2) Areal Demand

The areal demand of the intermunicipal bus terminal is calculated based on the future service frequency of intermunicipal buses and the future service level of the center building (See Table 12–5–6).

3) Plan

A model plan of the intermunicipal bus terminal has been designed based on the following consideration.

- The space requirement for the year 1988 should be assumed in the plan.
- The bus approach should lead to Calle 4 through the by-pass, and the entrance and exist should be located on Calle 4.
- The remainder of the plan should be used for some commercial facility.

A model plan is shown in Fig. 12–5–9.

4) Construction Cost

The construction cost for the intermunicipal bus terminal has been estimated in the same way as that for the interdepartmental terminal (See Table 12–5–7).

Table 12–5–6 Areal Demand of Inter-municipal Bus Terminal

	Space Requirement 1983		Space Requirement 1988	
	Amount	Area	Amount	Area
Average departures/hours 74 dep/hour (present) 82 dep/hour (5 years) (with 2.1% annual increaserrate)				
a) Operational Services				
– Embarkment Platforms	13	1,742.2 m²	14	1,881.6 m²
Passenger's circulation width 5 m x length of the platforms.		364 m²		392 m²
– Disembarkment Platforms	9	945 m²	10	1,050 m²
Passenger's circulation				
b) Operational Parking	46	3,385.6 m²	51	3,753.6 m²
c) Parcel Post Service	1	105 m²	1	105 m²
Space is established for one company.		60 m²		60 m²
d) Bus Service Station		1,700 m²		1,880 m²
e) Urban Transport Service				
– Taxi parking	30 veh.	900 m²	33	990 m²
– Urban buses	12 buses	1,080 m²	14	1,260 m²
– Private parking	40 veh.	1,200 m²	44	1,320 m²
– Circulation for vehicles		795 m²		892.5 m²
f) Auxiliary Services (area of direct use by users)		1,650 m²		1,810 m²
g) General Administration areas for companies		270 m²		270 m²
h) Area for General Terminal Administration		442 m²		442 m²
i) Complementary Services		1,340 m²		1,685 m²
Total (a + b + c + ... + i)		16,920.2 m²		18,234.1 m²
(a + b + c) x 25% (vehicle circulation)		1,820.3 m²		1,982.9 m²
(f + i) x 25% (users circulation)		745.5 m²		800 m²
		19,486 m²		21,017 m²
		1.95 ha.		2.1 ha.

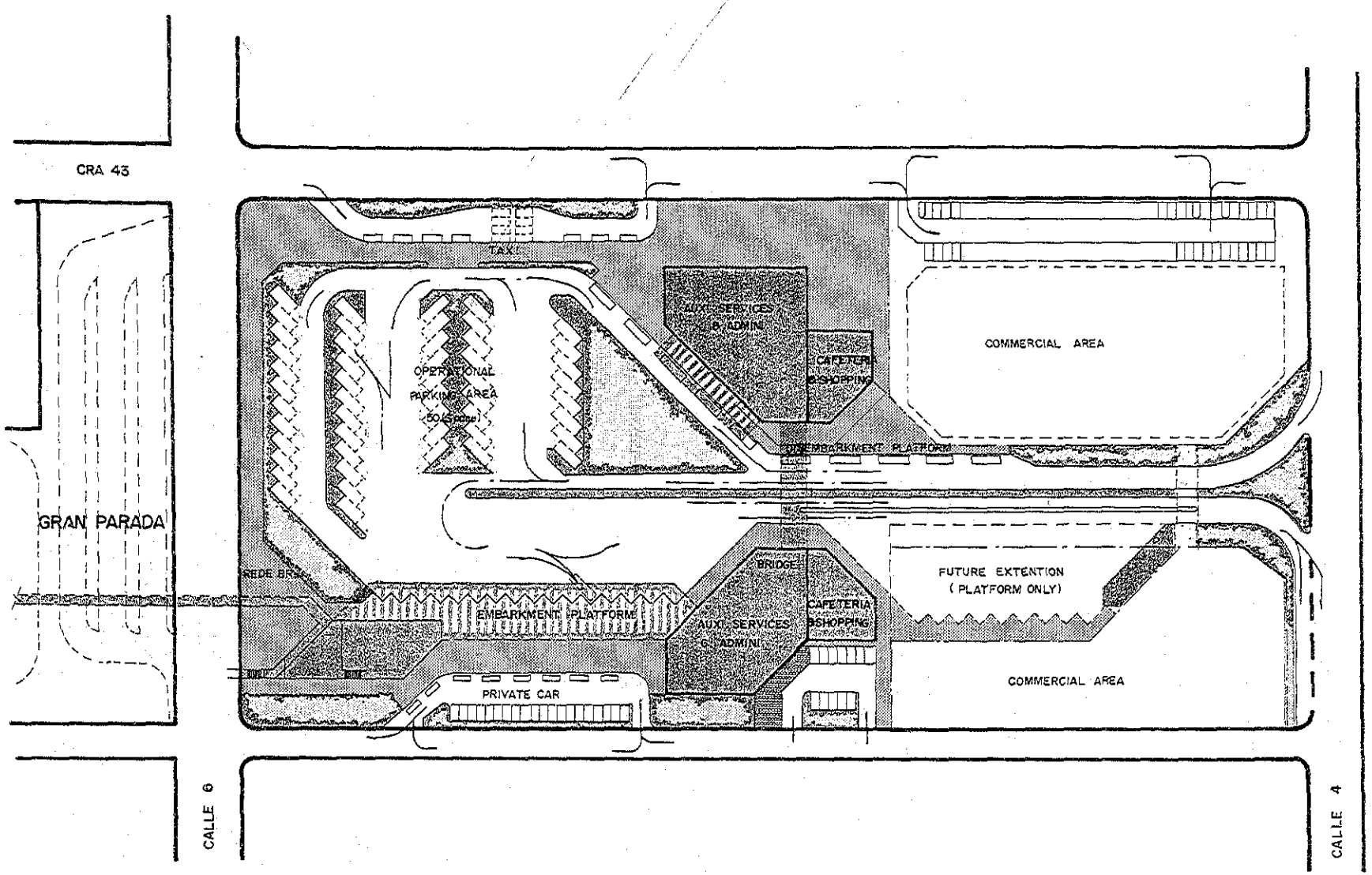


Fig. 12–5–9 Model Plan of Intermunicipal Bus Terminal

Table 12–5–7 Construction Cost of Inter-municipal Terminal

(thousand pesos)

Item	F.P.	L.P.	Amount
1) Site preparation	1,228	307	1,535
2) Road and parking	14,624	9,380	24,004
3) Platform and sidewalk	3,128	1,667	4,795
4) Pedestrian bridge	1,227	2,526	3,753
5) Utilities	3,960	3,858	7,818
6) Planting	620	2,597	3,217
7) Buildings	18,110	42,256	60,366
8) Building service	5,094	3,878	8,972
9) Others	4,701	4,215	8,916
Subtotal	52,692	70,685	123,377
10) Overhead (15%)	7,904	10,603	18,506
11) Contingency (10%)	6,060	8,129	14,188
12) Engineering (12%)	7,999	10,730	18,729
Total	74,653	100,147	174,800

12–5–3 Bus Inspection Center

1) Need for the Bus Inspection Center

The bus company survey conducted in 1983 revealed the following facts.

(1) More than 50% of the buses are at least 10 years old.

(2) More than 60% of the reasons for the suspension of bus services involve insufficient maintenance of buses.

To provide a stable and constant bus service, it is necessary to prevent breakdowns from occurring by providing adequate maintenance. To achieve this, bus companies should establish a periodic bus inspection program, and there should be a place for repairing buses either within the bus company or outside. To promote the bus inspection program and to ensure that maintenance is kept up, it is necessary to strengthen the official bus inspection system. And to implement this, a bus insepction center should be established. Bus maintenance is to remain the business of the private sector.

2) Bus Companies' Inspection Program

The bus inspection program is divided into 3 categories.

(1) Daily inspection

(2) Biweekly and monthly inspection

(3) Quarterly and yearly inspection

The yearly inspection should be conducted officially at the bus inspection center.

The bus inspection guideline is established through the following procedure.

(1) Identification of items to be inspected (classification into 13 bus sections comprising 159 items to be inspected)

(2) Selection of inspection frequency based on the following 2 criteria: (a) Need for inspection and (b) difficulty of work involved.

(a) the need for inspection depends on the following 2 factors: i) new urgent the problem is and ii) how often the problem occurs.

(b) The difficulty of the work involved depends on i) the technical level of the inspection and ii) the technical level of maintenance.

The frequency of periodic bus inspection is determined based on the 2 criteria (See Table 12–5–8).

Table 12–5–8 Number of Check Points by Parts

	I Daily	II Every 2 Weeks and Monthly	III Every 3 Months and Yearly	Total
Engine	3	5	3	11
Transmission	–	7	3	10
Clutch	–	3	2	5
Shock Absorber	5	4	5	14
Steering	5	2	4	11
Brake	6	14	5	25
Refrigeration	2	5	3	10
Fuel System	2	5	5	12
Exhaust System	–	1	3	4
Indications	1	7	–	8
Body	3	7	2	12
Electric System	–	16	4	20
Security	4	5	–	9
Tires	2	6	–	8
Total	33	87	39	159

3) Official Bus Inspection

The total number of buses that should be inspected officially is at least euqal to the number of urban buses in Barranquilla. Therefore, the official inspection items should be selected so as to minimize inspection time.

Inspection items are limited to the following:

(1) items relating to vehicle safety;

(2) item relating to passenger comfort.

Since there are many items to be checked – for example, engine, lights, brakes, and so on, for safety – the official inspection should eliminate those items that are duplicated by maintenance and should focus on items that indicate the fundamental condition of the bus.

Safety inspection will be conducted by means of an automatic inspection line and by observation, and passenger comfort inspection will be conducted mainly by observation. A final inspection will be made by test driving.

The main items to be checked by the automatic inspection line are as follows (See Table 12–5–9).

(1) Brakes

(2) Exhaust gas condition (as indicator of engine condition)

(3) Lights

(4) Speedometer

Table 12–5–9 Number of Check Points by Inspection Measures of Annual Bus Inspection

	For Safety			For Comfortability	For Total Check
	By Automatic Inspection Line	By Manual Check	By Observation	By Observation	By Test Drive
Engine	–	2	3	–	1
Transmission	–	1	2	–	3
Clutch	–	1	–	–	1
Shock Absorber	–	1	6	–	3
Steering	–	–	–	–	4
Brake	1	1	3	–	3
Refrigeration	–	1	5	–	–
Fuel System	–	2	2	–	–
Exhaust System	1	2	–	–	1
Indications	–	–	5	–	–
Body	–	–	2	6	–
Electric System	1	4	1	–	–
Security	1	6	1	–	–
Tires	–	–	5	–	–

4) Bus Inspection Center

a. Functions

The yearly official inspection of urban buses will be conducted at the Bus Inspection Cen-

ter. The inspection will be conducted by an automatic inspection line, by observation, and by test driving.

The Center should have an automatic inspection line and space for manual checks, a test driving course, and administrative offices.

b. Demand

Barranquilla, in the year 2000, will have more than 5,000 units of urban buses. If the inspection time for one bus is assumed to be about 15 minutes, one inspection line is enough to meet demand. The total area of the inspection center will be about 2.4 hectares.

c. Model Plan

A model plan of the Center is shown in Fig. 12–5–10. The total construction cost is estimated to be about 29,000,000 pesos, of which 50% is for the procurement of inspection equipment and tools (See Tables 12–5–10, 12–5–11).

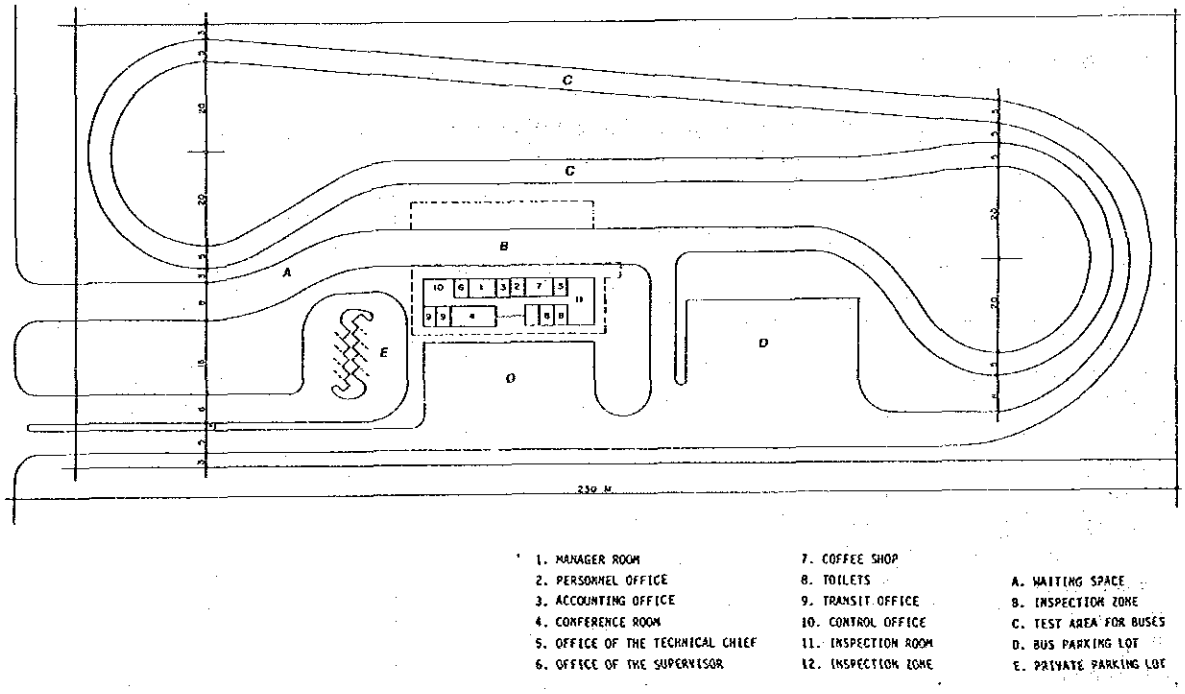


Fig. 12–5–10 Model Plan of Bus Inspection Center

Table 12–5–10 Necessary Area for Inspection Center

Item	Area m^2	
Building	370.0	
Area with Pavement	7,950.0	
Waiting space and inspection		1,140.0
Trials bus		3,450.0
Bus parking and circulation		2,340.0
Private parking and circulation		1,020.0
Clear Areas	15,680.0	
Total Area	24,000.0	

Table 12–5–11 Cost of Construction and Equipments for Bus Inspection Center

	Unit	Quantity	Unit Price 1984 Pesos	Amount 1984 (x 1000 Pesos)
Building	m^2	370	12,600.00	4,662.0
Waiting space and inspection	m^2	1,140	2,000.00	2,280.0
Trials area	m^2	3,450	2,000.00	6,900.0
Bus parking and circulation	m^2	2,340	2,000.00	4,800.0
Private parking circulation	m^2	1,020	2,000.00	2,040.0
Construction Cost (A)	–	8,320	–	20,682.0
Installation of Public service				
Installation of Water	m	1,200	3,400.00	4,080.0
Installation of Sewage	m	1,200	1,300.00	1,560.0
Installation of Electricity	m	1,600	2,500.00	4,000.0
Installation of Telephone	L-km	3L x 4km	15,000.00	180.0
Installation of Public service (B)	–	–	–	9,820.0
Land Cost (C)	m^2	24,000	200.00	4,800.0
Total Cost (A + B + C)	–	–	–	35,302.0
Equipment	–	–	–	33,488.4
Total	–	–	–	68,790.4

12–6 Plan to Introduce an Intermediate Rail Transit

12–6–1 Planning Perspective

The urban traffic demand in the year 2000 will not exceed the limit that can be dealt with by the development of roads and streets. The traffic demand for public transportation, however, shows a tendency to increase annually by 3% or more in the years to lead 2000, while the vehicle traffic demand in the city center will also show an annual rate of increase of 3% or more during 1990 and 2000.

One analysis predicts that the traffic facility capacity in the city center will approach the limit soon after 2000. The smooth introduction of a mass transit system at the beginning of the 21st century should be considered.

In this section, a more concrete image of a mass trasit system public transportation demand in 2000 will be offered, and items that need to be provided for the introduction of a mass transit system will be discussed.

12–6–2 Rail Transit Systems Subject to Examination

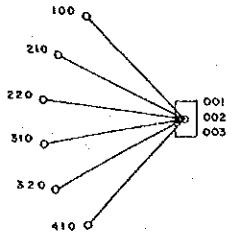
a. Sectors where the Introduction of a Rail Transit System is Possible

A summary of the demand for public transport by major corridors in the city area shows the existence of a relatively large demand in Sector 100 heading north, Sector 220 heading west and Sector 410 heading south. In addition, a large demand can be seen along the circular corridor which runs along the periphery of the area within a 4 km radius of the city center (See Fig. 12–6–1).

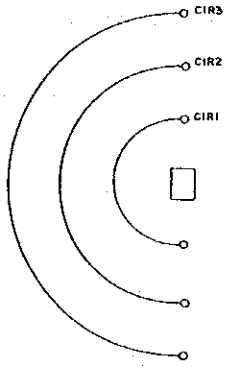
When the sub-centers are developed to the north and south of the existing urban area, transportation connecting northern and southern areas via the city center should be strengthened. Based on the assumption that rail transit systems will be introduced along the arterial roads, 4 corridors and 6 routes are selected for an examination of existing road conditions, etc. (See Fig. 12–6–2).

b. Types of Rail Transit Systems

Transit systems are selected based on a comparative analysis of the possible demand along the proposed routes and the transportation capacities of the respective systems.



Sector	Estimated Demand By Sector	* Estimated Pagr of Mass Transit By Hour
110	288.9	12.5
210	65.5	3.4
220	250.9	13.2
310	293.6	15.4
320	140.8	7.4
410	203.5	10.6



	Estimated Demand By Sector.	* Estimated Pagr of Mass Transit By Hour.
CIRI	287.3	15.1
CIR2	181.0	9.5
CIR3	163.3	8.6

* 50% OF ESTIMATED DEMAND BY SECTOR HAS POSSIBILITY TO USE MASS TRANSIT.
* PEAK HOUR RATIO : 15%
* PEAK DIRECTION RATIO : 70%

Fig. 12–6–1 Sectorial Demand of Public Transportation, 2000

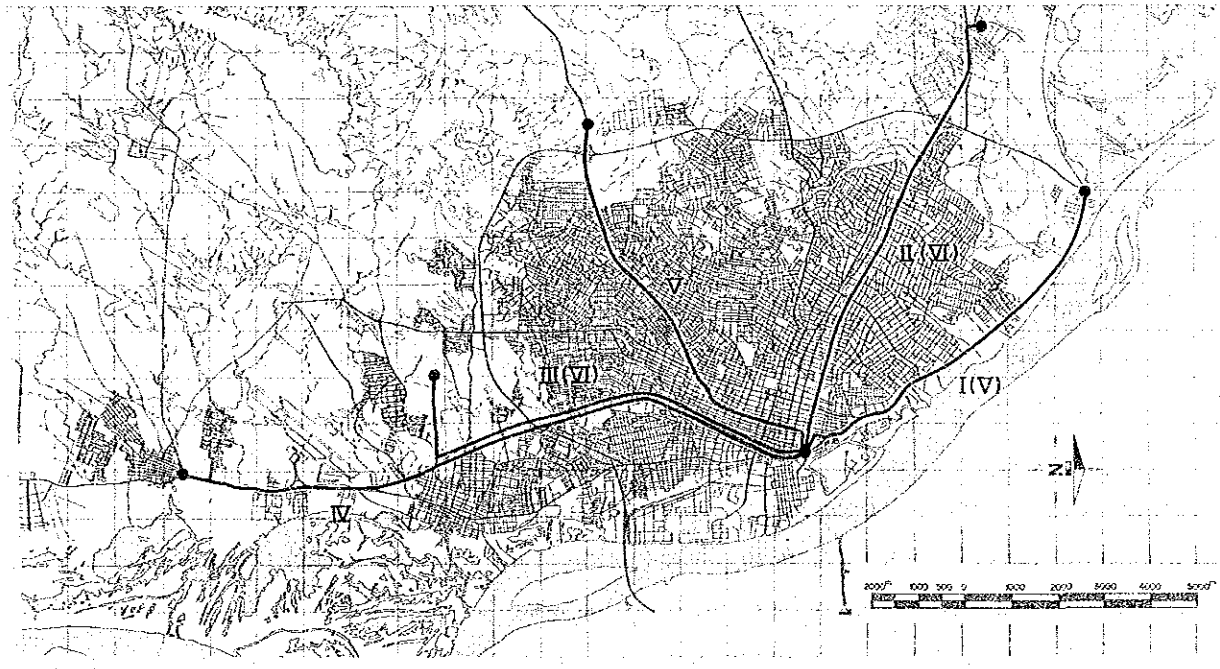


Fig. 12–6–2 Candidate Route of Rail Transit

The demand for a rail transit system along the major corridors is given as the number of PTs in the zones served by the corridors (See Fig. 12–6–1).

With regard to the transportation capacities of rail transit systems, the following are generally considered to be appropriate transportation volumes (See Table 12–6–1).

Table 12–6–1 Transport Capacity of Public Transport System

(Psgr/Hour)

System \ Operation Intervals	10 min.	5 min.	2 min.	Note
				A x B x C
Subway	13,000	25,000	63,000	140 x 1.5 x 10
Mono rail	4,300	8,600	22,000	120 x 1.5 x 4
AGT	2,700	5,400	13,500	75 x 1.0 x 6
Bus	500	1,000	2,400	80 x 1.0 x 1

Source: Integrated Transportation Policies based on Long Term Perspectives by Ministry of Transportation, Japan

Note: AGT System: Automated Guideway Transit System
A : Number of passengers of one unit ofvvehicle
B : Occupancy ratio in peak hour
C : Number of coaches in one train

Based on the above Table, the demand along the amjor corridors in Barranquilla appears to be roughly equivalent to the transportation capacity of the AGT system and monorail. The so-called intermediate rail transit system is considered an adequate transit system. However, the new system should be selected after there has been a more detailed consideration such as a feasibility study. The intermediate rail transit system, which may be introduced, will be called, hereinafter, the rail transit. When the difficulty of acquiring necessary land in the existing urban area is taken into account, an elevated rail transit appears to be the most viable system, but this is subject to ecamination.

