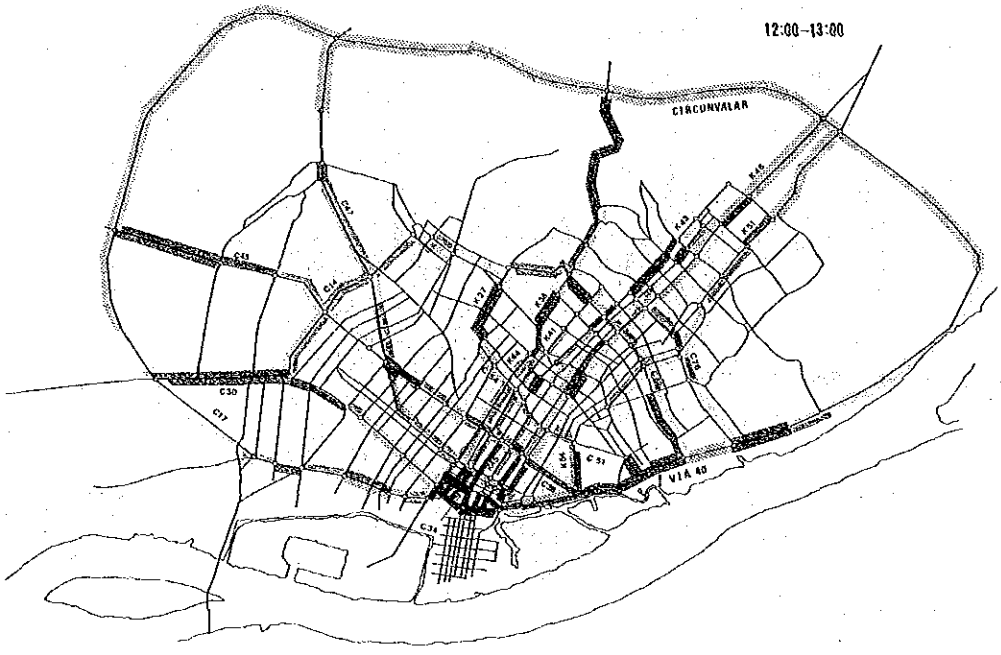


Fig. 5–2–1 (3) Average Vehicle Travel Speed

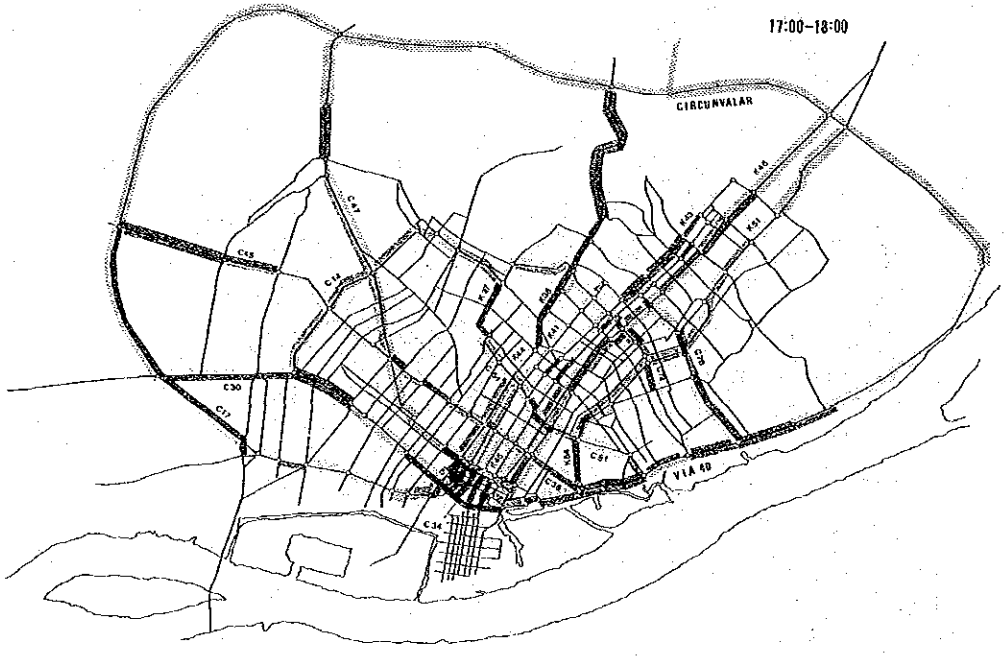


Fig. 5–2–1 (4) Average Vehicle Travel Speed

(5) Traffic diverging onto side streets

(6) Left-turning traffic

(7) Curb parking

(8) Poor pavement surface conditions

(9) Narrow width of the streets

5–2–1 Morning Peak Hours

Serious traffic congestion occurs on the arterial streets surrounded by Cras 38, 45 and 46 and Calle 30, where the average travel speed drops to 10 kilometers per hour or less. In addition, similar situations can be seen at some signalized intersections on Calle 72.

5–2–2 Midday Peak Hours

The area of traffic congestion is similar to that in the morning peak hours. Rush hours caused by workers returning home for lunch are overcrowding such semi-arterials as Cras 38, 40, 41, 43, 44, 45 and 46. The average travel speed on these streets is below 10 kilometers per hour.

5–2–3 Evening Peak Hours

Traffic congestion occurs in the area bordered by Cras 38, 45 and 46, and Calle 30, where conditions are more serious than at other peak times. One bottleneck location is on Calle 34, where inappropriate signal phasing, indiscriminate crossing of pedestrians and slow-moving buses near bus stops all combine to reduce the average travel speed to under 10 kilometers per hour. Other routes show less congestion. For instance, there is some traffic delay at the Calle 72–Cra 46 intersection in residential district.

5–3 Traffic Accidents

5–3–1 Annual Figures

The annual numbers of traffic accidents in the Republic of Colombia and in Barranquilla during the recent 10 years (1973–1982) are shown in Figure 5–3–1. In Colombia, the number of traffic accidents has increased during the past 10 years along with the increase in vehicle ownership. The number of traffic accidents in 1982 was approximately 3.5 times greater than that of 10 years ago. On the other hand, the number of traffic accidents in Barranquilla has decreased at a rate of about 20% after reaching a peak in 1980. In 1982, there were 2.58 accidents per 100 vehicles registered.

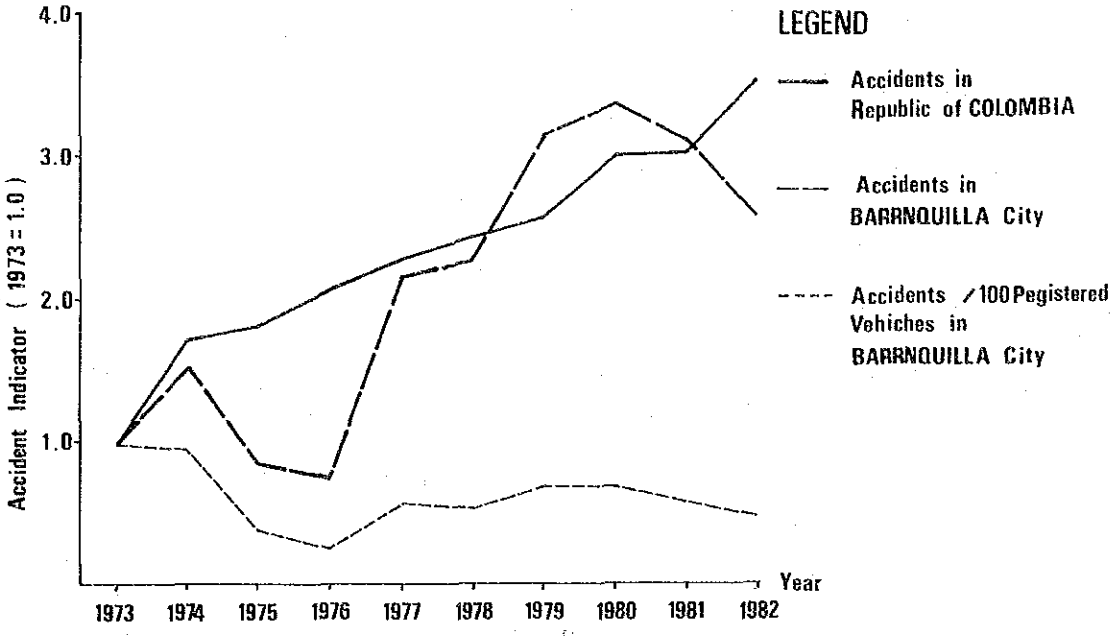


Fig. 5–3–1 Yearly Trend of Traffic Accidents ('73–'82)

5–3–2 Accidents by Vehicle Type

The number of traffic accidents by vehicle type in Barranquilla in 1982 is shown in Table 5–3–1. Of all accidents caused by four-wheeled vehicles, 54% involved passenger cars, about 23% involved trucks and about 15%, buses. When broken down into accidents caused by private vehicles and those caused by commercial vehicles, buses showed the greatest number of accidents per 100 vehicles registered.

