CHAPTER 5: ROADS AND STREETS

5-1. General

The second step of the road planning study in Barranquilla has been carried out collecting information, the key point survey, and analyzing the data of the last time study which was explained in progress report (1).

The main items in this study are the classification of the roads and the streets, selecting the route and connecting between the street link and the person trips survey zone, an inventory survey that is measured over 300 cross sections of the major link of streets, selecting the most critical Arroyo problems which are a result of the drainage system of the city, and collecting the information from the municipal civil engineering organization, such as road construction policy, circumstances of road construction and cost.

5-2. Existing Road Network.

5-2-1. Outline of the Network.

The major streets and roads in Barranquilla develop radiatly like the rivet of a fan that start from the center of the city, which is called "El Centro". Outside of the urban area, the high standard road which is named Circunvalar encircles the city. The collector and local streets join together in a complicated manner along the major route. The streets in Barranquilla are difficult to judge in character only from the geometrical elements, according to the results of the inventory study. A consideration for the determination of the street classification has been carried out viewed from the macrocosmical point that is existing actual city traffic movement. The above mentioned, the roads and streets, can be divided into the following four categories.

1) Road and Street Classification.

The purpose of the planning of the roads and streets in the transportation

study and the classification of the roads and streets into different systems or types are necessary for communication among engineers, administrators, and the general public.

Classification of roads and streets by design type is most helpful for location and design and also for traffic operation needs.

For transportation planning purposes, roads and streets are most effectively classified by function: the purpose of a certain portion of the road and streets system. Although different functional classification methods may be used satisfactorily for planning, one widely accepted method divides all urban roads and streets into the following categories as shown in Figure 5-2-1.

(a) Arterial Road.

In the urban area of Barranquilla there exists a system of roads and streets which can be identified as unusually significant to the area in which it lies in terms of the nature and composition of travel it servers. The importance of these facilities also is derived from the service to rural oriental traffic, but equally or even more importantly, their importancy is derived from service for major movements within this urbanized area.

The arterial system should serve the major centers of activity of a metropolitan area, the highest traffic volume corredor, and the long trip desires. The arterial system should carry a high proportion of the total urban area travelled on a minimum of kilometrage. This system should be integrated, both internally and between 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 movements desiring to by-pass 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.

b. Semi-arterial Street.

The semi-arterial street system should interconnect with, and compliment the urban principal arterial system and provide service to trips of moderate lenghts at a somewhat lower level of travel mobility than principal arterials. This system also distributes travel to geographic areas smaller than those identified with the higher system.

The semi-arterial street system includes all arterials not classified as principals and contains facilities that place 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 carry local bus routes and provide intracommunity continuity but ideally should not penetrate identifiable neighborhoods. The semi-arterial streets should include urban connections to rural collector roads, where such connections have not been classified for internal reasons as urban principal arterials.

c. Collector Street.

The collector street differs from the arterial roads in that facilities on the collector streets may penetrate 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 local streets in the neighborhood and channels it into the arterial road system. But in some cases, due to the plan of the overall street system, a minor amount of through traffic may be carried on some collector streets, for example Carrera 41 and Carrera 44.

d. Local Street.

The street comprises all facilities not on one of the higher street systems. It serves primarly 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 usually contains no bus routes. Service to through traffic movement usually is deliverately

discouraged.

The following Table 5-2-1 shows the arterial and semi-arterial of roads and streets in metropolitan Barranquilla.

Table 5-2-1. The road and street classification in metropolitan Barranquilla.

Arterial

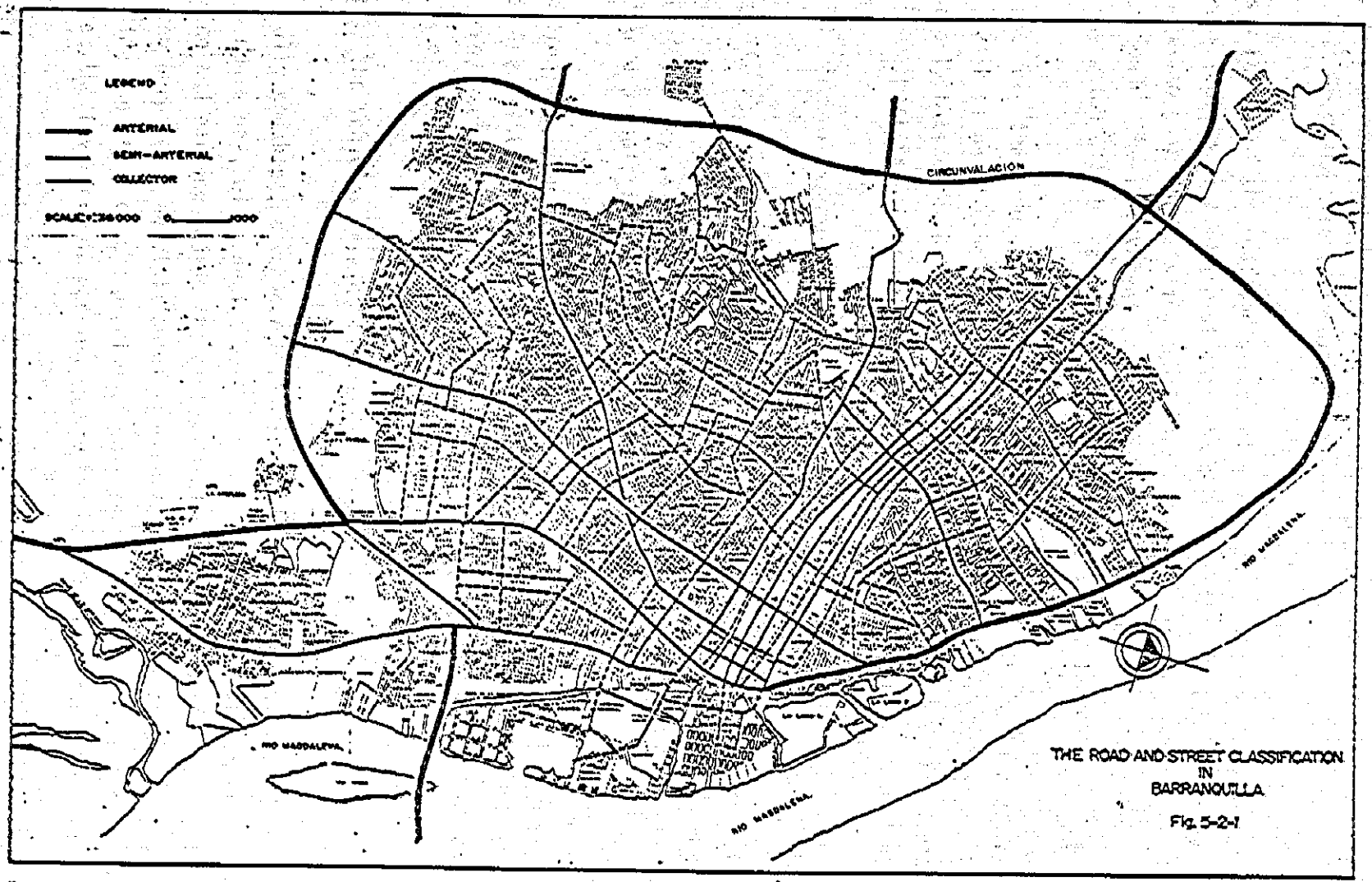
Road Name	From	To	Distance (km)
Circunvalar	Cll 30	Las Flores	18.85
Vía 40	Cr. 45	Las Flores	8.70
Autopista al Aereopuerto	Cruce con Circunvalar	Aereopuerto	5.30
Total			32.85

Semi Arterial

Road Name	From	To	Distance (km)
Cll 17	Cr. 38	Ingral (Soledad)	4.65
Cll 18	Ingral	Vía al Aereopuerto	3.75
Cll 19	Cll 30	Cll 17	1.90
Cll 30	Cruce con Circunvalar	Cr. 46	6.05

Semi Arterial (2)

Road Name	From	To	Distance (km)
Cll 34	Cr. 38	Cr. 46	1.00
Cll 38	Cr. 46	Cr. 30	1.80
Cll 39	Cr. 30	Cr. 27	0.40
Cll 47	Cr. 27	Cruce con Circunvalar	6.00
Cll 45	Vía 40	Cruce con Circunvalar	8.45
Cll 72	Vía 40	Cr. 38	3.42
Cr. 46	Vía 40	Cruce con Circunvalar	7.72
Cr. 44	Cll 84	Cll 30	5.10
Cr. 43	Cll 30	Cll 84	5.20
Cr. 38	Cll 17	Cruce con Circunvalar	7.40
Total			62.84



THE ROAD AND STREET CLASSIFICATION IN BARRANQUILLA

Fig. 5-2-1

5-3. Physical Street Conditions.

5-3-1. Road and Street Inventory Survey.

As a result of the road and street classification, the key point of each cross section of road and streets has been selected for the inventory survey to gain the existing geometrical street condition: chiefly the cross section for the improvement or new planning of the roads and streets in this study which will be carried out next step in the near future.

About more than 300 cross section has been meassured at the survey: Table 5-3-2 shows one of the result of the survey, this utilized value data has not only this study but this will be useful for the Municipal of Barranquilla for the matters of the political, civil engineering, traffic management.

5-3-2. Arroyo Inventory Survey.

With the road and street inventory survey, the survey of Arroyo: one of the drainage system which is rain water flowing in the street, has been carried out at the key points and sections from the result of semiarterial street and Arroyo route investigation.

The problems, findings and counterplan of the Arroyo explained at paragraph 5-5. The existing problems in detail are shown in Figure 5-5-2. The routes of Arroyo are shown in Table 5-5-2 in the paragraph 5-5 shows one of the forms of the Arroyo cross section survey.

5-3-3. The Vehicles Parking Inventory.

Generally speaking, a vehicle parking time is longer than running in every city. Now a day, with the increasing of vehicles have not enough space for running and parking inside the cities: including the city of Barranquilla. For the purpose of adquisition of the knowledge and information on the existing condition of the parking circumstance at the major zone in Barranquilla, the inventory of parking survey has been carried out. The main

survayed items are that the condition of the parking on the streets, with the zone of person trip survey. The result of surveyed data, now analysing at the traffic management study: street capacity analysing the number of future vehicles demand following Table 5-3-1 shows the result of the survey.

Table 6-5-1

PARKING INVENTORY

UNIT : C.P.U

P/T ZONE \ ITEM	ON-STREET PARKING					OFF-STREET PARKING				
	PARKING		NO PARKING			PRIVATE PARKING		PUBLIC PARKING		BATERIA
	PARALEL	45°& 60°	NO PARKING	PRIVATE ZONE	TAXIS ZONE	WITH HOUSE	WITHOUT HOUSE	WITH HOUSE	WITHOUT HOUSE	
1	242	40	127	-	-	-	-	80	20	-
2	304	33	84	-	-	61	-	238	-	-
3	378	75	426	-	-	-	-	-	43	100
4	362	121	631	-	-	418	35	439	25	-
5	322	46	529	-	-	73	-	-	65	16
6	580	44	294	5	2	72	70	97	32	14
7	314	-	200	46	-	-	-	-	-	33
8	298	-	316	9	-	-	25	-	132	5
9	1457	-	162	-	-	-	60	20	-	5
10	672	22	392	-	-	-	-	-	-	14
11	452	-	51	-	-	-	-	-	80	5
12	504	65	19	-	-	-	-	-	-	13
13	1465	-	50	-	-	-	14	-	16	44
14	1305	-	9	1	-	-	-	-	35	10
18	2452	-	56	-	-	12	60	-	30	98
19	610	44	145	-	-	-	-	-	-	13
20	1247	-	1	-	-	-	-	-	-	-
24	957	-	150	-	4	66	95	20	173	42
25	1241	-	51	1	26	-	34	-	15	91
26	560	-	140	-	-	-	-	-	-	60
27-1	4483	63	865	-	-	67	104	-	198	732
27-2	2418	-	148	-	-	-	88	-	-	292
28	2687	-	168	-	56	533	92	-	87	246
29	2892	-	60	-	-	357	-	-	-	119
38	844	-	221	-	-	-	11	-	-	94
61	1752	121	96	-	-	6	50	-	60	21
62	3030	-	180	-	7	316	37	-	60	961
63	2344	10	70	-	-	232	183	-	20	58
TOTAL	36,172	684	5,641	62	95	2,213	947	894	1,021	3,081

ROAD INVENTORY SURVEY (EXAMPLE)

TABLE 5-3-2

PLACE BARRANQUILLA - CIRCUNVALAR

DATE OCT 1993

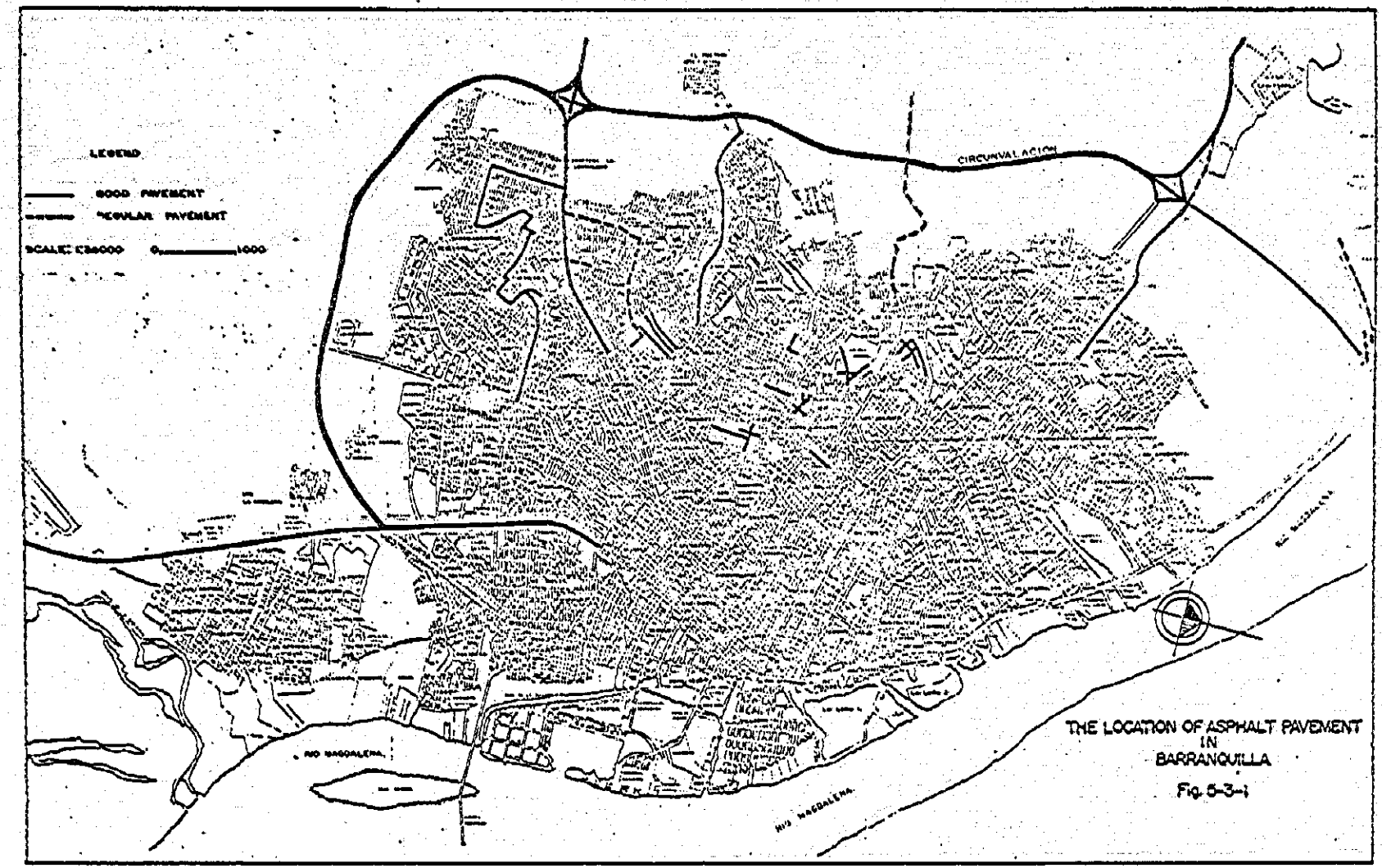
NAME OF THE STREET	FROM	TO	DISTANCE (Km)	JURISDICTION	TRAFFIC CONDITION				GENERAL STATEMENT OF THE ROAD			CROSS SECTION	REMARKS
					DIRECTION	PARKING	BUS. RUTES	RESTRICTION	SURFACE CONDITION	SIDEWALK CONDITION	LIGHTENING		
CIRCUNVALACION	VIA 40	BEGIN OF THE BOULEVAR	0.3	DEPARTMENT		YES	YES		SURFACE CONDITION BAD	GOOD	30 m EACH		ASPHALT PAVEMENT BAD DRAINAGE
"	END OF THE BOULEVAR	Km 12 + 600	2.2	DEPARTMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv. PROFIL IN SLOPE GOOD DRAINAGE
"	Km 12 + 600	CROSSROAD WITH K 51B	1.0	DEPARTMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv. MEDIAN GOOD DRAINAGE
"	CROSSROAD WITH K 53	BRIDGE K 46	0.5	DEPARTMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv. BRIDGE
"	BRIDGE K 46	100m AFTER	0.1	DEPARTMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv.
"			1.6	DEPARTEMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv. SETTING SIDEWALK RIGHT SHOULDER BAD
"			0.6	DEPARTEMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv. DRAINAGE WORKS
"		BRIDGE CLL 47	0.4	DEPARTMENT		NO	NO		GOOD	NO	30 m EACH		Asp. Pv.
"	BRIDGE CLL. 47	BEFORE CLL 45	5.3	DEPARTMENT		NO	YES		GOOD	NO	30 m EACH		Asp. Pv. GOOD DRAINAGE
"	BEFORE CLL 45	CLL 30	2.6	DEPARTMENT		NO	YES		GOOD	NO	30 m EACH		Asp. Pv.

* K= CARRERA *CLL = CALLE

5-3-4. The pavement Condition in the streets in Barranquilla.

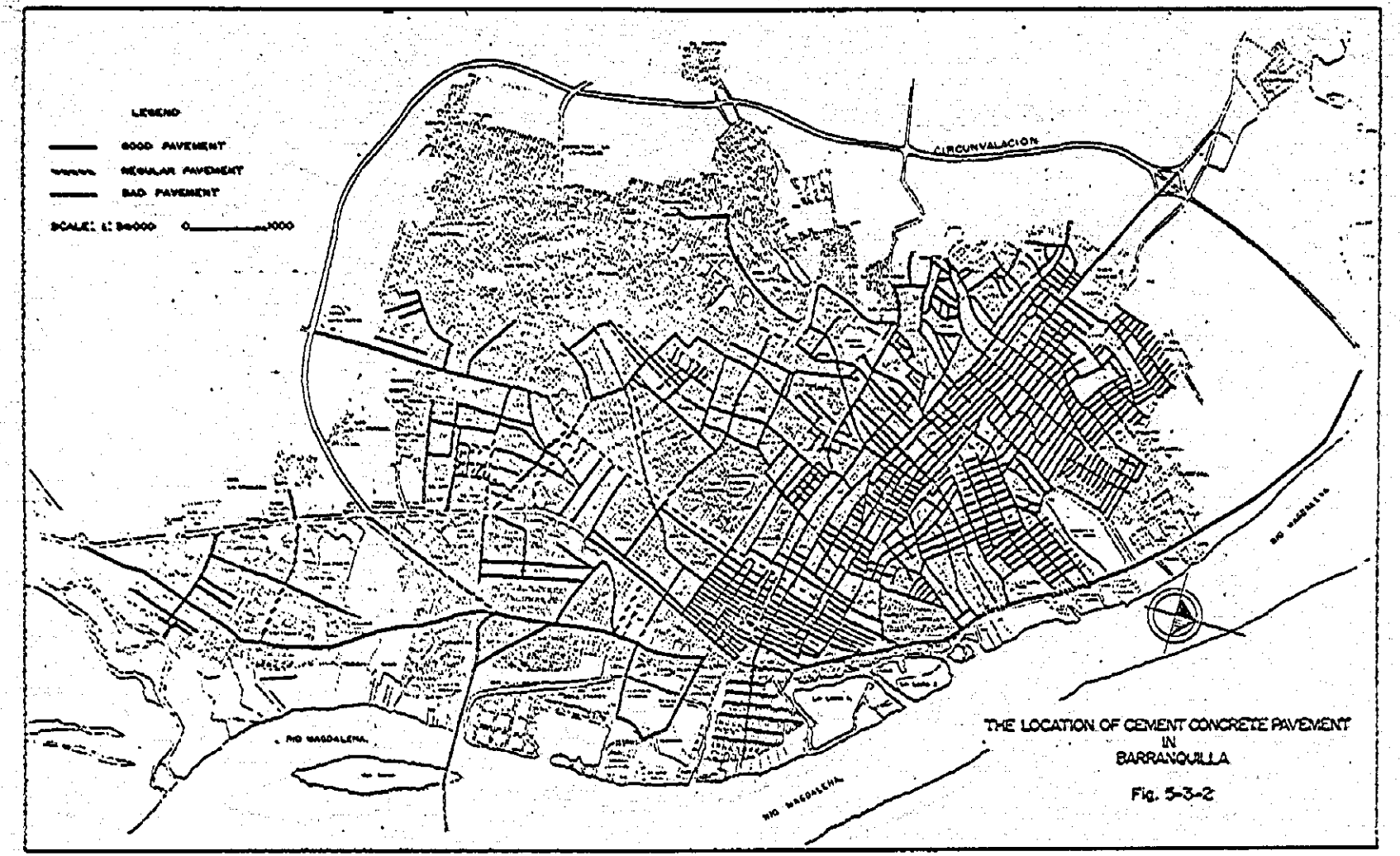
As the result of the roads and streets investigation the most of three quarter of the roads and streets are paved by cement concrete and only a few parts of the routes are paved by asphalt concrete such as the road Circunvalar, but the condition of the maintenance is nearly poor. In the south west area of the city: middle and low class residential zone, the local streets were not paved with even low cost asphalt pavement: some of them were constructed many years ago, but now the pavement has been completely damaged by an erosion due to the Arroyo water flow.

The pavement surface condition makes the vehicles running effectively and also dominates its speed and road capacity. Veiwing from engineering most of the streets in Barranquilla are not in a satisfactory condition. Another physical situation of pavement is that the old concrete pavement has a thickness of only 13 cms in the zone of El Centro: without A. Boyacá (Calle 30), and also most of the streets in the city has a poor drainage system and protection for the underground water. Generally the problems between road and water are not acceptable each others. Many cracks and collapse of the pavement are found in the city and are sometimes reaching at the basement because of heavy traffic loads and impacts, therefore such a basement does not have enough supporting power. Many points on the arterial Vía 40, have been damaged by heavy trucks transportation from the Factory Cementos del Caribe, Monómeros Colombo Venezolano and rubbish place.



THE LOCATION OF ASPHALT PAVEMENT IN BARRANQUILLA

Fig. 5-3-1



THE LOCATION OF CEMENT CONCRETE PAVEMENT IN BARRANQUILLA

Fig. 5-3-2

THE LOCATION OF THE NO PAVED STREETS
IN
BARRANQUILLA
Fig. 5-3-3
CIRCUNVALACION
RIO MAGDALENA

THE COLLAPSED PAVEMENT IN THE STREETS
IN
BARRANQUILLA
Fig. 5-3-4
CIRCUNVALACION
RIO MAGDALENA
LEGEND

5-4. Institutional Conditions.

For the purpose of the understanding of the existing road administration and engineering of the city Barranquilla, following items are compiled that concerned the public works such as the law, the legal limitation, the organization, the engineering system, the financial system, and the construction.

(1) The Organization.

The information of the organization of the public works on the municipal and the government concerned the study are compiled.

At the present, the traffic planning and/or constructed division and public works division do not exist in the municipality. The traffic matters with roads are managed by Instituto Departamental de Transportes y Tránsito, one of Atlántico Department organization such as the traffic plan, management, control and education in the department of Atlántico. The Institude has few budget to execute the planning and construction for the traffic problem solution. The public works in the city is managed by Empresas Públicas Municipales de Barranquilla (EPM) which is one of outside municipal organization.

(2) Design Standards for Road.

The design criteria of road that is useful for planning or improving the road. Colombian design criteria "Criterio Geométrico Para Diseño de Carreteras" is good for rural roads but not applicable for urban one. A design standard will be proposed in the next step of this study.

(3) Existing Public Works.

The public works under planning or construction undertaken by municipal has been compiled. The locations of the project sites are shown in Figure 5-4-1 and Table 5-4-1.

(4) Construction Cost.

For the purpose of the roads and streets cost estimation in the next step, the existing construction data are collector and also are investigated the existing condition of the constructers and construction material suppliers.

The List of Public Works Under Construction in Barranquilla. Table 5-4-1.

Location	ITEM
Cll 30 Cr. 21/40	The repavement construction
Cr. 21 Cll 30/70	The repavement cosntruction
Plazoleta de la Aduana	The repavement construction
Puente Cr. 54 y Cll 45	The new bridge construction
Cr. 15 Cll 17/30	The repavement construction
Cr. 15 Cll 76 C	Under excavation of the drainage
Solución pluvial	
ENTRADA CARRIZAL Cll 45 B Cr. 25 A	The pavement construction cost under estimation.
BAJADA DE LA MANGA Cll 76 D Cr. 25 A Circunvalar	The pavement construction cost under estimation.
Cr. 52 Cll 40/48	The pavement construction cost under estimation.
GERLEIN, VILLATE Y BUENA ESPERANZA Cr. 15 A Cll 61/64	The pavement construction cost under estimation.
Barrio La Sierra Cr. 13 Clles 45 D/47 Cll 45 E Cras 13, 13 B, 13 C y 14.	The pavement construction cost under estimation.
Barrio Chiquinquirá Cll 47 Cr. 30/31 Cr. 31 Cll 47/50	The pavement construction cost under estimation.
La Ceiba Cll 63 B Cr. 14/9 Cr. 10 Cll 63/60	The pavement construction cost under estimation.
Los Alpes Cll 85 Cr. 42 D/42 G	The pavement construction cost under estimation.

San José Cll 46 Cr. 20/21	The pavement construction cost under estimation.
San Felipe Cr. 23 B Cll 64 A/68	The pavement construction cost under estimation.
Alfonso López Cr. 26 Cll 45-49 Cr. 25 Cll 46-48	The pavement construction cost under estimation.
Recreo Cr. 34 Cll 55/58 Cll 56 Cr. 33/35 Cll 57 Cr. 33/35	The pavement construction cost under estimation.
Cr. 8ª Cll 45 a 19	The topographical survey and detailed design for pavement construction.
Cr. 14 Cll 30 a 76 D	The topographical survey and detailed design for pavement construction.
Cr. 40 Cll 17 a 45	The topographical survey and detailed design for pavement construction.
Cr. 19 Cll 17 a 30	The topographical survey and detailed design for pavement construction.
Cr. 20 Cll 30 a 47	The topographical survey and detailed design for pavement construction.
Cll 30 y Cll 47 desde Cr. 38 a Circunvalar.	The topographical survey and detailed design for pavement construction.
Paso elevado Cll 45 Cr. 22	Under studing for the second stage of the interchange project: the ramps construction effects.
Interconección vial de la Vía 40 con la Cll 30 y Cll 17	Under studing the interconection of the road: topographical survey and detailed design for construction.
Intersección Vía 40 Cr. 48	Under studing the intersection: topographical survey and detailed design for construction.

The sewage pipes reconstruction under planning: enlargement of the sewage pipe diameter.

From	To
Cll 38 Cr. 33	Cll 38 Cr. 39
Cr. 54 Cll 48	Caño de las Compañías
Cr. 54 Vía 40	Caño
Estación N° 1	Río Magdalena.

5-5. The Existing Problems.

5-5-1. The Streets Maintenance Problem.

The maintenance condition on the streets in Barranquilla are being poor that express in the paragraph 5-3. The Physical Street Conditions. The following items explain the main findings of the maintenance problem in the survey.

(1) The Pavement Maintenance Existing Problems.

There are necessarely to establish the high quality streets maintenance and reparation system for the pavement destruction, the construction method, the material quality control, and the construction supervision.

(2) The Communication System Problems.

The close co-operation system should be established for the engineers concerned the road, water supply and others such as EPM, E.M.T. Electrificadora del Atlántico, etc.

The streets in the city, there are many pavement destructions with the construction of the water supply or the electricity facility: the destructed pavement are developed into other part of the pavement by the construction without repavements or leaving the disposal maintenance by leaking out water from the supply pipe.

(3) The Problem At The Intersection At-Grade.

The most of existing intersection at-grade in the city are poor condition in the category of the geometrical elements and traffic safety. thus the improvement plan for the intersection should be carried out not only the plan to expand the through lane widing or to set the lanes additional for the vehicles left or right turning movement, and to establish the traffic signal at the major points, but it should be classified more clear by the marking on the

pavements such as the center line, the width of carriage way, the side strip, the stopping position for the vehicle, and the pedestrian crossing.

The planning of intersection at-grade should be given more considerable attention for the efficienty of vehicle and pedestrian movement with the plan of islands or painted marks of channelization.

(4) The Sidewalks Problems.

The sidewalks are constructed along most of the streets city but in condition are not satisfactory for the pedestrian activity, following items explain the major problems of the sidewalk improvement plan in the study.

a) The Curves At The Edge Of The Sidewalks.

There are many high amount curves of the sidewalks at the intersections which are crossing between the streets and the routes of Arroyo. Those high mount curves are setting as the Arroyo water protection nevertheless the hight of curves are highest than the normal curve standard. Those high mounted curves are interrupting the pedestrians movement, thus the streets improvement plan should be included the setting the steps or some other facilities.

b) The Traffic Safety Planning.

There are necessary to have plan for the pedestrian movement at the major intersections and streets such as the marking crosswalks on the pavement the signal controls, and the setting the guadrails along the main section of the arterial and semi arterial streets as the barrier to the protection of inside the sidewalk pedestrians from the vehicles accidentally leaving the streets and also to obstruct desorder the pedestrians streets crossing and the buses stoping.

c) The Sidewalks In The Right-Of-Way.

The sidewalks inside of the right-of-way are not only meaning of the road-side or border, to provide the space for the pedestrian movements.

Nevertheless, the many part of the sidewalks in the city are occupied by the parking vehicles: Bateria in spanish, and those Bateria system are destroyed the curves and constructed for the private parking space by the individual owner without authorized permission of streets management division of the city.

These parking vehicles in the Bateria interrupt pedestrian movement flow and make one of the reasons for the traffic accident.

The open space of right-of-way and the sidewalks located in front on the public utilities and dead space are occupied by dirty things; such as the rubbish, broken bricks, sand, and soil. Those are one of the street maintenance problem, thus inside the right-of-way should kept the public use only and also given the precisional policy between public and private use.

5-5-2. Drainage in the Streets.

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

When it rains, the water collects and flows on certain streets and roads turning them into rivers. This water severely obstructs traffic activity by temporaly halting all pedestrian and vehicle movement. The study has been researching this problem of obstruction only on the arterial and semi arterial streets in the city. The obstruction can be divided into two categories: one is the situation that an Arroyo is intercrossing with major streets and the other one is the case that the rain water flows on the surface of major streets.

In order to formulate an Arroyo counterplan, the following items are considered:

(1) The local rainfall observation data.
(2) The estimation of the yearly rainfall probability.
(3) The speed of water flow.
(4) The volume of the water flow.

The Instituto Colombiano de Hidrología y Adecuación de Tierras (HIMAT) has been observing the rainfall data at the airport in Barranquilla.

The Arroyo problem is one of the important issues for the city, then in this comprehensive urban transport study in Barranquilla, the Arroyo problem has been attached only in the critical sections or points in the arterial and semiarterial streets which are interrupted by the Arroyo water flow.

The Method of Investigation.

The following information explains the main investigation items on the critical sections and points in the streets by the Arroyo water flow.

Inventory Survey
Rainfall catchment area decision.
Arroyo capacity estimation
Water flow roughness estimation
Point out the problem in the streets and networks.
Planning the facility.

a) Inventory Survey.

As explained in paragraph 5-3-2. the Arroyo survey was carried out only on the streets and semi arterial streets. Thus, the Arroyo's principal route is no included. The cross section of the main point of the Arroyo has been surveyed, along with other factors such as vertical alinement and water out flow. The coefficient has been measured with 1/2000 scaled maps.

b) Rainfall Catchment Area Decision Measured by 1/10.000 scaled maps.

c) Estimation of Arroyo Capacity.

The capacity of each main point of the Arroyo has been calculated based on the data which was given in items (a) and (b).

d) Rain Water Flow Estimation.

At this moment, the interior city rainfall data has not been observed. The rainfall intensity was estimated by assumption. As the result of above mentioned, the probability of rainfall intensity has not been researched. The rainfall intensity was taken from the following student report.

"Estudio y Diagnóstico de Algunos Arroyos en Barranquilla".

Reporte presentado por los estudiantes George Jaar Rubio y Javier Bassi Cer. Asesorado por los ingenieron Francisco Sánchez y Rafael Caparroso, y por la Compañía Glasson & Glasson. Barranquilla Corporación Unicosta. "Facultad de Ingeniería Civil 1982."

The following Tables 5-5-1 shows the critical points and sections in the arterials and semi arterials as created by the Arroyo, the Table 5-5-2, 5-5-3 shows an example of the Arroyo inventory and the analysis. The Figure 5-5-1, 5-5-2 show the route of the Arroyo and the location of critical places.

Table 5-5-1. THE CRITICAL POINT AND SECTION BY ARROYO ON THE MAJOR STREETS IN BARRANQUILLA

THE STREET NAME	CRITICAL POINTS	CRITICAL SECTION	REMARKS (ARROYO)
VIA 40	PELOAR		"SIAPE" Passing through natural canal. Impossible traffic. The pavement in the intersection is bad.
	CALLE 80		"COUNTRY" Passing through canal. Bad pavement. The arroyo flow out the canal. Impossible traffic.
	CALLE 79		"Calle 79" Passing through colector. Cross the arteria Vía 40. The arroyo flow into the river. Impossible traffic.
	CALLE 72		"Calle 74" Passing through colector. Impossible traffic.
	CALLE 68		"COLTABACO" Passing through colector. Bad pavement. Impossible traffic.
	CALLE 58		"Calle 65" Passing through colector. Impossible traffic.
	CR. 53		"Carrera 53" With the erosion by arroyo. The street became a big natural ditch. Impossible traffic.
	CR. 51		"Carrera 51" Passing through colector. Bad pavement. Impossible traffic
	CR. 46		"BOLIVAR" Passing through semi-arterial. The arroyo flow into small cana Impossible traffic.

THE STREET NAME	CRITICAL POINTS	CRITICAL SECTION	REMARKS
CALLE 45	CR. 9C		"REBOLO Passing through boxculuert Not enough capacity. Impossible traffic.
	CR. 21		"REBOLO Passing through colector. Big volume water. Bad pavement. Impossible traffic.
	CR. 25		"HOSPITAL Passing through colector. Good pavement. Impossible traffic.
	CR. 29		"HOSPITAL Passing through by a big natural ditch. Good pavement. Impossible traffic.
	CR. 36		"LA PAZ Passing through semi-arteria. Good pavement. Impossible traffic
	CR. 38		"LA PAZ Passing through semi-arteria. Impossible traffic.
		CR. 30 CR. 29	"HOSPITAL Passing through semi-arteria. Impossible traffic.
	CR. 68		"La 74 Passing through colector. Impossible traffic.
		CR. 43 CR. 47	"COLTABACO Passing through semi-arteria. Has critical points in Carrera (45-47). Impossible traffic.
		CR. 54 CR. 51	"COLTABACO Passing through semi-arteria. Impossible traffic.
		CR. 68 Vía 40	"La 74 One of the impossible traffic. Critical point in Vía 40.
CALLE 34	CR. 40		" La Paz Passing through colector Carrera 40. Impossible traffic.

THE STREET NAME	CRITICAL POINTS	CRITICAL SECTION	REMARKS (ARROYO)
	CR. 46		"BOLIVAR" Passing through semi-arteria. Impossible traffic.
CALLE 30	CR. 13		"Las Nieves" Passing through by a natural ditch. Impossible traffic.
	CR. 35		"HOSPITAL" Passing through colector. Bad pavement. Impossible traffic.
	CR. 40		"La Paz" Passing through colector Carrera 40. Impossible traffic.
CALLE 17	CR. 15		"Las Nieves" Passing through colector. Impossible traffic.
CR. 46	CALLE 84		"SIAPE" Passing through colector. Impossible traffic.
	CALLE 80		"COUNTRY" Passing through colector Good pavement. Impossible traffic.
	CALLE 76		"COUNTRY" Passing through colector. Impossible traffic.
	CALLE 75		"COUNTRY" Passing through colector Good pavement. Impossible traffic.
	CALLE 62		"Calle 65" Passing through colector. Good pavement. Impossible traffic.
		CALLE 80 CALLE 76	"COUNTRY" Passing through semi-arteria. Cross colector.
		CALLE 41 CALLE 34	"BOLIVAR" Passing through semi-arteria. The arroyo flow into the caño. Impossible traffic.

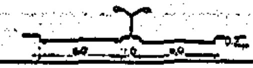
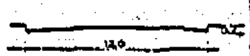
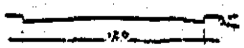
THE STREET NAME	CRITICAL POINTS	CRITICAL SECTION	REMARKS (ARROYO)
CR. 44	CALLE 84		"SIAPE" Passing through colector. Good pavement. Impossible traffic.
	CALLE 80		"COUNTRY" Passing through colector Good pavement. Impossible traffic.
	CALLE 76		"COUNTRY" Passing through colector Bad pavement. Impossible traffic.
	CALLE 75		"COUNTRY" The same characteristic of critical point 76.
	CALLE 66		" 65 " Passing through colector. Good pavement. Impossible traffic.
	CALLE 52		"LA FELICIDAD" Passing through colector. Good pavement. Impossible traffic.
	CALLE 51		"LA FELICIDAD" Passing through colector. Good pavement. Impossible traffic.
	CALLE 41		"BOLIVAR" Good pavement. Impossible traffic.
		CALLE 79 CALLE 76	"COUNTRY" Passing through semi-arteria. Impossible traffic.
		CALLE 53	"LA FELICIDAD" Passing through semi-arteria. Impossible traffic.
		CALLE 44 CALLE 41	"BOLIVAR" Passing through semi-arteria. Impossible traffic in Carrera 41 and 44.
CR. 43	CALLE 80		"COUNTRY" Passing through colector. Good pavement. Impossible traffic.

THE STREET NAME	CRITICAL POINTS	CRITICAL SECTION	REMARKS (ARROYO)
	CALLE 51		"LA FELICIDAD" Passing through colector. Bad pavement. Setting the water protection.Wall a the corner of the intersection.
	CALLE 41		"BOLIVAR" Passing through colector. Impossible traffic.
		CALLE 71 CALLE 66	"La 65" Passing through semi-arteria Carrera 43. Impossible traffic.
		CALLE 63 CALLE 59	"LA FELICIDAD" Passing through semi-arteria Carrera 43.Impossble traffic.
		CALLE 59 CALLE 54	"LA FELICIDAD" Passing through semi-arterial. Impossible traffic.
CR. 38	CALLE 54		"LA FELICIDAD" Passing through colector. Impossible traffic.
	CALLE 44		"LA PAZ" Passing through semi-arteria. Bad pavement. Impossible traffic.
	CALLE 36		"LA PAZ" Passing through semi-arteria. Impossible traffic.
		CALLE 54 CALLE 52	"LA FELICIDAD" Passing through semi-arteria after cross colector (Carrera 41). Impossible traffic.
		CALLE 48	"LA PAZ" Passing through semi-arteria. Bad pavement. Impossible traffic.

ARROYOS IN THE RUTE OF THE SEMI-ARTERIAL STREET (EXAMPLE)

TABLE 5-5-2

NAME OF THE STREET: CALLE 72
Nº OF INTERSECTIONS: 1
Nº OF SECTIONS: 3

CRITICAL PLACES			CALCULATING ELEMENTS OF THE ARROYO CAPACITY									REMARKS
INTERSECTION	SECTION	TRANSVERSAL SECTION	A m²	R m	L m	H₁ m	H₂ m	S %	n	V m/s	Q m³/s	
K68			2.4	0.188	150	20	18	1.3	0.012	3.12	7.5	ARROYO LA 7 [illegible] CIRCULANDO POR SEMI ARTERIA CAUSA PROBLEMAS AL TRAFICO
	K43+K47		2.4	0.195	420	70	60	2.4	0.012	4.34	10.4	ARROYO [illegible] CIRCULANDO POR SEMIARTERIA CONSTITUYE PUNTOS CRITICOS [illegible] NO CAUSA GRANDES PROBLEMAS AL TRAFICO
	K54+K61		2.4	0.195	700	49	32	2.4	0.012	4.34	10.4	ARROYO [illegible] CIRCULANDO POR SEMIARTERIA CAUSA PROBLEMAS AL TRAFICO EN ESTE [illegible]
	K68+VIA40		2.4	0.188	300	18	8.0	3.3	0.012	4.97	11.9	ARROYO LA 7a CAUSA PROBLEMAS AL TRAFICO EN ESTE SECTOR HASTA CONVERTIRSE EN PUNTO CRITICO PARA LA VIA 40

LEGEND

A: CROSS SECTION OF ARROYO (m²)
R: HIDRAULIC RATIO (m)
L: LENGTH OF THE SECTION
H₁: HIGHT LEVEL (m)
H₂: LOW LEVEL (m)
S: SLOPE (%)
n: MANNING COEFICIENT
V: WATER VELOCITY (m/s)
Q: ARROYO CAPACITY (m³/s)

MANNING FORMULATION: $Q = V \cdot A$
$= \frac{1}{n} R^{2/3} S^{1/2} \cdot A$

THE LIST OF ARROYO WATER FLOW (EXAMPLE)

TABLE 5-5-3

NAME OF THE STREET: CALLE 72

Nº OF INTERSECTIONS: 1

Nº OF SECTIONS: X

Nº	CRITICAL PLACES		CALCULATING ELEMENTS FOR WATER FLOW													REMARKS
	INTERSECTION	SECTION	A ha	L m	Hs m	He m	S %	V m/sec	t min	Ia $\frac{mm}{min}$	C	Q m^3/sec	Wv m^3/sec	Q/W	
18	K 68		76.2	1600	121	80	2.5	3.4	8.30	.330	0.7	7.5	18.1	.041	
										350		7.5	19.2	039	
										370		7.5	20.3	037	
										410		7.5	22.4	033	
19		K 43-K 47	31.1	900	91	70	2.3	4.3	3.50	390	0.7	10.4	8.5	1.22	
										410		10.4	8.9	1.17	
										430		10.4	9.4	1.10	
										450		10.4	9.8	1.06	
20		K 54-K 61	18	700	49	32	2.4	4.3	2.70	410	0.7	10.4	5.2	2.0	
										435		10.4	5.5	1.9	
										470		10.4	5.9	1.8	
										500		10.4	6.3	1.7	
21		K 68-VIA 40	86.2	1600	58	18	2.5	4.9	5.4	360	0.7	11.9	21.7	0.55	
										380		11.9	22.9	052	
										420		11.9	25.3	047	
										450		11.9	27.2	044	

LEGEND

A: RAIN CATCHMENT AREA (ha)

L: ARROYO LENGHT (m)

Ms: HIGHT OF THE TOP ELEVATION

Mi: HIGHT OF THE BOTTOM ELEVATION

S: SLOPE (%)

V: WATER VELOCITY (m/sec)(Ref: Table 5-5-2)

t: FLOWING TIME (min) t=L/v

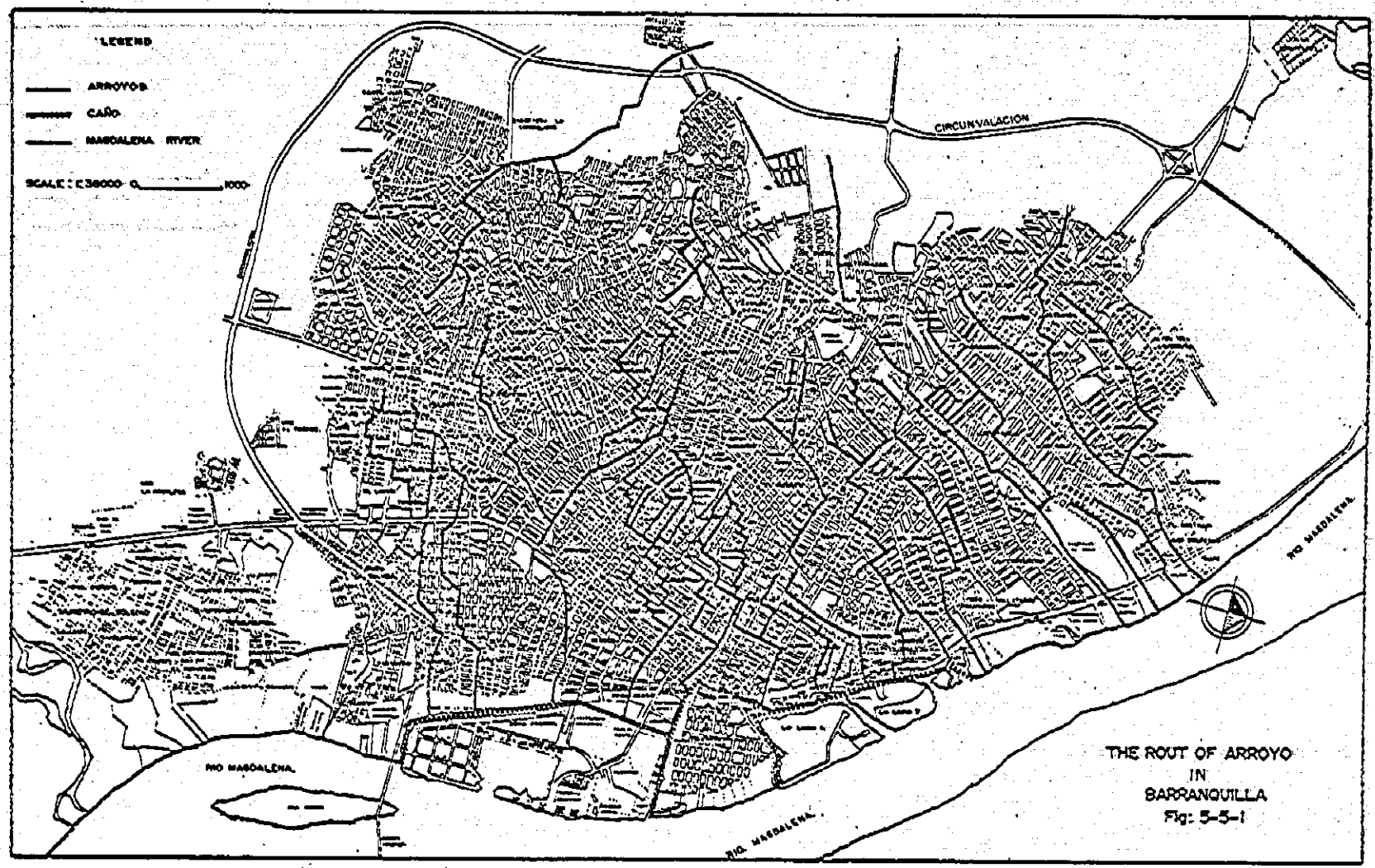
Ia: RAIN INTENSITY EACH YEARS (n=1,2,5,10 YEARS)

C: CONSTANTS

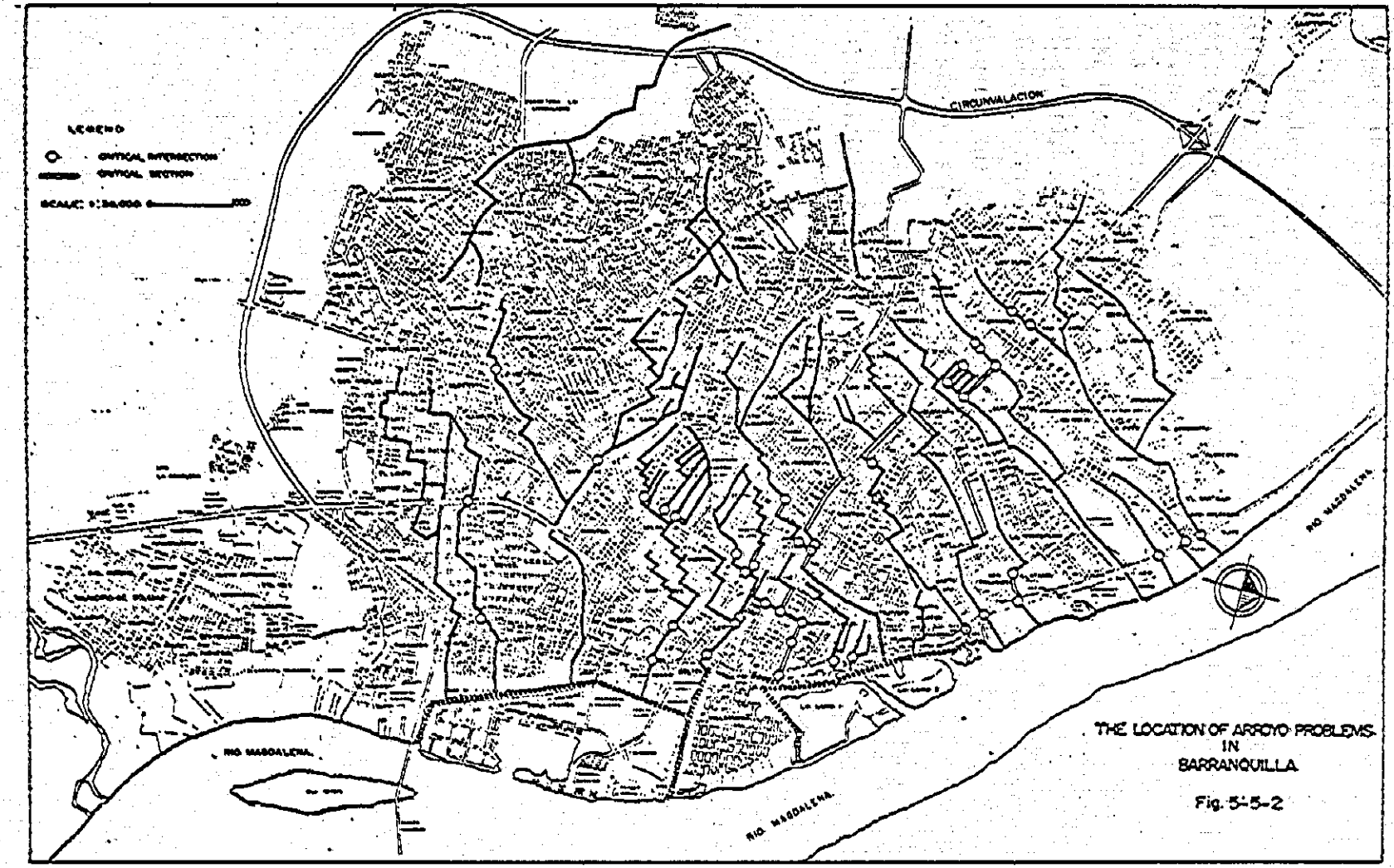
Q: ARROYO CAPACITY (m^3/sec)(Ref: Table 5-5-2)

Wv: WATER FLOW VOLUME (m^3/sec)(n=1,2,5,10 YEARS)

RATIONAL FORMULATION: Wv = C · Ia · A



THE ROUT OF ARROYO
IN
BARRANQUILLA
Fig: 5-5-1



THE LOCATION OF ARROYO PROBLEMS IN BARRANQUILLA

Fig. 5-5-2

e) Under Inspection and Proposition Of The Arroyo Counterplan

The selected critical points and sections of the roads and the streets by the Arroyo water problems explain above, are under inspection from the point of the roads and the streets improvement, new plan, and the renewal plan of El Centro. Following items are under consideration :

- The bypass or detour of the Arroyo routes plan.
- The bridge construction plan.
- The pipe culvert construction plan.

Following the information under collection with the roads and the streets study :

- The land use and housing conditions; possibility of the land acquisicion of the facilities construction.
- The improvement and plan of the roads and streets.

The Arroyo counterplan on the roads and the streets will be carried out in the next stop of the study.

CHAPTER 6. TRAFFIC ENGINEERING AND MANAGEMENT

6-1. General.

The existing traffic flow conditions on arterial streets based on the results mainly of the travel time survey were shown in the progress report 1, which makes it clearly that the traffic problems were caused by the main reasons for traffic congestion.

In the progress Report II, in addition to another field survey, the analysis of existing traffic management problems were carried out.

The contents of the additional survey is as follows:

1) Sampling Parking Survey on-street.

a) Survey Items
- Average parking turnover rate
- Average parking duration

b) Survey Purpose
The purpose of the survey to study on-street parking, and thus to study the effectiveness establishing a toll parking lot and its standard, by means of calculating the average parking duration and the turnover rate at each of the links with high parking rates.

c) Survey Schedule
The sampling parking survey on-street was carried out one day in November. In this survey, after analyzing the data obtained by the survey of parking vehicles survey on-street by zone, the survey area for the survey, proper as sample, were selected.

d) Survey Methods
° Survey area
- The survey area is shown in Fig. 6-1-1, which is on the streets surrounded by Cr. 41, Cr.43, Cll. 39 and Cll. 37.