12–6–3 Selection of Candidate Routes and their Evaluation

Major corridors where the introduction of an intermediate rail transit system is possible based on the distriction of demand, are as follows:

(1) Sector 100: Centro and northern part of the city

(2) Sector 300: Centro and western part of the city

(3) Sector 400: Centro and southern part of the city

The method of acquiring the right-of-way for the rail transit system will have an effect on the ease or difficulty with which the project is implemented and the financial condition of the rail transit operation.

It may be difficult to acquire public land in Barranquilla for a rail transit system, considering its urban pattern; e.g. the fact that the central district has a large road area.

On the other hand, some of the major roads in Centro must be widened because of concentrated traffic demand, and the right-of-way for the rail transit system can be acquired when these streets are expanded. If the space above the streets is used for the rail transit system, construction costs will be reduced.

The candidate routes to be reviewed are as follows (See Table 12–6–2).

Table 12–6–2 Candidate Alignment of Rail Transit

Route No.	Origin and Destination	Streets
Route 1	Centro – Las Flores	Via 40
Route 2	Centro – North Subcenter	Cra. 46
Route 3	Centro – South Subcenter	Calle 30
Route 4	Centro – Malambo	Calle 30
Route 5	Studium – Centro – Las Flores	Calle 47, Via 40
Route 6	Combination of Route 1 and 3	

To evaluate the candidate routes, values for the following indicators are calculated for each route.

(1) Number of passengers

(2) Number of services per day

(3) Number of trains required

(4) Total train-km per day

(5) Total income and operation cost per day

(Item (5) is calculated to compare the financial conditions of the routes. If the value arrived at is less than 1.0, it does not necessarily mean that the route would not allow a viable operation.)

The total number of passengers ranges from about 90,000 to 250,000 per day depending on the route. These are roughly speaking, proportionate with the route length, in other words the size of passengers.

The number of passengers per km of rail transit, which is an indicator of the effectiveness of a transportation system, also ranges from about 9,000 to 12,000 per day. Routes that are efficient from this viewpoint are Routes IV, V and VI, with 11,000 to 12,000 passengers per km per day, and a route that is inefficient is Route II.

The number of passengers per train-km, which is another indicator of the efficiency of a transportation system, ranges from 33 to 64 per day. Route I has 64 passengers per train-km, which is the largest figure, and Routes III and V have 51 to 52 passsengers per train-km, respectively. Comparing the estimated income and expenditure expected from each Route, Route I has the most favorable ratio, followed by Routes III and V. Routes IV and VI, at 0.35 and 0.36, respectively, are in the middle.

Based on the total number of passengers, the number of passengers per unit length of route, the number of passengers per train-km, and the ratio of expenditure to income, Route III and V are evaluated to be the best. However, route selection for a major transportation system like the rail transit should take into consideration the future structure of the city, existing road space and so on, in addition to transportation demand predicted for the year 2000.

Via 40, which Route V will follow, has enough space to meet a future increase in traffic demand. Therefore, rail transit is not absolutely required along this road.

Route II, which is a part of Route V, will follow Cra. 46. The street is a major street connecting Centro and the north sub-center. According to the predicted traffic demand, one of the streets connecting Centro with the north sub-center should be expanded.

Consequently, the rail transit system of Barranquilla should follow Route VI, which overlaps Route III. Additionally, Route V will be considered as a branch route to be constructed after the completion of Route VI.

Table 12–6–3 **Evaluation of Alternative Rail Transit Routes**

Line	Length km	No. of Psgr (Psgr/day)	No. of Psgr/km of Length	No. of Psgr/km of Train-km	Rank of B/C Ratio
I	8.9	93,000	10,400	64	A
II	12.1	108,000	8,900	33	D
III	10.2	117,000	11,500	51	B
IV	13.4	166,000	12,400	42	C
V	16.5	190,000	11,500	52	B
VI	21.8	247,000	11,400	42	C

Note: Rank of B/C Ratio A: Over 0.5 B: 0.4 – 0.5
C: 0.3 – 0.4 D: Less 0.3

12–6–4 Plan

1) Planning Conditions

The basic conditions of the rail transit system are as follows:

Length of the route	: 21.3 km
Number of passengers	: 280,600 psgrs/day
Largest number of accumulated passengers by station-pair	: 124,700 psgrs/day
Service frequency	: 328 services/day
Service frequency at peak hour	: 12 ser./hr/direction
Number of train requred	: 20 trains (80 coaches)

The rail transit system will follow Calle 30 and Cra. 46.

A minimum road width of 22 m for general sections and 30 m for station areas will be required if a rail transit is to be introduced. These figures are calculated based on the following installation standards.

(1) Pylons should, in principle, be erected on medians.
(2) The width of a median should exceed 2.5 m.
(3) The horizontal distance between the construction limit and the road boundary should, in principle, exceed 6 m.
(4) The horizontal distance between the construction limit of a station and the road boundary should, in principle, exceed 7.5 m.
(5) Sidewalks will be required for roads and, in principle, their width should exceed 2.75 m.
(6) The distance between the pylons should, in principle, exceed 20 m.
(7) The minimum clearance between the monorail structure on a road and the road's surface should be 5.5 m. The height of the pylons should exceed the height of the pedestrian overpass.

A detailed application of these standards is given in the following Fig. 12–6–3.

Seen from wider perspective, the introduction of a rail transit system may cause problems in terms of noise, vibration, the privacy of people living along the route and the urban landscape, etc. Furthermore, there is no set standard for the proper judgement of these problems. However,

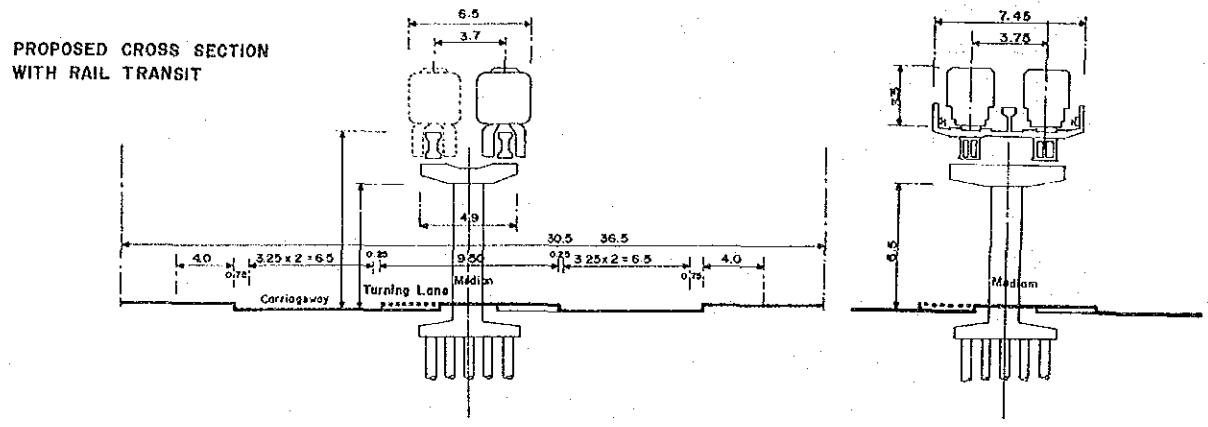


Fig. 12–6–3 Typical Structure of Intermediate Rail Transit

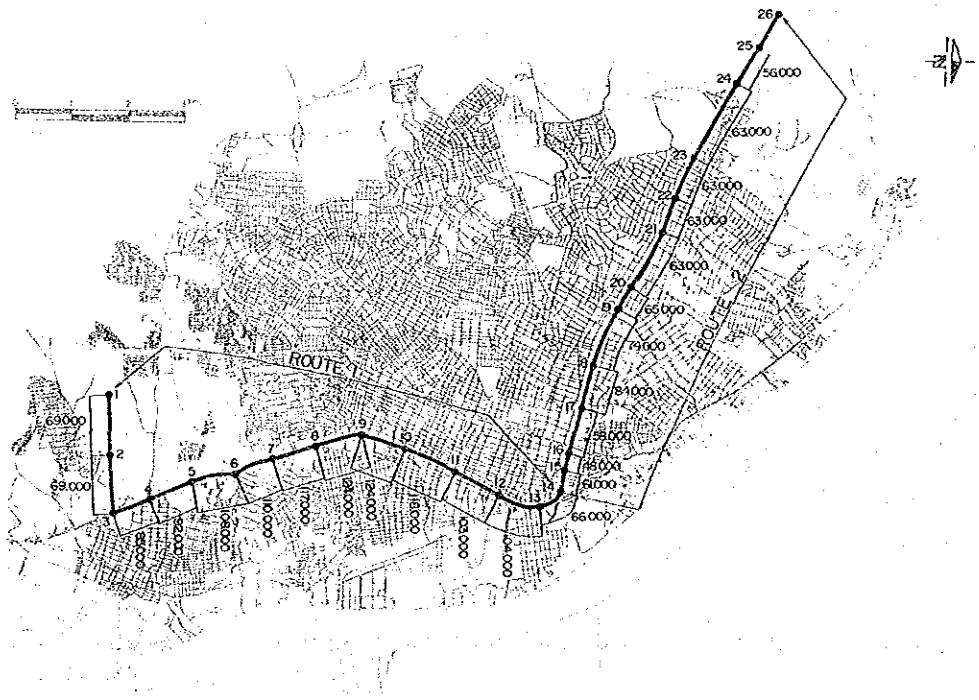


Fig. 12–6–4 Route of the Rail Transit

if a system is located on the median of a major urban road which has a wide road width and a large vehicle traffic volume, the above-mentioned problems will not cause any decisive damage to the einvromenta along its route.

2) Existing Conditions of Prospective Routes

Fig. 12–6–4 shows the planned route of the rail transit. An outline of the existing conditions for each of these routes is given below. In addition, the possible problems following the introduction of a system and solutions to these problems will be described as a guideline for the rail transit plan and related future plans.

a. Route-1

The existing route conditions for Route-1 are described in order, starting from the southern sub-center. Refer to Fig. 12–6–5 given at the end of this section for the current cross-section of the roads where a system is planned. The cross-sections in this figure are shown in order from the southern sub-center side to the Centro side. A detailed description for each part of the route is given below.

i) Part 2

Most of this section is included in the planning site for the sub-center and is currently undeveloped. However, 2 or 3 large residential complexes have been either developed or are under construction in the neighboring and surrounding areas, and most houses have already been occupied. These are mainly one storey houses of either the semi-detached or tenement style for low-income families. Since the location of the transit route is considered as a part of a comprehensive plan for the sub-center, the construction of the system is not likely to pose any problems.

ii) Part 1 (the Section of the Airport Road)

Many high bankings to avoid a nearby Arroyo can be seen in this section of the road. Although houses and factories are scattered along the road, more than half of the roadside is empty. The widening of the median and thus of the road itself will be necessary since the axis of the transit line preferably should stand on a median and since the median of this road section is slightly less than 2 m wide. As there is abundant road space, road expansion towards one side can be carried out easily.

iii) Circunvalar Intersection

At this point, the airport road changes to Calle 30 and heads towards Centro. This road section consists of a road bridge, and it bends sharply eastward over the Circunvalar. Since a high-tension line passes over the road, the transit route preferably should run almost straight to the north of the intersection ramp site.

iv) Calle 30 of Part 1

Except for the section in the Centro district, the road site width exceeds 30 m and most parts have a median about 4 m wide. Large factories can be seen along the southern part of the road, while small and medium sized factories and service industries increase in number as the road approaches the center of the city. Beyond these factories and offices is a series of high density residential areas. This is the section of the city most suited to the introduction of a rail transit system.

v) Calle 30 (Centro District) of Part 1

The introduction of the system is currently impossible in this section due to the narrow road width and bad road alignment. In addition, the road is occupied by street vendors. A lot of attention must be paid to these existing problems that must be solved before a transit line can be considered. This section urgently requires widening and improvement, and the execution of extensive improvement work, including the preparation for the planned transit line, will be requested when the road improvement work is carried out.

b. Route-2

The existing route conditions for Route-2 are described below in order, starting from the northern sub-center.

i) Part 2

The northern sub-center is adjacent to the new arterial road (Puerto Colombia Road) connecting Barranquilla and Puerto Colombia. The rail transit route will join this road right outside the terminal station and will head for the Circunvalar intersection. A university and houses are scattered along the route and land preparation for new development projects is currently underway. Since this road section is both straight and wide, no serious problems are anticipated.

ii) Around the Circunvalar Intersection

If the transit line is introduced first for the Part 1 section, this site is best for the terminal station for Part 1, as well as for a transfer station when Part 2 is opened in the future. This site would also be conveniently located for future bus passengers changing via the Circunvalar to the transit system heading to the city center. The station should therefore have a square in front of it and located on the northwest side of the intersection. In addition, this location and the land behind it are still undeveloped and would be suitable for a railway-yard.

The present site which is separated from surrounding areas by the Circunvalar and the Puerto Colombia Road satisfies the required conditions ,namely that a railway yard have at least 2 hectares of land and that it be isolated from surrounding areas.

The Puerto Colombia Road changes to Cra. 46 at the intersection with the Circunvalar and then heads for the city center. This intersection is of an interchange type, with Cra. 46 running over the Circunvalar. The line should pass to the south of this interchange and then move over the median of Cra. 46.

iii) Cra. 46 of Part 1

Some 60% of the entire route, i.e. the northern section between the Circunvalar and Calle 72, has a road more than 25 m wide with a median 4.0–2.5 m wide. In addition, buildings along this road have wide front years. Newly-developed, high class detached houses, flats and shops are particularly noticeable along the road. The introduction of a transit line in this section should not cause many problems.

The width of the section between Calle 72 and the Centro district, however, is a relatively narrow 22.5–24.6 m, and the width of the median is in general 2 m and 0.8 m in the Centro district. Road improvement work will be required for this section of the road, since the introduction of a transit line would be impossible under existing conditions.

Particular attention should be paid to the fact that many high-class residential areas, and splended large churches, banks and flats are located along this section of the road. In addition, a number of fully grown trees are on the median and the sidewalks and make this section especially attractive. Any development plan for this section must take this into consideration.

c. Connection Point of Route-1 and Route-2

Route-1 and Route-2 will be connected at Centro Station. Calle 30 for Route-1 and Cra. 46 for Route-2 will cross there at an angle of 120°. Since the track for the system cannot curve at this angle, the connection must be made by the introduction of a large curve outside this possible connection point. As a result, Centro Station will be located somewhere near the San Andresito market and the vacant land to the north of the market, Route-1 will reach the station with a curvature having a radius of 250 m. Route-2 will join the station with a gentle curve, since it is almost parallel to the axis of the station.

Since the block surrounding the station is subject to the Renewal Plan, its development will be considered together with other facilities envisioned in the plan.

The conclusion of the analysis of existing route conditions is that introducing a transit system along these routes is highly possibles the only adverse factor being environmental disruption. Road improvement work for the Calle 30 section of the Centro district and the Cra. 46 section between Centro and Calle 72 will be the minimum necessary condition for the implementation of the system.

The present road cross-section and the proposed cross-section for the Road Improvement Project and the proposed cross-section with the rail transit system for Route-1, as well as for Route-2, are given in the following pages for the purpose of comparison.

3) Outline of the Facilities and Construction Costs

a. Outline of Facilities

Facilities for the system will largely consist of track, stations, vehicles, railway-yards, transformer stations and circuit facilities, signal security facilities and communication security facilities. Of these, the explanations for vehicles, transformer stations and circuit facilities, etc. will be left to specialized books. Here, only the descriptions of important items concerning functions, design size, structures, etc. will be given.

i) The total route length will be 21.3 km and most parts will use elevated track.

ii) Among the various kinds of track, the straddle-type track will be selected since it occupies little space and is of a small structural size that will not unduly disturb the urban land-

scape.

iii) The standard track beams will be made of pre-stressed concrete and the pylons will be made of reinforced concrete in order to reduce construction costs. The standard measurements of structures and their rough drawings are given in Fig. 12–6–5.

iv) When the location of a station is to be decided, it is imperative to consider not only the Land Use Plan along the route but the convenience of prospective passengers and to try to achieve continuity with other transportation systems. Although the standard distance between stations will be about 1 km, a distance of some 700 m is planned for Barranquilla as the system there is intended to be a substitute for the bus service.

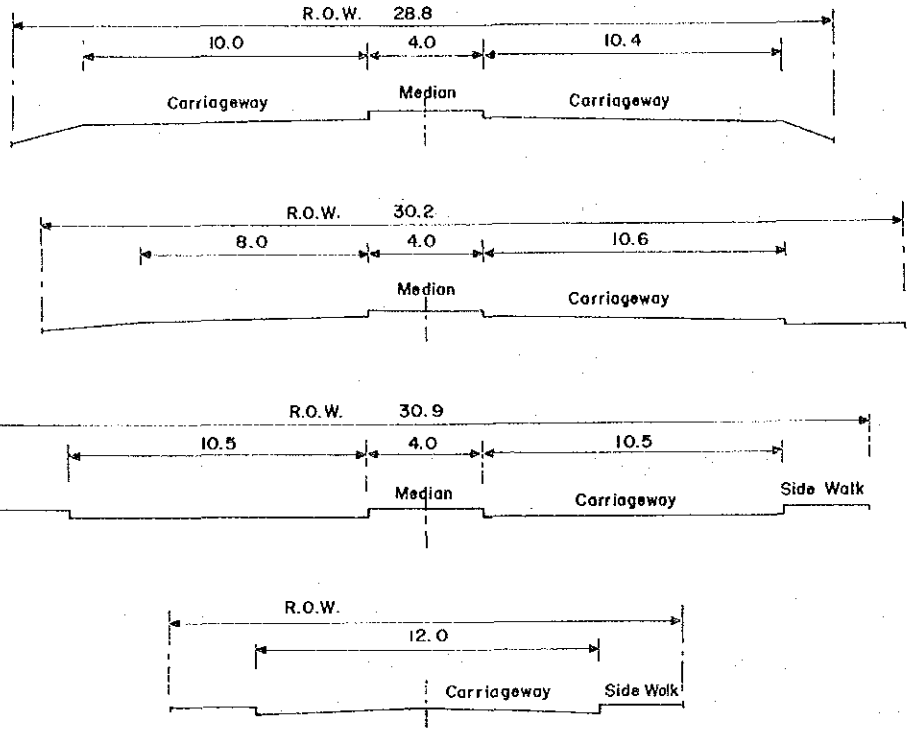
v) Stations will be classified into ordinary stations and terminal stations/transfer stations. There will be 11 ordinary stations for Route-1 and 10 for Route-2, and 5 terminal/transfer stations along both routes. These 2 types of stations necessarily differ in the sizes of their facilities. Ordinary stations will be provided with minimum station facilities as well as facilities for passengers to get on and off of the trains. Terminal/transfer stations will be provided with facilities to get on and off the trains, minimum passenger service facilities, station facilities necessary for them to function as principal stations and station squares. Since all stations are elevated, particular attention will be paid to their appearance.

vi) 2 types of platforms exist, i.e. the island-type and the up/down line separate symmetrical-type. The island-type will, in principle, be employed for ordinary stations and the other type will be employed for terminal/transfer stations. Since the train consists of 4 compartments, the length of the platform is taken to be 60 m. The platform width will be 3 m minimum for the island-type and 2 m for the other type.