Table 5–3–1 Traffic Accidents by Type of Cars in Barranquilla City (1982)

Accidents Type of Cars	Private Vehicles		Commercial Vehicles		Total	
	No. of Accidents	Accidents/ 100 vehicles	No. of Accidents	Accidents/ 100 vehicles	No. of Accidents	%
Passenger Car	973	3.7	520	6.7	1,493	54.3
Bus	66	11.2	351	9.9	417	15.2
Truck	519	4.2	105	3.4	624	22.7
Others	63	22.9	–	–	63	2.3
Motorcycle	138	7.4	–	–	138	5.0
Bicycle	15	107.2	–	–	15	0.5
Total	1,774	4.1	976	6.8	2,750	100.0

5–3–3 Accidents by Route

Routes with the highest accident rates were Calles 30 and 34, where the rate was about 2.0 accidents per 100 meters, followed by Calles 45 and 54, where the rate was 1.5 to 1.8, and Calle 72 and Cras 46 and 43, where the rate was 1.3.

5–3–4 Locations of High Accident Frequency and Types of Accident

1) Locations of High Accident Frequency

The locations of high accident frequency are shown in Figure 5–3–2. There was an especially high occurrence of accidents at the following sections: Cras 46-33 on Calle 45 and Cras 38-11 on Calle 30. As shown in Figure 5–3–2, a large number of accidents occurred at intersections of arterial streets, and the biggest concentrations of accidents were located around Cra 38 in the city center and the commerical district in north Barranquilla bordered by Cra 46 and Calles 72 and 76.