° Survey contents

This survey observed the condition of vehicles which were going to park and were parking at the designated links.
The observation items are as follows:

- Arrival time for parking
- Departure time after parking
- Plate number of vehicles
- Vehicle classification
- Link number
- Walking distance (Origin-Destination)

The record sheet is shown in Fig. 6-1-2 .
The survey time was fourteen hours from 7:00 to 21:00.

2) Off-street parking survey (Toll parking lot)

a) Survey Items

- Average parking turnover rate
- Average parking duration
- Peak hour rate

b) Survey Purpose

The survey's purpose is to examine the use of off-street toll parking lots. It is to study the effectiveness of establishing the toll off-street parking lot by means of grasping the average parking duration and the turnover rate of the toll off-street parking lot.

c) Survey Schedule

This survey was conducted on the same day as the on-street parking survey.

d) Survey Methods

- Survey point
- Survey point is shown in Fig. 6-1-1. The parking lot is located in the Centro (Parqueadero Las Flores). The capacity of the parking lot is shown in Table 6-1-1.

Table 6-1-1. Capacity of parking lot

Capacity	Charge	Location
180 Vehicles	20 pesos/hour	Cr. 43, Cll 39

- Survey Contents

This survey observed vehicles entering into and exiting from the toll parking lot. The enumerator recorded the following items:

- Arrived time for parking
- Departure time after parking
- Plate number of vehicles
- Vehicle classification

The record sheet is shown in Fig. 6-1-2.

FIG 6-1-1 SURVEY AREA

FIG. 6-1-2 SURVEY SHEET

ENCUESTA DE ESTACIONAMIENTO Nº____

Nombre Del Encuestador _____

Lugar _____

Nº	Número De Placa		Tiempo De Estacionamiento		Clasificación			Distancia Caminada Dirección
	Registro	Número	Llegada	Salida	Carro de Pasajero	Camión 5 Ton. V	Camión 5 Ton. ^	

ENCUESTA DE ESTACIONAMIENTO Nº____

Nombre Del Encuestador _____

Lugar _____

Antes _____ Despues _____

	Hacia Adentro
	Hacia Afuera

Nº	Número De Placa		Tiempo De Estacionamiento		Clasificación			Comentarios
	Registro	Número	Hora	Minuto	Carro de Pasajero	Camión 5 Ton. V	Camión 5 Ton. ^	

6-2 Parking Condition.

6-2-1 Parking Vehicle on Street by Zone.

The parking density by zone is shown in Table 6-2-1. and Fig. 6-2-1. While Fig . 6-2-2 show the parking density by link, the parking density indicates the percentage of parking demands per parking capacity on the street. The capacity is a regulatory capacity, which is conceived of as a function of the extension of streets where parking is authorized by regulations.

Distribution of parking density is:

The central area surrounded by Carrera 38, Calle 45, Calle 30, and Carrera 46, has high parking density. Especially in businness hours (10-11, 16-17), the parking density in P/T Zone No. 3 and 4 show above 100%, which makes it clear that violative parking exist on the street. On the other hand, P/T Zone No. 1, 2, 5 and No. 6 show the density of 50% to 100%, while the density is nearly 100% in P/T No. 1 and 5. In the other P/T Zone, the density is below 50%.

Hourly distribution of parking density is as follows:

(1) 08:00 - 09:00: P/T Zone No. 1, 2, 3, 4 and 5 show high density, Zone No. 1 and 2 show nearly density of 90%.

(2) 10:00 - 11:00 & 16:00 - 17:00: P/T Zone No. 3 and 4 show a high density increased.

(3) 19:00 - 20:00: P/T Zone No. 3,4 and 5 in the central area show a density of 30% to 50%, while the density is below 30% in all other zones.

6-2-2 Parking purpose of destination (sample survey)

A parking purpose by a sampling interview survey is shown in Fig. 6-2-1, Table 6-2-2.

An interview survey of parking drivers resulted in the finding that approximately 42% are parking for businness purposes, about 23% for going to office or school, 12% for going home, and 23% for miscellaneous purposes. 10% of the miscellaneous purposes are shopping, going to restaurant, and recreation.

The parking purposes by zone are as follows:

(1) In central area, P/T Zone No. 1, 2, 5 and 6 show a high percentage of 40% and 67% for business purposes, and P/T Zone No. 3 and 4 show a high percentage of 38% to 60% for going to the office.

In the P/T Zones No. 7 - No. 14 (excepting No.9 is for going office), there is a high percentage for business purposes.

(2) In other areas, where the percentage of parking for business /going to office is relatively high are P/T Zone No. 25, 26, 28 and 29. While such percentage is high for business purposes in all the other zones.

6-2-3 Average Walking Distance (Sampling Survey).

Average walking distance by a sampling survey is shown in Fig. 6-2-4. The average walking distance from the point of parking to the dstination is only approximately 50 meters.

6-2-4 Parking Duration and Parking Turnover Rate.

Parking duration and parking turnover rate by link in a high parking density area is shown in Table 6-2-3.

In the area of no-parking restriction, the average parking duration is about fourteen minutes. On the other hand , in the area of unrestricted parking, the average parking duration is seventy-eight minutes. The value of no parking restriction is a quarter that of the unrestricted parking time.

According to the sampling interview survey, an average parking duration which drivers desire is about fifty-seven minutes (Fig. 6-2-5). Average parking duration in the area of unrestricted parking actually differs by twenty minutes.

The average parking turnover rate is approximately 6.4.

6-2-5 Off-street Parking (Toll parking lot)

The traffic variation of a toll parking lot is Fig. 6-2-6, and parking duration is shown in Fig. 6-2-7, and Table 6-2-4.

According to the demands of a toll parking lot, a peak hour rate of traffic volume is about 11.2% and peak hour is a period of time between 12:00 - 1:00 midday.

The average parking duration of the toll parking lot is about 130 minutes, which is longer than the parking duration on the street.

The average parking turnover rate is 1.4. This value is in small proportion compared to on-street parking.

6-2-6 Parking Density and Traffic Congestion Area.

A relationship map between the parking density area to the traffic congestion area is shown in Fig. 6-2-8.

To find the traffic problem area where parking problems are relate of traffic congestion problems, a distribution map is indicated by the countour line with classified congestion/parking density.

An indicator of traffic congestion will be expressed by travel speeds on streets.

The criteria for evaluation of traffic problem area is as follows:

° Parkin density: above 50%
° Travel speed: under 10km/hour

The realtionship between the two is as follows:

(1) Traffic problem areas will be in the central area surrounded by Carrera 38, Call 45, Calle 30, and Carrera 46. Another limited area located in the north commercial area near Calle 72 is also shown.

(2) Hourly distribution of traffic problems are as follows:

- 08:00 - 09:00: Area surrounded by Cll 45 - Cr. 38 - Cr. 46 - Cll 7 will be a problem, in addition to around Cr. 46 - Cll 72.

- 10:00 - 11:00: Problem areas in area surrounded by Cll 45 - Cr. 38 - Cr. 46 - Cll 30.

- 16:00 - 17:00: Problem area in the central area connecting with arterial streets, which coincides with the heavy traffic concentration in the central area. These are as follows: Cr. 38 - Cll 38, Cll 38 - Cll 37, Cr. 46 - Cll 45.

- 19:00 - 21:00: The problem areas which have been decresing, are as follows:

Cll 30 section Cr. 38 - Cr. 46
Cll 37 " "
Cll 38 " "
Cll 40 " Cr. 45 - Cr. 30
Cll 41 " "
Cr. 38 " Cll 45 - Cll 30

TABLE.6-2-1 PARKING DENSITY BY ZONE

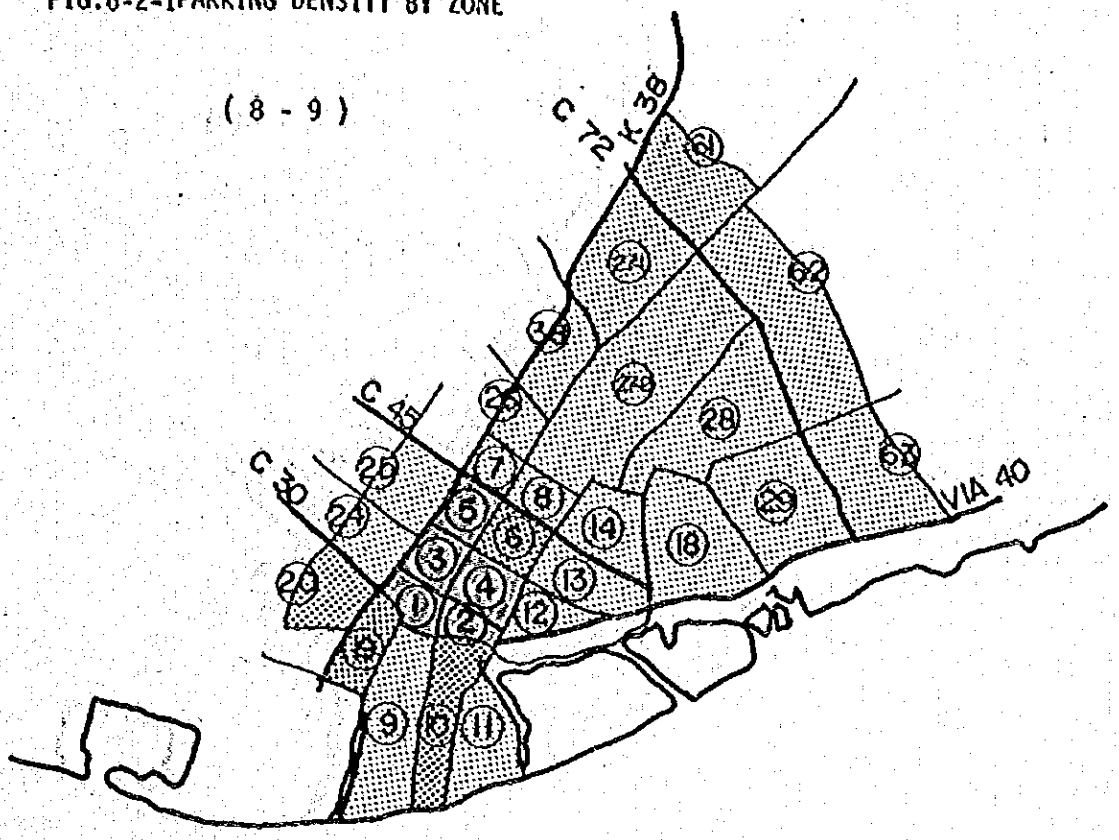
UNIT: %

P/T ZONE\TIME	8 - 9	10 - 11	16 - 17	19 - 20
1	90.0	95.0	89.0	12.0
2	64.7	61.1	75.9	7.7
3	77.0	104.0	107.7	30.0
4	96.6	113.2	123.0	32.9
5	68.0	82.0	75.0	30.0
6	33.0	53.0	50.0	9.7
7	24.7	28.6	32.5	18.8
8	26.8	28.8	27.2	13.1
9	18.7	22.1	7.8	1.0
10	38.3	33.5	22.7	5.0
11	13.7	12.6	16.8	1.1
12	21.8	37.3	33.6	4.3
13	11.5	15.0	12.1	6.9
14	5.3	6.4	5.2	2.5
18	5.9	6.3	5.8	6.4
19	43.1	45.0	37.9	16.5
20	5.3	5.3	5.3	5.3
24	24.9	24.4	25.3	12.9
25	21.8	18.3	19.9	10.4
26	11.8	10.4	16.6	6.8
27-1	9.0	10.8	11.7	9.0
27-2	5.6	8.1	7.0	7.2
28	5.0	6.5	7.0	8.5
29	4.7	4.4	5.5	5.5
38	11.7	8.5	10.2	13.0
61	6.0	5.9	5.5	5.3
62	5.7	6.7	8.0	5.0

NOTE: Parking density = Demand /Capacity (Parking vehicles on street)

FIG.6-2-1PARKING DENSITY BY ZONE

(8 - 9)



(10 - 11)

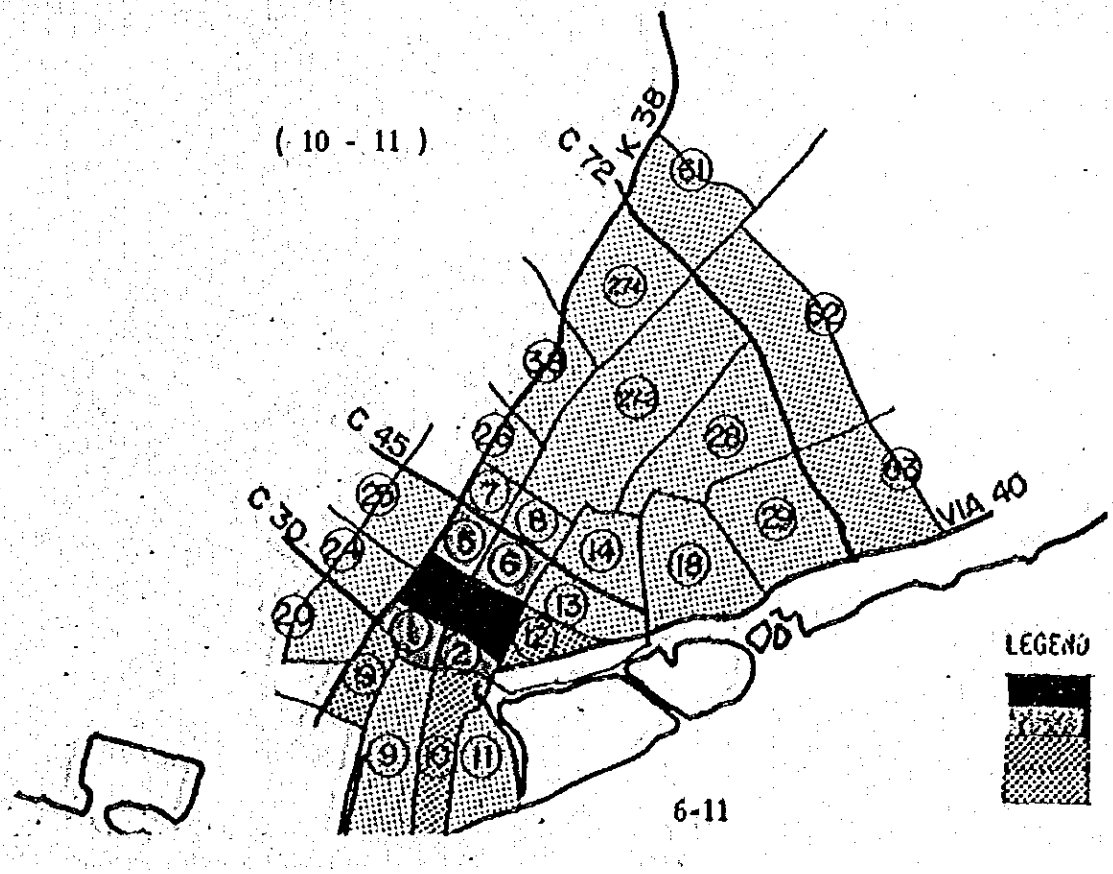
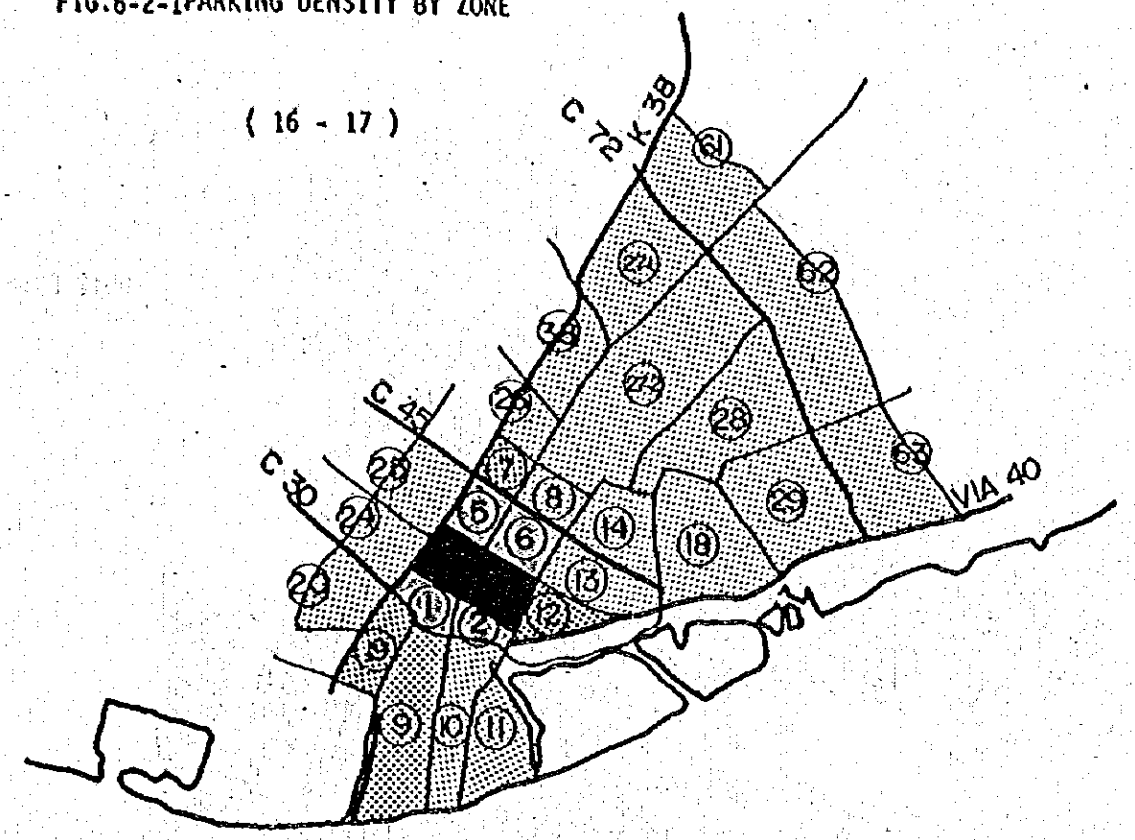
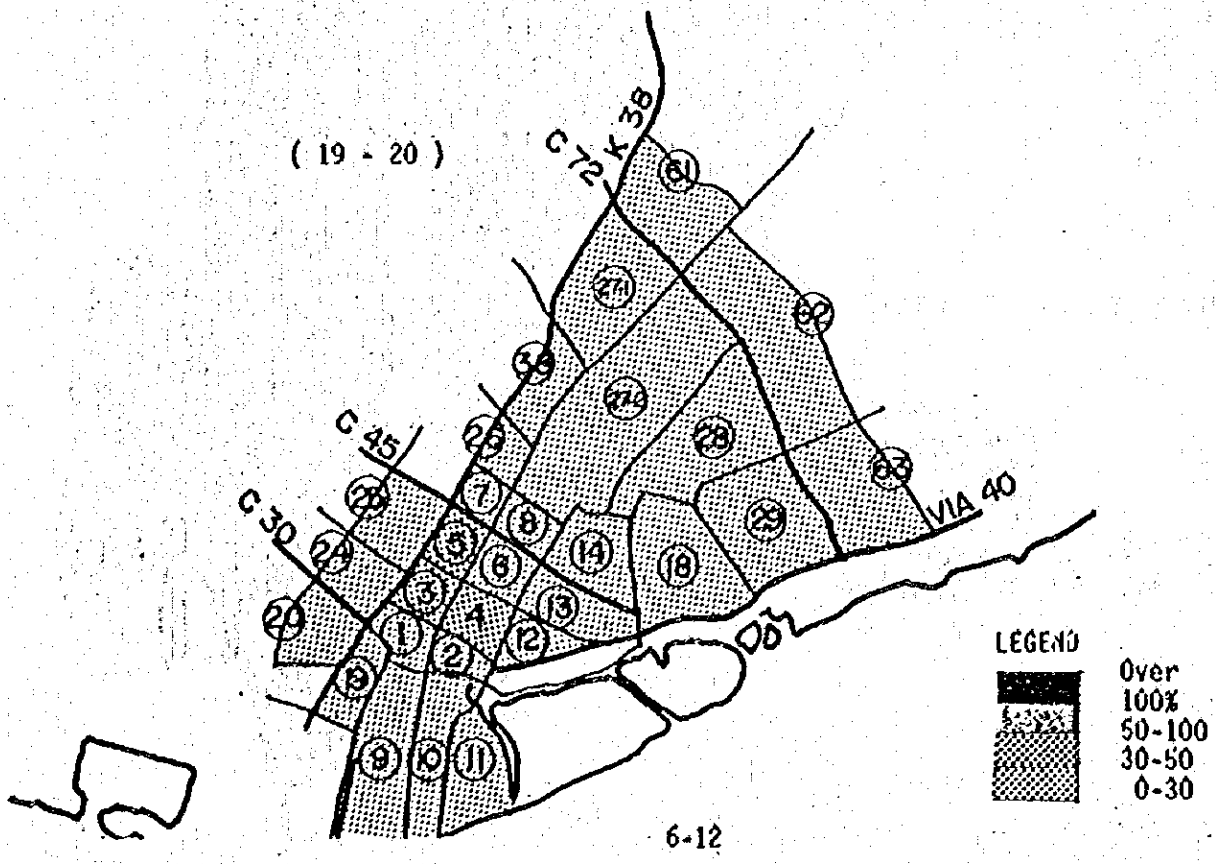


FIG.6-2-1PARKING DENSITY BY ZONE

(16 - 17)



(19 - 20)



8:00-9:00

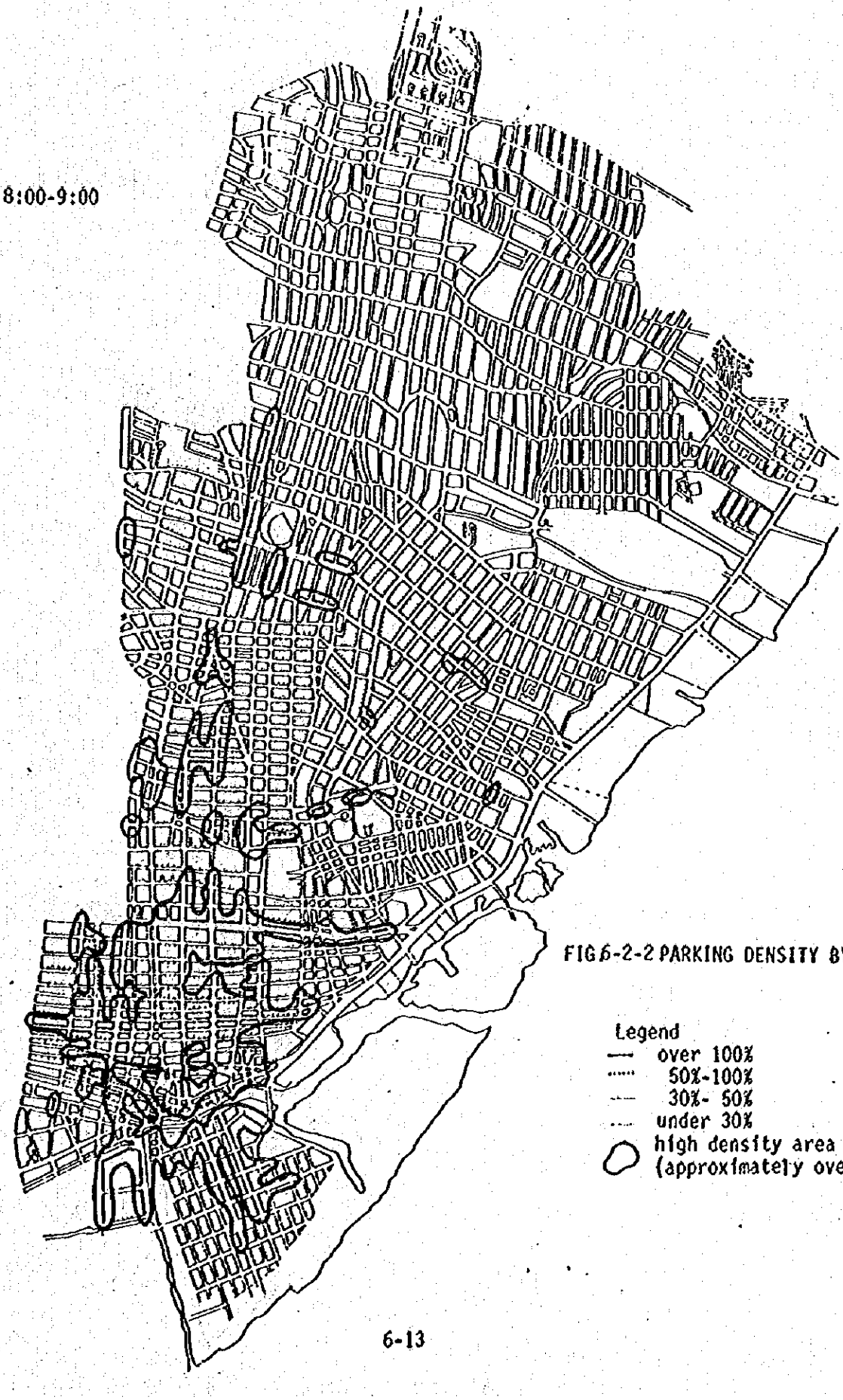


FIG 6-2-2 PARKING DENSITY BY LINK

10:00-11:00

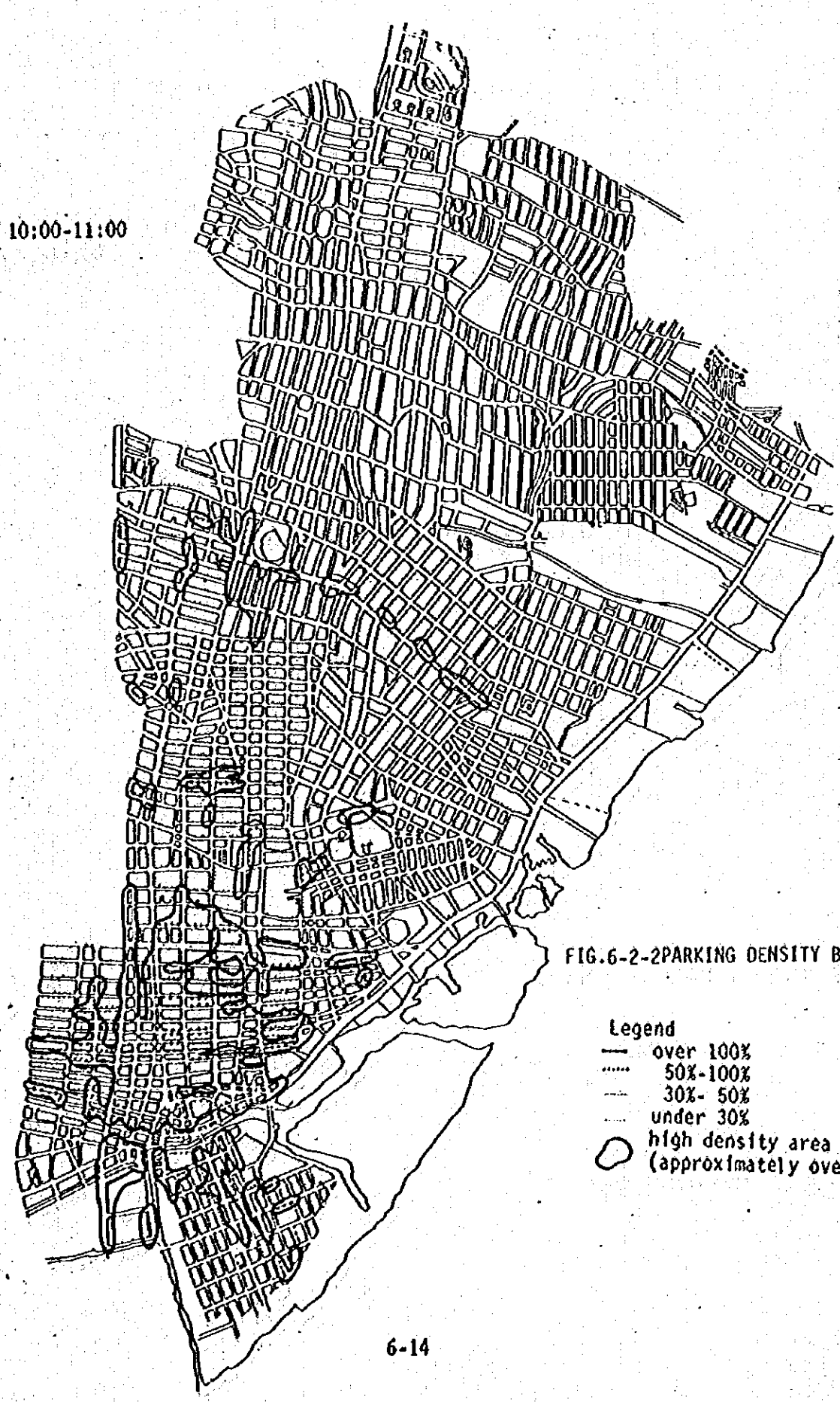


FIG.6-2-2PARKING DENSITY BY LINK

Legend
- over 100%
- 50%-100%
- 30%- 50%
- under 30%
- high density area (approximately over 50%)

16:00-17:00

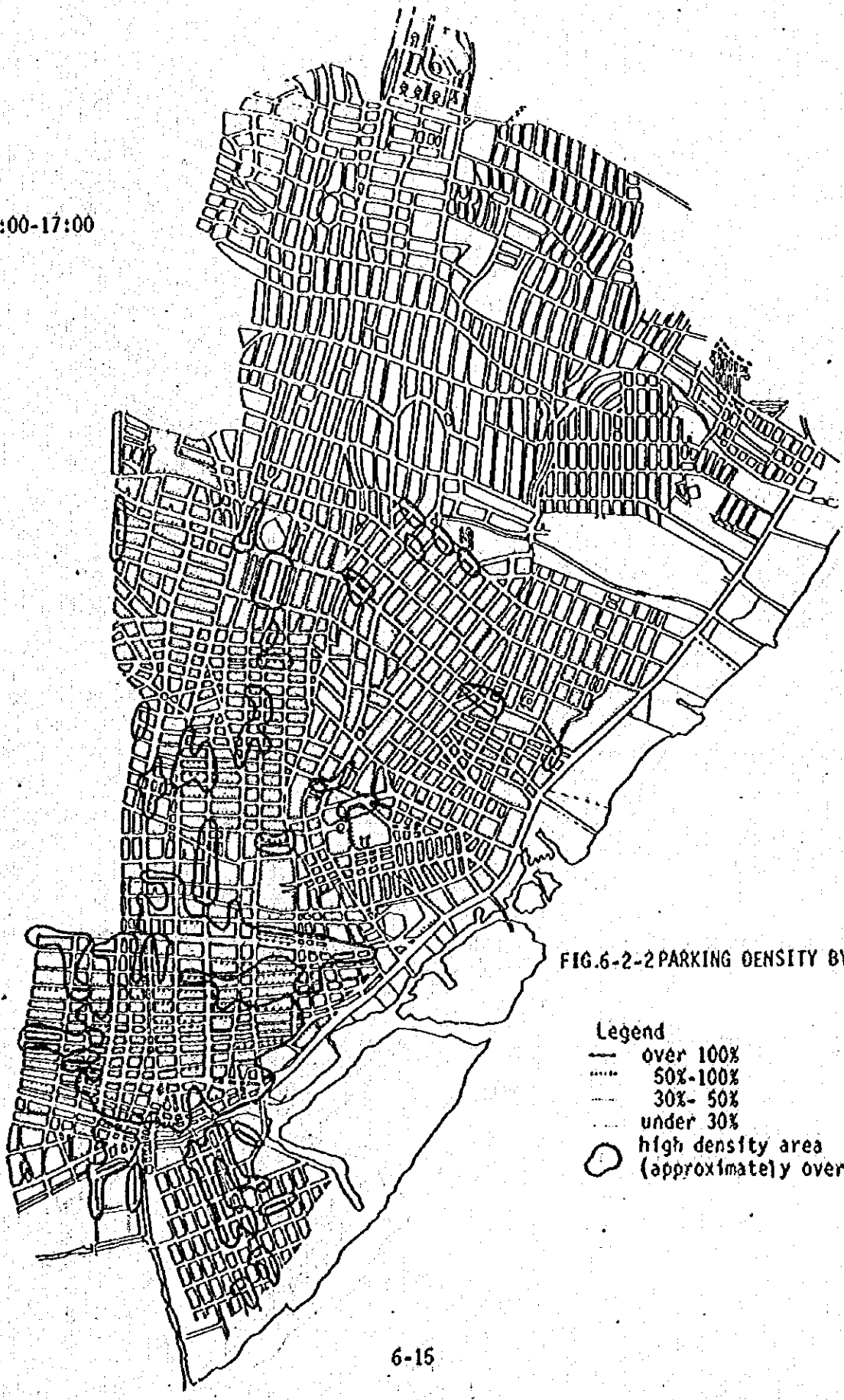


FIG.6-2-2 PARKING DENSITY BY LINK

Legend
- over 100%
- 50%-100%
- 30%- 50%
- under 30%
- high density area (approximately over 50%)

19:00-20:00

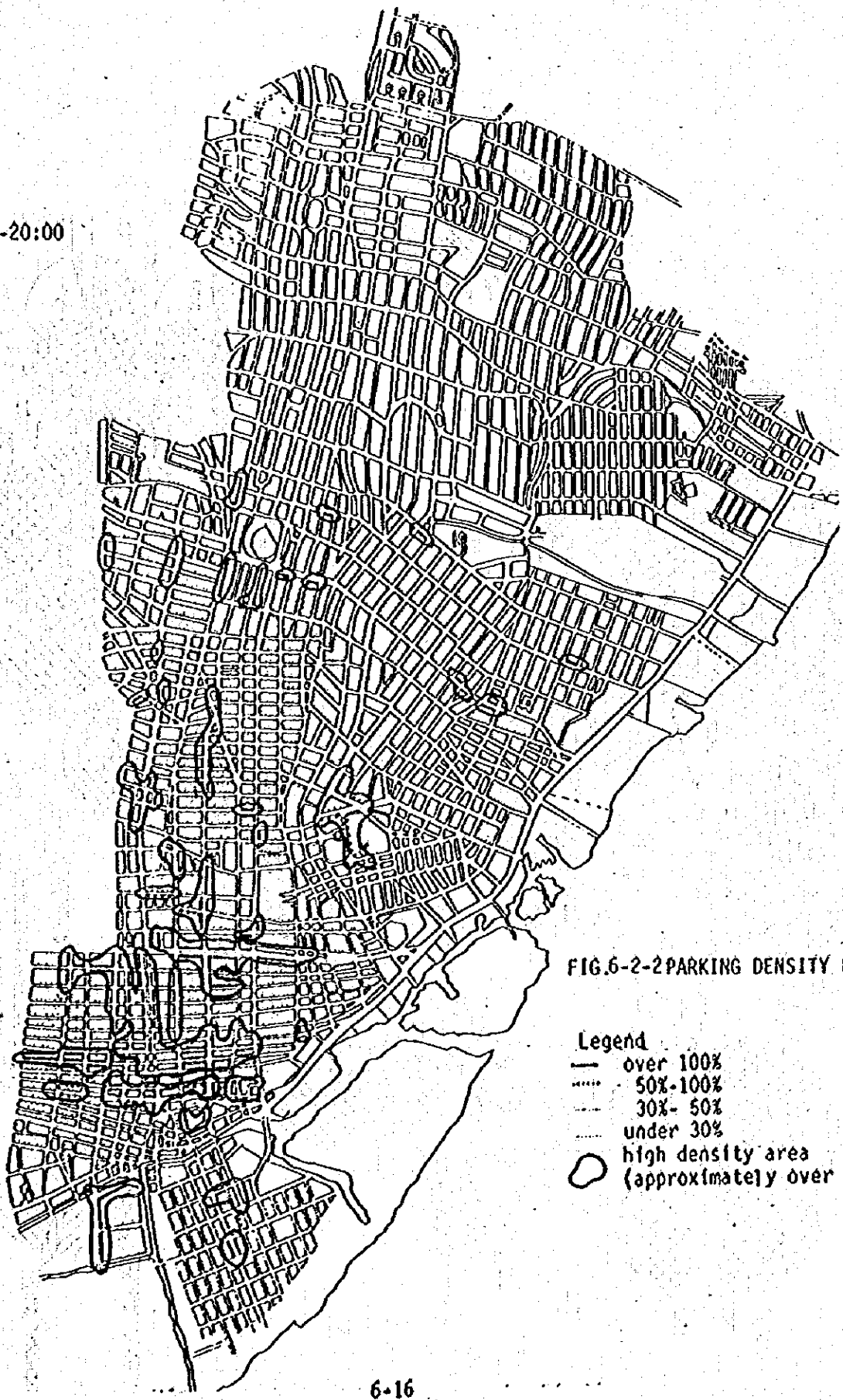


FIG.6-2-2 PARKING DENSITY BY LINK

Legend
- over 100%
- 50%-100%
- 30%- 50%
- under 30%
- high density area (approximately over 50%)

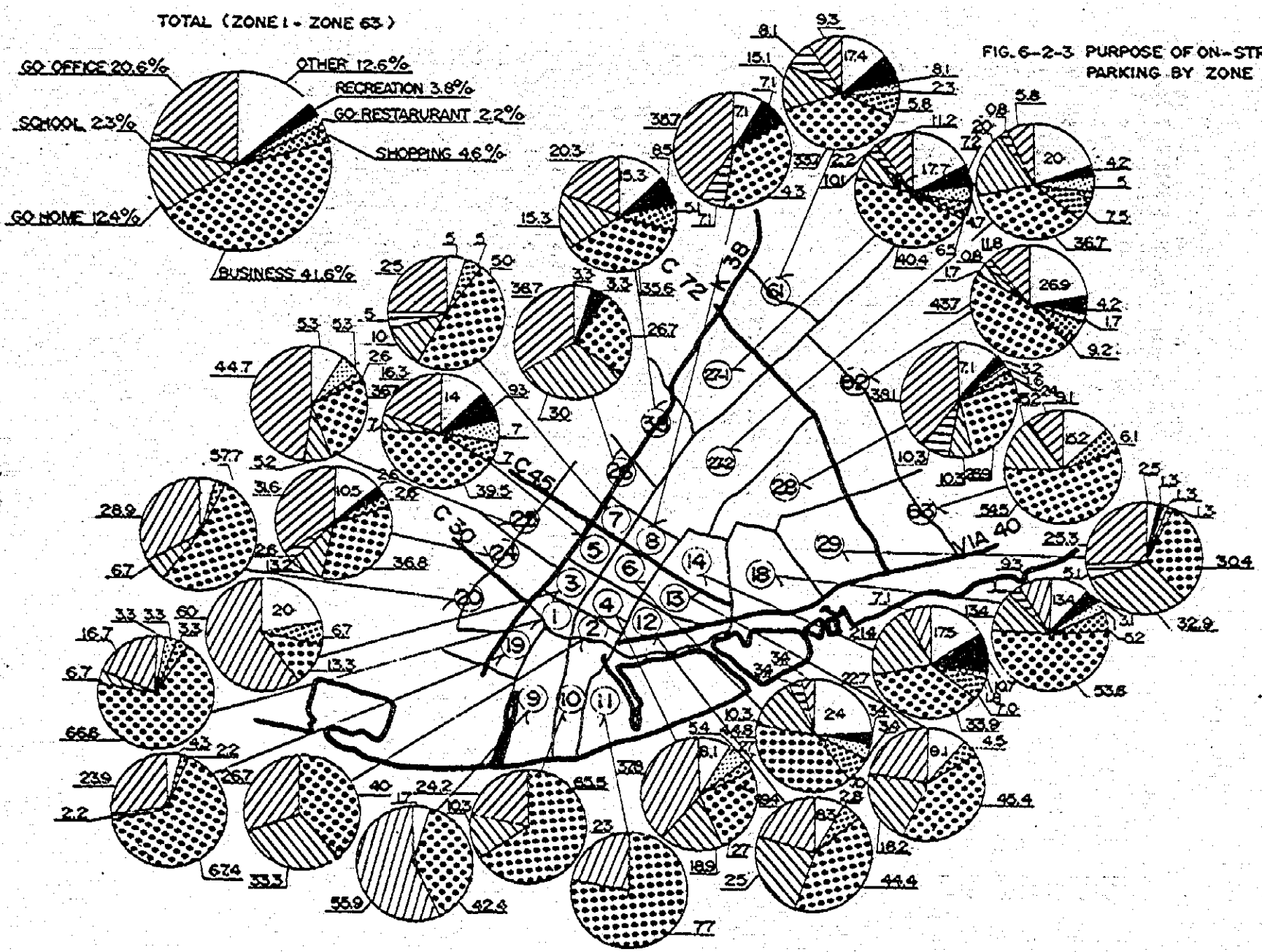


FIG. 6-2-3 PURPOSE OF ON-STREETT PARKING BY ZONE

TABLE.6-2-2 PARKING PURPOSE ON STREET (INTERVIEW)

UNIT:DRIVER

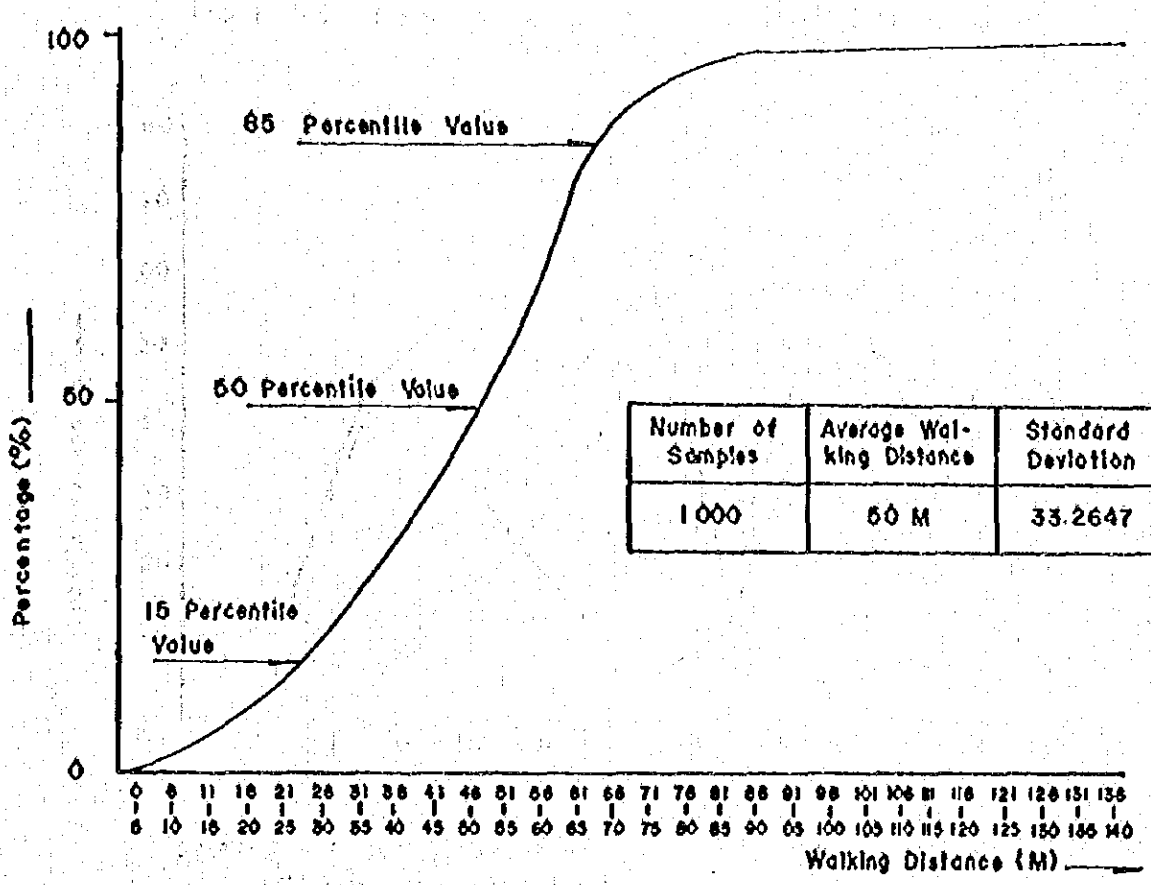
P/T ZONE	PURPOSE	1. GO OFFICE	%	2. GO SCHOOL	%	3. GO HOME	%	4. BUSINESS	%	5. SHOPPING	%	6. GO RESTARUANT	%	7. RECREATION	%	8. OTHERS	%	TOTAL	%
1	5	16.7	-	-	2	6.7	20	66.6	1	3.3	1	3.3	-	-	1	3.3	30	100
2	4	26.7	-	-	5	33.3	6	40.0	-	-	-	-	-	-	-	-	15	100
3	18	60.0	-	-	-	-	4	13.3	2	6.7	-	-	-	-	6	20.0	30	100
4	14	37.8	-	-	7	18.9	10	27.0	1	2.7	2	5.4	-	-	3	8.1	37	100
5	7	16.3	-	-	3	7.0	17	39.5	3	7.0	3	7.0	4	9.3	6	14.0	43	100
6	1	3.4	1	3.4	3	10.3	13	44.8	2	7.0	1	3.4	1	3.4	7	24.0	29	100
7	5	25.0	1	5.0	2	10.0	-	50.0	1	5.0	-	-	-	-	1	5.0	20	100
8	5	35.7	1	7.1	-	-	6	43.0	-	-	-	-	1	7.1	1	7.1	14	100
9	33	55.9	-	-	-	-	25	42.4	-	-	-	-	-	-	1	1.7	59	100
10	14	24.2	-	-	6	10.3	38	65.5	-	-	-	-	-	-	-	-	58	100
11	6	23.0	-	-	-	-	20	77.0	-	-	-	-	-	-	-	-	26	100
12	7	19.4	-	-	9	25.0	16	44.4	1	2.8	-	-	-	-	3	8.3	36	100
13	10	22.7	-	-	8	18.2	20	45.4	2	4.5	-	-	-	-	4	9.1	44	100
14	4	7.1	-	-	12	21.4	20	33.9	4	7.0	1	1.8	6	10.7	10	17.5	57	100
18	9	9.3	1	1	13	13.4	52	53.6	5	5.2	1	1.0	3	3.1	13	13.4	97	100
19	11	23.9	1	2.2	-	-	31	67.4	1	2.2	-	-	-	-	2	4.3	46	100
20	13	28.9	-	-	3	6.7	26	57.7	1	2.2	-	-	-	-	2	4.4	45	100
24	12	31.6	1	2.6	5	13.2	14	36.8	1	2.6	-	-	1	2.6	4	10.5	38	100
25	17	44.7	-	-	2	5.2	14	36.7	1	2.6	2	5.3	-	-	2	5.3	38	100
26	11	36.7	-	-	9	30.0	8	26.7	-	-	-	-	1	3.3	1	3.3	30	100
27-1	31	11.2	6	2.2	28	10.1	112	40.4	18	6.5	13	4.7	20	7.2	49	17.7	277	100
27-2	7	5.8	1	0.8	24	20.0	44	36.7	9	7.5	6	5.0	5	4.2	24	20.0	120	100
28	48	38.1	13	10.3	13	10.3	34	26.9	3	2.4	2	1.6	4	3.2	9	7.1	126	100
29	20	25.3	4	5.1	4	5.1	24	30.4	1	1.3	1	1.3	1	1.3	2	2.5	79	100
38	12	20.3	-	-	9	15.3	21	35.6	3	5.1	1	-	5	8.5	9	15.3	59	100
61	8	9.3	7	8.1	13	15.1	29	33.7	5	5.1	2	2.3	7	8.1	15	17.4	86	100
62	14	11.8	1	0.8	2	1.7	52	43.7	11	9.2	2	1.7	5	4.2	32	26.9	119	100
63	3	9.1	-	-	5	15.2	18	54.5	2	6.1	-	-	-	-	5	15.2	33	100
TOTAL	349	20.6	38	2.3	209	12.4	704	41.6	77	4.6	37	2.2	64	3.8	213	12.6	1691	100

TABLE. 6-2-3 Parking Situation on Street

Link Number \ Item	Number of Total Parking Vehicle A	Number of Parking Demand B	Number of Maximum Parking & Time C	Number of Average Parking D= A/56	Number of Minimum Parking E	Capacity F	Maximum Parking Percentage G= C/F	Average Parking Percentage H= D/F	Minimum Parking Percentage I= E/F	Average Parking Turnover Rate J= B/F	Average Parking Duration K= total parking duration/B
* 110-1-08.C37	207	117	12 15:00	4	1	0	-	-	-	-	20.5 s=21.5509
* 110-1-08.K41	135	104	7 11:00	2	1	0	-	-	-	-	13.6 s=13.3842
* 116-4-15.K41	97	86	7 15:30	2	0	0	-	-	-	-	6.4 s= 7.2927
* Total	439	307	17 14:45	8	1	0	-	-	-	-	14.2 s=16.9387
116-5-02.C39	615	141	29 10:00	11	1	18	161.1	61.0	5.5	7.8	55.4 s=63.2137
110-1-08.C38	1405	217	40 16:30	25	4	35	114.2	71.7	11.4	6.2	89.6 s=97.8827
116-5-01.C39	1408	239	46 10:30	25	4	41	122.2	61.2	9.8	5.8	81.0 s=72.1940
Total	3428	597	107 10:30	61	4	94	113.8	64.9	42.6	6.4	78.4 s=82.3990

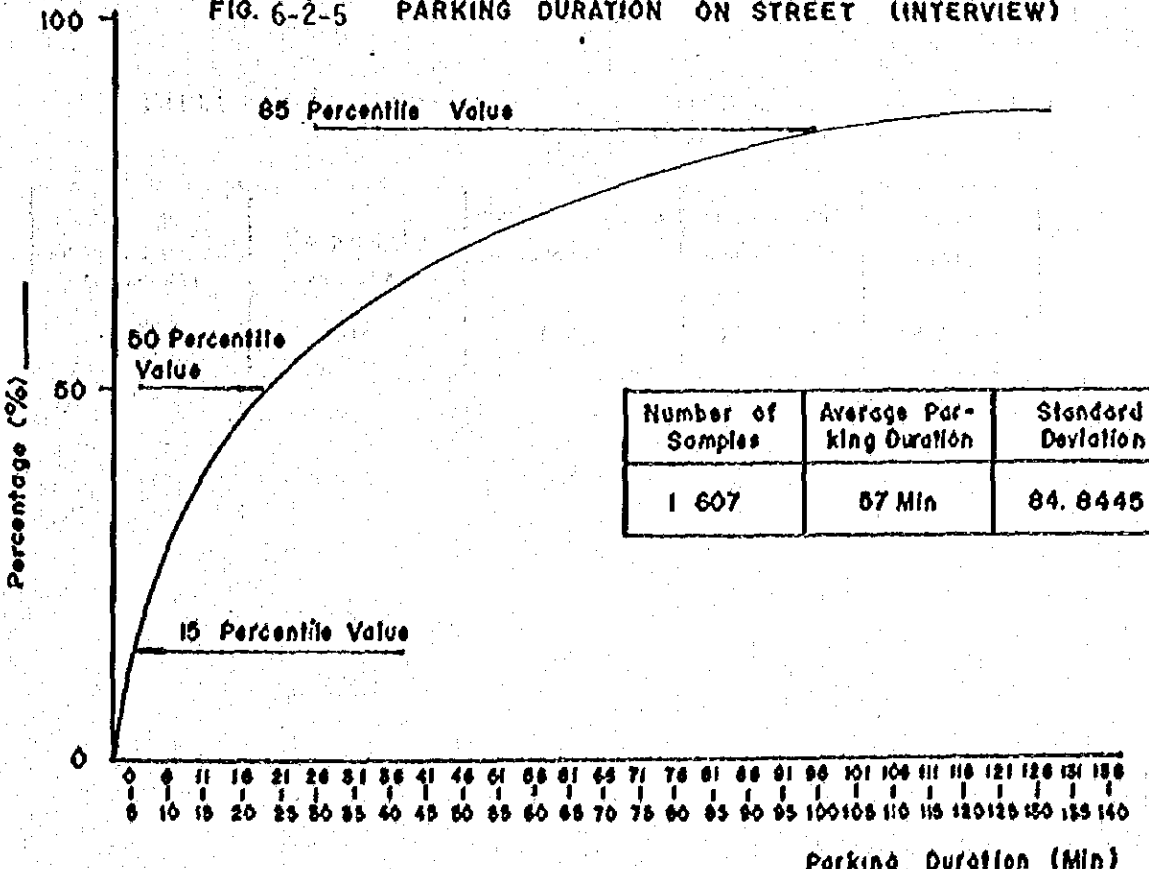
Notes : * Mark are indicated area of no-parking restriction.
56 times = 14 hours ÷ 15 minutes.
s = standard deviation.