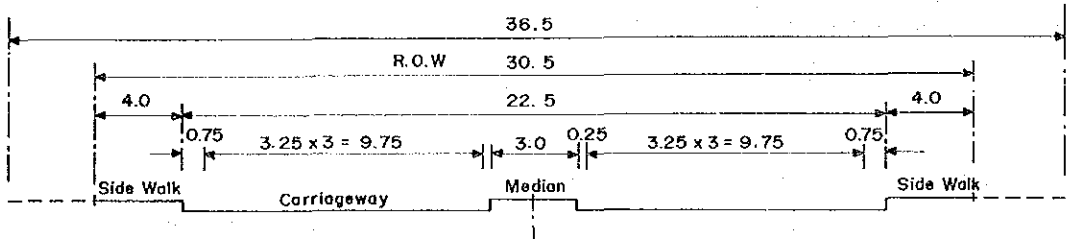
vii) The train will have a fixed, 4 compartment formation. Since it runs through the urban area, its design should suit the environment. Efforts should be made towards the achievement of a maintenance-free train , and the compartment design should improve maintainability. The body structure of the compartments should be lightweight and resistant to corrosion.

viii) Detaining track will be provided at the railway-yard, the train inspection yard, the maintenance yard for important and overall inspections, and reparis, the painting yard and the wash-

PRESENT CROSS SECTION



PROPOSED CROSS SECTION
FOR ROAD PROJECT



PROPOSED CROSS SECTION
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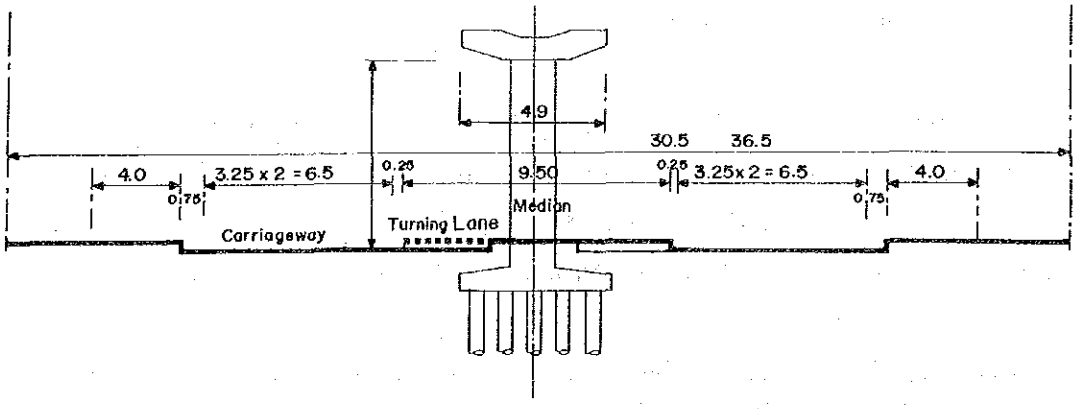
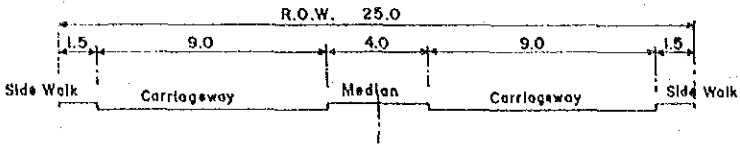
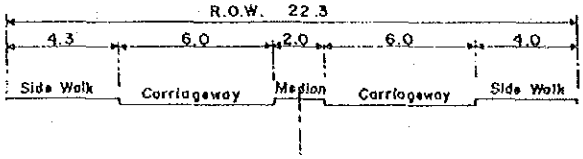
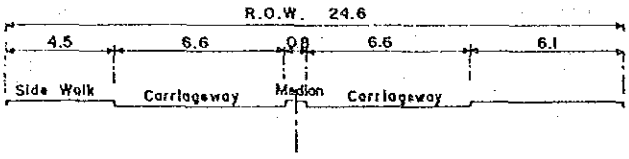


Fig. 12–6–5 (1) Standard Cross-Section of Route 1

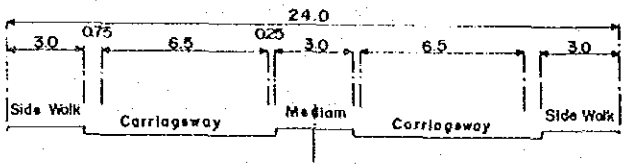
PRESENT CROSS SECTION







PROPOSED CROSS SECTION
FOR ROAD PROJECT



PROPOSED CROSS SECTION
WITH RAIL TRANSIT

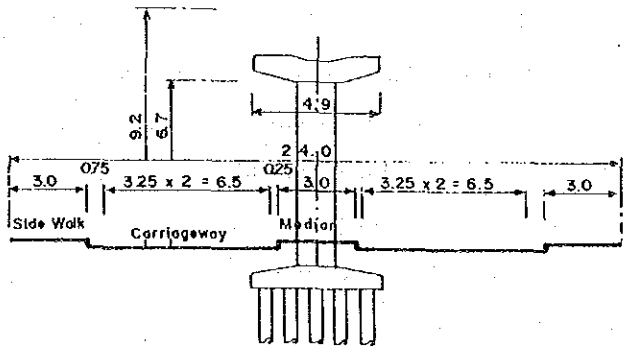


Fig. 12–6–5 (1) Standard Cross-Section of Route 2

ing yard. In addition, a building for general administration from which instructions, including train operation and power supply instructions, will be issued and which will house signal equipment and maintenance mens' station, etc. will be provided in this railway-yard.

b. Construction Costs

Construction costs are estimated based on construction examples in Japan and are modified using the construction unit prices in Barranquilla. The following are preconditions for estimates.

i) Preconditions for Integration

(1) Since route structures and ordinary stations (excluding terminal stations) are located above roads, the cost of land is not accounted for. However, a small amount of land will be necessary for passengers to desembark and use, stairs. Therefore, a standard 100 m^2 of land will be acquired for each ordinary station apart from the sites for sidewalks. This land will be used so as not to disturb pedestrian traffic around the landing area.

(2) The 5 terminal stations will be located as follows: at the Centro Station; at the north and south sub-center stations and at the end of each Part 1 for both routes. On average, 3,000 m^2 of land will be acquired for each one of these stations.

(3) One railway-yard will be provided for each route, bringing the total of land area required to 4 hectares.

(4) With regard to the structures of the routes (track beams, pylons and foundations), the track beams will be made of pre-stressed concrete and the others of reinforced concrete. However, special sections (where long spans are required at intersections, etc.) which will account for 20% of the total length, will be made of metal.

(5) The pylon span will, in principle, be 20 m. The length of the foundation piles will be 10 m on average given the ground conditions of Barranquilla.

(6) It has been decided not to employ labor-saving equipment to drive the train or automatic equipment for passengers at the initial stage.

(7) It has been decided not to take into account the cost for road improvements since all road work improvements are presumed to have been completed by the time the rail service is introduced.

(8) It has been decided not to account for the cost of insurance, which may be necessary when the rail service is introduced.

(9) The time for integrating construction unit prices is 1984.

ii) Results of Integration

The overall construction cost for introduction of rail transit services, calculated on the basis of the facility outline and the conditions for integration described above, is shown in Table 12–6–4.

Table 12–6–4 Construction Cost of Rail Transit

Infrastructure	13,428.1 mil. $
Station Cnt	1,500
Station Sub	4,200
Yard (Fixed)	4,434.7
Building (Sub. Sta/Elec)	1,366.9
Building (Sign/Cont)	0
Electricity Supplyer	3,241.2
Signal, Commun	2,592.8
Design/Engen/Supervi	1,296.3
Rolling Stock	3,477.6
Land Acquisition – Sta. Cnt	30
Land Acquisition – Sta. Sub	6
Land Acquisition – Sta. Min	4.2
Land Acquisition – Yard	20
Contingency (5%)	1,778.89
Total	37,376.69 mil. $
Const. Cost/km	1,754.7 mil. $

Chapter 13.

URBAN RENEWAL PLAN FOR THE CENTRAL DISTRICT

Chapter 13 URBAN RENEWAL PLAN FOR THE CENTRAL DISTRICT

This chapter focuses on the urban renewal plan in the central district of Barranquilla in connection with the metropolitan transport master plan. First, the necessity for a basic renewal policy, the planning area and the overall targets of the renewal are stated. Next, the future land use policy is discussed in relation to the future framework and land use density. Then, strategic areas of renewal are selected, and more concrete ideas of renewal for these aras are set forth. Finally, implementation measures of urban renewal are introduced together with a study of their applicability to the strategic project areas.

13–1 Basic Urban Renewal Policy

13–1–1 Necessity for a Basic Policy

The necessity for a basic urban renewal policy in the central district arises, among other reasons, from the objective of this Study. In order to work out a comprehensive transport plan for the Metropolitan Region, the future of the district has to be made clear in the context of metropolitan development. The present traffic congestion and other transport problems in the district are, to a considerable extent, due to the accumulation and concentration of major urban functions, and to the configuration of these functions. Thus, the reorganization of urban functions in the district is vital if the district is to fulfill its future functions in the Region, and this firmly established as a renewal policy.

There are, however, more positive and substantial reasons why a renewal policy is necessary. In fact, in spite of the locational importance of the central district, there appears to be nothing that can be identified as a guiding principle for the development or renewal of the district.

The zoning ordinance of Barranquilla revised in 1968 stipulates some land use features but it is far from being the guideline needed to eliminate the present urban blight in the district. Much of the district has not been considered in the PIDAMB study and its development has not been specified. In addition, the general climate in terms of construction in the district, especially from Calle 40 to the east including Barranquillita, seems to be quite unfavorable for renewal. Construction has almost stopped owing to scarce demand, in other words, an unprofitable market for rental space.

The central district was once the focus of urban activities, but no overall planned measures ever appear to have been taken for its reorganization so that it might respond to an ever growing scale of urban functions. All through the past decades of rapid urban expansion, the dis-

trict has been without a clear vision of its future. The invasion and growing settlement of squatters, uncontrolled street vendors, the fleeing of major urban functions from the district, traffic confusion, and environmental deterioration along the canal -- these are all natural consequences of not having a development policy.

Thus, it is time to firmly establish a basic renewal policy so that both the public and private sectors can work collectively, toward the revitalization of the district.

A renewal policy is intended primarily to serve as a guideline in the administration of planning by the public sector. But it also should make clear how the public sector can take the initiative in renewal and induce the involvement of the private sectors.

13-1-2 Planning Area

The planning area for which a renewal policy is to be established covers about 600 ha. The entire survey area of about 500 hectares is included in, and about 100 ha. in the Loma 1 area is added because of its future importance for central district use. The area is shown in its metropolitan setting in Fig. 13-1-1.

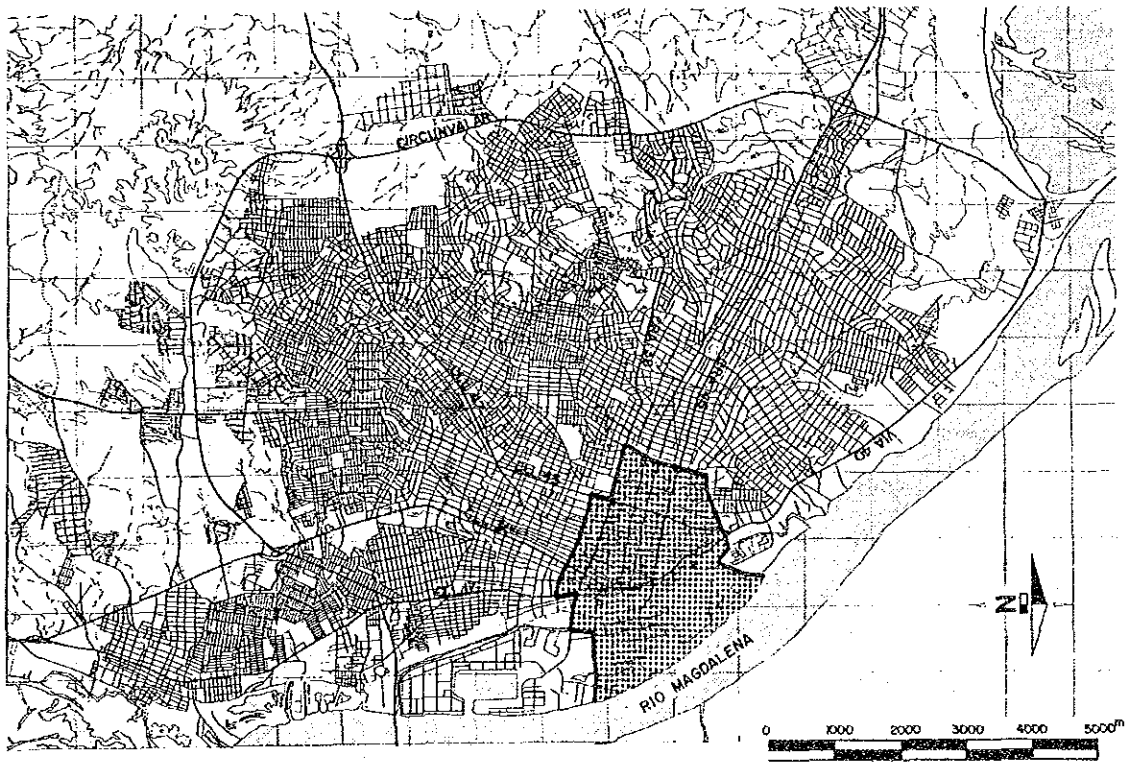


Fig. 13-1-1 Renewal Policy Area

Some characteristics of the area in terms of the sub-divisions used for the purpose of the survey are as follows.

(1) Areas where land-use intensity from various points of view is remarkably low and future high-intensity land use is expected. Locational features of this item are shown in Fig. 13–1–2 and Table 13–1–1.

a. High vacant land ratio: 2A2, 2B1, 2B3

b. Relatively low construction investment compared to land value: 2A2, 2A4, 2B1, 2B2, 2B3, 3A, 4B2, 5A1, 5A2, 5B1, 5C2.

c. Low real estate value: 2A2, 2A3, 2A4, 2B1, 2B2, 2B3, 3A, 3B, 3C, 5A1, 5A3, 5B2, 5C2.

d. Low floor-area ratio: 2A2, 2A3, 2A4, 2B1, 2B2, 2B3, 3A, 4B2, 5A1, 5A2, 5A3, 5C2.

(2) Areas with key commercial and business activities where a changeover in land use is expected in the future in accordance with the region-side reorganization of urban structure: 1A, 1B, 1C, 2A, 4B, 5A, 5B.

(3) Areas where dilapidated buildings have to be removed: 1 A.

(4) Areas where a confused mix of land uses is to be eliminated: 1C, 3B, 3C, 5B, 5C.

(5) Areas where environmental improvements are to be considered: 1A, 2A, 4A, 4B, 5C.

Table 13–1–1 Low Land Use Intensity Index by Sub-Division

Sub-Division	Vacant Land Ratio (%)	Investment Intensity Index	Real Estate Value ($/m²)	Floor Area Ratio (%)	Land Value ($/m²)
1A1	5.2	0.92	8,650	150.4	3,400
1A2	4.9	0.76	9,640	150.7	3,970
1B1	1.7	0.94	13,900	162.5	5,030
1B2	7.9	1.32	19,390	306.4	6,020
1C1	6.4	1.52	10,000	140.5	2,820
1C2	6.3	0.92	5,560	86.9	2,160
1C3	5.5	1.80	14,920	133.2	3,570
1C4	11.4	1.17	8,190	98.1	2,700
2A1	0.4	3.07	5,780	63.1	940*
2A2	43.1*	0.53	1.790*	38.8*	950
2A3	23.4	0.81	2,280*	47.9*	980*
2A4	16.8*	0.57	1,380*	35.1*	710*
2B1	44.5*	0.22	640	7.4*	480*
2B2	22.5*	0.53*	830*	14.0*	440*
2B3	79.0*	0.53*	580*	7.1*	300*
3A	7.4	0.43*	720*	44.8*	380*
3B	3.2	1.24	2,820*	89.1	900*
3C	7.7	1.29	2,050	63.5	640*
4A1	4.1	1.33	6,060	75.0	1,880
4A2	1.7	0.81	5.470	56.9	2,320
4B1	17.0	0.97	7,600	62.9	2,850
4B2	15.8	0.64*	5,960	48.0*	2,890
5A1	13.1	0.57*	1,240*	37.9*	630
5A2	2.2	0.42*	3,320	48.7*	1,910
5A3	0.0	0.85	1,790*	40.7*	740
5B1	7.7	0.47*	3,490	61.8	1,890*
5B2	2.7	1.14	2,910*	70.1	1,000
5B3	5.8	0.97	3,760	63.0	1,380*
5C1	25.0*	0.91	6,250	62.4	2,410
5C2	5.0	0.45	2,700*	43.6*	1,510

Source: IGAC

* : The area where land use intensity is low.

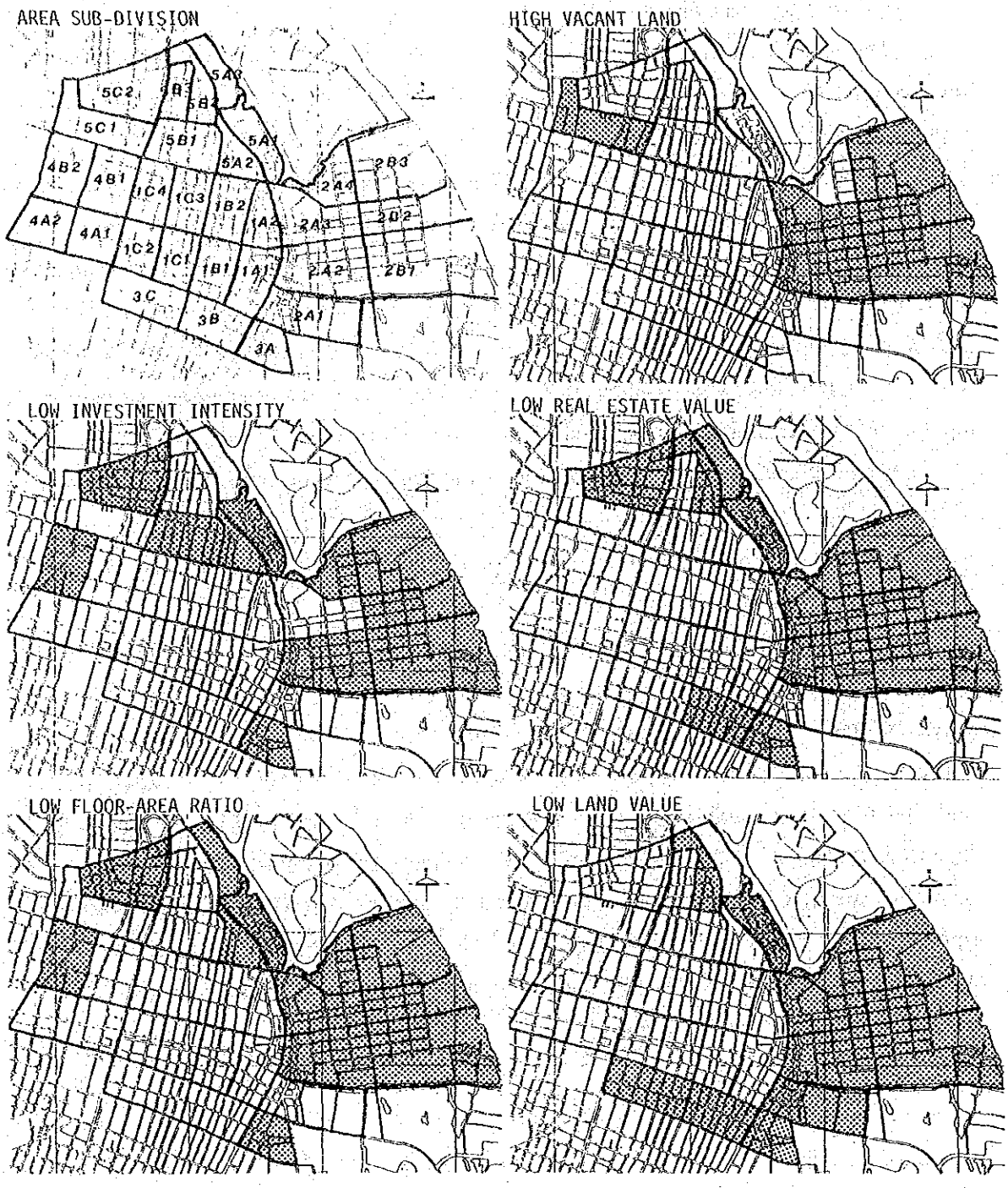


Fig. 13–1–2 Low Land Use Intensity Area

13–1–3 Urban Renewal Targets

The renewal targets can be set forth from various points of view, taking into consideration the existing state of the central district and in accordance with the future development concept of the metropolitan region.

There are 4 major targets: urban functions, transport, environment, and buildings. Urban functions and activities in the central district are to be upgraded to conform with future, region-wide urban restructuring. Transport is another important target of renewal. A safe and functional transport system has to be introduced not only to solve existing transport problems but to support intensified urban activities in the future. Environmental improvements are the basis of sound urban functions, and buildings in the district have to be given some general criteria for buildings in the area must be established in connection with renewal.

A more detailed explanation of the renewal targets is given below.

1) Renewal and Revitalization of Primary Urban Functions in Connection with Urban Restructuring

Urban functions now concentrated and accumulated in the central district will have to be substantially reorganized. This is because the district is expected to be the most important major activity center of the region. It may be argued that because of the present urban blight of the district the future regional center should be newly established in some other area. However, land that is actually suitable to live on is rather limited in the metropolitan region due to the region's hydrological condition. In spite of the seemingly wide metropolitan area, a more compact urban structure is suitable from the viewpoint of an efficient development of infrastructures, especially water supply and sewerage systems. This is the basic reason why the central district should be reorganized in its structure and have a higher intensity of land use, and why its major urban functions should be revitalized.

a. Business activities in the central district have to be reinforced in line with the future growth of industrial activities in the region. Consequently, more of those business activities must be higher-level activities and the district must function as the business center of the region as well as the coastal area. This requires an expansion of the space for business activities, and to achieve this, the present tendency for business locations to expand should be taken into consideration.

b. Commercial activities are also to be refinforced so that the district might become a

regional center. The existing everyday commercial functions, however, do not necessarily have to remain in the district. These can be transferred to sub-centers that might be created in suburban development areas for easier access.

c. Public administration functions should be intensified in connection with the growing urbanizaion of the Region. This means the renovation of the existing civic center. It is necessary to recognize the importance of the public sector and its role in the reinforcement of business and commercial activities. At the same time, institutional and educational activities in the central district are significant elements which activate the district. In this regard, these functions have to be maintained or strengthened in the future.

d. Manufacturing activities are not always welcomed in the central district. Basically, removal is recommended, but in some areas, for example in Barranquillita, the creation of an industrial park needs to be promoted for those factories that do not contribute to environmental pollution. On the other hand, the widespread mix of residences and micro-industries in the district requires special attention if they are to coexist in a well-coardinated manner.

e. As for the central district's descreasing residential function, it must be given a positive role. The introduction of a resident population will bring about a more effective use of existing public investment in the district and a revitalization of the district by bringing the residence closer to the work-place. Thus, the possibility of a new residential area has to be explored, and the environmental improvement of the existing residential areas also needs to be considered.

2) Development of a Safe and Functional Transport System

a. The existing transport confusion has to be resolved by means of a well organized traffic control system as well as by the removal of its causes, that is, unfavorable locations for bus centers, concentrated and confused bus routes, scarcity of parking space, etc.

b. It is vital to introduce a safe and functional transport system to meet the future transport demand in the district, in close connection with the reinforcement of business and commercial activities. In this regard, the proper modal shares of private cars and public transport must be considered, and the coexistence of cars and pedestrians must be achieved.

c. Transport facilities that develop as the above-mentioned system is realized must be in-

tegrated with urban renewal. In other words, the introduction of a better transport system in a sense will make urban renewal necesssary.

d. Pedestrian space networks have to be installed in the central district in order to facilitate the safe movement of people. This is one of the features that will activate the district, and the networks should be integrated with green spaces so as to humanize the district.