Fig. 5–3–2 High Accident Frequency Points

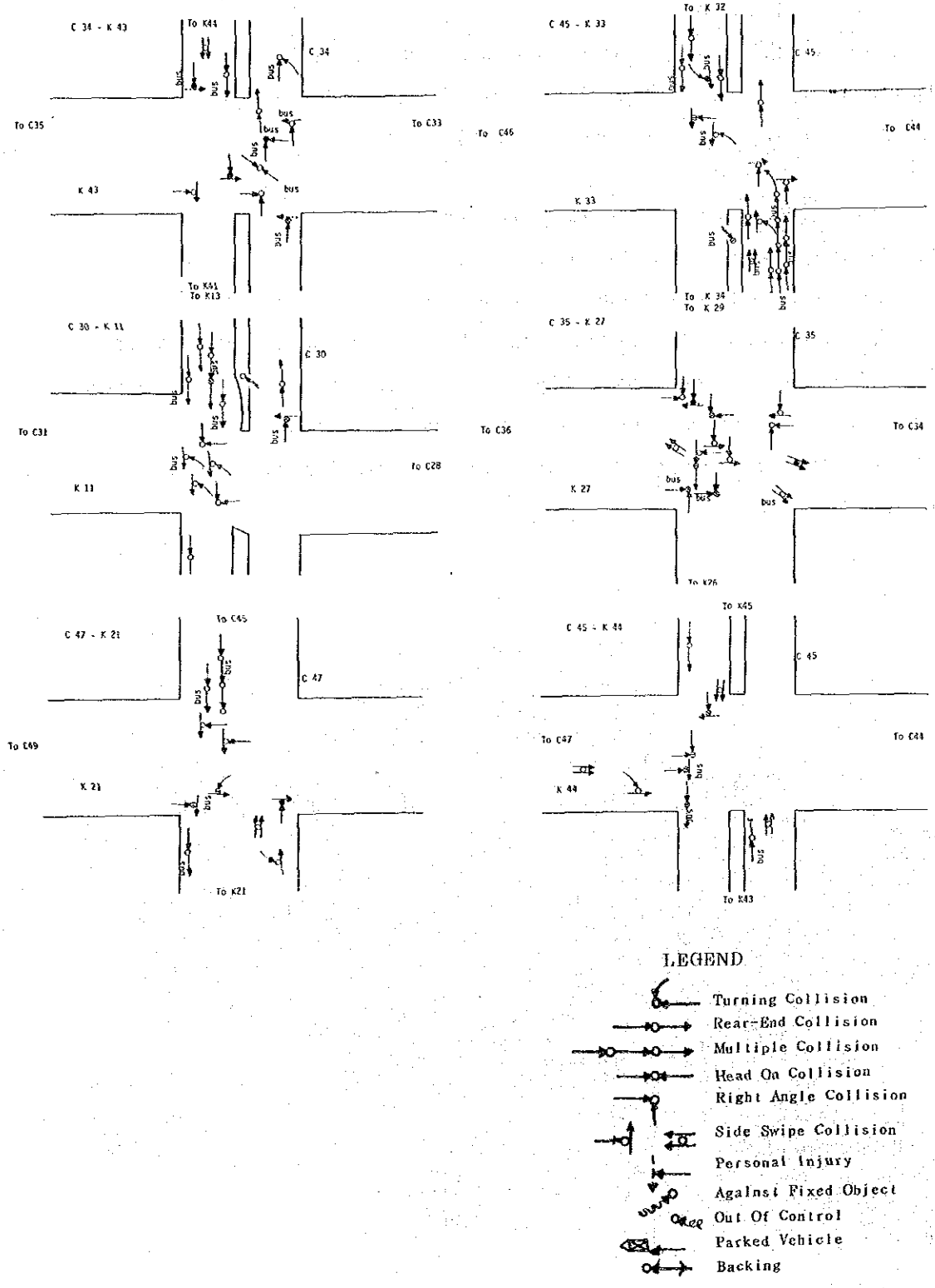


Fig. 5–3–3(1) Collision Diagram

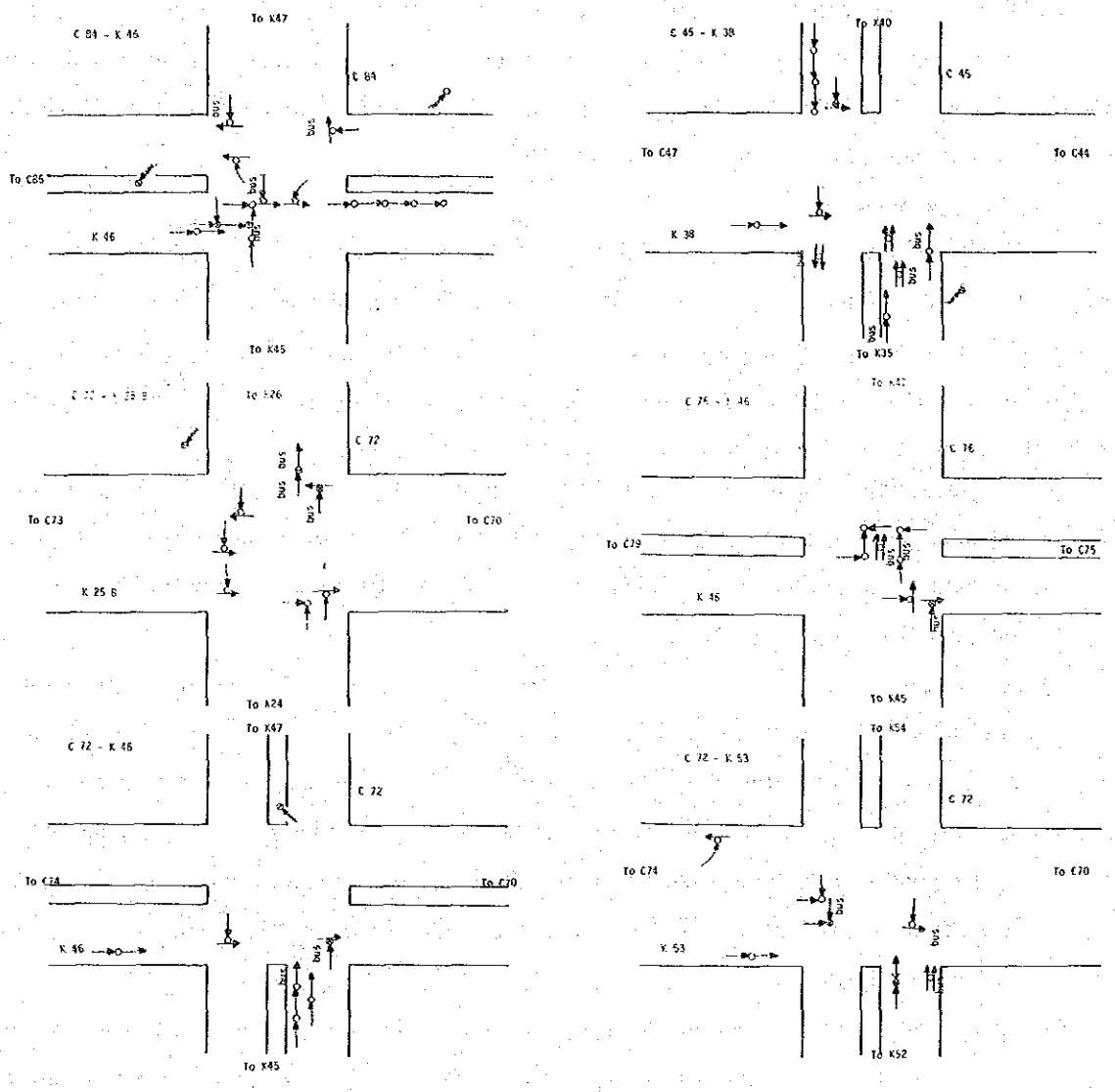


Fig. 5–3–3(2) Collision Diagram

The location with the highest accident frequency is the Calle 45–Cra 33 intersection, where 16 accidents were recorded in a year. Other high frequency points are the intersections of Calle 45 and Cra 34, Calle 35 and Cra 27, Calle 30 and Cra 11, Calle 47 and Cra 21, Calle 45 and Cra 44, Calle 64 and Cra 46, and Calle 45 and Cra 38.

2) Types of Accidents

Figure 5–3–3 shows the distribution and types of accidents which occurred at high accident frequency points. The most frequent type of accident is sideswipe collision, which represents 30% of the total, followed by rear-end collision, which represents 20% of the total. By type of traffic violation, accidents caused by disregarded traffic signals represent the highest proportion, at 17%, followed by accidents caused by following too closely, at 13%.

A qualitative analysis of accident causes based on these data indicates the following:

(1) At most signalized intersections, there is a high occurrence of sideswipe collisions. This is thought to be due mainly to indistinct stop lines, which causes drivers to drive past the line, and disregard traffic lights.

(2) At congested intersections involving traffic jams, there is a high occurrence of rear-end collisions. This is thought to be caused mainly by the fact that the smooth flow of traffic is being obstructed by slow-moving buses near bus stops located at the intersections.

(3) At congested signalized intersections, traffic jams are being caused by inappropriate signal phasing and insufficient capacity of roads. This causes vehicles to stop in the middle of an intersection so that the flow of right-of-way traffic is obstructed, causing sideswipe collisions.

(4) At approaches to intersections, left-turn collisions and sideswipes when changing lanes are occurring. The large number of left-turning traffic at certain intersections is causing entanglements with through traffic moving in the opposite direction.

(5) At high accident frequency points in the central district, there is a high occurrence of pedestrian accidents, caused mostly by indiscriminate crossing of pedestrians.

(6) At unsignalized intersections, there is a high occurrence of sideswipe collisions due to indistinct stop signs and right-of-way indications.

5–4 Parking

5–4–1 Curb Parking by P/T (Person/Trip) Zone

Curb-parking density by P/T zone is shown in Figure 5–4–1. Parking density is the ratio of parking demand to parking supply on a street link. The parking supply is calculated from the sections where parking is legally allowed.

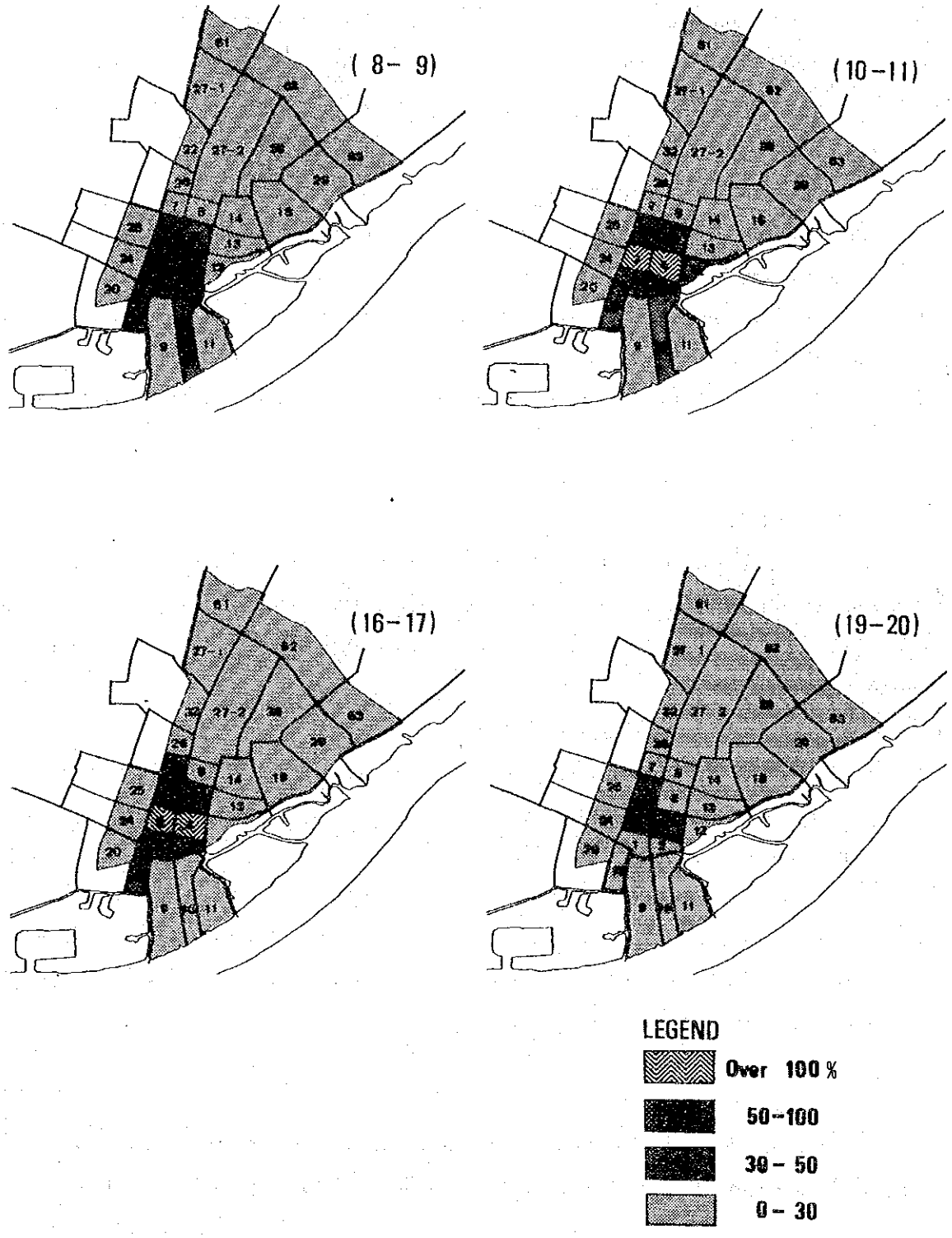


Fig. 5—4—1 Parking Density by Zone

The zonal distribution of parking density is as follows:

The Centro District bordered by Cras 38 and 46 and Calles 45 and 30 has high parking density. Especially in zones 3 and 4 during business rush hours (10:00–11:00, 16:00–17:00), the parking density exceeds 100%, so that illegal curb parking occurs. Zones 1, 2, 5 and 6 show densities between 50% and 100%; densities in zones 1 and 5 are actually near 100%. In the remaining zones, the density is below 50%.