FIG. 6-2-4 AVARAGE WALKING DISTANCE ON STREET (INTERVIEW)



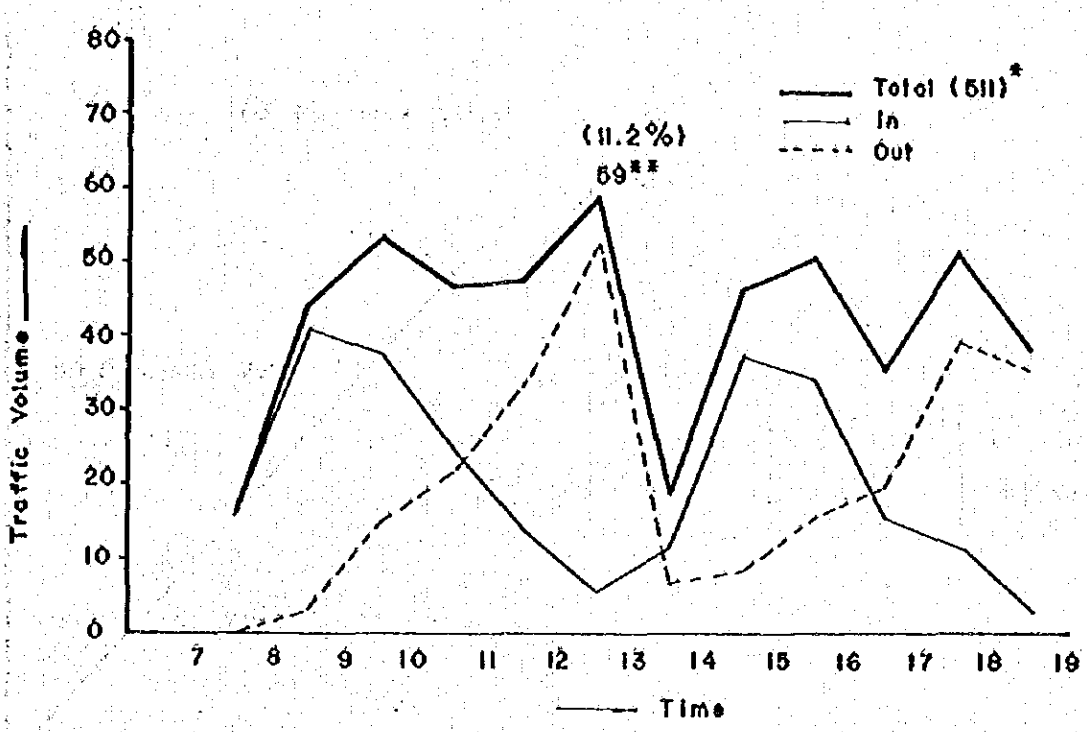
Number of Samples	Average Walking Distance	Standard Deviation
1000	50 M	33.2647

FIG. 6-2-5 PARKING DURATION ON STREET (INTERVIEW)



Number of Samples	Average Parking Duration	Standard Deviation
1 607	57 Min	84. 8445

FIG 6-2-6 Traffic Variation of Toll Parking Lot
(Off-Street)

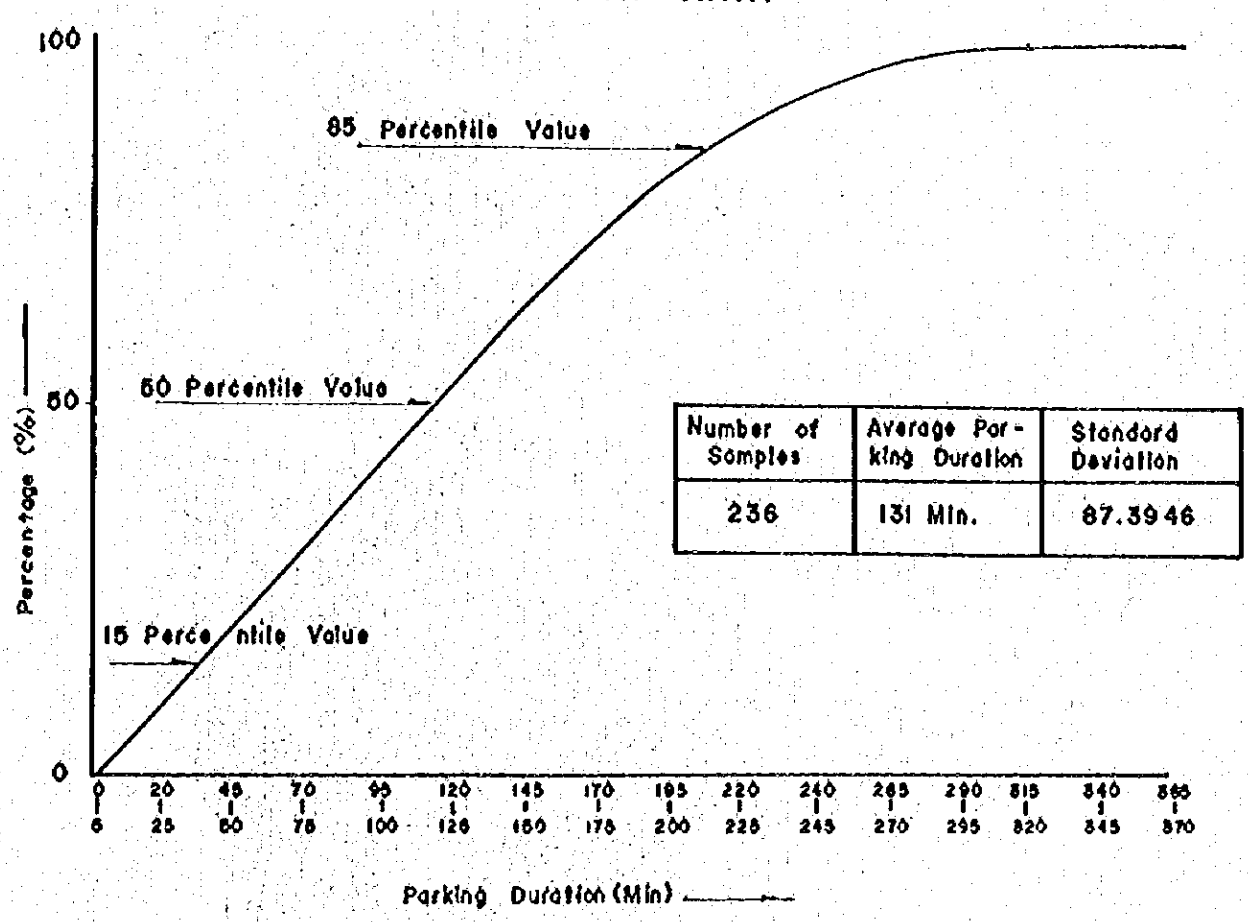


NOTA : * 13 Hours Parking Demands
** Peak Hour Parking Demands

TABLE 6-2-4 Average Parking Duration Of Toll Parking Lot
(Off-Street)

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

FIG. 6-2-7 PARKING DURATION OF TOLL PARKING LOT
(Off Street)



Number of Samples	Average Parking Duration	Standard Deviation
236	131 Min.	87.3946

8:00-9:00

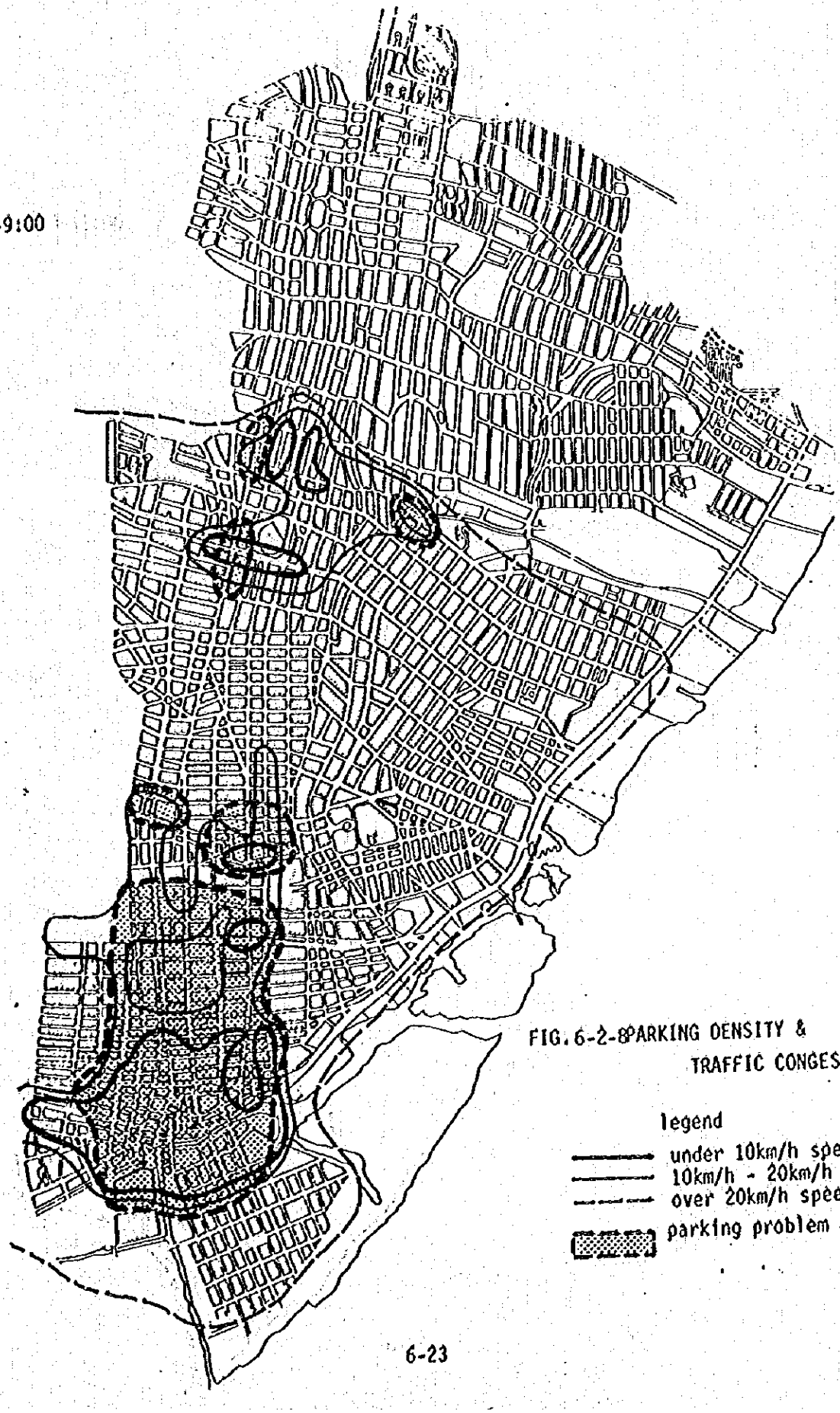


FIG. 6-2-8 PARKING DENSITY & TRAFFIC CONGESTION AREA

legend

- under 10km/h speed
- 10km/h - 20km/h speed
- over 20km/h speed
- parking problem area

10:00-11:00

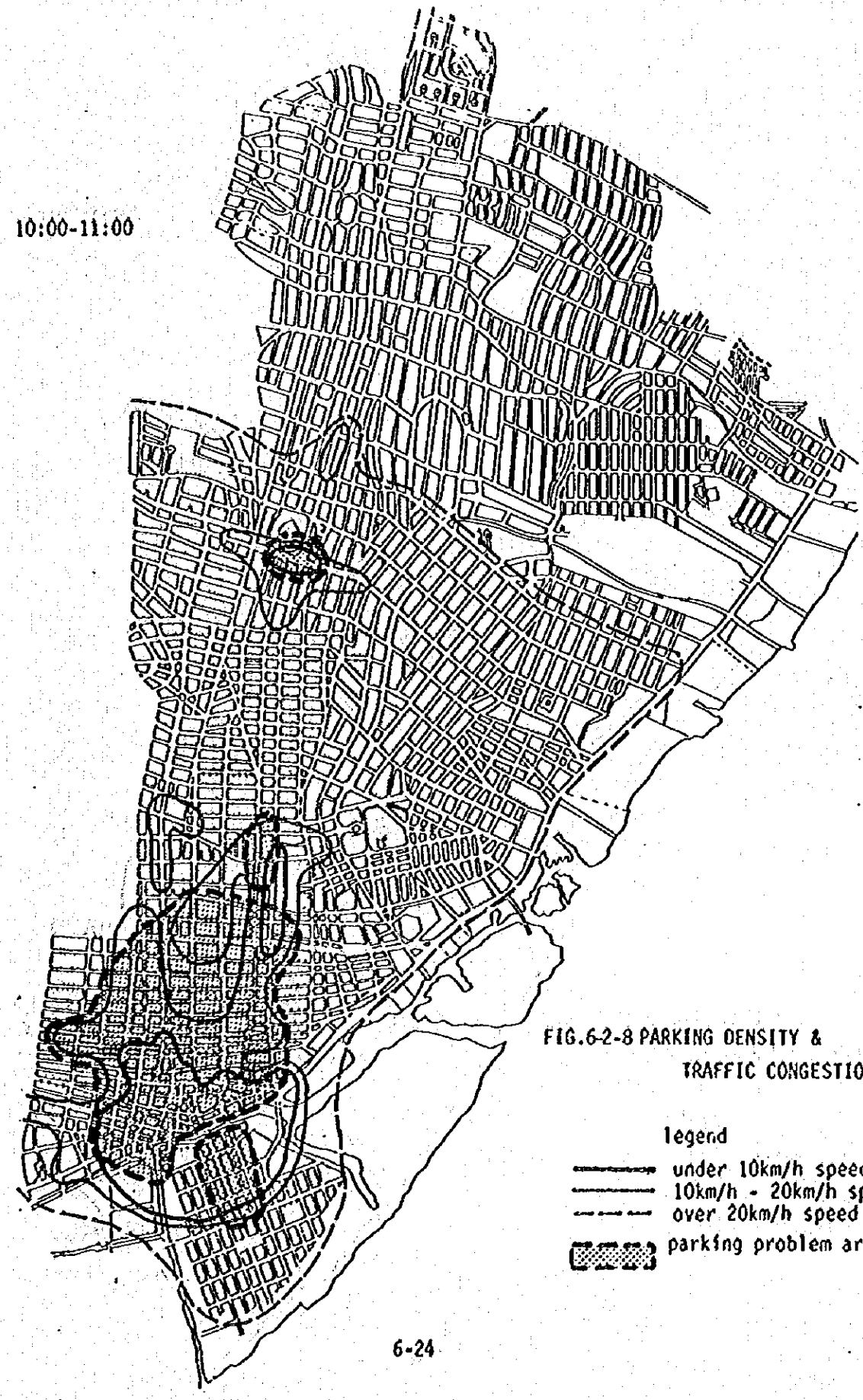


FIG.6-2-8 PARKING DENSITY &
TRAFFIC CONGESTION AREA

legend

- under 10km/h speed
- 10km/h - 20km/h speed
- over 20km/h speed
- parking problem area

16:00-17:00

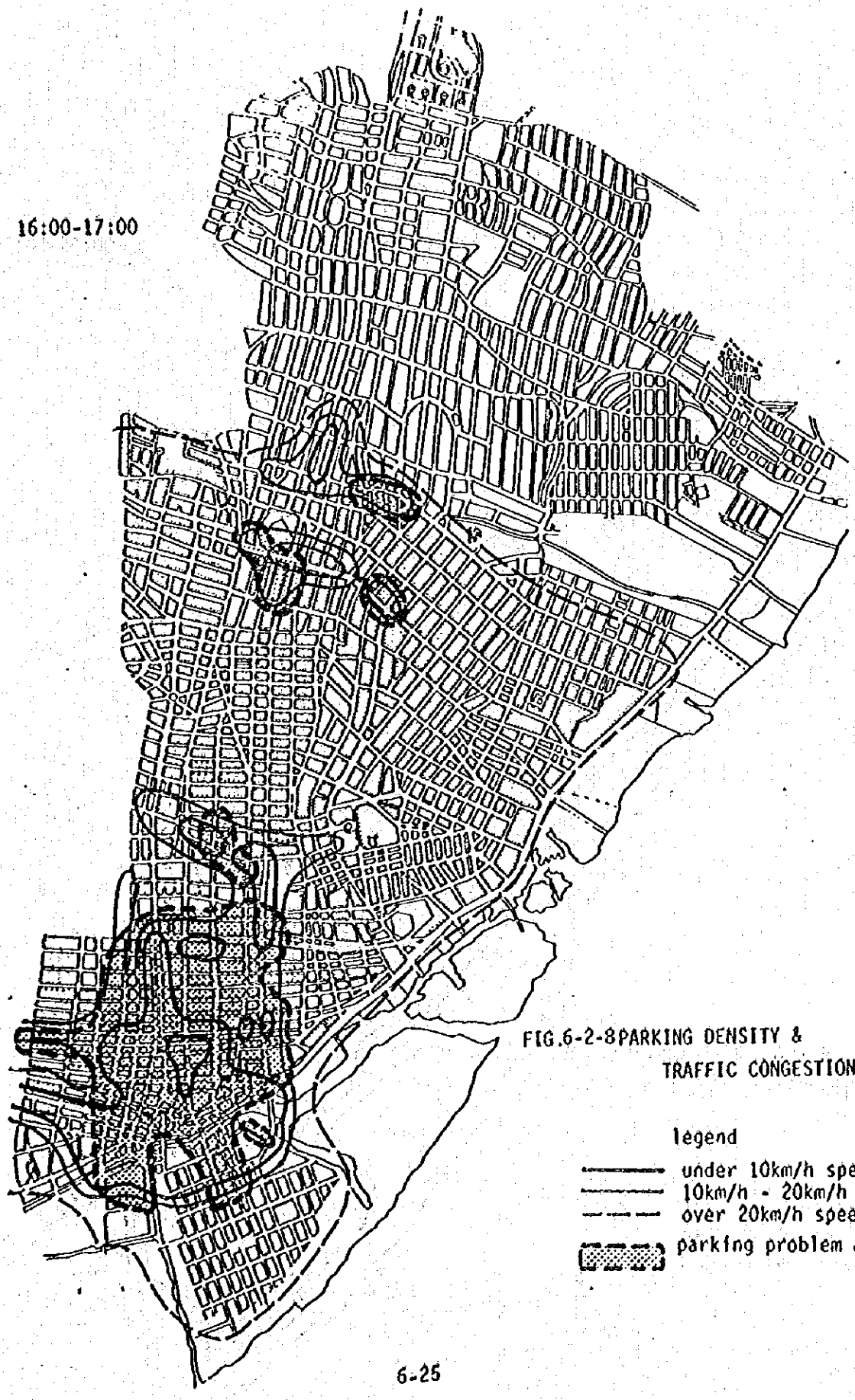


FIG.6-2-8PARKING DENSITY &
TRAFFIC CONGESTION AREA

legend

- under 10km/h speed
- 10km/h - 20km/h speed
- over 20km/h speed
- parking problem area

19:00-20:00

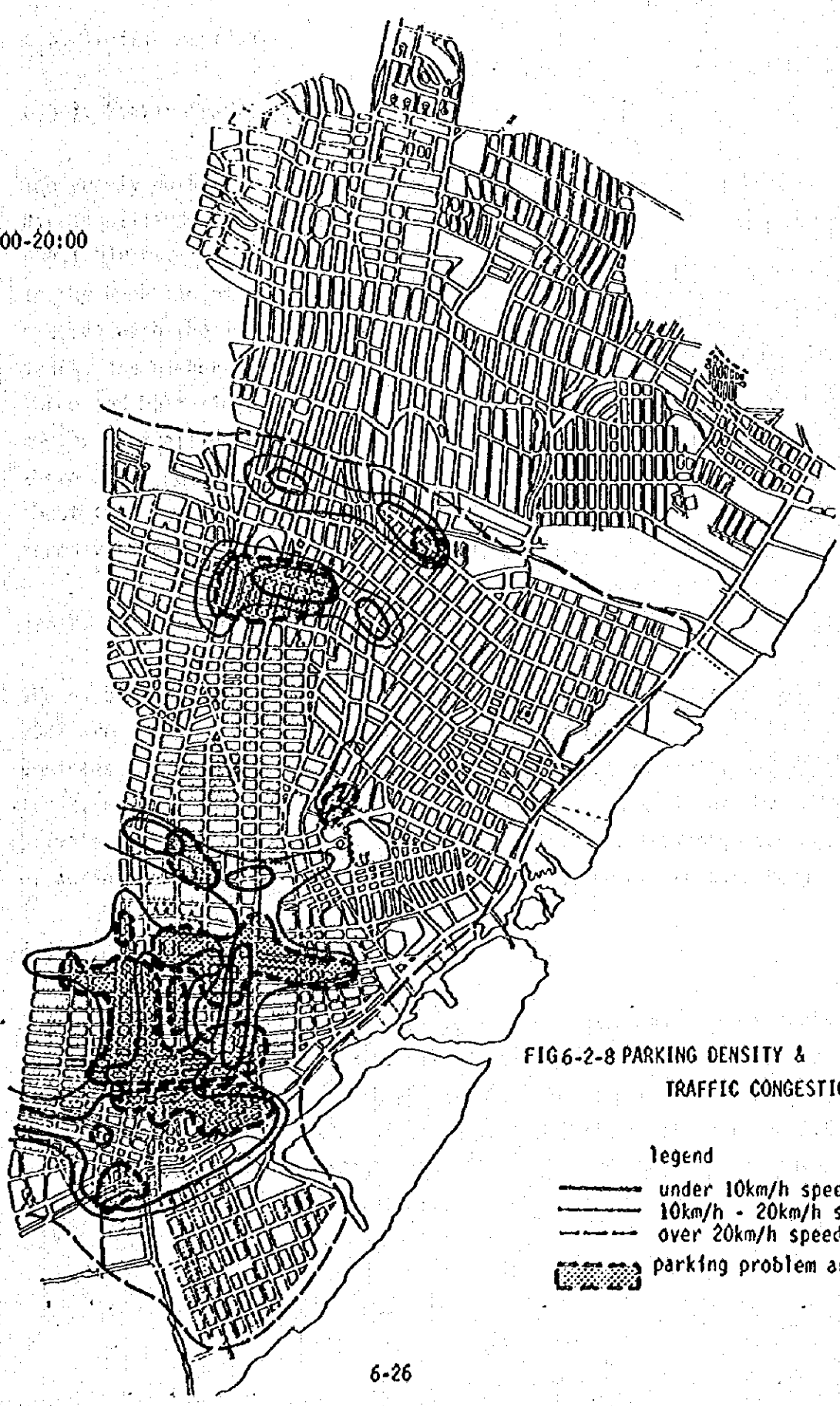


FIG6-2-8 PARKING DENSITY &
TRAFFIC CONGESTION AREA

legend

- under 10km/h speed
- 10km/h - 20km/h speed
- over 20km/h speed
- parking problem area

6-3. Traffic Accidents.

6-3-1. Yearly Traffic Accidents.

The yearly number of traffic accidents in the Republic of Colombia/ Barranquilla during ten years (1973 - 1982 Y) is shown in Fig. 6-3-1, and table 6-3-1.

In the Republic of Colombia, the number of traffic accidents has increased with the increase of registered vehicles during the last ten years. The number of traffic accidents in 1982 show approximately three and half times that of ten years ago. On the other hand, the number of traffic accidents in Barranquilla has decreased after there was a peak of traffic accidents in 1980. The decrease rate is about twentty percent. The average number of accidents per 100 registered vehicles was 2.58 accidents in 1982.

6-3-2. Traffic Accidents by Vehicle Type.

The number of traffic accidents by vehicle type in Barranquilla in 1982 are shown in Table 6-3-2. Of all accidents caused by 4 wheel vehicles, about 54% involved a passenger car, about 23% involved a truck, and 15% involved a bus. When broken down into accidents by private vehicles and those by commercial vehicles, a very high average of accidents per registered vehicles is shown to be by the bus group.

6-3-3 . Traffic Accidents by Route.

The number of traffic accidents per 100-meter section of major streets in 1982 are shown in Fig. 6-3-2. Listed with the high accidents ratios are Calle 30 and Calle 34, with about 2.0 accident per 100-meter each. Secondly, the accident ratios at Calle 45 and Calle 54 are between 1.5 to 1.8, and other high accident routes are Calle 72, Carrera 46 and Carrera 43. (Those accidents ratios are each 1.3).

6-3-4. High Incidence Locations and Accident Types.

1) High Incidence Location.

The high accident frecuency points are shown in Fig. 6-3-3. The incidence of accidents were high at the following sections; Carrera 46 - Carrera 33 on Calle 45, Carrera 38 - Carrera 11 on Calle 30. The high accident locations have been plotted on a map in Fig. 6-3-3, which shows that a large number of accidents occured at the intersections of major arterials, being two areas centering around Carrera 38 and the North-Commercial area surrounded by Carrera 46 - Calle 72 - Calle 76.

The highest accident frequency point is the intersection, Calle 45 - Carrera 33, anually 16 accidents followed by intersections of Calle 45 - Carrera 34, Calle 35 - Carrera 27, Calle 30 - Carrera 11, Calle 47 - Carrera 21, Calle 45 - Carrera 44, Calle 84 - Carrera 46 and Calle 45 - Carrera 38.

2) Accident Types.

In Fig. 6-3-4, samples of accidents types recorded are shown by symbols. Accidents are also classified by type of violation in Table 6-3-3. The msot frequent accident type is the side swipe collision, representing about 30% of all accident types, followed by the rear-end collision (20%), the turning collision (12%), the right angle collision (9%), the multiple collision (7%), and personal injury (5%). Accidents tend to be caused by disregarded traffic signals at intersections and collisions at non-signalized intersections.

On the other hand, according to violation types, it is clear that accidents are caused most frequently by disregarded traffic signals (about 17% of all accidents), followed by failure to allow sufficient headways (13%), by break failure caused by old vehicles (10%), by improper passing (10%), and by not stopping at stop signs (10%). In

order to minimize accidents, the establishment of new traffic signals with traffic channelization and the improvement of the traffic signal system will be essential in addition to traffic regulation enforcement.

3) Accident Analysis of High Incidence Locations

The analysis of high accident incidence locations, above 10 accident occurences per year, was carried out. In residential areas, unless a small number of accidents occured, the accident analysis was carried out.

The results of the qualitative analysis based on the accident collision diagram, etc. are as follows:

(1) At most signalized intersections, the high frequency accidents are side swipe collisions, which makes it clear that these accidents are caused by exceeding the stop due to indistinct stop lines and disregarded traffic signals.

(2) At congested intersections with traffic jams, rear-end collisions are the most common type of accident, which makes it clear that these accidents are caused by the obstruction of smooth traffic flow due to the congestion of buses near bus stops.

(3) At congested intersections with signals, traffic stagnation with traffic jams are caused by traffic capacity due to inadequate signal cycle systems, which result in side swipe collisions caused by waiting traffic.

(4) At the approach to the intersection, accidents are caused by cars turning to the left, side swipe collisions are caused by sudden lane changes and also a serious hindrance to opposite through traffic flow is caused by frequent left turning vehicles.

(5) In the centro area especially, at the locations of high frequency accidents, personal injury accidents are caused by indiscriminate crossing of pedestrians.

(6) At no-signalized intersections, many side swipe collisions are caused by the absence of stop signs and indefinite classification of major/minor streets.

TABLE 6-3-1 YEARLY TRAFFIC ACCIDENTS IN COLOMBIA BARRANQUILLA

YEAR	ACCIDENTS		REGISTERED VEHICLES IN BARRANQUILLA	ACCIDENTS/100 REGISTERD VEHICLES IN B/QUILLA
	COLOMBIA	BARRANQUILLA		
1973	19,312	550	10,195	5.39
1974	34,078	844	16,760	5.04
1975	35,177	464	22,450	2.07
1976	41,036	411	31,150	1.32
1977	44,087	1201	38,991	3.08
1978	46,782	1249	41,873	2.98
1979	50,847	1756	45,234	3.88
1980	57,843	1848	48,793	3.79
1981	58,079	1719	52,903	3.25
1982	68,378	1426	55,692	2.58

FIG. 6-3-1 YEARLY TREND OF TRAFFIC ACCIDENTS (1973-1982)

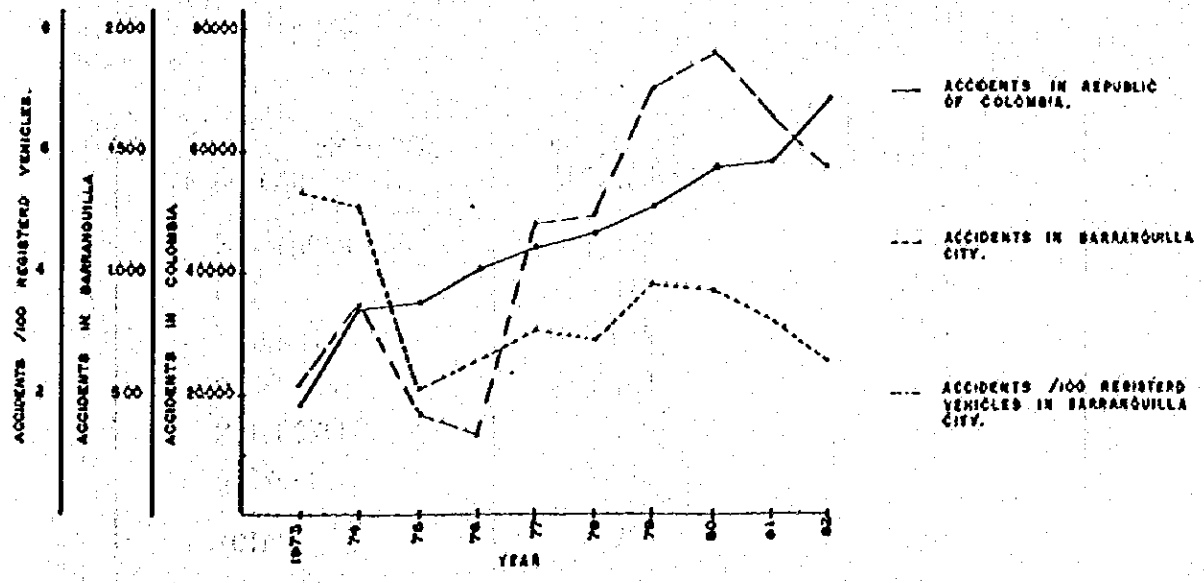
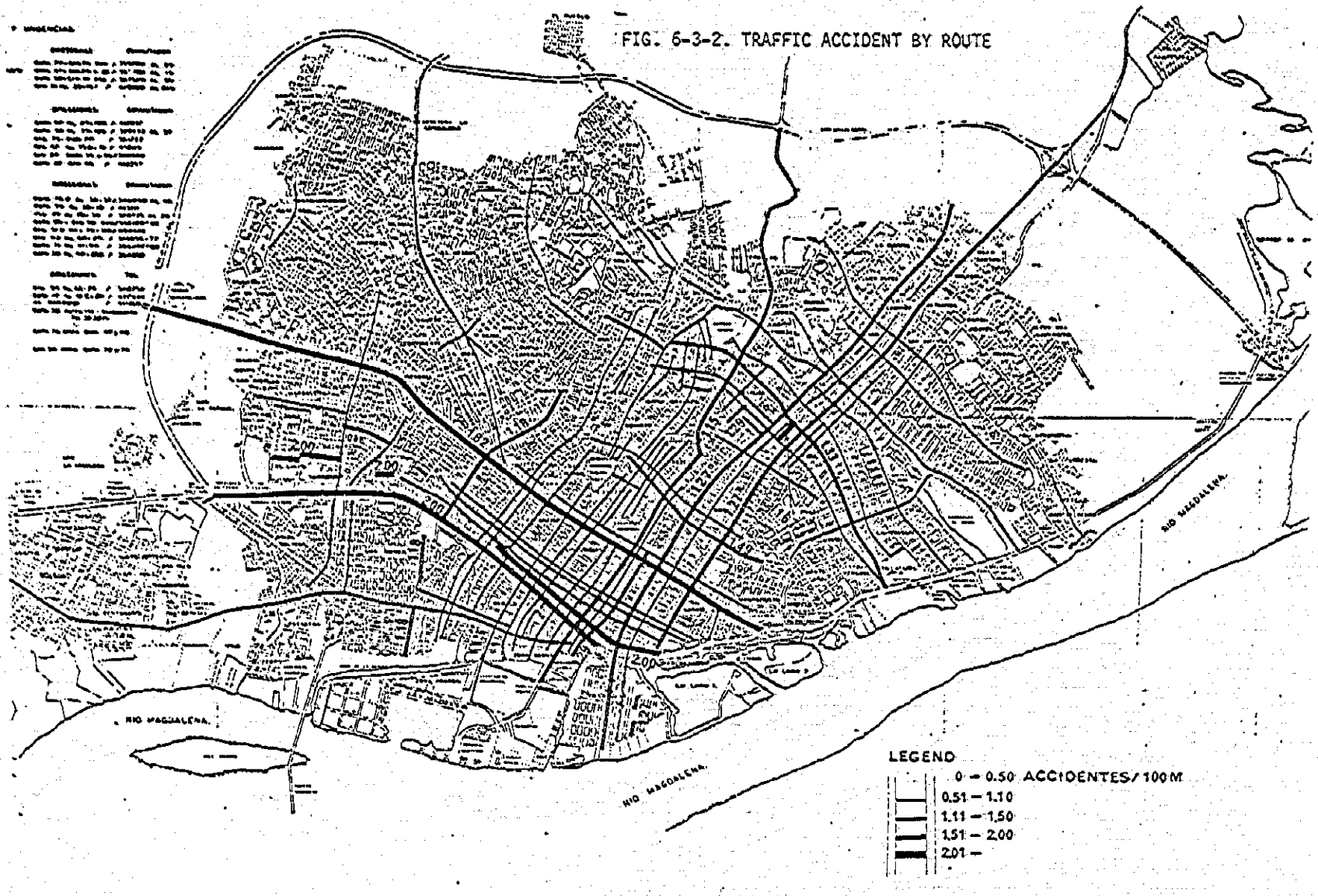


TABLE.6-3-2 TRAFFIC ACCIDENTS BY TYPE OF CAR IN BARRANQUILLA CITY (1982)

TYPE OF CAR \ ACCIDENTS		NUMBER OF ACCIDENTS	ACCIDENTS/ 100 REGISTERED
PRIVATE	PASSENGER CAR	973	3.7
	BUS	66	11.2
	TRUCK	519	4.2
	OTHERS	63	22.9
	TOTAL	1,621	4.1
COMERCIAL	PASSENGER CAR	520	6.7
	BUS	351	9.9
	TRUCK	105	3.4
	OTHERS	-	-
	TOTAL	976	6.8
	MOTERCYCLE	138	7.4
	BICYCLE	15	107.1
	TOTAL	2,750	4.9

TYPE OF CAR \ ACCIDENTS	NUMBER OF ACCIDENTS	PERCENTAGE
PASSENGER CAR	1,493	54.3
BUS	417	15.2
TRUCK	624	22.7
OTHERS	63	2.3
MOTERCYCLE	138	5.0
BICYCLE	15	0.5
TOTAL	2,750	100.0

FIG. 6-3-2. TRAFFIC ACCIDENT BY ROUTE



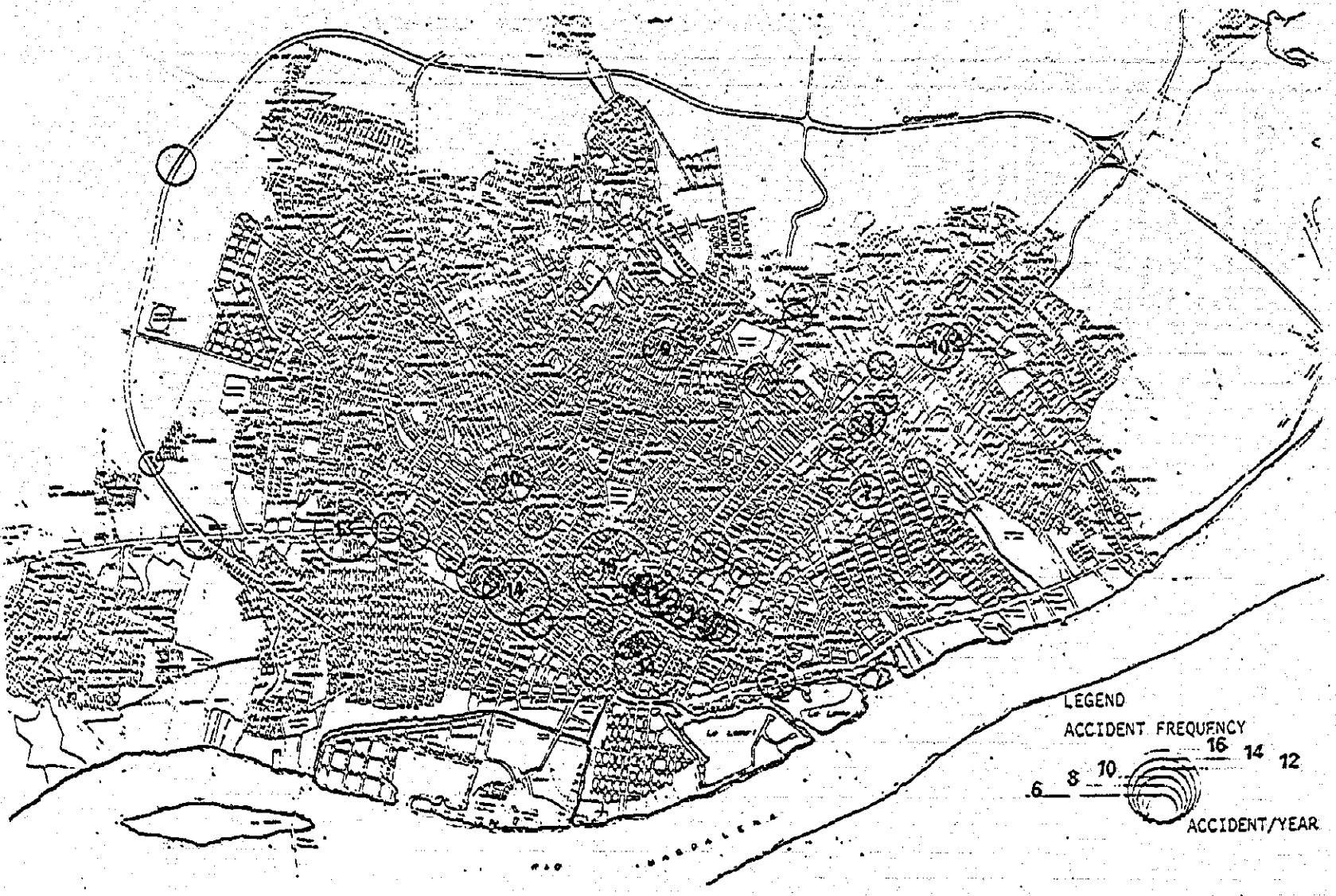


FIG.6-3-3 HIGH ACCIDENT FREQUENCY POINTS (1982)

TABLE.6-3-3 TYPES OF ACCIDENTS AND TYPES OF VIOLATIONS (1)

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	C 45 - K 33															C 35 - K 27													
	REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MULTIPLE 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	MULTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY	4														4														
IMPROPER CHANGE OF LANE								1							1														
IMPROPER CROSSING																													
OPENED DOOR																													
OVER SPEED																													
BREAK FAILURE	1						1								2														
DISREGARDED TRAFFIC SIGNAL					1										1			1					1						2
NO FORWARD ATTENTION																													
IMPROPER PEDESTRIAN CROSSING																													
IMPROPER TURNING				2				1							3														
IMPROPER FOR BACKING																													
DRIVING ON WRONG LANE																													
LOOKING ASIDE IN DRIVING																													
IMPROPER OVERTAKING					2										2					2									2
NO STOP AT STOP SIGN																		3		4									7
DEFICIENTLY ROAD																													
IMPROPER IN COMING OUT OF PARKING																													
CARELESS DRIVING					2			1							3														
CARELESS PARING																													
NO PREVENTIVE CARE																			1	2									3
TOTAL	5			2	5		1	3							16			4	1	8			1						14

TABLE 6-3-3. TYPES OF ACCIDENTS AND TYPES OF VIOLATIONS (2).

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	C 34 - K 43															C 30 - K 11														
	REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MULTIPLE 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	MULTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL
NOT ENOUGH HEAD-WAY																3							1							4
IMPROPER CHANGE OF LANE																														
IMPROPER CROSSING																														
OPENED DOOR																														
OVER SPEED																						1								1
BREAK FAILURE																1		1												2
DISREGARDED TRAFFIC SIGNAL			2		2									4																
NO FORWARD ATTENTION																														
IMPROPER PEDESTRIAN CROSSING		1				2								3						1										1
IMPROPER TURNING				1										1																
IMPROPER FOR BACKING																														
DRIVING ON WRONG LANE																														
LOOKING ASIDE IN DRIVING																														
IMPROPER OVERTAKING	1				1									2				1	2		-									3
NO STOP AT STOP SIGN																			1											1
DEFICIENTLY ROAD																														
IMPROPER IN COMING OUT OF PARKING																														
CARELESS DRIVING																														
CARELESS PARING																														
NO PREVENTIVE CARE	1			1	1									3														1		1
TOTAL	2	1	2	2	4	2								13		4		2	3		1	1	1					1		13

TABLE.6-3-3 TYPES OF ACCIDENTS AND TYPES OF VIOLATIONS (3)

INTERSECTION / TYPE OF ACCIDENTS / VIOLATION	TOTAL															REAR-END COLLISION	HEAD-ON COLLISION	RIGHT ANGLE COLLISION	TURNING COLLISION	SIDE SWIPE COLLISION	PERSONAL INJURY	AGAINST FIXED OBJECT	MULTIPLE 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	MULTIPLE COLLISION	AGAINST PARKED VEHICLE	OUT OF CONTROL	BACKING	AGAINST ANIMALS	PASSENGER'S FALLING DOWN	OUT OF WAY	TOTAL																
NOT ENOUGH HEAD-WAY	28	2	-	2	4	-	-	5	-	-	-	-	-	-	41															
IMPROPER CHANGE OF LANE	-	-	-	-	2	-	-	1	-	-	-	-	-	-	3															
IMPROPER CROSSING	1	1	1	1	2	-	-	-	-	-	-	-	-	-	6															
OPENED DOOR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-															
OVER SPEED	3	-	-	-	5	-	3	2	-	-	-	-	-	-	13															
BREAK FAILURE	8	2	3	-	10	-	5	2	-	3	-	-	-	-	32															
DISREGARDED TRAFFIC SIGNAL	4	2	7	8	26	-	2	3	-	1	-	-	-	-	52															
NO FORWARD ATTENTION	4	-	-	2	1	-	-	1	-	-	-	-	-	-	8															
IMPROPER PEDESTRIAN CROSSING	3	2	-	-	-	13	-	-	1	-	-	-	-	-	20															
IMPROPER TURNING	-	-	1	5	7	2	-	3	1	-	-	-	-	-	19															
IMPROPER FOR BACKING	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2															
DRIVING ON WRONG LANE	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1															
LOOKING ABIDE IN DRIVING	-	-	-	-	2	-	-	-	2	1	-	-	2	-	7															
IMPROPER OVERTAKING	2	-	3	9	16	-	-	-	-	-	-	-	-	-	30															
NO STOP AT STOP SIGN	4	1	7	3	15	-	-	-	-	-	-	-	-	-	30															
DEFICIENTLY ROAD	1	-	2	1	4	-	-	-	-	-	-	-	-	-	8															
IMPROPER IN COMING OUT OF PARKING	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1															
CARELESS DRIVING	1	-	-	-	5	-	1	1	1	-	-	-	-	-	1															
CARELESS PARING	1	-	-	-	-	-	-	1	-	-	-	-	-	-	2															
NO PREVENTIVE CARE	3	3	3	3	13	-	-	2	-	-	-	-	1	-	28															
TOTAL	61	13	29	36	112	15	11	21	5	5	-	-	3	1	312															

FIG. 6-3-4COLLISION DIAGRAM (1)

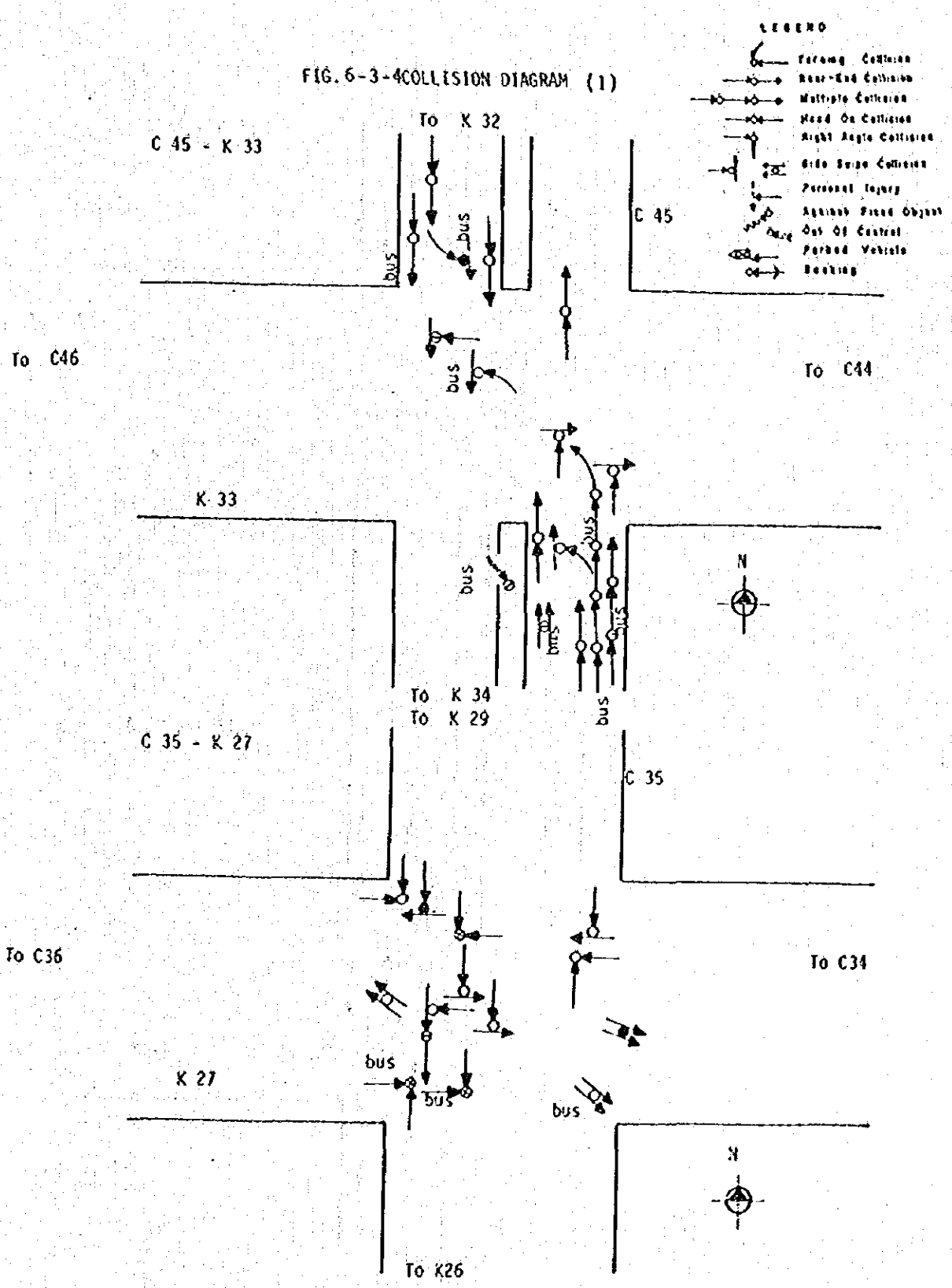


FIG.6-3-4 COLLISION DIAGRAM (1)

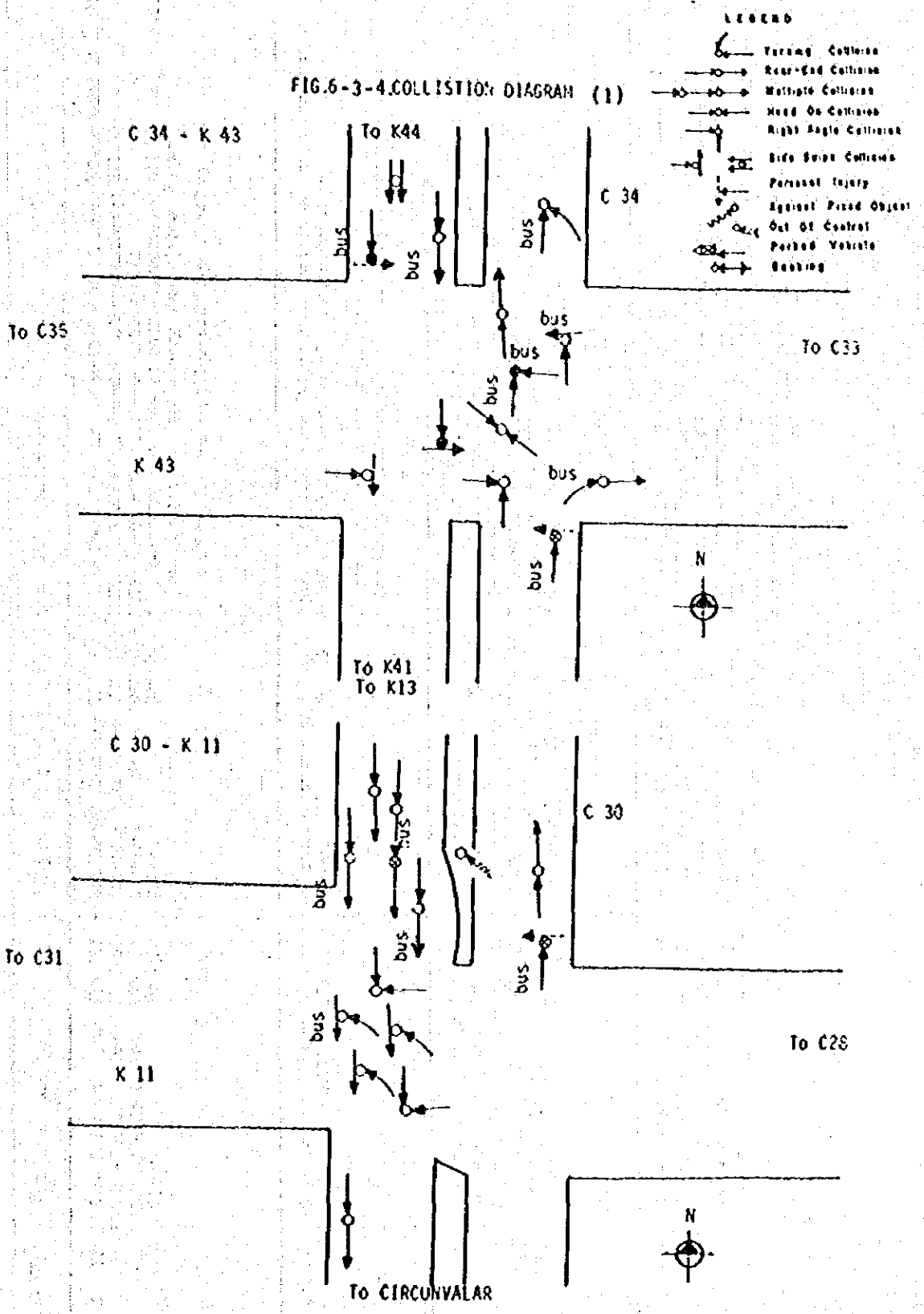


TABLE 6-3-4 Accident Analysis (1)

Items Location	Type of Accident	Type of Violation	Comment
Cll 45 - Cr. 33 (16)	Side Swipe collision 31% (5) Rear-End collision 31% (5) Multiple collision 19% (3) Others 19% (3)	Not Enough Head-Way 25% (4) Improper Turning 19% (3) Careless Driving 19% (3) Others 37% (6)	° Rear-End collision: high-frequency, at Cr. 32 approach on Cll45. ° Side Swipe collision:-do-, at approacheson Cll 45. ° Collision with bus: -do- (about 50%) ° Left-turning vehicles at both approacheson Cll 45: many exist. ° Cycle length of signal: very short (about 50 sec). ° Caused by failure to allow sufficient headways.
Cll 35 - Cr. 27 (14)	Side Swipe collision 54% (7) Right Angle collision 38% (5) Others 8% (2)	No stop at stop sign 54% (7) Others 46% (7)	° Side Swipe collision, Right angle collision: high frequency. ° Infinite classification of major/minor street. ° Collision with bus: about 21%. ° Caused by no stop at stop sign. ° Caused by indefinite classification of major/minor street.
Cll 34 - Cr. 43 (14)	Side Swipe collision 30% (4) Rear-End collision 14% (2) Right Angle collision 14% (2) Turning collision 14% (2) Personal Injury 14% (2) Others 23% (3)	Disregarded Traffic Signal. 30% (4) Improper Pedestrian Crossing. 21% (3) No Preventive Care 21% (3) Improper Overtaking 14% (2) Others 14% (2)	° Side Swipe collision: high frequency, unless traffic signal exist. ° Accidents with personal injury: about 14%. ° Collision with bus: high frequency (about 50%). ° Caused by traffic confliction due to traffic congestion ° Caused by disregarded traffic signals. ° Caused by indiscriminate crossing of pedestrians.
Cll 30 - Cr. 11 (13)	Rear-End collision 31% (4) Turning collision 23% (3) Right Angle collision 15% (2) Personal Injury 8% (1) Others 23% (3)	Not Enough Head-Way 31% (4) Improper Passing 23% (3) Break Failure 15% (2) Improper Pedestrian Crossing. 8% (1) Others 23% (1)	° Turning collision/Right angle collision: high frequency at CIRCUNVALAR approach on Cll 30. ° Rear-end collision: high frequency, at Cr 13 approach on Cll 30. ° Accident with personal injury: about 8%. ° Collision with bus: about 30% ° Left-Turning vehicle at approach on Cll 30: many exist. ° Rear-end collisions caused by many left-turning vehicles. ° No-signalized intersection.