3) Environmental Improvement

a. Contamination of the Canal Ahuyama and environmental deterioration of areas along the canal must be halted in order to improve the urban landscape and to create a sense of spatial continuity with Barranquillita.

b. An urban open space system that is as extensive as possible must be introduced in the district and coordinated with pedestrian spaces and the surface water system. As for the surface water system, Loma 1 and the riverside zone at Barranquillita will have to be developed as a large-scale urban open space, since the riverside zones of the Magdalena River are almost all occupied at present by manufacturing industries and the port.

c. In order to maintain a level of environmental quality, measures should be taken against rain water flow (arroyo) in the district. The basic idea is to minimize the influx of surface rain water in the district. This should be recognized as an important measure for reinforcing the infrastructure in preparation for the renewal of the district.

4) Betterment of Buildings

a. Areas where a group of dilapidated buildings is identified should be integrated in the renewal. But, the restoration of buildings with historic importance for possible reuse should be considered.

b. In general, buildings in the central district must be made taller. This is mainly to develop more open space in the district, and the zoning ordinance will have to be revised for this purpose.

13–1–4 Reorganization of Spatial Structure

To achieve the intended goals of the renewal policy, it is vital that the spatial structure of the central district be drastically reorganized since a renewal scheme limited just to the existing

built-up areas would be quite difficult.

Special attention should be paid to Barranquillita where land use intensity is very low with 40% vacant land. However, the western half of Barranquillita is an obstacle to the inclusion of Barranquillita in the reorganization scheme. The contaminated channel, the disorderly market areas, and the arbitrary configuration of warehouses and bus facilities are in the north-south direction, cutting off the available vacant land from the present built-up center.

It is essential to set up an east-west activity axis through the district to ensure access to Barranquillita and to facilitate the aggregation of major urban activities in this direcion. In fact, 2 axes are established: one is the north axis using Cra. 46, where mainly business and housing functions are developed, and the other is the south axis with Cra. 38 facilitating commercial and industrial agglomeration. These 2 axes end at the riverside bypass by means of which the district is conncected in the region.

Thus restructuring in terms of a road network and land use configuration is an essential aspect of urban renewal in the district, and the following land use policy is based on this idea.

13–2 Land Use Policy

13–2–1 Framework of Population and Employment

The future framework in terms of resident population and employment in the central district is based on the overall framework described in Chapter 8.

However, the overall framework is given for each person trip zone, so the related person trip zones are coordinated with the sub-divisions for the central district survey. The outcome of this rearrangement is shown below and illustrated in Fig. 13–2–1 and Table 13–2–1.

As for the spatial extent of this frame, Loma 1 area is excluded, because the figures given to Loma 1 by the overall framework is negligible.

Another point to be taken into consideration in setting up the framework is the number of street vendors. It is natural to include street vendors in the overall framework since the framework is based on the P.T. Survey. Since their activities take place outdoors, an adjustment of their number is required when establishing the relationship between the employment framework and building use in the central district. The present number of street vendors and their distribution have been studied by the Study Team in coordination with the Chamber of Commerce, and it is assumed that some 20,000 street vendors will be active in the district in the future. Their number and distribution are shown diagrammatically for both 1983 and 2000 in Fig. 13–2–2.

The result of this adjustment is shown in Table 13–2–2 in terms of resident population and employees by secondary and tertiary sectors. However, it should be noted that employment

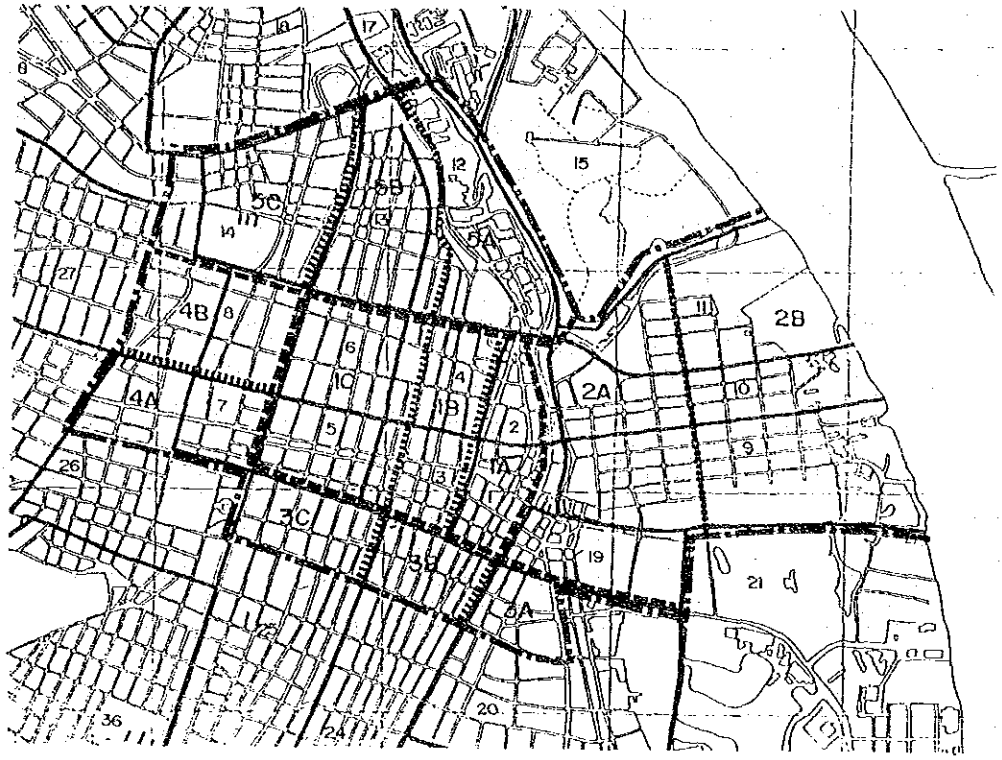


Fig. 13–2–1 (1) Coordination of Zones (Original P.T. Zones & Survey Sub-Divisions)

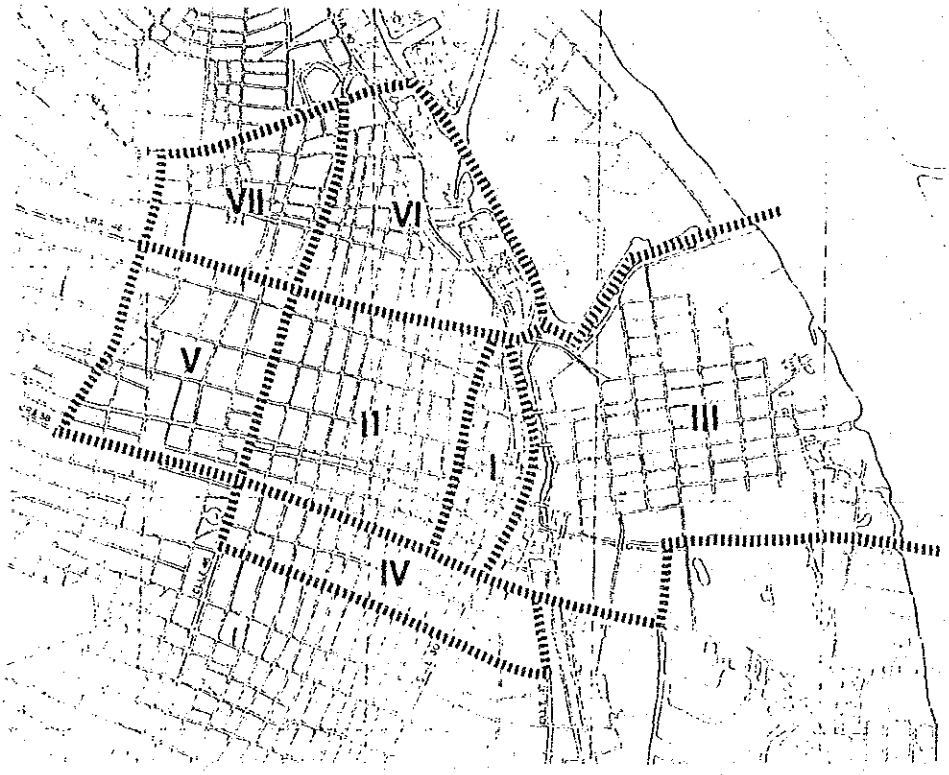


Fig. 13–2–1 (2) Coordination of Zones (Final Zone)

Table 13–2–1 Coordination of Zone

New Zone	P.T. Zone	C.D. Survey Sub-division
I	1, 2	1A
II	3, 4, 5, 6	1B, 1C
III	9, 10, 11, 19	2A, 2B
IV	(20), (24), (25)	3A, 3B, 3C
V	7, 8, (26), (27)	4A, 4B
VI	12, 13	5A, 5B
VII	14, (27), (28)	5C

Note: P.T. Zone numbers with parenthesis shows that a partial area of the zone is included in the new zone.

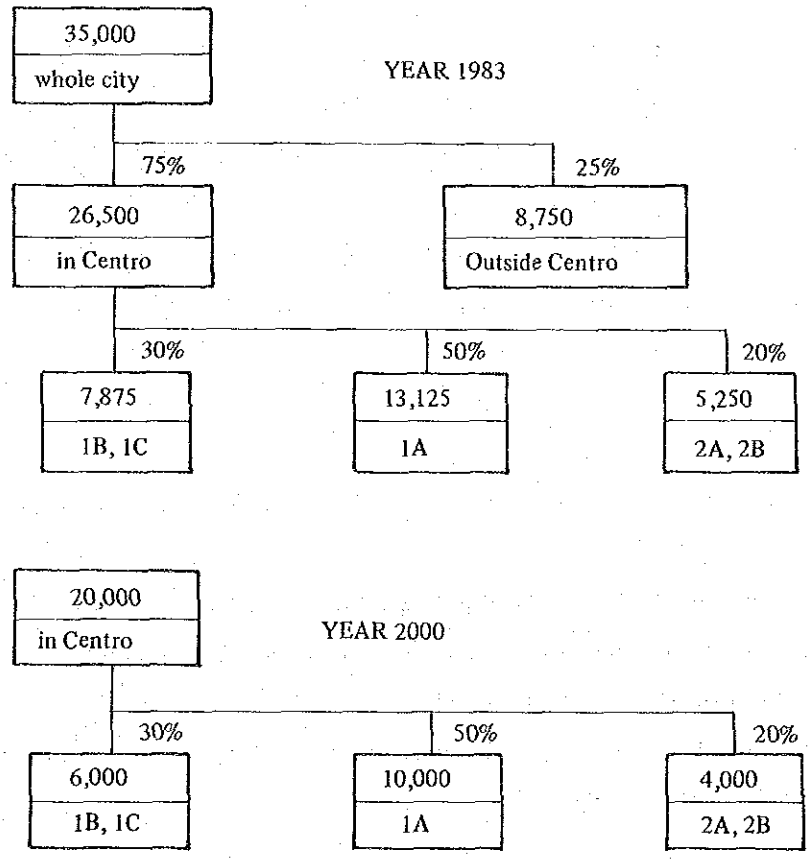


Fig. 13–2–2 ESTIMATION OF STREET VENDORS

by sector is rather misleading, since, in the central district even the secondary sector activities are, to a considerable extent, business functions.

13–2–2 Land Use Density

The framework obtained above was studied in terms of data on space use – that is, land use area and floor area data by use – which were collected by IGAC and arranged by the Study Team. In order to verify the reliability of the existing space use data, floor-area per capita was checked for tertiary sector employees, and the result is shown in Table 13–2–2.

Table 13–2–2 Floor-Area per Capita for Tertiary Sector

Zone	Floor-area per Capita	Remarks
I	15.3 m^2	Mixture of shops and offices
II	19.0	Mainly offices
III	25.1	Commerce with warehouses
IV	7.5	Small-scale shops and offices
V	13.9	Large institutions
VI	7.6	Small-scale shops
VII	12.4	Mainly offices

The result is reasonable and acceptable considering the activity features of each zone. Consequently, land use converted directly from building use can serve as the basis for a land use density study.

Thus, the net land use density was worked out for 1983 by industrial sector, and future density is proposed based on this and taking into consideration zonal land use ideas. The existing and proposed densities are shown in Table 13–2–3.

13–2–3 Land Use Policy

Land use area by zone can be calculated on the basis of land use density, and the result is shown in Table 13–2–4.

However, the calculated land use covers a rather clearly defined area, and in reality mixture or overlap of use is characteristic of the central district. Consequently, this must be taken into consideration in working out a land use plan.

The land use policy is established taking into consideration the existing land use, the renewal policy, and the land use density study.

1) Residential

(1) The residential environment of the existing low-density housing areas (5A, 5B, 5C) should be improved, and the density should be slightly increased (from 300–400 to 400–500

Table 13–2–3 Framework and Land Use Density by Zone

Zone	Number		Net Density (p/ha)		P.T. Zones
	1983	2000	1983	2000	
President Population					
I	421	0	5,263	–	(1), (2)
II	4,651	2,720	684	800	(3), (4), (5), (6)
III	2,070	20,000	622	800	(9), (10), (11), (19)
IV	9,873	11,240	702	900	(20)x0.25, (24)x0.2, (25)x0.2
V	8,215	7,850	610	700	(7), (8), (26)x0.5, (27)x0.1
VI	5,735	3,580	420	500	(12), (13)
VII	5,757	6,320	324	400	(14), (27)x0.02, (28)x0.03
Total	36,722	61,710			
Secondary Sector					
I	3,300	5,610	2,773	3,000	(1), (2)
II	8,245	11,460	1,672	1,400	(3), (4), (5), (6)
III	2,918	2,800	58	70	(9), (10), (11), (19)
IV	3,930	5,610	992	1,100	(20)x0.7, (24)x0.8, (25)x0.6
V	1,031	2,550	144	200	(7), (8), (26)x0.3, (27)x0.03
VI	1,655	2,000	87	200	(12), (13)
VII	740	520	196	200	(14), (27)x0.02, (28)x0.01
Total	21,819	30,550			
Tertiary Sector					
I	13,240	17,800	1,015	1,300	(1), (2)
II	32,392	50,880	835	1,200	(3), (4), (5), (6)
III	4,623	9,150	218	400	(9), (10), (11), (19)
IV	8,480	16,190	769	1,100	(20)x0.7, (24)x0.8, (25)x0.6
V	6,825	12,230	296	500	(7), (8), (26)x0.3, (27)x0.05
VI	6,262	14,000	678	700	(12), (13)
VII	1,755	2,700	306	300	(14), (27)x0.02, (28)x0.02
Total	73,577	122,950			

Source: JICA Study

Table 13–2–4 Land Use Area by Zone & Use

(Unit: Ha, %)

Zone	Residen.	Residen. (Mixed)	Commer.	Mixed *1)	Business	Instit.	Admini.	Indust.	Transpo.	Urban Park	Recre.	Reserve Zone	Total
I	–	–	11.34	1.49	–	0.15	–	–	1.72	1.50	–	–	16.21
	–	–	70.0%	9.2%	–	0.8%	–	–	10.6%	9.3%	–	–	100.0%
	–	–	*19.7%	*3.2%	–	*1.2%	–	–	*16.1%	*6.5%	–	–	*4.1%
II	–	4.96	13.03	27.32	3.67	1.87	3.75	–	1.79	0.86	–	–	57.25
	–	8.7%	22.8%	47.7%	6.4%	3.3%	6.6%	–	3.1%	1.5%	–	–	100.0%
	–	*7.0%	*22.7%	*58.7%	*10.1%	*14.9%	*79.2%	–	*16.8%	*3.7%	–	–	*14.5%
III	32.22	2.64	14.90	8.67	15.33	–	–	28.01	7.18	12.14	5.76	30.88	157.71
	20.4%	1.7%	9.5%	5.5%	9.7%	–	–	17.8%	4.6%	7.7%	3.7%	19.6%	100.0%
	*61.3%	*3.7%	*25.9%	*18.6%	*42.2%	–	–	*66.8%	*67.1%	*52.3%	*100.0%	*100.0%	*40.1%
IV	–	21.85	9.66	–	–	–	–	–	–	–	–	–	31.51
	–	69.3%	30.7%	–	–	–	–	–	–	–	–	–	100.0%
	–	*30.8%	*16.8%	–	–	–	–	–	–	–	–	–	*8.0%
V	–	27.90	5.95	0.62	3.47	7.95	0.99	–	–	3.07	–	–	49.94
	–	55.9%	11.9%	1.2%	7.0%	15.9%	2.0%	–	–	6.2%	–	–	100.0%
	–	*39.8%	*10.4%	*1.3%	*9.5%	*63.2%	*20.8%	–	–	*13.2%	–	–	*12.7%
VI	5.85	2.48	–	4.71	13.86	0.31	–	13.95	–	4.88	–	–	46.03
	12.7%	5.4%	–	10.2%	30.1%	0.7%	–	30.3%	–	10.6%	–	–	100.0%
	*11.1%	*3.5%	–	*10.1%	*38.2%	*2.4%	–	*33.2%	–	*21.0%	–	–	*11.7%
VII	14.47	11.17	2.59	3.75	–	2.31	–	–	–	0.75	–	–	35.04
	41.3%	31.9%	7.4%	10.7%	–	6.6%	–	–	–	2.1%	–	–	100.0%
	*27.5%	*15.7%	*4.5%	*8.1%	–	*18.4%	–	–	–	*3.2%	–	–	*8.9%
Total	52.53	71.00	57.47	46.56	36.32	12.58	4.74	41.96	10.69	23.20	5.76	30.88	393.69
	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%	*100.0%

Note: *1) Commercial + Business ;

person/ha.)

(2) Areas with mixed land use (1B, 1C, 2B, 3A, 3B, 3C, 4A, 4B) should be rearranged and open space should be created through the use of high-rise buildings (Density should be increased from 600–700 to 700–900 persons/ha.).

(3) It is necessary to introduce new planned residential areas in Barranquillita (2A, 2B), housing some 20,000 persons. There will be 2 types of areas, one environment-oriented and the other convenience-oriented. The average density should be about 500 persons/ha.

2) Industrial

(1) Rearrangement and integration of industrial zone in the north part (5A) along Via 40.

(2) Most industries in Barranquillita are to be relocated in other areas (for example, Gran Abastos and Malambo Industrial Development); other are to be relocated in the south-eastern part of Barranquillita in an industrial park.

(3) Mixed use with residential use (especially micro-industries in 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C) should be rearranged, and where possible the mix should be eliminated.

3) Commercial

(1) The old commercial area (1A) should be revived with some restoration of historic buildings.

(2) Market areas (in 2A including the public market) should undergo environmental improvement. The southwestern part of Barranquillita should be restructured in a fundamental way new intermunicipal bus terminal.

(3) Strip development along main streets (Calle 45, Cra. 38) should be duly arranged.

(4) As for street vendors, restricting them to a fixed building or space may not be the solution. Provision of wider streets or pedestrian corridors to house them may after a flexible solution to the problem how to make the situation of street vendors more stable.

4) Business

(1) Extension of the renewal to include the existing civic center may be a key to the central district renewal.

(2) The trend of business activities to expand toward the west (toward and along Calle 45) has to be taken into consideration in future land use demarcation.

(3) Areas to the north of the civic center are another important factor in finding new locations for business activities. The conversation of the custom house and the clearance of the squatter area (Barlovento) are key to the renewal of the area.

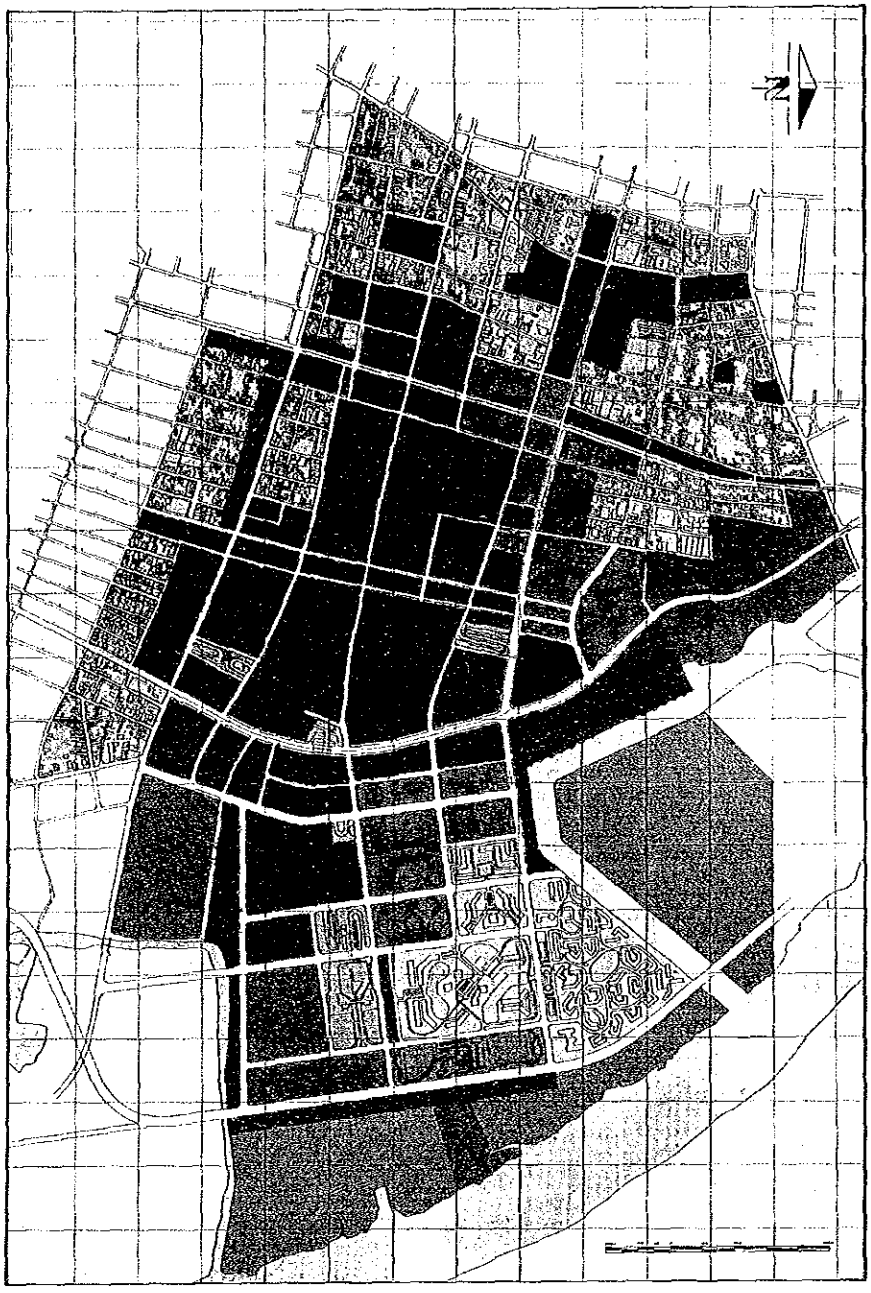


Fig. 13–2–3 Land Use Plan (2000) in the Central District

(4) New business areas are arranged in the northwestern part of Barranquillita.