The hourly distribution of parking density is as follows:

(1) 08:00–09:00: Zones 1, 2, 3, 4 and 5 show high density, especially zones 1 and 2, where it reaches nearly 90%.

(2) 10:00–11:00 and 16:00–17:00: Parking density in zones 3 and 4 rises even further and exceeds 100%.

(3) 19:00–20:00: Zones 3, 4 and 5 in Centro show density of 30% to 50%, while it is below 30% in all other zones.

5–4–2 Parking Purpose

The interview survey of drivers parking revealed that about 42% of all parking in the Study Area are for business Area are for business purpose, about 23% for commuting to work or school, 15% for going home and 23% for miscellaneous purpose. Shopping, dining out and recreation account for 10%.

Parking purposes by P/T zone are as follows:

(1) In the Centro District, zones 1, 2, 5 and 6 show high percentages of parking for business purposes, at 40% to 67%, and zones 3 and 4 show high percentages of parking for commuting purpose, at 38% to 60%. Business purposes account for a high ratio of parking in zones 7–14, except for zone 9, where the main purpose of parking is to go to work.

(2) Outside the Centro District, zones 25, 26, 28 and 29 show relatively high percentages of parking for business and commuting purposes, while all other zones show high percentages of parking for business purposes.

5–4–3 Average Walking Distance

The results of a sampling survey on walking distance are shown in Figure 5–4–2. The average walking distance from parking space to destination point is only about 50 meters.

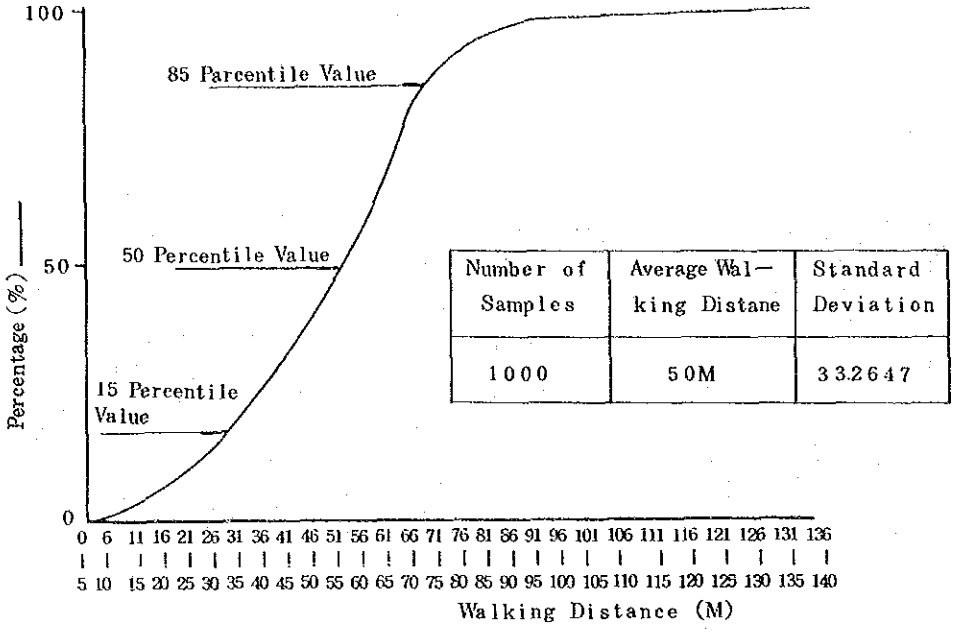


Fig. 5–4–2 Average Walking Distance from Parking Space on Street

5–4–4 Parking Duration and Turnover

Average parking duration in areas where parking is restricted is about 14 minutes, and average parking duration in areas where curb parking is permitted is 78 minutes, or about five times longer. An interview survey of drivers revealed that the desired length of parking time is about 57 minutes, or 20 minutes shorter than parking duration in non-restricted areas.
Average turnover is about 6.4 times.

5–4–5 Off-street Parking (Toll Parking)

The fluctuations of incoming/outgoing vehicles at toll parking lots are shown in Figure 5–4–3, and the parking duration of such traffic is shown in Table 5–4–1. Based on demands for toll parking, the peak rate is about 11.2% and the peak hour is between 12:00 and 1:00 in the afternoon. Average parking duration at toll parking lots is about 130 minutes, which is longer than on-street parking duration. Average turnover is 1.4 times, which is about 1/5 that of curb parking.

5–4–6 Parking Density and Traffic Congestion

The relationship between parking density and traffic congestion is shown in Figure 5–4–4. To identify the traffic problem areas where parking conditions are causing traffic congestion, a distribution chart of parking problem areas and traffic congestion areas using contour lines

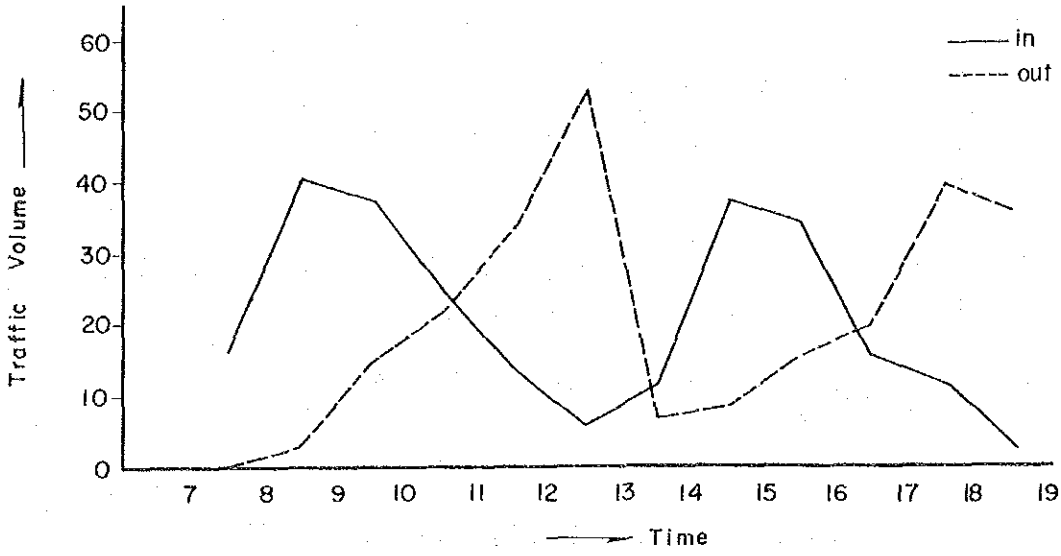


Fig. 5—4—3 Traffic Variation of Toll Parking Lot (Off-Street)

Table 5—4—1 Average Parking Duration of Toll Parking Lot (Off — Street)

Number Parking Demand (12 Hours)	Capacity (Vehicles)	Average Parking Turnover Rate	Average Parking Duration	Standard Deviation
256	180	1.4	131. Min.	87.3946

was prepared. Travel speed is used as the indicator of the degree of traffic congestion, and parking density is used as the indicator of parking problems. The sections where areas with average peak-time travel speed of 10 kilometers per hour or less and areas with parking density of 50% or more overlap are considered to be traffic problem areas.