TABLE 6-3-4 Accident Analysis (2)

Items / Location	Type of Accident	Type of Violation	Comments
C11 45 - Cr. 38 (11)	Side-Swipe collision 36% (4) Rear-End collision 27% (3) Personal Injury 10% (1) Others 27% (3)	Break Failure 27% (3) Disregarded Traffic 18% (2) Not Enough Head-Way 10% (1) Improper Change of Lane. 10% (1) Improper Pedestrian Crossing. 10% (1) Others 28% (3)	° Side- swipe collision: high frequency, at Cr. 35 approach C11 45. ° Rear-end collision: -do- , at both approaches on C11 45. ° Accident with personal injury: about 10%. ° Collision with bus: about 36%. ° Caused by traffic congestion with jams. ° Left-turning vehicles at Cr. 35 approach on C11 45: many exist. ° Caused by disregarded traffic signal/imrpoper overtaking.
C11 45 - Cr. 44 (10)	Side-Swipe collision 50% (5) Rear-End collision 30% (3) Others 20% (2)	Over Speed 20% (2) Disregarded Traffic Signal. 20% (2) No Preventive Care 20% (2) Others 40% (4)	° Side-Swipe collision: high frecuency, unless traffic signal exist. ° Side-Swipe /right angle collision: high frecuency, at C11 46 approach on Cr. 44. ° Collision with bus: about 30%. ° Caused by traffic congestion/disregarded traffic signal. ° Caused by congestion of buses near bus stop.
C11 47 - Cr. 21 (10)	Side-Swipe Collision 50% (5) Rear-End collision 20% (2) Turning collision 20% (2) Others 10% (1)	Break Failure 20% (2) No Forward Attention 20% (2) No stop at stop sign 20% (2) Others 40% (4)	° Side-Swipe/rear-end/Multiple collision: high frequency, at C11 45 approach on C11 47. ° Collision with bus: about 40%. ° Caused by obstruction of smooth traffic flow due to poor condition of pavement maintenance. ° Caused by disregarded traffic signal/traffic congestion.

TABLE 6-3-4 Accident Analysis (1)

Items / Location	Type of Accident	Type of Violation	Comment
Cl 45 - Cr. 33 (16)	Side Swipe collision 31% (5) Rear-End collision 31% (5) Multiple collision 19% (3) Others 19% (3)	Not Enough Head-Way 25% (4) Improper Turning 19% (3) Careless Driving 19% (3) Others 37% (6)	° Rear-End collision: high-frequency, at Cr. 32 approach on Cl 45. ° Side Swipe collision:-do-, at approacheson Cl 45. ° Collision with bus: -do- (about 50%) ° Left-turning vehicles at both approacheson Cl 45: many exist. ° Cycle length of signal: very short (about 50 sec). ° Caused by failure to allow sufficient headways.
Cl 35 - Cr. 27 (14)	Side Swipe collision 54% (7) Right Angle collision 38% (5) Others 8% (2)	No stop at stop sign 54% (7) Others 46% (7)	° Side Swipe collision, Right angle collision: high frequency. ° Infinite classification of major/minor street. ° Collision with bus: about 21%. ° Caused by no stop at stop sign. ° Caused by indefinite classification of major/minor street.
Cl 34 - Cr. 43 (14)	Side Swipe collision 30% (4) Rear-End collision 14% (2) Right Angle collision 14% (2) Turning collision 14% (2) Personal Injury 14% (2) Others 23% (3)	Disregarded Traffic Signal. 30% (4) Improper Pedestrian Crossing. 21% (3) No Preventive Care 21% (3) Improper Overtaking 14% (2) Others 14% (2)	° Side Swipe collision: high frequency, unless traffic signal exist. ° Accidents with personal injury: about 14%. ° Collision with bus: high frequency (about 50%). ° Caused by traffic confliction due to traffic congestion ° Caused by disregarded traffic signals. ° Caused by indiscriminate crossing of pedestrians.
Cl 30 - Cr. 11 (13)	Rear-End collision 31% (4) Turning collision 23% (3) Right Angle collision 15% (2) Personal Injury 8% (1) Others 23% (3)	Not Enough Head-Way 31% (4) Improper Passing 23% (3) Break Failure 15% (2) Improper Pedestrian Crossing. 8% (1) Others 23% (1)	° Turning collision/Right angle collision: high frequency at CIRCUNVALAR approach on Cl 30. ° Rear-end collision: high frequency, at Cr 13 approach on Cl 30. ° Accident with personal injury: about 8%. ° Collision with bus: about 30% ° Left-Turning vehicle at approach on Cl 30: many exist. ° Rear-end collisions caused by many left-turning vehicles. ° No-signalized intersection.

TABLE 6-3-4 Accident Analysis (3)

Items / Location	Type of Accident	Type of Violation	Comment
CII 84 - Cr 46 (10)	Multiple collision 30% (3) SideSwipecollision 21% (2) Turning collision 20% (2) Others 30% (3)	Not Enough Head-Way 30% (3) Improper Overtaking 30% (3) No Preventive Care 20% (2) Others 20% (2)	° Multiple collision: high frequency, at CII 85 approach on Cr. 46. ° Most of multiple collisions consists of rear-end/side swipe collisions ° Collision with bus: about 40% ° Caused by improper overtaking/disregarded traffic signal. ° Cycle length of signal: very short (about 40 sec).
CII 72 - Cr. 258 (9)	SideSwipecollision 56% (5) Rear-End collision 11% (1) RightAnglecollision 11% (1) Out of Control 11% (1) Others 11% (1)	No stop at stop sign 34% (3) Break Failure 22% (2) No Preventive Care 22% (2) Others 22% (2)	° Side swipe collision: high frequency, at central of intersection. ° Collision with bus: about 22%. ° Caused by no stop at stop sign. ° Caused by indefinite classification of major/minor streets.
CII 72 - Cr. 46 (7)	Rear-End collision 29% (2) SideSwipe collision 29% (2) Others 42% (3)	Break Failure 44% (3) Not enough Head-Way 14% (1) Disregarded Traffic Signal. 14% (1) Others 28% (2)	° Rear-end collision: relatively high frequency, at Cr.45approach CII 72. ° Collision with bus: about 29%. ° Left-turning vehicles at Cr. 45 approach on CII 72.; many exist ° Caused by traffic congestion.
CII 76 - Cr. 46 (7)	SideSwipecollision 42% (3) Multiple collision 29% (2) Others 29% (2)	Break Failure 57% (4) No stop at stop sign 14% (1) Others 29% (2)	° Side swipe/multiple collision: high frequency, unless traffic signals exist. ° Collision with bus: about 43%. ° Caused by traffic congestion/disregarded traffic signal.
CII 72 - Cr 53 (7)	Rear-End collision 29% (2) RightAnglecollision 29% (2) SideSwipe collision 29% (2) Others 13% (1)	No Preventive Care 30% (2) Disregarded Traffic Signal. 14% (1) Not Enough Head-Way 14% (1) Improper Backing 14% (1) No stop at stop sign 14% (1) Improper in Coming out of parking 14% (1)	° Right angle/side swipe/rear-end collision: high frequency, at CII 74 approach on Cr. 53, at Cr. 52 approach on CII 72. ° Collision with bus: about 43%. ° Unless traffic signals exists, those accidents showhigh frequency, which is caused by traffic congestion/disregarded traffic signal .

6-4. Traffic Facilities and Existing Management System.

6-4-1. Traffic Regulation.

1) One-Way Streets.

One-way streets by traffic regulations are shown in Fig. 6-4-1. One-way streets are limited to the Centro area and a few radial streets in Boston, Colombia, and El Porvenir. In particular, streets surrounded by Calle 45, Carrera 38, Carrera 46, and Calle 30 are designated as one-way. In absence of strict enforcement against curb parking in north – south direction, the intended effect is not being achieved.

Arterial one-way streets are Carrera 41, Carrera 43, and Carrera 44. Carrera 43 and Carrera 44, are a pair of one-way streets serving as the arterial streets in the central area of Barranquilla.

2) Speed Limit.

Speed limits by traffic regulation are shown in Fig. 6-4-2 on arterial streets in the urban area of Barranquilla. Speed limits are 30 to 40 Kilometers per hour in the central parts an 50 to 80 Kilometers per hour in the perimeter parts.

3) Curb-Parking Controls.

Curb-parking controls in commercial and business areas are shown in Fig. 6-4-3. Curb-parking controls are enforced in the central areas. The curb-parking control rate, street extension (length) of regulatory parking capacity/ street extension (length) of physical parking capacity, is about 64% in P/T Zone No. 1, No. 3, No. 4, while it ranges from 30% to 50% in P/T Zone No. 6, No. 7, No. 8, of the Centro area. The value is relatively high in the Centro area surrounded by Carrera 38 - Calle 45 - Carrera 46 - Calle 30.

6-4-2. Road Signs.

1) Information Signs.

Information signs giving route directions and distances are posted relatively well on arterial streets, and signs giving the name of the street are fully posted throughout, on the arterial and narrow streets. Especially the number of information signs posted in the Centro area are high.

2) Directive/Control Signs.

A sample of the location density of direction/control signs are shown in Fig. 6-4-5. The "Stop" sign is relatively numerous without traffic control signals and narrow streets in residential areas also. "Bus Stop" signs are equipped relatively well on streets with bus routes and "One Way" signs exist in the Centro area. The others, for instance, "No Parking", "No U-Turn", "Pedestrian Crossing", and "School Zone" are rarely used.

It may be generally pointed out that traffic signs are ambiguos, insufficient in number, and need improvement in how they are managed, and the enforcement of traffic regulations indicated by the sign is inadequate. A traffic sign system should be developed in the future if the number of traffic accidents are to be minimized.

6-4-3. Traffic Signals.

Signalized intersections are located in the urban area of BARRANQUILLA, many of them occuring in the Centro area. (Fig. 6-4-6).

About 30% of the total number of traffic signals are multiphased fixed cycle signals, while others are two phased ones. These cycle lengths are relatively short, between 37 and 59 seconds. Yellow time of splits is 5 seconds constantly. Traffic signals are often hard to find, because their lighting fixtures are insufficient and their supporting poles are short. Also, because inadequate traffic signals are installed at

each intersection; however, the signal indication is sometimes difficult to read depending on the viewing angle of the driver.

During rush hour in the morning, noon, and evening, traffic congestion is often caused by improper signal phase scheduling, and also sometimes the operating of the signals does not work due to mechanical failure.

The existing non-sychronous signal control is short of achieving effective traffic management between a closely positioned pair of intersections in the Centro area.

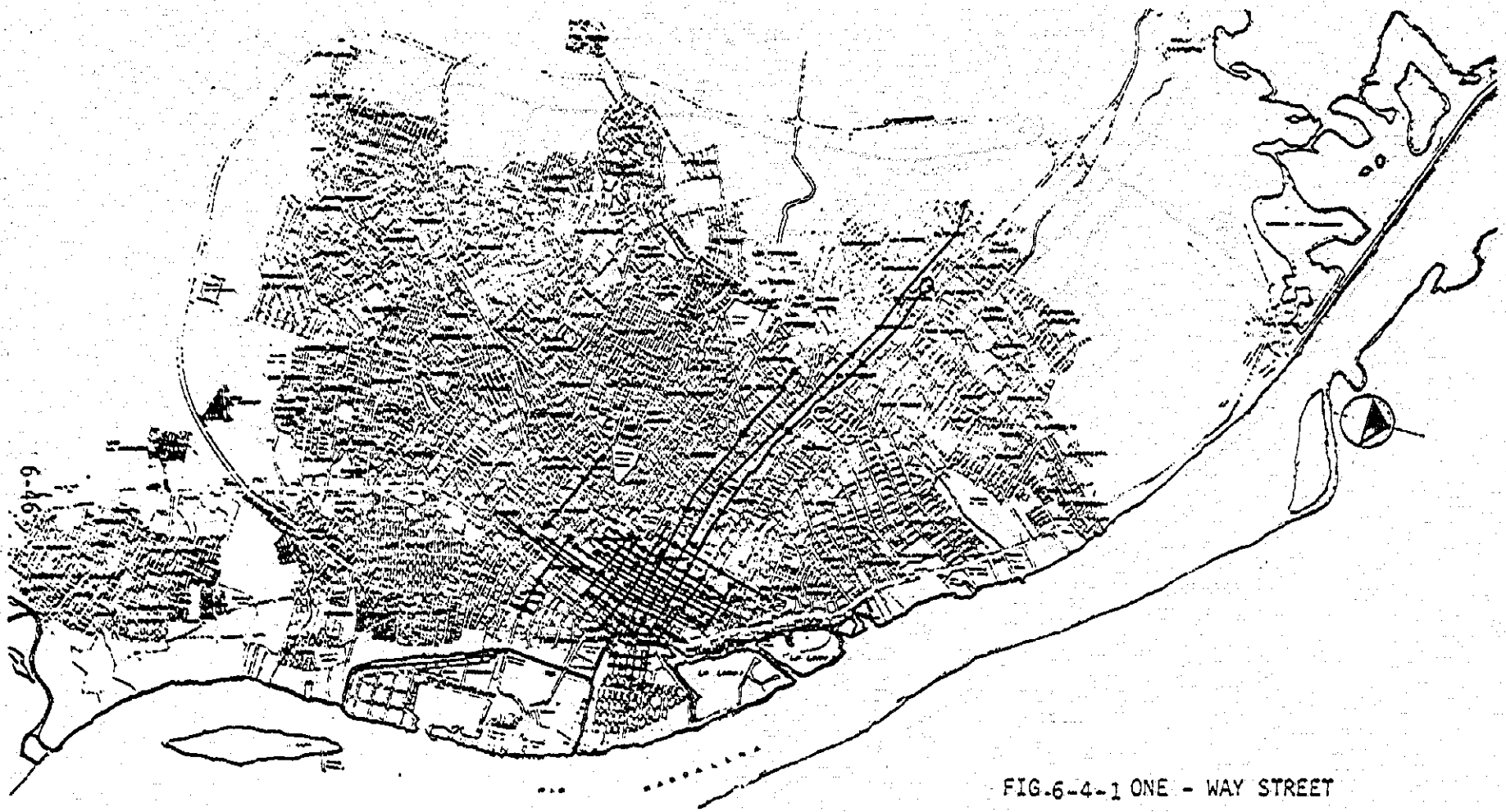
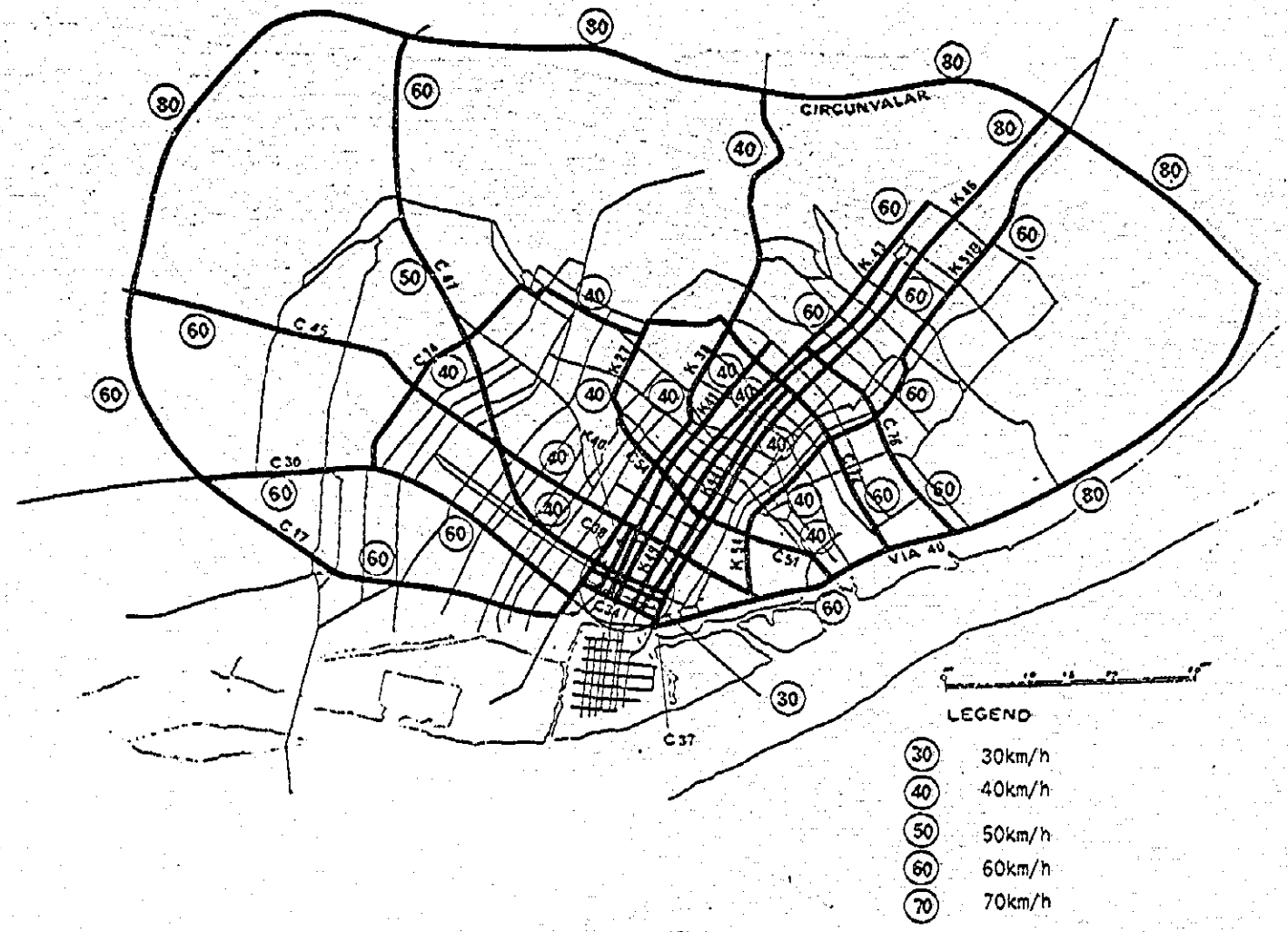


FIG.6-4-1 ONE - WAY STREET

one way

FIG.5-4-2 SPEED LIMIT



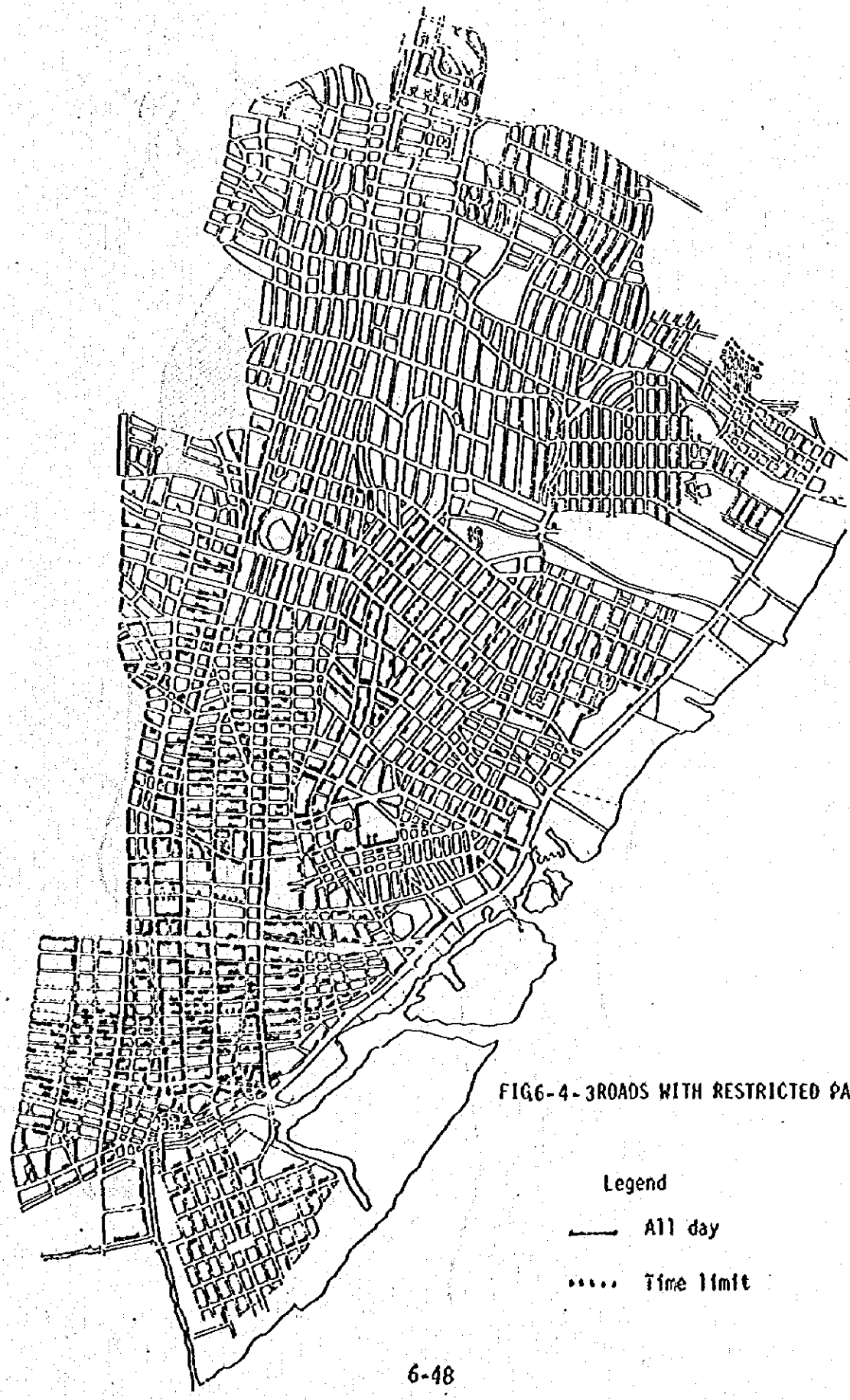


FIG6-4-3ROADS WITH RESTRICTED PARKING

Legend

—— All day

····· Time limit

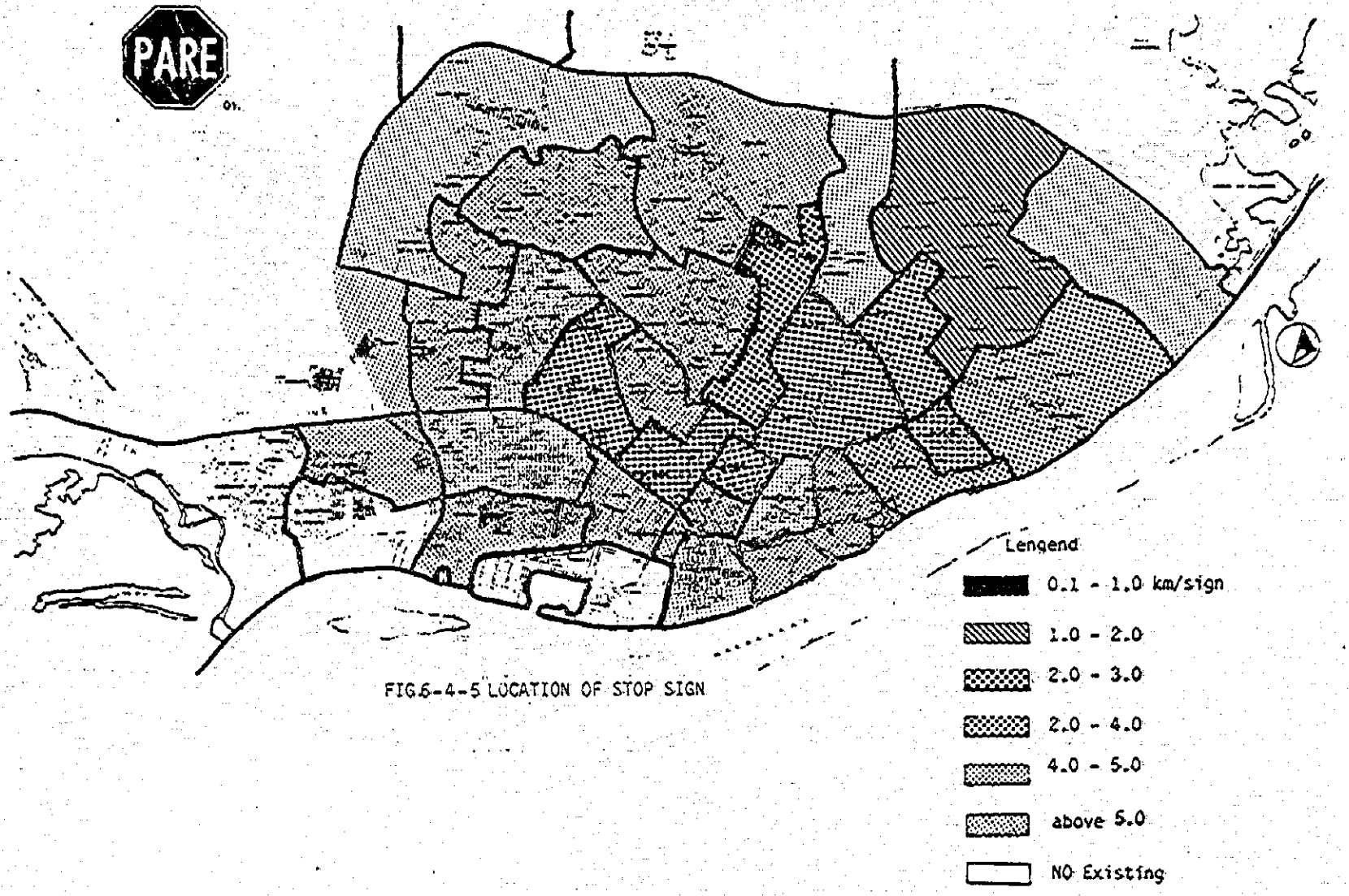


FIG.6-4-5 LOCATION OF STOP SIGN

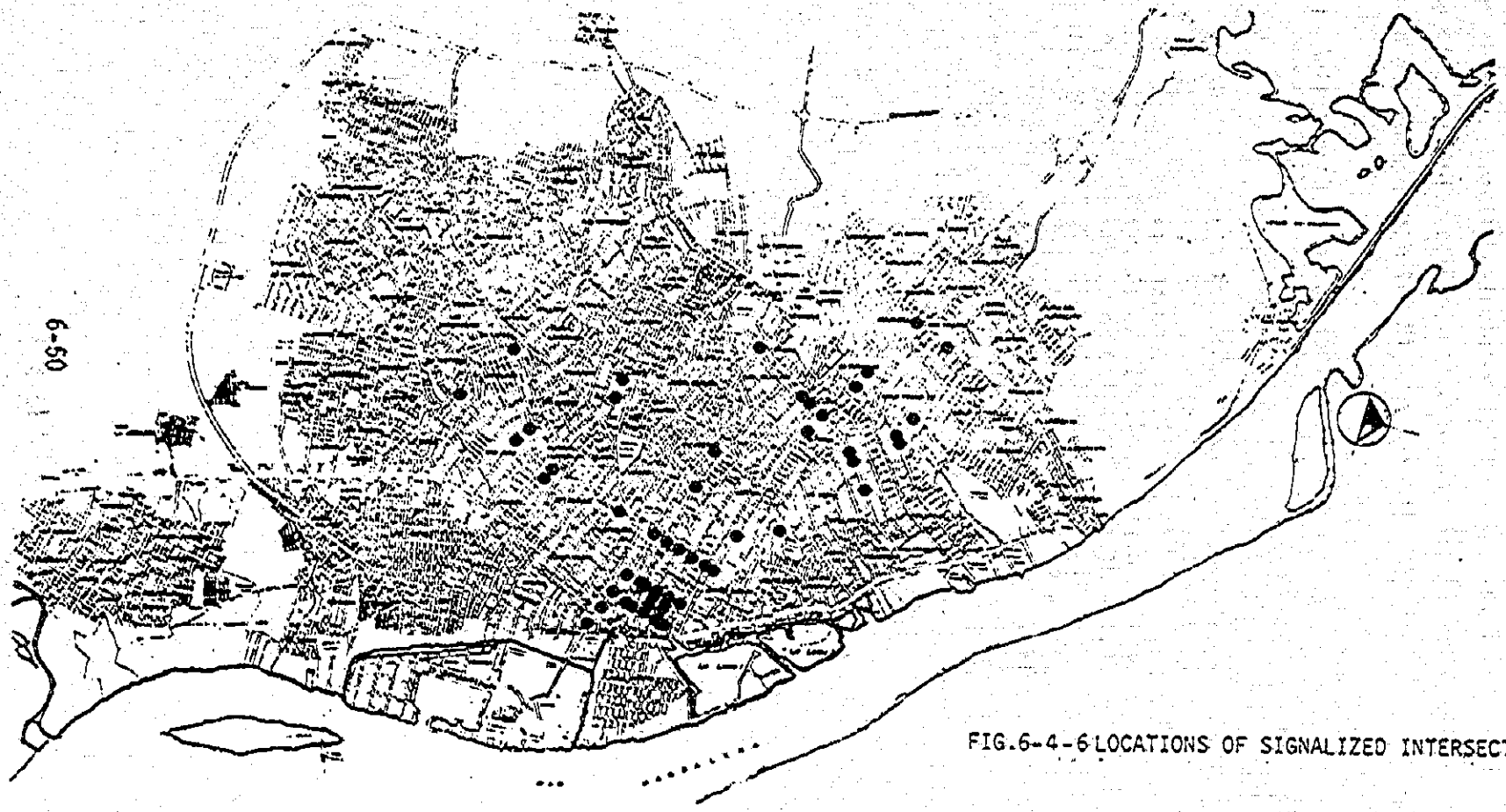


FIG.6-4-6 LOCATIONS OF SIGNALIZED INTERSECTION

● signalized intersection
(45 intersections)

6-5. Traffic Capacity.

A sample of traffic capacity calculated is shown in Fig. 6-5-1, Table 6-5-1 show the bottle neck intersections, traffic capacity is conceived to be fundamentally in accordance with the Highway Capacity Mannual.

Table 6-5-1. Bottle neck intersections

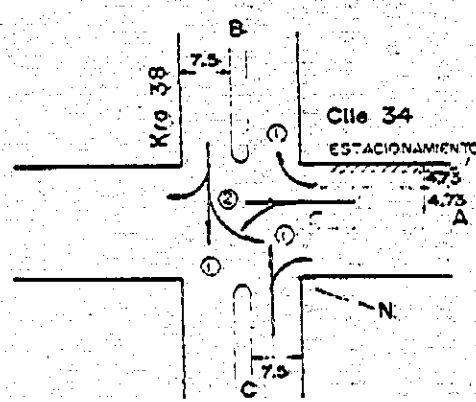
Locations	Approach	Congestion rate. (traffic volume/ traffic design capacity).
1. Cll 34 - Cr.38	Cll 41 on Cr. 38	1.05 - 1.33
2. Cll 34 - Cr.41	Cll 37 on Cr. 41	1.11 - 1.26
	Cr. 43 on Cll 34	1.13 - 1.28
3. Cll 34 - Cr. 44	Cr. 41 on Cll 34	1.09 - 1.36
4. Cll 45 - Cr. 38	Cr. 33 on Cll 45	1.18 - 1.35
5. Cll 45 - Cr. 46	Cr. 45 on Cll 45	1.01
	Cll 44 on Cll 45	1.03 - 1.11
	Cll 53 on Cll 45	1.03 - 1.11
6. Cll 72 - Cr. 46	Cr. 47 on Cll 72	1.25 - 1.47
	Cr. 45 on Cll 72	1.17 - 1.43

Fig. 6-5-1. Traffic Capacity.

INTERSECTION Nº 3 : Calle 34 Karrera 38

LEVEL OF SERVICE : D

LOAD FACTOR : 0.7



C = 56"

1Ø	2Ø	3Ø	4Ø
5Ø	6Ø	7Ø	8Ø

APPROACH	ITEM: Straight Traffic and Turn	Width	Basic Capacity	ADJUSTMENT FACTORS: Peak-Hour Factor and Metropolitan area Population	Location Within Metropolitan Area	G/C	Right Turn	Left Turn	Trucks and Buses	Opposite Traffic	Capacity Design: Straight Traffic and Turn	Capacity Design: Approach (A)	(B) Volume in the Peak Hour	B/A
A	1	4.73	1200			0.30			0.97 (7.8)		349	640	* 493	0.77
	2	4.73	1000	1.19	1.0	0.30	1.20	0.80 (4.4)	0.85 (25.0)		291		** 480	0.75
													*** 508	0.79
B												533	557	1.05
	1	7.5	2000	1.18	1.0	0.30	0.995 (10.6)	0.85 (43.2)	0.89 (16.4)		533		631	1.18
													708	1.33
C												596	586	0.98
	1	7.5	2000	1.18	1.0	0.30	0.90 (4.8)	1.10	0.85 (10.2)		596		550	0.92
													338	0.90
D														

* Morning Peak-hour : 8 a 9

** Midday Peak-hour : 11 a 12

*** Evening Peak-hour : 17 a 18

6-6. Existing Problems.

6-6-1. Areas with compounded Traffic Problems.

Each arterial street was evaluated from the aspects of the capacity of signalized intersections, traffic flow at such intersections, pedestrian crossing practices, degree of congestion at bus stops, traffic entry to and from minor streets, left-turn vehicles, traffic accidents, parking situations, and street structures (See Table 6-6-1).

The street sections and the areas, where are evaluated to be seriously in a bad condition, from the viewpoint of traffic flow, are presented in Table 6-6-2. Namely, particulary , the Centro area surrounded by Carrera 38, Calle 45, Carrera 46, and Calle 30. North-commercial area near Calle 72 - Calle 76, have been identified as traffic management problem areas.

TABLE 6-6-1 CRITERIA FOR EVALUATION OF TRAFFIC CONDITIONS

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

Note: * Based on Travel Time Survey

CONTINUATION TABLE 6-6-1 CRITERIA FOR EVALUATION OF TRAFFIC CONDITIONS

Cause of Exisiting Traffic Problems	Criteria	Standard	Evaluation
8.High Frequency of The Occurrence of Traffic Accident	Yearly Accident Rate by Route (Accident/100m)	-Above 2.0	Serious
	Frecuency of Yearly Accident at Intersection	-Above 5.0	Serious
		-Under 4.0	Tolerable
9.High Parking Density & Heavy Traffics on Minor Road	Parking Rate on Street (Demand Capacity)	-Above 50%	** Serious
	Average Travel Speed During Rush Hour	-Under 10Km/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

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

TABLE 6-6-1 EXISTING TRAFFIC PROBLEMS BY LOCATION (1)

Existing Traffic Problems / Area & Location	Average Travel Speed Km/H (Direction Wise, Peak-hour)	High Frequency of Traffic Accident	TRAFFIC CONDITIONS: Signalized Intersection	Indiscriminate Crossing of Pedestrians	Congestion of Buses near bus stops	Merging from Alley	Diverging to Alley	Influence of Cars Turning to the Left	Parking on Street	Bad Pavement	High Parking Density & Heavy Traffic on Minor Roads	Beyond the Capacity at Signalized Intersection	Physical Condition
① Calle 34													
Cra 46 - Cra 45	~ 10					○		○			●		
Cra 45 - Cra 44	~ 10	○	●		●			○	●		●	●	
Cra 44 - Cra 43	~ 10	●			○						●		
Cra 43 - Cra 41	~ 10		●	○	●	○			○		●	●	
Cra 41 - Cra 40	~ 10	○	●	●	●	○			○		●		
Cra 40 - Cra 38	~ 10	○	●	○	●						●	●	
② Calle 37													
Cra 38 - Cra 40	~ 10	●			○				●		●		
Cra 40 - Cra 41	~ 10				○						●		
Cra 41 - Cra 43	~ 10										●		
Cra 43 - Cra 44	~ 10	○									●		
Cra 44 - Cra 45	~ 10	○			○						●		
Cra 45 - Cra 46	~ 20	○									●		
③ Calle 38													
Cra 46 - Cra 45	~ 20	○									●		
Cra 45 - Cra 44	~ 20										●		
Cra 44 - Cra 43	~ 10	○									●		
Cra 43 - Cra 41	~ 10	●		○									
Cra 41 - Cra 40	~ 10												
Cra 40 - Cra 38	~ 20	○											
Cra 38 - Clle 45	~ 20	●			○	○		○					
④ Calle 45													
Via 40 - Cra 46	~ 20	○	○								○	●	
Cra 46 - Cra 45	~ 10	●	○								●		
Cra 45 - Cra 44	~ 20	●											
Cra 44 - Cra 43	~ 10	●	●								●		
Cra 43 - Cra 41	~ 20	●											
Cra 41 - Cra 40	~ 10	○											
Cra 40 - Cra 38	~ 10	●	●									○	
Cra 38 - Cra 33	~ 20	●			○	○							
Cra 33 - Cra 22	~ 10	●	○			○			○	○			
Cra 22 - Cra 14	~ 20	●				○		○					
Cra 14 - Circunv.	~ 30			○	○	○		○					
⑤ Calle 30													
Cra 38 - Cra 33	~ 10	●	●	●	●	○							
Cra 33 - Cra 14	~ 20	●			●	○				●			
Cra 14 - Circunv.	~ 20	●		○		○		○					
6 Calle 17													
Cra 38 - Cra 8	~ 20	○				○				○			
⑦ Carrera 38													
Clle 17 - Clle 30	~ 10	●	○		○	○		●			●		
Clle 30 - Clle 34	~ 10	○	●		●	●					●		
Clle 34 - Clle 38	~ 10	○			○	●					●		
Clle 38 - Clle 45	~ 10	○	○		○	○							
Clle 45 - Clle 54	~ 20	○	○		●	○		○					
Clle 54 - Clle 72	~ 20	●	○		○								○
Clle 72 - Clle 76	~ 20	○		○	○								
Clle 76 - Circunv.	~ 40	●		○	○								
⑧ Carrera 40													
Clle 34 - Clle 37	~ 10	○	●	○	●	○		○			●		
Clle 37 - Clle 38	~ 10	○			○	●		○			●		
Clle 38 - Clle 45	~ 10	○	●		○	○							
⑨ Carrera 41													
Clle 34 - Clle 37	~ 10	○	●	●		○		○	○		●		●
Clle 37 - Clle 38	~ 20	●			○				○		●		●
Clle 38 - Clle 45	~ 20	●			○				○		●		●
Clle 45 - Clle 54	~ 30	○											○
Clle 54 - Clle 72	~ 20	○											●
⑩ Carrera 43													
Clle 34 - Clle 37	~ 10	●		●	●	○			○		●		
Clle 37 - Clle 38	~ 10	○									●		

TABLE 6-6-1 EXISTING TRAFFIC PROBLEMS BY LOCATION (2)

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

Existing Traffic Problem / Road & Location	Average Travel Speed Km/H (Peak Hour)	High Frequency of Traffic Accident	Signalized Intersection	Inadequate Crossing of Pedestrians	Congestion of Buses near bus stops	Weaving from Alley	Diverging to Alley	Influence of Cars turning to the Left	Parking on Street	Poor Pavement Marking	High Parking Density & Heavy Traffic on Main Roads	Exceed Capacity of Standard Intersection	Physical Condition
Cra 38 - Clle 45	~ 10	●	○	○	○		○				●		
Clle 45 - Clle 53	~ 40	○											
Clle 53 - Clle 72	~ 10	●	●		○								
Clle 72 - Clle 76	~ 20	○					○						
Clle 76 - Clle 96	~ 20	●											
(11) Carrera 44													
Clle 34 - Clle 37	~ 10	○		○	○		○						
Clle 37 - Clle 38	~ 20	○			○								
Clle 38 - Clle 45	~ 20	●					○						
Clle 45 - Clle 53	~ 20	○											
Clle 53 - Clle 72	~ 30	○											
Clle 72 - Clle 76	~ 30	○											●
Clle 76 - Clle 87	~ 20	○											●
(12) Carrera 45													
Clle 34 - Clle 37	~ 20	○		○	○		○		○				
Clle 37 - Clle 38	~ 10	○											
Clle 38 - Clle 45	~ 10	●	●		●		○						
Clle 45 - Clle 53	~ 20			○	○		○						
Clle 53 - Clle 72	~ 30	●		○	●		○	●					
(13) Carrera 46													
Via 40 - Clle 37	~ 10						○				●		
Clle 37 - Clle 38	~ 10	○					○				●		
Clle 38 - Clle 45	~ 20	○	○				○				●		
Clle 45 - Clle 53	~ 10	○	●					○			●		
Clle 53 - Clle 72	~ 10	●	○				○					●	
Clle 72 - Clle 76	~ 20	●											
Clle 76 - Circunv.	~ 10	●	○										
(14) Calle 47													
Clle 45 - Cra 21	~ 10	○			○								
Cra 21 - Cra 14	~ 20	○			○			○		○			
Cra 14 - Circunv.	~ 20				○			○		○			○
(15) Cra 51B													
Clle 45 - Clle 53	~ 30				○		○						
Clle 53 - Clle 72	~ 20			○	○								
Clle 72 - Clle 76	~ 30	○			○			○					
Clle 76 - Circunv.	~ 20				●		○	○					○
(16) Clles 52-53 Cra 27			○										
Via 40 - Cra 54	~ 20	○		○	○								
Cra 54 - Cra 46	~ 20	○			○		○	●					●
Cra 46 - Cra 45	~ 10		●										○
Cra 45 - Cra 44	~ 10						○						●
Cra 44 - Cra 43	~ 10	○					○						
Cra 43 - Cra 41	~ 10												
Cra 41 - Cra 39	~ 10	○											
Cra 38 - Clle 68	~ 20				○		○	○					
(17) Clle 72 Cra 14													
Via 40 - Cra 54	~ 30	○					○	○					
Cra 54 - Cra 46	~ 10	●	●	○			○	●					
Cra 46 - Cra 45	~ 10										●		
Cra 45 - Cra 44	~ 10	○											
Cra 44 - Cra 41	~ 10	○											
Cra 41 - Cra 38	~ 40	○											
Cra 38 - Clle 68	~ 20	○			●		○						●
Clle 68 - Clle 47	~ 20	○		○	●		●						●
Clle 47 - Clle 45	~ 20	○			○		○						●
Clle 45 - Clle 30	~ 20	○			●		○						●
(18) Calle 76													
Via 40 - Cra 54	~ 20	●			○		○						
Cra 54 - Cra 46	~ 10	○	●		○			●					●
Cra 46 - Cra 44	~ 10						○						●
Cra 44 - Cra 45	~ 20	○											●

TABLE 6-6-1 EXISTING TRAFFIC PROBLEMS BY LOCATION (3)

Existing Traffic Problems / Area & Location	Average Travel Speed Km/H (One Block Wise, Maximum)	High Frequency of the Occurrence of Traffic Accident	Signalized Intersection	Indisciplined Auto Crossing of Pedestrians	Congestion of Buses near bus stops	Merging from Alley	Diverging to Alley	Influence of Cars Turning to the Left	Parking on Street	Poor Pavement Maintenance	High Parking Density & Heavy Traffic on Minor Roads	Demand > Capacity of Signalized Intersection	Physical Condition
(19) Via 40													
Cra 46 - Cra 45	~ 20	O					O	O			●		
Cll 45 - Cra 58	~ 40												
Cll 58 - Cll 72	~ 40												
Cra 72 - Cll 76	~ 50												
Cll 76 - Circunv.	~ 30				O								
(20) Circunvalar													
Cll 6 - Cra 46	~ 50	O			O		O						●
Cra 46 - Cra 38	~ 60												●
Cra 38 - Cll 760	~ 60												●
Cll 760 - Cll 47	~ 60				O								●
Cll 47 - Cll 45	~ 60												●
Cll 45 - Cll 30	~ 40	●					●						●
Cll 30 - Cll 17	~ 40						●						●

CHAPTER 7: PUBLIC TRANSPORTATION

7-1. INTRODUCTION

The major means of public transportation in Barranquilla is the bus. Taxis are also available as are some ferry boats. The latter is used between villages where there is poor land transportation crossing the Magdalena River.

There exist sixty one bus routes which are operated by twenty one organizations, and 2.180 buses are under those organizations.

All of bus routes radiate from the "CENTRO", and their pattern of routes is a reflection of the urban expansion of the city. The expansion of developing neighborhoods at the out-skirts of the city causes the extention of bus routes and the increase in the number of buses. This expansion of the bus service areas has made the traffic congestion more severe in the Centro area.

There are two types of bus operating organizations: companies and cooperatives. Previously, many bus owners operated individually, but recently they were asked to integrate into one of the two organizations. Even as of now, bus companies have many individual bus owners who pay a royalty to use "cupo" which means the operation licence of bus from INTRA. The entity of the bus operating organization seems to be under process of modernization from individual operation to organizational operation such as the bus companies.

Many types of buses are under operation; for instance, one company operates various models from the 1940's to 1983. Other companies operate buses of more than ten kinds of bus makers.

Many maintenance problems exist because of the above mentioned condtions accompanied with poor maintenance facilities and manpower of each bus company. Major types of buses recently introduced were Dodge and Chevrolette.

There are three kinds of buses in Barranquilla: first, buses with 30 seats or more; second, the buseta with 30 seats or less; and third, the microbus.

Buses can be divided into two types because of different fares: one is bus called the "corriente" with cheaper fare because of governmental subsidy, and the other is the TSS bus without subsidy.

In 1960's three kinds of buses operated with different fares with subsidy, and then there were integrated into two kinds.

After the construction of a university outside of the circumferencial road, they introduced busetas with a higher fare because of no subsidy. At the end of 1981, the TSS bus was introduced.

The introduction of the TSS bus has two objectives: One is to promote the renewal of old buses, and the other is to slow down the increase of total amount of subsidies to the corriente buses. Consequently, now it is very difficult to introduce new corriente buses. And on the other hand, CFT has provided soft loans for procurement of new buses for TSS.

The Corporación Financiera de Transporte (CFT) is one section of the Ministerio de Desarrollo Económico (MDE), and it aims to provide financial resources for public transportation businesses. CFT has a master-plan for bus terminals in major cities of the country. They have completed some bus terminals in Bogotá, Cali, and some other cities. As one of these cities, Barranquilla was selected and some studies on site selection of the terminal have been conducted, but it has not yet implemented.

Four taxi companies and about thirty associations of taxis exist in Barranquilla. More than 5.000 taxi vehicles are registered. Generally, the taxi is considered as a supplemental form of public transportation. According to the traffic survey along major roads, however, taxi traffic occupies a significant share of the total traffic.

Another supplemental form of transportation are ferries on the Magdalena River, Because of poor land transportation, these ferries connect Barranquilla with other small municipalities which are located along the river. But the total number of passengers on the ferry boats are limited as of now.

7-2. Bus as Passenger Service.

7-2-1. Bus Route and Bus Service Area.

1) Division of Sectors and Zones.

For explanation and analysis of bus services, geographical sectors and zones are formulated.

The urbanized area of Barranquilla consists of four sectors besides the "Centro" and islands which include the port area and Barranquillita. These sectors are subdivided into sub-sectors and zones based on major roads and the distance from the "Centro".

Approximate location of sectors are as follows:

1st sector (100): Between Río Magdalena and Cr. 46.
2nd sector (200): Between Cr. 46 and Cll 47.
3rd sector (300): Between Cll 47 and Cll 30.
4th sector (400): Between Cll 30 and Río Magdalena.

( ): Code Number of Sector.

The boundary of subdivisions in the second sector is Cr. 36, and Cll 45 in the third sector mentioned above. The zones in each sector are divided at the line with 4 km. and 8 km, from the Centro. (See Fig. 7-2-1).

2) Bus Routes.

Almost all of the sixty one bus routes radiate from the Centro to each sector, with three special routes passing through the Centro from one sector to the other.

The former type of bus routes mentioned above called "Radial Type" and the

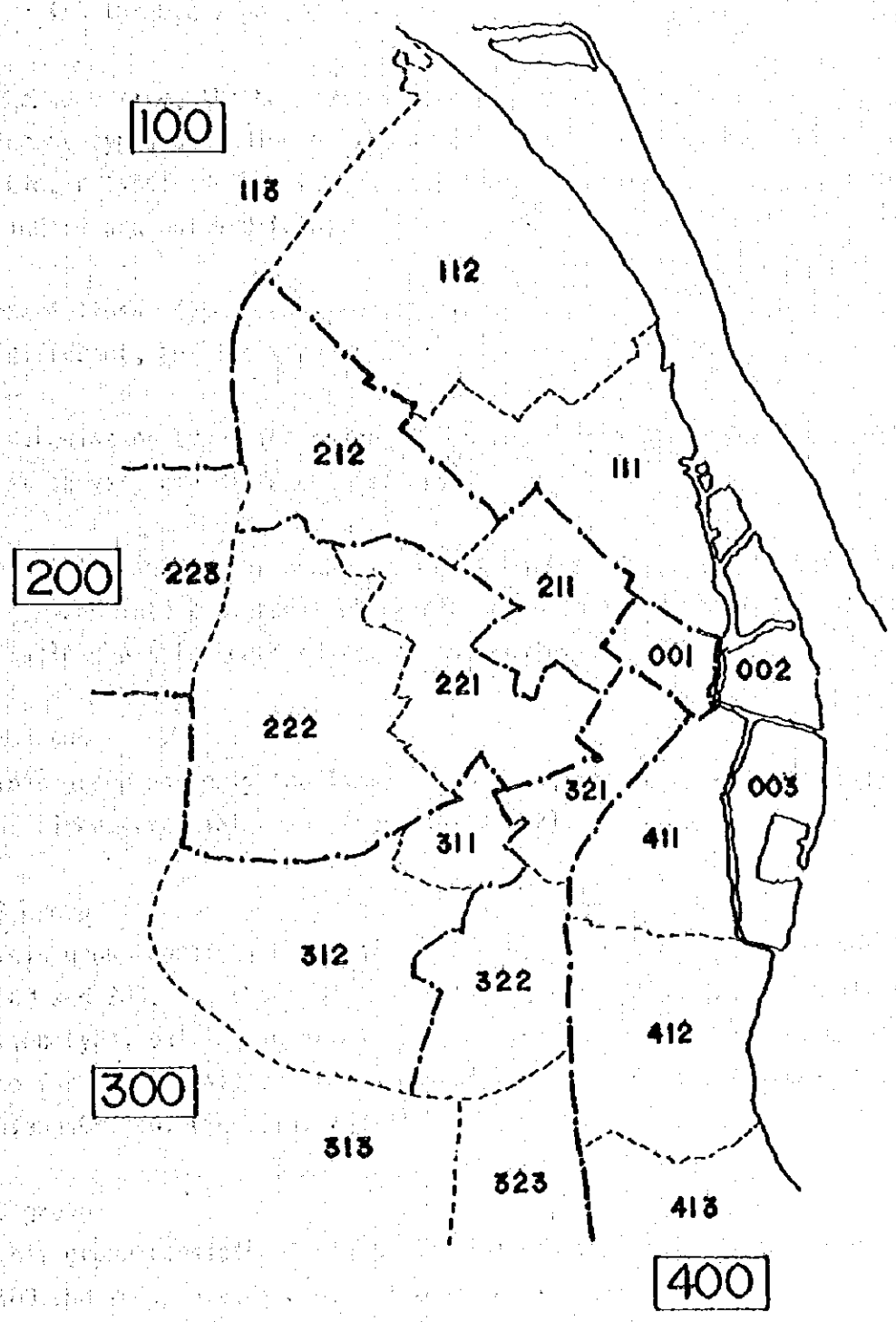


Fig. 7-2-1 DISTRIBUTION OF SECTOR

latter is "Through Type".

At the same time, the bus routes with radial type can be divided into three different types depending on the shape of the routes such as:

(1) Linear type: the bus routes uses the same and/or adjacent on the south inward and outward trips.

(2) Semi-linear type: roads for the inward and outward trip of bus are different, but the service area of both trips is similar.

(3) Circulation type: The shape of bus route as a whole forms a circle and it serves some different sectors.

Based on the service area and type of each bus route, the 60 bus routes are categorized into ten groups which are shown in the table 7-2-1. (Numbers in the table shows the cord number of bus routes).

1) A group
This group has only one linear type route inside sector 100, till outside of circumferencial road. (See Fig. 7-2-2).