(5) Large-scale institutional facilities (educational and religious) tend to be concentrated in 4A, 4B. The environmental improvement of the area will facilitate the creation of a proper mix of land uses – residential, commercial and business.

5) Green Space

(1) It is necessary to introduce urban parks that are as extensive as possible, especially in areas where strategic projects for renewal are being considered (5A, 2A).

(2) Along the Magdalena River in Barranquillita and Loma 1, reserve green space should be established. Even in the year 2000, the Barranquillita area will still have open space without any definite use, and this space should be considered as a reserve area for use after 2000. However, it is necessary to give the area some function and to provide good maintenance in order to prevent an invasion by squatters.

(3) Extensive pedestrian space should be introduced especially in areas where principal urban functions are located (1A, 1B, 2A).

6) Special Use

(1) In Loma 1, a site is being considered for a fair center with some park function in accordance with the expansion of urban activities. This is a new concept of business and tourism, and will be the key to future business activities in the central district.

13–3 Strategic Project Areas

The central district is divided into 2 groups from the standpoint of the execution of the overall urban renewal: one is the "strategic project areas", and the other is the "renewal guidelines and/or control areas". The former consists of areas where renewal is executed through projects, while the latter consists of areas where renewal is promoted through various guidelines or control measures prepared by planning authorities.

In this section, a set of criteria for the selection of project areas is introduced and the selected areas are explained on the basis of existing conditions and the urban renewal and land use policy.

13–3–1 Criteria for the Selection

Criteria for the selection of strategic project areas are established taking into consideration various factors crucial to project identificaion.

1) Some urban problems are identified or foreseen in and around an area. This is the endogenous aspect of area identification, and the area requires solutions to the problems.

2) Change or intensification in land use is expected in the future to conform with the principal urban functions in the district. This is mainly the consequence of the renewal policy and is an exogeneous factor in the selection of strategic project areas.

3) A spatial rearrangement is required to improve the street network system. In this transport study a new road and street network is proposed for the region, and the portion related to the central district necessitates a spatial rearrangement together with the reorganizationa of corresponding streets in the districts.

4) Some study or project relevant to the renewal of the area is under way or under consideration. This type of study shows that attention has been already paid to the area in terms of some problems or need, that must be taken into account in an urban renewal process.

5) Public or quasi-public land is preferably located in and around the area. In general, public land can be the key to an involvement by the public sector and its playing a significant or leading role in the renewal process.

These are the basic criteria, but in the final selection attention is paid to other, local conditions and also to the aggregation of areas to form more effective project areas.

13–3–3 Features of the Selected Strategic Project Areas

As a result, 10 areas with a total area of about 180.3 ha. are identified as strategic project areas. On a whole, the selected areas cover the older parts of Centro and most parts of Barranquillita as shown in Fig. 13–3–1. Features of these areas are given with reference to the criteria for their selection.

1) Area 1 (12.86 ha.): the lower part of Barrio Abajo between the old custombhouse and the civic center. This area including the customhouse was once a focus of urban activities in BArranquilla. It is noteworthy that the area was included in the urban renewal plan of 1957 when the municipality established the office of regulating plan. The area is characterized by the mixture of industrial, commercial and residential land use and rather dilapidated buildings. The old customhouse is one of the most significant historic buildings in the city, and it is now being

restored by the chamber of commerce which will use it as its headquarters. This is an important project for the future of the area, because the organization has a great influence on business and commerce activities. The area is therefore conceived as a major business block in Barranquilla. Another factor promoting the renewal of this area is the rearrangement of Cra. 50. The widening of this street has been a longstanding issue, and the necessity of realignment is another motive for renewing the area.

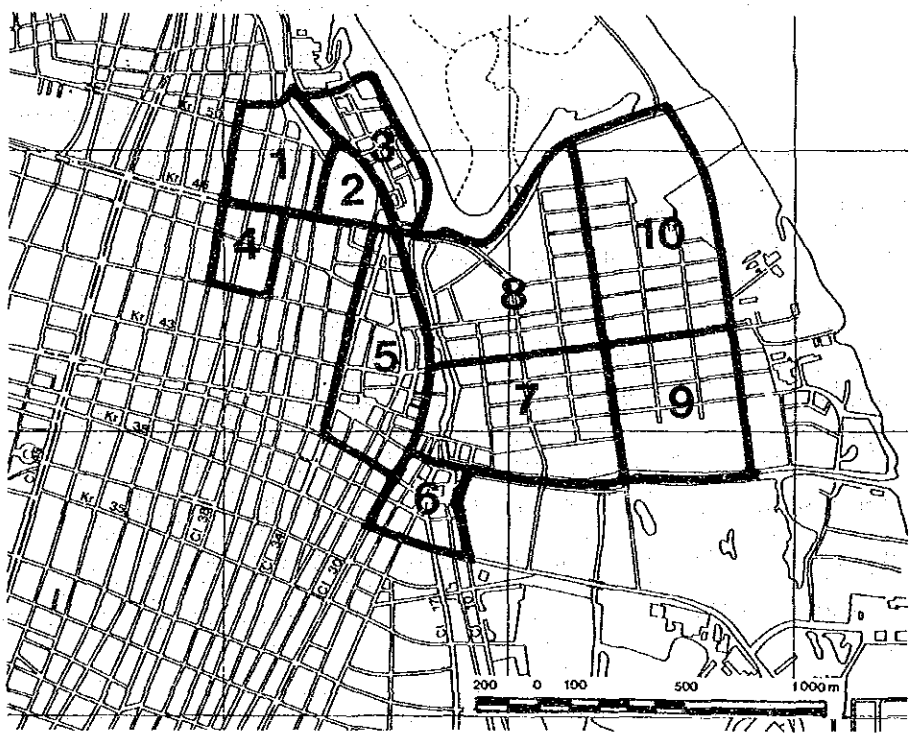


Fig. 13–3–1 Strategic Project Areas

2) Area 2 (4.99 ha.): the northwestern corner of the intersection of Cra. 46 and Calle 30. Industrial and transport land usees occupy more than 80% of the area, and the building-area ratio is as low as 25%. The average lot size is relatively large amounting to around 3,900 m^2. This makes the land use intensity quite low, the total floor area being small, although an active tourist market (San Andresito) is included. The area was also identified as a renewal area in the 1957 plan. A principal urban park to expand open space in the central district is proposed in this study.

3) Area 3 (9.79 ha.): the Barlovento area along the channel. Squatters occupy most of the area, and residential land use accounts for 56%. The buildings in the settlement tend to be of

solid material. The area is not provided with water supply and sewerage systems. It is said that, on account of this deficiency, most squatters hope to eventually evacuate the area. The land tenureship is national. The area is expected to be an upgraded business, commercial and cultural complex. Its location on the water front will make the area completely different from other business areas.

4) Area 4 (6.04 ha.): the existing civic center and the neighboring blocks on the west. The existing civic center suffers from a shortage of open space and parking space, and renewal with an expansion of space must be programmed considering the on-going urbanization and the life-cycle of the buildings. The public sector is in the leading role in urban renewal, and it is quite important to renew the civic center not only to meet future public administration demand but also to demonstrate to the public that it has the will to renew the central district.

5) Area 5 (20.36 ha.): the old Centro area between Paseo Bolivar and Calle 30. Commercial land use accounts for almost 82%. On the whole, the building-area ratio and the floor-area ratio are high, 87% and 163%, respectively. The area is an old historic center of Barranquillita with St. Nicolás church and its plaza. There are several buildings in this area that might be worth restoring, though most of the buildings are in a dilapidated condition. The main objective of renewal in this area is to revive the area as and to make it a commercial core with historic character. The widening of Calle 30 will have a major effect on the area and the rearrangement of the blocks along the street. Public facilities such as the city jail and the headquarters of EPM are located in the area and may be a key to renewal action.

6) Area 6 (8.11 ha.): the area surrounded by Cra. 38, Calle 30, the channel and the Aquila beer factory. The land use of the area is mainly commercial with some industrial mix. Around the public grain market there are a number of street vendors and a bus terminal. There are many elements that are to move to GRAN-ABASTOS, and some spatial reorganization is expected. The widening of Calle 30 and the realignment of Calle 17 will also require the readjustment of the area.

7) Area 7 (29.94 ha.): the southwestern part of Barranquillita. Commercial and industrial activities extend along the channel, and vacant land amounting to around 43% of the total area can be identified to the south and east. Commercial activities are mainly market functions, and there are a number of street vendors. A major market area is proposed for this area in the future.

The realignment of Calle 17 necessitates the rearrangement of some blocks. The existing public market has to be a part of any overall reform of the area.

8) Area 8 (33.23 ha.): the northwestern part of Barranquillita. Commercial and industrial land uses account for 70%, and 20% of the total area is vacant land. Commercial activities are concentrated along the channel, and a fish and fruit market on public land is quite active. All through the market area there are numerous street vendors and the result is spatial confusion. The proposed realignment of Cra. 46 and Calle 17 requires a rather radical rearrangement of the area together with the implementation of the new land use proposal for the business area. GRANABASTOS is expected to attract commercial and industrial establishments to the area.

9) Area 9 (23.54 ha.): the southeastern part of Barranquillita demarcated by the proposed bypass. More than 50% of the area is vacant land, and in dustrial establishments and bus facilities occupy some 17%. On the remaining area squatters are extending their settlement. The future land use concept is to bring together the industrial establishments in Barranquillita and to form an industrial park. The proposed riverside bypass is expected to facilitate this kind of rearrangement.

10) Area 10 (31.48 ha.): the northeastern part of Barranquillita demarcated by the bypass. Vacant land amounts to 60% and the rest is mostly industrial use. The proposed land use for the area is residential, and it is expected that existing industrial establishments will be removed to Area 9 or some other area. The rearrangement of Cra. 46 and the proposed bypass are major factors affecting the area.

Thus, the selected strategic project areas have a variety of characteristic in terms of existing conditions and future land use or renewal policy. However, it should be noted that the areas in Barranquillita are somewhat different from the viewpoint of infradtructure development. The absence of water supply, sewerage and drainage systems must be taken into consideration in future renewal or development action. This is one of the reasons why a new idea for renewal measures is necessary.

13–4 Renewal Plan

The renewal plan for the strategic project areas is studied with an emphasis on public facilities which will be the basis for the reorganization of the urban structure.

As to infrastructures, a new street system is introduced in coordination with the overall road and street network proposal for the metropolitan region and the future bus circulation route plan for the central district. Arroyo measures are determined to prevent the inflow of arroyo

water into Centro, and a drainage system is proposed for both Centro and Barranquillita. The preparation of land in Barranquillita is also considered essential for the future development of the area.

The introduction of parks and greenery system is another important aspect of renewal, and a pedestrian network that is closely coordinated with this system is proposed.

13–4–1 Street, Arroyo Measures, Drainage and Land Preparation

1) Basic Policy

A street network plan for Centro and Barranquillita is proposed with reference to the future land use plan and public transport plan for the district and the Barranquilla metropolitan road network plan. Streets subject to planning are collector streets within the district. Such collector streets shall be included in some of the combinations of arterial and semi-arterial streets comprising the road network of the metropolitan area of Barranquilla and furthermore shall act as important taxes in the land use plan for the district.

Local streets within residential areas created under the land use plan will be connected to collector streets as a rule and, in order to prevent the invasion of through traffic from outside the areas, will not be connected directly to arterial and semi-arterial streets. Since streets in Centro which correspond to local streets are currently linked directly to arterials, future street plans will provide for facilities such as continuous sidewalks for arterials so that such linkage will be minimized.

Collector streets in Centro and Barranquillita are expected to be used as bus routes, which means that a great number of large vehicles will use these streets. Hence, collector streets in the district will have through traffic lane widths of 3.25 m, which is one of the road specificaions listed in Chapter 11 of this Report. Since routes planned for Centro take advantage of existing streets, which are located in the old built-up area and are narrow, the proposed road width cannot be provided.

The plan for collector streets calls for a widening of the road width. When widening a road, the side where the new Gran Parada is planned will be used as a rule, but if there are control points along the route that should be avoided, the street center line will be revised as the case may be.

The arroyo, which is a major problem in Centro, will be dealt with by facilities to be newly installed up to Calle 45. For areas further east of Calle 45, the entry of arroyo from outside Centro will be eliminated, so that drainage facilities will be planned within the district only for rainfall.

Caño Ahuyama, which currently extends between Barranquillita and Calle 30, will be reclaimed under the Barranquillita land preparation plan.

To improve the currently poor drainage conditions in Barranquillita, filling work will be conducted to make the ground level and drainage facilities will be installed.

In addition, sections where Caño Los Tramposos has made an inroad into Barranquillita will be reclaimed at the same time that the route of Cra. 46 is altered. In order to maintain the current width of the canal, however, the Loma 1 District side will be cut and the center line of the canal will be adjusted.

Caño Los Tramposos currently leads to a deadend, but MOPT is now planning to kink this canal with the Magdalena River. This Study proposes an alignment wherein the center line of the canal leads in a straight line to the river, which means that the trip of the canal's dead-end section will not coincide with the planned route of the canal. Since the district is planned as a residential area under the Barranquillita land use plan, this portion of the existing canal that will become superfluous will be reclaimed in order to allow the effective use of land.

2) Street Network Plan

a. Standards

Road standards used in the street plan for Centro and Barranquillita correspond to those given in Chapter 11 of this Report. However, in order to adjus to special conditions in the district, such cross-section elements as number of lanes, width of through traffic lane, should width and sidewalk width are partially revised to the extent that they do not deviate from the basic concept behind the road standards. The standards used are as follows.

Table 13–4–1 Road Standards

	Collector Street	Local Street
Design Speed (km/hr)	40	30
Number of Lanes	2	2
Lane Width (m)	3.00 – 3.25	3.00
Shoulder Width (m)	0.75 – 1.50	0.5 – 1.50
Sidewalk Width (m)	3.00 – 4.00	0 – 3.00

The through traffic lane width of streets corresponding to the planned bus route shall be 3.25 m, and streets which come into contact with the intermunicipal bus terminal to be constructed in Barranquillita shall have 4 lanes. Collector streets within commercial and industrial

areas shall, in consideration of parking needs, have shoulders of 1.5 m widths. Sidesalks with widths of 3.0 m or more shall be provided along local streets corresponding to bus routes and local streets in commercial areas.

b. Street Plan

(1) Collector Streets in Centro

Collector streets in Centro shall be located along the bus circulation system and the gran paradas to be established in the future. Since hardly any sections of existing streets have the planned width, they must be widened. When widening a street, the side where a gran parada is to be located with removal of a large number of buildings will be used as a rule. This is to follow the policy of the Renewal Plan for the Central District to leave existing buildings intact whenever possible.

Table 13–4–2 Collectors in Centro

Street Name	Length (m)	Street Width (m)	Through Traffic Lane Width (m)	Shoulder Width (m)	Sidewalk Width (m)	Land Acquisition (m)
Calle 37	1,664.0	14.0	2 x 3.25	2 x 0.75	2 x 3.0	2,525.4
Calle 38	1,650.0	14.0	2 x 3.25	2 x 0.75	2 x 3.0	295.6
Calle 44	1,678.0	14.0	2 x 3.25	2 x 0.75	2 x 3.0	4,091.9
Cra. 40	1,210.0	14.0	2 x 3.25	2 x 0.75	2 x 3.0	113.1
Cra. 45	1,016.0	14.0	2 x 3.25	2 x 0.75	2 x 3.0	542.0

Note: gran parada is not included in the land acquisition listed above.

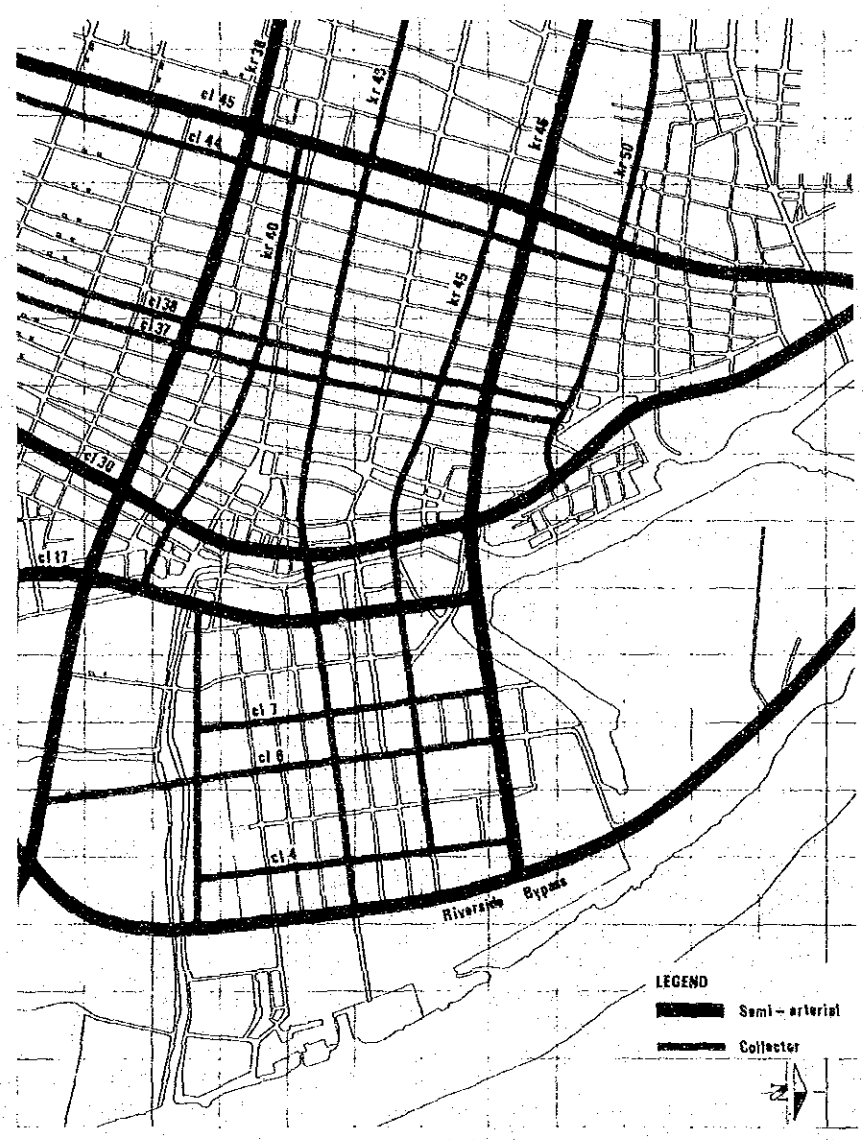


Fig. 13–4–1 Street Network Plan

(2) Collector Streets in the Barranquillita District

Collector streets in Barranquillita, like those in Centro, shall be located in such positions as to take into account semiarteials such as Calle 17 and 30, the riverside bypass and Cras. 38 and 46, as well as the future land use plan, especially the planned location of the intermunicipal bus terminal.

Streets subject to planning are Calle 4, 6, 7 and 9 (Calle 17) and Cra. 43 and 44. Calle 9 will merge with Calle 17 in the future when Calle 17, under the Barranquillita land preparation plan, is extended from the intersection with Cra. 38 to Cra. 46 through Calle 9. A new collector road is to be constructed along Caño Arriba between the riverside bypass and the new Calle 17.

The various conditions of collector streets planned for Barranquillita are as follows.

Table 13–4–3 Collectors in Centro

Street Name	Length (m)	Street Width (m)	Through Traffic Lane Width (m)	Median (m)	Shoulder Width (m)	Sidewalk (m)	Land Acquisition (m^2)
Calle 4	913.0	19.5	3.25x2=6.5	–	1.5x2=3.0	5.0x2-10.0	17,803
Calle 6	1,372.0	25.5	3.25x4=13	1.0	1.5x2=3.0	4.0x2=8.0	9,711
Calle 7	998.0	22.0	3.25x4=13	–	1.5x2=3.0	3.0x2=6.0	9.476
Calle 17	1,300.0	25.5	3.25x4=13	1.0	1.5x2=3.0	4.0x2=8.0	3,760
Cra. 43	906.0	22.5	3.25x4=13	–	0.75x2=1.5	4.0x2=8.0	0
Cra. 45	910.0	14.0	3.25x4=13	–	0.75x2=1.5	4.0x2=8.0	
Cra. 46	1,076	22.5	3.25x4=13	–	1.5x2=3.0	3.0x2=6.0	

Note: Calle 17 and Cra. 46 are listed because they are major streets in Barranquillita. Land acquisition calculations are given in the Barranquilla road plan. No land acquisition is required for Cra. 43 because the current size of the street is adequate.