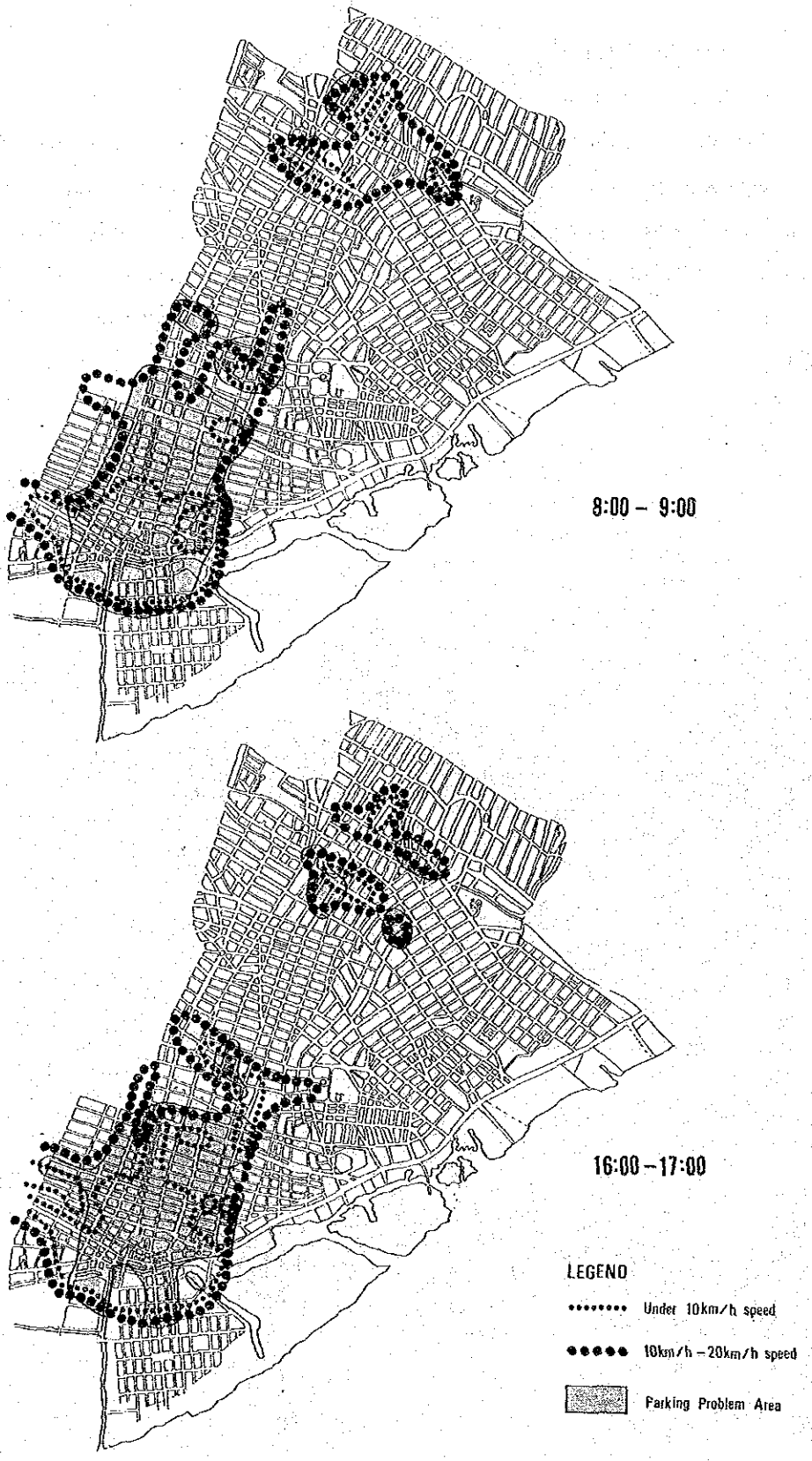


Fig. 5–4–4 Parking Problem Area

5–5 Traffic Regulations

5–5–1 One-way Streets

As shown in Figure 5–5–1, many streets located in the Centro District and a few major radial streets in the Boston, Colombia and El Porvenir districts are one-way streets. Concentration of one-way streets is especially heavy in the Centro District bordered by Calle 45, Cra 38, Cra 46 and Calle 30. Semi-arterials designated as one way are Cras 41, 43 and 44. Cras 43 and 44 in particular are a pair of one-way arterials that link thae central district of Barranquilla with the northern area.

Fig. 5–5–1 One Way Street

5–5–2 Speed Limits

Figure 5–5–2 shows the speed limits on arterials in the urban area of Barranquilla. The speed limit is 30–40 kilometers per hour in the city center and 50–80 kilometers per hour at the city perimeter.

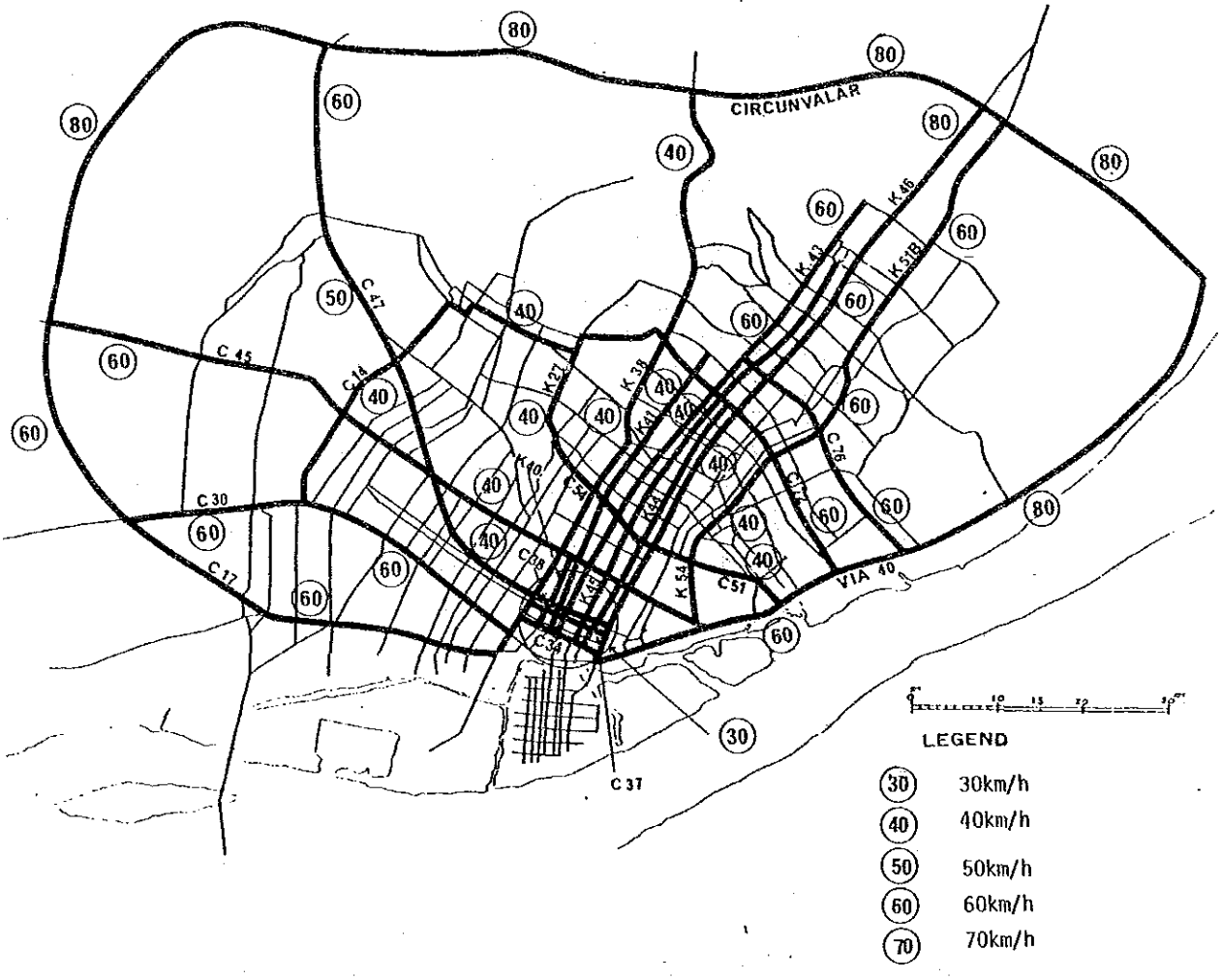


Fig. 5–5–2 Speed Limit

5–5–3 Parking Restrictions

Areas in the commercial/business district where parking is restricted are as shown in Figure 5–5–3. Curb parking restrictions are widely enforced in the city center, where the restriction rate (the ratio of total street extension where parking is restricted to total street extension where parking is physically possible) is as high as 64% in P/T zones 1, 3 and 4. The restriction rate in zones 6, 7 and 8 in the Centro District is in the range of 30%–50%. Thus, areas with high

parking restriction rates tend to be located in the Centro District bordered by Cra 38, Calle 45, Cra 46 and Calle 30.