2) B group
This group consists of eight routes that serve some parts of both sector 100 and 200. The shape of the routes in this group are the small circulation type, but the interval of roads for inward and outward trips is not so far. Almost all service areas of these routes are limited to the area along Cr. 46. (See Fig. 7-2-3).

3) C group
This group consists of eight circulation type routes which cover sector 100 and 200. Service areas of these routes are limited within about five kms from the Centro. (See Fig. 7-2-4).

4) D group
This group consists of three routes which connect sector 100 and 300

Fig. 7-2-1.CLASSIFICATION OF URBAN BUS ROUTES

SECTOR SERVED	TYPE OF ROUTE	RADIAL TYPE: LINEAR TYPE	RADIAL TYPE: SEMI LINEAR TYPE	RADIAL TYPE: CIRCULATION TYPE	THROUGH TYPE
100	110	18° A			
100/200	110/210		B 07.08	01. 02. 03. 04. 05. 06 22. 23°	
	110/210/220			21-A. 21-B, 35	D
100/300	110/210/220/310				47.48.49
200	210	17,26°			
	210/220		24.25 E	C 33.34.36	
	220	37°,38.39	31.32 41.42 F		
300	310/320	51.52.54.55	56°57 G		
	320	53.61.62.63-B	64°65 H		
300/400	320/410	63-A			
400		71.72.73.74.75.76. 81.82°.83.84. 96.97.98 85.87°	I J		

NOTE: Numbers in this Table are cord No. of Bus Route

passing through the Centro. (See Fig. 7-2-5). These are only three exceptions which pass through the central area among sixty one routes.

5) E group
This group consists of four routes, linear and semi-linear type routes. Almost all service areas are limited in Subsector 110. (See Fig. 7-2-6).

6) F group
This group consists of eight routes. Five of them serve the central area of subsector 210 and the other two serve the same area, but almost all the routes are along Cll 47. (See Fig. 7-2-7).

7) G group
This group consists of eleven routes. The service area of all routes is limited to sector 300, six of them serve sector 310, and the others serve sector 320. All of the routes are within Circumferencial roads. (See Fig. 7-2-8).

8) H group
This group consists of two routes. The roads for these circulation type of route are Cll 45 and Cll 30. Service areas of both routes are limited inside circumferencial road. (See Fig. 7-2-9).

9) I group
This group consists of thirteen routes. Service areas of all the routes are limited to the area between Cll 30 and 17. The service area of six routes is limited to inside Avenue Simón Bolivar and that of six routes reach eight kilometer zone, and the major road of these routes is Cll 30. The other three routes use Cll 17 for their major road. (See Fig. 7-2-10).

10) J group
This group consists of three routes. They pass through Cll 30 towards the airport and the concord subdivision in Malambo. (See Fig. 7-2-11).

Fig. 7-2-2 BUS ROUTE 16

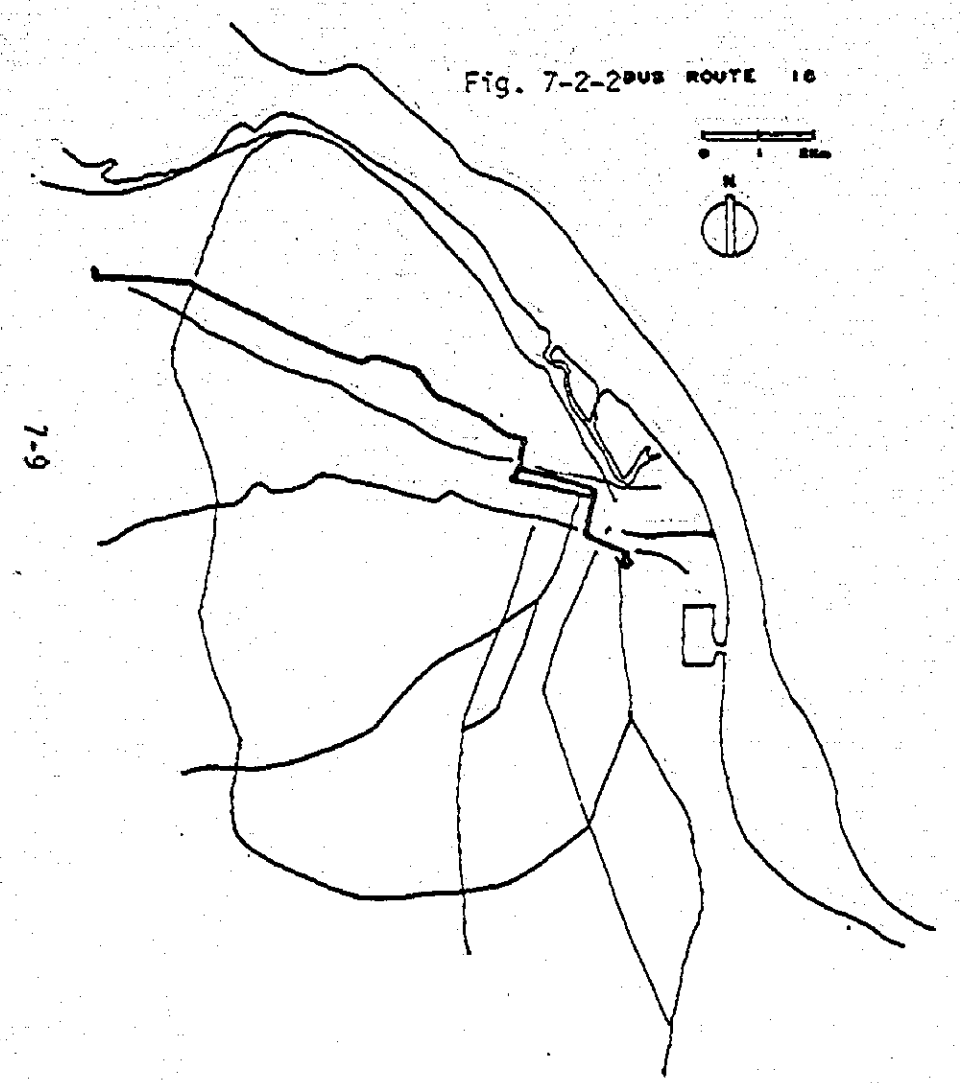


Fig.7-2-3 BUS ROUTE 06

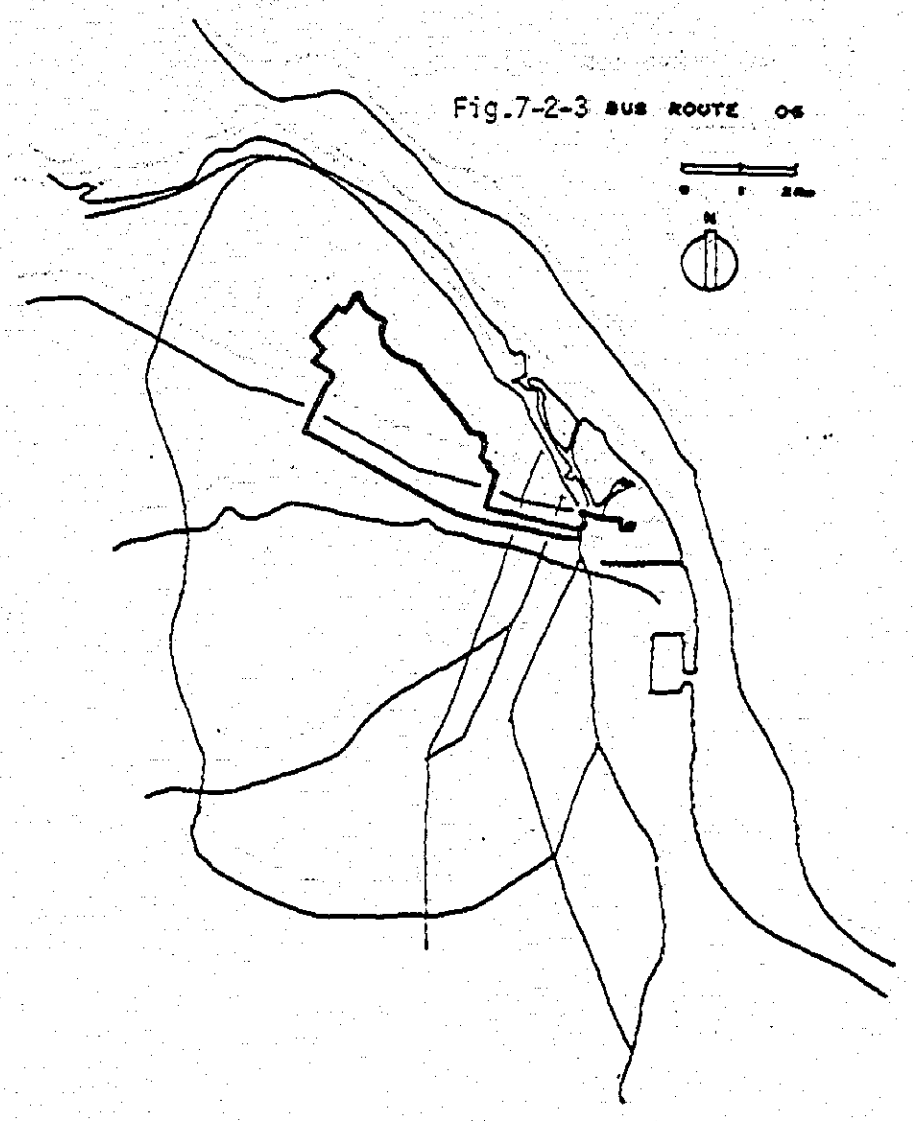


Fig. 7-2-4 BUS ROUTE 23

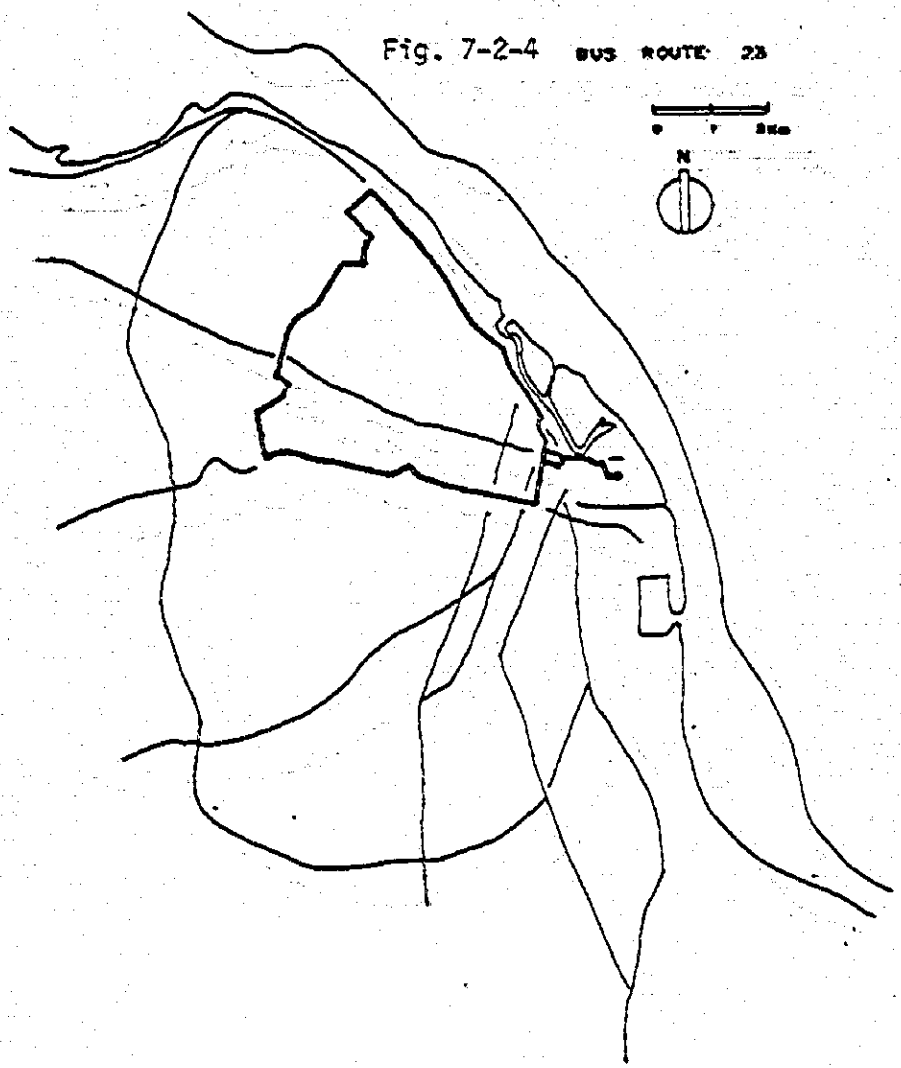


Fig.7-2-5 BUS ROUTE 48

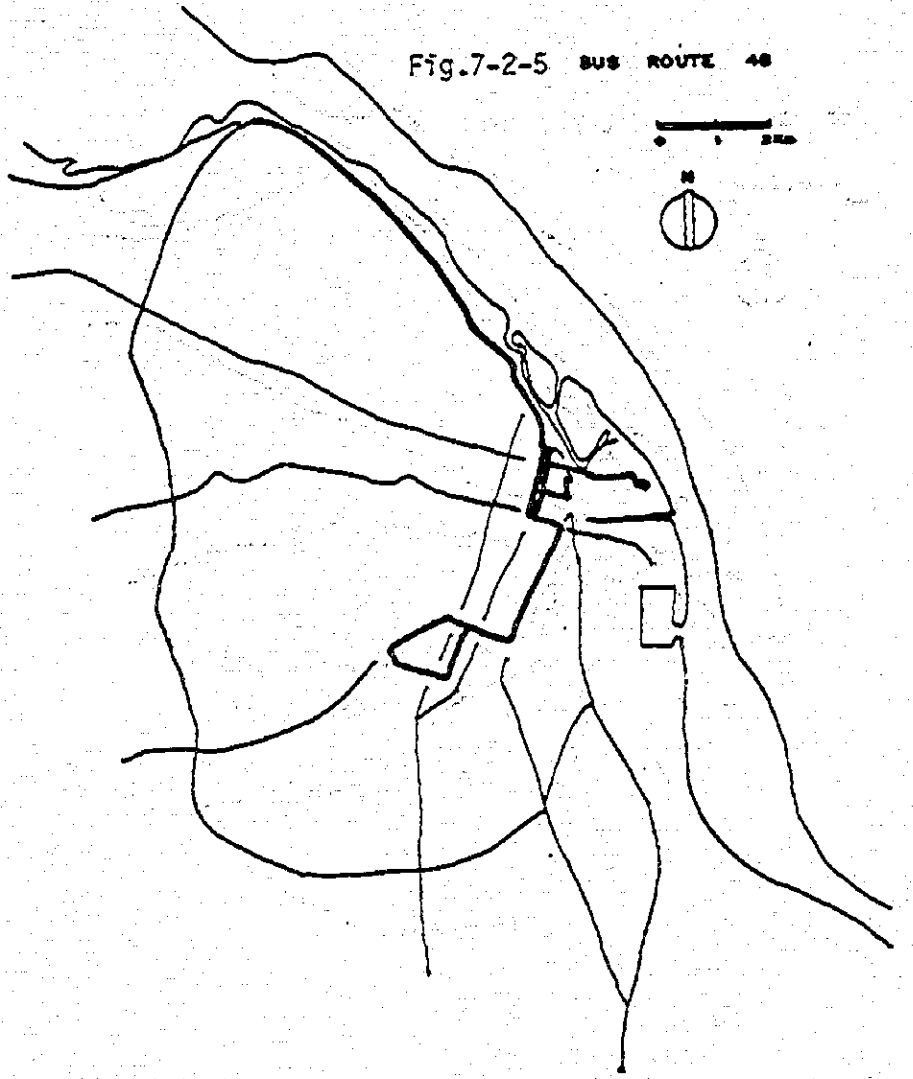


Fig. 7-2-6 BUS ROUTE 26

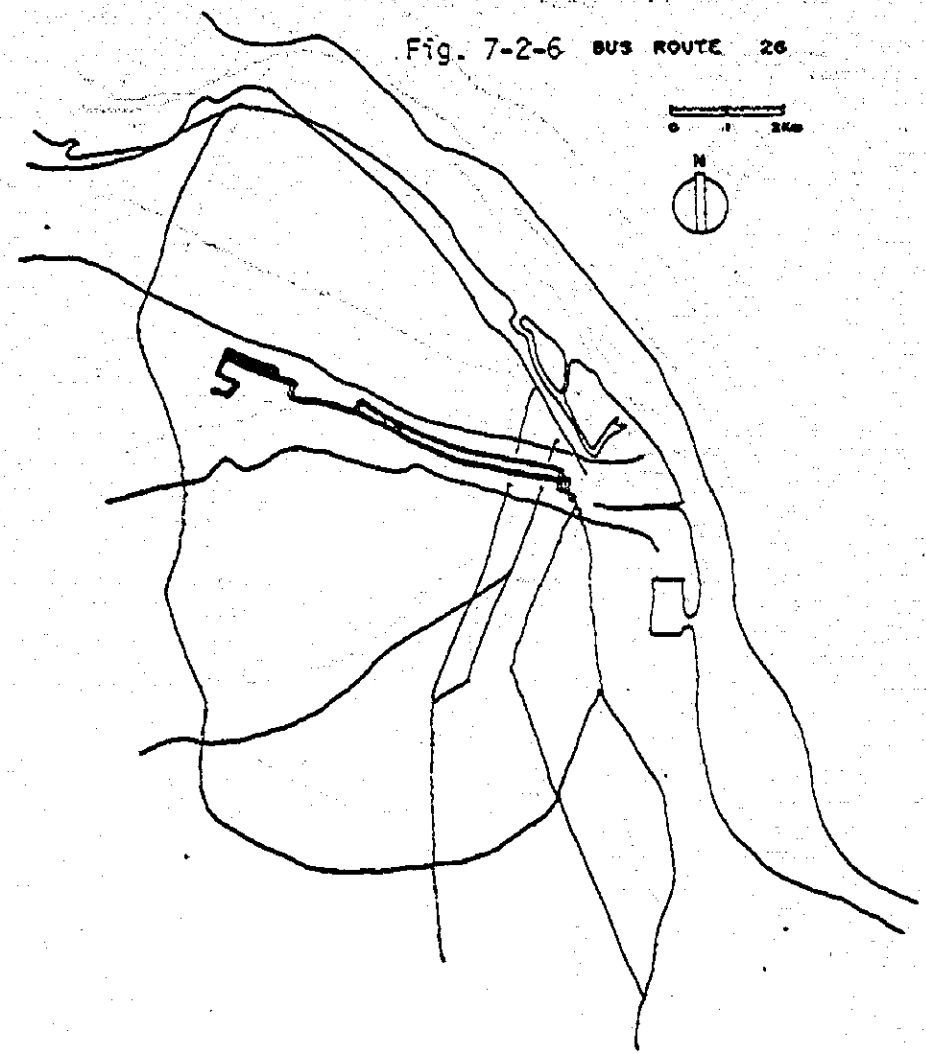


Fig. 7-2-7 BUS ROUTE 37

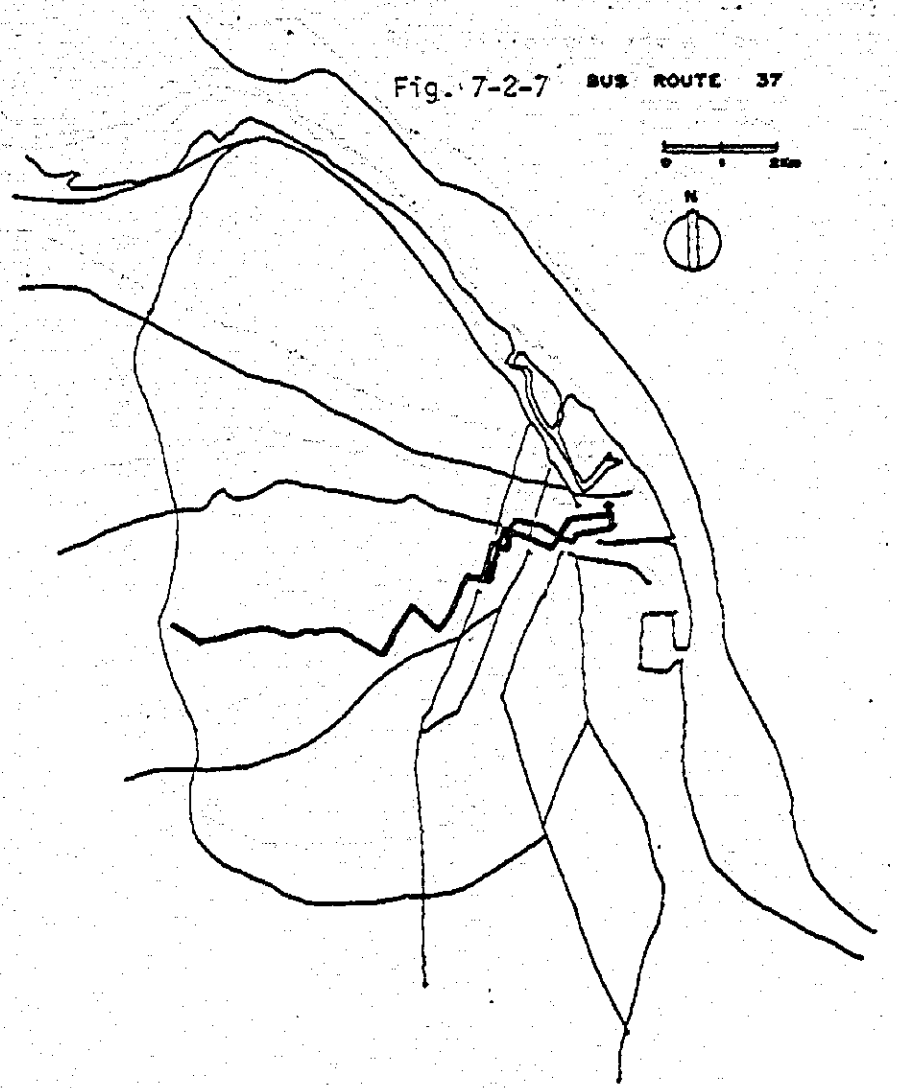


Fig. 7-2-8 BUS ROUTE 56

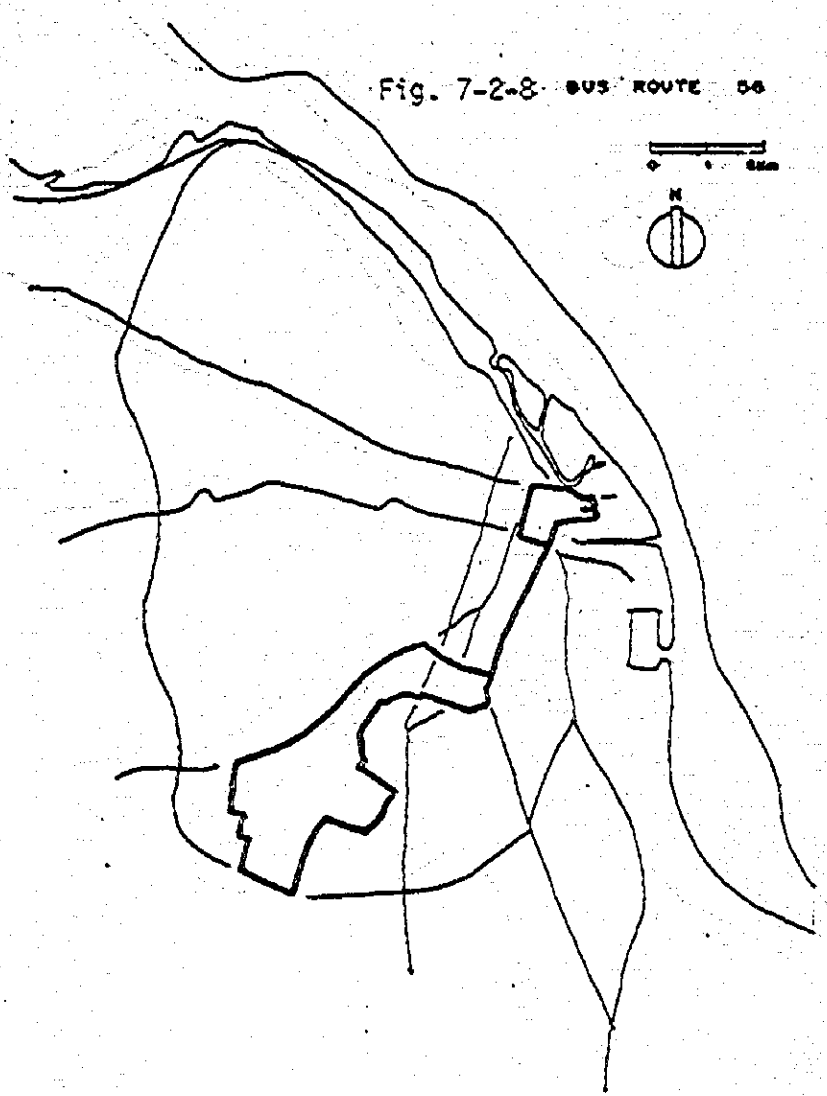


Fig. 7-2-9 BUS ROUTE 64

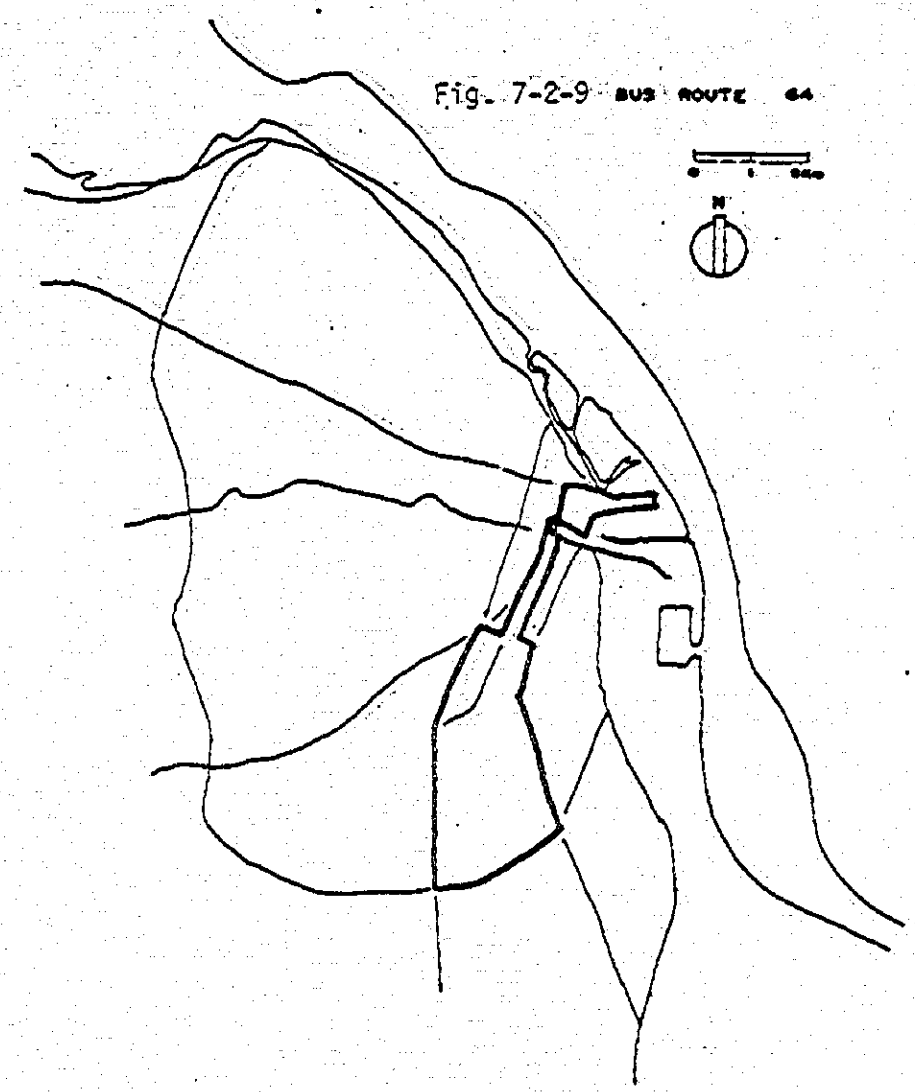


Fig. 7-2-11 BUS ROUTE 87

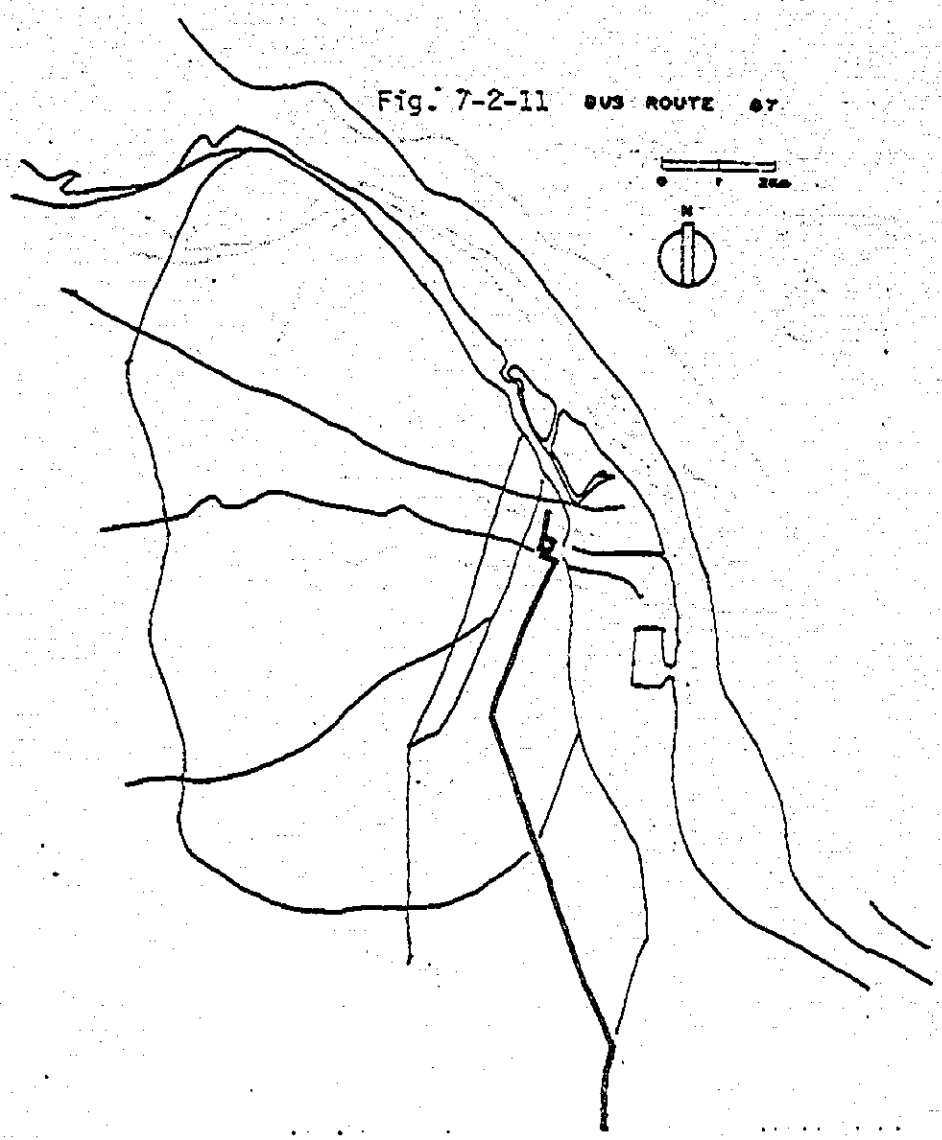
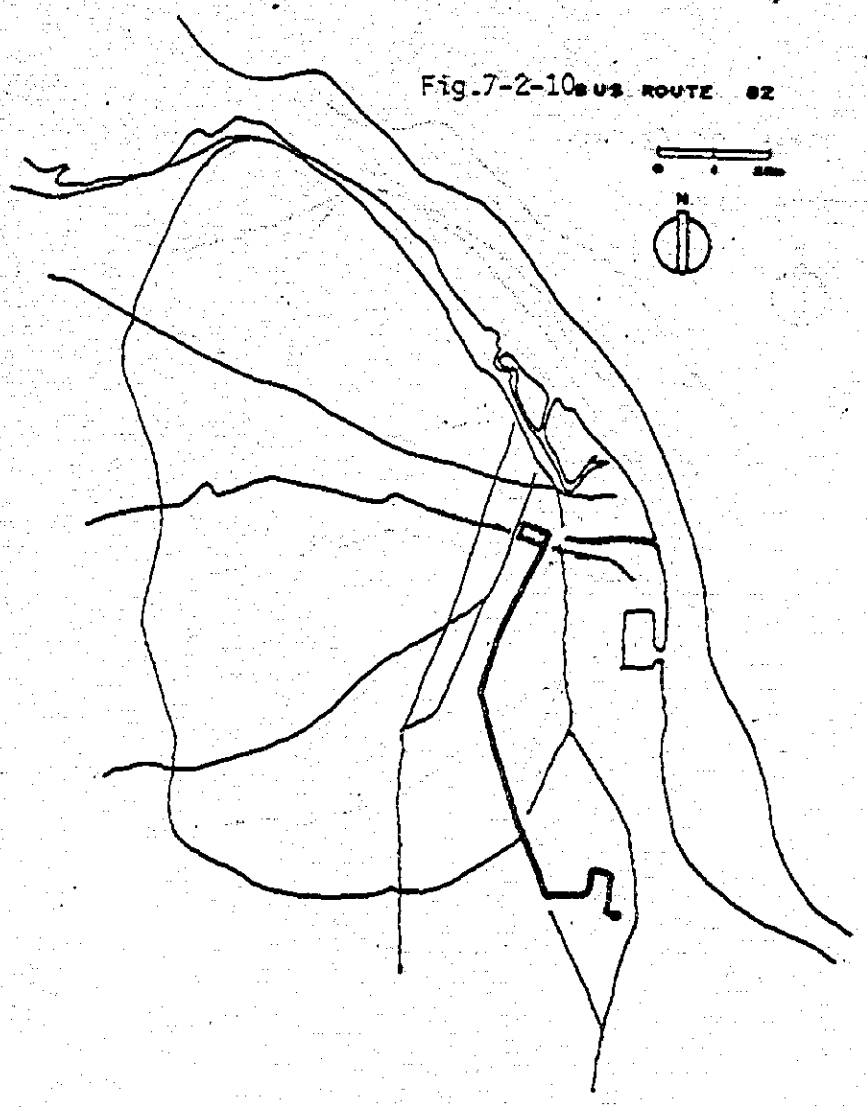


Fig.7-2-10 BUS ROUTE 82



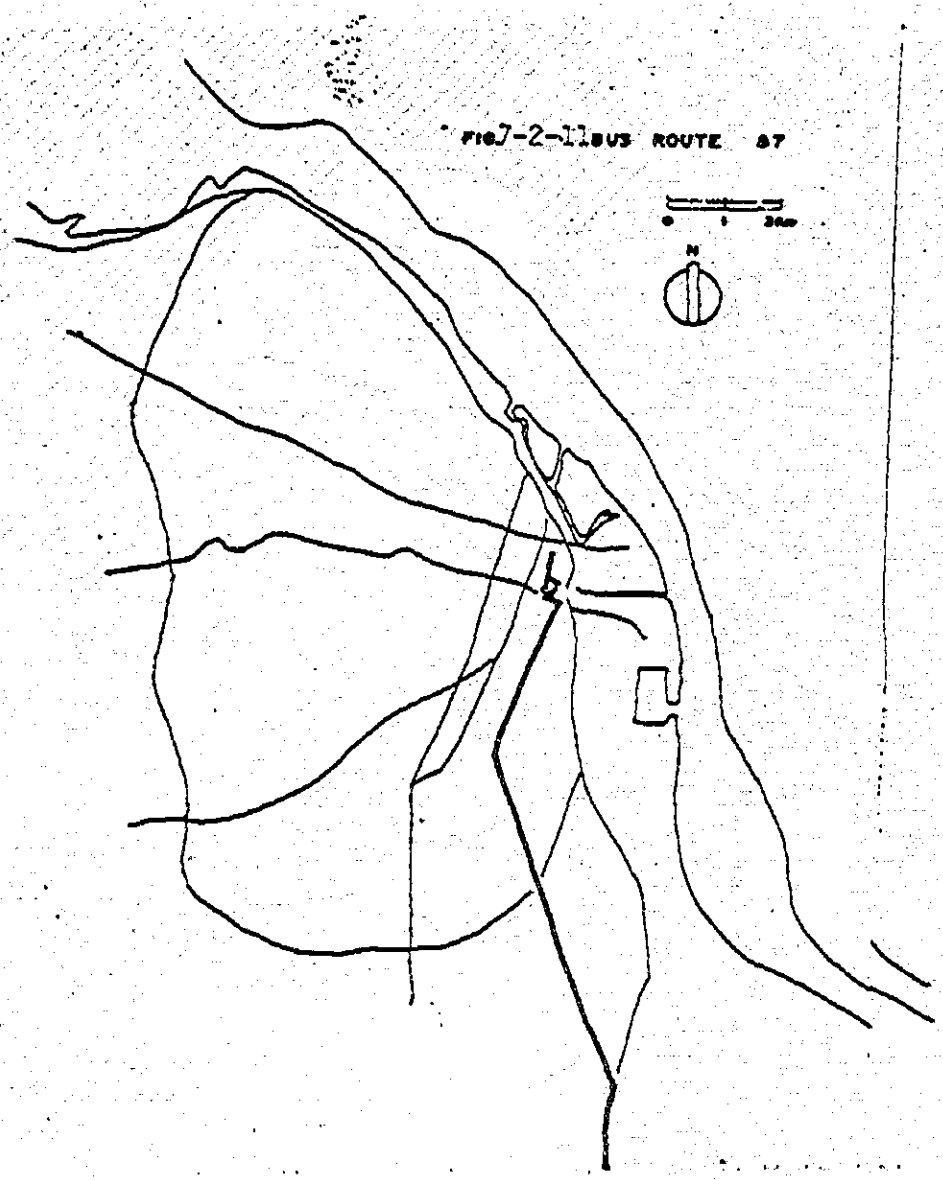


FIG.7-2-11 BUS ROUTE 87

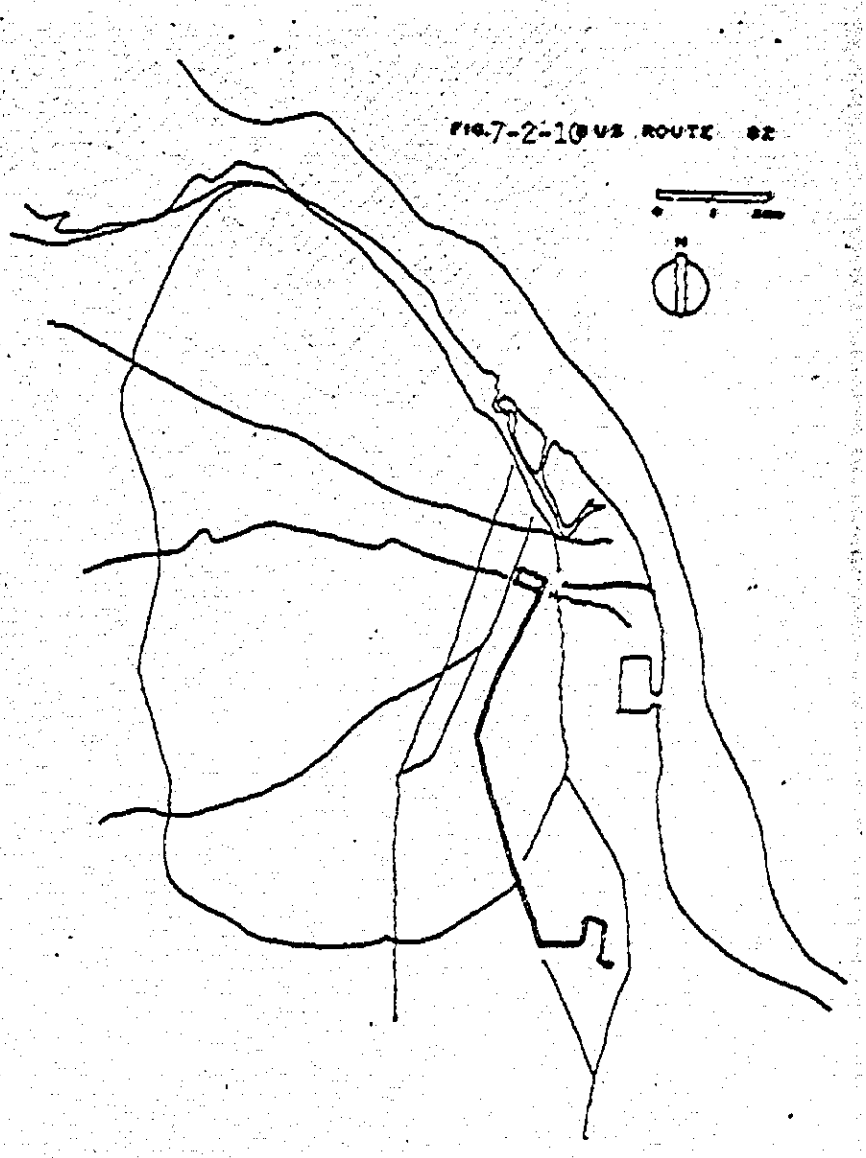


FIG.7-2-12 BUS ROUTE 82

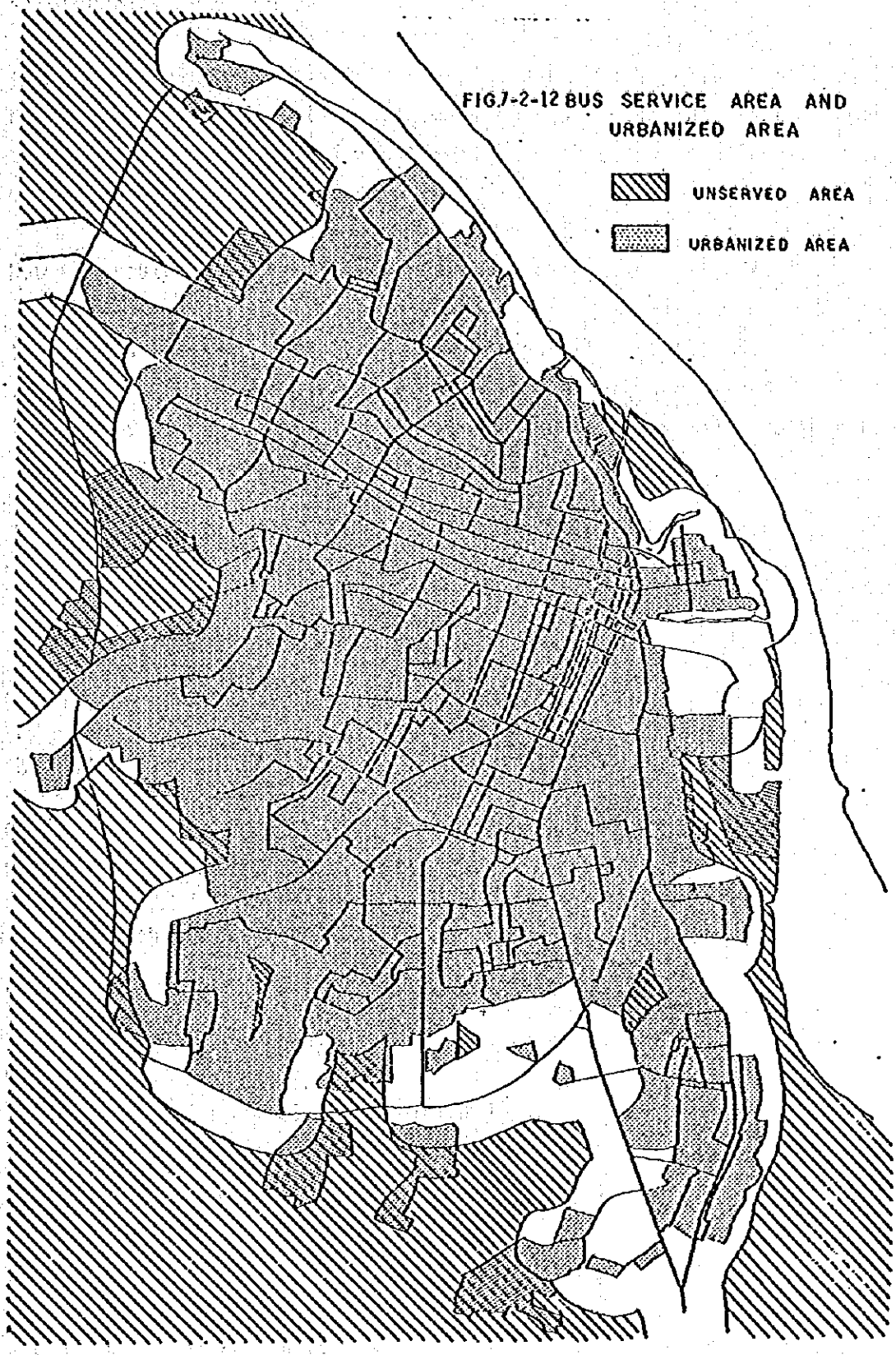


FIG.7-2-12 BUS SERVICE AREA AND URBANIZED AREA

4) Proposals on Bus Routes.

There have been proposals submitted to INTRA which include three types of new routes and modifications of existing routes. Besides these proposals, there are two proposals of modifications of bus routes which are under operation as provisional routes.

New bus routes are classified into three categories, such as

(1) Routes to serve areas which did not have bus routes before.
(2) Routes with new route patterns which had not been served.
(3) Routes which are new for certain companies are similar to some routes which are operated by other companies.

Table 7-2-2. Proposals of New Bus Routes.

Destination	Road for Route
New Routes for Areas with No Bus Service	
1) Costa Hermosa	Simón Bolivar Calle 13
2) Soledad 2000	Calle 30 Calle 45
3) Cosmos 2000	Cll 30/Circun/Cll 45
4) Urbanización Estadio	Calle 45
New Routes with New Service Pattern	
5) EL PUEBLO Circulation	Circun/CLL47/CLL38/Circum
6) EL PUEBLO Circulation	Circun/CLL38/CLL46/Circum
7) Calle 70 Circulation	Cll30/Cll70/Via 40 Via 40/CLL70/Cll30
New Routes but Similar to Another Company's Route	
8) Circulation in Sector 100	Cra60/Cra44
9) Soledad (Centro)	Calle 17
10) Soledad	Calle 17

Table 7-2-3 Proposals on Modification of Bus Routes

Cord No. of Bus Route	Modification
11) Cord 08	Extention of service route along Cra 51 B towards Universidad del Norte
12) Cord 35	Changing of service route from local to major roads
13) Cord 48	Changing of destination and service route
14) Cord 65	Changing of service routes

Four routes in the first category are concentrated in the southern parts of Barranquilla such as Soledad 2000, Cosmos 200, and Urbanización Estacio which are along Calle 45, and Costa Hermosa which is located between Barranquilla and Soledad.

The three routes in the second category are circulation type which connect sector 100, 200, and 300. This route seems to formulate the inner circunferencial road through the urban area of Barranquilla inside existing "Circunvalar".

One of the three routes in the third category is a circulation route in sector 100, and the other two routes serve Soledad.

One of the four route modifications is the extention of a route towards Universidad del Norte. Another is to change their service route form local roads to major roads near central area of Barranquilla.

Those proposals seems to show following points:

(1) Urban bus service for the southern area of the city is not enough because of the rapid expantion of urban area.

(2) Circulation routes passing major roads, including the Circunvalar, are needed because the demand for buses has grown along the Circunvalar.

(3) Circulation routes connecting sectors at the distance in between the "Centro" and the Circunvalar are needed because of the new passenger activity.

7-2-2 Supply and Demand of Bus Transportation

1) Supply of Bus Transportation

a. Basic Information of Bus Service

The basic data for the estimation at supply bus transport supply are as follows:

(1)	Number of bus companies	21
(2)	Number of buses under operation	2,180 units
(3)	Number of bus routes for urban service	61 routes
(4)	Total length of bus routes	1,200 Kms
	Average length of route (vice vesa)	19.7 Kms/route
(5)	Total Service Frequency	13,490 trip/day
	Average Service Frequency for a route	221.1 trip/day/route

b. Bus Transportation Capacity

In this section, bus transportation capacity is measured in terms of passenger.Kilometers.

The total bus transportation capacity is estimated at 11,290,700 pass.kms/day which is allocated to all OD combinations of CENTRO area and each sector.

(See Fig. 7-2-13.)

The OD combination with the largest bus transportation capacity is CENTRO and sector 400 serving Soledad with approximately 293,900 pass.Kms/day followed by other OD combinations, such as;

CENTRO - Sub-sector 320 with 259,200 pass.kms
CENTRO - Sub-sector 210 with 190,500 pass.kms
CENTRO - Sub-sector 110 with 185,500 pass.kms
CENTRO - Sub-sector 220 with 150,200 pass.kms
CENTRO - Sub-sector 310 with 97,800 pass.kms

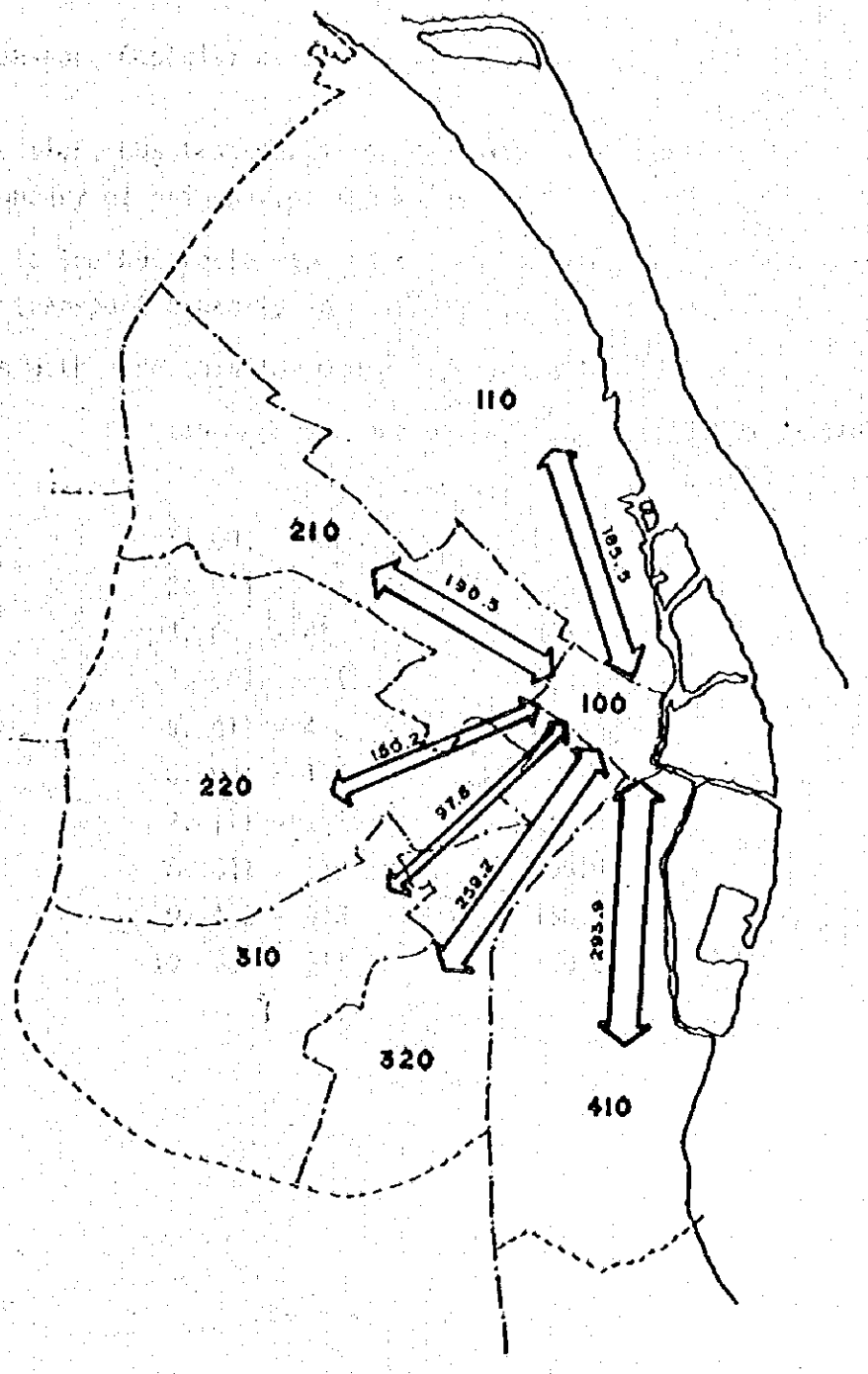


FIG. 7-2-13 TRANSPORTATION CAPACITY
BETWEN CENTRO AND EACH SECTOR
(UNIT = x 1000 pass.km)

c) Bus Transport Capacity at Boundery of Zones

In this section, bus transportation capacity is measured in terms of pass/day at the boundary of neighboring two zones.