3) Arroyo Measures

There are at present three arroyo which greatly affect Centro. By changing the route of these arroyo, water flow into Centro will be prevented. Calle 47 and 59 and Cras. 25 and 65, which are local streets, will be used for the route change. Since these streets are narrow and are used rather frequently because of their proximity to Centro, box culverts will be installed to contain the water flow.

Since there is a limit on the planned height of the drainage outlet and since water and sewage facilities exist 1.5 – 1.6 m below the street surface, the inside height of the box culvert shall be kept to 1.8 – 2.0 m. And to achieve a maximum structural economy of cross-section, the inside width of the box culvert shall be limited to 2.3 – 2.5 m. The cross-sectional area of the

box culvert fails to provide the planned drainage capacity, so 2 or more culverts shall be placed side by side.

Detailed information concerning arroyo water flow is given in Chapter 11 in relation to the road drainage plan. A 10-year probability analysis of rainfall conditions indicates that box culverts alone will be insufficient for handling the substantial volume of water flow expected. Therefore, reservoirs will be provided so that the difference between the volume of arroyo water converging onto Centro and the volume of water drained by the box culverts can be temporarily adjusted.

– Arroyo Route, Reservoir and Outlet

The system wherein the flow of Arroyo water from upstream is led into a reservoir, passed through a box culvert and finally discharged into a canal is planned as follows.

(1) Arroyo La Pax and one of the 2 branches of Arroyo Felicidad will lead to a reservoir to be provided on Parque Universal, pass through a box culvert installed beneath Calle 47, merge with the arroyo which flows along Cra. 64 and flow into the Caño de Las Compañias.

(2) For Arroyo de Hospital, a reservoir will be provided on Talleres E.P.M. The water then will flow beneath Cra. 25 to reach Canal de Arroyo de Rebolo.

(3) Water flowing down Arroyo de Calle 65 and the other branch of Arroyo Felicidad will go to a reservoir to be provided below the Cra. 41 median, pass through a box culvert placed beneath Calle 59 and Cra. 65 and flow into Caño de las Compañias.

The shape and capacities of the facilities shall be as follows.

Table 13–4–4 Arroyo Measures Facilities

Reservoir Condition					
Reservoir Name		Length (m)	Side (m)	Height (m)	Capacity (m^3)
Parque Universal		250	100	3	75,000
Talleres E.P.M.		160	100	3	48,000
Median of Cra. 41		500	18	3	27,000
Box Culvert Condition					
Route No.	Width (m)	Height (m)	Coninous (m)	Distance (m)	Reservoir
Calle 47	2.3	1.8	3	1.630	P. Universal
Cra. 25	2.3	2.0	2	1,460	Talleres E.P.M
Calle 59	2.5	2.0	2	2,440	Median Cra. 41

4) Drainage System Plan

a. Centro District

All streets in Centro shall be provided with gutter drainage systems. Since arroyo flowing in from outside the district is to be dealt with by facilities being planned for the purpose, the drainage system will be mainly for rainfall in the district. Rain which falls on street surfaces and nearby areas will be collected in roadside L-shaped gutters, led into small box culverts installed below the gutters and collectively drained into a canal.

b. Barranquillita District

The drainage system for the Barranquilla District shall be installed at the same time that the land preparation plan for the district is implemented.

5 channels and 2 box culverts will be installed as drainage facilities. Rainwater collected in the same way as in Centro will be led via the channels and dulverts to canals in and around the Barranquilla District.

5) Barranquillita Land Preparation Plan

Drainage facilities in Barranquillita are extremely inadequate now, and a land preparation plan will be implemented to correct this situation. Low areas will be filled with earth to prevent water from collecting and pooling.

The height of filling work at the outlet of the drainage system shall be 1.8 m above sea level. In order to minimize the amount of filling to be done, the finished ground level shall have the smallest possible gradient of 0.2%.

The land preparation work will start at Calle 30 in Centro, reclaim Ahuyama Channel and extend to 50 m in front of the bank of the Magdalena River under one alternative and up to the riverside bypass under the other alternative. The volume of earth required by the first alternative, under which nearly all of Barranquilla will be prepared, is about 657,000 m^3, or half the volume. This is because the 1,390 m^2 of ground between the riverside bypass and the Magdalena river currently has a low ground level and will require as much as 337,000 m^3 of earth for filling. Therefore, the latter alternative will be selected. The quantities of earth and other materials required for each type of work necessary for land preparation are as follows.

Table 13–4–5 Land Preparation Features

Filling Work (m^3)	320,000	Calle 30 – Riverside bypass
Cutting Work (m^3)	2,500	
Canal Reclamation (m^3)	97,800	Caño Ahuyama
	91,800	Caño Tramposos
	10,400	Barlovento
Canal Cutting Work (m^3)	16,900	Loma 1
– Channel – like Wall Work		
Concrete Pile Method (m)	528	
– Drainage System		
Open Channels (m)	3,162	(width, 1.0–5.0 m)
Box Culverts (m)	9.58	(width, 0.20–3.5 m x height, 2.0 m)

13–4–2 Park and Greenery System

Parks and a greenery system are introduced rather intensively in the renewal plan. At present, the park and greenery area in the central district is estimated to be less than 0.5% of the total area. This is extremely small for the central part of a city where major urban activities of the majority of workers are located. The plan is primarily to increase the ratio up to 5%; the result is about 4.8% with around 23.2 ha. of newly created urban parks. Including a proposed sports part. The ratio is 5.7% when a proposed sports park is included and 11.8% when reserve greenery is included.

This is the quantitative aspect of the development; from the qualitative point of view, each development has its own character, and overall, these will form a park and a greenery system that will be closely integrated with the pedestrian network.

1) Caño Park: The portion of Caño Ahuyama between Centro and Barranquillita is to be converted into a park with the reclamation of the channel. The present channel is seriously contaminated and works and maintenance necessary to clean it appear to be quite expensive. On the other hand, there is a recognized the need for open space in the central district. The solution is to convert the channel to a park. However, the channel which has contributed greatly to the development of the city should be retained symbolically in the development of the park, and a water stream is proposed as an urban landscape element. It should be planned so that people will become familiar with it, unlike the channel which has been an obstacle separating Barranquillita from Centro. The park is to serve as a major pedestrian mall in the north-south direction. Since an intermunicipal bus terminal is proposed for a site in the middle of Barranquillita, an eastwest flow of pedestrians is expected, and the Caño Park can serve as a primary distributor of pedestrians.

2) Central Urban Park: at the corner of the intersection of Cra. 46 and Calle 30. This park can be multipurpose. One function is to serve as a park for the proposed new business areas, and another is to serve as a transport node since a grand parada and a rail-system station are to be located in and near the park. It can be considered an extension of Paseo Bolivar, and formal ceremonies, festivals and other events can be performed there.

3) Paseo Bolivar and St. Nicolas Plaza: these 2 areas must have been once pleasant places and historically closely related to the development of the city. They are presently in very bad condition and occupied by cars, buses and street-vendors. These 2 areas are to be connected to form a park and to permit the coexistance of pedestrians and cars. Pedestrians are given priority in the area, and cars are given only limited access.

These are the 3 major parks introduced by the renewal plan, and linked to each other, they will provide access in various directions. Various kinds of activities can take place in these parks and give them the active character of urban parks. In addition, 2 other types of parks or greenery is proposed for specific use.

4) Sport Park: a sports park is planned beside the proposed housing development in Barranquillita and along the riverside bypass. Since the demand for outdoor sports appears to be growing, this kind of park, equipped with appropriate facilities, will be indispensable.

5) Rio Magdalena Reserve Greenery: although this is not included in the strategic project areas, it is closely connected with the future development of Barranquillita and Loma 1 areas. The land use demand in the year 2000 will not cover Barranquillita and Loma 1 entirely, and some positive measures have to be taken to reserve land for future land use. The idea of reserve greenery is, thus, primarily for use in the future; however, it is reconnended that it be converted to urban parks to the extent that there is demand for them – to keep the riverside area as accessible as possible. In Loma 1, facilities for fairs and exhibitions in comparison with the development of proposed strategic project areas, will be desirable.

13–4–3 Pedestrian Network

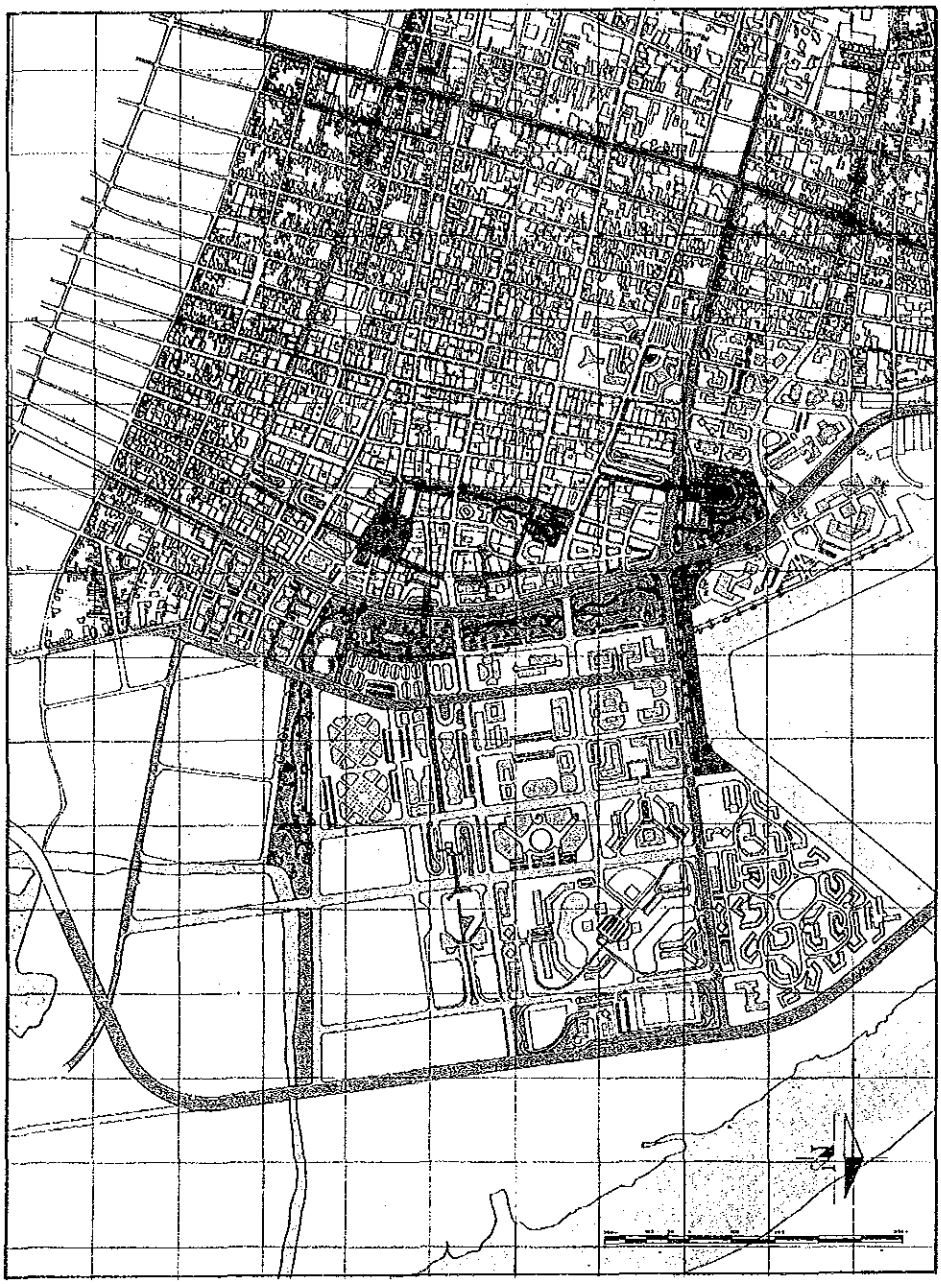
An extensive pedestrian network is provided in the strategic project areas and throughout the central district.

1) Pedestrian street: this is an exclusive pedestrian way intended mainly to serve a rather massive flow of pedestrians. 3 pedestrian streets are proposed. One is from the gran parada in the middle of Barranquillita to Caño Park. This is mainly for pedestrians generated by the intermunicipal bus terminal and for people who come to the proposed market areas in Barranquillita. Another is the existing Calle 32 where a series of historic buildings is located. With some restroration measures, the street will be converted to a pedestrian-only street. Connected to the first pedestrian street coming from the intermunicipal bus terminal, this will serve as the major pedestrian distributor in the north-south direction. Finally, Paseo Bolivar is shown as a pedestrian street, although, as previously explained, a coexistence of pedestrians and cars is to be sought.

2) Pedestrian Path: Pedestrian paths are intended to help maintain a safe and pleasant environment for pedestrians, even thoug a massive flow is not expected. An extensive pedestrian path will be provided in the Caño Park areas, and minor parths will be installed in the project areas where considerable redevelopment of blocks are to be carried out (Area 1 and 6).

3) Sidewalk: the sidewalks in the central district are not wide enough, and the widening of sidewalks of collectros is being considered, as previously stated. The basic function of a sidewalk network is to connect activity or mobility modes. In Centro Gran Paradas are the target points. and in Barranquillita business and residential districts are served by this network.

4) Other Pedestrian Facilities: pedestrian bridges are provided (1) between the intermunicipal bus terminal and the major Gran Parada over Calle 6, (2) between the Caño Park and the Gran



LEGEND

Arterial & Semi-Arterial Street

Collector Street

Pedestrion Space

Public Greenery

Plaza

New or Renewal Building

Fig. 13–4–2 Renewal Plan

Parada in Area 5 over Calle 30, and (3) between the Central Urban Park and the Gran Parada along Cra. 46 over the street. Plazas are provided at major points where people gather: (1) Plaza St. Nicolas, (2) Paseo Bolivar, (3) the Central Urban Park, (4) the Civic Center, (5) the Caño Park, and (6) the waterfront area along the new alignment of Cra. 46 leading to the new residential development.

13–5 Implementation Measures

To ensure the implementation of the proposed urban renewal plan for 10 strategic project areas, special consideration has to be given to measures that may facilitate the process of renewal in various ways. In general, land acquisition or expropiation has been the principal measure for carrying out urban renewal in Colombia. This imposes too great a burden on the executors of projects who most often have limited financial resources. Thus, ample financial aid is necessary for the success of a renewal project. This is one of the reasons why renewal schemes are apt to face difficulties and to become stagnant.

Even though financial supports and land acquisition or expropiation are important, it is essential to introduce some new measures to promote the renewal process while imposing a smaller financial burden on the executor. In this section, 2 kinds of measures, that might possibly be taken for the proposed renewal plan are introduced. However, any implementation measure will have to be supported by regulations and a financial aids system; therefore, as an initial step, the basic mechanism is introduced and its applicability studied.

1) Introduction of New Measures

a. Replotting (or Land Substitute) System

In a specific urban area where development of infrastructures is required, public facilities such as roads and parks can be newly developed or improved through replotting each piece of land and arranging the shapes of lots. Each landowner or leaseholder is requested to offer a portion of his land on equitable terms to create land for public facilities development and for sale to get the financial resources for development costs. The contribution of land by the landowner or leaseholder is called "land reduction", and it is offset by the increase in land value after the execution of the project, as a result of the provision of public facilities and the ordered shape of lots.

Some of the generally recognized advantages of this system are as follows.

(1) Integrated and area-based development of an urban area. A wide area can be covered by this system to develop various types of public facilities at one time. Consequently, a project using this system is more efficient and economical compared to other individual projects.

(2) Uneven or excessively small lots are not generated. In contrast to the land acquisition system, uneven or excessively small lots are deliberately avoided, and therefore a more intense use of land can be realized.

(3) Equitable share of development benefits among participants. Participants are given re-plotted land proportional to their prior rights in marked contrast to expropiation projects which sometimes benefit people in areas outside the project area more than it does people in the project area.

(4) Elimination of mixed land use. By applying the replotting system, facilities and buildings can be removed in keeping with the appropriate land use policy.

b. Right Conversion (or Exchange of Property Rights) System

This system evolved from the idea of the replotting system. By clearing an urban built-up area, buildings can be constructed together with an improvement or up-grading of public facilities. Existing property rights on land and buildings are equitably converted to newly arranged land and buildings. The project cost is covered, in general, by the disposal of additionally constructed reserve floors.

Some of the generally recognized advantages are as follows.

(1) Integrated development of public facilities, lots and buildings. This contributes greatly to the creation of a better urban environment.

(2) Intensive use of urban built-up land. An integrated redevelopment of land and buildings results in the removal of otherwise useless land and leads to the creation of appropriate open space.

Thus, generally speaking, the replotting system is suitable for the reassrangement of land, and the right conversion system is suitable for the three-dimensional redevelopment of built-up areas. However, these two systems may also be used in combination.

2) Application Directions

(1) Although 10 project areas are established, they are considered to be one project area for the easier application of the replotting system. This is because first, for the provision of public facilities (mainly roads and parks) a project area must be extensive to minimize the land reduction from each lot of land, second, the replotting of land will involve the relocation and rearrangement of urban function over a wide area. Especially in this renewal plan, a rather drastic reorganization of the urban structure is porposed, and this is an essential aspect of the measures for implementation.

(2) The replotting system will be applied also to those areas where a widening or realignment of streets will affect the area, and where the shapes of blocks are to change considerably. Special attention should be paid to areas along Calles 17 and 30 and Cras. 50, 46.

(3) The combined system can be applied to areas where lots are relatively small and/or where proprietors have difficulty participating in a redevelopment scheme by the right conversion system. By using the replotting system, landowners can be persuaded to participate, and the right conversion system can then be adopted for the three-dimensinal rearrangement of the area.

(4) Public land can facilitate the replotting of private land. In this regard, special attention must be paid to the clearance of squattered areas to recover public tenureship.

(5) As to areas where the replotting system is applied extensively (areas 7, 8, 9, 10), some follow-up measures must be introduced to make certain the land use idea is carried through and suitable buildings are constructed.

In conclusion, the measures introduced here are based on the idea that a renewal project requires the participation of people in the project area. The two measures both involve the sharing of the cost of development and the benefits by the participants. This is how they differ in a fundamental way from land acquisition and expropriation methods. Thus, the understanding, collaboration and coordination of people in the central district are as vital to success as the well-organized leadership of the planning administration.

Table 13–5–1 Summary of Implementation Measures by Area

Area No.	Areal Features		Related Project	Possible Renewal Measures
	Present	Future		
1 (12.86 ha.)	Mixture of industrial commercial and residential land use: Old buildings and smaller lots.	New business blocks around the custom house.	1. Realignment of Cra. 50 2. Restoration of the custom house.	Combination of the replotting and Right Conversion System (Replotting for easier execution of the right conversion system).
2 (4.99 ha.)	Larger lots for industrial warehouses and bus facilities.	Principal urban park.	1. Realignment of Cra. 50. 2. Widening of Cra. 46 and Calle 30.	Replotting to convert the land tenureship from private to public.
3 (9.79 ha.)	Squatter area on public land (national)	Business, commercial and cultural complex (intense land use on the water-front)	1. Squatter-clearance.	Squatter-clearance with integration to other housing development on renewal scheme, and land subdivision with infrastructure development.
4 (6.04 ha.)	Civic center	Regional center with open space and transport facilities.	1. Gran Parada	Expansion of public land by land replotting to get public land.
5 (20.36 ha.)	Commercial center with historic and old buildings.	Redeveloped commercial center with restoration of old buildings.	1. Widening of Cll 30. 2. Restoration of historic buildings. 3. Gran Paradas.	Combination of the Replotting and Right Conversion Systems.
6 (8.11 ha.)	Mixture of industrial, commercial and residential land use.	Redevelopment for appropriate mixed land use.	1. Realignment of Cll 17. 2. Relocation of some functions to Granabastos.	Combination of the replotting and Right Conversion System (Replotting for easier execution of the right conversion system).
7 (29.94 ha.)	Market and vacant lands with degrated chahnel.	Intensified market area with park.	1. Realignment of Cll 17.	Replotting market function into the area with land preparation, sewerage and drainage systems.
8 (33.23 ha.)	Mainly market and industrial use with degraded channel.	New business district with possible introduction of public buildings.	1. Arrangement of Cra. 46. 2. Realignment of Cll. 17. 3. Relocation of some market function to Granabastos.	Replotting to convert land use from market to business with infrastructure development.
9 (23.54 ha.)	Mostly vacant land with some squatter areas.	Integrated industrial land use with bus terminal.	1. Riverside bypass. 2. Inter-municipal bus terminal.	Replotting to introduce industrial function with infrastructure development.
10 (31.42 ha.)	Mostly vacant land with industrial land use.	New housing development	1. Riverside bypass. 2. Arrangement of Cra. 46.	Replotting to introduce housing development.

Chapter 14.

SHORT TERM TRANSPORT IMPROVEMENT PLAN

Chapter 14 SHORT TERM TRANSPORT IMPROVEMENT PLAN

14–1 Traffic Management Plan

14–1–1 Need and Policy of the Plan

As previously pointed out in the analysis of the current situation, the problem of the existing traffic congestion is partially caused by the inadequate road capacity with the main cause being a lack of well-developed traffic management facilities. Short term countermeasure objectives are, therefore, listed below and measures to improve the traffic management facilities are proposed.

(1) To accomplish a smooth traffic flow.
(2) To mitigate traffic congestion.
(3) To reduce traffic accidents.

An appropriate, systematic traffic management plan is essential for the safe, smooth flow of the increasing amount of motor traffic on the roads. Traffic management is particularly important to make the maximum use of the existing road facilities and to improve the current road capacities. Since a road traffic improvement plan requires relatively low cost, except for those measures which involve facilities of a large size, and since it makes it possible to carry out a trial-error method while observing the effects on the traffic flow, etc. it is necessary to introduce improvement measures that respond to the changing requirements of different times. As a result, the present plan only deals with short term planning and merely shows the preferable direction for long term planning.