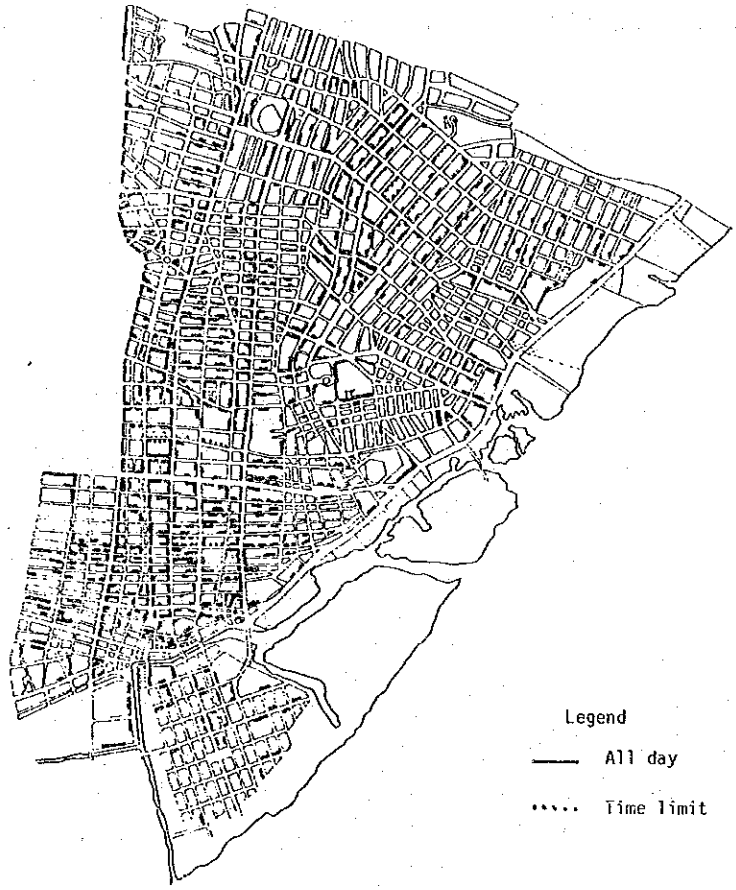


Fig. 5–5–3 Road with Restricted Parking

5–6 Traffic Control Devices

5–6–1 Traffic Signs

1) Guiding Signs

Guiding signs giving route designations, distances and other information are seen relatively frequently on major roads. Signs indicating road designations are well maintained on all streets, including major roads and minor streets. The number of quiding signs is especially large in the city center.

2) Regulatory Signs

STOP signs are seen relatively frequently at intersections without signals and minor streets in residential districts. BUS STOP signs are relatively well maintained along bus routes, and ONE-WAY signs are concentrated in the central district. Other signs are NO PARKING,

NO U-TURNS, PEDESTRIAN CROSSING, and SCHOOL ZONE, but these are seen infrequently.

In general, the traffic signs are hard to see, insufficient in number, and poorly managed, and the enforcement of the regulations is inadequate. In order to reduce the number of traffic accidents, it is necessary in the future to correct this undesirable situation.

5–6–2 Traffic Signals

Signalized intersections are located in the urban area of Barranquilla, many of them in the central district (see Figure 5–6–1). About 30% of all traffic signals installed are multiphase fixed-cycle systems, while the remaining are two-phase systems. The cycle lengths are relatively short, between 37 and 59 seconds, and the clearance (yellow) intervals are fixed at 5 seconds. Many of the signals are hard to see because of weak illustration and short supporting poles. In addition, some intersections do not have enough signals to ensure that all drivers can see a traffic signals easily regardless of the viewing angle.

During the morning, noon and evening rush hours, traffic congestions are often caused by inappropriate phasing and traffic signal breakdowns. The nonsynchronous control system currently in use cannot deal with traffic flow on certain streets in the central district where the distance between signals is short.

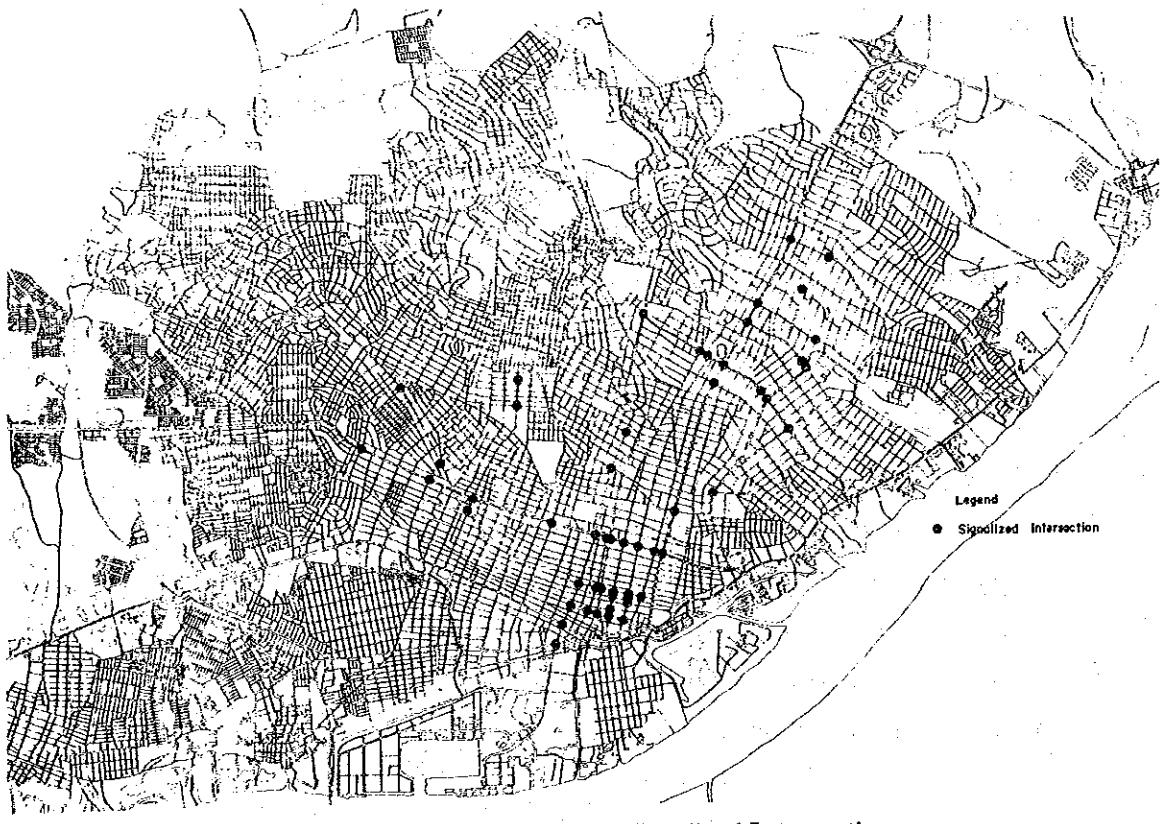


Fig. 5–6–1 Location of Signalized Intersection

5–7 Current Traffic Problems

In order to make an evaluation of each of the major roads, evaluation standards were established for various evaluation criteria such as traffic flow at intersections, pedestrian crossing, congestion at bus stops, traffic flowing in from and out onto minor streets, left-turning traffic, traffic accident frequency, parking conditions, capacity of signalized intersections, and road stucture. These are given in Table 5–7–1.

The road sections of major roads evaluated to be in poor condition based on the above criteria are given in Table 5–7–2. The Centro District bordered by Cra 38, Calle 45, Cra 46 and Calle 30 and the northern commercial district near Calles 72 and 76 are found to be the greatest problem areas with regard to traffic control.