According to the bus route map and the bus service frequency of each bus route, total bus transport capacity in pass/day are calculated. (See Fig. 7-2-14)

Zone pairs with more than 100,000 pass/day are listed below:

Tab. 7-2-4. Zone pairs with over 10,000 pass/day

		x 1000 pass/day
1.	001 - 002	627.1
2.	001 - 321	486.7
3.	001 - 411	343.1
4.	001 - 211	224.1
5.	411 - 412	203.5
6.	001 - 111	186.1
7.	111 - 112	156.4
8.	311 - 312	155.4
9.	412 - 413	135.3
10.	321 - 311	120.6

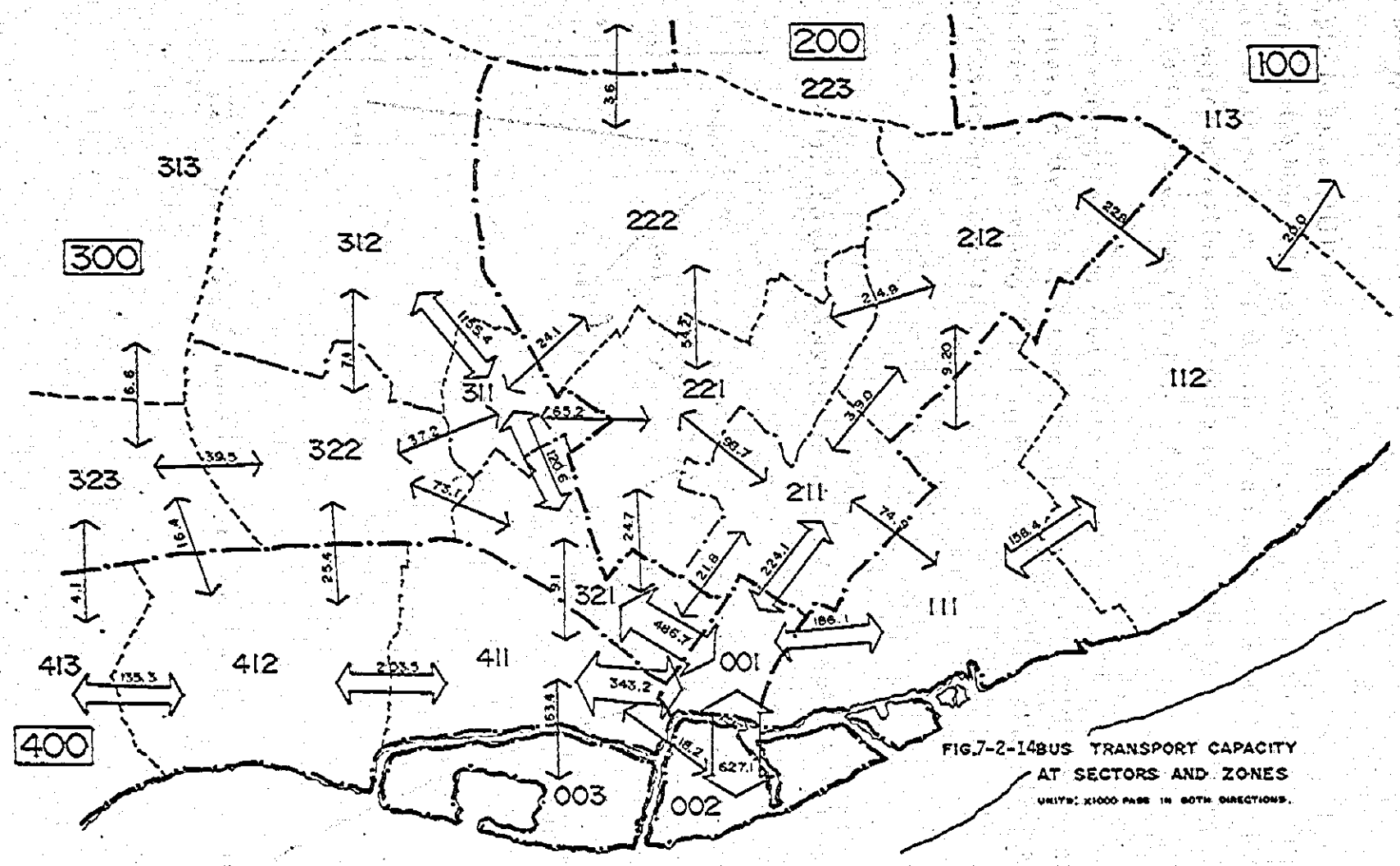


FIG.7-2-14BUS TRANSPORT CAPACITY AT SECTORS AND ZONES

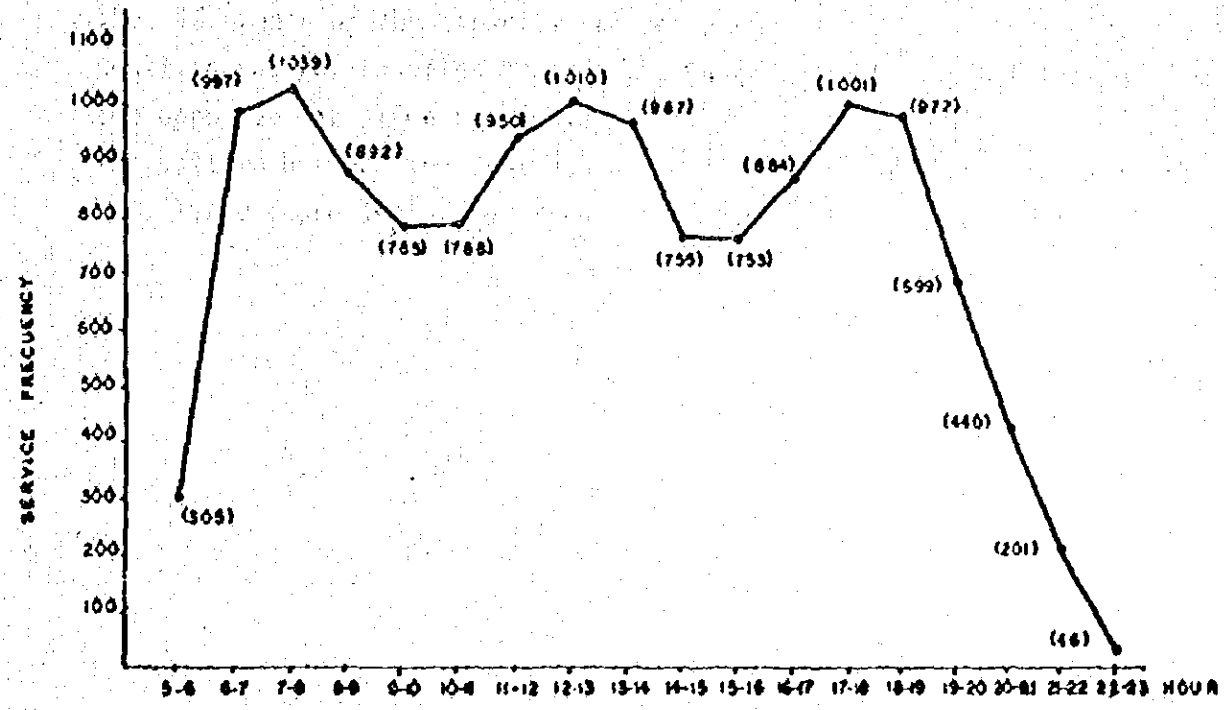
UNITS: X1000 PAX IN BOTH DIRECTIONS.

d. Hourly Fluctuation of Bus Transport Capacity.

People in Barranquilla are accustomed going back home to eat lunch because they have two hours recess at noon, even in governmental offices. Consequently, there are three times of peak hours when road traffic is congested because of communiting activities. Bus service frequency in total also fluctuates according to the bus demand. (See Fig. 7-2-15).

In the morning peak hour from six to eight o'clock, there are about 2,000 services, in day time peak hour from eleven to two o'clock, about 3,000 services, and in evening peak hour from four to seven o'clock about 2,900 services in Barranquilla.

FIG. 7-2-15. TOTAL SERVICE FREQUENCY OF URBAN BUSES



The hourly fluctuations of bus transport capacity at the boundary of zone 011 (Centro Area) in terms of passenger per day below:

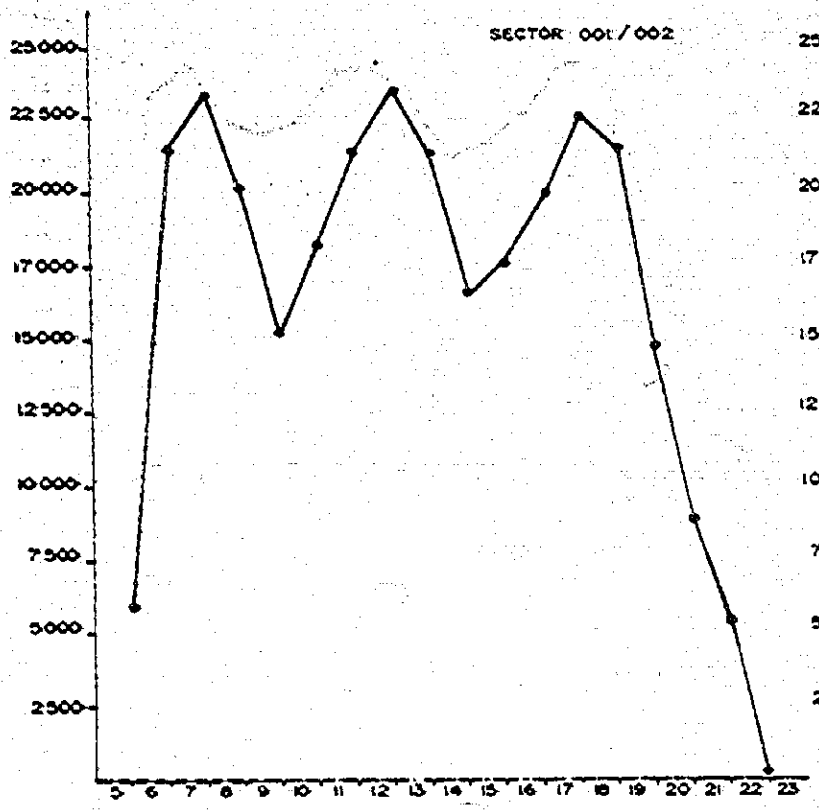
The hourly fluctuation pattern between the Centro area (001) and Barranquillita (002) has the highest peak of the capacity among others because almost all the routes cross this boundary.

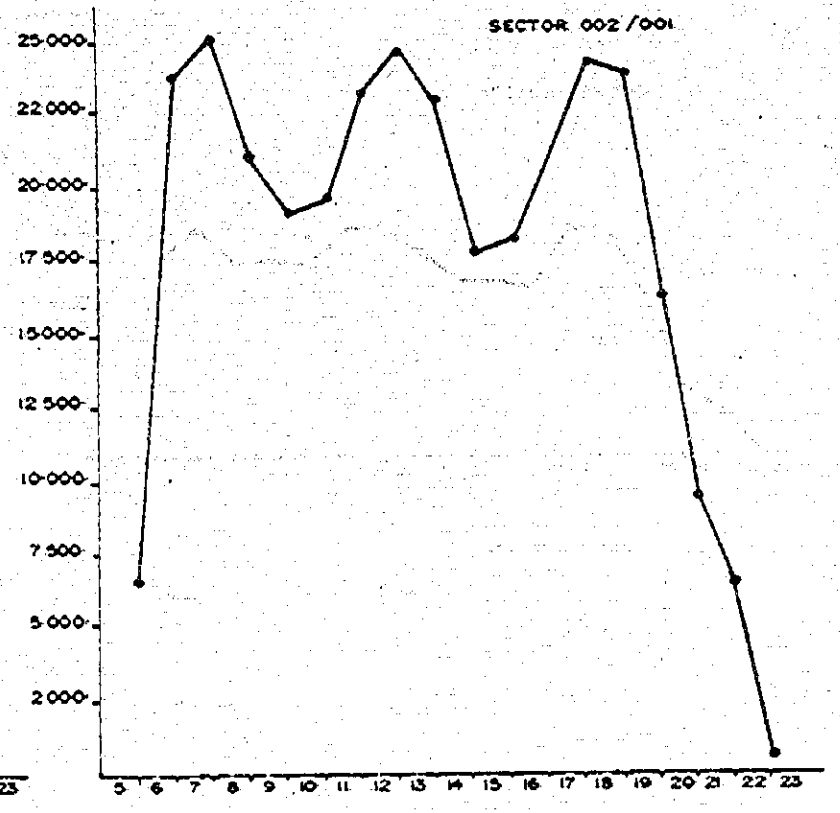
The fluctuation pattern between the Centro area (001) and sector 100 (111) varies with smallest difference in peak and off peak time.

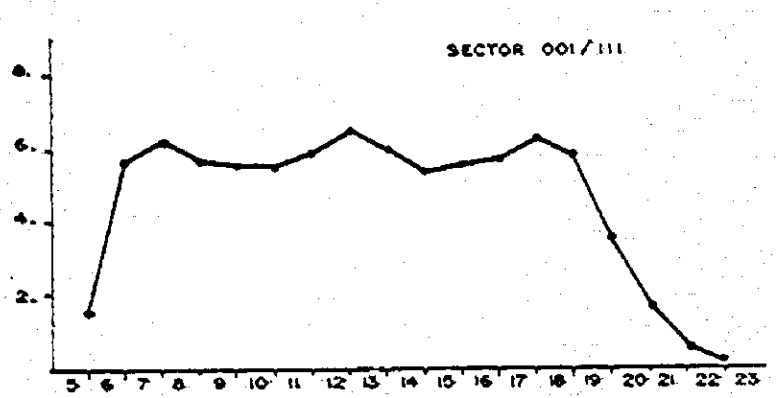
The hourly fluctuation of bus capacity in zone-pair between the Centro area (001) and sector 211 is characterized by following two points:

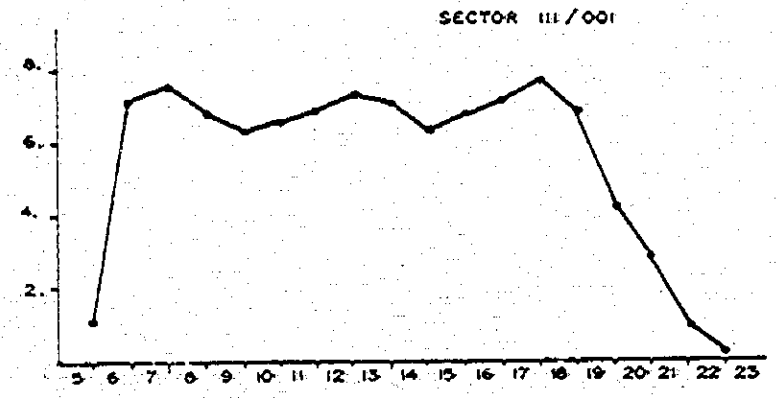
(1) Total bus transport capacity to and from the Centro are different.
(2) Hourly fluctuation pattern of bus transport capacity to and from the Centro area are different.
The difference of the capacity between peak and off peak time is very small in case of bus flow towards the Centro area (011), but that of the opposite direction is similar to others.
The pattern between the Centro area (001) and sector 321 is characterized by a large depresion of bus transport capacity in off peak hours.

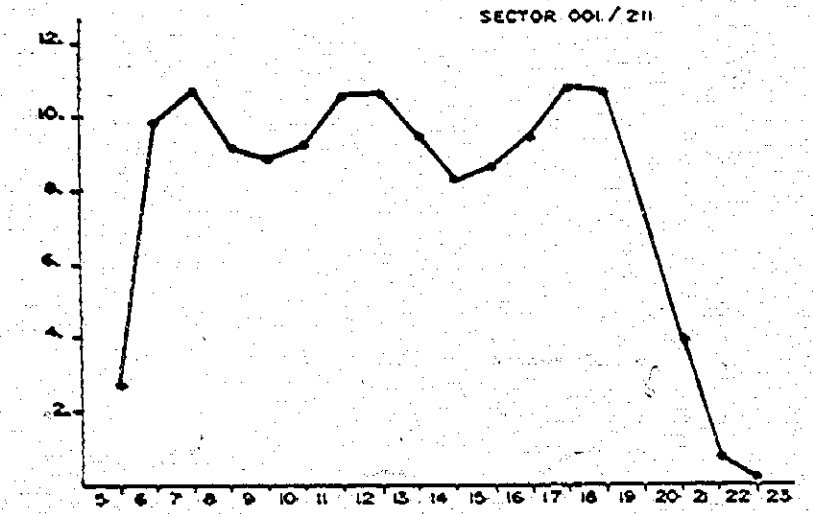
FIG.7-2-16 HOURLY FLUCTUATION PATTERN OF BUS TRANSPORTATION CAPACITY AROUND CENTRO AREA







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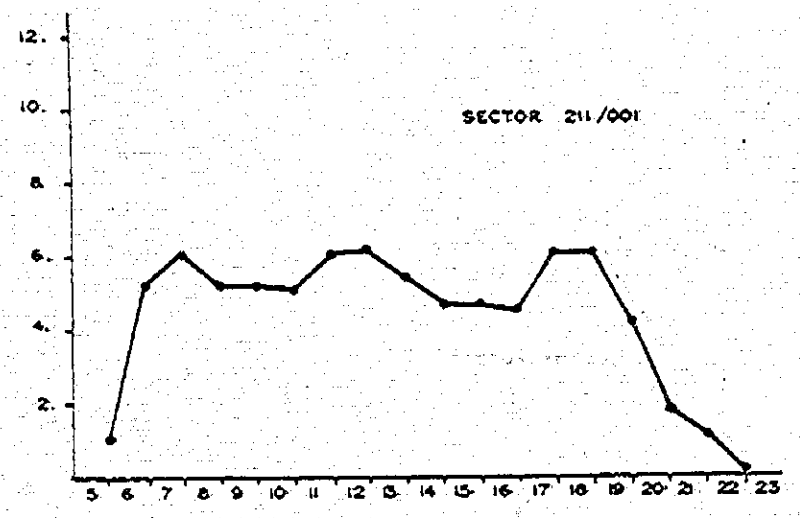
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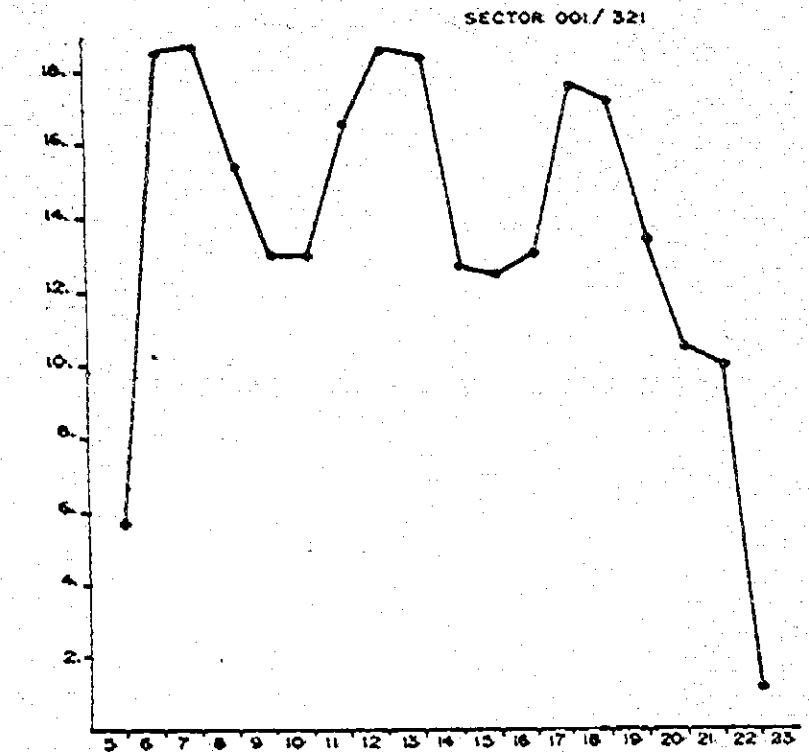
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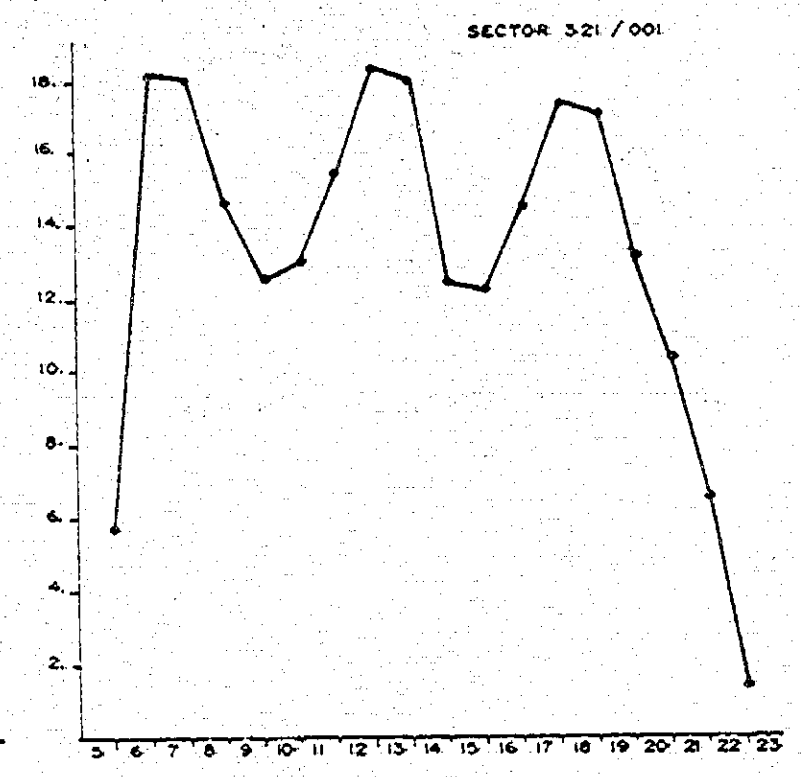
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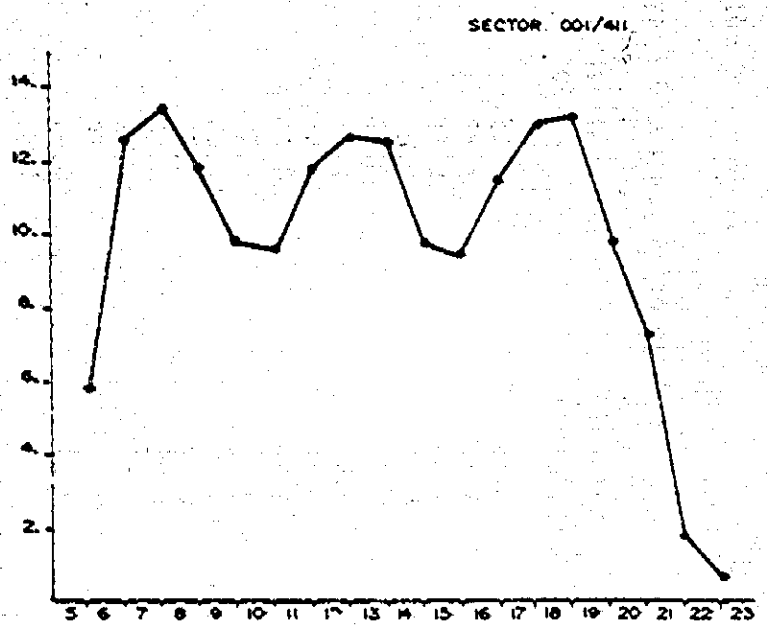
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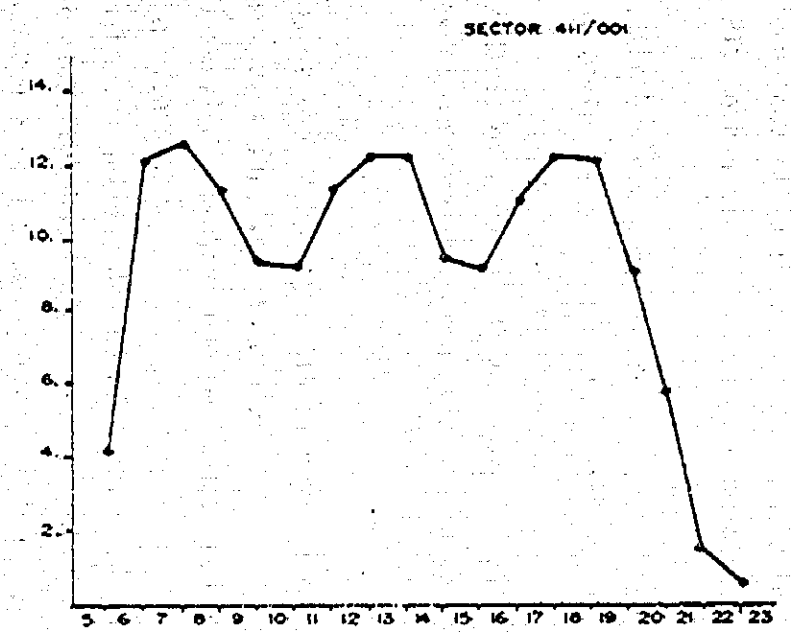
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e. Bus Occupancy Ratio.

The average bus occupancy ratio is needed for convertion from bus passenger's flow in terms of PT. to bus flow in terms of bus units.

For this purpose, the bus occupancy ratio survey has been conducted. Average Occupancy ratio by route are summarized is Table 7-2-5.

Average Occupancy Ratio of a bus is 85.7% with 32.3 passengers per unit. On the other hand, average occupancy ratio by route surveyed fluctuates from 59.5% to 121.2%.

Major survey items of the occupancy ratio survey are summarized below:

(1) Number of bus routes surveyed: 16 routes.
(2) Number of Bus service surveyed: one per hour, from 6:00 in the morning to 6:00 in the evening.
(3) Number of passengers getting on and off during two observation stations which are set along the bus route. Intervals of the observation stations fluctuate from 300 m to 1.5 km depending on the characteristics of the roads along the bus routes.

Table 7-2-5. Average Occupancy Ratio of Urban Bus.

Cord No. of Bus Route surved	Average No. of Pass in a certain Section	Average Capacity (Pass/unit)	Occupancy Ratio
04	17.8	28.2	63.1%
08	48.1	39.7	121.2%
17	21.35	27.1	78.8%
18	16.01	26.9	59.5%
22	40.04	44.9	89.2%
24	20.1	23.2	86.6%
34	32.0	42.8	74.8%
37	46.03	42.1	109.3%
41	37.3	42.8	87.1%
48	26.17	37.2	70.3%
52	49.56	44.3	118.7%
55	37.6	39.1	96.2%
61	33.36	43.4	76.9%
75	37.2	39.8	93.5%
87	29.44	43.8	67.2%
98	25.4	38.2	66.5%
Total	517.4	603.5	85.7%

5) Trip-cutting and Passenger's Behavior

The bus operation entities should operate the buses along the designaded route by INTRA. However the Trip-cutting which is to change and/or shorten the route is usually observed during time when bus demand is uneverly distributed.

These are three types of the Trip-cutting in this city.
(1) Routes inside Barranquillita before 8:00 a.m.
(2) Routes from South and West part of the city into the central area after 6:00 p.m.
(3) Routes to some barrios in the suburbs in the evening.

The reason of the first type of Trip-cutting are
(1) To save the less-effective operation time and cost a long the routes in Barranquillita with few passengers.
(2) To expect more service frecuencies along the routes with much demand.

To operate the buses Trip-cut, the bus company tranfers the bus dispatching points from Barranquillita to outside it.

The reasons of the second type of Trip-cutting are
(1) To save the operation time and cost along the route in CENTRO where traffic is congested.
(2) To ensure enough passengers before going into CENTRO area.

Some bus companies transfers their dispatching points from Barranquillita and Zona Franca to CENTRO but others have no dispatching points after 6:00 p.m.

The reason of the third type of Trip-cutting are
(1) To save the operation time and cost along the routes in the suburbs where they can expect less passengers than along major road.

(2) To avoid dangerous area where drivers of buses suffered.

The passengers who want to go to some areas with bus routes tripcut are obliged to use taxi. But passengers in CENTRO who want to go bach home in South and West part of the city should go to Car.38 to catch the buses. Further more the passengers walk towards South along Cal.30 to ensure the seat in the buses. This activity of passengers seems to promote the Trip-cutting of buses connecting CENTRO and South and West part of the city along Cal. 30 and Cal. 42.

7-3. Bus as Road Traffic

7-3-1. Bus Traffic at Major Road sections.

The buses, in general, have advantage in community transport service with relatively smaller capacity, and shorter service distance and connecting areas of origin and destination with a smaller service areas.

According to the expantion of urbanized area, service areas of bus and number of buses increase. On the other hand, the traffic capacity of the road into central area of the city can not expand with same pace of urban expansion.

Consequently, the traffic conjestion occures in the central area of the city.

Barranquilla is judged to have similar situation mentioned above. Consequently, following items are selected as criteria of analysis on the traffic problems in the central area of the city.

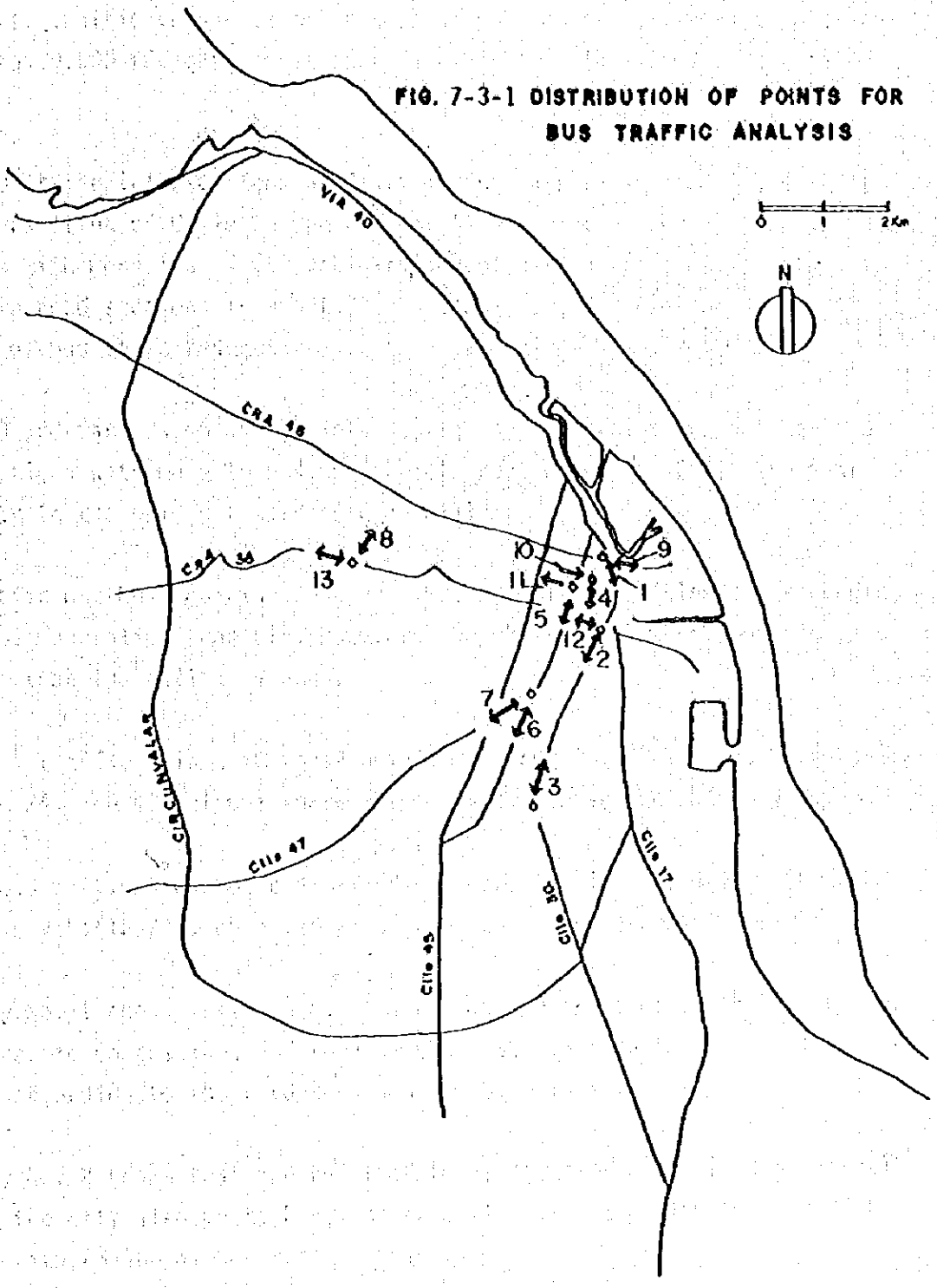
(1) Estimated bus traffic volume based on the service frequency.
(2) Comparison of the bus traffic volume mentioned above and the actual survey.
(3) Bus traffic share of total traffic volume.
(4) Total traffic volume.

Observation points selected for the analysis mentioned above are thirteen points which are along major roads of the bus routes. Results of the analysis are summarized in Table 7-3-1.

Calle 30 and Carrera 38 around intersection of both roads are two of six roadsections which have more than 4.000 bus/day, their traffic volume is about 8.800 bus/day and 7.600 bus/day respectively, based on the schedule of bus service.

Comparing the actual number of buses surveyed at the same points, estimates of bus traffic are larger than the surveyed with 75% and 55% more respectively. Total traffic volume at Calle 30 is about 6.800 vehicle/day with 74% of bus

FIG. 7-3-1 DISTRIBUTION OF POINTS FOR BUS TRAFFIC ANALYSIS



share, and at Carrera 38 it is about 12.700 vehicle/day with about 40% of bus share. Traffic volume at the road sections can be converted to between 15.000 to 20.000 PCU/day. These intersections are classified as category No. 1.

Calle 30 at the intersections of Calle 30 and Carrera 14, and Calle 34 at the intersection of Calle 34 and Carrera 44 are another two of the six road sections with more than 4.000 vehicles/day of bus. Total traffic volume in these two road sections is about 23.000 and 15.000 vehicles/day with 24% and 27% of bus share respectively. These are category No. 2.

Calle 30 and Carrera 46 at the intersection of both roads are another two intersections with more than 4.000 vehicles/day of bus traffif. These are very near to the bridge towards Barranquillita.

Bus traffic of these points is about 5.000 and 8.500 vehicles/day according to the bus operation schedule. However, the observation were about 75% and 35% less than the estimated ones.

The total traffic volume in these points is about 23.000 and 15.000 vehicles/day with 24% and 43% of bus share respectively. These are category No. 3.

Other road sections can be classified category No. 4. They have 1.000 and 2.000 bus vehicles/day observed with 7-30% bus share of total traffic.

Category No. 1 shows that the bus traffic at the entrance of the central area meets traffic congestion, and some of the buses passing through this intersection,according to their routes, want to by-pass it.

Category No. 2 shows that the bus traffic along major roads in the central area of the city also meets heavy traffic flow with approximately 20.0000 veh/day with 25-30% of bus traffic share.

Category No. 3 shows that the bus traffic at the entrance of Barranquillita meets heavy traffic congestion which seems to reach the maximum of the traffic

Tab 7-3-1 BUS TRAFFIC AT MAJOR INTERSECTIONS

Road Section Intersection	BUS SERVICE TOWARDS CENTRO No.of Bus Route (A)	No.of Bus Route (B)	Bus Service Frequency*	TOWARDS OUTSIDE No.of Bus Route (A)	No.of Bus Route (B)	Bus Service Frequency*	TOTAL Service Frequency	Bus Traffic Observed	Difference	total Traffic Volume	Bus Traffic Share of Total Traffic
1. Cll 30.Cll 30/Cr 46	16	3	2083	11	5	2934	5017	3992	1.26	6600	60.5%
2. Cll 30.Cll 30/Cr 38	23	13	4317	25	2	4474	8791	5043	1.74	6790	74.3%
3. Cll 30.Cll 30/Cr 14	11	22	2684	9	8	1973	4657	5455	0.85	22666	24.1%
4. Cll 34.Cll 34/Cr 44 (Paseo Simón Bolivar)	10	5	2324	11	5	2736	5060	4173	1.21	15262	27.3%
5. Cll 45.Cll 45/Cr 43	3	16	514	2	16	706	1220	1137	1.07	9591	11.9%
6. Cll 45.Cll 45/Cr 22 and Cll 47.	2	21	774	3	9	952	1726	1634	1.06	16228	10.1%
7. Cll 47.Cll 45/Cr 22 and Cll 47.	5	22	1427	4	29	1283	2710	2416	1.12	8470	28.5%
8. Cll 72.Cll 72/Cr 38**	3	-	715	2	-	650	1365	1028	1.33	10543	9.8%
9. Cr 46 .Cll 30/Cr 46	16	22	5468	27	20	3119	8587	6377	1.35	14911	42.8%
10. Cr 44 .Cr 44/Cll 34	13	5	2427	-	one way	-	2427	1744	1.39	5820	30.0%
11. Cr 43 .Cr 43/Cll 45	-	-	-	8	-	1441	1441	1384	1.04	13889	10.0%
12. Cr 38 .Cr 38/Cll 30	20	11	3700	17	11	3958	7658	4968	1.54	12689	39.2%
13. Cr 38 .Cr 38/Cll 78	2	3	617	2	3	524	1141	1186	0.96	16709	7.1%

* For 13 hours from 6:00 to 19:00

** Towards west: Towards Centro

capacity of the roads. Accompanied with the trip-cut of the bus, the number of buses that passed through these points is 20-40% less than that observed.

Category No. 4 shows that the traffic flow is 1.000-2.000 bus.vehicles/day .

7-3-2. Bus Travel Speed.

Bus travel is analyzed for traffic control and the bus operation study. Bus travel time was observed during the bus occupancy ratio survey and the route lenght was measured on the map with a scale 1/10.000 based based on the route surveyed through the bus company survey.

Average bus travel speed by bus route fluctuates between 8.9 and 18.4 km/hour and the average of all routes surveyed is 13.5 km/hour.

Table 7-3-2. Travel Speed of Bus.

	Average Travel Speed	Length of Route
04	14.6 km/h	18.5 km
08	11.7	17.4
17	12.5	14.9
18	16.7	25.3
22	13.1	20.0
24	14.7	21.2
34	12.3	15.0
37	12.5	19.5
41	8.9	16.1
48	16.1	31.5
52	11.0	21.4
55	15.2	26.6
61	14.2	19.1
75 (A)	12.0	15.1
87	18.4	25.6
98	13.3	18.7
TOTAL	13.5 km/h	325.9 km

7-4. Administrations and Institutions.

There are three kinds of administrations on public transportation in Colombia such as INSTITUTO NACIONAL DEL TRANSPORTE (INTRA), Cooperación Financiera Transportation (CFT), and INSTITUTO DEPARTAMENTAL DE TRANSITO (T.T).

7-4-1. INTRA.

1) INTRA's Function.

INTRA was established in 1968 as a part of Ministry of Public Works and transportation and branch office of INTRA were created in major cities of the country.

The functions of INTRA are policy making and its implementation on transportation of the country.

More detail functions are introduced below:

(1) To conduct studies technically, economically and financially for rationalization of transport equipment, demand and supply analysis on various aspects of transportation, operation cost of public transportation.

(2) To decide service area for urban, Inter-municipal and Interdepartmental bus and total volume of neccessary equipment and transportation service.

(3) To create semi-governmental company to operate transport service if neccessary.

(4) To coordinate various agencies concern such a ministry of labour and social security and to promote integrated transport measures such as containerization and palettization.

(5) To issue licenses such as drivers licenses, bus operation license (Cupo) and other transportation businesses and to accept the registration of automobiles.

2) Procedure of Issuance of CUPO.

There are two kinds of cupo on bus transportation businesses. One is CUPO for route and the other is for number of equipment. The issuance of cupo by INTRA is basically implemented by application of bus company.

First an applicant like bus companies submit the proposals for new routes or modification of routes to INTRA. The proposals should include the following items:

(1) Items on route such as location and lenght of route, bus stops and terminal.
(2) Items on operation such as trand line, operation hours, service frequency.
(3) Items on demmand and social condition of the influence zone.
(4) Items on influence on competing bus route and road traffic.
(5) Items on financial and technical capacity of bus operation.

Items in the proposals for the modification of the route are limited than that of new routes which are regarding demmand for users mainly.

INTRA make announcement three times on the proposal after receiving the application. If nobody make objection against its CUPO will be issued to the applicants. If somebody make objections against it, decision will be done by higher ranked agencies such as INTRA, Bogotá, and courts.

INTRA assessed the proposals based on the following items:

(1) Category of the company.
(2) Equipment age.
(3) Availability of equipment to use inmediately.
(4) Company experiences of furnishement.
(5) Service schedule and programs of vehicle usage.

7-4-2. CFT.

CFT which is semi-public agency, was established in 1964 under the Ministry of Economic Development.

Major functions of CFT are as follows:

(1) To promote and finance to the land transportation development.
(2) To administer the subsidies of the corriente buses.
(3) To study on transportation terminal.

1) Loans for Transportation.

CFT has twenty loan systems: two of them are for bus procurement, another two of them are related to the construction of facilities of bus, four are procurement of parts of vehicle including bus, five for taxis and another eight are for the other transportation businesses.

a. Urban bus replacement program.

This loan is established in 1982 to replace old buses for TSS buses only. At the same time this system request to borrowers not to use old buses for public service. Major loan conditions of this program are as follows:

Limitation of loan: 73% of procurement cost or 2,650,000 pesos per bus.
Interest: 26% annual
Duration of repayment: 60 months.

b. Loans for Terminal construction and Special Project.

One of two loan systems mentioned here is for construction of company terminal which includes parking space, maintenance shop, offices, etc.

The other is for special projects which is not identified specific characteristics of the project. However this loan system might be utilized for

special project like construction of common passenger terminal.

c. Loans for vehicle parts procurement and for repairing.

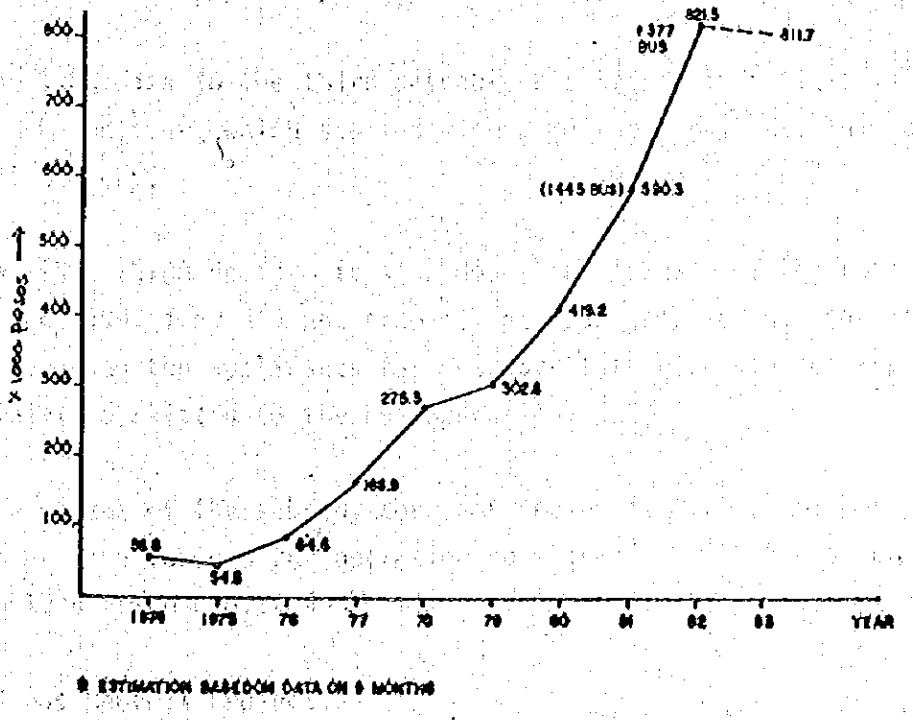
There are four kinds of loan systems in this category; three of them are for procurement of parts such as body, engine and spare parts. Another is for repairing vehicles.

3) Subsidy for Corriente Buses.

There are various subsidies for bus transportation which are mentioned in 7-4-3. In this section, the subsidy for corriente bus is discussed.

The amount of subsidy in 1983 is 2,36 pesos per passenger and it is decided based on the INTRA's survey.

In Barranquilla nineteen bus companies have gotten subsidies till today. Total amount of subsidies given to those companies in ten years has been increased rapid recently. (See Fig.7-4-1).



* ESTIMATION BASED ON DATA ON 9 MONTHS

FIG.7-4-1 INCREASE OF SUBSIDY FOR CORRIENTE BUS

7-4-3. Subsidy and Policy for Bus Transportation.

1) Subsidy for Bus Transportation.
Subsidies related with bus transportation are divided into three categories:
(1) Subsidies for bus users.
(2) Subsidies for bus companies
(3) Subsidies for bus drivers.
The subsidies in the first category started at 1958. According tothe law, 18 students could get tickets from their school to supplement their bus fare, but this system was cancelled at 1966. According to the same law, all employers of the companies were obligated to pay the transport expenses of their employees, and this system is still alive at present.

The subsidies in the second category started at 1966. According to the Decree 424, buses and busetas could get the subsidy for vehicle for public use. The subsidies were given to the companies as "BONUS" which is one kind of evidence of debt. This decision was followed by a rapid increase of fuel price in 1966, but in 1971, the payment system was changed from the indirect way of using "BONUS" to the direct payment to the companies.

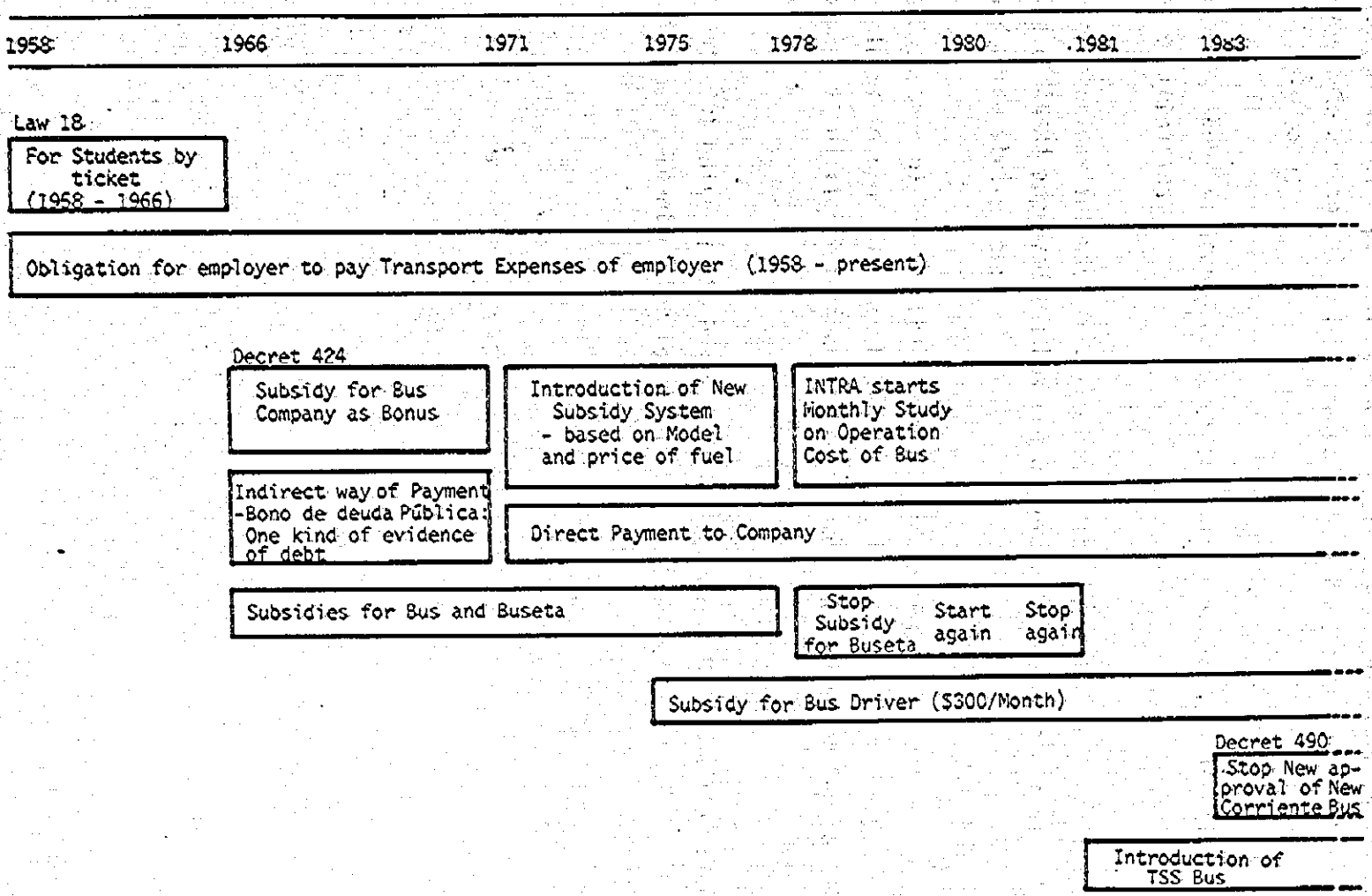
The subsidies in the third category started at 1975. This is the subsidy for the bus driver, which started with a 300 peso payment. This system is still alive today.

In 1983, INTRA decided to slow down the increase of the corriente bus under Decree 490. They did not stop giving approvals for new corriente buses, but they asked the applicants for new corriente buses to get approvals from three ministers related to the bus operation.

The amount of the subsidy corriente buses is 2.36 pesos per passenger which is decided through the operation cost analysis which was conducted by INTRA in 1978. (See Fig. 7-4-2).

2) Bus Renewal Project.
More than 50% of the buses in the Barranquilla bus fleet are over ten years

Fig.7-4-2 History of Subsidies related with Bus Transportation



old. Accompanied with poor maintenance facilities and manpower of the bus companies, the mechanical and passenger service conditions of the buses are seriously poor.

For example, about fifteen percent of the total bus fleet is inactive because of repairing.

The government has intended to renew old buses. In 1981, the executive committe of INTRA approved the bus renewal project. This project has followed three strategies:

(1) Introduction of TSS bus which was decided in 1981.
(2) CFT loans to procedure new buses.
(3) To make it difficult to increase corriente buses based on Decree 490, 1983.

After 1981, 391 units of TSS buses were introduced in Barranquilla. That is about eighteen percent of the total bus fleet of the city.

7-5. Bus Operation.

7-5-1. Bus Fleets.

1) Bus Stadistics.

The bus stadistics mentioned here are based on the Bus Company Survey which was conducted at the end of 1983.

The number of bus fleets of each bus company is regulated by INTRA. This regulation is included in the bus operation permit which is called "CUPO", and this CUPO decides a maximum and minimum number of bus fleets. Consequently, the number of buses of each company is usually in between the maximum and minimum, with some exceptional companies.

The present bus fleet of bus companies in Barranquilla is shown in Tab.7-5-1. The total number of buses in Barranquilla are summarized below.

Table 7-5-1. Total number of Bus/Buseta in Barranquilla 1983.

	Bus		Buseta		Total	
	max.	min.	max.	min.	max.	min.
No. of buses in CUPO	2208	1699	240	190	2448	1889
No. of buses owned by companies.	1892		279		2180	

* including nine mini buses.

The distribution of the number of bus units by company is shown in Fig. 7-5-1. The largest company in terms of the number of buses is COOCHOFAL(1) with 238 bus units, and the smallest is SOTRAUSQUE(12) with 53 bus units. The average number of buses in the twenty one (21) companies is 104 bus units.

Some companies such as FLOTA ROJA, TRANS. LOLAYA, and TRASALFA have a smaller number of buses than those designated in CUPO, because the insentives for utilization of a fewer number of buses than CUPO's are adopted for these companies. On the other hand, there is a company which uses more bus units

than CUPO's. They intend to upgrade from the present category to the higher, which is used by INTRA to categorized and evaluate bus companies.