In view of the required accomplishment of a smooth traffic flow in important areas, the objective of the short term plan is to mitigate the traffic congestion at bottlenecks and, thus, it is necessary to employ measures to increase the traffic capacity by the improvement of traffic management facilities. These measures can be seen in Fig. 14–1–1.

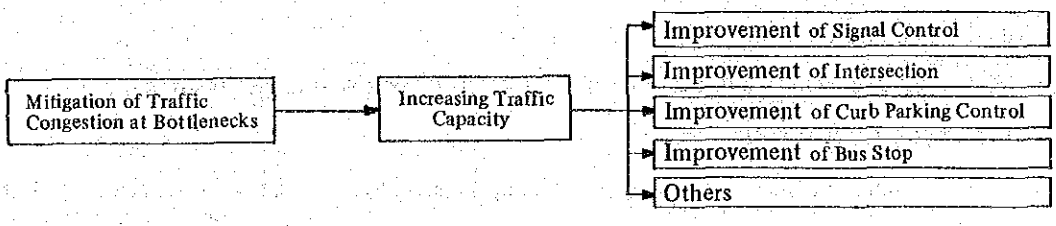


Fig. 14–1–1 Method of Countermeasures for Increasing Traffic Capacity

14–1–2 Signal Control Plan

1) Basic Policy

The signal Control plan mainly aims at the installation of new traffic signals at intersections in order to control both motor vehicle and pedestrian traffic which in turn will prevent traffic accidents at those high accident incidence points which are currently without traffic signals. It also includes the improvement of existing signals.

As this plan is still in the preliminary stage, the overall plan should be carried out after a more detailed survey. The urgent short-term signal control plan will be dealt with here while examining the possible methods of control and the devices to be used for medium and long-term planning.

2) Plan Conditions

a. Plan Location

Both the singal intersections pinpointed as traffic bottlenecks through the analysis of the current situation, as well as non-signalized intersections where the volume of merging and/or diverging traffic is large or where there is a high incidence of traffic accidents, will be subject to the signal control plan.

b. Control System

The type of traffic signal, pre-timed or traffic actuated, will be decided for each of the subject intersections dependent on the volume of traffic on major streets, minor streets and the traffic fluctuation pattern. The type of signal coordination, simple or automatic, will be decided based on the intervals of signaled intersections, street width, traffic regulations and other road facility conditions on major streets. Table 14–1–1 shows the criteria for the type of signal control system to be set up.

In the case of a coordinated control system, the following criteria should be used. When either a simple or an automatically controlled system is to be selected, the criteria given in Table 14–1–2 should be used.

(1) The locations of bottlenecks where a 10 km/h or below average speed is recorded during the Travel Time Survey.

(2) Places where at least 3 successive signal intersections exist and where the distance between each signal intersection is less than 400 m in the urban area.

Table 14–1–1 Criteria for the Type of Signal Control System

System		Description	Traffic Flow Condition
Fixed time signal	Mono Dial Type	The cycle/phase does not vary	The hourly traffic variation in both roads is not notable. It is not necessary to vary the cycle/phase in order to maintain smooth traffic flow.
	Multi Dial Type	The cycle/phase does vary	The hourly traffic variation pattern is distinguished as follows: 1. Morning peak hour 2. Midday peak hour 3. Evening peak hour It is necessary to change the cycle/phase pattern with each traffic variation in order to maintain a smooth traffic flow. The total traffic volume passed at intersection does not vary, although the hourly percentage of turning by direction is variable. The daily variation pattern of turning will be constant.
Traffic actuated signal	Semi-Traffic Actuated Signal	Traffic actuated cycle/phase changes to control traffic volume of major street, allowing for traffic in minor streets.	There is great traffic volume in both streets. It is necessary to maintain smooth traffic flow at the major street. The traffic variation of the minor street is notable. In case that it does not satisfy the fixed time adjustment at the major street.
	Full Traffic Actuated Signal	Traffic actuated cycle/phase changes to control the traffic v volume in both streets (major/minor).	This system must be adopted when one of the following requirements must be met: – The traffic variation in both roads is notably different. – The geometric structure is complex, as in the case of a multiple intersection, causing the number of phases to be more than 3. – The traffic in the major street crosses by group, and it is necessary to direct and/or merge traffic in both streets without obstructing the traffic at the major road. – Both streets are major streets. – In case that it is not satisfying the fixed time adjustment.

Table 14–1–2 Criteria for Coordinated Control System

System		Description	Traffic Flow Condition
Simple Coordinated Control	Mono Dial Type	The coordinated pattern does not vary.	The traffic variation on the major street is not notable. It is not necessary to change the coordinated pattern in order to keep a smooth traffic flow on the major street.
	Multi Dial Type	The coordinated pattern does not vary.	The hourly traffic variation pattern is distinguished as follows: 1. Morning peak hour 2. Midday peak hour 3. Evening peak hour It is necessary to vary the coordinated pattern in order to maintain a smooth traffic flow on major street.
Automatic Actuated Signal		The main flow in the major street w will be the through traffic. It is necessary to increase capacity and travel speed in order to maintain a smooth traffic flow. It is necessary to decrease rear collision accidents.	As it was mentioned above, the distance condition of each intersection will be just as the criteria. The number of lanes in each direction are more than 2. The number of signalized intersections in planned route is more than 10. (Including the signalized intersection plan). There are parking restrictions.

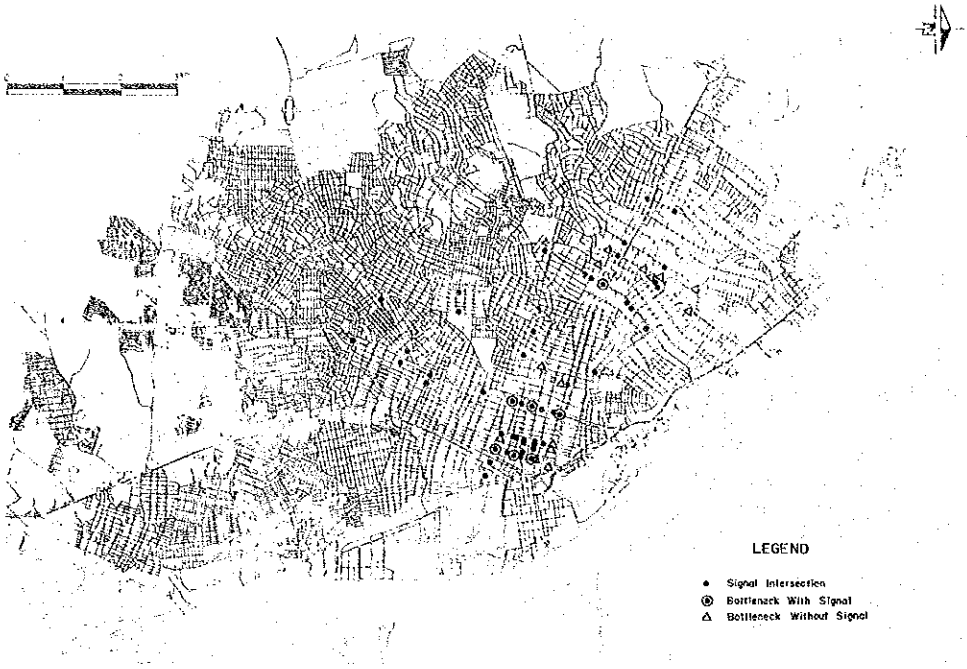


Fig. 14–1–2 Location of Bottleneck Intersections

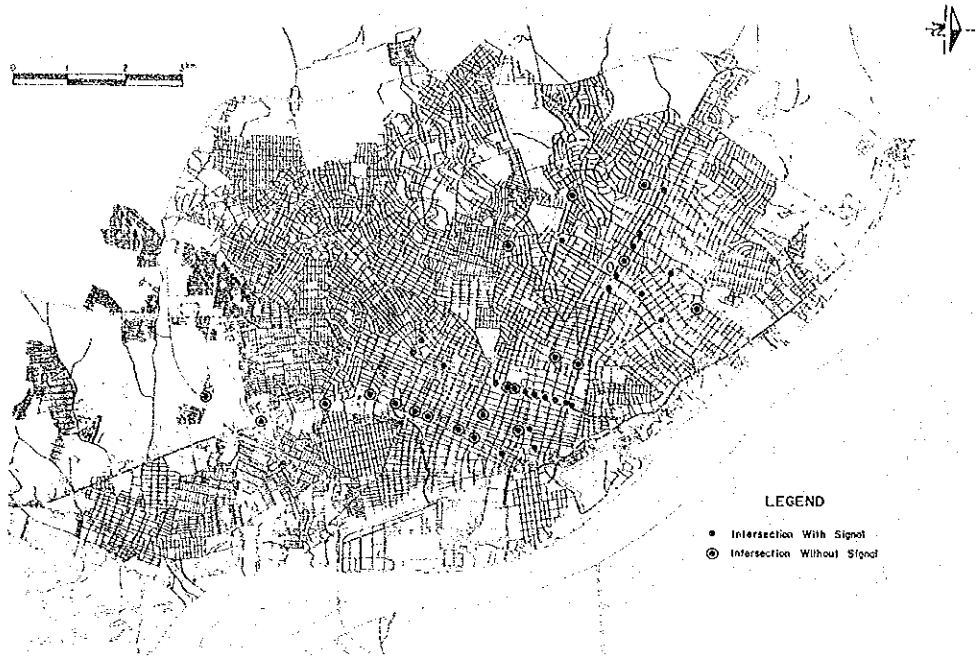


Fig. 14–1–3 Location of Traffic Accidents

(3) Places which do not meet criterion (1) but where the neighbouring intersections satisfy criterion (2) and where vehicles tend to move in groups.

(4) Where the distance between 2 neighbouring signal intersections is less than 250 m.

c. Point Control

Major and minor streets at bottleneck intersections are classified by the hourly traffic variation pattern. The control system must be selected depending on the particular traffic pattern at a given intersection; mono-dial type signal control, multi-dial type coordinated control, semi traffic actuated control or full traffic actuated control.

Mono-dial type or multi-dial type signal controls will be installed at the intersections that are currently without signals, where the merging/diverging traffic is heavy or where traffic accidents tend to occur, based on the belief that they do not require the precision level of traffic actuated control (See Fig. 14–1–4, Hourly Fluctuation Pattern of Traffic at Bottleneck Intersections and Fig. 14–1–5, Typical Hourly Variation Patterns).

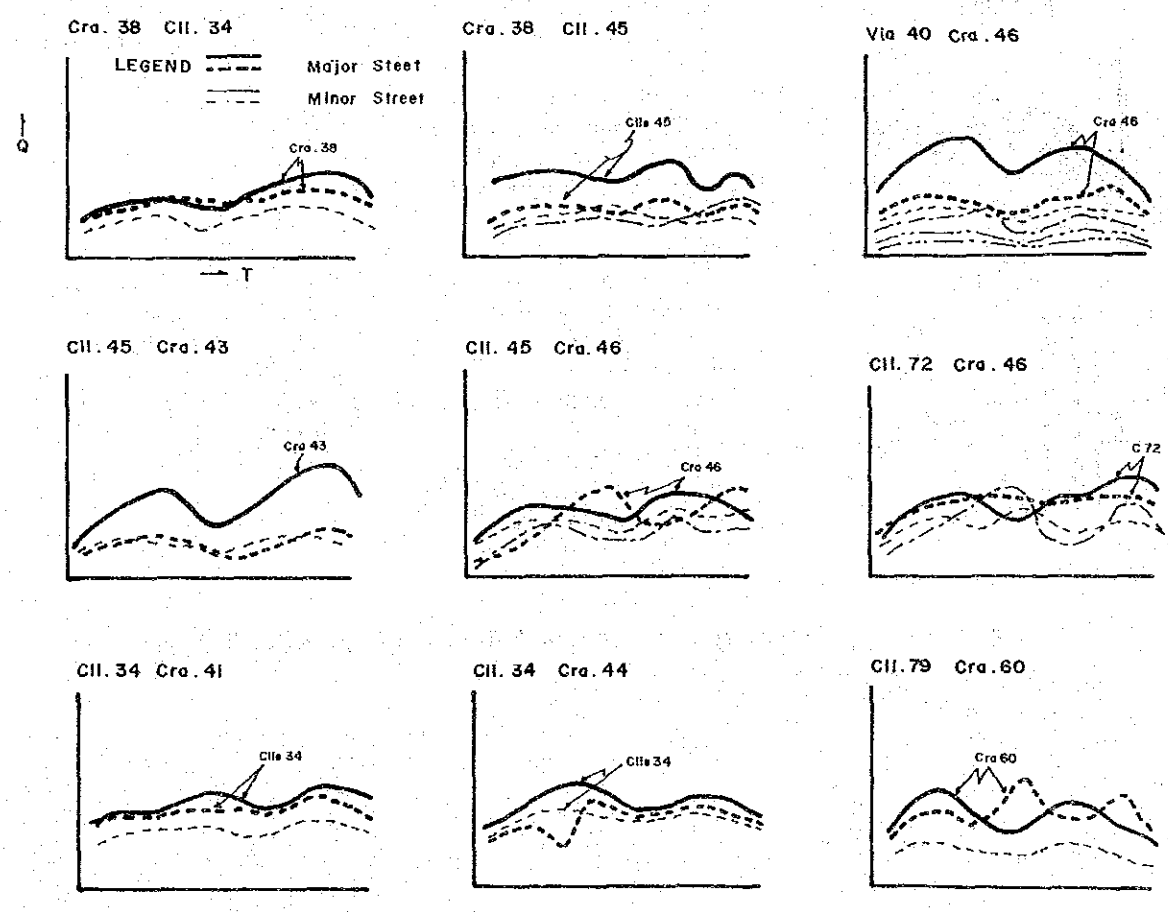


Fig. 14–1–4 Hourly Variation Pattern of Traffic at Bottleneck Intersections

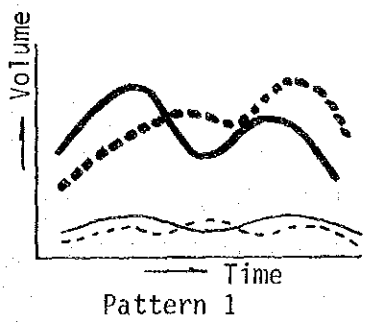
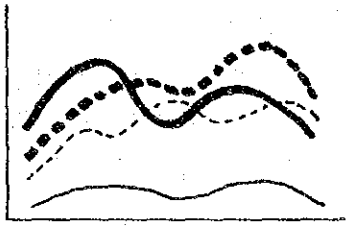
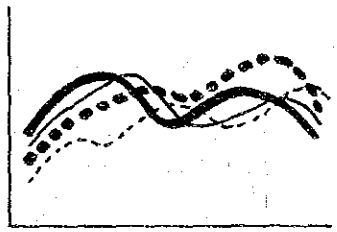
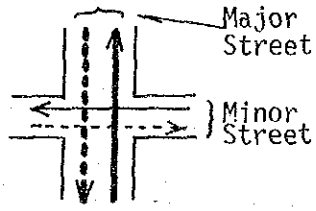
Pattern	Traffic Flow Condition	Selection of the Signal Control System
 Pattern 1	Traffic Volume: There is a great difference between the major to minor streets, and little traffic in the minor street. Traffic Variation: Notably in major streets at peak hours. (There are three patterns: Morning peak hours, Midday peak hours, Evening peak hours). It is not notable in the minor streets.	Checking the traffic in the major street, the traffic on the minor street will be controlled. The signal control type will be the multi-dial type signal or the semi-traffic actuated signal.
 Pattern 2	Traffic Volume: The volume in the major street is the same as the volume in one direction of the minor street. Traffic Variation: Notable in the flow of one direction on minor street at peak hours. It is different between major street toward minor street. The number of patterns will be more than 5 in both streets.	Checking the flow of one direction in minor street, the traffic on the major street will be controlled. The signal control type will be the semi-traffic actuated or the full traffic actuated signal control.
 Pattern 3	Traffic Volume: There is heavy traffic on both streets. (Both streets will be arterial streets). Traffic Variation: Notable on both streets at peak hours. It is different between major street toward minor street. The number of patterns will be at least 6 on both streets.	Checking both directions, the traffic on both streets during each peak hour will be controlled. The signal control type will be the full traffic actuated signal control.
		

Fig. 14–1–5 Typical Hourly Variation Patterns of Intersection Traffic

d. Coordinated Control

The selection of the type of coordinated control, simple or automatic, will be carried out dependent on the distance between signals, street width, traffic regulations and other road facility conditions on major streets.

3) Description of Control

There are 2 types of point control signals, i.e. a fixed time signal and a traffic actuated signal. The traffic actuated signal for point control is activated by the situation of the traffic itself and automatically selects the optimum phasing by means of traffic detectors which are installed on all approaches to the intersection.

The fixed time signal uses 2 phase signal cycles which are adjustable for green time in the major direction in accordance with variations in the traffic (See Fig. 14–1–6, Typical Signal Phase). Free left turn lanes will be installed at those intersections where a high proportion of the vehicles make left turns. Based on a detailed review of the traffic variation pattern, phasing will be predetermined for time periods for multi dial control.

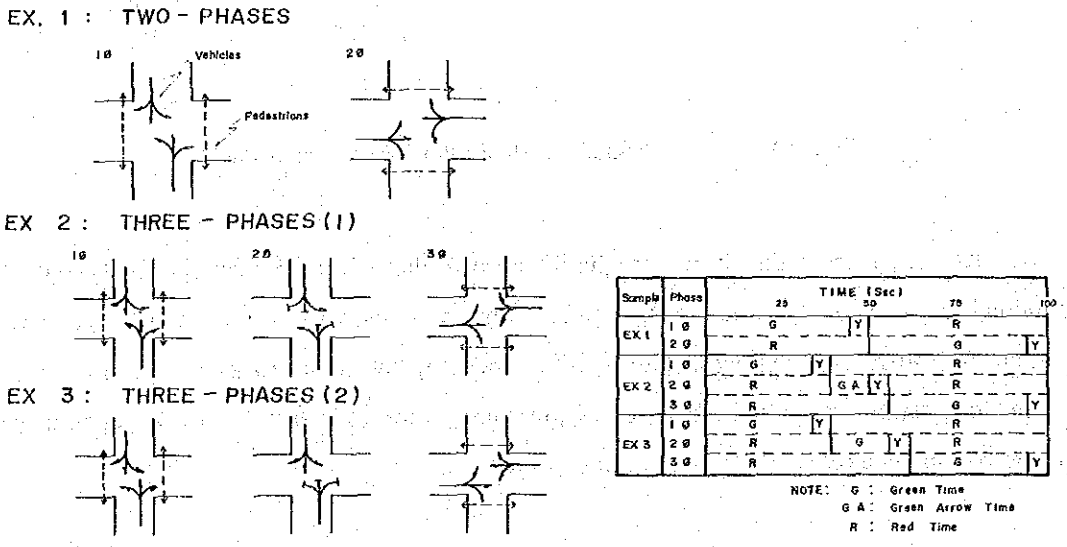


Fig. 14–1–6 Type of Signal Phase

There are also 2 types of coordinated control, i.e. a simple coordinated signal and an atuomatic traffic actuated signal. The fixed time method is used by the former with the latter using traffic detectors which are capable of automatically selecting the optimum phasing for a given traffic situation. The short-term signal control plan is shown in Fig. 14–1–7.

Fig. 14–1–7 Signal Control Plan (Short Term Plan)

As the range of the short-term signal control plan will be 5 years, a coefficient of 1.22, obtained from the analysis of the Person Trip Survey, is used to estimate the growth rate of the volume of traffic between 1983 and 1988. Either improvements to signal systems or improvements to intersections will be selected as measures to improve signal control depending on the traffic volume in excess of the calculated capacity.

4) With the upgrading of the existing signals and the installation of new signals, in order to prevent the deterioration of intersection capacity and to protect pedestrians, plans for the installation of left-turn lanes, safety facilities and road markings, etc. should be made.

14–1–3 Intersection Improvement Plan

1) Basic Policy

The purpose of the Intersection Improvement Plan is the mitigation of traffic congestion at intersections in order to secure a smooth traffic flow and to prevent or reduce traffic accidents. This plan will include the widening of approaches (the building of additional lanes) and the channelization of traffic.

As the intersection improvement plan is a short-term plan which is connected to the signal control plan, it should be carried out based on a more detailed survey.

2) Plan Conditions

The subject locations of this plan will be the signal intersections which are considered by the analysis of the current situation to be traffic bottlenecks and the intersections where there is a high incidence of traffic accidents. The traffic volume capacity of each bottleneck will be calculated and at bottlenecks where the traffic volume is in excess of the calculated capacity, the signal phases will be improved and/or the approach will be widened. Traffic channelization will be introduced where it is deemed necessary by the analysis of traffic accidents and/or where the shape of the intersections will change due to the widening of the approach, etc.

The estimated growth rate of the traffic volume for 1988 is calculated using a coefficient of 1.22, given by the analysis of the Person Trip Survey. Based on the calculation results, either the improvement of signal phases or the widening of approaches will be selected. In those cases where these improvements are considered to be impracticable, the introduction of an interchange method, etc. planned for the middle and long-term plans, will be relied upon.

3) Description of the Plan

a. Improvement of Bottleneck Intersections

Table 14–1–3 shows the method of intersecion improvement for each location. Bottlenecks with a traffic volume in excess of the calculated capacity and their expected degrees of congestion in 1988 are shown in Fig. 14–1–8 and Table 14–1–4.