5–7–1 Problems

1) Vehicle Traffic
   (1) Traffic congestion at signalized intersections
   (2) Slow-moving buses near bus stops
   (3) Obstruction of traffic flow caused by left-turning vehicles
   (4) Traffic congestion at unsignalized intersections caused by converging and diverging traffic
2) Pedestrian Traffic
   (1) Obstruction of traffic flow caused by indiscriminate crossing of pedestrians
3) Others
   (1) Obstruction of traffic flow caused by curb parking
   (2) High frequency of traffic accidents
   (3) Traffic problems caused by poor pavement surface conditions
   (4) Traffic problems caused by arroyo

5–7–2 Causes

(1) Inadequate signal control
(2) Deficiency of signalized intersections
(3) Inappropriate channelization of intersections
(4) Inadequate traffic capacity
(5) Unsuitable bus stop locations near intersections
(6) Inadequate pedestrian control devices

(7) Inadequate safety devices

(8) Inappropriate parking restrictions on congested streets

(9) Inappropriate control of traffic flowing in from and out onto minor streets

(10) Poor pavement surface maintenance

Table 5–7–1 Criteria for Evaluation of Traffic Conditions

Cause of Existing Traffic Problems	Criteria	Standard	Evaluation
1. High Frequency of The Occurrence of Traffic Accident	Yearly Accident Rate by Route (Accident/100m) Frequency of Yearly Accident at Intersection	– Above 2.0 – Above 5.0 – Under 4.0	Serious Serious Tolerable
2. Signalized Intersection	Average Travel Speed during Rush Hour Waiting Time at Signalized Intersection Average Travel Speed during Rush Hour	– Under 10 km/h – Above 60 seconds (with Jam) – Under 20 km/h	* Serious * Serious * Tolerable
3. Indiscriminate Crossing of Pedestrians	Frequency of Test Car's Stop due to Crossing Pedestrian – Do. –	– Above 6 Times/8 Round Trips – Under 5 Times/8 Round Trips	* Serious * Tolerable
4. Congestion of Buses near Bus Stops	Frequency of Test Car's Stop by Congestion of Buses near Bus Stops – Do.–	– Above 6 Times/8 Round Trips – Under 5 Times/8 Round Trips	* Serious * Tolerable
5. Traffic Merging from Minor Road & Traffic Diverging to Minor Rd.	Frequency of Test Car's Stop due to Traffic Merging from Minor Road – Do. –	– Above 6 Times/8 Round Trips – Under 5 Times/8 Round Trips	* Serious * Tolerable
6. Influence of Cars Turning to the Left	Frequency of Test Car's Stop in Left Turn Vehicles – Do.–	– Above 6 Times/8 Round Trips – Under 5 Times/8 Round Trips	* Serious * Tolerable
7. Parking on Street	Frequency of Test Car's Stop due to Parking on Street – Do. –	– Above 6 Times/8 Round Trips – Under 5 Times/8 Round Trips	* Serious * Tolerable

Note: * Based on Travel Time Survey

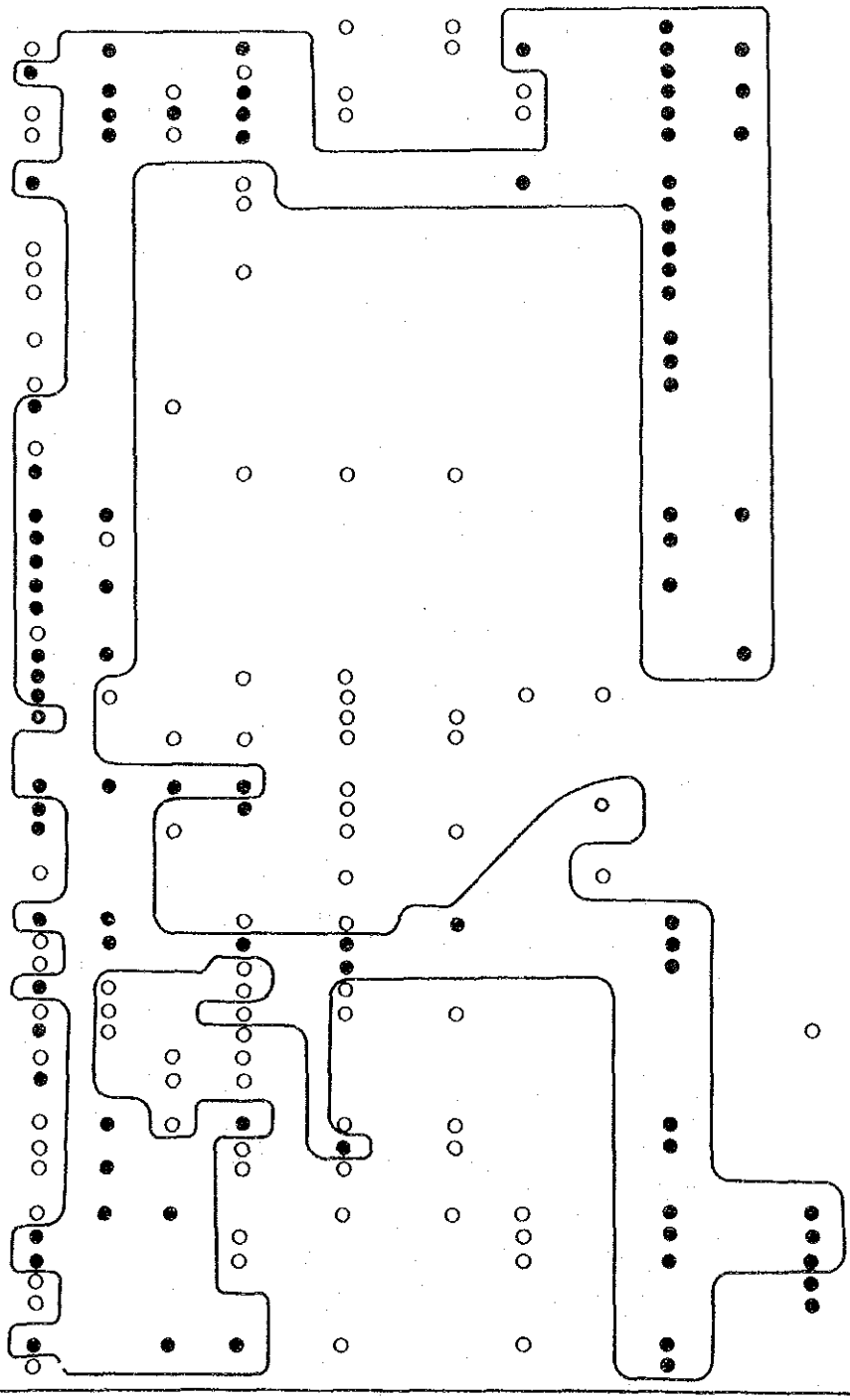
Table 5–7–1 (Cont'd)

Cause of Existing Traffic Problems	Criteria	Standard	Evaluation
8. Poor Pavement Maintenance	Frequency of Test Car's Stop due to Poor Pavement Maintenance	– Above 6 Times/8 Round Trips	* Serious
	– Do. –	– Under 5 Times/8 Round Trips	* Tolerable
9. High Parking Density & Heavy Traffic on Minor Road	Parking Rate on Street (Demand Capacity)	– Above 50%	** Serious
	Average Travel Speed During Rush Hour	– Under 10 km/h	* Serious
10. Demand/Capacity At Signalized Intersection	Traffic Congestion Rate at Intersection (Demand/Capacity)	– Above 1.0	Serious
11. Phasical Condition	Width of Road Way	– Under 11.0 m	Serious
	Lateral Clearance	– Under 1.0 m	Serious
	Sidewalk	– Under 2.0 m	Serious

Note : * Based on Travel Time Survey
** Based on Parking Survey

Table 5–7–2 Existing Traffic Problems by Location

Area & Condition \ Existing Traffic Problems	Problem Item 1	2	3	4	5	6	7	8	9	10	11*
① Via 40											
Cra 46–Clle 45	○				○	○			●		
Clle 45–Clle 58											
Clle 58–Clle 72											
Clle 72–Clle 76											
Clle 76–Circunv.				○							
② Calle 34											
Cra 46–Cra 45					○	○			●		
Cra 45–Cra 44	○	●		●		○	●		●	●	
Cra 44–Cra 43	●			○					●		
Cra 43–Cra 41		●	○	●	○		○		●	●	
Cra 41–Cra 40	○	●	○	●	○		○		●		
Cra 40–Cra 38	○	●	○						●	●	
③ Calle 37											
Cra 38–Cra 40	●			○			●		●		
Cra 40–Cra 41				○					●		
Cra 41–Cra 43									●		
Cra 43–Cra 44	○								●		
Cra 44–Cra 45	○			○					●		
Cra 45–Cra 46	○								●		
④ Calle 38											
Cra 46–Cra 45	○								●		
Cra 45–Cra 44									●		
Cra 44–Cra 43	○								●		
Cra 43–Cra 41	●		○								
Cra 41–Cra 40											
Cra 40–Cra 38	○										
Cra 38–Clle 45	●			○	○	○					
⑤ Calle 45											
Via 40–Cra 46	●	●							●	●	
Cra 46–Cra 45	●	○							●		
Cra 45–Cra 44	●										
Cra 44–Cra 43	●	●							●		
Cra 43–Cra 41	●										
Cra 41–Cra 40	○										
Cra 40–Cra 38	●	●								●	
Cra 38–Cra 33	●			○	○						
Cra 33–Cra 22	●	○			○		○	○			
Cra 22–Cra 14	○				○	○					
Cra 14–Circunv.			○	○	○	○					
⑥ Calle 30											
Cra 38–Cra 33	●	●	●	●	○						
Cra 33–Cra 14	●		○		○	○		○			
Cra 14–Circunv.											
⑦ Calle 17											
Cra 38–Cra 8	○				○			○			
⑧ Carrera 38											
Clle 17–Clle 30	●	●		●		●			●		
Clle 30–Clle 34	○	●		●	●				●		
Clle 34–Clle 38	○			○					●		
Clle 38–Clle 45	●	○		○							
Clle 45–Clle 54	○	○		○	○	○					○
Clle 54–Clle 72	○	○		○	○						
Clle 72–Clle 76	○		○	○							
Clle 76–Circunv.	●		○	○							
⑨ Carrera 40											
Clle 34–Clle 37	○	●		●	○	○			●		
Clle 37–Clle 38	○			○	●	○			●		
Clle 38–Clle 45	○	●		○							
⑩ Carrera 41											
Clle 34–Clle 37	○	●	●		○	○	○		●		●
Clle 37–Clle 38	●			○			○		●		●
Clle 38–Clle 45	●			○			○		●		●
Clle 45–Clle 54	○										●
Clle 54–Clle 72	○										
⑪ Carrera 43											
Clle 34–Clle 37	●		●	●	○		○		●		
Clle 37–Clle 38	○								●		