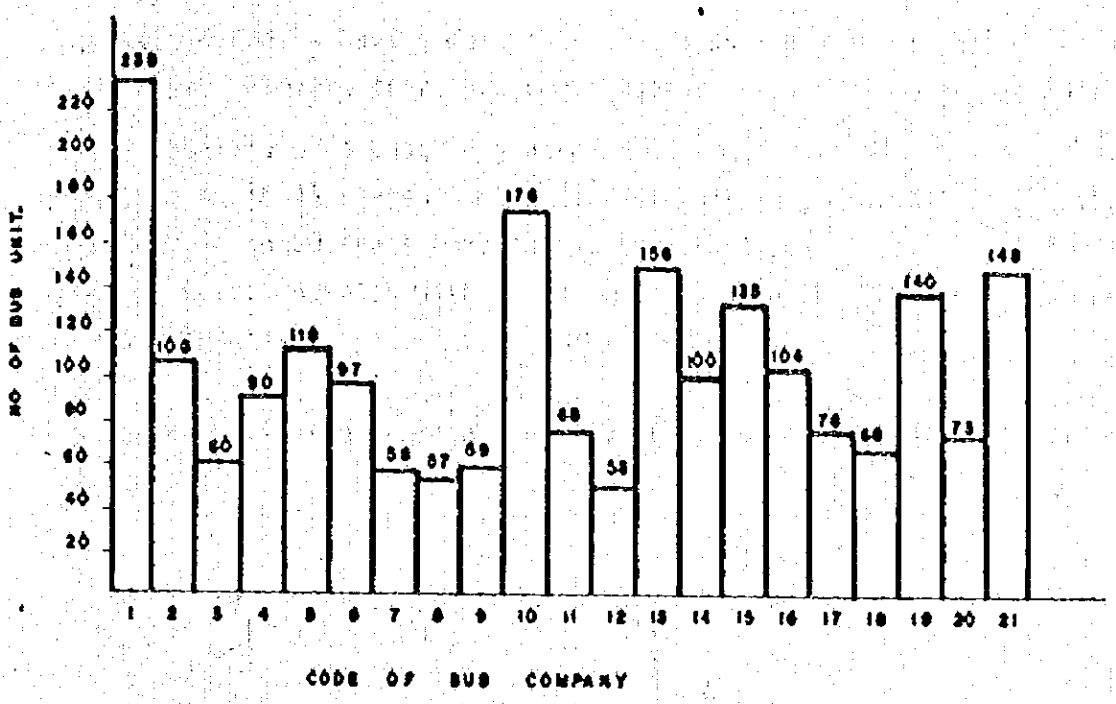


FIG. 7-5-1. NUMBER OF BUS UNIT BY COMPANY

Only 12.8% of the total number of buses are Busetas. 34.8% of the Busetas (97 units) are under COOLITORAL, which has no buses. 28.3% of the Busetas (79 units) are under SOBUSA which is ranked as second of all companies in the city.

Buses are divided into two categories: The corriente bus and the TSS. Only 18.0% of the total number of buses are TSS buses. TRANSDIAZ has 60 units of TSS buses, the highest number, and the second is TRANSURBAR with 52 units.

SODETRAUSQUE has 53 corriente buses. That means that all of the buses of this company are subsided. On the other hand, COOLITORAL has no corriente buses. That means this company has no subsided buses.

2) Bus Capacity

Bus capacity is defined as the number of seats on the bus. However, actual bus transport capacity per vehicle includes the number of passengers without seats.

A bus is defined as having more than 30 seats, and a Buseta has between 20 to 30 seats. However, there are some Busetas which have more than 30 seats.

Sitting capacity of a bus, in general, fluctuates from 21 to 60 seats per bus. Buses from 41 to 45 seats have the highest share with 30.8% (671 seats), and buses from 46 to 50 seats have the second share (535 units) among the total number of buses. Busetas with 26 to 30 seats have the highest share with 84% among Busetas. (See Fig. 7-5-2)

42.5 seats/bus is the average capacity of all buses including Buseta in Barranquilla.

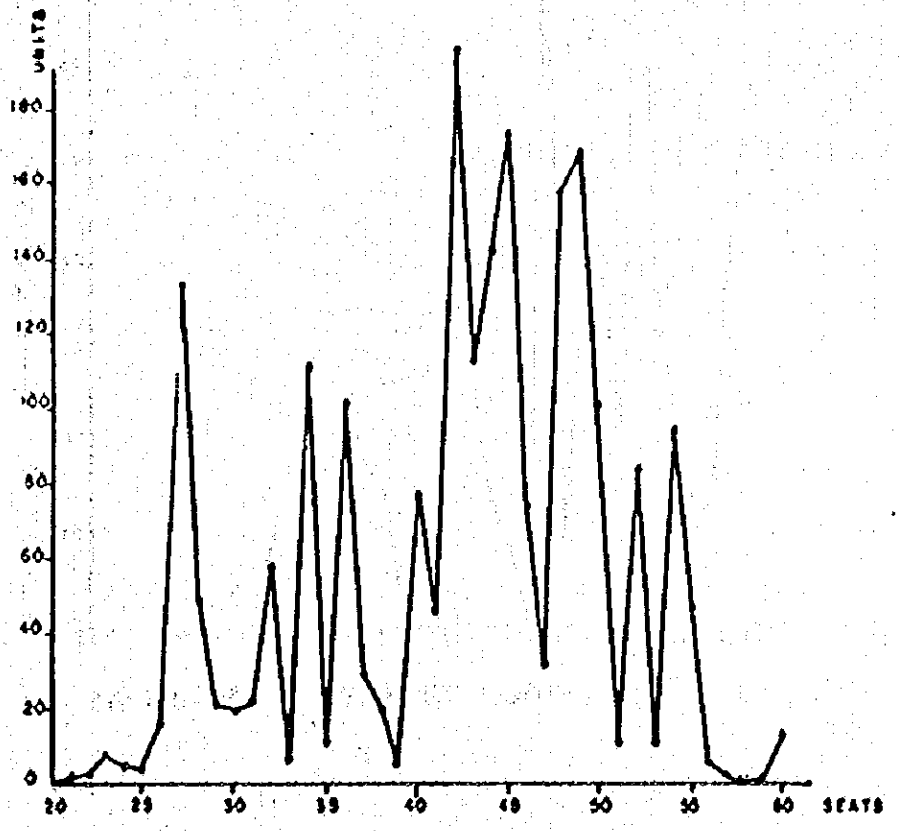


FIG. 7-5-2 BUS FLEET BY CLASS OF CAPACITY

3) Bus Model

Bus models in Barranquilla range from the 1940's to 1983. 25.8% of all buses are 1980 to 1983 models which has the largest share among buses. The second largest number of buses with 21.5% are 1975 to 1979 models.

The 1982 bus model with 297 units ranks highest among the number of buses by model by year, 1970 model is second, 1981 is third, 1965 is fourth, 1976 is fifth, 1977 is sixth. (See Fig. 7-5-3)

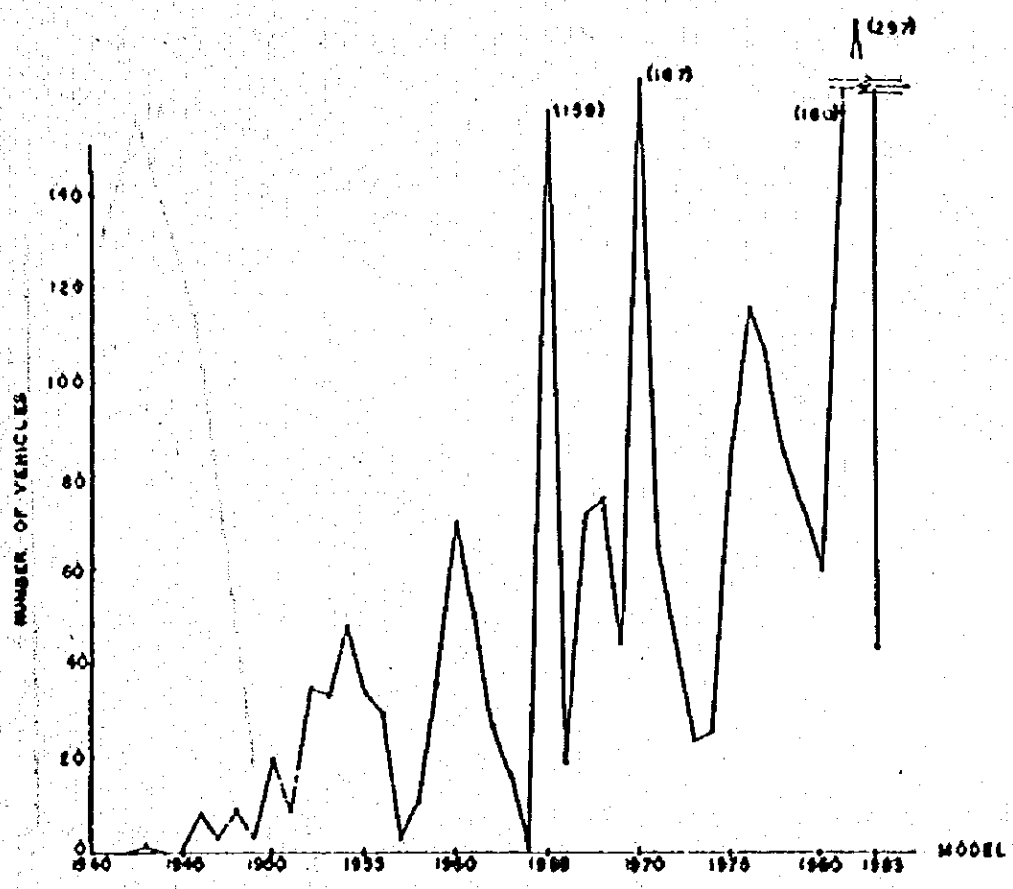


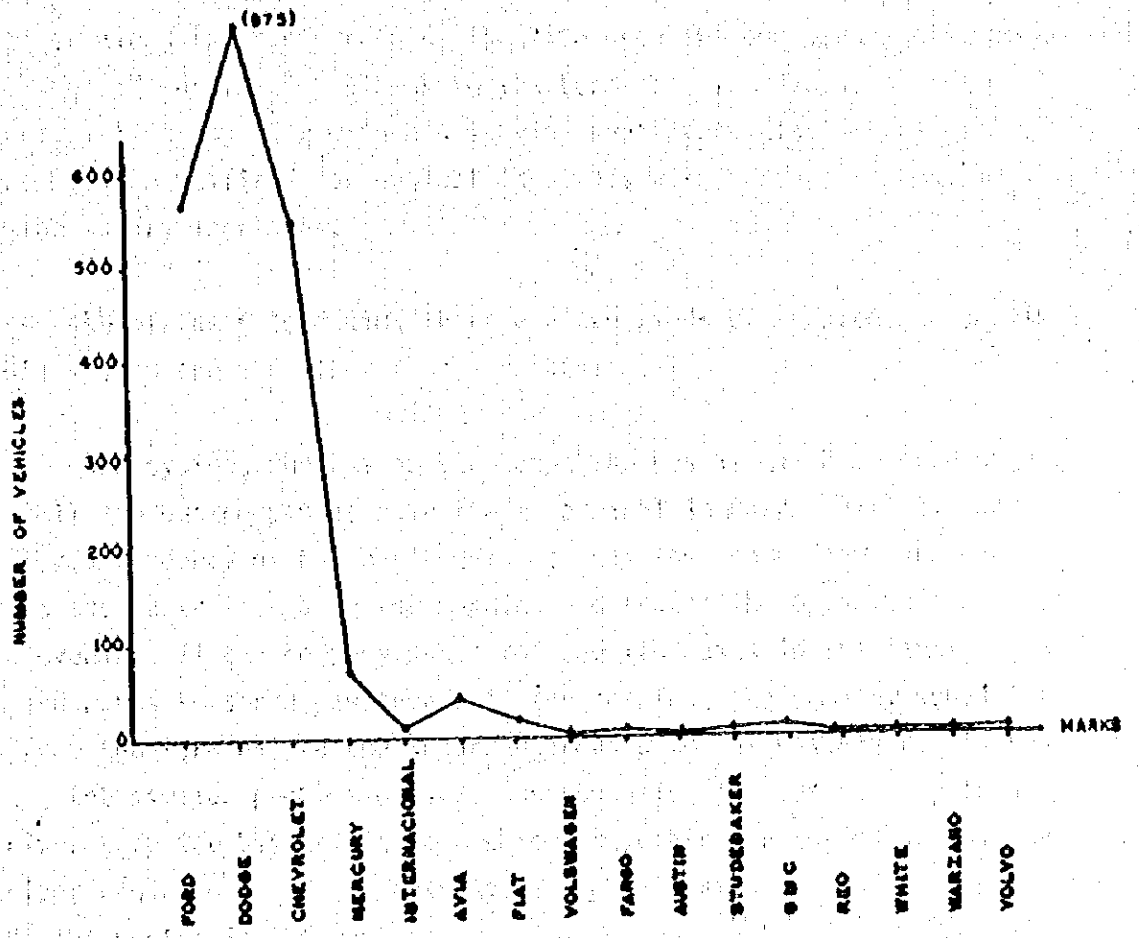
FIG 7-5-3 BUS FLEET BY MODEL

4) Bus Manufacturer

There are sixteen bus manufacturers in the bus flee in Barranquilla; however, the major makers are three: Ford, Dodge,and Chevrolet. The share of each company is 26.0%, 40.1%,and 25.1% respectively, and the total share of these three companies is 91.2%. Besides these three companies, there are six companies in the USA, five in Western Europe,and two in Eastern Europe.

Between 1970-1980, many Dodge buses are introduced because Dodge operated its factory in Bogotá for the above mentioned duration. As of 1981, the factory ownership transfered from Dodge to Chevrolet; thus, Chevrolets have been introduce recently.

FIG. 7-5-4 BUS FLEET BY CAR-MAKER



7-5-2. Bus Operation Control System.

The aims of bus operation control of bus companies are as follows:

(1) Regular and constant operation.
(2) Less travel distance not for passenger service.
(3) To promote bus drivers to ensure more passengers.

For the sake of the first aim, all bus companies introduced dispatchers in the terminal and intermediate controllers along the bus route.

Each bus driver is given the times when he should pass the intermediate control points and when he must come back to the terminal. An intermediate controller along the route records the time when the bus passes his check-point. When the driver comes back to the terminal, the dispatcher records his arrival time together with his leaving and intermediate times. Those records will be utilized for evaluation of his work performance which will determine salary increases.

For the sake of the second aim, there are two kinds of strategies: one is the cuña system and the other is route-cutting.

With the cuña system, the bus driver keeps the bus at his home over night. Almost all teh bus companies have their terminal in Barranquillita, but the natural tendency of bus passengers is that they come from suburban areas to the central area in the morning and travel the opposite direction in the evening. If the company wants to keep its buses in the terminals at night and wants to serve passengers in the morning, the company sends the buses from teh terminal to the suburban areas with few passengers. In the evening, the similar problem occurs. Consequently, the bus company lets the driver keep the bus at his home which is located in the suburban. Then, the driver begin to serve the passengers from the area around his house towards the Centro in the morning.

Route-cutting occurs when the driver neglects some parts of his route during slack periods when there are few passengers, for example, in Barranquillita in the morning and late in the evening.

Besides those strategies mentioned above allowing the driver to pick up more passengers, the companies have introduced a percentage system to the driver's salary. The salary consists of a fixed and a percentage portion. The percentage portion is determined by the number of passengers the driver picks up.

Consequently, drivers make an effort to pick up more passengers and waste time along routes with few passengers.

On the other hand, about 65% of the drivers get their salary consisting on a fixed and a percentage according to the drivers survey.

7-5-3. Maintenance condition of bus company.

1) Bus fleet inactive.

Among 2,180 units of bus fleets or 15% of total bus units are inactive. Reasons for inactive buses asr as follows:

Table 7-5-2.
Reasons for inactive buses

Reasons	Percentage
Repairing	76.0%
major	8.6
minor	60.0
special	7.4
Very old and lack of parts	4.0%
No driver	20.0%
TOTAL INACTIVE	326 UNITS (100%)

According to the statistics of bus fleets by model, approximately 50% of the total number of buses are more than 10 years old. Each bus company also has buses from approximately six different manufacturers.

Since the company may have so many different types of buses, this creates a difficult problem concerning maintenance and procurement of spare parts of bus.

2) Driver's Interest in Maintenance.

During the driver's survey, the driver's interest on pre-operation - inspection for the vehicles was questioned, and the results of the survey are summarized below.

(1) Almost all the drivers inspect the oil and the water of motor but only

15% check the fan belt.

(2) Effectivity of brake and brake oil are checked by about 70% and 40% of drivers respectively; effectivity of the hand brake is checked by few drivers.

(3) Direction of head light beam is checked by about 50% of the drivers, but the brake lights are checked by only 40%.

(4) Condition and cleaning of rear exit door is checked by 30% of the drivers but only a small percent check the windows.

(5) Tire conditions are checked by 80% of the drivers.

(6) Steering conditions are checked by 50% of the drivers.

Almost all the drivers are interested in some parts of vehicle which are related to driving itself and which can be observed from the outside, but only a few drivers in the bus interior and passenger comfort.

3) Maintenance Capacity of the bus company.

To know the level of maintenance capacity of each company, various activities of car maintenance are divided into three levels.

(1) The first level: This light works includes car repairing without special tool and equipment, and trained manpower.
(2) The second level: This medium works include maintenance works which do not need ordinary tool and equipment but need manpower educated.
(3) The third level: This heavy works include maintenance works which need specialized tools and equipment and trained and experienced manpower.

This classification was prepared based on the maintenance works classified for estimation of maintenance costof INTRA's study on Barranquilla. The classification of levels on each part of vehicle is considered based on Technical level mentionedabove. (See Tab. 7-5-3).

During bus company survey, maintenance facilities, equipment and tools, and manpower of each company are surveyed. According to that information the level of maintenance capacity of each company are classified by sectors of parts of vehicle. (See Tab. 7-5-4).

Six companies among twenty one bus operating organizations have no maintenance capacity.

Three companies such as SOBUSA, TRASATLANTICO, and TRANSDIAZ have maintenance capacity for all sectors of parts of vehicle which need maintenance. However almost all mechanics in those companies are on the contract basis.

Table7-5-3 Classification of Maintenance Level.

SECTOR / LEVEL	MOTOR 1	GEAR BOX 2	CLUTCH 3	SUSPEN-TION 4	STEE-RING 5	BRAKES/ CONTROL 6	COOLING SYSTEM 7	FUEL SYSTEM 8
1º st. Level	1.7	2.2 2.6	3.1 3.2 3.3	4.1 4.2 4.6 4.7	5.3 5.4 5.5	6.1	-	8.3
2º nd. Level	-	2.1 2.5 2.4 2.7	-	4.8 4.9 4.10 4.11 4.3	5.1 5.2	6.2 6.3	7.2 7.1	8.1 8.2 8.4
3º rd. Level	1.1 1.2 1.4 1.5 1.3 1.6	2.3	-	4.4 4.5	5.6	-	-	-

Table 7-5-4 Classification of Maintenance Level.

SECTOR / LEVEL	EXHAUST SYSTEM 9	PAINTING AND REPAIRING 10	BODY 11	ELECTRICITY 12	WASHING AND GREASING 13	OIL CHANGE 14	STATION SERVICE 15	TIRE 16
1º st. Level	-	10.1 10.2 10.3 10.4	11.1	12.1 12.2 12.3 12.4 12.5	13.1 13.2	14.1 14.2	-	16.1
2º nd. Level	9.3	-						
3º rd. Level	9.1 9.2	-					15.1	

Table 7-5-5 Sector on the parts of vehicle.

1	Motor.	
1.1	Overhaul	3
1.2	To change 3/4 of the engine	3
1.3	To change the gear chain with the lid	3
1.4	Rectify the crane shaft	3
1.5	Rectification of the connecting rod	3
1.6	Change engine support	3
1.7	General sincronization of the engine	1
2	GEAR BOX	
2.1	General repair	2
2.2	Change the spud cable	1
2.3	Transmission general repair	3
2.4	To change universal joint, front and rear	2
2.5	To change the bearing of the comand aixel	2
2.6	To change the bearings and seal of the bocin	1
2.7	To fix the bajo	2
3	Clutch	
3.1	Graduate the clutch's pedal	1
3.2	To change some part of the clutch	1
3.3	To change the clutch's bearing	1
4	Front suspension	
4.1	To change, tide the pins, and screws and align	1
4.2	To change the rubber support	1
4.3	To take apart and mount the front aixel, change the bearing of the aixel	2
4.4	To change housing, it doesn't include the adjust or change of part	3
4.5	To mount and take apart to check the differential box of the rear aixel and the rent	3
4.6	To change the speed pin	1
4.7	To change the ball bearing of the rear aixel	1
4.8	To replace a splinter bar of the rear spring	2
4.9	To replace the main cramp iron of the rear spring	2
4.10	To change the rear central screw	2
4.11	To change the rear spring with arm	2
5	Direction	
5.1	Remove and mount the direction mecanism	2
5.2	Graduate the mechanism of the endless screw of the direction box	1
5.3	To change the top bearings of the direction box	1
5.4	To change the terminals	1
5.5	To change the rubber	1
5.6	To align	3
6	Brakes and control	
6.1	Graduate the brakes, checking the fluid level of the pomp and of the pedal, not necesary to remove tired	1
6.2	To change the bands, chupas, and check all the brake system	2
6.3	Change the bands and graduate the brakes	2
7	Cooling system	
7.1	To change the pomp interior	2
7.2	To remove and mount the radiator, general check up	2
8	Fuel system	
8.1	To change multiple of admission single and double	2
8.2	To change the fuel pomp or cleaned	2

8.3	To clean the carburator and sincronization	1
8.4	To change the fuel pipe from the pomp to the carburator	2
9	Exhoust sistem	
9.1	Réplace the front escape tube	6
9.2	To replace rear escape tube	3
9.3	Replace the support and adjust the exhoust	2
10	Others	
10.1	Chassis painting	1
10.2	General painting	1
10.3	General body repair	1
10.4	Upholstery of a bus	1
11	Body	
11.1	Body repair	1
12	Electricity	1
12.1	Battery recharge	1
12.2	Change or cleaning spark pluig	1
12.3	Change the bobbin	1
12.4	Lights repair	1
12.5	Alternator repairing or motor starter	1
13	Washing and greasing	
13.1	Washing	1
13.2	Greasing	1
14	Oil change	
14.1	Engine oil change	1
14.2	Oil change of the gear box	1
15	Station service	
15.1	Fuel	3
16	Tired repair	
16.1	Tired repair	1

7-5-4. Financial Condition of Bus Operation.

1) Financial condition by bus route.

The aims of this analysis is to know the cost/benefit relationship on the selected bus routes as an example of bus operation condition in the city.

Number of passengers in the buses of sixteen bus routes were surveyed during bus travel time survey. Service frequency and route length of each bus route were also surveyed through bus company survey.

Operation cost of bus are surveyed by INTRA monthly. Bus fare is 4.50 peso/person on corriente bus and 11.00 peso/person on TSS bus when the survey's were conducted.

Methodology of the analysis are as follows:

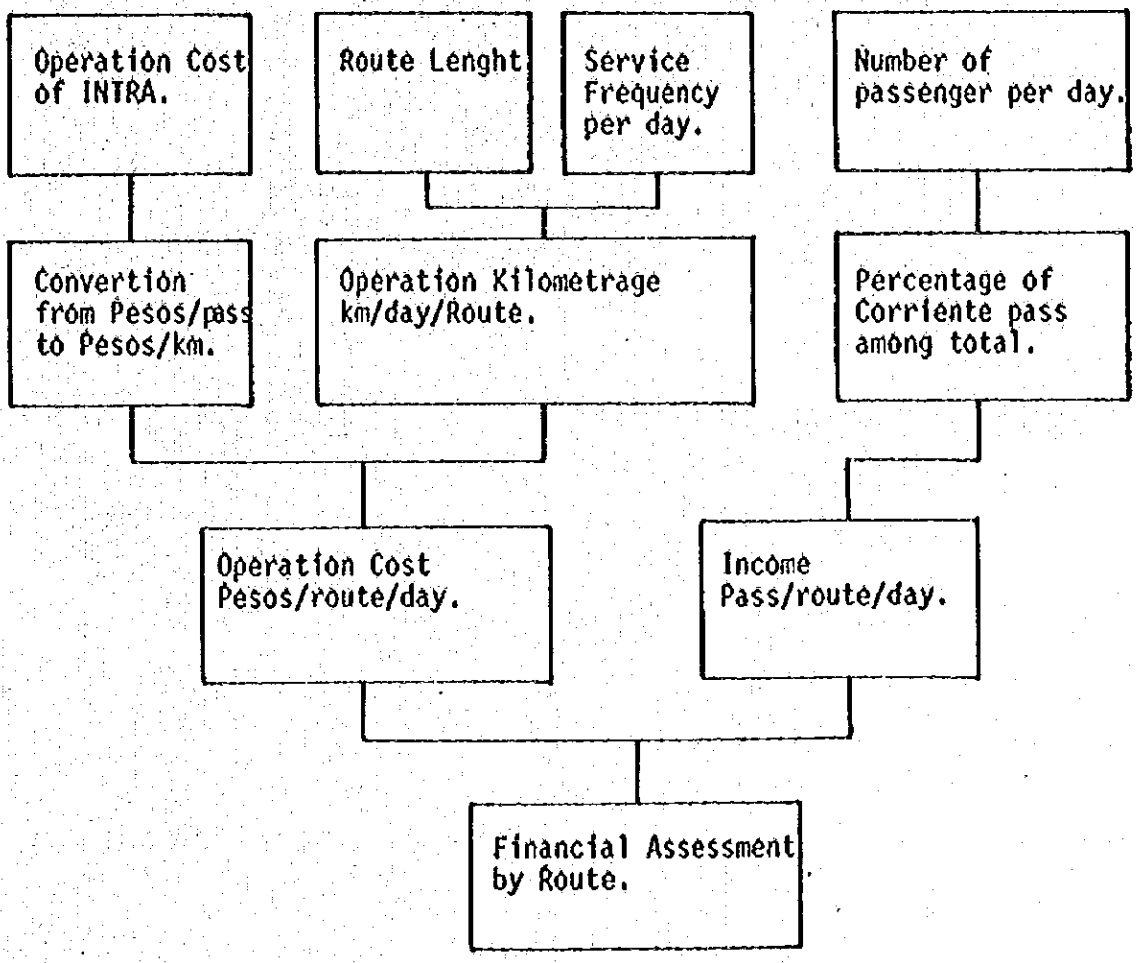
(1) Estimation of operation kilometrage per route.
(2) Estimation of total operation cost based on the INTRA's information, including adjustment of operation cost of busetas.
(3) Estimation of total number of passengers per route.
(4) Estimation of total fare income per day, per route including adjustments of bus fare of busetas.
(5) Calculation of income/cost ratio. (See Fig.7-5-5).

The result of analysis on selected sixteen routes are summerized in Tab. Some routes serving northern part of the city has better income/cost ratio generally than the other.

Following three reasons can be pointed out:

(1) The operation cost of busetas is about 62.5% of that of buses. Consequently the routes using busetas only has high cost/benefit ratio.
(2) The fare of TSS bus is almost double of that of corriente buses.

FIG. 7-5-5 FLOW CHART OF ANALSYSIS ON FINANCIAL CONDITION BY BUS ROUTES SERVICES.



Consequently the routes with higher TSS bus share has good cost/benefit ratio, which served the northern part of the city.

(3) The routes serving the western and southern part of the city, use corriente buses with 80-100 percent of total number of buses. Consequently the ratios are bad in general.

In case of routes using corriente buses, they can get subsidies which is almost the same amount of bus fare collected from passengers. Considering this subsidy addition to the actual fare income, almost all bus routes surveyed have relatively good income/cost ratio except one route which uses TSS buses but has the ratio with less than one.

7-5-5 Inventory on Bus Terminal of Urban.

The terminal mentioned here is the bus companies facilities and not passenger terminal. Usually the terminal includes parking space, garage, gas station and office to achieve followings functions such as bus storing, dispatching,maintenance and management of bus operation.

Thirteen companies of twenty one bus company in Barranquilla have terminal facilities which varies from 1300 m2 in the case of smallest to 1.8 ha in the largest. Total areas of these terminals is 73.500 m2.

Seven terminals of thirteen companies are located in Barranquillita and another terminals are scattered in the western and Southern part of the city. (See Fig. 7-5-6).

Three companies which has no terminals such as COOLITORAL, FLOTA ANGULO, and EMBUSA have facilities with maintenance shops and offices. But they do not despach their buses from those facilities.

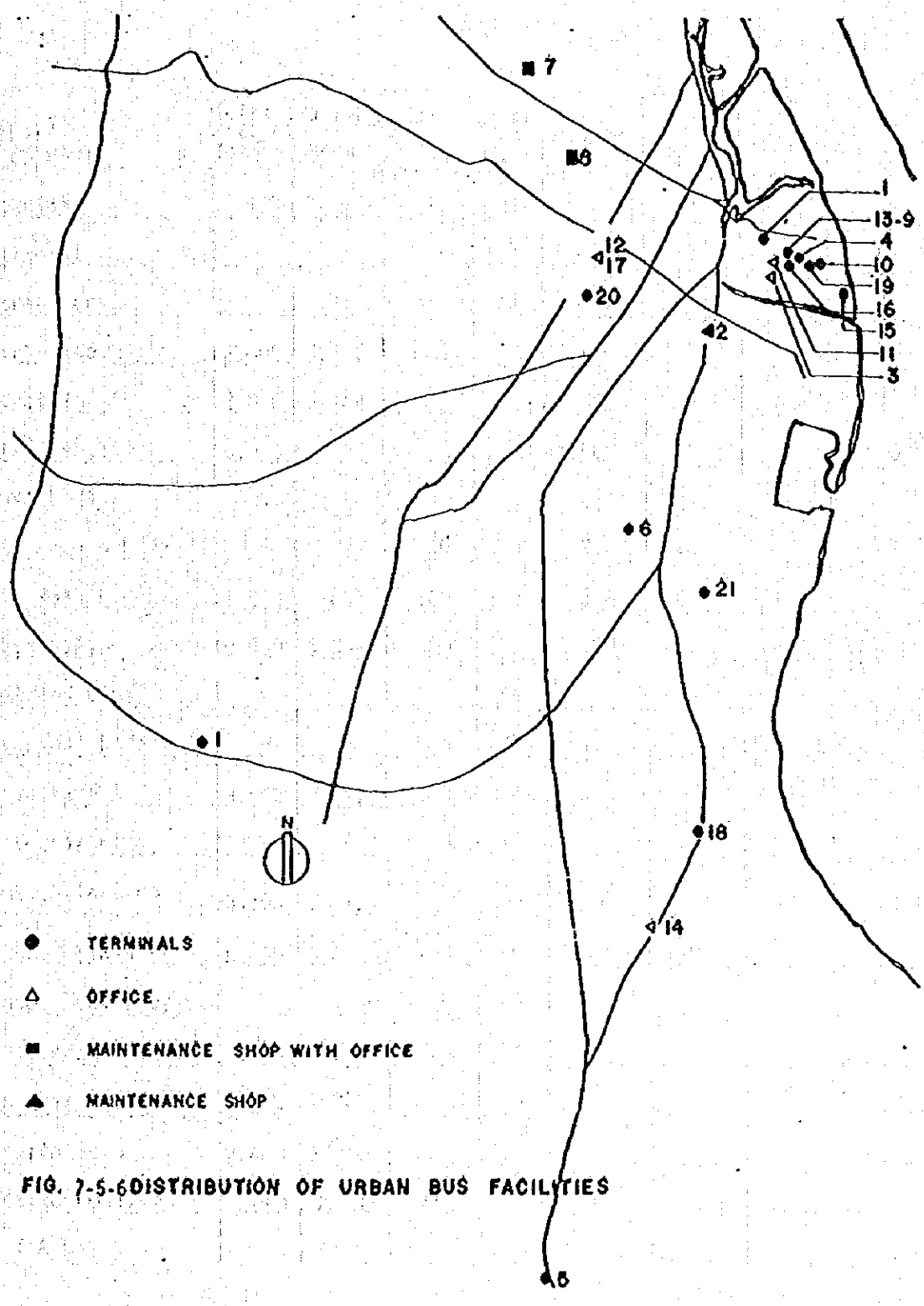


FIG. 7-5-6 DISTRIBUTION OF URBAN BUS FACILITIES

TAB 7-5-6 FACILITY IN THE TERMINAL OF BUS COMPANY

FACILITY BUS COMPANY	Total Area of Termin	Parking Area	Gas Station	Floor Area Office	Workshop	Parts Shop	Cafeteria	Others
1. Coochofal	800	-	30	100	-	18	-	8
2. Coolitoral		-	-	180	1.000	60	-	60
3. Cootransnorte	-	-	-	28	2.800	4	-	-
4. Cootrantico	3.600	3.476	4	78	-	-	42	-
5. Cootrasol	18.000	17.864	-	30	36	45	-	25
6. Cootratlantico	3.000	500	210	769	1.500	15	-	6
7. Embusa Ltda	-	-	-	84	432	-	-	-
8. Flota Angulo Ltda	-	-	10	100	200	20	-	-
9. Flota Roja Ltda	1.300	666	100	150	324	60	-	-
10. Sobusa S.A.	0,000	5.000	500	400	1.100	400	200	2.400
11. Sodetrans Ltda	-	-	-	40	-	-	-	-
12. Sotrausque Ltda	-	-	-	32	-	-	-	-
13. Transdiaz S.A.	9.800	9.047	90	306	410	40	60	-
14. Transmecar Ltda	-	-	-	18	-	-	-	-
15. Transp.Atlántico	3.300	-	-	400	2.200	-	40	-
16. Transp. Lolaya Ltda	6.400	3.000	1.200	50	1.650	150	-	-
17. Transp. Monterrey Ltd	-	-	-	60	-	-	-	-
18. Transoledad S en C.	2.400	900	876	24	660	-	-	-
19. Transubar Ltda	2.500	1.000	3	40	-	15	50	30
20. Trasalfa Sc.A	2.400	2.310	-	30	60	-	-	-
21. Trasallanco S.A.	10.000	9.200	400	-	-	-	-	400
TOTAL								

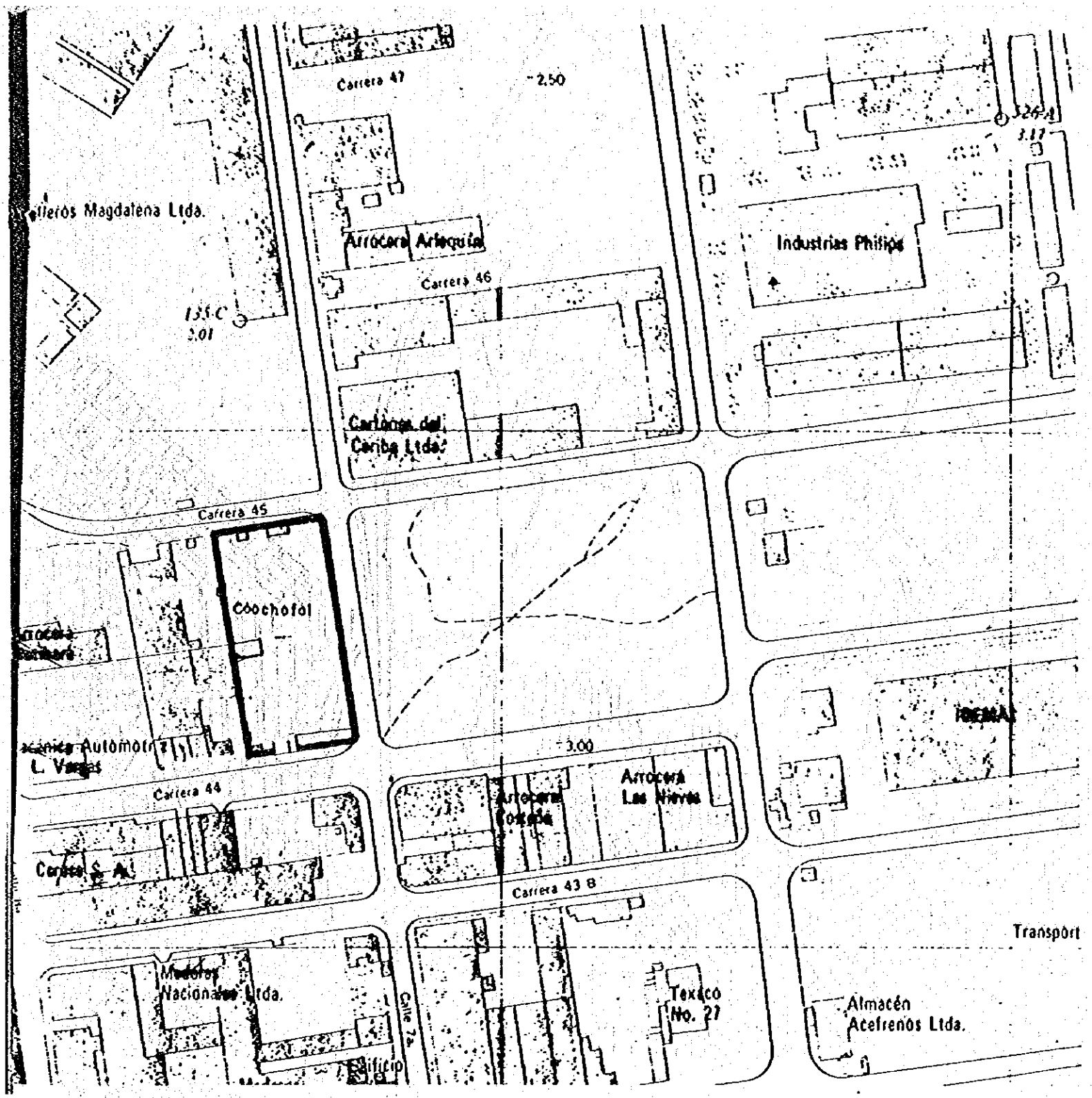


FIG. 7-5-7 TERMINAL OF COOCHOFAL

AREA: 600 m2 AREA: * 3 600 m2

MAJOR FACILITIES

Offices

Parts - Shop

Parking

* MEASURED ON MAP 1/2000

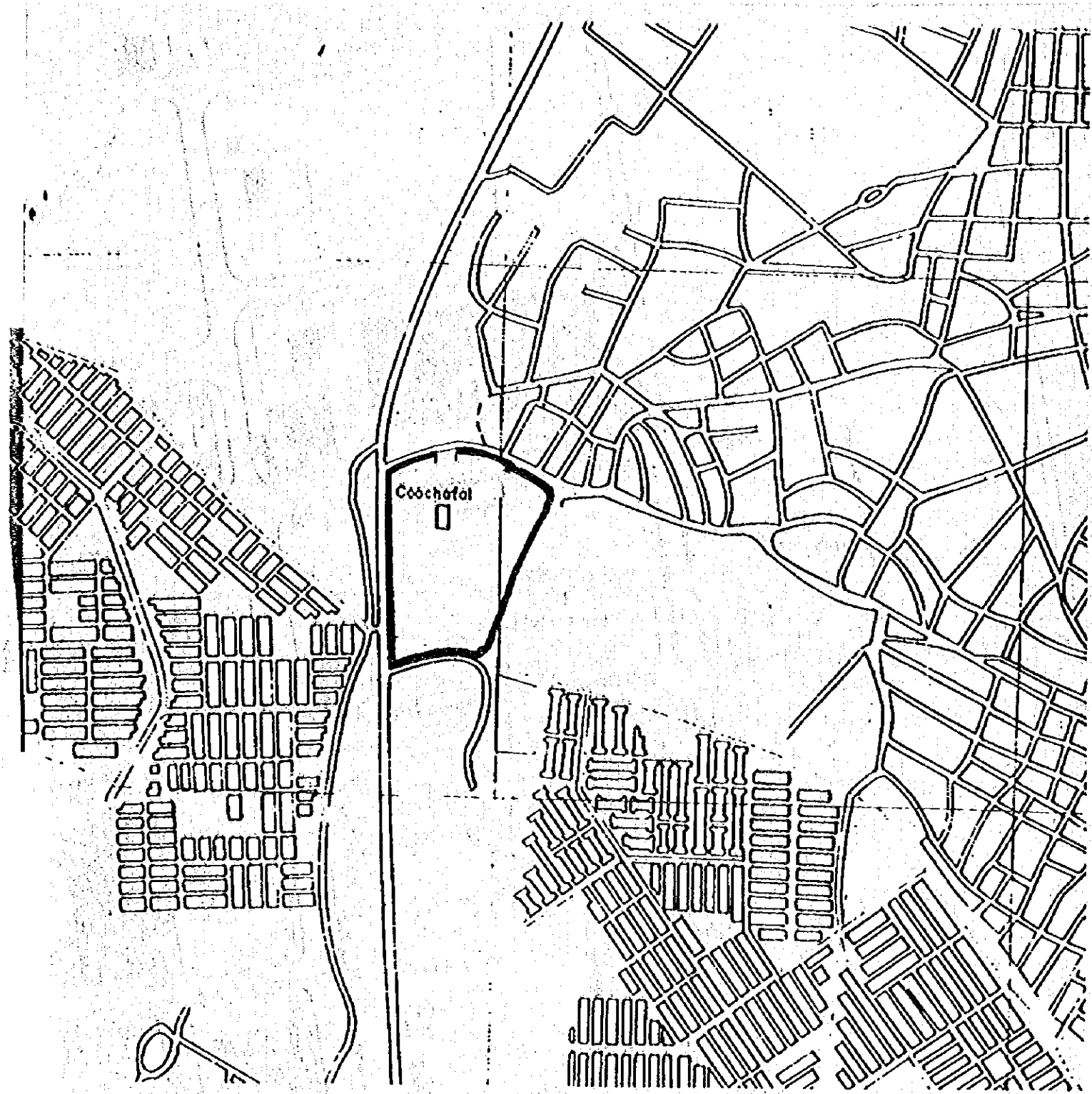


FIG. 7-5-8 TERMINAL OF COOCHOFAL

AREA: 3 370 m2

MAJOR FACILITIES

Parking Area

Gas Station

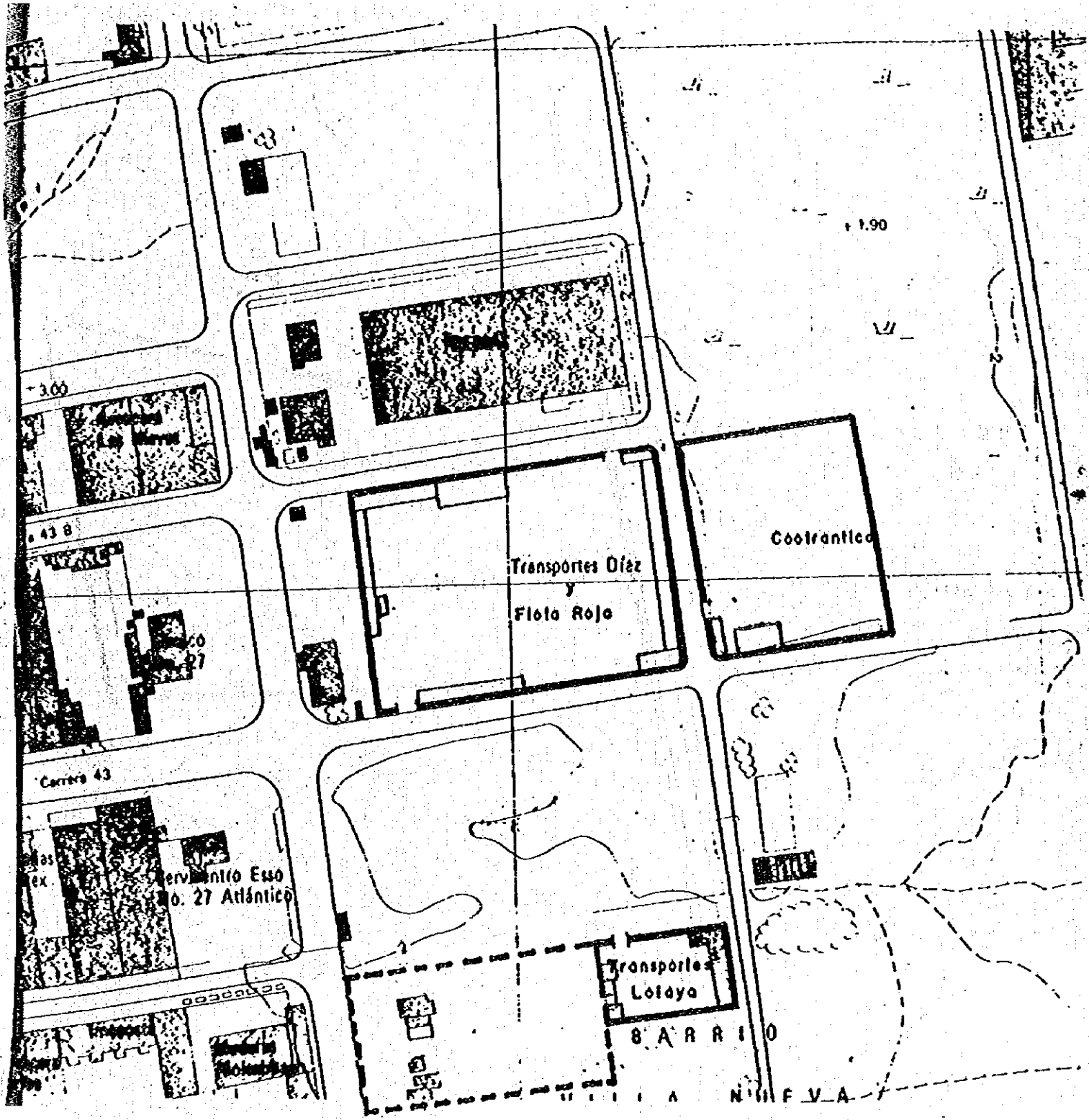


FIG. 7-5-9 TERMINAL OF BUS

	COOTRANTICO	TRANSPORTES LOLAYA LTDA
AREA:	8 600 m2	6 400 m2
MAJOR FACILITIES	Parking Area	Parking Area
	Gas Station	Gas Station
	Offices	Offices
	Cafeteria	Workshop
		Parts Shop

N

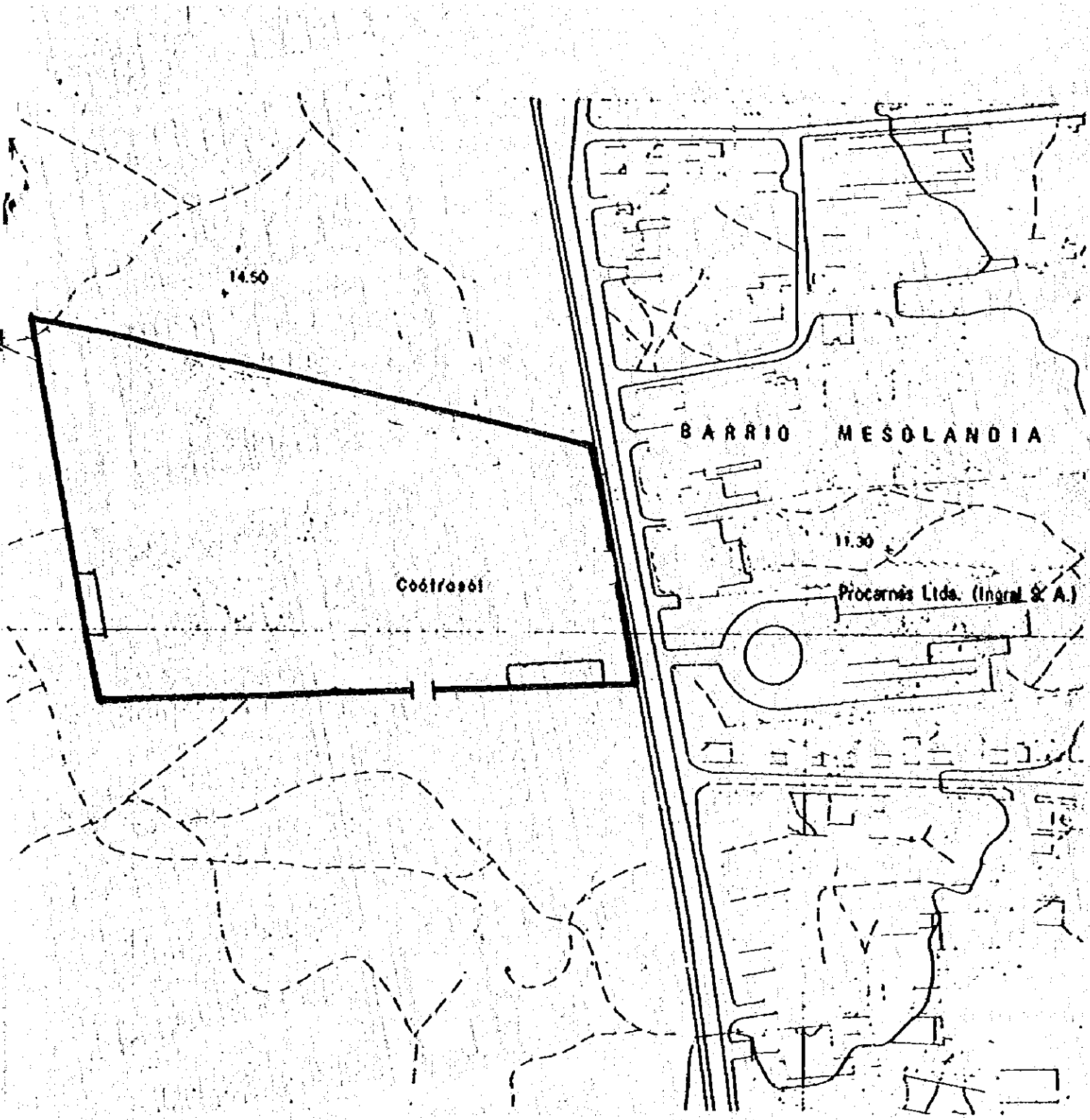


FIG. 7-5-10 TERMINAL OF COOTRASOL

AREA: 18 000 m2

MAJOR FACILITIES

Offices
Workshop
Parts - Shop
Parking Area

FIG. 7-5-11 TERMINAL OF COOTRATLANTICO

0 50 100 m2

AREA : 3000m2 AREA : * 1.360m2

N

MAJOR FACILITIES
Parking Area
Gas Station
Offices
Workshop
Parts-Shop

* MEASURED ON MAP 1/2000

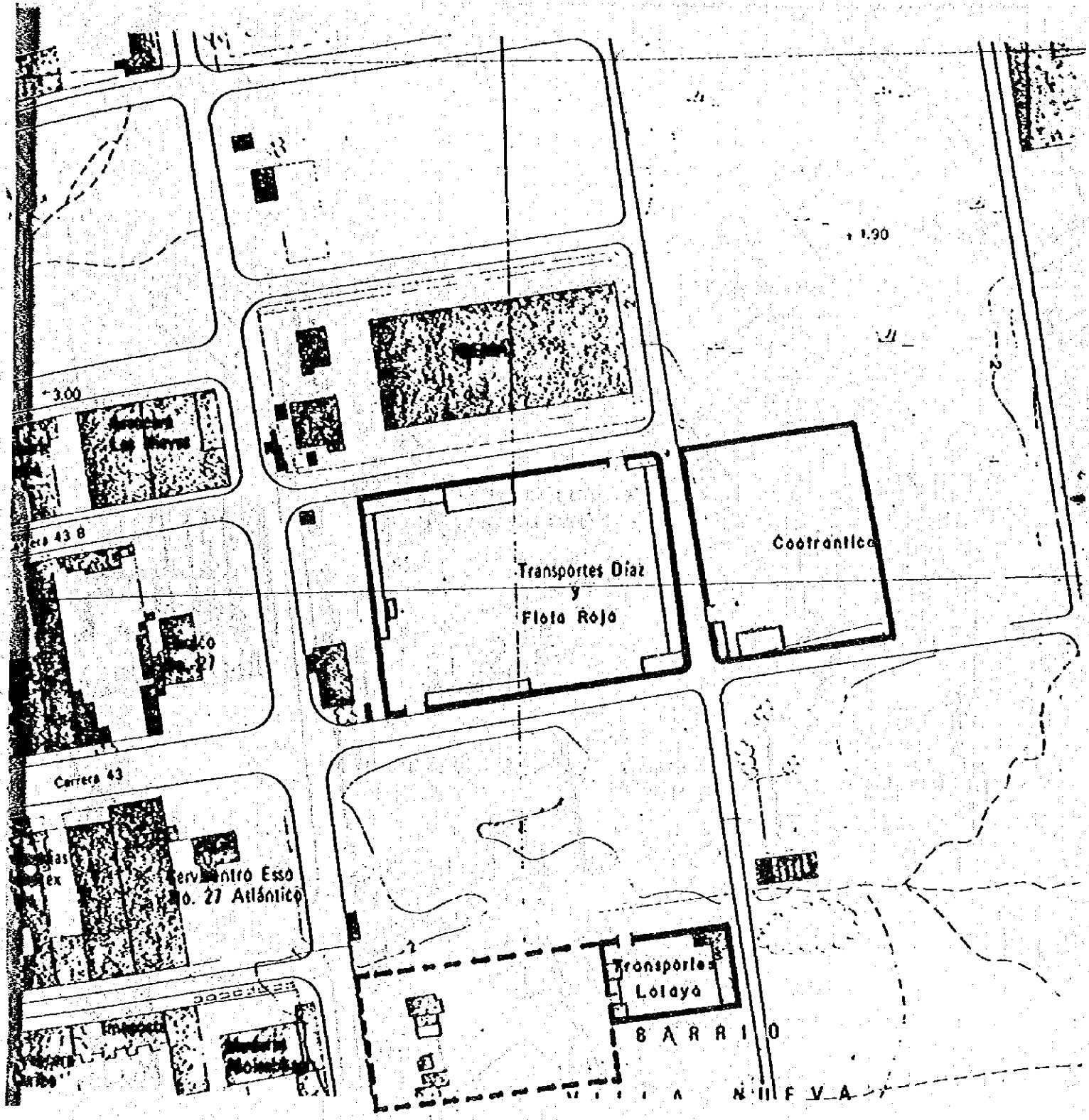


FIG 7-5-12 TERMINAL OF BUS

	TRANSDIAZ S.A	FLOTA ROJA LTDA
AREA:	9.800 m2	1 300 m2
MAJOR FACILITIES	Parking Area Gas Station Offices Workshop Parts Shop Cafeteria	Parking Area Gas Station Offices Workshop Parts Shop