Table 14–1–3 Methods of Intersection Improvement

Street	Intersection	Type of Improvement
Cra. 38	1. Calle 17	Improvement of signal phase
	2. Calle 30	Improvement of signal phase
	3. Calle 34	Flared intersection with additional lane
	4. Calle 37	Newly established signal
	5. Calle 38	Improvement of signal phase
	6. Calle 45	Flared intersection with additional lane
	7. Calle 72	Improvement of signal phase
Cra. 41	8. Calle 34	Improvement of signal phase
Cra. 43	9. Calle 45	Flared intersection with additional lane
	10. Calle 54	Newly established signal
	11. Calle 72	Improvement of signal phase
Cra. 44	12. Calle 34	Improvement of signal phase
	13. Calle 74	Newly established signal
	14. Calle 76	Newly established signal
Cra. 45	15. Calle 34	Newly established signal
	16. Calle 53	Newly established signal
	17. Calle 37	Newly established signal
	18. Calle 38	Newly established signal
	19. Calle 45	Flared intersection with additional lane
	20. Calle 72	Flared intersection with additional lane
	21. Calle 76	Improvement of signal phase
	22. Via 40	Newly established signal
Cra. 52	23. Calle 76	Newly established signal
Cra. 54	24. Calle 76	Improvement of signal phase
Cra. 60	25. Calle 77	Newly established signal
	26. Calle 79	Newly established signal

Table 14–1–4 Inadequate Capacity Locations

Intersection	Congestion Rate (Traffic volume/Traffic design capacity)
1. Cra. 38 – Calle 17	1.02
2. Cra. 38 – Calle 30	1.01
3. Cra. 38 – Calle 34	1.19 – 1.61
4. Cra. 38 – Calle 38	1.01
5. Cra. 38 – Calle 45	1.65
6. Cra. 38 – Calle 72	1.06 – 1.10
7. Cra. 41 – Calle 34	1.04
8. Cra. 43 – Calle 45	1.14 – 1.36
9. Cra. 43 – Calle 72	1.01 – 1.13
10. Cra. 44 – Calle 34	1.09 – 1.74
11. Cra. 46 – Calle 45	1.24 – 1.35
12. Cra. 46 – Calle 72	1.18 – 1.79
13. Cra. 46 – Calle 76	1.06 – 1.20
14. Cra. 54 – Calle 76	1.02

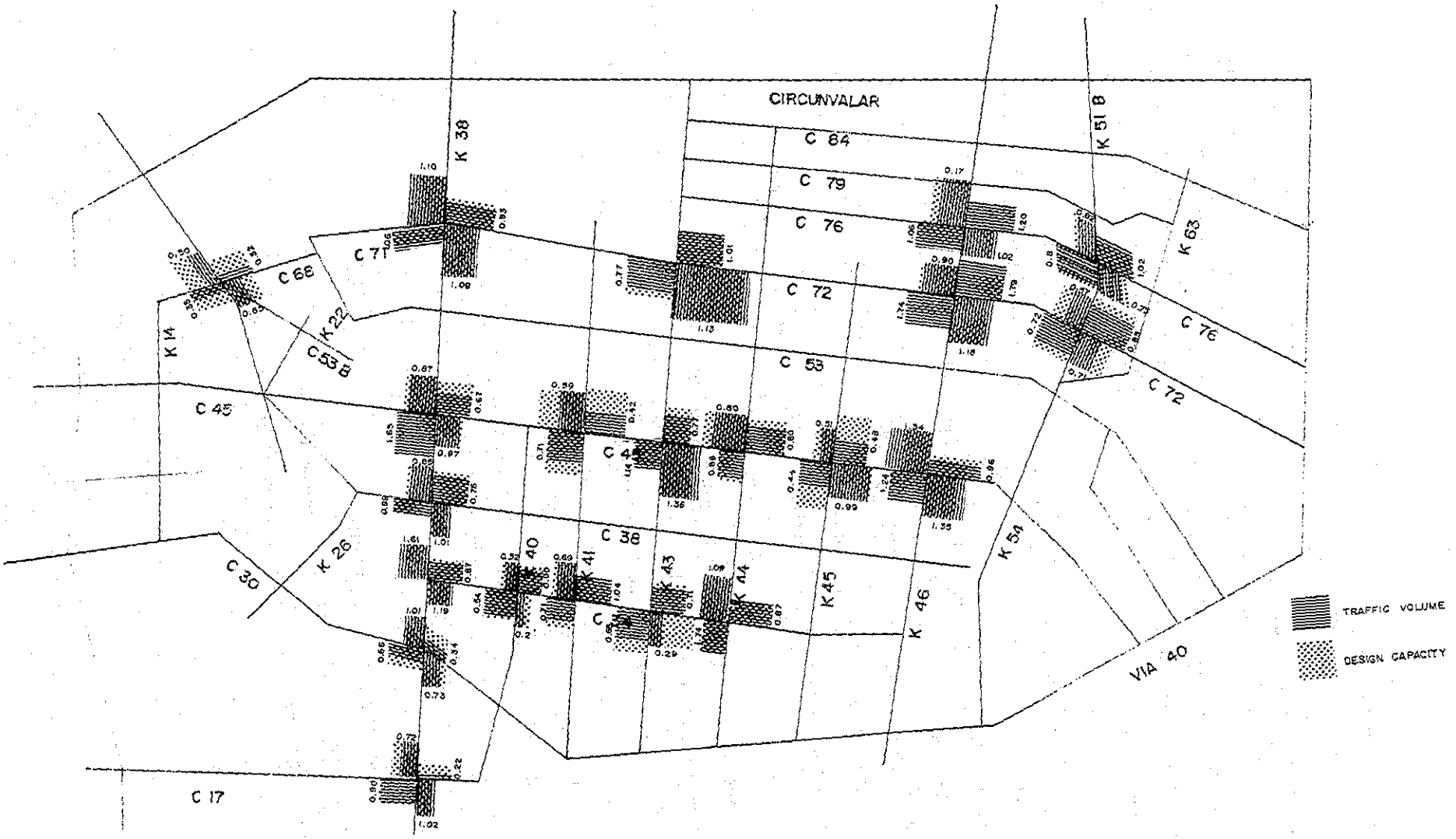


Fig. 14–1–8 Relationship between Traffic Volume and Capacity

b. Improvements in High Incidents Locations

According to the qualitative analysis of traffic accidents described earlier, it is clear that one of the causes of these accidents lies with the geometric conditions of the intersections. The traffic channelization plan will, therefore, prove to be effective in reducing the number of traffic accidents. In regard to those locations that do not have traffic signals and where there is a high incidence of accidents, the provision of new signals will prove to be effective for the same purpose.

The traffic channelization plan will be carried out at locations which satisfy the following criteria.

(1) Locations where channelization is deemed to be necessary based on the traffic accident analysis.

(2) Locations where improved channelization is deemed to be necessary as a result of the introduction of the signal control plan.

(3) The improvement of locations which are flared intersections with additional lanes.

The traffic channelization plan will be executed in accordance with the following basic items (See Table 14–1–5, Basic Items of Traffic Channelization).

(1) The introduction of channelizing islands.

(2) The improvement of the size of channelizing islands.

(3) The landscaping of channelizing islands.

(4) The available width of channels (the provision of plants).

(5) Channelization by pavement markings.

(6) Directional pavement markings.

(7) The protection of pedestrians.

(8) The improvement of corner cut-offs.

(9) The minimization of the area of the intersection.

(10) Moving the flow of traffic as close as possible to right angles.

The plans for channelization should be carried out on the basis of the following standards.

(1) When the areas of traffic conflict are large, tending to distract drivers and pedestrians and, therefore, causing traffic accidents, reduce the size of the areas.

(2) Move the traffic flow as close as possible to right angles in order to reduce the areas of possible conflict and to give drivers a better understanding of their relative positions in view of their vehicles and speed.

(3) Reduce the angle of access into through traffic to less than 15° in order that traffic will be able to effectively merge with a minimum difference in speed and, therefore, allow the utilization of a minimum distance between vehicles.

(4) Reduce the speed of traffic flow at the approach to an intersection by narrowing or bending the approach way. It is, however, necessary to ensure that the curve does not present an impediment to the main flow of traffic.

(5) A conflict point within an intersection may be divided by channelizaiton.

(6) Channelization may be used to prevent turning in a forbidden direction.

(7) It is possible to provide the necessary space for traffic control devices which complement channelization (such as road markings and signals) by the use of the channels themselves.

Table 14–1–5 Basic Items of Traffic Channelization

Intersections			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cra. 46	1.	Calle 45					o	o	o	o		
	2.	Via. 40	o		o		o	o	o			
	3.	Calle 72					o	o	o	o		
	4.	Calle 76						o	o	o		
	5.	Calle 79						o	o	o		
Cra. 45	6.	Calle 45						o	o	o		
	7.	Calle 53					o	o	o	o		o
Cra. 44	8.	Calle 45					o	o	o			
Cra. 43	9.	Calle 34						o	o	o		
	10.	Calle 45						o	o	o		
Cra. 41	11.	Calle 45	o				o	o	o	o	o	
Cra. 40	12.	Calle 45										
Cra. 41	13.	Calle 38						o	o	o		
Cra. 38	14.	Calle 30						o	o	o		
	15.	Calle 45						o	o	o		
	16.	Calle 72					o	o	o	o	o	o
Cra. 33	17.	Calle 45						o	o	o		
Cra. 30	18.	Calle 30						o	o	o		
Cra. 24	19.	Calle 30					o	o	o	o		
	20.	Calle 45						o	o	o		
Cra. 23	21.	Calle 30					o	o	o	o		
Cra. 21	22.	Calle 30					o	o	o		o	
	23.	Calle 45						o	o	o		
Cra. 19	24.	Calle 30						o	o	o		
Cra. 14	25.	Calle 30					o	o	o	o		
Cra. 11	26.	Calle 30					o	o	o	o		o
Cra. 60	27.	Calle 79					o			o		o
Cra. 53	28.	Calle 72						o	o	o		
Cra. 46	29.	Calle 84						o	o	o		
Cra. 27	30.	Calle 35						o	o	o		
Cra. 21	31.	Calle 47						o	o	o		

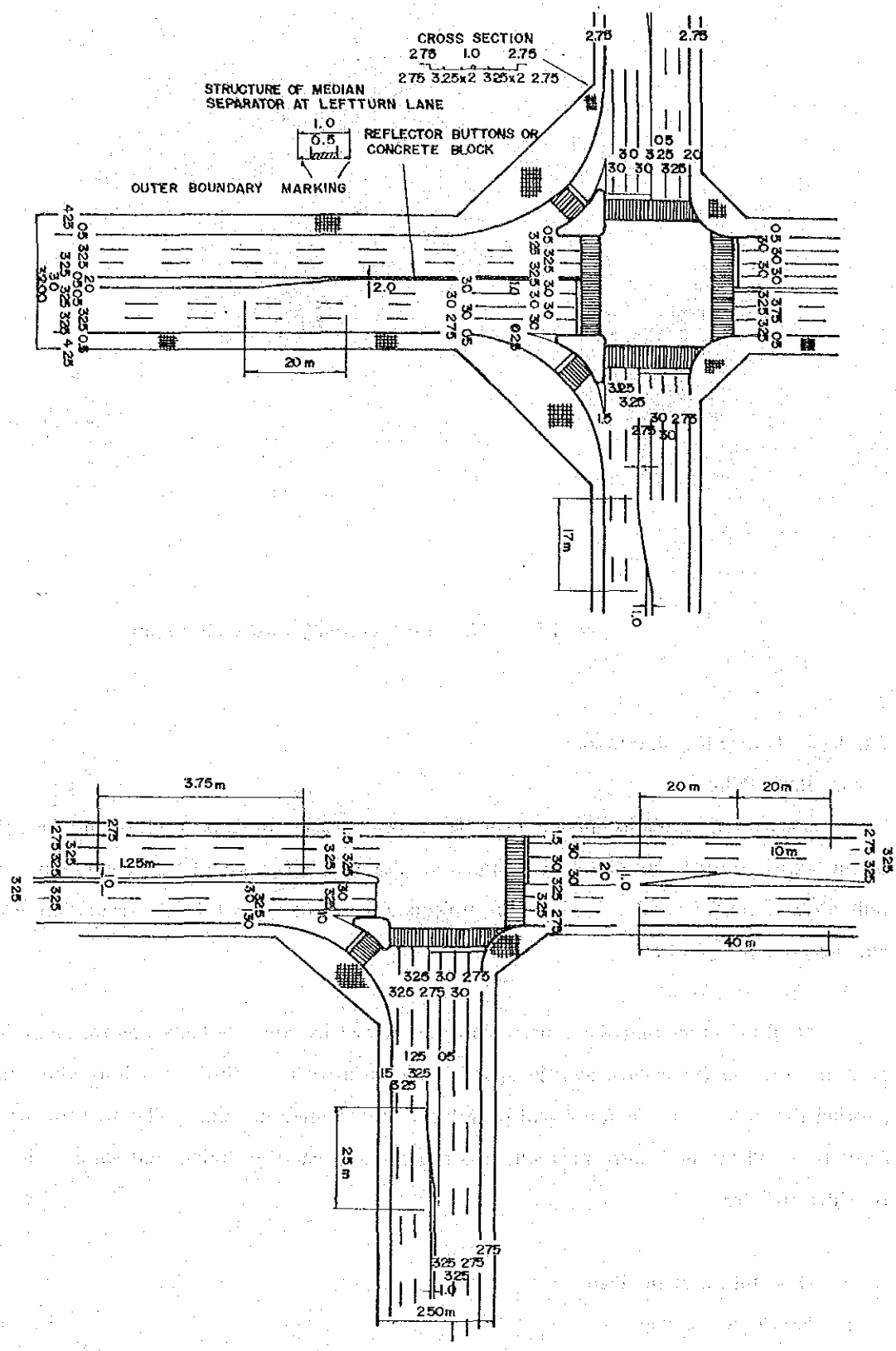


Fig. 14–1–9 Standard Structure of Typical Intersection

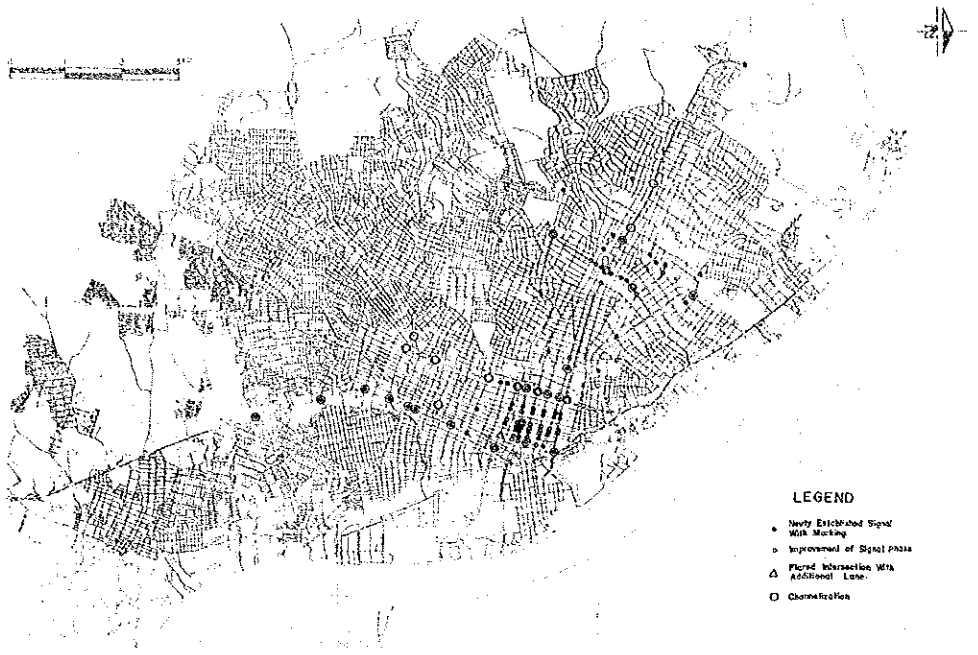


Fig. 14–1–10 Intersection Improvement Plan

14–1–4 Traffic Regulation Plan

1) Basic Policy

The traffic regulation plan is a supplementary measure in view of improving the efficiency of the signal control plan and other plans, intending the mitigation of traffic congestion and the reduction of traffic accidents. The main subjects to be regulated will be the regulation of parking and directional regulation.

2) Plan Conditions

Of those areas that thave been identified as heavily congested areas by the analysis of the current situation (where the average speed is 10 km/hr or less), those locations where the curb parking density is 50% or more will be subject to parking regulations. The area for directional regulation will be the Centro area which is heavily congested by traffic and where it is difficult to widen the streets.

3) Description of the Plan

a. Parking Regulation

When an arterial street is congested, the congestion tends to spread from the arterial street to the access roads that connect to it and compete with it as the traffic diverts from the

arterial street to these roads. It is, therefore, necessary to control curb parking in order that the volume of the traffic capacity at the signal intersections along the access roads is not reduced and that traffic accidents caused by vehicles parking along side streets can be prevented.

Based on the Public Transport Survey, the walking distance limit is given at approximately 350 m and it is, therefore, expected that the areas subject to parking control will be within a 350 m radius from each area of congestion. It is also preferable that parking be prohibited within 100 m from each signal intersection on all approaches of access roads to arterial streets as the approach capacity is considered to be influenced by on-street parking within 50–100 m from a signalised intersection. In this case, it will be necessary to provide off-street parking facilities which will accommodate the vehicles displaced from the streets. Within the above-mentioned 350 m radius, controlled parking areas will be determined depending on the geometric configuration of the roads and the surrounding conditions. The type of parking control, i.e. time limited control/all day control, etc. will then be decided for each specific area (See Fig. 14–1–11).

Based on the present parking conditions, the time limited control will be classified into the following 2 categories.

– Curb parking permitted up to 6 minutes.

– No curb parking zones between 08.00–20.00 hours.

As well as causing traffic accidents, the use of "Baterias" along intersection approaches by cars entering and leaving obstructs the smooth flow of traffic on the street. "Baterias" within 50 m from the main intersections and signal intersections should, therefore, be removed and the establishment of future new ones should be prohibited.

b. Directional Regulation

At locations where there is a high incidence of collisions caused by turning, it will be effective to prohibit left-turns in order to reduce the number of these accidents. The diverted traffic, however, sometimes results in traffic congestions on other streets and, therefore, the introduction of directional regulation should be carried out based on a number of detailed studies. Accordingly in this plan, the improvement of traffic problems relating to left-turn traffic is regarded to be satisfied by the previously-mentioned intersection improvement measures, including the signal control plan, in the short-term perspective. As a result, the directional regulation to prohibit left-turns is not considered in this plan.

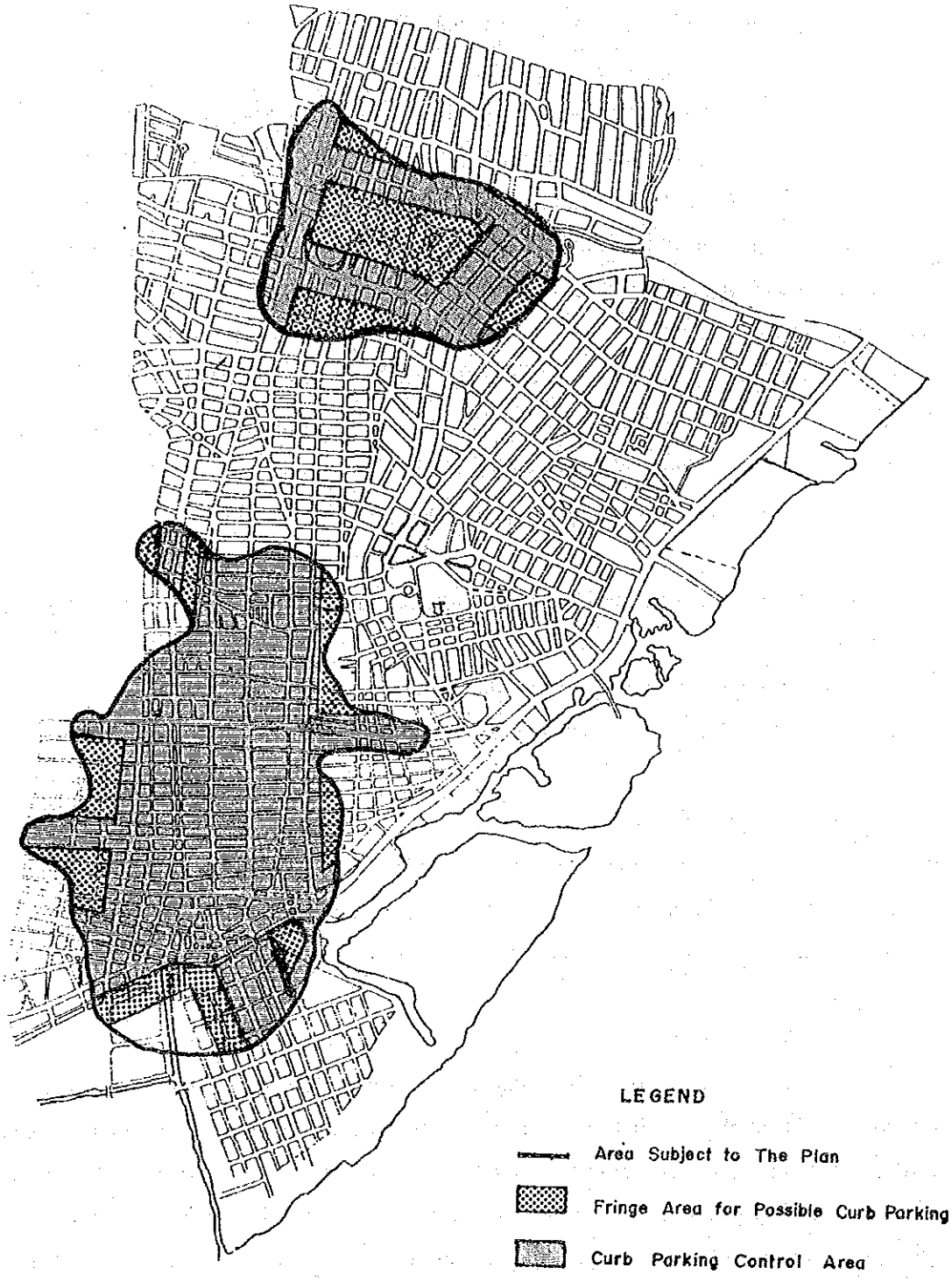


Fig. 14–1–11 Curb Parking Control Area