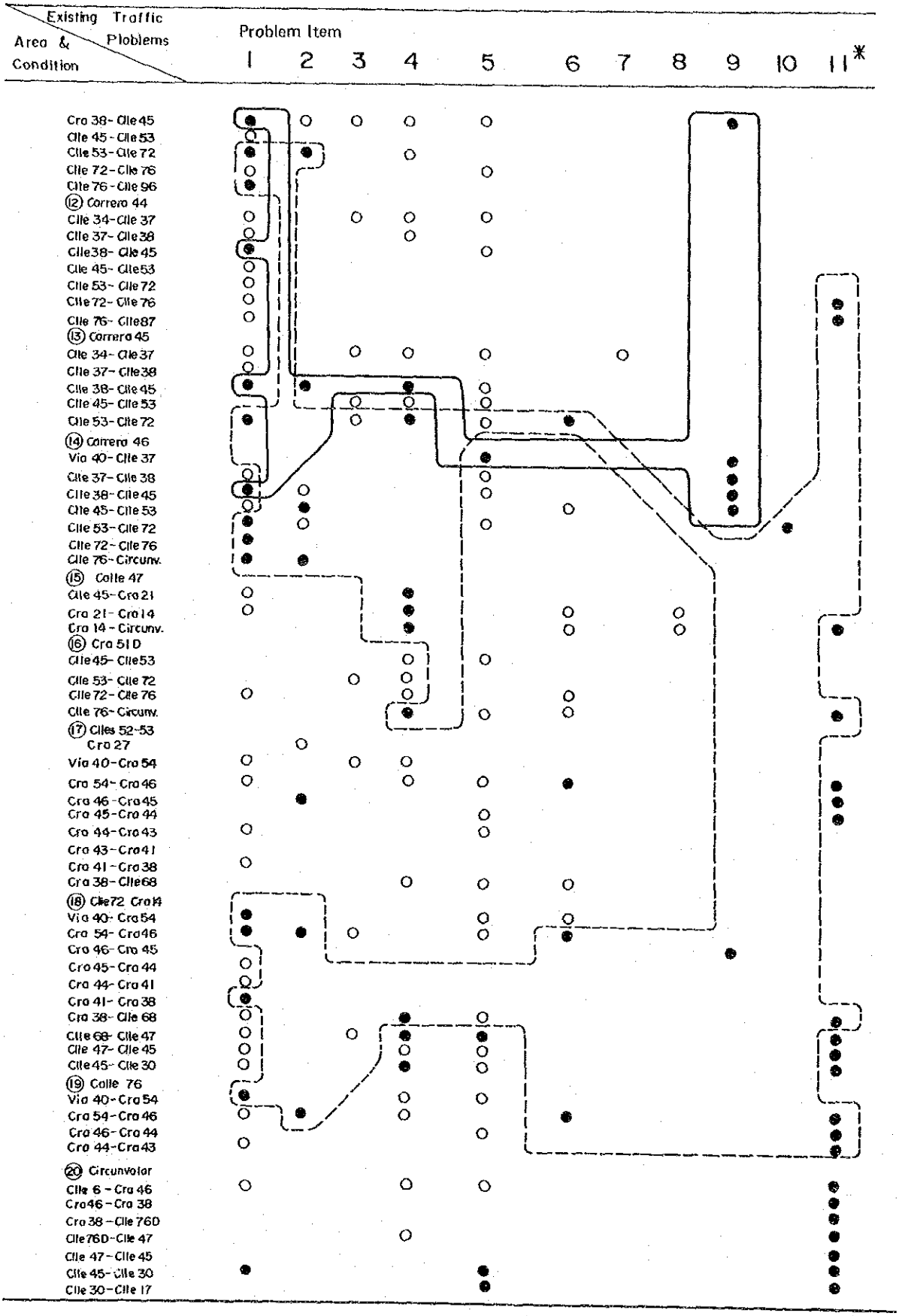


LEGEND

* See Table 5–7–1.

● SERIOUS ○ TOLERABLE —— CENTRO AREA ---- NORTH COMMERCIAL AREA

Table 5–7–2 – Continued –



* See Table 5–7–1.

Chapter 6.

CHARACTERISTICS OF EXISTING PERSON TRIP

Chapter 6 CHARACTERISTICS OF EXISTING PERSON TRIP

6–1 General (Outline of Person Trip Survey)

6–1–1 Person Trip Survey

The purpose of the Person Trip Survey is to obtain detailed information on the movement characteristics of residents in the Barranquilla Metropolitan Area. The survey normally covers the travel of persons in terms of trip purpose, transport mode, origin and destination of trip, travel time, etc. It also covers the socio-economic characteristics of the person, such as sex, age, occupation, type of house, car ownership, etc. Consequently, by analyzing the data collected, the following characteristics can be clarified:

1) Trip generation/attraction level and characteristics.
2) Distribution and flow of person trips.
3) Modal split and traffic demand.
4) Socio-economic characteristics of residents and transport users.

This Person Trip Survey was carried out by sampling. The samples should be expanded to the total number of the population, in order to obtain various information on the existing socio-economic conditions and person trips.

6–1–2 Sampling

In 1983, the total population in Barranquilla was estimated at approximately 961,000. The number of houses was estimated to be 156,000 in Barranquilla and 17,000 in Soledad. The population over 5 years old within the city of Barranquilla in 1983 was estimated at about 843,000. In the city of Soledad it was estimated to be nearly 118,000.

Table 6–1–1 Result of Sampling

	Population (1) 1983 (persons)	Sampled (2) Population (persons)	Sample Rate (%)
Barranquilla	843,125	41,776	4.95
Soledad	117,767	4,707	4.00
Total	960,882	46,483	4.84

Remark: 1) Study Team estimated at the sampling stage:
Population of 5 years old and above
2) Person Trip Survey

Because of the lack of house-hold data by zone in Barranquilla, sampling was done by means of a house unit. The sampling rate is determined to be 5% of the total number of houses and by assuming a validity of 75%. As a result, the number of the valid samples is shown in Table 6–1–1.

6–1–3 Data Processing

Data processing of the Person Trip Survey was carried out through the following steps.

(1) Manual data check
(2) Data coding
(3) Data entry into magnetic tapes
(4) Logic error check and editing by computer
(5) Sample Master tape
(6) Tabulation of samples
(7) Determination of the expansion factor
(8) Development of sample master tapes
(9) Preliminary tabulation
(10) Screen line adjustment
(11) Making up of the OD Table

Expanded master files were made to obtain the following information for further review and analysis of the present traffic situation in the Barranquilla Metropolitan Area.

1) Socio-economic characteristics in 1983
   - Population and household
   - Occupation
   - Employment by residence/working place
   - Car ownership
   - Type of house

2) Trip characteristics of Barranquilla residents
   - Trip rate
   - Trip by occupation and industry
   - Trip generation/attraction by zone
   - Other trip characteristics