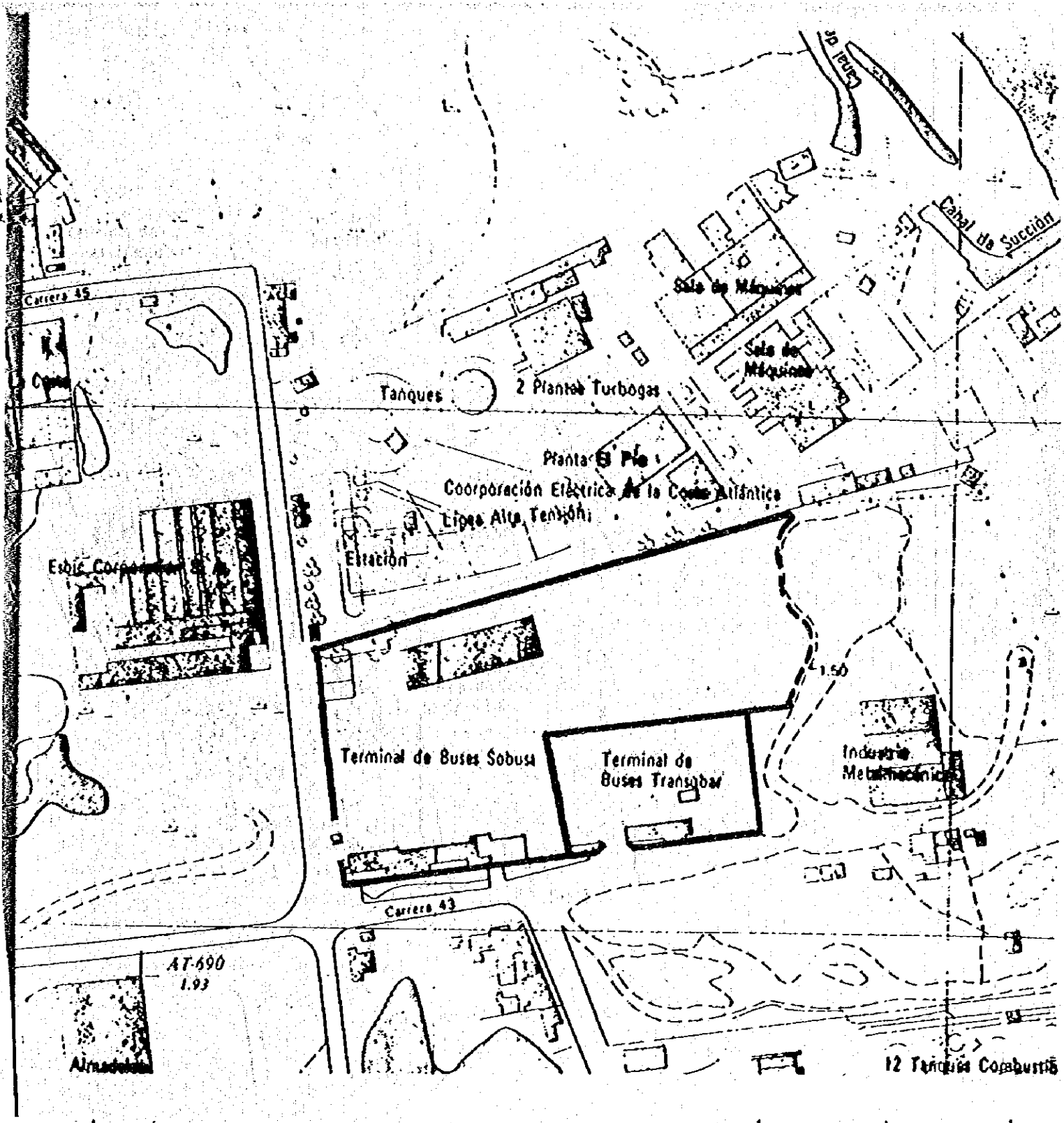


FIG. 7-5-13 TERMINAL OF BUS

	SOBUSA S.A.	TRANSURBAR
AREA :	10 000 m2	2 500 m2
MAJOR FACILITIES	Parking Area Gas Station Offices Parts Shop Cafeteria Workshop	Parking Area Gas Station Offices Parts Shop Cafeteria

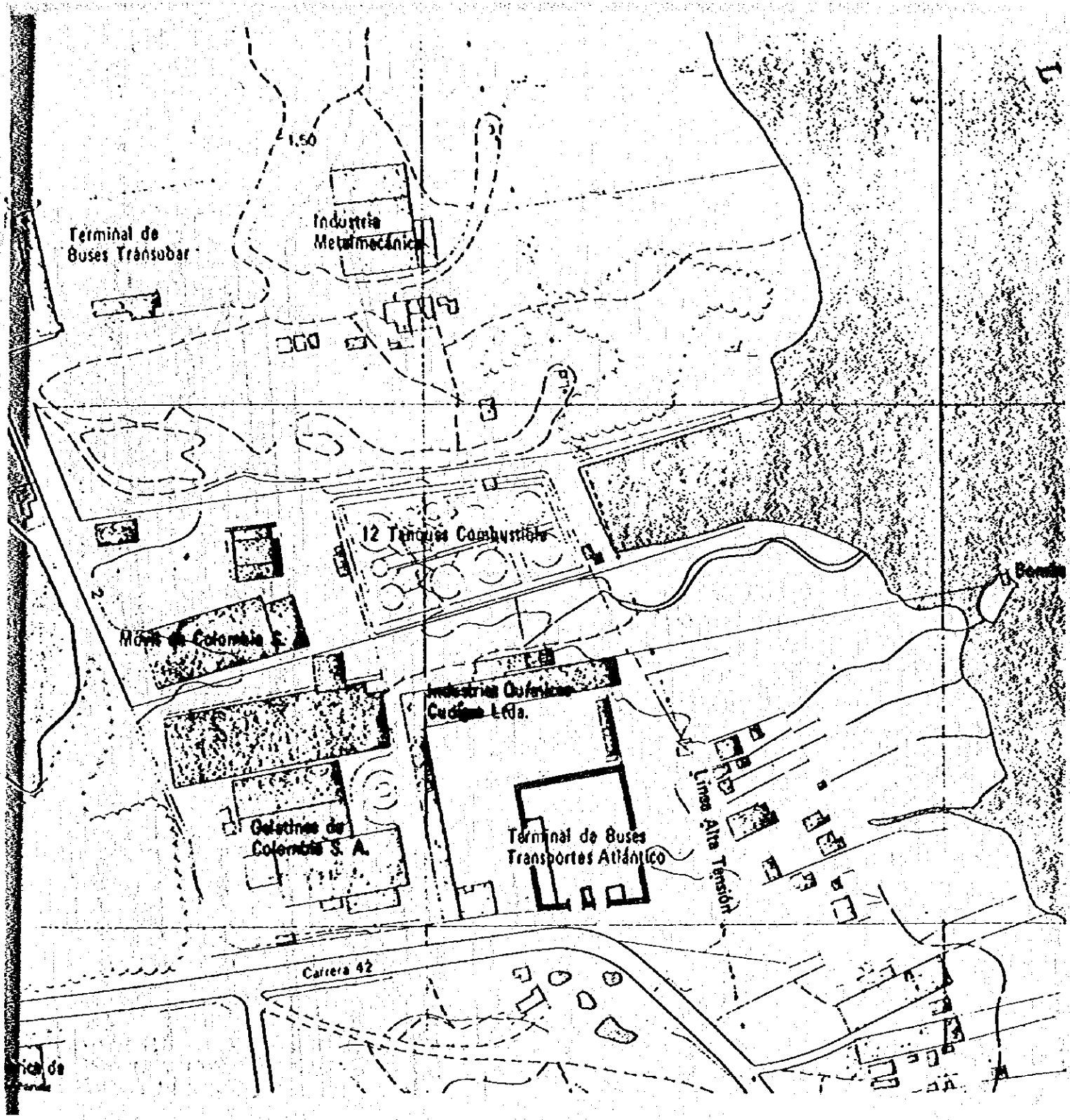


FIG. 7-5-14 TERMINAL OF TRANSPORTES ATLANTICO S.C.A

0 50 100m

AREA: 3 300m AREA: *2 250

MAJOR FACILITIES

Offices

Workshop

Cafeteria

N

* MEASURED ON MAP 1/2000

FIG.7-5-15 TERMINAL OF TRANSOLEDAD S. en C

0 50 100m2

N

AREA: 2 400m2 AREA: 1200 m2

MAJOR FACILITIES

Parking Area (without dispatching)

Gas Station

Offices

Workshop

FIG. 7-5-16 TERMINAL OF TRASALFA S.C.A.

AREA: 2 400 m2

MAJOR FACILITIES

Offices
Parking Area (without dispatching)
Workshop

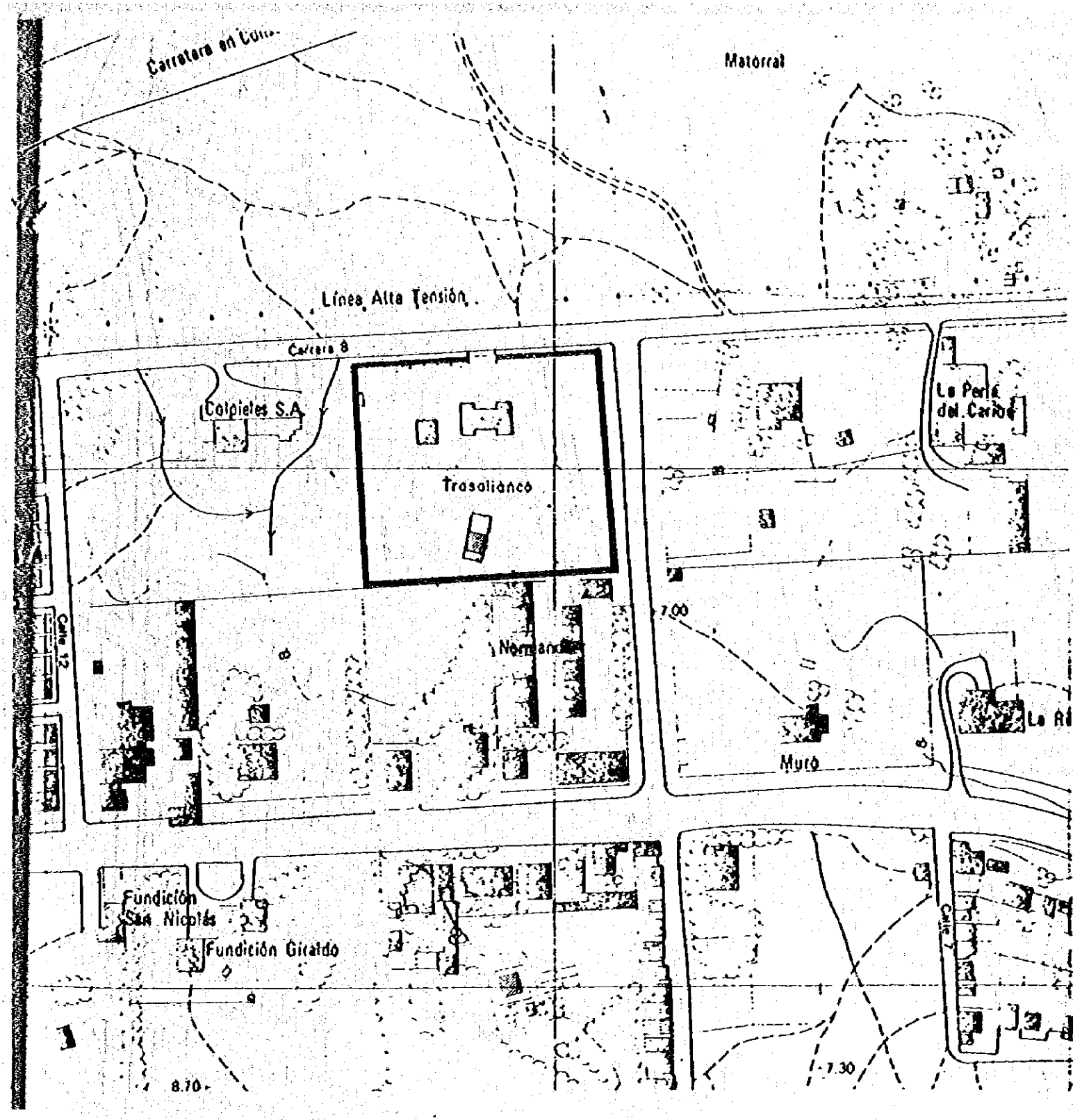


FIG. 7-5-17 TERMINAL OF TRASALIANCO S.A.

0 50 100m2

N

AREA: 10 000 m2 AREA: *8 500 m2

MAJOR FACILITIES

Parking Area
Gas Station
Offices

* MEASURED ON MAP 1/2000

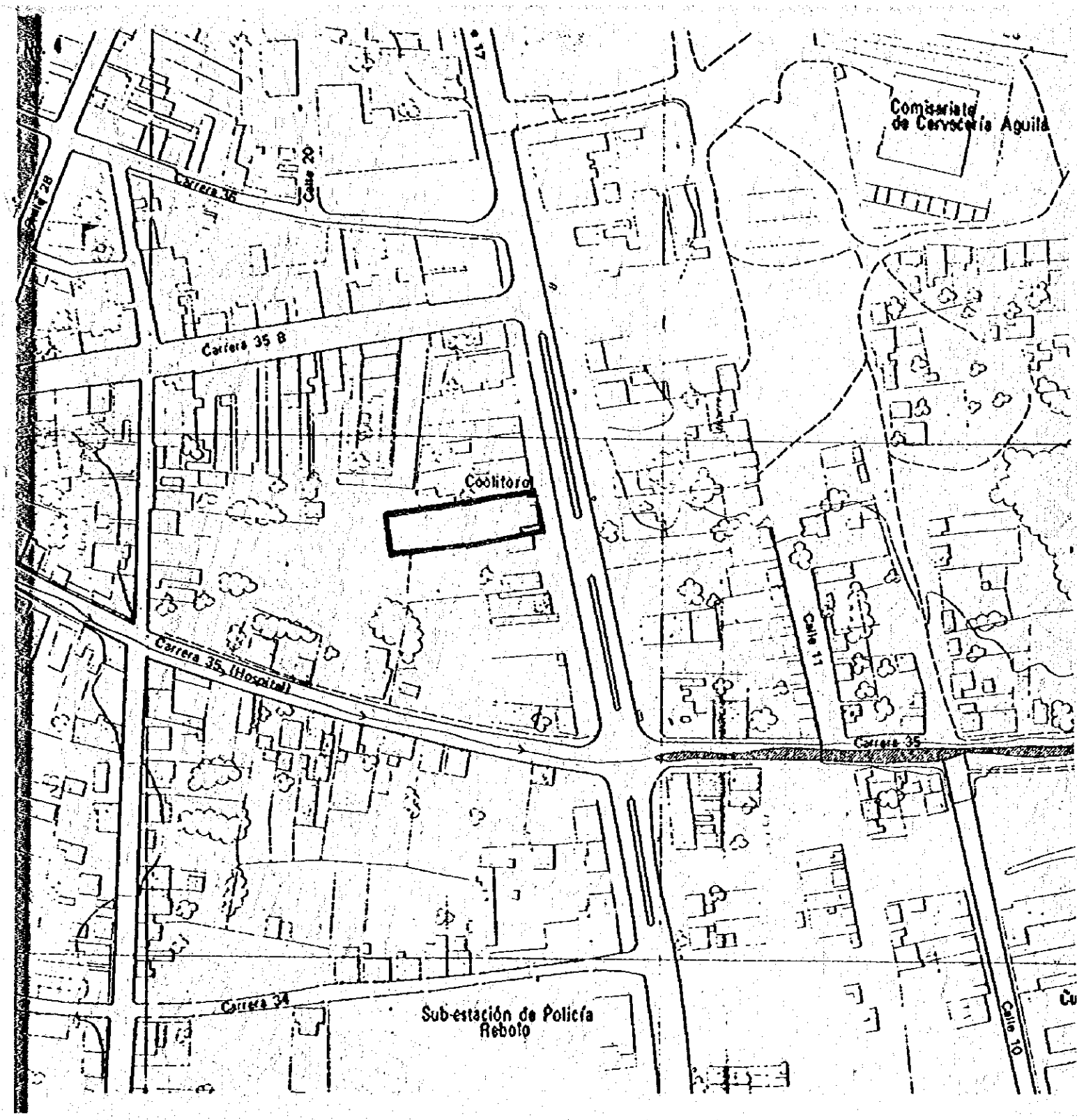


FIG. 7-5-18 TERMINAL OF COOLITORAL

AREA: 1300m2

MAJOR FACILITIES

Workshop

Parts- Shop

FIG. 7-5-19 TERMINAL OF FLOTA ANGULO LTDA

0 50 100 m

AREA: 330 m² AREA: *1 600

MAJOR FACILITIES

o Gas Station

Offices

Workshop

Parts - Shop

N

* MEASURED ON MAP 1/2000

FIG. 7-5-20 TERMINAL OF EMBUSA LTDA.

0 50 100m2

N

AREA : 516 m2

MAJOR FACILITIES

○ Workshop

Offices

7-6. Other Public Transportation.

7-6-1. Inter-regional Bus Service.

The inter-regional public transportation measures which might affect road traffic of Barranquilla is long distance buses such as interdepartmental and intermunicipal buses.

The interdepartmental bus connects Barranquilla as a capital city of Atlántico Department and the capitals of another Departments such as Antioquia, Cundinamarca, Bolivar etc.

The number of bus routes for interdepartmental service which have origin or destination of their routes in Barranquilla are sixty two with 681 services per day in total. (See Fig.7-6-1).

The number of bus routes for intermunicipal service from Barranquilla are 31 routes with 721 services per day. (See Fig. 7-6-2).

The terminal facilities of interdepartmental bus companies are concentrated in the central area of the city. (See Fig.7-6-3, 7-6-4).

The bus companies of intermunicipal service have no terminal facilities in Barranquilla.

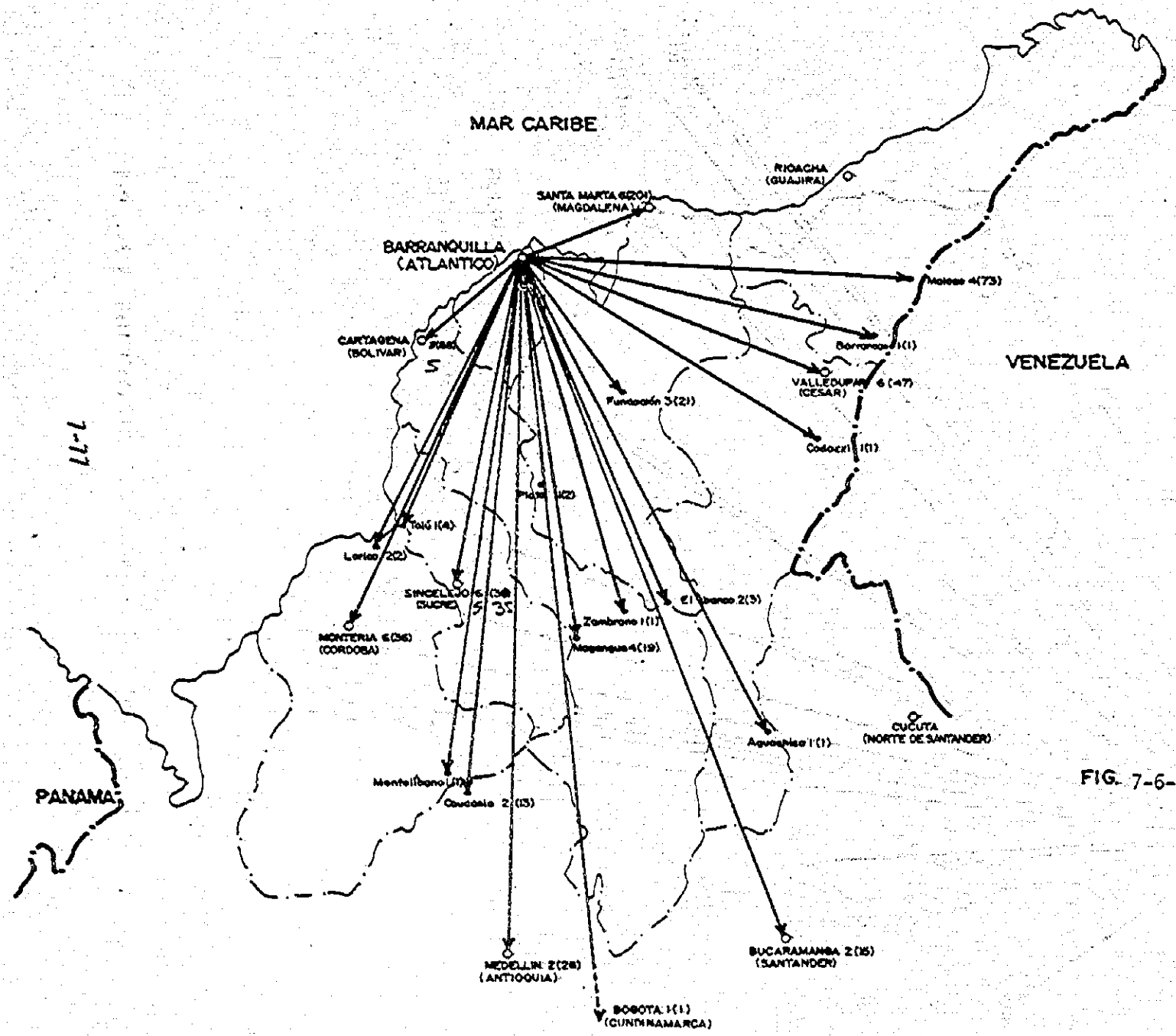


FIG. 7-6-1 INTERDEPARTAMENTAL BUS SERVICES FROM BARRANQUILLA

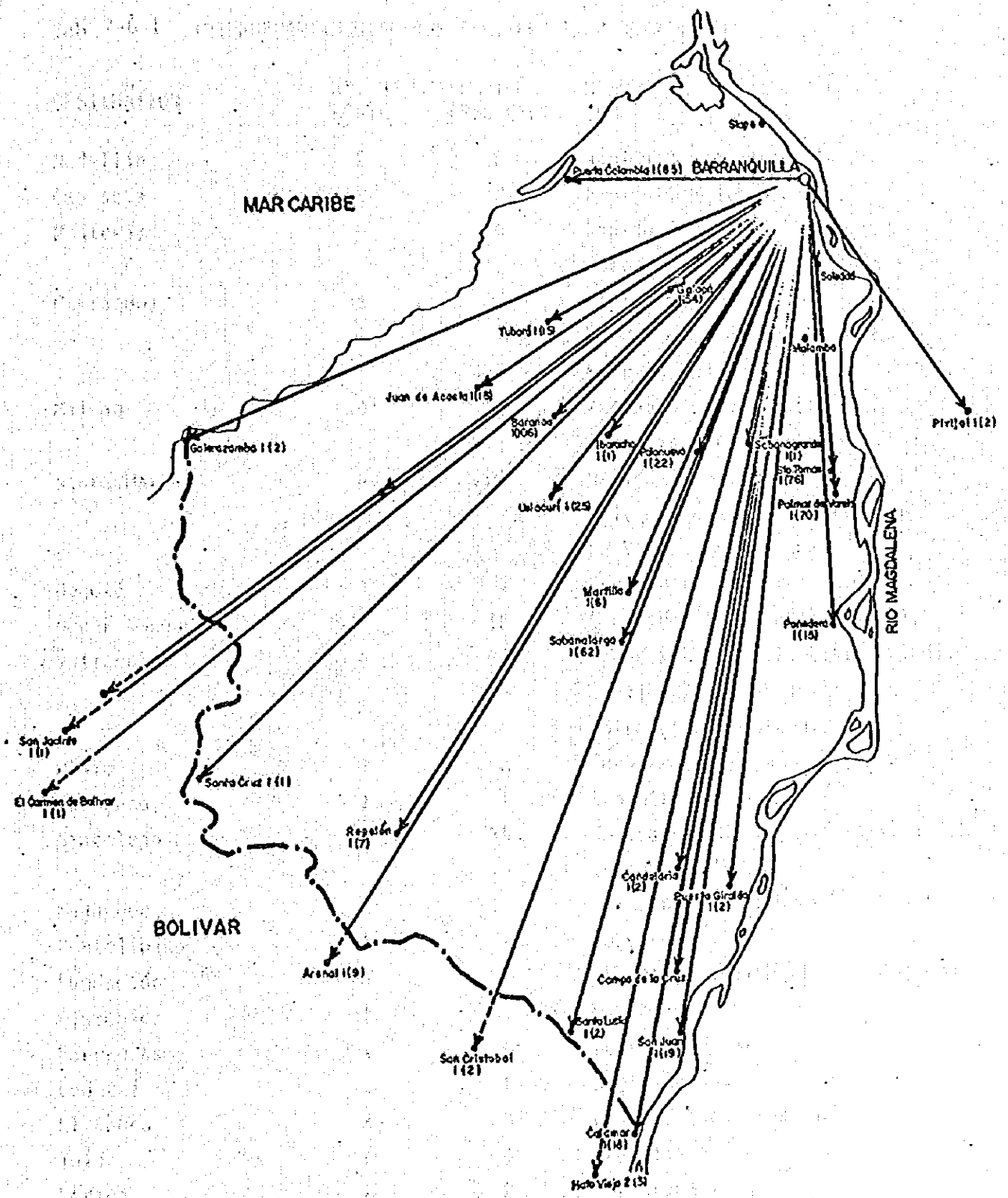


FIG. 7-6-2 INTERMUNICIPAL BUS SERVICE IN ATLANTICO DEPARMENT

Tab 7-6-1 INTERDEPARTAMENTAL BUS SERVICES FROM BARRANQUILLA

DESTINATION	NO. OF ROUTE	SERVICE FREQUENCY	NAME OF COMPANY
Medellín	2	28	Rapido Ochoa. Brasilia S.A.
Caucasia	2	13	Rapido Ochoa. Torcoroma.
Montería	6	36	Rapido Ochoa. Torcoroma (2) Unitransco S.A. Brasilia S.A(2)
Cartagena	5	88	Rapido Ochoa. Brasilia S.A. La Costeña. Unitransco S.A Expreso Cartagena S.A.
Maicao	4	73	Rapido Ochoa. Brasilia S.A. Copetran. Coolibertador.
Santa Marta	6	201	Rapido Ochoa. Coolibertador. Unitransco S.A. Brasilia.S.A La Veloz. La Costeña.
Bogotá	1	1	Coopetran.
Bucaramanga	2	15	Coopetran Ltda. Brasilia S.A.
Valledupar	6	47	Coopetran Ltda. T. Cosita Linda. Coolibertador. Brasilia S.A. Cotracegua. Costeña.
Plato	1	2	Coopetran Ltda.
Zambrano	1	1	Coopetran Ltda.
Sincelejo	5	35	Unitransco S.A. (2). Brasilia S.A. Torcoroma (2).
Magangue	4	19	Unitransco (2). Brasilia S.A (2).
Montelíbano	1	1	Torcoroma
Fundación	3	21	La Veloz. Coolibertador. Costeña.
Aguachica	1	1	Cootracegua.
Barrancas	1	1	Cootracegua.
Codazzi	1	1	Cootracegua.
El Banco	2	3	Cootracegua. Brasilia S.A.
Tolú	1	4	Brasilia S.A.
Lorica	2	2	Torcoroma (2).

Tab 7-6-2 INTERMUNICIPAL BUS SERVICE, FROM BARRANQUILLA

DESTINATION	NO OF ROUTE	SERVICE FRECUENCY	NAME OF COMPANY
Galapa	1	54	Cootragal
Sabanalarga	1	62	Cootransa
Santa Lucía	1	2	T. Trasalfa
Puerto Giraldo	1	2	T. Trasalfa
Puerto Colombia	1	85	Trans.Costa Azul
Polo Nuevo	1	22	Trans. Guajaro
Usiacurí	1	29	Trans.Guajaro
Baranoa	1	(106)	Trans.Guajaro
Calamar	1	18	T. Trasalfa
Candelaria	1	2	T. Trasalfa
Suan	1	19	T. Trasalfa
Martillo	1	6	T. Trasalfa
Repelón	1	7	T. Trasalfa
Santa Cruz	1	1	T. Trasalfa
Hibacharo	1	1	T. Trasalfa
Ponedera	1	19	T. Trasalfa
Puerto Colombia	1	85	T.Pto.Colombia
Tubará	1	15	T. Pto.Colombia
Juan de Acosta	1	18	T. Pto.Colombia
Piojó	1	2	T. Pto.Colombia
Sabana Grande	1	1	Rutas Oriente
Santo Tomás	1	76	Rutas Oriente
Palmar de Varela	1	70	Rutas Oriente

ORIGEN : BARRANQUILLA.

	DESTINATION	NO OF ROUTE	SERVICE FREQUENCY	NAME OF COMPANY
(Bolivar)	Mahates	1	1	Media Luna
	San Jacinto	1	1	Trans.Renaciente
	El Carmen de Bolivar.	1	1	Trans.Renaciente
	Arenal	1	9	Trans.Renaciente
	San Cristobal	1	2	T. Trasalfa
	Hato Viejo	2	3	Media Luna T. Trasalfa
(Magdalena)				
	Pivijai	1	2	T. Trasalfa.

TAB. 7-6-3 TERMINAL FACILITY OF INTERDEPARTAMENTAL BUS COMPANY

Transport Company	INSIDE TERMINAL								OUTSIDE TERMINAL									Total Area
	Maintenance Shop m²	Parking m²	Office m²	Baggage Ware House m²	Waiting Room m²	Ante for Driver m²	Room Dormitory m²	Service Station m²	Maintenance Shop m²	Parking m²	Office m²	Baggage Ware House m²	Waiting Room m²	Ante Room for Driver m²	Dormitory m²	Service Station m²		
Brasilia	-	2922.0	952.0	15.0	860.0	-	-	-	-	-	-	-	-	-	-	-		4749.0
Expreso *1 Cartagena	-	-	21.3	-	125.6	-	-	-	-	-	-	-	-	-	-	-		146.9
Coolibertador *2	-	235.12	27.0	27.9	279.0	-	-	-	-	-	-	-	-	-	-	-		569.02
Copetrán	-	-	36.45	96.4	39.44	-	-	-	-	-	-	-	-	-	3000.0	3000.0		6172.29
Costa *1 Linda	-	-	21.3	-	125.6	-	-	-	-	-	-	-	-	-	-	-		146.9
Cootracegua	-	-	40.9	11.25	52.7	-	-	-	-	-	-	-	-	-	-	-		104.85
La Costeña	-	216.0	89.1	11.1	54.5	-	-	-	506.25	-	-	-	-	-	-	-		876.95
La Veloz *3	-	109.7	51.75	-	-	-	-	-	-	-	-	-	-	-	-	-		161.45
Rapido Ochoa	-	209.3	101.25	48.7	112.4	-	-	-	-	-	-	-	-	-	-	-		471.65
Torcoroma *2	-	235.12	27.0	27.9	279.0	-	-	-	-	-	-	-	-	-	-	-		569.02
Unitransco *3	-	116.4	75.3	16.9	58.5	-	-	-	-	-	-	-	-	-	-	-		267.1
Total		4043.64	1443.35	255.15	1986.74				506.25						3000	3000		14,235.13

Notas: *1 & *2 Two companies use the same Terminal

*3 Two companies use the same Terminal but they have their own space separately in the Terminal.

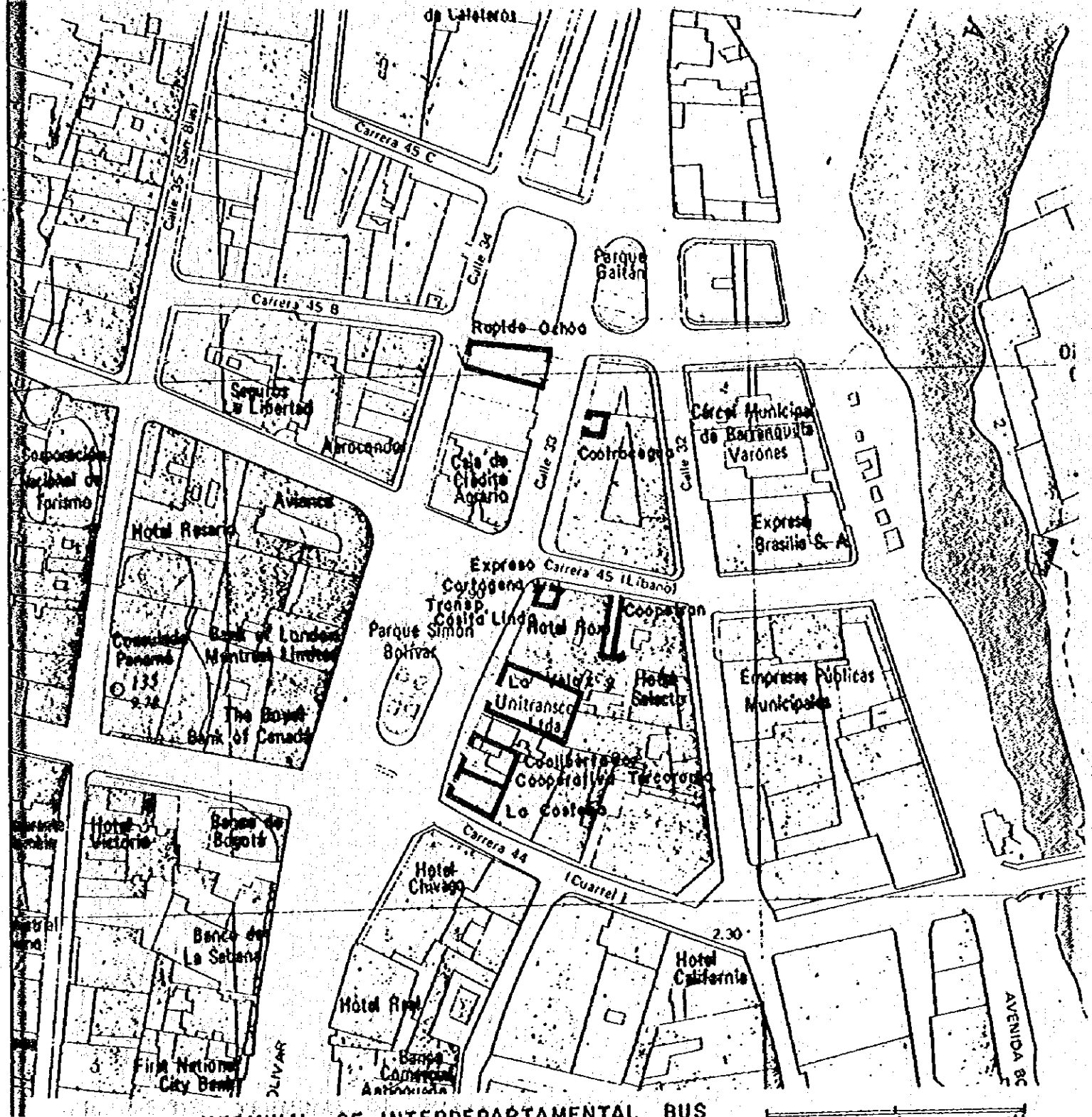


Fig.7-6-3-1 TERMINAL OF INTERDEPARTAMENTAL BUS

	RAPIDO OCHOA	COOTRACEGUA	LA COSTENA	LA VELOZ UNITRANSCO
AREA	456.90 m^2	104.65 m^2	370.70 m^2	442.05 m^2
MAJOR FACILITIES	Baggage Warehouse Waiting Room Offices Parking Area	Baggage Warehouse Waiting Room Offices	Baggage Warehouse Waiting Room Offices Parking Area	Baggage Warehouse Waiting Room Offices Parking Area

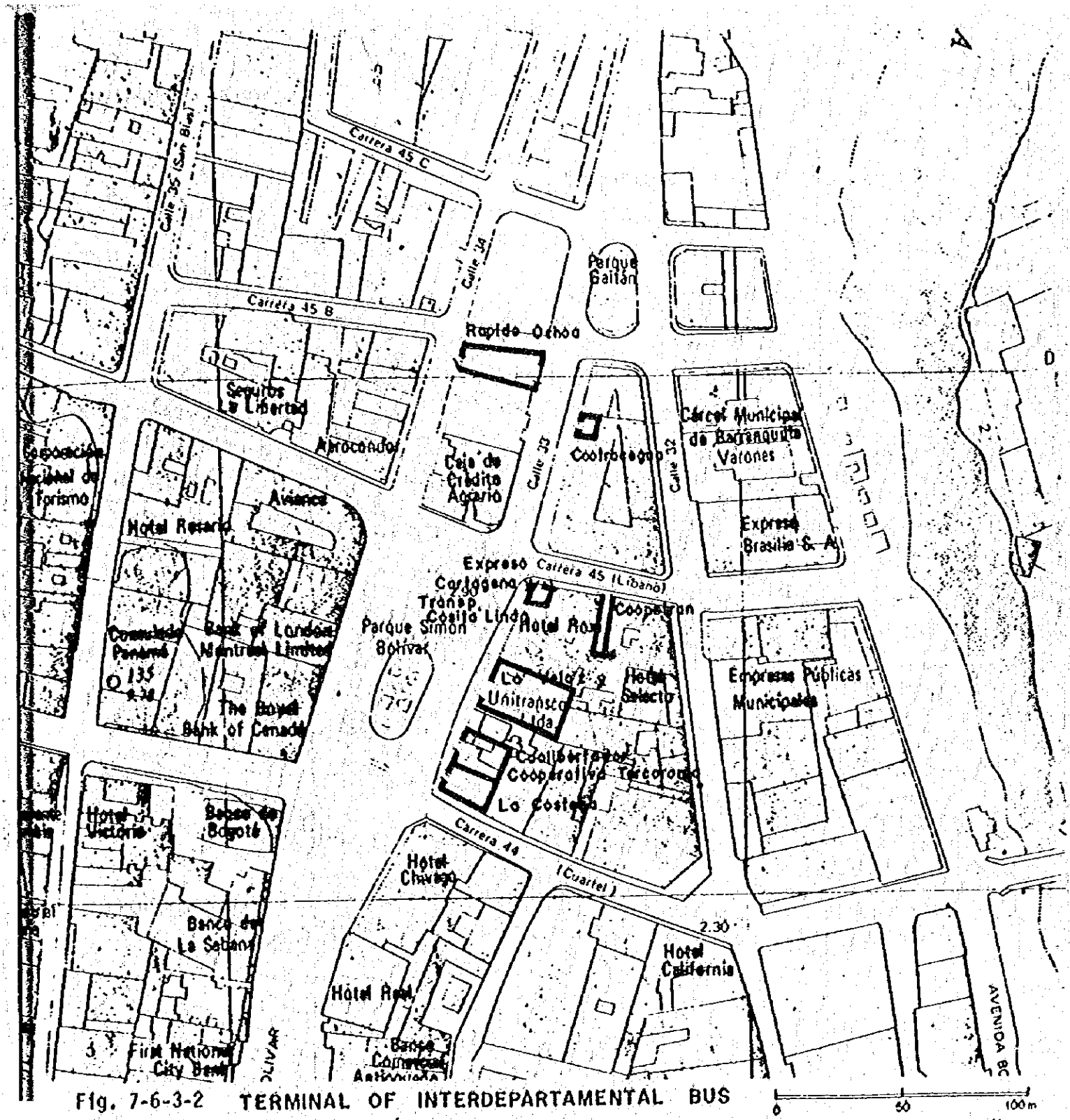


Fig. 7-6-3-2 TERMINAL OF INTERDEPARTAMENTAL BUS

	EXPRESO CARTAGENA COSITA LINDA	COOLIBERTADOR COOPERATIVA TORCOROMA	COPETRAN
AREA	1 469 m2	569.02 m2	172.29 m2
MAJOR FACILITIES	Offices Waiting Room	Offices Waiting Room Baggage Warehouse Parking Area	Offices Waiting Room Baggage Warehouse

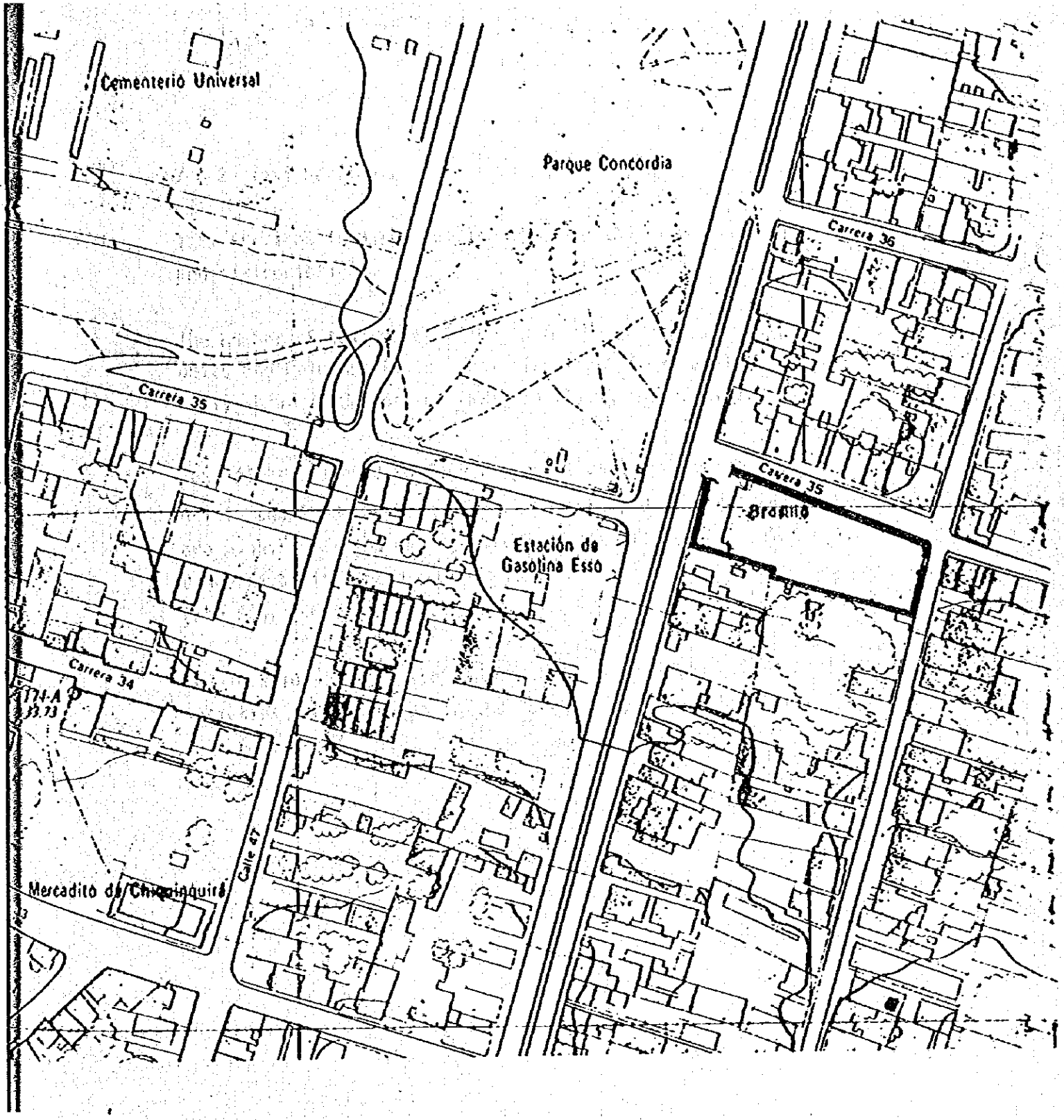


FIG. 7-6-4 TERMINAL OF INTERDEPARTAMENTAL BUS BRASILIA S.A.

0 50 100m

N

AREA: 2.992 m2

MAJOR FACILITIES

Parking Area
Offices
Baggage Warehouse
Waiting Room

7-6-2- Taxi Service

Taxi services in Barranquilla are conducted by four companies and six societies .

The number of taxi units belonged to the companies are 5,251 units and belonged to the societies are approximately 1700. Totally about 7,000 unit of taxi are plying in the city.

Taxi fleet belonged to four companies varies from the 1940 model to the 1983 model. And share of 1955 and 56 model of total are high, regarding car-producers of taxi fleet, Chevrolet and Dodge have high share among total.
(See Fig. 7-6-5 , Fig. 7-6-6).

The location of taxi station which was formulated by the taxi societies are scattered in the Northern, part of the city.
(See Fig. 7-6-7).

FIG. 7-6-5 NUMBER OF TAXI BY MODEL

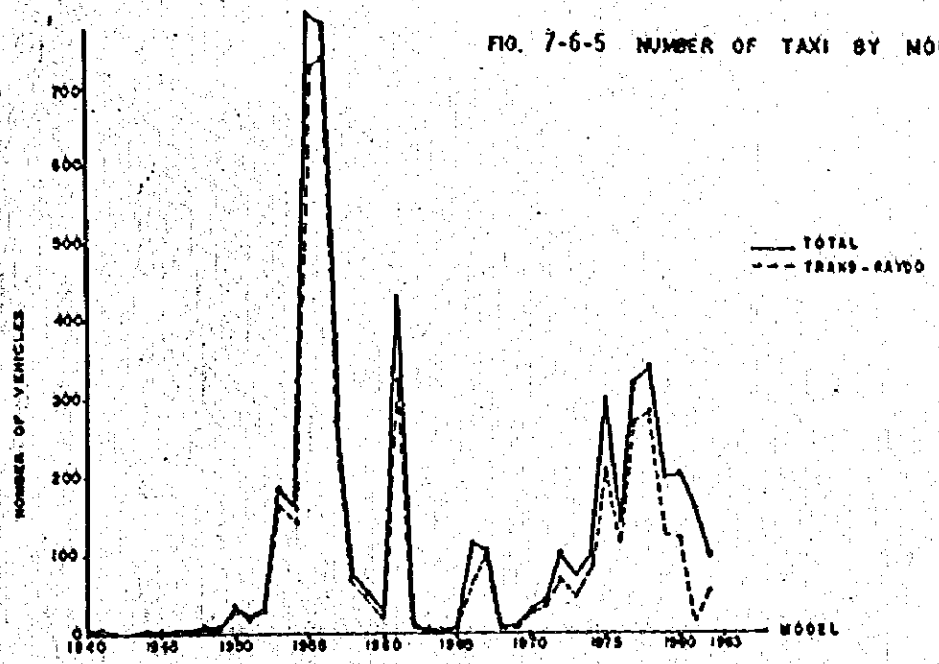
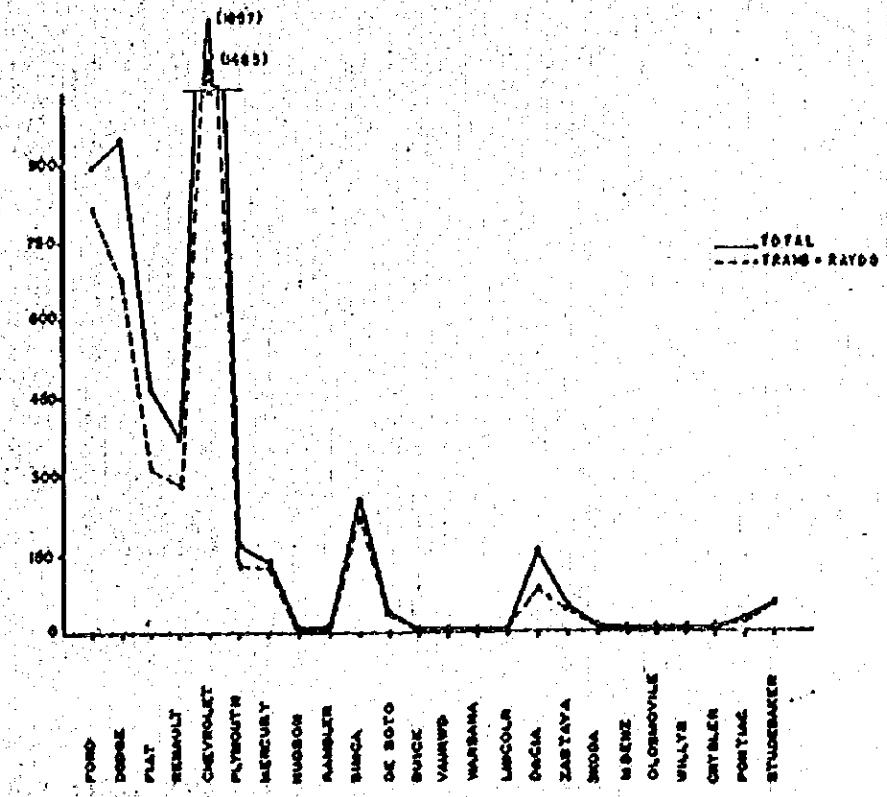


FIG. 7-6-6 NUMBER OF TAXI BY CAR MAKER



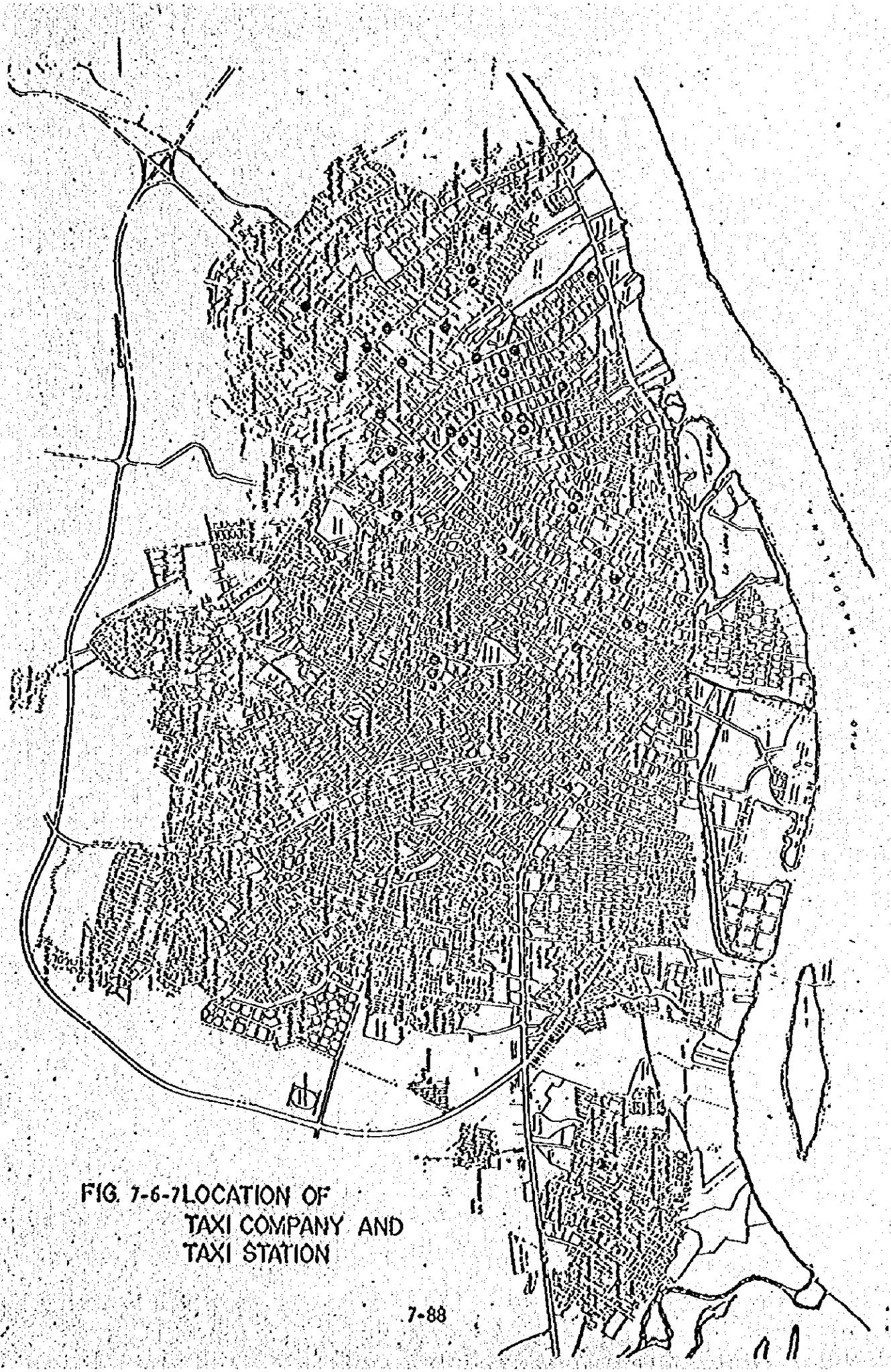


FIG. 7-6-7 LOCATION OF TAXI COMPANY AND TAXI STATION